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IMPROVING UNIVERSITY DROPOUT AND STUDENT CAREERS. WHAT ROOM FOR INSTITUTIONAL ACTION?

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Improving university dropout and student careers. What room for institutional action?

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Index

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NOTE

Chapter 1 was written by Dalit Contini and Guido Salza
Chapter 2 was written by Marco Romito with the collaboration of Dalit Contini
Chapter 3 was written by Dalit Contini and Roberto Zotti, with the collaboration of Guido Salza and Riccardo Ricciardi
Chapter 4 was written by Dalit Contini with the collaboration of Roberto Zotti
The Appendix was written by Riccardo Ricciardi with the collaboration of Dalit Contini and Roberto Leombruni

Introduction

Despite the absence of formal access barriers, Italy is lagging behind the majority of the developed countries in the share young individuals with tertiary education. However, based on national level administrative archives, the National Agency for the Evaluation of University and Research has produced extensive evidence that at the aggregate level retention and on-time-degree rates have improved steadily over the past one and a half decade (ANVUR 2016, 2018). Parallel to the trends in university outcomes, in the past years we have witnessed a substantial change in the university student body composition. The share of students from lyceums (the most demanding and academically oriented upper secondary school type) has increased markedly up to academic year 2013-14, although the pattern has reversed since then (see Appendix to Chapter 3). The improvements in retention and time to degree could be driven by changes in the student composition: if students become more positively selected, ceteris paribus we expect more favourable university careers at the aggregate level. However, the observed improvements could also be due to changes in individuals' behaviour after university enrolment. Behavioural changes could be triggered by the season of institutional transformations underwent in the Italian tertiary education system since the 3+2 reform – that moved teaching management to departments and enhanced accountability processes – or by the ongoing changes in the labor market structure also due the long lasting economic crisis that has hit Italy since 2008.

The research we present in this report builds on our previous work (Contini, Salza 2019) analysing student careers with longitudinal microdata released by the national university student registry (Anagrafe Nazionale Studenti) for the University of Torino, taken as a relevant case-study. This is the larger of the two universities in Torino – a large city in the North-West of Italy with a longstanding industrial tradition, partially reconverted to the tertiary sector from the 1980s – offering degree courses at the BA, MA and PhD level in most disciplines. This institution occupies a middle-high position in national university rankings and has aggregate level dropout probabilities similar to those at the national level.

Our original data archive contained the entire careers of all students first enrolled at the University of Torino between academic years 2004/05 and 2013/14, recording degree attainments, dropout, degree changes and transfers to other institutions[1]. We analysed the careers of students matriculated in 3-year bachelor (BA) programs up to either BA completion or dropout, with flexible discrete-time competing risks models, in order to evaluate the determinants of successful vs. less successful trajectories and assess the extent to which trajectories differ across previous schooling backgrounds. We found extremely large differentials in student academic careers across high school tracks and prior performance, and between regular students and those enrolled with delay. Although the direction of the differentials was largely expected and in line with the existing literature, the most notable result was their magnitude. While students from traditional lyceums and high marks performed generally well, the predicted trajectories of most other profiles were discomforting. For example, young individuals from technical schools with final high school mark at the 25° percentile displayed

[1] Our interest was on university system dropout. To identify it correctly, we obtained from the Ministry of Education a special data release including the career segments occurred after transfers to other national higher education institutions.

a 50% probability of withdrawing within 6 years and a 30% probability of graduating within the same time span. Even worst results were observed for students from the vocational track and in general for students enrolling with delay[2]. Given the strong social stratification of high school choices in Italy, these findings highlight the existence of a severe structural problem in terms of both efficiency and equity of the university system.

Yet, in line with the national-level results for the same period, we observed a decline in dropout rates and increasing on-time-degree probabilities across cohorts. To shed some light on the drivers of this improvement, we decomposed the observed changes into three distinct components, related to the composition of the student body, the choice of the field of study and a residual component that we may interpret in terms of 'individual behaviour' after enrolment. We found that compositional effects – in both enrollment and degree choices – were able to explain only a limited share of the observed changes. Moreover, when analysing academic careers by field of study we realized that behavioural effects were relevant, but varied substantially across disciplines. The best performing was the area of economics, for which both retention and timely graduation rates have been constantly improving over cohorts (and mainly driven by behavioral effects). Less clear-cut patterns were observed for the other fields.

These conclusions contributed to raise our interest in why these improvements have occurred, or, less ambitiously, to analyze the role played by the recent institutional changes and labor market factors on student academic careers. The variability among fields of study (largely corresponding to different institutional structures, Facoltà or Departments) provides the empirical ground to identify the effect of actions implemented at the level of departments or degree courses on student success.

In this perspective, the current research program extends our previous work on the individual determinants of student academic careers, by focusing on the role of institutional changes and labour market factors. The research proposal is organized into three working units. In the first working package (WP1), we aim at reconstructing norms, regulations and actions introduced at the university level and at the level of departments and degree courses that could have had an impact on student academic careers. In this perspective, we carried out 15 interviews with key informants – apical figures in the central governing body of the university, head of departments, head of degree courses – capable of reconstructing the functioning and the genesis of interventions proposed at the central and local levels. Drawing on these findings, in WP2 we planned to analyse the role of institutional factors by "translating" the results of WP1 into diachronic indicators of the changes intervened in the past years, and incorporate these indicators as time-varying explanatory variables in the quantitative analyses of student academic careers. However, as we will discuss in Chapters 2 and 3, we will actually be able to include only one institutional variable in the regression. In order to disentangle the institutional effects related to the recent reforms and the effects related to labour market changes we also include in the models two indicators of labour market capturing the employment prospects of the youth in general, and of the graduates in each field of study. A third working unit aims at analysing the effects of a

[2] These figures refer to matriculation cohort 2008 and were produced by flexible discrete-time competing risks modelling.

specific action recently implemented to improve weak students' academic careers. From the interviews to the governing bodies of the university, we identified one intervention enforced at the UNITO University level in academic year 2018/19, specifically designed to strengthen the soft skills of low-ability students.

To carry out the research program, we updated the existing database to incorporate more recent matriculation cohorts: the new database contains the academic careers of all students matriculated at the University of Torino from 2004/05 to 2017/18. However, we analyze the entire panel only at a descriptive level. The reason is that we have reliable indicators of institutional and labor market factors only from year 2008 (see Chapter 3 for details), so the analysis of macro-level factors is conducted on matriculation cohorts 2008/9-2017/18. Differently from previous work, we define dropout as withdrawal from the Torino's institution, and not as dropout from the university system[3]. We also investigate a topic that we had not included in the original proposal: the effect of family economic conditions on the university dropout probability. To this aim, we added to our longitudinal database the available data on ISEE (Indicatore della Situazione Economica Equivalente), and the information on parental education and occupation autonomously collected at matriculation since 2014/15 by the University of Torino. This allows to improve our understanding of socio-economic inequalities in higher education, assess the independent contribution of each of these family characteristics, and disentangle the effect of economic conditions.

The final report is organized as follows. In chapter 1 we describe the methodology and selected results of our previous work focused on individual-level determinants of academic careers, based on matriculation cohorts 2004/05-2013/14 (the content of this chapter has been drawn from previous work, available in: Contini and Salza 2019). In chapter 2 we describe the results of the qualitative research, and discuss which indications emerge to feed the quantitative research on the effects of institutional changes. Drawing on these findings, in chapter 3 we enrich our previous models and analyze the role played by institutional changes and the labor market. In chapter 4 we move back to the individual-variables perspective and use data of recent cohorts to analyze the impact of family background and economic conditions on academic careers. Finally, in the Appendix we present preliminary results on the causal impact of an intervention (a 40-hour online course) designed by a team of psychologists and pedagogues to raise weak students' soft skills and in turn improve their academic careers.

[3] In this latest release we were unable to obtain data on the careers of students who transferred to other (national) institutions before attaining the degree. Yet, given that the research question focuses on institutional changes, we think this is most appropriate choice in this context.

Chapter 1

Individual determinants of student academic careers[4]

1.1 Introduction

There is a huge literature from the economics and sociology of education analysing the role played by family background and resources on individuals' schooling and college choices. Some focus on social class (Boudon 1974, Collins 1979, Bourdieu and Passeron, 1990; Breen and Goldthorpe 1997, Barone et al. 2018), others on parental education and income (eg. Carneiro and Heckman 2002, Dynarsky 2003, Stinebrickner and Stinebrickner 2008, Gloker 2011). A systematic review of the personal and institutional factors affecting dropout is in Larsen et al (2103). Tinto (1975) focuses on the role of academic and social integration. Smith and Naylor (2001) and Arulampalam *et al.* (2005) highlight the role of individual's prior performance as an indicator of preparedness. Integration and prior performance are possible channels that can explain differences across family background. Still, students from advantaged backgrounds experience higher retention and completion probabilities, although they often display better outcomes also net of prior schooling (Ishitani 2006, Vignoles and Powdthavee 2009, Bowen et al. 2009). Possible channels explaining differences across family backgrounds in a rational behaviour perspective are different aspirations (Breen and Goldthorpe, 1997) and risk aversion (Checchi et al. 2014). Manski (1989) highlighted that due to incomplete knowledge of learning targets and actual chances to attain the degree, individuals may first enroll and then reevaluate their choices once they have acquired more information. In this perspective, Stinebrickner and Stinebrickner (2013), show that students update their beliefs about their own ability over time and that this process plays a decisive role in dropout decisions. This body of research provides theoretical explanations of the overwhelming evidence that more prestigious educational choices are strongly influenced by family background.

Within this scenario, Italy stands as a country with particularly large inequalities in upper secondary school choices and access to tertiary education (Jackson, 2013). Despite the absence on formal barriers to track choice and access to university, the Italian educational system is flawed by strong socioeconomic inequalities (Cobalti and Schizzerotto 1993; Checchi and Flabbi 2006). Social background critically influences students' high school choices (Gambetta 1987; Schizzerotto and Barone 2006). Even if inequalities in access to upper secondary education have witnessed a consistent reduction and a moderate increase in the share of students enrolling to the academic track[5], inequalities in track choices have not changed much over time (Panichella and Triventi 2014). Horizontal segregation in high-school has strong consequences on inequalities on university enrolment, as the transition rate to tertiary education varies largely across tracks (see Appendix, Figure A1.1). Overall, there is evidence of increasing participation to higher education and slightly decreasing inequalities up to the 2000s (Argentin, Triventi 2011, Guetto and Vergolini 2017), but in the most recent

[4] The content of this chapter has been drawn from previous work, available in: Contini and Salza (2017) and by Contini and Salza (2019), currently submitted.
[5] ANVUR (2016)

decade, probably due to the economic crisis, transition rates have been declining and differences across high school tracks have increased up to the early years of the current decade, determining a change in the composition of the enrolled population.

Research on student academic careers has been limited by the lack of appropriate longitudinal data at the national level. For this reason, the existing literature on university dropout is largely based on survey data, and in particular on a retrospective survey data on high school graduates[6] (e.g. Di Pietro and Cutillo 2008; Cingano and Cipollone 2007, Contini et al. 2018). This literature reports substantial differentials related to family background and prior schooling. Only a few studies are based on micro-level administrative data, because the Ministry of Education has released the data only in recent years; moreover, the archives on schooling and university careers are not linked (so the enrolment choice cannot be studied) and universities have access only to the data of their own institution. Among them, Clerici *et al.* (2014) highlight that determinants of academic careers differ across the fields of study, whereas Carrieri et al (2015) find that a stronger selection at entrance considerably reduces dropout risks. Only few contributions focus on time to degree. Aina *et al.* (2011) highlight the role of individual and family factors and find that weak labour market conditions tend to delay degree completion. Garibaldi *et al.* (2012) find that time to degree is negatively related to tuition costs. Contini et al. (2018) show that timely completion is a more stringent outcome than (formal) retention and depends heavily on prior scholastic performance.

1.2 Data and modelling

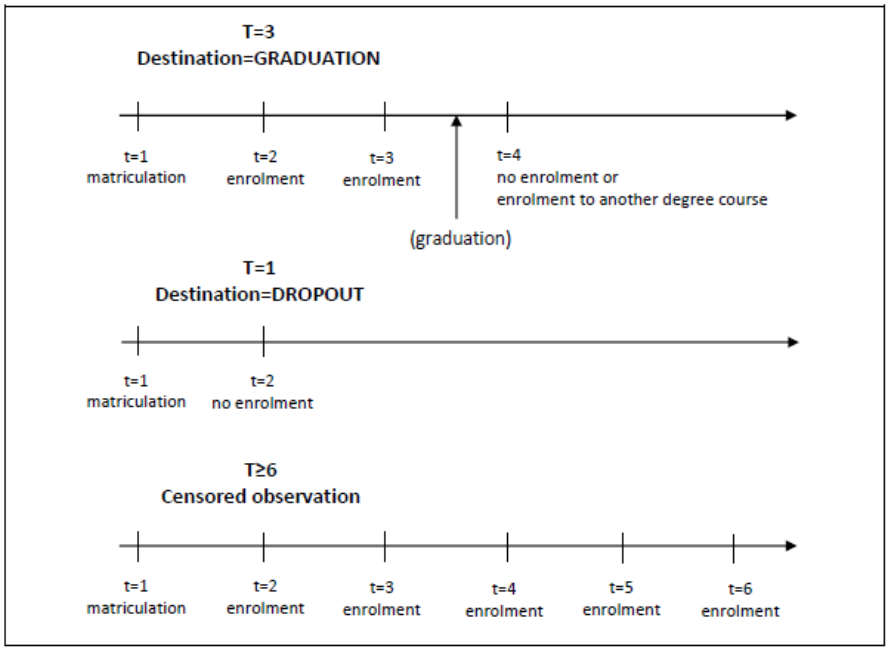
In this work we analysed student academic careers with a particular focus on system-dropout and time to degree. To this aim, we exploited the administrative data provided by the Ministry of Education on the entire careers – degree programs, exams and grades, number of credits – of the cohorts of students first enrolled at the University of Torino in a bachelor's program (BA) in the academic years 2004/05-2013/14 (approximately 90,000 individuals) up to 2015. Providing extremely reliable and detailed data, university registries have the advantage of allowing not only the study of final outcomes (dropout or graduation), but also the study of the trajectories within higher education – and the timing of the relevant events – including degree changes, transitory withdrawals, passage to masters' courses, as well as the credits accumulation process. Moreover, involving student population data, university registries overcome the limitations of surveys analysing the population at large (and may thus have small samples in the appropriate age range), or focused surveys at the national level that involve heterogeneous subpopulations.

In order to be able to distinguish between change of institution and withdrawal from higher education altogether, we obtained from the Ministry of education a special data release including the career segments occurred after transfers to any other national higher education institution. The administrative data provides full information on the students' progression as well as demographic information on individuals (gender, age at first enrolment, place of birth) and information on previous schooling (type of high school and final examination marks).

[6] Survey of Upper Secondary School Graduates (ISTAT, 2015).

By “drop out” we mean that the student, after having formalized enrolment for a number *t* of subsequent academic years (not ended with degree completion), does not re-enrol (at the University of Torino or at any other national higher education institution) in year *t*+1. In this case, we will say that she has dropped out after *t* years. Similarly, we say that a student has graduated at year *t* if she attains the degree after *t* enrolment years. Examples of student trajectories, time in the university system T and destination states are shown in Figure 1.1 Enrolment spells following a first dropout are not analysed in this paper. However, the share of dropout students eventually re-enrolling is low (around 10%) and only a minority of them eventually attain the degree.

Figure 1.1 Time in the system and exit states



Academic trajectories are modelled with event history techniques, particularly well suited to study the temporal nature of student academic careers (DesJardins 2006). We investigated the educational outcomes of the different cohorts of BA degree entrants using a flexible step-by-step longitudinal approach that mimics the estimation of discrete-time hazard functions within a competing risk (CR) framework.

Event history analysis builds on survival analysis. Survival analysis aims at modelling time elapsed in a given state of a discrete-state process. When the event “exit” can occur only at isolated time points (say, at times T =1, 2, 3…), we refer to discrete time models. In this context, the functions of main interest are the survival function $S(j) = P(T > j)$, the probability that exit will not occur up to time $T = j$, and the hazard function $h(j) = P(T = j|T > j - 1)$, the probability of exiting the state at time $T = j$ given survival up to time $j - 1$. Common specifications including explanatory variables are the discrete-time version of the proportional hazard model or, within the logit modelling framework, the proportional odds model (Jenkins, 2005).

Competing risks (CR) models are extensions of survival models when exit from the state of interest may occur towards different destination states, and we are interested in considering the destination along with the

timing of the exit event. Our case study fits this situation. Students remain in the university system until they either drop out (one possible destination) or attain the degree (alternative possible destination). Individuals are censored if they are still enrolled at the end of the observation window. More specifically, while survival analysis typically models the hazard function, CR models focus on the so-called *transition intensities* (as named in the econometric literature, Lancaster 1990) or *cause-specific hazards* (in the bio-statistical literature, Collett 2015), defined as:

$$h_v(j) = P(T = j, D = v | T > j - 1) \quad (1)$$

the probability of exiting at time $T = j$ towards destination $D = v$ given survival up to time $j - 1$. The unconditional probability that a given individual exits the system at time $T = j$ towards destination $D = v$ is related to the transition intensities by:

$$P(T = j, D = v) = h_v(j) \prod_{k=1}^{j-1} (1 - h_v(k)) \quad (2)$$

and equals the probability of not exiting the system at time 1 times the probability of not exiting the system at time 2 given survival up to time 1, etc. …times the probability of exiting the system towards a given destination (dropout or graduation) at time *j* given survival up to time *j*-1.

The literature on CR models has been largely developed within the framework of continuous time models. Discrete time models can be specified with multinomial logit modelling (Jenkins 2005). Considering matriculation cohorts separately, at each year, we use multinomial logit models to estimate the probability of all possible options (Table 1.1). At year 1, we estimate the probability of continuing in the chosen degree program, versus switching to another degree, versus dropping out. Transfers to other institutions (rare) are included in the degree change option, and we distinguish between changes to 3 year programs and to 5/6 year programs. If the student drops out, she falls out of the risk set. At year 2, we consider only students still in the risk set and model choices within the same set of options. From year 3 graduation is also possible (instead, since degree changes are infrequent after the first years, we collapse them with the 'continue' option). Graduation is an exit state, like dropout.

Table 1.1. Options and exit states by academic year after enrolment

Academic year	Options	Exit states
1	CONTINUE, DROPOUT, CHANGE TO OTHER 3Y, CHANGE TO 5/6Y	DROPOUT
2	CONTINUE, DROPOUT, CHANGE TO OTHER 3Y, CHANGE TO 5/6Y	DROPOUT
3-6	CONTINUE, DROPOUT, GRADUATE	DROPOUT GRADUATE

At each step, we include the individual time-invariant explanatory variables described above. We also insert a time-varying indicator of whether the student has previously changed degree program.

Formally, the CR model, defined as a multinomial step-by-step model, may be written as:

$$P(T = j, D = v | T > j-1) = \frac{\exp(\beta_{vj} X_{j-1})}{1+\sum_v \exp(\beta_{vj} X_{j-1})} \qquad \forall v \in set\ of\ options \neq 'continue'$$
$$P(T > j | T > j-1) = \frac{1}{1+\sum_v \exp(\beta_{vj} X_{j-1})} \tag{3}$$

where $T > j$ means that at time j the student is still in the university system and $T = j, D = v$ represents exit at time j towards one the other possible options v. If the destination belongs to the set of exit states, the student falls out of the risk set thereafter.

For each matriculation cohort we then estimate the *Cumulative Incidence Functions (CIF)*, describing the probability that a newly enrolled student with a specific profile of explanatory variables will exit the university system by dropping out or graduating within 1-6-years:

$$CIF_D(j) = P(T \leq j, D = d)$$
$$CIF_G(j) = P(T \leq j, D = g) \tag{4}$$

The destination state can be either D=dropout (d) or G= graduation (g). The complementary function:

$$P(T > j) = 1 - P(T \leq j, D = d) - P(T \leq j, D = g) \tag{5}$$

is the probability of being still enrolled after *j* years.

Estimation of the *CIF* is accomplished by means of Monte Carlo simulations of a large number of educational careers using the predicted probabilities of occupying a specific state at each step, and then computing the share of simulated cases experiencing the desired outcomes. For large N, this approach is equivalent to the analytic computation of probabilities. We compute the *CIF* for specific profiles of explanatory variables and for the entire observed populations, with their actual population composition in terms of all the relevant individual characteristics[7].

Differently from conventional CR models, with this strategy we can easily estimate the probability of any specific trajectory or any complex outcome of interest. For example, the probability that an individual with given characteristics will change degree after year 1, continue in the same degree program after year 2 and then drop out after year 3; or instead the probability of graduating after 5 years after having experienced a degree change at some point in time. These probabilities can be easily computed by the share of simulated trajectories giving rise to the desired outcome over the total number of simulated trajectories.

The advantages of our step-by-step estimation approach over conventional competing-risk (CR) models are related to its greater flexibility. The main reason for adopting it in this particular context is the possibility to distinguish between events of interest determining an exit from the state of interest (*final destinations*) and events of interest that we want to model, but not consider as exit states. In conventional CR modelling, once

[7] More specifically, when we analyse specific profiles we use *N*=20000, when we focus on the overall population we expand the observed samples by a multiplier factor *N*=1000.

individuals are assigned a destination, they fall out of the risk set. Consider the event "change of degree program". This event is not rare: approximately 10% of the students make a change during the first two years after matriculation. We are interested in modelling degree changes, because they are informative on individuals' attitudes and help predicting future outcomes. Horizontal moves (change to another BA program) usually come along with dissatisfaction over the current degree program or insufficient academic skills to continue, while upward moves (degree changes from BA to 5- or 6- year programs) usually demonstrate high aspirations and/or high ability[8]. Yet, we want to model their occurrence without defining them as exit states. However, this is not possible within the conventional CR framework. Instead, with step-by-step analysis we are able to make degree changes endogenous, by including them as possible transitory outcomes within the process under study, and as explanatory variables upon occurrence. Once individuals experience the change, we do not force them out of the risk set, so we are still able to analyse their trajectories up to dropout or graduation (or censoring).[9]

Step-by-step modelling also allows to relax the usual assumption in CR models that explanatory variables have the same effect at all times. A limitation of our step-by-step procedure is the large number of parameters, that might yield to inefficiency of the estimates. However, our samples should be large enough (approximately 9,000 individuals per matriculation cohort) to ensure the delivery of reliable estimates of the probabilities of the outcomes of interest.

1.3 Empirical analysis. Differentials across student profiles

We apply the competing risks model in (3) to the different cohorts of students, matriculated at the University of Torino between academic years 2004/05 and 2013/14. The administrative data provides full information on the students' progression as well as demographic information on individuals (gender, age at first enrolment, place of birth) and information on previous schooling (type of high school and final examination marks). We thus include the following explanatory individual variables: gender, age at enrolment, the high school type and final mark. More specifically, we define a dummy variable for female gender (FEMALE); AGE at first enrolment has been categorized into 4 groups: 18-19, 20-21, 22-25 and more than 25 years old; thus we include dummy variable indicators of the groups (reference category regular age 18-19). The high school type, classified as TRADITIONAL LYCEUM (classical, scientific), OTHER LYCEUM (socio-pedagogical, linguistic, artistic) lyceum, TECHNICAL schools and VOCATIONAL school. The high school final grade (HS MARK) is a quantitative variable ranging between 60 and 100. Moreover, we control for the field of study, grouped into the following categories: health, economics, social sciences, scientific, humanities. Due to institutional changes occurred within the period under study, degree course in the law school have been excluded from the analyses.

At each step of the step-by-step modelling of student trajectories we find the effects usually reported in the literature: less dropout and higher graduation probabilities for students enrolled at younger age, for students

[8] The majority of these upward moves are from 3-year scientific degrees like biology or chemistry to the 6-year medical school degree program.

[9] Our model can also be seen within the framework of dynamic discrete choice models, as a special case of that proposed by Cameron, Heckman (2001).

coming from traditional lyceums (followed by other lyceums, technical schools and vocational schools) and with good prior scholastic performance. Gender differences exist and are substantial (girls do better than boys), but reduce and often disappear once we control for prior schooling and fields of study. Different outcomes are observed also by field of study.

As regards degree changes, we observe that the risk of experiencing a horizontal degree change (towards another 3-year program) relative to continuing in the original one is larger for students from non-academic tracks and students with low high school marks, whereas the probability of changing towards a 5/6-year program (mainly medical and law schools) is higher for students from more advantaged schooling backgrounds. Instead, older students have a lower probability to make a degree change of whatever type. Students who have experienced a horizontal degree change are more likely to drop out in subsequent years and also to make another change and, not surprisingly, take more time to attain the degree.

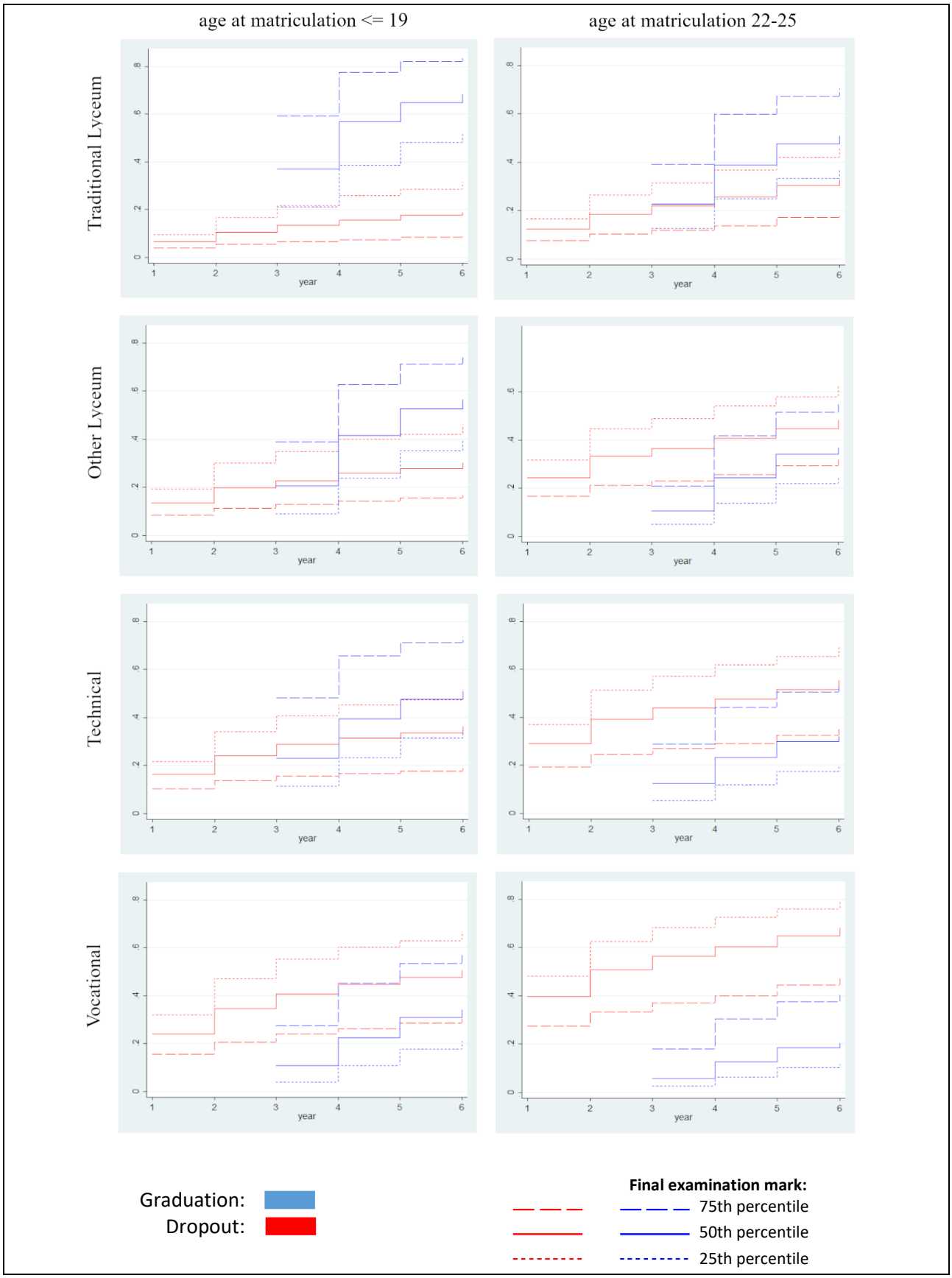
The estimates of the Cumulative Incidence Functions for females of selected profiles defined by age at matriculation, school track and final high-school examination grade of the students matriculated in 2008 and enrolled in 3-year degree courses (BA) are depicted in Figure 1.2[10]. On the left side we consider individuals who first matriculated at age ≤19 (the regular age of end of high-school), on the right side individuals matriculated at age 22-25. Blue lines depict graduation probabilities and red lines dropout probabilities. The solid line refers to students with a median high school mark, the dashed line to students at the 75th percentile ("high mark") and the point line to students at the 25th percentile ("low mark"). As mentioned above, females do better than males, but when adding controls, the differences largely fade away, so the outcomes corresponding to males are very similar to those shown in the figure.

Both dropout probabilities and graduation probabilities vary markedly along these dimensions. Consider younger students from traditional lyceums (upper left panel) as an example. For students with high marks in high school we estimate a probability of 54% of attaining the degree within 3 years and 82% within 6 years. The withdrawal probability within 6 years is 10%. The remaining 8% is the quota of students still enrolled after 6 years: in general, an indicator of system ineffectiveness. As we move towards lower high school marks, the picture deteriorates. Academic careers of students of school types different from traditional lyceums are substantially poorer. Students from other lyceums and technical schools display similar patterns, and high mark students from these tracks behave similarly to medium mark students from traditional lyceums. Outcomes further deteriorate for students coming from the vocational track Among those delaying entrance to 22-25 years old (right panel), the large majority leaves the system before degree completion.

Altogether, it seems that only the outcomes of very well performers from lyceums, enrolling with no delay after high school, may be considered "good" outcomes. Our estimates show that the issue of effectiveness involves students from all schooling backgrounds, including those exiting from academic oriented high schools with average prior performance levels.

[10] The reported CIFs refer to the average student with a specific profile (where "average" is with respect to the field of study). In practice, this is obtained by taking a population of N=20000 individuals with a given profile, simulating the choice of the field of study and then simulating the trajectories given the fields of study.

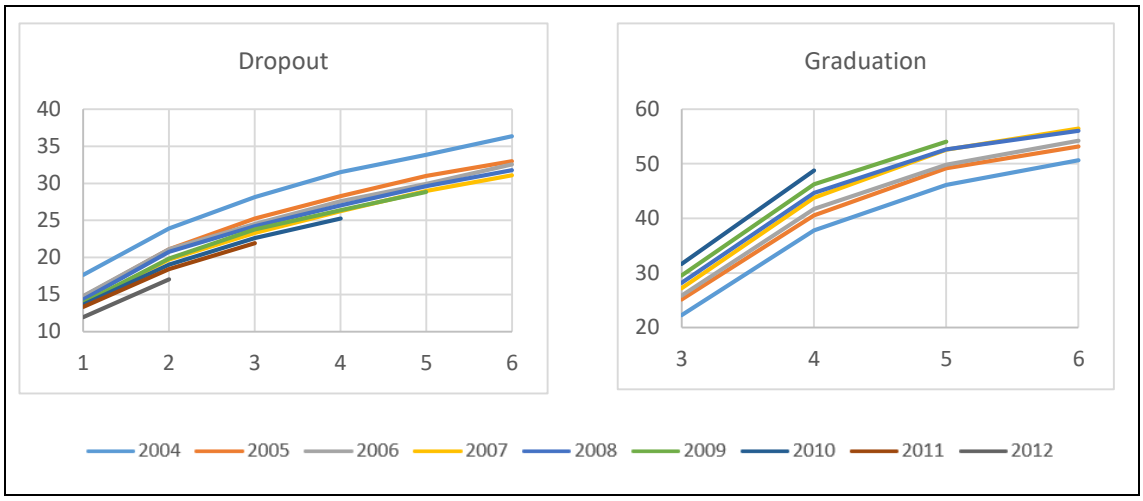
Figure 1.2. CIF estimates for individuals enrolled in 3-year degree programs, by age at enrolment, school type and final examination mark (matriculation cohort 2008)



1.4 Time trends

In Figure 1.3 we show the raw probabilities of withdrawing university and graduating within 1-6 years from matriculation for students enrolled in 3-year programs for cohorts 2004-2012. Since the end of the observation window for this work was end of 2013, we could not observe 6 years for all cohorts (for this reason, the lines are shorter for the most recent cohorts). Dropout probabilities and the share of graduates increase steadily over time. This evidence is consistent with the national figures reported by ANVUR (2016).

Figure 1.3 Cumulative dropout and graduation rates within 6 years from enrolment, by matriculation cohort, BA degrees (3-year programs)



As shown in Figure A1.1 in this chapter's Appendix, the composition of students has changed markedly at the University of Torino in these years. In particular, the share of students from technical and vocational degrees decreases markedly. Students enrolling with large delays after the end of high school have also been decreasing. In the light of the results on the individual determinants of student academic careers, the question is whether this improvement is explained by compositional changes.

To analyse time trends we focus on 4-year outcomes. Starting from the estimates of the step-by-step multinomial logit models, we apply a Blinder-Oaxaca-like decomposition of the observed changes in the population-level *CIF* estimates at time 4, i.e. on the probability of dropping out within 4 academic years and the probability of graduating within 4 academic years. We choose this threshold, because 4 years is a reasonable amount of time for graduating in a 3-year program, given that the share of students graduating within the institutional time is actually quite low. The aim is to evaluate the extent to which the differences in selected outcomes for two cohorts are related to the different composition of the populations of students enrolled (i.e. are *explained* by the different composition) or instead to different "behaviour" (i.e. to changing model parameters), possibly entailed by organizational changes or different teaching practices or by changes in student attitudes.

More specifically, we assume that the decision process of the individual who attained a high-school diploma first consists in choosing whether to enrol in university and then the field of study: this defines the composition of the enrolled population in each field of study. What happens next – university careers – is expression of the

behaviour of the actors involved: students in first place, and the university institutions. Since data on all students eligible for university enrolment are not available, we cannot study the enrolment process, but only account for the distribution of the characteristics of the higher education student population at matriculation $f(X|enrolled)$. We may then analyse the probability of choosing a specific field of study given enrolment $P(F|X, enrolled)$, and the probability of different academic careers' outcomes $P(Y|F, X, enrolled)$ given the field of study[11].

In the end, the outcome's Y distribution for each matriculation cohort may be expressed as follows:

$$P_C(Y) = \sum_F \sum_X \sum_{track} P_C(Y|F, X, track) P_C(F|X, track) P_C(X, track) \quad (6a)$$

$$P_C(Y|track) = \sum_F \sum_X P_C(Y|F, X, track) P_C(F|X, track) P_C(X|track) \quad (6b)$$

where X are time invariant explanatory variables, F the field of study at matriculation and c the cohort of matriculation. Expression (6a) refers to the entire student population, expression (6b) to each track separately. In this framework, we may study how university careers change over time across cohorts by decomposing the observed change into three parts: a first one related to changes in the composition of the student body, a second related to changes in the choice of the field of study and a third one related to changes in "behaviour". Since this component is defined residually, rigorously speaking it can be interpreted as truly behavioural only conditional on all the relevant determinants being accounted for.

We apply this decomposition to the change between the outcomes of the two extreme cohorts for which we observe 4 years after matriculation, i.e. cohorts 2004 and 2010:

$$P_{222} - P_{111} = (P_{222} - P_{122}) + (P_{122} - P_{112}) + (P_{112} - P_{111}) \quad (7)$$

Subscript 2 represents cohort 2010 and subscript 1 represents cohort 2004, the first subscript refers to the composition of the enrolled, the second to the choice of the field and the third to behaviour. In practice, this decomposition is performed by means of simulations. Each "counterfactual" probability is estimated by combining probabilities relative to different cohorts. For example, we estimate P_{122} by applying to the population of the first cohort (2004) the estimated parameters of the model for the choice of the field of study of the second cohort (2010), and then the parameters of the academic careers' models of the second cohort. Since what varies is only the student body composition, the first term in parenthesis refers to compositional changes; similarly, the second term refers to changes in the pattern of choice of the field and the third to changes in student trajectories given individual characteristics and field of study.[12]

Results

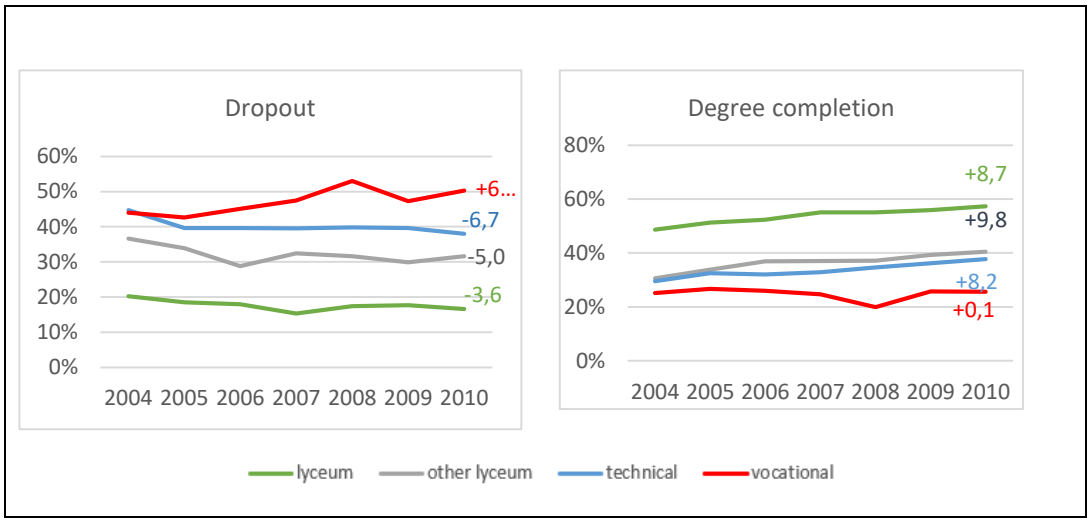
Consider the within 4-year dropout and graduation probabilities. In Figure 1.4 we report these probabilities for matriculation cohorts 2004-2010 (we do not observe 4 years after enrolment for later cohorts). However, these

[11] We consider here the choice of the field of study at matriculation. As described above, students may change degree course; the occurrence of this event is modeled within the CR modeling of students' academic careers.

[12] In principle, 6 decompositions are possible. We report only results relative to (7), as it seems to be the most meaningful one. The others are less salient because do not follow the hypothesized time ordering of the decision process.

changes are not homogeneous across high school types. Students from the vocational track do not benefit as the other subgroups. Their dropout rates – already very high in earlier cohorts (43%) – increase by more than 6 percentage points between matriculation cohorts 2004 and 2010, and the share of degree completion is stable around 25%. Instead, all other groups improve substantially in dropout and particularly in graduation probabilities. Recalling that they have become increasingly fewer in number, altogether these results suggest that students from the vocational track are being progressively marginalized from the higher education system.

Figure 1.4. Probability of dropping out or completing the degree within 4 years from enrolment, BA students, by high-school track and matriculation cohort



Is this descriptive picture driven by behavioural changes, or is it due to changes in the composition of the high-school subgroups enrolling at university, or to the pattern of choice of the field of study? The student composition has changed markedly over the observed time span. The share of students coming from lyceums has increased from 57% to 73% between matriculation cohorts 2004 and 2010, and students first enrolled before age 21 increased from 87% to 93%. This tendency also holds when we look at data by field of study, although the changes are marked for some fields (economics, scientific and health) and mild for others (humanities and socio-politics). Thus, we expect compositional changes to have contributed to the reduction of overall dropout rates and time to degree. However, the share of older students has increased substantially among students from the vocational track, and the mean final high-school examination mark has decreased for all school types.

Figure 1.5 shows the decomposition of the total difference in the 4-year dropout and graduation probabilities between matriculation cohorts 2010 and 2004. Since the share of younger students and from lyceums has been increasing, on the whole the university student-body population has become more positively selected. The reduction of the dropout probability can be partly ascribed to these compositional changes and partly to changes in individual behaviour. No role is played instead by changes in the pattern of choice of the field of study. Instead, the improvement in the graduation probability is almost entirely due to changes in behaviour.

Inspection of the changes observed within high school tracks provides additional insights (Figure 1.6). The improvements observed for students from traditional lyceums, other lyceums and technical schools are largely due to behavioural effects. Compositional effects are small: they contribute to a dropout increase for the first group and to a small reduction for the other two, and to a graduation probability decrease for all. Instead, the role played by changes in the choice of the field of study is negligible. A completely different picture is observed for the students coming from the vocational track. As mentioned above, this is the only subgroup exhibiting a (large) aggregate deterioration of dropout probabilities. This change is entirely due to compositional effects (probably because the average age at enrolment increases substantially over time for this group). Instead, stability observed at the aggregate level in the graduation probability results from the sum of a negative compositional and a positive behavioural component. We may conclude that, other things being equal, students from the vocational track do not experience a reduction in their chances to dropout, while they share with the other students an improvement in the within 4-year graduation probability.

Figure 1.5. Decomposition of the changes between matriculation cohorts 2010 and 2004 in the probability of dropping out and completing the degree within 4 years (population)

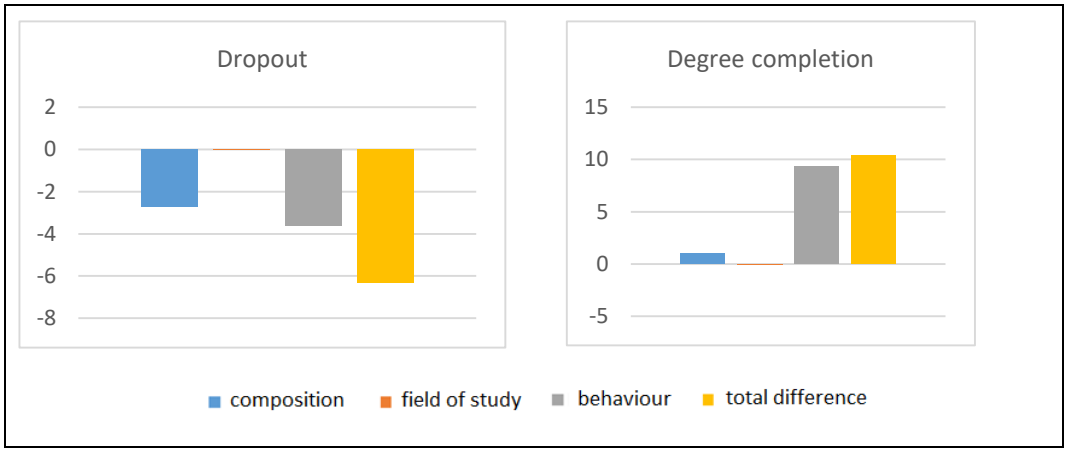
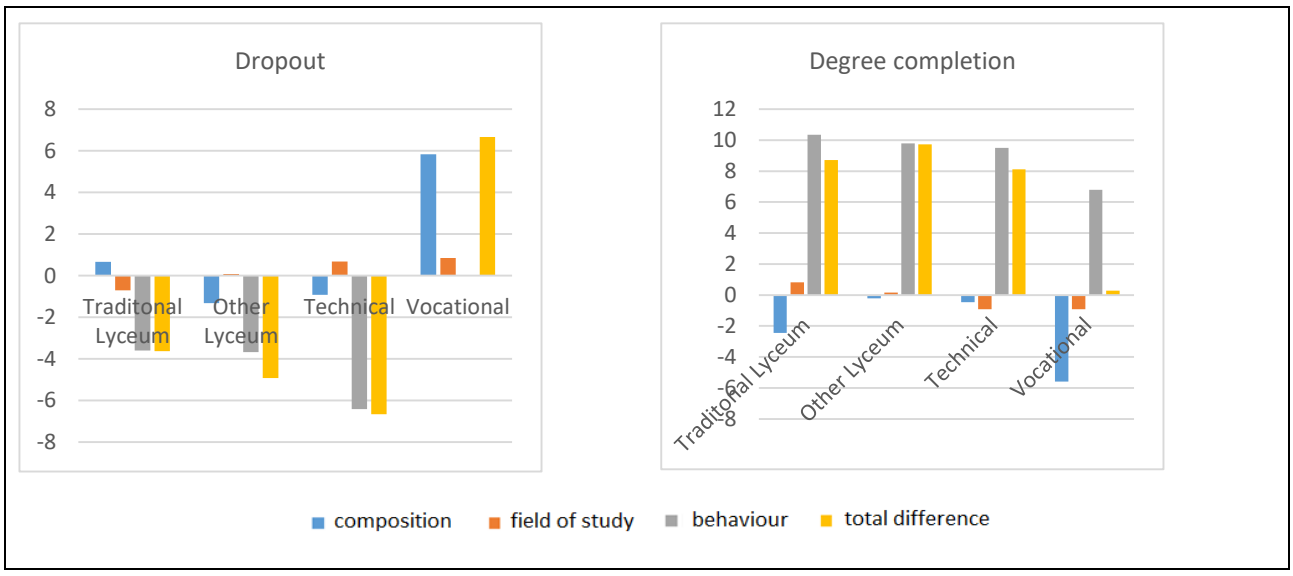


Figure 1.6. Decomposition of the changes between cohorts 2010 and 2004 in the probability of dropping out and completing the degree within 4 years, within high school tracks



1.5 Trends by field of study

When decomposing the observed differentials across cohorts by field of study we obtain heterogeneous results. In Figure A1.2 in this chapter's Appendix, we depict the raw trend in within-3-year dropout and graduation probabilities (blue line), the estimated trend we would have witnessed if only composition effects were operating (grey line), and estimated trend we would have witnessed if only behavioral effects were operating (orange line). Dropout probabilities decrease between matriculation cohorts in all fields, but the picture is much less clear than at the aggregate level. In the same period, timely graduation rates increase markedly in most fields, but changes do not occur smoothly across cohorts. Overall, there is clear evidence that the observed changes are not only nor largely due to compositional effects. Behavioral effects are relevant, but vary substantially across fields of study. The best performing is the area of economics, for which both retention and timely graduation rates have been constantly improving over cohorts (and are mainly driven by behavioral effects). Instead, the other fields have witnessed less clear patterns. This variability provides the empirical ground to identify the role played by institutional actions implemented at the level of departments or degree courses in contributing to the observed improvements in student career outcomes.

1.6. Conclusions

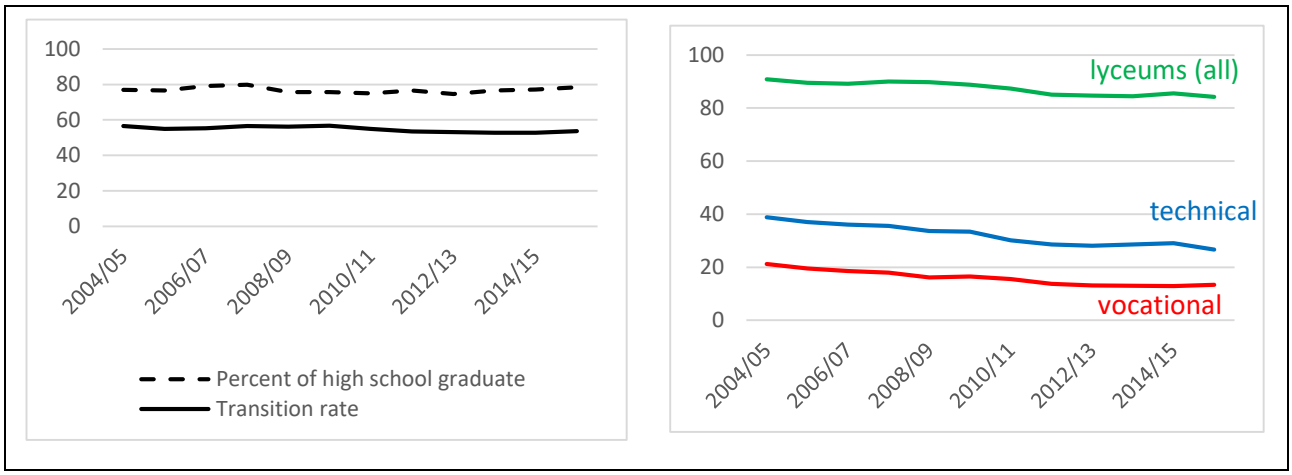
By analysing student academic careers with flexible competing risks models and depicting the results by means of Cumulative Incidence Functions, we have been able to highlight the existence of huge differentials in the student trajectories across high school tracks, prior performance and age at matriculation. Although the presence of these differentials is not new, in this contribution we have shed light on their magnitude, not easy to grasp from previous studies. The policy relevance of these results is evident. However, their interpretation is less obvious. Are these differences inevitable and perhaps even intended or should they be read under the lenses of social inequalities? Indeed, the different progression of students with different schooling backgrounds reflects their different preparedness. On the other hand, given the strong social stratification of high school choices in Italy, a heavy dependence of university outcomes on prior schooling reflects the existence of dramatic inequalities across family backgrounds. Moreover, these findings are in explicit conflict with the goal of the EU agenda to increase the inclusiveness of higher education and to provide opportunities to individuals from more disadvantaged backgrounds to enter and complete higher education.

When we examine changes over time we may take a more optimistic view: what we observe is an overall reduction of dropout rates and a progressive increase in the timely graduation probabilities across matriculation cohorts. The observed improvements in student trajectories are not mainly due to compositional effects, but instead, to changes in the behaviour of the actors involved. Students from all high school tracks have been exposed to steady improvement in their graduation probabilities. However, while students from lyceums and technical schools have also experienced a reduction in their chances to drop out, this is not true for the student from the least advantaged vocational track.

Finally, we have analysed patterns by field of study and behavioral effects are relevant, but vary substantially across fields of study. This raises a question. Why do we observe these differences? What is the role of contextual factors like institutional changes in university and conditions of the labor market?

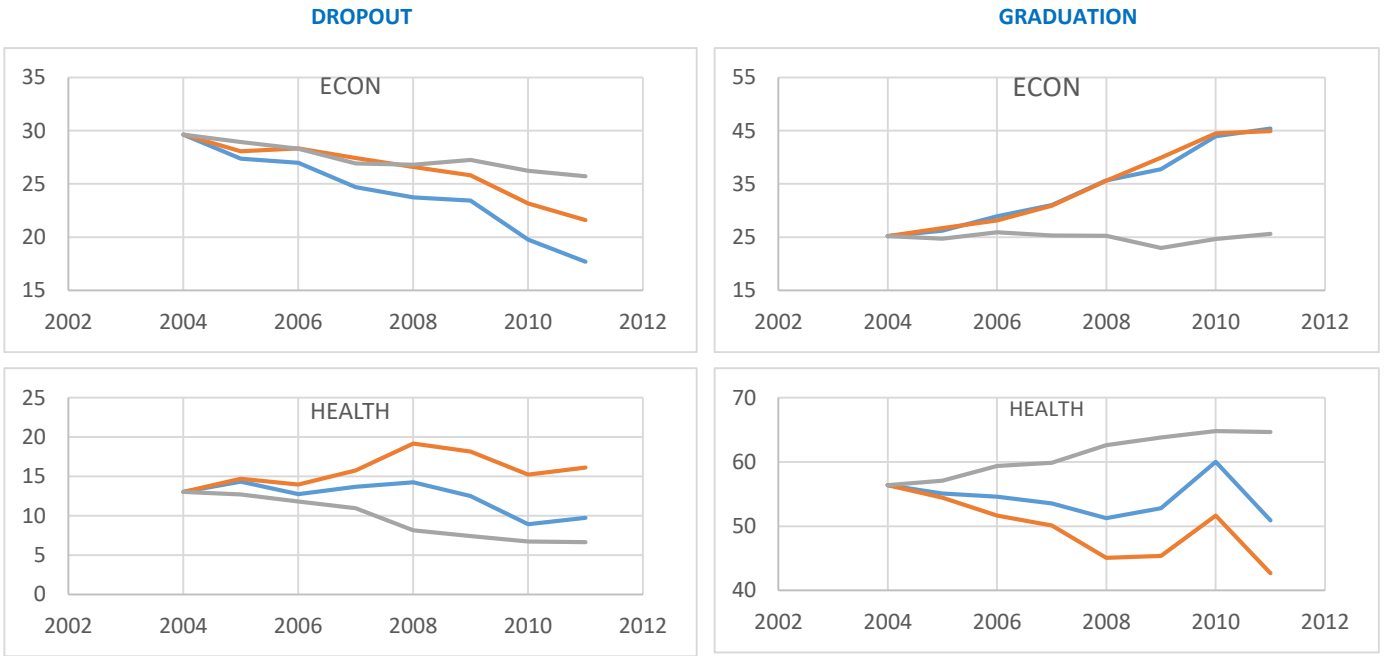
Appendix to Chapter 1

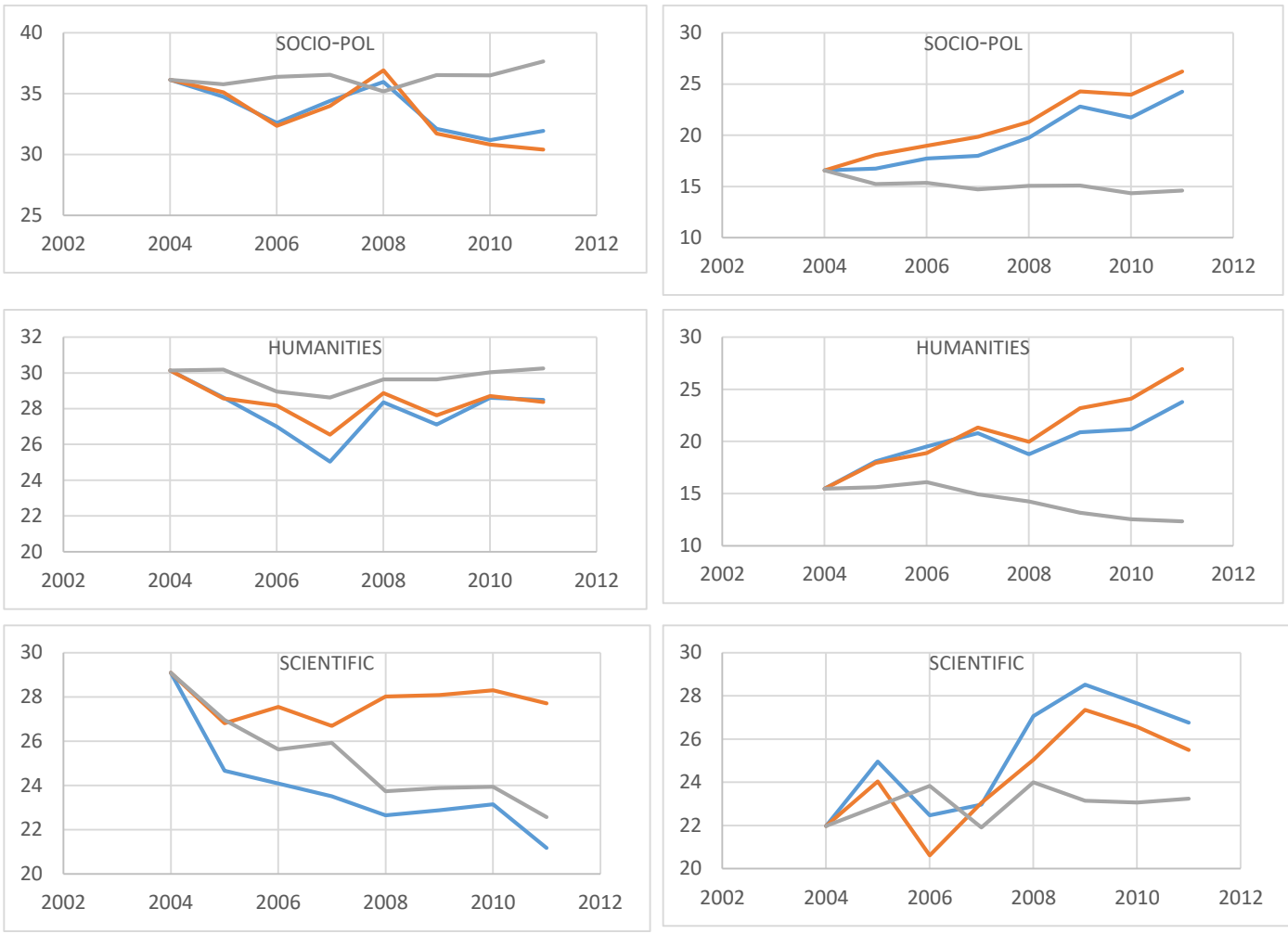
Figure A1.1 Transition rates from upper secondary to tertiary education



Source: Own elaboration from data reported by ANVUR (2016)

Figure A1.2. Composition/behavioural changes across cohorts. 3-year probabilities





NOTES. **Blue line**: total share of dropouts within 3 years (graphs on the left) and timely degree (graphs on the right). **Orange line**: estimated shares if only behavioral effects operated. **Grey line**: estimated shares if only composition effects operated.

Chapter 2

Institutional changes in university and implementation of actions: in-depth interviews to key informants

2.1 Introduction

As outlined in the research proposal the objective of the Work Package 1 (WP1) has been to detail *what* specific policies (regulations, incentive structure and interventions) were put in place during the time-span considered; and *how* these policies have been implemented. As Italian university and university governance have been involved by massive reforms and changes in recent years (Capano, Regini, & Turri, 2016), attention has been devoted to policies and interventions that could have been identified as specifically aimed at promoting students' careers.

Reviews, reconstructions and analysis of the numerous regulations and interventions that have been enacted at national level in the past years have been provided by a significant number of publications (Agasisti, Barbato, Dal Molin, & Turri, 2017; Borrelli & Stazio, 2018; Decataldo, 2018; Vaira, 2003). In this report we take a different, bottom-up, viewpoint. Instead of beginning from an overview or national regulations, we start from interviews with key informants and we identify the changes and regulations that has been perceived as being capable of promoting changes that might be relevant for promoting students' careers. In this way, we obtained three intertwined findings: we gathered information on the relevance of specific normative – national level – interventions; we have information on how these interventions have been interpreted and; we detailed the type of practices and action they have enforced at local level.

At the methodological level, key informants have been identified on the basis of their current or previous position within the University organization. We have realized 15 interviews in total. Three interviews have been carried out with key figures in the university governing bodies: 1) pro-rector with a delegation to didactic quality; 2) pro-rector with a delegation on tutoring and guidance interventions; 3) the president of the Didactic Commission within the Academic Senate. Besides their actual position offering them an important viewpoint on the issues at stake in this research, in the past these figures had been head of faculties and have been involved in various level university government in the timespan here considered. The remaining key informants interviewed were heads of Departments (Economy and Business Management; Culture, Politics and Society; Humanities; Sciences); heads of various degree courses within the same departments; administrative staff with an overview on past years interventions and changes.

Each interview lasted between one and two hours, was tape recorded and transcribed. Interview questions were differentiated according to the position key informants occupied within the university governance structure. In particular, the themes touched with informants occupying position at the level of the central

governing structure (CDA, Academic Senate, deputy-rectors) were asked to reflect on how the university responded to national reforms and regulation and on which actions have been implemented to produce changes at the level of Department and degree courses. Informants occupying these latter positions where asked questions about enactment of interventions as well as more in-depth reflection on how everyday organizational and professional routines and practice have been changing and about their possible impact on students' careers. All informants interviewed have been asked to reflect on the outcomes provided by our previous research on students' careers (cohorts 2004-2013) and have been involved in identifying possible explanations. In this respect, informants have been left relatively free to frame their answers according to their peculiar expertise and professional viewpoints, but further solicitations have been used to focus interviewees on issues pertaining institutional changes in terms of regulations or specific interventions.

Qualitative data have been analysed through a qualitative data software (Atlas.ti) which helped in coding the empiric material and to find recurrences, commonalities and associations among various processes elicited in the interview material. In the next sections, findings will be presented by following a structure which moves from the general to the particular. First, we will highlight the more general trends and changes that have involved the university institution that our informants have identified as meaningful to account for how students' outcomes have been changing through times. Second, we will point out our informants' perspective on if and how an incentive structure has been set up at the university level to steer departments toward an improvement of students' outcomes. Third, we will point out the role played by the increasingly pervasive introduction of evaluation and assessment procedures on teaching quality and students' careers. Forth, we will focus on the role played by the entrance of new cohorts of teachers, an element identified by our informants as one among the main levers through which the university structure is adapting to the reforming process characterizing the last decades with possible consequences on students' outcomes indicators. Finally, we will point out some of the factors involving institutional policies and practices at level of department and degree course that might account for specificities in students' performance according to disciplinary area.

2.2 The reorganization of university education

R: One of the issues at stake in the reforming process was that Italy had very high late of dropout and time-to-degree. What type of policies the university implemented in this respect?

I7: You are interviewing me as you think that there as been a policy at university level about this [improving students careers], but there was not such a policy. I have been in the Academic Senate for many years and I do not remember any discussion about this. In those years we undertook an approach which left almost total autonomy to Faculties, Departments, degree courses. And we did that choice, knowing that we might encounter problems in the implementation. The problem that we actually encountered. In those years the university entered very little in decisions on didactic policies.

I5: We have to consider that the 3 + 2 at the beginning was a like a little monster. At the beginning there has been the tendency to pack in 3 years what was before meant to be done in the traditional 4 years degree courses. Today, after many years, things are improving, all these actions of evaluation have increased our self-reflexivity and slowly the bachelor's degree are reorganizing themselves

I2: One of the most difficult parts has been to make teachers understand, for example, that 6 CFU in our area is 48 hours of lesson. So you cannot pack in 6 CFU what you did before in 90 hours of lesson. You have to adapt the

programme. But slowly, with discussion, with students' evaluation, etc, we have started thinking on the basis of CFU and to make more proper study-loads.

We start from these two quotations as they illustrate particularly well some of the recurrent themes emerged in our interviews with key informants. As we were looking for specific intervention and policies aimed at improving students' careers in the time-span considered, our informants solicited us to keep attention to more wide range structural changing dating back to the implementation of the dr. 509/1999 reorganizing university education within the framework of the Bologna Process. As outlined by various authors (Capano et al., 2016), the reform has been made operational by Italian universities very rapidly and without permitting an adaptation of academic culture to its spirit and objectives.

As outlined in particular in the first quotation, before subsequent regulations have been established (dr. 207/2004), a 'cosmetic operation' has been witnessed. The former degrees courses (generally lasting 4 years) have been packed in 3 years, or 3 + 2 years, courses. This has led in many cases to increasing study-load and to the definition of degree courses whose formative objectives lacked clarity from the perspective of the students. This had an impact on how the new organization of university courses did not had the expected impact in improving students' careers the immediately subsequent years (Trivellato & Triventi, 2015). At the same time, as our informants point out, the introduction of new regulations (in particular in 2004) and the slow adaptation of the academic culture to the objectives of the reform (third quotation) might have had an impact on slowly contributing to the reduction of dropout and time-to-degree indicator at a more general level.

Echoing analysis provided by previous research (Vaira, 2003), and as the first quotation acknowledge, the implementation of the reform has given rise to processes of negotiation between academic groups in a framework where the university did not display the capacity to orient faculties practices. The complexities arising from the rapid implementation of the reform left little room to design policies and interventions aimed to steer the reorganization of degree courses in more student-centred approach with the aim of improving the quality of teaching and tackling university dropout. In this context, being in charge of the didactics' organization, faculties played a key role. We have interviewed informants in the field of Science, Economy, Political Sciences, Humanities, Informatics. All of them have highlighted how Faculties constituted a key point of reference in the attempt to adapt the didactic to process of reorganization and, more specifically, in designing and enacting intervention aimed at support students in their study.

I2: Recently there has been this operation to organize tutoring services at the university level. But faculties have always had tutoring, support on degree courses, on specific subjects, particularly in the first-year. To me it was something normal, when I taught Chemistry having 2 hours a week someone an older student or a graduate student doing support exercises both during the course or afterward, before the exam. And this was something transversal along all degree courses.

In this context, we have tried to explore with more depth how the reorganization of university education has been implemented along various disciplinary areas. The aim was identifying structural or processual factors capable of accounting for differences in students career indicators. Moreover, as we will discuss in the next paragraphs, we have gathered interesting data capable of accounting for more general trends characterizing

institutional cultures at the level Faculties and Departments. These data refer in particular to different approaches in terms of how curricula and study programme have been subjected to constant changes through time with an eye on students' careers.

2.3 Monetary incentives to improve students' careers

Since the 1999 reform, incentives and measures have been defined by the Ministry of Education to improve the careers of Italian university students. Ministerial decrees in 2001 and 2002 funds specific measures to reduce dropout and time-to-degree. In the following years, in particular since the DR108/2008, parts of the resources allocated with the FFO have been defined on the basis of indicators regarding the quality of educational offer and on the basis of various indicators related students' outcomes (10% of the 'quota premiale' in 2010; 12% in 2011; 13% in 2012; 13,5% in 2013; 10% in 2014; 8% in 2015 and 2016). During the interviews, our informants have pointed out how, although regulations have been described as not always consistent, on a general level the governing body of the university of Turin have understood that improving students career would have been increasingly important for evaluation and funding allocation, even before these funding have started to be allocated on the basis of university performance.

> I1: Even though ministerial policy is not always consistent, it is clear that the direction is that you have to have students, the more the better, that they graduate, that they graduate in due time […]. This is a constant. If you put 10 million within the FFO as the ministry did recently, you understand that the incentive is powerful. But in our University I think that we were already structured to go in that direction, we understood the direction before and we started with and advantage.

As this quotation shows, the importance of improving students' career was clear at those occupying position within the university governance. In this respect, it is not a case that, since the 2012, indicators concerning students' performance have been identified within the university triennial strategic programming as particularly important to evaluate improvements. Similarly, it is not a case that since 2013 – as a result of the recognition of the increasing importance of improving students' performance – the rector appointed two of his deputy-rector with delegation on didactics and on guidance and tutoring activities. In accordance to the new empowered role defined by the law 240/2010, the *rectorship* has identified improving students' career as one among the key area of programming and policy implementation of his mandate.

Improving students' outcome need to engage a variety of actors positioned at various level of the institutional organizations (head of departments and degree courses, teachers, researchers, administrative staff). Thus, beside specific intervention that have been implemented in particular since 2014 and promoted directly by the *rectorship* (tutoring services and programmes to improve students' at-risk academic knowledge and, more recently, soft-skills), our investigation has tried to identify those policies capable engaging actors positioned at lower lever of university structure to participate in a shared project of improving student careers. In particular, our attention has been directed toward criteria associated to the allocation of FFO at departmental level.

It could be hypnotized indeed that economic incentives may represent powerful 'steering' levers to engage head of departments and consequently head of degree courses to promote actions and changing aimed at improving students' careers. However, as the following quotation illustrate, this type of incentives have played a marginal role in this process.

> I1: From 2008 to 2012 funds to department were allocated on an historical base, on parameters that where mainly numerical. These funds have been stable. Today we have different parameters and things are changing, although very little. One part of the funds are allocated on the basis of students equivalent number. One part is allocated on other principles, such as how many teaching hours have been done outside the department, the number of students in due course… and there is also a part based on the costs of laboratory didactic.

Interviews point out, the financial lever has never been particularly influential in steering departments (and consequently degree courses and individual teachers) to improve students' performance, as the allocation of the FFO to departments has not been based on indicators related to students' careers. On the contrary, informants highlight two major processes that has been more relevant in this respect and which relate to accountability processes in a context where institutional performance is not directly associated with funding allocation: the establishment of formal assessment and evaluation procedures; and, intertwined with the former, informal pressures and broader changes in the academic profession.

2.4 Assessment and Evaluation

Interviewees positioned at different level of the institutional structure and within different disciplinary areas, almost consensually, have identified the normative on "minimal requirement" (d.m. 544/2007) as one among the first ministerial inputs soliciting a change in the academic body approach to didactic quality.

> I4: I think 2007 has been the moment where I remember we have been particularly engaged with the minimal requirement normative which has produced a big change. Before, there was a system where you needed 100 teachers, if you have them it was ok, regardless their disciplinary sector or where they were teaching. In that period, we have all been embarked in trying to find correspondence between teachers, scientific sector and the teaching associated to teacher. There has been a global much more accurate counting. We have been forced to be more careful, and of course this has improved the didactic. Not only it has improved the recruiting so that it has become to be more related to sectors where there were effective needs.

Although it has been mentioned the existence of practices aimed at 'gaming the system' (Broucker, De Wit, Verhoeven, & Leisyste, 2019; Espeland & Sauder, 2007; Musselin & Teixeira, 2014), new regulations have been pointed out as capable of sending academic body a signal about the growing importance of planning recruiting strategies in accordance to didactic offer and to students' needs. In the long run, this might have had an impact in increasing the number of teachers engaged in teaching within their scientific sectors and a possible improvement of teaching quality.

Alongside 'minimal requirement' normative, our key informants have identified a second intertwining element contributing to promote more students-centred academic practices in the introduction of the AVA system (2013) and in the strengthen role of the Internal Evaluation Committee (Nuclei di Valutazione) with the task (among other) of assessing teaching, submitting results of its assessment to university management to be used for strategic planning. As this unit is also responsible for reporting and operating in conjunction with

the National Agency for Evaluation (ANVUR), it has been considered as an important governing dispositive through which actors positioned at various level (university management, head of degree courses, etc.) are incentivized do improve their practices.

> I9: In my view these structures that have been created (Presidi di Qualità, Nuclei di Valutazione) they work with good results. They do continuous auditions. For example the Nucleo di Valutazione say 'what audition do we do this year?', and they do like three departments and three degrees in those departments. And they listen to us, they make critics, comments. There are moments of tensions of course, but they are positive, they say 'look, in this way it is not working well', and we register what they say… and we discuss like that in a heated meeting for like 50 minutes with the head of the degree programme, the teachers that works in the student-teacher joint commission. After those 50 minutes, students get in, without their teachers so they can feel free to expose their problematics which sometimes converge with those elicited by the teachers, sometimes not. So you can hear the students saying 'Ok, this is true, but the teacher ask us to study three monographies without having explained anything about them'. So than the teacher is heard and the head of the degree and… this is what it is constantly done nowadays.

We have reported this long quotation as it illustrates particularly well the functioning of the procedures of evaluation, monitoring and constant improving that are operated through the work of university evaluation units. These procedures constitute a key moment of evaluation which, however, are connected to the spread of other moments of more or less formalized processes of evaluation carried out at the level of Department and degree courses. As the above reported quotation shows, and as other interviewers have pointed out, these evaluation processes are contributing academics at various level of the institutional structure to change their practices and attitudes in order to take into consideration students' needs and students' viewpoints.

Of course, this may entail drawbacks and we will discuss them briefly further. However, if some general improvement of students' outcomes in the past years has been witnessed, it must also be related to changes in academic practices and attitudes that has been enabled by the evaluative procedures described above.

Beside the more or less formalized 'pressures' which are steering academics to re-shape their study-programmes, didactic methods and exam requirements, interviews have also revealed significant actions aimed at re-structuring some of the features of degree-courses' architecture in order to facilitate student transition, in particular during their first-year.

> I6: In the last ten years we have changed, adjusted almost every year something in the structure of the curricula. For example, at the first year had Mathematic, Financial Mathematics and Statistics.. in 2011 we have redesigned this, so now we have only two exams Matematica per l'Azienda and Statistics. We have drastically reduced the weight for students.

> I5: At the beginning there were exams without much linkage between them (*propedeuticità*). So the problem was that some exams that was perceived as more difficult, students did not even tried to do it in the first year.. so this caused delay in the graduation at the end. Now we have a much more rigid structure and much more clear. Students do not have optional courses in the first two years anymore. They are in a structure that is more rigid and this allow them to go faster.

Although we have found differences among departments in their attitude to design and implement particularly significant changes in study programmes' architectures, interviews revealed that continuous attempts to introduce measure capable of improving students' outcomes constitute a significant expression of broader transformations of the academic culture and profession. These changes can be represented by shared

attempts to change the number of exam sessions (in general increasing them) in order to respond to students requests; by the introduction of incentives for on-time-graduation; by the decreasing weight and engagement required for the final-examination; by the increasing weight associated to stage or internship experiences that, conversely, reduce the amount of work required for exams.

Further, subtler changes might for example be illustrated in the following quotation. Within a framework where work-load per credit is defined by ministerial regulation and which allow study programmes to define which is the balance between students' engagement in frontal-lessons and in individual working hours, it is possible to experiment specific adjustment in order to avoid an excessive study weight for students.

> I11: we are experimenting a reduction of the number of frontal lesson hour we do for each credit. At ministerial level one credit is 25 hour of student work. We had chosen to dedicate 10 hours of this 25 hours for frontal lesson and 15 for individual, at-home, work. Because we thought that it was important for students to work also in the classroom with other students, doing exercise together and so forth. But the result is not always what we expected, because for example some teachers use those 10 hours not to do exercises, but to provide more contents… which than students have to study at home by themselves. So, we have reduced the number of frontal lesson hours to 8 in order to lighten a little bit the study weight.

Overall, interviews reveal how evaluation and assessment procedures and the increasing pressures to improve students' outcomes are mobilizing academic actors (both individually and as organizations) in developing a variety of heterogeneous practices. Further research is needed to ascertain in which way these practices are affecting the quality of educational offer and study programmes. It is quite shared among our informants the perception that over the time, and in general terms, there has been a reduction of the work-load for students: an outcome which cannot be judged as positive or negative if the possible changing in teaching quality is not examined. In this respect, however, an element of complexity needs to be highlighted.

Our interviews have clearly point out the need to look at the broader picture and, in particular, to other evaluation, assessment and performance-based rewarding mechanisms involving institutional structures as well as academics individually. We are referring here to what has been identified the enormously more relevant field of scientific research.

FFO allocation and recruiting policies are indeed mostly based on performance evaluation on the basis of scientific research. Scientific research is what is taken into consideration within the ASN procedures (although professorships involve *both* researching and teaching). In synthesis, both resources provided to institutions and individual academics careers are almost completely conditioned by scientific research outcomes. Interviews point out how that – even if new units for evaluation and evaluation procedures are encouraging academic self-reflexivity – current regulation and funding allocation (in a context of increasing competition due to budget constraints) are pushing actors to adapt their practices to respond sometimes superficially to standards of quality and assessment mechanisms.

> I8: In our department we have invested a lot on didactic, we are persuaded that there is not an opposition between didactics and research… if not regarding individual academics' time balance... and the situation here is dramatic. If I am evaluated on the basis of my publication, and I doing a honest, very good didactic, this penalize me. Doing a good and honest didactic with the numbers that we have, with the structural problems that we have… it means that we

should have less students. Do we want a university with less students but more prepared? This are the contradiction we are into.

2.5 Teachers' cohorts

Discussing about changes occurred in the timespan considered at the micro-level – i.e. in the everyday routines of teaching activities and of teachers-students' relationships – our informants shared the view that teachers turn-over might have had an impact on an overall improvement of students' careers.

In particular, it has been stressed that younger teachers – even though in a relatively precarious condition – display a relatively different approach in their relationship with students and in their didactic methods if compared to older professors.

Although in-depth research (possibly using observational-ethnographic techniques) would be needed to explore empirically this hypothesis, our informants have pointed out two main domains where these cohorts' differences can be articulated. On the one hand, younger cohorts of teachers may be perceived by students as more reachable, favouring teachers-students' interactions during lectureship as well as in more informal settings. As retention literature has widely shown, higher level of interactions facilitates students' engagement, sense of belonging, and study success (Chambliss & Tackas, 2014; Tinto, 2012). On the other hand, it has been stressed that younger cohorts of teachers have been professionally socialized within the broader reforming processes briefly outlined above. This might imply that their teaching and examination practices – in more or less explicit ways that need to be explored empirically – are shaped by a more student-centred approach (i. e. more emphasis on competences vs disciplinary knowledges, attention to the overall formative objectives of degree courses, a higher interest toward didactic innovation, etc.).

As the following quotations illustrate, younger cohorts are perceived as capable of taking charge of the more 'positive' aspect of the reforming process leading a change toward university practices more concerned with students needs and teaching quality.

> I9: The teaching body has evolved. There has been a relevant transition in terms of personnel, a relevant turn-over during those years, and this has brought younger cohorts of teacher to get in. These teachers, of course we couldn't say that they "born" with the Gelmini reform. But they are certainly more sensitive to students needs, to the need to improve students' careers, to all these evaluation and assessment needs, if compared to me for example as well as other professors of my age. These new cohorts took charge of interpreting better the 'positive' part of the Gelmini reform, they have been useful to lead a transition toward, I would say, more responsible and mature attitudes.
>
> I6: Having more young teachers coming in might have played a role. Because they change didactic methods, because they have done experiences abroad, because they have seen realities that are different from the one that are more common in our universities.
>
> Researcher: maybe they have also contributed to modified their targets, their requests to students?
>
> I6: mmh.. in my view it is more about improving didactic..
>
> R: in which way?

> I6: in my view younger teachers are more capable of doing a more interactive didactic, based on active engagement, on team-work, they use case-studies to make students really understand in practices the concepts they are discussing… this is very different from the traditional didactics where I teach in disciplinary terms my subject and you study on your own.

The above quotations show vividly how a process of change in the everyday life of university practices might have been led by younger cohorts of teachers. Our informants have mainly stressed that personnel turn-over might have had an impact on improving teaching quality and on making university practices more responsive to students' needs.

However, it must also be noticed that younger cohorts of teachers have been also more heavily exposed to a precarious academic career, to the need increase their research 'productivity' in order to navigate an increasingly competitive academic market. Younger academics, in other words, have been shaping their professional habitus, routines, behaviours, dispositions, within a changing academic system intersected by the two above mentioned contradictory pushes: increasing teaching quality in order to make the system more efficient in terms of students output; and increasing research productivity in order to survive in the academic profession.

In this context it is not straightforward to ascertain in which ways younger cohorts of teachers have contributed to improve students' careers. It is probably true that being exposed to increasing pressures to improve quality, being responsive to students' needs, and being more internationally mobile, might have pushed toward the enactment of didactic innovation.

It is however also possible that 'adaptive' practices – such as being less demanding toward their students – are also at stake in order to reach a teaching/research balance capable of not undermining their academic survival or progression.

Overall, however, it should also be noticed that – considering the specificities of the academic profession, which favour greater flexibility and autonomy in determining working hours – the latter balance should be expanded to become a teaching/research/personal life balance. In this respect, processes of adaptations to the growing and sometimes contradictory pushes of being accountable, evaluable, productive, quality sensitive, etc., produce increasingly relevant consequences on the overall personal, familial, health and psychological well-being of academics that, as research is showing in recent years, affect in particular younger cohorts of teachers.

2.6 Differences among disciplinary areas

As outlined in the previous chapter, alongside average improvements of students' outcomes in the timespan considered, our data show remarkable differences among disciplinary areas. Our investigation has thus attempted to disentangle the factors and processes capable of explaining these differences. In particular, our design strategy has been to identify an area which has witnessed a particularly strong improvement and to keep particular attention to it.

This has led us to focus on the Economic area (in particular the degree-course in Business and Management) which display a significant, constant, improvement during the timespan considered as shown in the previous section.

Interviews have allowed us to identify the following factors and measures that might explain this pattern. Overall, our analysis reveal that it is difficult to ascribe changes observed to few overarching factors. A complex configuration of profoundly intertwined factors has taken place pertaining: the organizational domain; the institutional leadership and its impact on shaping the teachers' attitudes and, we can say, the institutional culture; the way through which the teaching/research balance has been managed at the level of the Faculty and, later, Departments.

1. <u>The organizational domain</u>

Our interviews have outlined two main changes occurred in the timespan considered that might be implied in the overall improvement of students' outcomes in the Economic area. The first one is concerned with the introduction, in 2005, of selective admission (*numero chiuso*) which has been removed in 2013 and re-introduced in 2017.

Selective admissions shape the composition of the student body increasing its affinity with the academic institutional culture and, consequently, favouring its capacity to cope with academic requests. Part of changings in the composition of student body can be identified relying on available data, for example those concerning students previous schooling paths and results. This has allowed us to distinguish between "composition" and "behavioural" effects (see chapter 1). However, a number of variables pertaining students' individual and social traits – that research has shown having an impact on university careers (initial commitment, sense of purpose, familial aspirations, available social resources, etc.) – remain unobserved and maybe intertwined with changings in more properly defined "behaviour" of agents.

Moreover: 1) as selective admissions may impact on student-teacher ratio at degree course level and it is somehow expectable that it favours more easy management; 2) during the years where selective admissions were not operating, systematic guidance activities for 'at risk' students at the beginning of the academic years have been implemented.

> I5: In those years were we did not have entry selection we were still doing a compulsory orientating test before enrolment in order to give students an indication, a message [...] We defined a minimum threshold and we have carried out individual interviews with all those matriculating students below that threshold to verify with them like: "did you expect that result?, "are you aware that you might encounter difficulties?" and so forth.

However, as selective admissions have been introduced in a number of different disciplinary areas within the university of Turin without experiencing a significant improvement of student outcomes, it is unlikely to conceive this mechanism as capable of accounting, *per se*, for the specific improvement of students' outcomes in the Economic area.

Looking at the organizational domain, a second features has been outlined by our interviews: a continuous adjustment of the study plan with a view of facilitating students' careers.

> I6: There has not been a big rupture. During the years we have changed the study plan almost every year. Every year we have changed credits, weights, we have eliminated or modified some exams that we believed as excessively demanding [...] we have introduced a bonus for those who graduate on time. So student run, because they have this bonus, because they have a quite rigid system where they do not have to choose subject, first years is the same for everyone, the second year is the same for everyone, the third year they choose an area of study… but it is not like that they have to choose subjects, they take a number of subjects in bloc… having options among different subjects makes your run more mushy, you have to inform yourself, you have to ask… here everything is already channelled and probably this push students to finish faster.

As this quotation shows, a constant focus on making students careers more 'efficient' has been put in place. It is particularly interesting that the 'race' metaphor is used in this interview to elaborate the way through which students' university experiences are framed and managed. It is also particularly relevant noticing how this metaphor align with wider policy discourses aimed at promoting an 'efficiency' paradigm within the higher education field (Gunter, Grimaldi, Hall, & Serpieri, 2016).

2. Institutional leadership and culture

A more in-depth analysis of interviews carried out among informants in the economic area at the University of Turin have revealed that the changes observed in the organizational domain outlined above need to be considered as part of a more general institutional culture shaped through the years. In this respect it is relevant noticing that a specific Faculty leadership might have mobilized the teaching body in developing a more student-centred approach having a positive impact on their careers as the following quotations show.

> I5: In this department, probably due to our leadership we have been somehow naturally inclined to give an incredible attention to students. A professor, now retired, told us younger teachers: "you see that door that is open now, it has to remain always open, because students should feel free to come in and make questions to any of us teachers". […]
>
> I6: To us, what has been said is that students should be treated in certain ways, that they have to be put in the condition to learn at their best.
>
> I10: When I arrived in this department at the beginning, we, in June, after the end of the semester gave students the opportunity to come to us in groups to ask questions. It was something extra, and unpaid, we were doing just to give students this further support.
>
> I6: In 2009, my director, now retired, spent 20.000 euros to take a group of psychologists to make interviews on a sample of our students to understand their weakness. We were asking, how these students were, what fears they had, why did they dropout? We put not only our head into that, but also Faculty money. They never gave money for research and to send me in US, but they put money to do this study! (laughing). This is to tell you that we have put energy and resources toward the students, probably more than the energy and resources we have spent in research.

These quotations have been chosen because they are particularly apt at exemplifying what can be defined as a specific institutional *habitus* (durable dispositions which orient choices, practices and routines) which in various ways has been shaped by past leadership or more correctly – but further research would be needed in this respect – by the complex articulation of leadership styles, teaching staff features, students' social composition and disciplinary specificities. It is within this broader cultural context that the specific

interventions outlined in the previous paragraph should be inscribed. And it is in this context that possible specificities in teaching practices and in students-teachers' interactions should be empirically investigated and interpreted. Moreover, as particularly evident in the last quotation above reported, it is in this context that should be read the specific position occupied by the Department of Economics and Management within research field (which is particularly low) testifying, once again, the existence – within the current institutional arrangement and evaluation procedures – of a trade-off between research productivity and students outcomes.

Table 1: Key informants

I 1	Pro-rector (delegation Tutoring, Guidance), deputy head of Faculty
I 2	Pro-rector (delegation on Didactic), former deputy head of Faculty
I 3	Teacher and rector's delegate for tutoring activities
I 4	Former head of Faculty
I 5	Head of Degree course
I 6	Head of Degree course
I 7	Head of Department, former president Senate Didactic Commission, former head of Faculty.
I 8	Head of Department, former deputy head of Faculty
I 9	Head of Department
I 10	Teacher and didactic manager
I 11	Head of department
I 12	Teacher
I 13	Teacher and didactic manager
I 14	Former head Faculty Administrative Staff
I 15	Head of Department

Chapter 3

Contextual factors: institutional changes in university and the labor market

3.1 Introduction

In our previous work described in Chapter 1 we analyzed student academic careers focusing on the role of individual characteristics. We analyzed in particular how the trajectories depend on previous schooling (type of high school, performance and age at matriculation) and highlighted the existence of huge differentials in the dropout and time-to-degree probabilities across student profiles. Although the presence of differentials was already well known, their magnitude was not easy to grasp from previous studies. These differences could be considered inevitable and perhaps even intended consequences of the Italian secondary school system or the product of severe social inequalities to be eliminated. Indeed, the different progression of students with different schooling backgrounds reflects their different preparedness. On the other hand, given the strong social stratification of high school choices in Italy, a heavy dependence of university outcomes on prior schooling reflects the existence of dramatic inequalities across family backgrounds.

We also analysed time trends in academic careers and showed that the observed improvements – increases in retention and timely degree attainment – were driven only in part by changes in the composition of the student body. We found substantial changes in the behavior of individuals given their (observed) characteristics, although analyses by field of study highlighted that these changes varied substantially across fields. This latter result has contributed to raise interest in the role played by the internal and external environment. To this aim, we now put attention to the *institutional changes* that have interested the university system in the past two decades. The Italian higher education system has been invested by a season of reforms started with the Bologna process since the beginning of the 2000s, leading towards a more competitive environment for the assignment of public funds. University funding began to be allocated according to their level of virtuosity and both quantitative and qualitative indicators were developed to evaluate their productivity. The process has interested the entire university system, but might have led to different organizational changes and actions across institutions (Atenei) and within institutions, by Facoltà and Departments. However, in the same years Italy has been hit by a long lasting economic crisis that does not seem to be completely over yet. For this reason, we also analyze how student careers depend on the conditions of the *labor market*. This is the topic of the research work presented in this chapter.

We do not engage here in a comprehensive literature review of the empirical studies on the effects of the institutional framework and management of universities. To give a few examples, Aghion et al. (2010) underlined the importance of the external environment, as measured by the degree of competition and autonomy from central government control of decision-making, faced by universities in the US and Europe as an important driver of performance in world rankings. They find that an exogenous increase in a university's expenditure generates more output, measured by either patents or publications, if the university is more autonomous and faces more competition. McCormack et al. (2014) focus on the quality of management within

university institutions. They found that departments in older and more research-intensive universities tend to be better managed than departments in newer and more teaching-focused universities. The main difference is in managerial practices with respect to incentives for recruitment and retention of academic staff. However, internal characteristics of the universities (e.g. management) as well as external features of the (political) environment in which higher education institutions operate, may not only determine how the university performs in international rankings in research and teaching. These factors may also influence student careers.

In this perspective, the present paragraph extends our previous work, by adding to the models of student academic careers indicators of institutional and labor market changes, varying over time and also between fields of study or structures in charge of teaching (Facoltà and Dipartimenti).

Institutional changes

As detailed in Chapter 2, we conducted a set of in-depth interviews with key informants (apical figures in the central governing body of the university, head of departments, head of degree courses) aimed at identifying the interventions and actions put in place at the level of Ateneo or Facoltà/Departments, that either had the explicit aim of improving student careers, or that could have had an indirect effect on student careers. Several potentially relevant actions emerged from the interviews: organizational changes of degree-courses (study plans; system selection based on the enforcement of 'numero chiuso'), incentives to in-time graduation (abolition of the final dissertation). Unfortunately, however, we are not able to incorporate these suggestions as time-varying explanatory variables in the quantitative analysis, because the information is not systematic for all fields of study, interventions are difficult to place exactly in time and are often characterized by many small actions put in place over time.

Nonetheless, our in-depth interviews described in Chapter 2 have underscored one point mentioned by many key informants, related to the turnover process and the progressive replacement of the teaching body by younger scholars, 'raised' in academia in parallel to the process of reforms and the increasing emphasis on accountability. Younger cohorts of teacher staff members might have contributed to improve student academic careers due to three – possibly coexistent – channels. The first is related to the incentive structure, markedly changed in the past years. In a context of a general reduction of funding to the university system, resource allocation as well as recruiting policies are now increasingly linked to performance evaluations of *research*. Scientific research is what is taken into consideration within the ASN procedures (although professorships involve both researching and teaching). This increasing competition has become particularly urgent for researchers that entered in academia in the recent years. Young researchers have strong incentives to focus on their research career and much weaker incentives to do well in teaching: this could turn into putting less effort into didactics, reducing the amount of work required for exams and teaching activities. A possible consequence highlighted in a number of interviews is the lowering of the learning standards for degree receipt, that could favor retention and reduce time to degree. Moreover, since younger cohorts of teachers have been professionally socialized within the broader reforming process and accountability practices that put increasing emphasis also on student outcomes (and to the parallel aim of increasing the share of young individual with tertiary degrees) they might have been conducive for organizational changes leading to an improvement of

academic careers, possibly (again) via a general reduction of the learning standards. More optimistically, young teachers might have promoted a general improvement of the didactics, being potentially more successful in attracting the attention of students and meeting their interests with a less 'professorial' teaching style or by using a wider array of technologically advanced tools along with new-fashioned approaches. Their teaching and examination habits could be shaped by a more student-centered approach, emphasizing competences vs disciplinary knowledge, and showing a higher interest toward didactic innovation.

Against this background, our assumption is that a larger share of staff members within teaching structures (Facoltà or Departments) from recent birth cohorts, entered in university in more recent years and more exposed to the above described incentives, will have a positive impact on students' academic performance.

Labor market conditions

Individuals react differently to adverse conditions of the labor market, according to preferences, risk aversion and other psychological traits. University students may form or adjust their predictions about the returns from education in the job market and evaluate the costs and benefits of education by looking at general labor market conditions on the one side, and the effectiveness of their degree on the labor market on the other. Therefore, we also include in the models two indicators of labor market capturing the employment prospects of the youth in general and of the graduates in each field of study.

3.2 Data and Modelling

We analyze the careers of students enrolled in bachelor (BA) programs up to either BA completion or dropout, in order to evaluate the determinants of successful vs. less successful trajectories and assess the extent to which students' academic careers are affected by institutional changes and labor market factors. We exploit administrative data provided by the Ministry of Education on the entire careers of the cohorts of students first enrolled at the University of Torino[13] (see Chapter 1 for more details) in a bachelor's program (BA) between the academic years 2007/08-2016/17. Differently from the analyses conducted in our previous work based on the elder matriculation cohorts 2004/5-2013/14, we cannot distinguish between system dropout and transfer from the University of Torino to another institution, thus by dropout we mean dropout from UNITO. We do not exploit data from cohorts 2004/5-2006/7 because the indicator of degree effectiveness (see below) is available only from 2008.

Academic trajectories are modelled with event history techniques, particularly well-suited to study the temporal nature of student academic careers (DesJardins 2006).[14] Event history analysis builds on survival analysis. Survival analysis aims at modelling time elapsed in a given state of a discrete-state process. When the event "exit" can occur only at isolated time points (say, at times T =1, 2, 3…), we refer to discrete time

[13] This is the largest of the two universities in Torino – a large city in the North-West of Italy with a longstanding industrial tradition, partially reconverted to the tertiary sector from the 1980s – offering degree courses at the BA, MA and PhD level in most disciplines. This institution occupies a middle-high position in national university rankings and has aggregate level dropout probabilities similar to that at the national level

[14] This section is largely drawn from the work of Contini and Salza (2019), see also Chapter 1.

models. In this context, the functions of main interest are the survival function $S(j) = P(T > j)$, the probability that exit will not occur up to time $T = j$, and the hazard function $h(j) = P(T = j|T > j - 1)$, the probability of exiting the state at time $T = j$ given survival up to time $j - 1$. Common specifications including explanatory variables are the discrete-time version of the proportional hazard model or, within the logit modelling framework, the proportional odds model (Jenkins, 2005). Competing risks (CR) models are extensions of survival models when exit from the state of interest may occur towards different destination states, and we are interested in considering the destination along with the timing of the exit event. Our case study fits this situation. Students remain in the university system until they either drop out (one possible destination) or attain the degree (alternative possible destination). Individuals are censored if they are still enrolled at the end of the observation window.

The literature on CR models has been largely developed within the framework of continuous time models. Discrete time models can be specified with multinomial logit modelling (Jenkins 2005). Considering matriculation cohorts separately, at each year, we use multinomial logit models to estimate the probability of all possible options (Table 3.1). At year 1, we estimate the probability of continuing in the chosen degree program, versus switching to another degree, versus dropping out. By 'drop out' we mean that the student, after having formalized enrolment for a number t of subsequent academic years (not ended with degree completion), does not re-enroll (at the University of Torino) in year t+1. In this case we will say that she has dropped out after t years. Similarly, we say that a student has graduated at year t if she attains the degree after t enrolment years. We distinguish between changes to 3 year programs and to 5/6 year programs. If the student drops out, she falls out of the risk set. At year 2, we consider only students still in the risk set and model choices within the same set of options. From year 3 graduation is also possible (instead, since degree changes are infrequent after the first years, we collapse them with the 'continue' option). Graduation is an exit state, like dropout.

Table 3.1. Options and exit states by academic year after enrolment

Academic year	Options	Exit states
1	CONTINUE, DROPOUT, CHANGE TO OTHER 3Y, CHANGE TO 5/6Y	DROPOUT
2	CONTINUE, DROPOUT, CHANGE TO OTHER 3Y, CHANGE TO 5/6Y	DROPOUT
3-6	CONTINUE, DROPOUT, GRADUATE	DROPOUT GRADUATE

More specifically, while survival analysis typically models the hazard function, CR models focus on the so-called *transition intensities* (Lancaster 1990):

$$h_v(j) = P(T = j, D = v|T > j - 1)$$

the probability of exiting at time $T = j$ (j years after matriculation) towards destination $D = v$ given survival in university up to time $j - 1$. Formally, the CR model, defined in a discrete time framework as a multinomial logit model, may be written as:

$$P(T = j, D = v | T > j-1) = \frac{\exp(\beta_{vj} X_{j-1})}{1+\sum_v \exp(\beta_{vj} X_{j-1})} \qquad \forall v \in set\ of\ options \neq 'continue'$$

$$P(T > j | T > j-1) = \frac{1}{1+\sum_v \exp(\beta_{vj} X_{j-1})}$$

Differently from conventional CR models, we distinguish between events of interest determining an exit from the state of interest (*final destinations*) and events of interest that we want to model (*options*), like the event 'change of degree program' (Table 3.1). We include a number of individual time-invariant explanatory variables (see below) as well as a time-varying indicator of whether the student has previously changed degree program. Moreover, we include 3 sets of dummy variables accounting for fixed effects of: field of study (according to the categorization defined by Almalaurea 'gruppo disciplinare'), matriculation cohort and year after enrolment (first year to sixth year, if not censored).[15] Finally, we include the time- and field-varying indicators capturing environmental variables, as described in the next section. In greater detail, the model specification becomes:

$$P(T = j, D = v | T > j-1) = \frac{\exp\left(\beta_v X_{j-1} + \theta(j-1) + \gamma_v LM_{y-1,f} + \delta_v U_{yf}\right)}{1 + \sum_v \exp\left(\beta_v X_{j-1} + \theta(j-1) + \gamma_v LM_{y-1,f} + \delta_v U_{yf}\right)}$$

Where j is the year after enrolment, X are individual characteristics including field of study and year of matriculation, LM are labour market variables, U university variables. Subscript y stands for calendar (academic) year and subscript f for the field of study.

3.3 Explanatory variables

Individual variables

We include several individual variables. Some were employed in the previous work described in Chapter 1. *Gender*, taking value 1 if the student is female and 0 otherwise. *Age at matriculation*, entering the models in a categorical form: 18-19, 20-21, 22-25 and more than 25 years old (age 18-19 as reference category. The *high school type*, classified as: *Lyceum* (reference category) including scientific or classical lyceum, Other lyceums (linguistic, socio-pedagogical, artistic lyceum), Technical schools and Vocational schools. The *high school final grade* is a quantitative variable ranging between 60 to 100. We also include two additional variables. The first describes the area of origin of the student (based on information of the region where the student has obtained the high school diploma), based on the classification: Torino (reference category), province of Torino (*Diploma region 1*), Centre-North (*Diploma region 2*) or South (*Diploma region* 3). The second is the equivalent household income (*Isee*), a measure of family economic derived from household income, parental wealth, and family size. We also include a dummy variable for missing *ISEE*, to handle the cases who do not disclose income (see Chapter 4 for a more in depth-analysis of this particular missing data problem).

[15] The model is employed here in a more compact form than the version used for previous work and described in Chapter 1. In that version, that we named step-by-step, we modeled each year and each matriculation cohort separately, because we aimed at providing very accurate estimates of the trajectories' probabilities for different student profiles.

Labor market conditions

Student behavior in university might be related to the effectiveness of their degrees in the labor market:[16] students may decide the amount of effort to put according to (perceived) opportunities. We assume that students make predictions on their degrees' effectiveness by considering the labor market outcomes recent graduates from their own degree program or from programs in the same field of study. In this perspective, we analyze the information on the labor outcomes of MA graduates provided by the Survey on Graduates' Employment Status (Almalaurea)[17] one year after degree attainment. We focus on the outcomes of MA students because the large majority of BA students do not enter directly the labor market (and those who do are a selected subgroup) and thus the outcomes of MA graduates might better represent the working prospects of all students.

We construct the variable ***Degree effectiveness*** as follows. Under the assumption that students from the University of Torino are mainly exposed to the labor market opportunities in the North-West of the country, we analyze the data of public universities in this area. We define a job "good" if a graduate enters the labor market and considers the degree obtained being effective or very effective.[18] Given that in today's labor market many students are involved in post-degree training programs that can be considered as first work experiences (stage, tirocini and also PhD programs), we consider their outcomes as well[19]. These students do not answer the question on job effectiveness, so we consider the job good if it is paid. Our index of *Degree effectiveness* is computed by 'gruppo disciplinare'[20], and is defined as:

$$Degree\ effectiveness: \frac{n°\ in\ \text{'good'}\ jobs}{n°\ working\ or\ in\ postdegree\ trainingor\ searching\ for\ work}$$

Our assumption is that students predict current labor market prospects on the basis of the outcomes of individuals who graduated the year before. Thus, the index is included in the models in a lagged form (each person/year is assigned the value corresponding to graduates in the previous year). Moreover, we compute this

[16] The few papers on the role of labour market conditions on enrolment and dropout in Italy reach inconclusive evidence. Focusing on the territorial variability of labour market indicators, Di Pietro (2006) finds a negative effect of unemployment on dropout rates. Instead, Di Pietro (2004) reports a negative effect on enrolment and no effect on dropout, whereas in Di Pietro and Cutillo (2008), the effect is insignificant on dropout but positive on enrolment. Ghignoni (2017) examines the effect of the recent economic crisis on dropout concluding that the observed slight reduction of the aggregate dropout probability is not due to changes in individual behavior but to differences in the composition of university students. Exploiting territorial variability Contini et al. (2018) find that dropout tends to increase and in-time graduation tends to decrease in high unemployment areas. However, due to the heterogeneity of the territories in a number of other aspects, these findings cannot be considered as causal effects of changing unemployment rates.

[17] AlmaLaurea is a consortium involving an increasing number of universities. Established at the University of Bologna in 1994, in 2010 it involved 62 Italian Universities, covering 77% of all graduates.

[18] Graduates are asked the following question: *What is the effectiveness of the university degree on your job?* Possible answers are: Very effective; Effective; Sufficiently effective; little effective; not effective.

[19] We exclude from both numerator and denominator those graduates that either do not search for a job or report being students enrolled in other degree courses.

[20] Considering the degree courses existent at UNITO, Almalaurea defines 11 disciplinary groups nested in 7 areas of study.

index by gender, as in certain fields gender differences are substantial (see Appendix for descriptive statistics by disciplinary group and gender).

Time trends of the index (for all students, males and females) are shown in Figure 3.1. Indeed, the largest differences are between disciplines: effectiveness ranges between around 30% for psychology and more than 80% for degree courses in the health field. Nonetheless, we do observe variation over time within fields. We observe an increase in effectiveness for economics from 2014, a U shaped pattern for humanities, psychology and the socio-politics fields (with the lowest value in 2013), a slightly decreasing patter for the scientific field. For some reason, the pattern for the law degrees presents instability in the latest cohorts.

To account for the general labor market conditions of young individuals, we use the gender specific youth unemployment rate (age 15-24) in the North-West of Italy (***Youth unemployment***), as reported by the Italian National Institute of Statistics (ISTAT). To some extent, this rate could be regarded as capturing employment prospects without the degree. Figure 3.2 shows the youth unemployment rate in the North-West of Italy: the index increases up to the 2014 and decreases afterwards, showing some recovery after the severe worldwide economic crisis that has hit Italy from 2008.

Figure 3.1 Degree effectiveness based on graduates' access to the labor market within 1 year after graduation, by broad field of study ('area disciplinare')

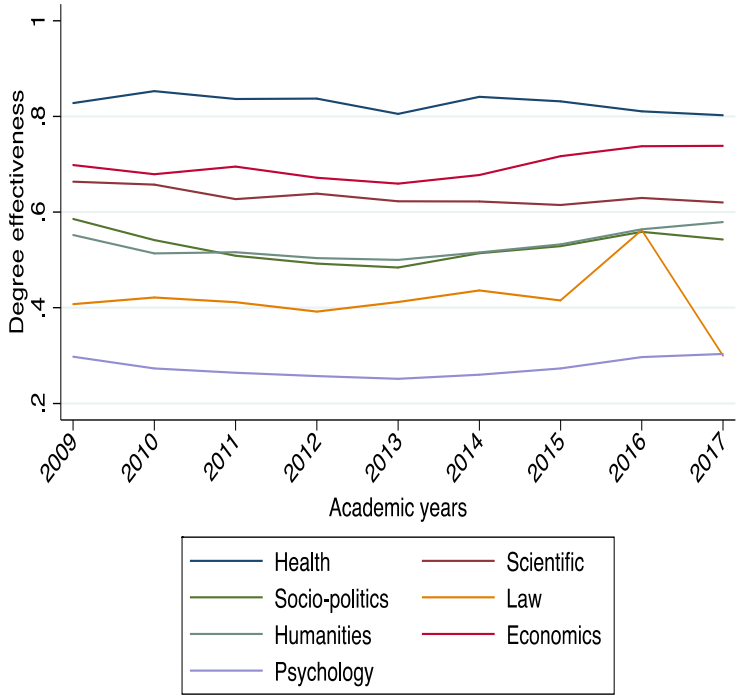
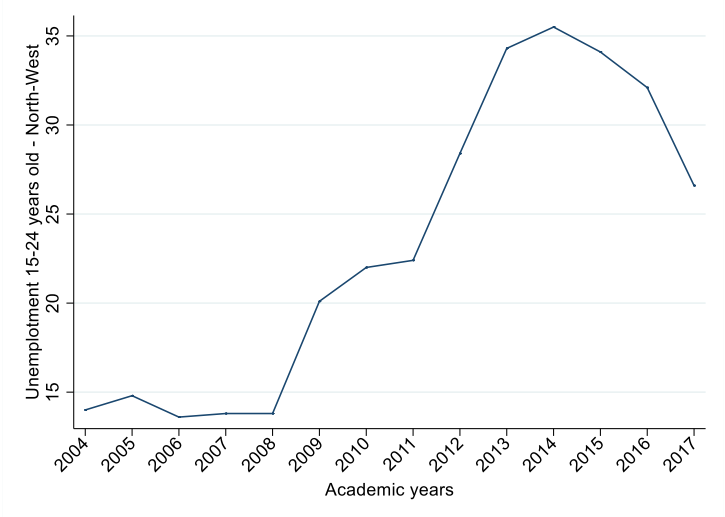


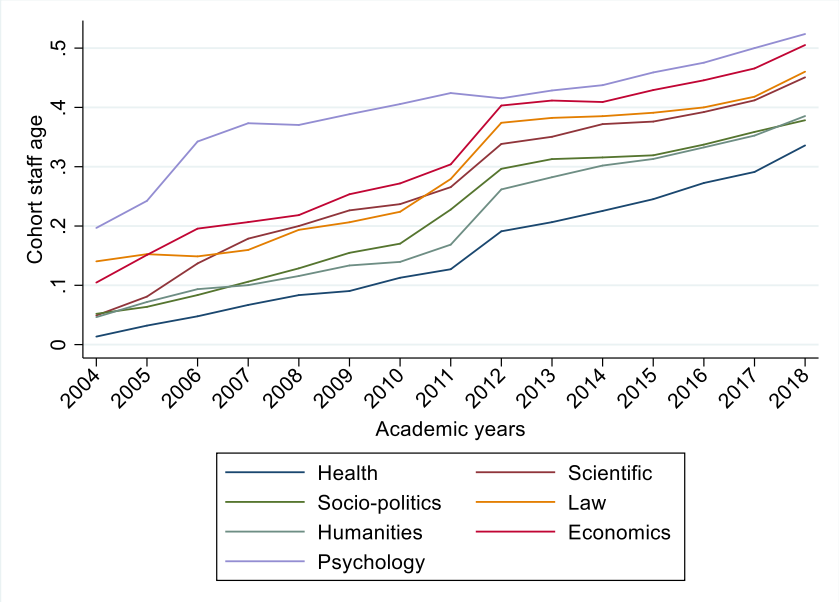
Figure 3.2. Unemployment rate of individuals age 15-24 in the North-West of Italy



University variables

Against the background described in the introduction to this chapter (subsection *Institutional changes*), we obtained from the university administration aggregate data on the year of birth of all permanent staff members (full professors, associate professors, permanent contract researchers) as well as all fixed term contract researchers (type A and B) working at the University of Torino in all the academic years under study. We define a variable measuring the share of academic staff born in 1970 and after (we call the variable *Academic staff cohort birth*), in each structure in charge of teaching (Facoltà up to 2011, Departments from 2012). Figure 3.3 depicts level and trends of the variables by area of study. The variable is attached to each individual according to the structure (Facoltà or Department) to which the students' degree course belongs to. Not surprisingly, the variable increases over time in all areas, although level and degree of change vary to some extent across areas.

Figure 3.3. Ratio of academic staff born >=1970 over the total academic staff, by area of study



3.4 Results

Figure 3.4 shows the share of dropouts and graduates by cohort of matriculation, the first within 1-6 years, the second within 3-6 years. While the share of graduates keeps increasing – implying a progressive reduction in time to degree – the share of dropouts has been falling up to cohort 2012, but slightly raising thereafter.

Figure 3.4. Share of dropouts (left) and graduates (right) within 1-6 years, by cohort

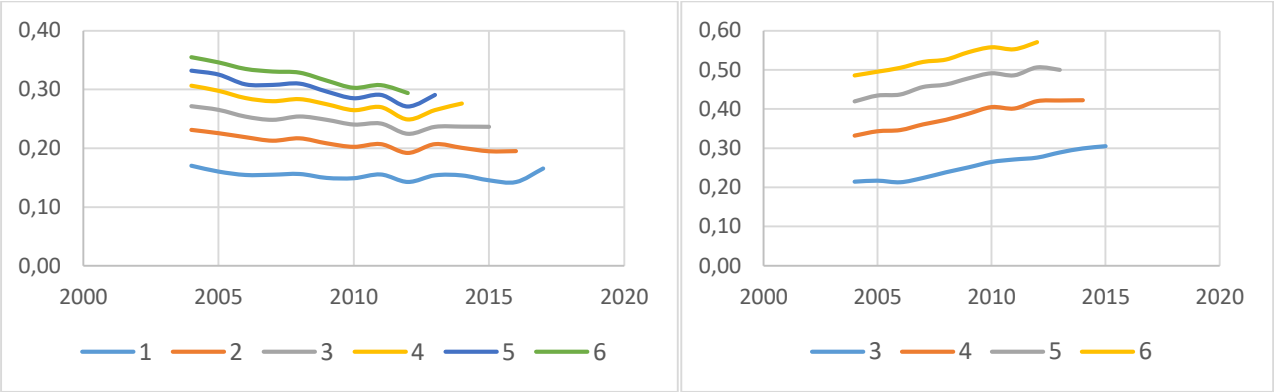


Table 3.2 shows the results of the estimation of the competing risks model, for the entire student population matriculated at age 18-35, using fixed effects for disciplinary group, as well as dummy variables for n° of years after enrolment (first year to sixth year if not censored) and matriculation cohort. In Table 3.4 columns 3 and 4, we also report the results of a model without the environmental variables, to capture cohort effects net of individual characteristics. Let us consider this model first.

Interestingly, we find little variability in the cohort dummy coefficients relative to the dropout probability, and only a weak *reduction* from cohort 2014. This implies that the observed rise in the latest years is due to composition effects (as shown in the Appendix Figures A3.2 to A3.4, the share of students from technical and vocational schools has started increasing in the latest years, after a steady fall in the previous decade). Focusing on graduation, the pattern in the model without environmental variables points to steadily and sharply increasing probabilities over time, in line with the descriptive pattern observed in Figure 3.4, implying that compositional effects do not drive the observed improvements.

Table 3.3 shows the results by area of study, with dummy variables for academic year, but no cohort dummies because there is not enough variation in the three environmental variables within the student population (computed by disciplinary group or area of study) to allow identification of the cohort effects.

With regard to individual characteristics, we find the usual results, in line with our own previous findings and the main contributions in the literature. Females are less likely to drop out than males as well as to be more likely to graduate in each academic year. Age at matriculation is also highly relevant: older students have a higher the probability of dropping out and a lower the probability of completing the degree. Relative to those who have obtained a scientific or classic lyceum, other things equal, having obtained a degree in other lyceums, technical or vocational schools increases the probability of dropping out and decreases the probability of graduation. The final examination mark is also important. Higher income students are less likely to withdraw

and the more likely obtain the degree. Students who have experienced a horizontal degree changes (from 3-year to 3-year programs) have higher probabilities to drop out in subsequent years and also to make another change and, not surprisingly, are less likely to obtain the degree.

Let us concentrate now on the effect of environmental variables.

Degree effectiveness. In the general model for all areas (Table 3.2) we find that a higher degree effectiveness corresponds to a lower probability of dropping out, consistently with the idea that good labor market prospects and possible higher perceived returns to students' own degree attainment affects motivation to continue university studies. Instead, we find no relationship between degree effectiveness and the graduation probability.

These results do not persist when running the model by area of study (Table 3.3). Considering the effects on dropout, we find a negative relation only in the field of humanities; most other areas display non-significant effects or even a positive effect (health, science). The positive effect – more dropout when own degree is more effective – is difficult to interpret if we assume that we are fully taking into account all compositional effects. However, if unobserved individual variables affecting the enrolment probability exist, when employment prospect are good (relative to other degrees) the share of students enrolling in that degree could increase. Attracted by positive labor market opportunities, more low-skilled individuals will be enrolling, raising the dropout probability. The rising share of enrolments of students coming from technical and vocational high schools, observed in recent years in the areas of Health, Scientific and Economics, provides descriptive support for this intuition (see this chapter's Appendix). Focusing on graduation, some areas (health and scientific) display a negative effect, other a positive effect (socio/politics). The positive effect implies that when employment prospect improve students graduate more quickly, to take advantage of the favorable conditions. The negative effect can be read as follows: when employment prospect decrease, the graduation probability increases (time to graduation reduces). This supports the existence of competition effects: the increasing competition over scarce job positions may induce students to attain the degree in time to give a good signal to prospective employers.

Youth unemployment. We find empirical evidence of a negative relationship between unemployment and dropout. Harsher labor market conditions, reducing the opportunity costs of education, reduce the likelihood of dropping out. However, our results also point to a positive relationship between unemployment and the graduation probability. This evidence does not support the opportunity costs explanation, as we would have expected lower graduation rates when students face worse labor market conditions. Instead, we can refer again to the increasing competition hypothesis, that may also induce students to attain the degree in time when labor market conditions are unfavorable in order to give a good signal to potential employers. These results are fairly stable across disciplinary areas, at least in terms of direction, although the effects are not always statistically significant.

Young academic staff. Finally, in line with our expectations, a high share of academic staff belonging to young cohorts decreases the likelihood of dropping out and increases the probability of getting the degree. As spelled out above, one possible explanation is that young academics may better meet the students' interests by

using a less 'professorial' attitude or employing more modern teaching methods. On the other hand, this empirical evidence could be also explained by the fact the young researchers have more incentives (even more than their older colleagues) to put little effort in teaching, thus possibly lowering learning standards and making degree completion easier. Still, the effect of young teachers' cohorts on student academic careers takes the opposite direction in the health and law fields.

3.4 Final considerations

We may sum up our results on the role of environmental variables as follows. Poor general youth unemployment conditions seem to reduce the dropout probabilities, supporting the decreasing opportunity cost explanation, and increase the probability of degree attainment, in line with the explanation of increasing competition over scarce job opportunities. The role of own degree effectiveness is less clear-cut. In the general model we find that a higher degree effectiveness corresponds to a lower probability of dropping out, consistently with the idea that higher returns positively affect the motivation to continue university studies, while we find no relationship between degree effectiveness and the graduation probability. However, the results – size and direction of the effects – vary by field of study. This calls for further research, to come up with a convincing explanation of why different mechanisms apply to different segments of the labor market. Moving to the teacher staff composition, we find results in line with the ex-ante expectations: in most fields, a high share of academic staff belonging to young cohorts decreases the likelihood of dropping out and reduces time to degree. More research is needed also to understand which of the above mentioned channels are driving these effects.

In Table 3.4, we also report results of a model that excludes the three environmental variables, in order to capture cohort trends net of individual characteristics. No large differences are observed on the dropout probability (cohort effects are always weak), but the observed rise in the latest cohorts seems to be due to composition effects. Instead, cohort effects relative to the graduation probability change sharply, from a strong increasing pattern when the environmental variables are excluded (columns 3 and 4) to almost no trend when they are all included (columns 9 and 10). Thus, these variables seem to explain most of the observed trend in the graduation probability. Moreover, when including either only the labor market variables or the teacher staff variable (columns 5-8), the cohort effects are substantially reduced but do not disappear. This additional result provides support to the evidence that both labor market and university institutional changes help explaining the observed reduction of time to degree.

Table 3.2. Competing risks model (in multinomial logit form). All areas

	Drop (1)	Graduation (2)
Female	-0.121***	0.062***
	(0.018)	(0.019)
Enrolment age 20-21 (ref. Age 18-19)	0.363***	-0.434***
	(0.018)	(0.020)
Enrolment age 22-25 (ref. Age 18-19)	0.641***	-0.605***
	(0.031)	(0.049)
Enrolment age 25+ (ref. Age 18-19)	0.875***	-0.575***
	(0.047)	(0.075)
Lyceum Others (ref. Lyceum)	0.588***	-0.638***
	(0.023)	(0.024)
Technical (ref. Lyceum)	0.686***	-0.553***
	(0.020)	(0.022)
Vocational (ref. Lyceum)	1.010***	-0.969***
	(0.025)	(0.033)
High School Marks	-0.033***	0.054***
	(0.001)	(0.001)
Isee	-0.008***	0.009***
	(0.001)	(0.001)
Isee missing	0.670***	0.427***
	(0.022)	(0.023)
Previous degree change	0.394***	-1.376***
	(0.028)	(0.025)
Degree Effectiveness	**-0.460*** **	**0.008**
	(0.174)	**(0.196)**
Youth unemployment	**-0.539** **	**1.583*** **
	(0.244)	**(0.303)**
Academic staff cohort birth	**-0.817*** **	**1.179*** **
	(0.148)	**(0.154)**
Diploma region 2 (ref. Diploma region 1)	-0.084***	0.216***
	(0.018)	(0.017)
Diploma region 3 (ref. Diploma region 1)	0.443***	-0.492***
	(0.031)	(0.036)
Diploma region missing	0.633***	-0.654***
	(0.066)	(0.134)
Academic year 2 (ref. Academic year 1)	-0.905***	15.336
	(0.020)	(628.784)
Academic year 3 Academic year 2 (ref. Academic year 1)	-0.951***	23.804
	(0.027)	(628.784)
Academic year 4 Academic year 2 (ref. Academic year 1)	-0.733***	24.091
	(0.033)	(628.784)
Academic year 5 Academic year 2 (ref. Academic year 1)	-0.470***	23.829
	(0.041)	(628.784)
Cohort 2009 (ref. Cohort 2008)	-0.019	0.065**
	(0.037)	(0.032)
Cohort 2010 (ref. Cohort 2008)	0.038	-0.000
	(0.039)	(0.039)
Cohort 2011 (ref. Cohort 2008)	0.093**	-0.028
	(0.042)	(0.045)
Cohort 2012 (ref. Cohort 2008)	0.061	-0.040
	(0.047)	(0.047)
Cohort 2013 (ref. Cohort 2008)	0.129**	0.006
	(0.050)	(0.045)
Cohort 2014 (ref. Cohort 2008)	0.075	0.060
	(0.052)	(0.045)
Cohort 2015 (ref. Cohort 2008)	0.092*	0.170***
	(0.053)	(0.046)
Cohort 2016 (ref. Cohort 2008)	0.073	-14.543
	(0.054)	(1,032.093)
Disciplinary groups	Yes	Yes
Constant	1.141***	-29.416
	(0.146)	(628.784)

NOTES. Standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1
Results for options characterizing exit states (dropout and graduation). Results for degree change omitted.
Environmental variables in bold

Table 3.3. Competing risks model (in multinomial logit form) by area of study

	Drop	Graduation
	(1)	(2)
	Health	
Degree Effectiveness	1.345**	-2.515***
	(0.568)	(0.413)
Youth unemployment	0.060	2.477***
	(0.763)	(0.525)
Academic staff cohort birth	2.333***	-2.479***
	(0.705)	(0.461)
Observations	29,133	29,133
	Scientific	
Degree Effectiveness	0.814***	-2.467***
	(0.192)	(0.205)
Youth unemployment	0.535	0.020
	(0.359)	(0.415)
Academic staff cohort birth	-0.905***	0.187
	(0.226)	(0.235)
Observations	45,830	45,830
	Socio-Politics	
Degree Effectiveness	0.254	0.550**
	(0.219)	(0.279)
Youth unemployment	-0.459	0.913*
	(0.392)	(0.480)
Academic staff cohort birth	-0.256	1.668***
	(0.255)	(0.271)
Observations	37,804	37,804

NOTES. Standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1
Results for options characterizing exit states (dropout and graduation). Results for degree change omitted.

Table 3.3. Competing risks model (in multinomial logit form), by area of study - continue

	Drop	Graduation
	(1)	(2)
	Law	
Degree Effectiveness	0.020	-0.441
	(0.452)	(0.547)
Youth unemployment	-2.260**	-0.000
	(1.045)	(2.122)
Academic staff cohort birth	-0.405	-3.185*
	(0.776)	(1.657)
Observations	5,830	5,830
	Humanities	
Degree Effectiveness	-1.288***	-0.237
	(0.134)	(0.149)
Youth unemployment	-0.020	0.565
	(0.407)	(0.433)
Academic staff cohort birth	-0.755***	2.844***
	(0.243)	(0.234)
Observations	58,367	58,367
	Economics	
Degree Effectiveness	1.046	0.884
	(0.756)	(0.659)
Youth unemployment	0.364	1.544***
	(0.466)	(0.445)
Academic staff cohort birth	-1.864***	1.545***
	(0.331)	(0.302)
Observations	43,559	43,559
	Psychology	
Degree Effectiveness	-1.528	1.048
	(2.133)	(2.240)
Youth unemployment	-1.478	1.557*
	(1.179)	(0.884)
Academic staff cohort birth	0.262	3.221*
	(2.106)	(1.787)
Observations	9,306	9,306

NOTES. Standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1
Results for options characterizing exit states (dropout and graduation). Results for degree change omitted.

Table 3.4. Competing risks model (in multinomial logit form), all areas, different models

	Drop	Graduation	Drop	Graduation	Drop	Graduation	Drop	Graduation	Drop	Graduation
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Degree Effectiveness	-0.503***	0.104			-0.480***	0.079			-0.460***	0.008
	(0.170)	(0.189)			(0.173)	(0.195)			(0.174)	(0.196)
Youth unemployment	-0.154	0.876***			-0.703***	1.920***			-0.539**	1.583***
	(0.188)	(0.192)			(0.238)	(0.298)			(0.244)	(0.303)
Academic staff cohort birth	-0.670***	1.510***					-0.949***	1.263***	-0.817***	1.179***
	(0.125)	(0.121)					(0.144)	(0.152)	(0.148)	(0.154)
Cohort 2009 (ref. Cohort 2008)			-0.003	0.165***	-0.041	0.102***	0.024	0.113***	-0.019	0.065**
			(0.030)	(0.029)	(0.037)	(0.031)	(0.031)	(0.031)	(0.037)	(0.032)
Cohort 2010 (ref. Cohort 2008)			0.023	0.250***	-0.002	0.099***	0.075**	0.116***	0.038	-0.000
			(0.030)	(0.029)	(0.038)	(0.037)	(0.032)	(0.033)	(0.039)	(0.039)
Cohort 2011 (ref. Cohort 2008)			0.033	0.281***	0.020	0.073*	0.126***	0.134***	0.093**	-0.028
			(0.031)	(0.030)	(0.040)	(0.043)	(0.034)	(0.034)	(0.042)	(0.045)
Cohort 2012 (ref. Cohort 2008)			-0.048	0.288***	-0.032	0.075*	0.077**	0.125***	0.061	-0.040
			(0.031)	(0.029)	(0.044)	(0.044)	(0.037)	(0.035)	(0.047)	(0.047)
Cohort 2013 (ref. Cohort 2008)			-0.003	0.326***	0.028	0.144***	0.134***	0.145***	0.129**	0.006
			(0.031)	(0.030)	(0.047)	(0.041)	(0.037)	(0.036)	(0.050)	(0.045)
Cohort 2014 (ref. Cohort 2008)			-0.078**	0.380***	-0.037	0.226***	0.075*	0.174***	0.075	0.060
			(0.031)	(0.031)	(0.048)	(0.039)	(0.039)	(0.039)	(0.052)	(0.045)
Cohort 2015 (ref. Cohort 2008)			-0.073**	0.459***	-0.035	0.375***	0.095**	0.224***	0.092*	0.170***
			(0.032)	(0.035)	(0.048)	(0.037)	(0.042)	(0.044)	(0.053)	(0.046)
Cohort 2016 (ref. Cohort 2008)			-0.108***	-14.726	-0.072	-13.790	0.079*	-15.008	0.073	-14.543
			(0.033)	(1,343.090)	(0.047)	(804.295)	(0.044)	(1,338.835)	(0.054)	(1,032.093)
Constant	1.077***	-29.371	0.507***	-29.331	0.986***	-28.754	0.737***	-29.619	1.141***	-29.416
	(0.132)	(580.086)	(0.069)	(773.286)	(0.143)	(487.476)	(0.077)	(777.049)	(0.146)	(628.784)

NOTES. All models include individual variables, dummy variables for disciplinary areas and academic year (first, second…).
Standard errors in parenthesis. *** p<0.01, ** p<0.05, * p<0.1
Results for options characterizing exit states (dropout and graduation). Results for degree change omitted.
(1)-(2) Model with environmental variables without cohort effects
(3)-(4) Model without environmental variables with cohort effects
(5)-(6) Model with labor market variables and cohort effects
(7)-(8) Model with teacher staff variable and cohort effects
(9)-(10) Model with all environmental variable and cohort effects

Appendix to Chapter 3

Table A3.1. Number of matriculated by area of study and academic year

	Academic years								
	2008	2009	2010	2011	2012	2013	2014	2015	2016
Health	5942	6736	7242	7623	7781	7865	7941	7772	7516
Scientific	6116	6914	4504	7882	8079	8369	8209	8915	625
Socio-Polit	5213	5322	5637	5597	5456	5619	6122	6472	6988
Law	4194	4551	4834	5239	5327	5230	5173	4907	4711
Humanities	8086	8590	9074	9474	9813	9483	9701	9773	10253
Economics	6366	6732	6782	6344	6088	5991	6280	6326	6889
Psychology	1474	1574	1479	1392	1333	1292	1266	1257	1242

Table A3.2. Degree effectiveness by disciplinary group (gruppo disciplinare) and gender

Group	Gender	2008	2009	2010	2011	2012	2013	2014	2015	2016
Agriculture	Female	0.6476	0.5938	0.4857	0.5929	0.5223	0.5962	0.5062	0.6012	0.5670
	Male	0.6727	0.6846	0.6240	0.6638	0.6441	0.6292	0.6000	0.6468	0.6375
Architecture	Female	0.7611	0.7103	0.6563	0.6020	0.5238	0.5306	0.5000	0.4845	0.5935
	Male	0.8165	0.7667	0.6913	0.5610	0.5600	0.5657	0.5870	0.5109	0.6144
Chemistry	Female	0.5432	0.5506	0.6818	0.6423	0.6111	0.6667	0.6582	0.7019	0.6405
	Male	0.6893	0.6569	0.7652	0.7834	0.7151	0.7569	0.7090	0.7627	0.7160
Difesa e sic.	Female	0.8333	0.7500	0.5000	1.0000	0.6000	0.7500	0.4444	0.6429	0.6000
	Male	0.8793	0.9091	0.8077	0.8235	1.0000	0.8919	0.8710	0.8451	0.8966
Economics	Female	0.7079	0.6786	0.6781	0.6645	0.6466	0.6591	0.7074	0.7258	0.7221
	Male	0.6870	0.6793	0.7153	0.6807	0.6746	0.7006	0.7266	0.7508	0.7568
Gymnastic	Female	0.7769	0.8167	0.7063	0.7933	0.7266	0.7519	0.7857	0.8168	0.8000
	Male	0.7444	0.7642	0.7411	0.7468	0.7086	0.8193	0.7360	0.7842	0.7662
Biology	Female	0.5922	0.5731	0.5363	0.5203	0.5149	0.4727	0.4562	0.4807	0.4314
	Male	0.6542	0.6293	0.5842	0.5776	0.5107	0.5394	0.5173	0.5230	0.5257
Law	Female	0.3972	0.4191	0.4000	0.3776	0.4422	0.3855	0.4000	0.7500	0.3000
	Male	0.4272	0.4255	0.4321	0.4163	0.3613	0.5200	0.4400	0.3750	0.4075
Engineering	Female	0.8118	0.7786	0.8179	0.7727	0.7283	0.7432	0.7991	0.7861	0.7683
	Male	0.8321	0.7975	0.8345	0.8117	0.7926	0.8060	0.8267	0.8382	0.8583
Teaching	Female	0.7725	0.7704	0.7051	0.7461	0.7098	0.7253	0.7056	0.7610	0.7528
	Male	0.5500	0.8056	0.7317	0.6889	0.6780	0.8462	0.7000	0.7966	0.7105
Humanities	Female	0.4834	0.4156	0.4250	0.3906	0.3940	0.4045	0.4580	0.4504	0.4988
	Male	0.5056	0.4375	0.4177	0.3748	0.4218	0.4279	0.4043	0.4777	0.4588
Linguistic	Female	0.5941	0.5699	0.5976	0.6059	0.5686	0.5840	0.6098	0.6372	0.6485
	Male	0.5275	0.5915	0.5602	0.5607	0.5848	0.5938	0.5924	0.5988	0.7135

Medical	Female	0.8723	0.8971	0.9213	0.8939	0.8995	0.8723	0.9050	0.8310	0.8273
	Male	0.8701	0.9059	0.9101	0.9082	0.8736	0.9302	0.9259	0.8095	0.8293
Politics	Female	0.5684	0.5160	0.5149	0.4940	0.4696	0.5144	0.5416	0.5435	0.5356
	Male	0.5913	0.5396	0.4823	0.4790	0.4941	0.4919	0.4805	0.5540	0.5208
Pshycology	Female	0.2815	0.2617	0.2616	0.2351	0.2393	0.2423	0.2519	0.2891	0.2861
	Male	0.3913	0.3399	0.2811	0.3546	0.3147	0.3459	0.3797	0.3389	0.3813
Scientific	Female	0.6596	0.6656	0.6323	0.6345	0.6794	0.6879	0.7819	0.7515	0.7327
	Male	0.7960	0.8081	0.7842	0.8185	0.8381	0.8143	0.8235	0.8025	0.8368

Own elaboration from Almalaurea data

Figure A3.1 Number of students enrolled in UNITO, by academic year

Figure 3 – Number of students enrolled

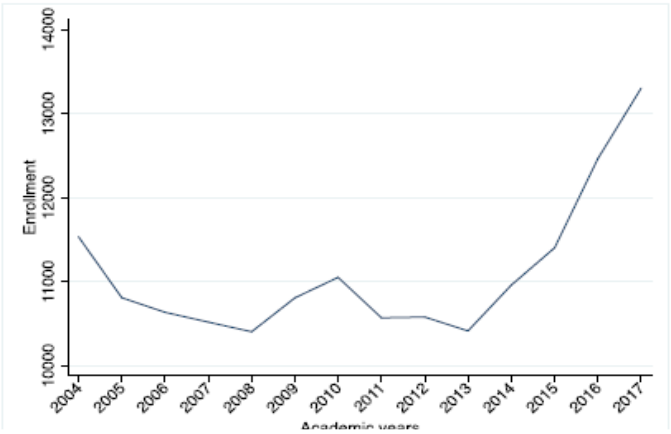


Figure A3.2 Share of matriculated coming from vocational high schools, by academic year

Figure 5 - Share of enrolled students coming from professional high schools

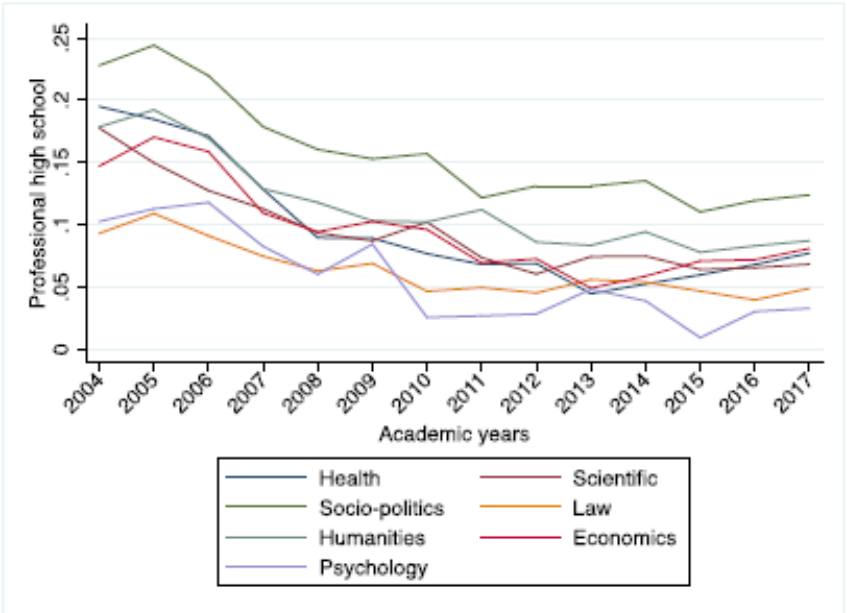


Figure A3.3 Share of matriculated coming from technical high schools, by academic year

Figure 4 – Share of enrolled students coming from technical high schools

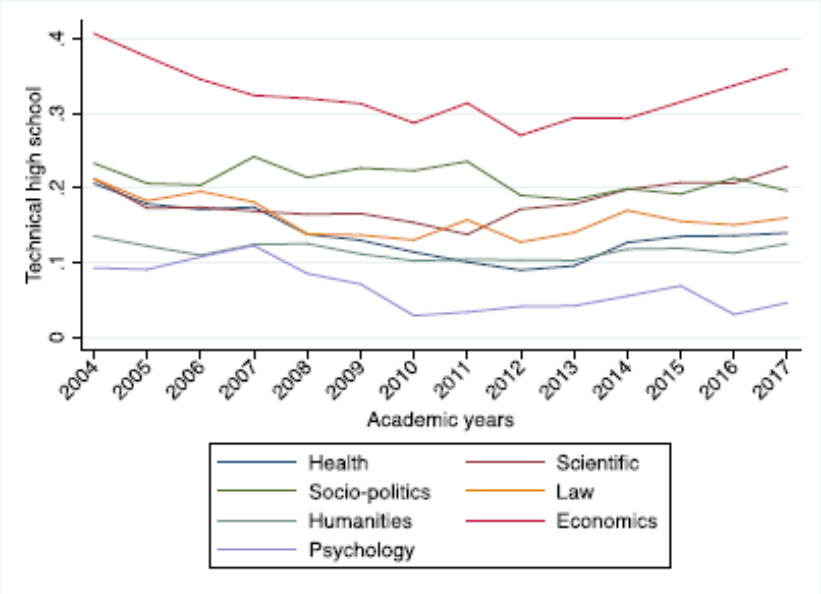
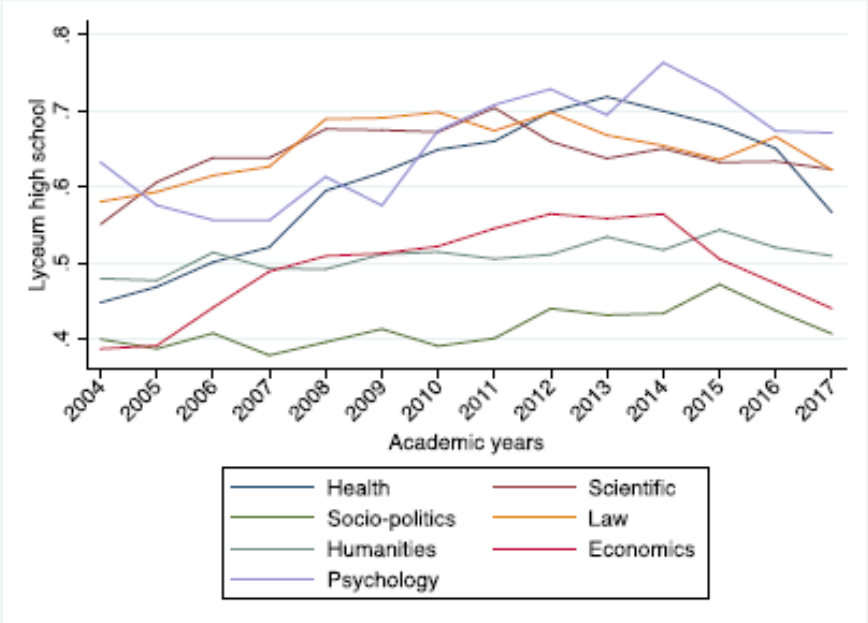


Figure A3.4 Share of matriculated coming from lyceums (all), by academic year

Figure 6 - Share of enrolled students coming from lyceum high schools



Chapter 4

The role of economic conditions and family background on university dropout

4.1 Introduction

To the best of our knowledge, there is little existing evidence in Italy on the role played by economic conditions on student academic careers in university, and in particular, on the probability (and timing) of degree completion. One reason is the lack of appropriate data. Although a measure of family wealth is available for most students (ISEE, see below), it is difficult to identify its effect because of the potential confounding effects of other parental characteristics. As shown by an extensive literature, the educational level of parents strongly influences children's educational attainment and choices, in particular at lower levels of schooling, and this effect is particularly large in Italy. Parental occupation has also been shown to affect schooling choices. Given that the three dimensions of family background – parental education, occupation and economic conditions – are correlated, information on all of them is needed to disentangle their independent effects. However, university registries do not provide information on parental characteristics. We are able to fill this gap, drawing on a unique dataset containing data on all dimensions of family background for the University of Torino for matriculation cohorts 2015/16-2017/18.

Parental education and occupation influence individuals' aspirations and shape their expectations about future life chances. Economic conditions influence the possibility to bear the direct and indirect costs of schooling. In Italy, this element is probably not too relevant at earlier stages of schooling, because schooling is compulsory up to age 16 and completely free up to high school completion. The expansion of the educational system has now made high school attendance almost universal and nearly 85% of youngsters attain a high school diploma. Instead, only less than 30% of Italian young people have a tertiary education degree. Even if tuition fees are highly income-dependent and can be very low for low-income families[21], tertiary education can have high indirect costs, including living expenses and foregone earnings. Thus, in order to design public interventions aimed at raising the share of young individuals with tertiary education and reducing social inequalities in educational attainment, it is important to assess whether and to what extent higher educational outcomes depend on the families' economic conditions.

There is a large international literature on the role played by family income or wealth on higher education choices and completion. This literature is mainly based on US and Anglo-Saxon countries, having a highly differentiated tertiary education system, with expensive tuition fees and a well-developed system of student aid in the form of scholarships and loans. This literature highlights that economic constraints do play a role in shaping college choices, but what matters most are the long-run factors associated with parental background and family environment, that influence educational choices via ability (Carneiro and Heckman, 2001 and 2005; Chowdry et al. 2013).

[21] In the most recent academic years, the University of Torino instituted a no tax area for students with ISEE below 13000 euros.

While these results are likely to apply to Italy as well, the role of family economic conditions on university attendance and completion needs specific investigation. The existing literature is scarce. Using administrative data and ISEE as a measure of family income, Belloc et al. (2010) find that high income students are more likely to drop out than low income students; however, these results result from a model that controls for performance in university exams (highly endogenous), so the interpretation in unclear. Assuming that living in large household is an indicator of lower income, Aina (2011) finds that students coming from larger household are less likely to withdraw before completion. Instead, indirect evidence of the role of financial constraints is provided by a small literature analysing the impact of various forms of scholarships and financial aid for low-income students, showing that income support favours study progression and degree completion (Mealli and Rampichini 2012, Azzolini et al 2018, Vergolini and Zanini 2015).

Our contribution

Our research focuses on student educational careers after higher education enrollment, exploiting the data of the Anagrafe Nazionale degli Studenti (ANS). In particular, we analyze the probability to drop out from the University of Torino in the first year after matriculation. Information on the economic situation of the family is provided by ISEE (*Indicatore della Situazione Economica Equivalente*). To allow the assessment of the independent contribution of the different aspects of family background on student academic careers, the University of Torino has started to collect data on parental education at occupation since academic year 2014/15. At matriculation students fill an online questionnaire with individual information; since 2014 they are also asked to report their fathers' and mothers' educational level and last occupation. Although this section is not mandatory, the large majority provide the information (approximately 90%).

A clarification on the limitation of the empirical analysis is in order. Since we exploit the administrative data from a database of university students, we cannot account for selection effects related to previous educational choices (choice of high school type, high school completion, university enrollment). Thus, we will not estimate the 'causal' effect of family economic conditions – i.e. the differential between individuals with different economic conditions but otherwise identical in terms of both observed and unobserved characteristics – but assess instead the magnitude of the differential given observed characteristics only. This is still a quantity of substantial interest for policy makers. It is useful to note that the estimated differential is likely to be smaller than the pure *ceteris paribus* effect, as due to the strong social selection operating along the entire schooling career, low-SES university students are (much) more positively selected than high-SES students in terms of unobserved traits.

4.2 Data on ISEE

In Italy tuition fees are dependent on the economic conditions of the family. Students make a first payment of a fixed amount at the beginning of each academic year. During the month of November-December students are asked to provide the yearly ISEE (*Indicatore della Situazione Economica Equivalente*) declaration, according to which the amount of the second payment is determined. ISEE is an official document released by the tax authorities, reporting a value synthetizing the economic conditions of the household, based on official

records of the family labor income, property and real estate assets, and normalized by the number of household components[22]. Students exceeding a given threshold (at UNITO, currently around 85,000 euros) or not providing the ISEE records, pay the maximum fee, now approximately 2500 euros per year, with small differences across fields of study. Information on ISEE and tuition fees payed are routinely included in the administrative university archives.

Yet, approximately 30% of the students do not provide their ISEE declaration. If we could make the assumption that this data is "missing at random" (MAR), even conditional on observed explanatory variables, we could safely conduct a complete case analysis. This is clearly not the case. A first reason is that since high income students have no tuition reductions, they have no incentives to provide the information. Let us label these students as "*rich"*. Indeed, if we could make the assumption that all the individuals with missing ISEE are rich, it would not be a great problem either, because we would have the information that ISEE is exceeding the threshold of 85,000 euro. Unfortunately, not even this assumption can be maintained. In fact, when we analyze the characteristics of the students with missing ISEE we find that:

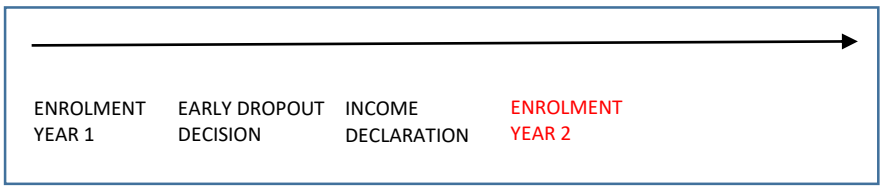
i) many of the students with missing ISEE come from disadvantaged family backgrounds in terms of parental education and occupation (Table A4.1 in the chapter's Appendix)

ii) many of those who do not declare income in year 1 do so in subsequent years, and often report a low ISEE (Table A4.2 in the chapter's Appendix). If economic conditions are fairly stable over short time spans, it is likely that in year 1 these students had missed the deadlines, so we label them "*sloppy*".

There is one additional major point to be made here. The students who decide not to continue their studies within the first couple of months of the academic year also have no incentives to declare ISEE, because ISEE determines the second tuition payment, due in the late fall of each year (Figure 4.1 clarifies the assumed timeline describing when choices are made). Let us label these students as "*early dropouts*".

While the *rich* and *sloppy* are relatively easy to account for, the existence of *early dropouts* involves an issue of endogeneity that has to be dealt with. Endogeneity results from the fact that, although we are dealing with missing of an independent variable, whether this variable is observed or not depends (to some extent) on the dependent variable.

Figure 4.1 Choices timeline



[22] Students may figure as an independent household only if they have lived on their own for at least two years and if they have earned at least 7000 euros/year for the same amount of time. This rule was introduced in the early 2000s to discourage the previous common practice of changing residence in order to declare a low-ISEE and pay very low tuition fees.

4.3 Missing ISEE and imputation strategy

As discussed above, to analyze the effect of economic conditions and other family background characteristics on the dropout probability, we first need to analyze the missing data more closely. As we now show below, exploiting the additional information resulting from year 2 allows to *impute* ISEE for students who did not provide the declaration in year 1, under fairly weak assumptions.

To this aim, in Table 4.1 we classify the 33485 students in the sample according to whether they present the ISEE declaration in year 1, whether they continue or withdraw after year 1 and whether they present the ISEE declaration in year 2.

Table 4.1 Classification of students (matriculated population in BA degrees, 2015-2017)

<table>
<tr><th>YEAR 2

YEAR 1</th><th>Dropout
(not enrolled)</th><th colspan="2">Continue
(enrolled)</th><th>ALL</th></tr>
<tr><td></td><td></td><td>ISEE
declared</td><td>ISEE
not declared</td><td></td></tr>
<tr><td>ISEE
declared</td><td>ISEE & DROP
N=3120
9.32%</td><td>ISEE & CONTINUE
N=19424
58.01%</td><td>ISEE & CONTINUE
N=1105
3.30%</td><td>70.63%</td></tr>
<tr><td rowspan="2">ISEE
not declared</td><td>NO ISEE & DROP
N=770
2.30%</td><td rowspan="2">SLOPPY & CONTINUE
N=1698
5.07%</td><td rowspan="2">RICH & CONTINUE
N=5873
17.54%</td><td rowspan="2">29.37%</td></tr>
<tr><td>EARLY DROP
N=1495
4.46%</td></tr>
</table>

Students declaring ISEE in year 1 are more than 70% of the entire student population matriculated in BA degree courses. Some of them (9% of the total population) do not re-enroll the following year (drops out), whereas the majority continues. Consider the 29% share of students not declaring ISEE in year 1. As discussed above, there are three groups of individuals to deal with: the *rich*, the *sloppy* and the *early dropouts*. How do we identify them and how do we overcome the missing data problem?

Let us start from those who enroll again in year 2. Some declare ISEE in year 2 and others do not. As argued above, assuming that those who declare ISEE in year 2 had previously missed the deadlines, we labeled them "*sloppy*" (5% of the total population). If we assume short-term stability of economic conditions (ISEE is quite stable in our data) we can *impute* ISEE by applying the value reported in year 2 to year 1. Others fail to provide the information even in year 2 (and in subsequent years). These students (17.5%) are labeled "*rich*", under the assumption that if a student persists in not disclosing ISEE it is because there would be no (substantial) tuition reduction justifying the burden required to produce the documentation. Thus, for these individuals we can *impute* ISEE with a value exceeding the threshold (we impute the value 100,000 and run robustness checks with alternative values).

After imputation of the ISEE recorded in year 2 in place of the missing ISEE for year 1, and the attribution of a "high" value for those who appear *rich*, the share of students with no information on economic condition drops from the initial value of 30% to 6.6%. Even if the size of the missing ISEE population is small at this point, we still have to account for another subgroup of students, those who do not enroll in year 2. Some of them (4-5% of the total population) did not make the second tuition payment. There are good reasons to believe that they have taken the dropout decision before they were asked to produce the ISEE record[23]. For this reason, we label them "*early dropouts"*. Due to the endogenous nature of the early dropouts, we cannot simply ignore the missing data issue and leave them out of the analyses.

To account for this subgroup (and the small residual group of dropouts who did not declare ISEE in year 1 but do not appear as early dropouts), we will exploit the information on parental education and occupation, and the correlation of these variables with the family economic conditions. Let us define y as the economic condition (ln(ISEE)) and z the vector of variables representing mother's and father's education and occupation. Assuming the linear relation:

$$y_i = a + bz_i + u_i$$

we estimate the vector of parameters, predict the income corresponding to a given combination of parental background characteristics, and then use $E(y|z)$ to impute ISEE when still missing. However, to address the endogeneity issue we have to acknowledge that the relation between y and z is generally different in the dropout population from that holding in the population at large, because the economic condition (and other dimensions of family background) may affect dropout.

Defining $w = (continue = 1, drop = 0)$ the binary variable describing the enrolment choice after year 1, it is easy to show that:

$$E(y|z) = a + bz \neq E(y|z, w = 0)$$

Now, the model for w assumes that the dropout probability depends on family economic conditions y, parental education and occupation z, as well as prior schooling characteristics q and other individual variables like age at enrollment and field of study. If w^* is the latent propensity of continuing studies after year 1, and $w^* = \mu + \theta z + \lambda y + \pi q + \varepsilon$:

$$P(w = 0|z, y, q) = P(w^* < 0|z, y, q) = P\big(\varepsilon < -(\mu + \theta z + \lambda y + \pi q)\big)$$

Thus
$$\begin{aligned} E(y|z, w = 0) &= a + bz + E(u|w = 0) \\ &= a + bz + E(u|\varepsilon < -(\mu + \theta z + \lambda y + \pi q)) \\ &= a + bz + E(u|\varepsilon < -(\mu + \theta z + \lambda(a + bz + u) + \pi q)) \\ &= a + bz + E(u|\lambda u < -(\mu + \lambda a + (\theta + \lambda b)z + \pi q + \varepsilon)) \end{aligned}$$

[23] This idea is corroborated by the results of the model with a dummy for missing income (naïve model 2), as individuals with missing ISEE have a higher dropout probability than very low income individuals.

We see that even if $\rho(u, \varepsilon) = 0$ the relation between y and z in the entire population is not the same as in the dropout group. The relation is likely to be weaker among dropouts because u is negatively correlated with z. If income affects the dropout decision, other things being equal, individuals from disadvantaged parental education and occupation need a relatively high income to make the no-dropout choice. Against this background, we estimate the relation between y and z among dropouts, and *impute* the predicted expected value $E(y|z, w = 0)$, under the additional assumption of same relation among dropouts and early dropouts.

We also need to impute ISEE for the small residual group named NO ISEE & DROP in Table 4.2. These students did not present the ISEE declaration but did not make the early dropout decision. We could either treat them as any other dropout (but this would imply neglecting the decision to not disclose their economic condition), or assume that they are better off than the average dropout population. We will adopt two distinct procedures, taken as extremes: in the first we use the predicted $E(y|z, w = 0)$; in the second we pretend they are all rich, and impute the same values used for the RICH & CONTINUE group. Although the truth is likely to lie somewhere in the middle, we will give more credit to the (conservative) estimate provided by the second alternative[24].

4.4 Economic conditions and family background

Our aim is to study the probability that the student enrolled in year 1 does not re-enroll in year 2. We will do so for students enrolled in 3-year degree programs (BA) of matriculation cohorts 2015/16-2017/18, for which we have information on parental education and occupation, data on ISEE, and up-to-date information on student outcomes. We disregard students matriculated in 2014, because at the end of this year ISEE computation rules were modified, so the values are not fully comparable with those of the subsequent cohorts.

Table 4.2 shows descriptive evidence on the family economic condition and parental education distributions of those who do not re-enroll in year 2 (dropouts) and non-dropouts. On average the former display less favorable economic conditions and a smaller share have parents with higher education degrees.

Table 4.2 Family economic condition (ISEE) and parental education, by dropout status

	ISEE			**Parental education**			%	%
	Q1	Q2	Q3	% >=HS	% >=1HE	% 2HE	(all)	(declaring income)
Not dropout	15819	28990	65116	80.71	29.40	10.24	84.54	87.30
Dropout	9886	18325	29025	75.76	22.19	6.85	15.46	12.70
Total	15047	27467	57011	79.64	27.44	9.71	100	100

NOTE: >=HS= both parents with at least high school degree; >=1HE= at least one parent with higher education
2HE= both parents with higher education

[24] The estimate is likely to be conservative because by not imputing a high value to any of the dropouts with missing ISEE, we tend to widen the economic differences between dropouts and non-dropouts.

In the following we present the results of the estimation of a number of logit models using different ways to deal with the missing information on economic conditions. Each column of Table 4.3 corresponds to a different strategy. All models control for parental education and occupation, the individual variables gender, age at enrolment, high-school type and final grade, as well a dummy vector of variables describing the field of study. Models in columns (3)-(6) also include two income-related variables: an indicator that the student is a scholarship recipient (see below for a brief explanation of the access regulations), and whether the individual is a student-worker[25].

We begin with two naïve strategies:

- A complete case analysis (column 1)
- A model (columns 2) including all observations, where the economic condition is equal to $ISEE$ if available and equal to 0 if missing, and with the inclusion of a dummy indicator d for missing $ISEE$. Hence, the latent propensity to continue vs. drop out from university is modeled as: $w^* = \mu + \theta z + \lambda y + \varphi d + \pi q + \varepsilon$. In this way λ describes the effect of ISEE among those who declared it, and φ captures the difference between those who do not provide the declaration and individuals with ISEE=0.
- A model like the previous one, that includes the variables scholarship and student-worker (column 3).

Moving to the models with imputed ISEE:

- In column 4 we estimate the ISEE equation on the entire student population declaring income.
- In column 5 we estimate the ISEE equation on the population of dropouts declaring ISEE (those labeled as ISEE&DROP in Table 4.2).
- In column 6 we do the same as in column 5, but only for early dropouts. Instead, we assume that all students in the NO-ISEE&DROP group are rich. The reason is that these students had not disclosed income but are not early dropouts, so they are likely to be well off. We consider this as the most convincing strategy.
- Finally, in column 7 we replicate the strategy in 6, but exclude the income-related variables, in order to capture an average effect describing the situation given that student-aid measures exist, and may thus help reducing inequalities.

First of all, notice that the effect of economic conditions appears weaker in the (1)-(3) naive models. Consistently with our arguments of endogeneity made above, the dropout probability for individuals not disclosing ISEE is substantially higher, being much larger even than that of those in very poor economic conditions. Model (4) is reported for completeness, but as discussed above, does not seem theoretically sound. Model (5) is likely to deliver an overestimate of the effect, because it does not account for the fact that many of those who did not disclose ISEE but were not early dropouts are likely to be well off (footnote 3).

[25] Youth from low-income families may decide to work while studying (Triventi and Trivellato, 2009), with possible negative effects on their academic careers.

Models reported in columns (6) and (7) represent our preferred strategies. In column (6) we control for the condition of scholarship recipients and student workers. Interestingly, both effects are large and highly significant. Ceteris paribus, students with scholarship have a 6 pp. lower dropout probability than other students, and this results confirms the results of rigorous impact evaluation studies reporting a positive causal effect of scholarships on student academic careers. Instead, student workers have a much higher dropout probability (13 p.p.) than non-workers. In column (7) we report the estimates of the same model without scholarship and student workers dummy variables. Since some scholarships are granted to poor students and may actually attenuate the potential detrimental effects of low income, one could argue that to capture the effects of economic conditions in the existing system it would be more appropriate to exclude this variable from the model. At the same time, controlling for the condition of student worker could hide the fact that student workers are on average less affluent than non-workers, so it is best not to include this mediating variable either. In this way, the estimated effect of economic conditions is slightly smaller than those resulting from model (6).

Table 4.3 Effect of family economic conditions on the dropout probability after year 1 (AME)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
ISEE (ln)	-0.0176***	-0.0156***	-0.0173***	-0.0395***	-0.0731***	-0.0302***	-0.0268***
ISEE mis		0.0675***	0.0592***				
Scholarship			-0.0339***	-0.0678***	-0.0861***	-0.0624***	
Student worker			0.1247***	0.1317***	0.1208***	0.1291***	
N	21116	29719	29719	29719	29719	29719	29719
PSEUDO R2	0.0852	0.1007	0.1200	0.1101	0.1382	0.1077	0.0849

*** p-value<0.001, ** p-value<0.01, * p-value<0.05

AME from logit models, controlling for parental education and occupation, the individual variables gender, age at enrolment, high-school type and final grade, and field of study

(1) Naive strategy only on valid cases
(2) Naive strategy + dummy missing income
(3) Naive strategy + dummy missing income, scholarship and student worker
(4) With imputation of sloppy and rich + of early dropouts (income regression on all), scholarship and student worker
(5) With imputation of sloppy and rich + of early dropouts (income regression of D1+D3 on D2), scholarship and student worker
(6) With of sloppy and rich +imputation early dropouts (income regression of D1 on D2, D3=rich), scholarship and student worker
(7) As in (6), excluding income dependent variables scholarship and student worker

How should we interpret the magnitude of this effect? Consider -0.0268 as our preferred estimate. Since the range between the lowest and highest value of ln(ISEE) is around 4 units[26], the predicted difference in the dropout probability of two otherwise identical individuals (including parental education and occupation) is 10 p.p. This is a very large effect, if we consider that the share of first year dropouts in the population of interest is around 15%.

[26] We consider the relevant range 2000-100000 euros. In the natural log metric this implies a variation between 7.6 and 11.6, thus 4 units. Notice that in model (2) we have included ln(ISEE) as the deviation from the lowest value, thus the range goes from 0 to 4.

The effect of parental education and occupation

As the role of ISEE emerges clearly, the effect of parental education and occupation is less clear. In Table 4.4, we show the results of model (7) for all family background dimension, and with one dimension at a time. The explanatory power of ISEE is much stronger, as we can appreciate from both goodness of fit indicators like pseudo-R2 and from size and statistical significance of the estimates (see also Table A4.3 in the Appendix, reporting the results of likelihood ratio tests comparing different models).

The effects of parental education go in the expected direction, but the differences are small and barely significant, even when parental occupation and ISEE are not controlled for. Similar results are observed for parental occupation. Hence, we can conclude that at this point of the educational career – after a strong previous social selection that has resulted in high obstacles for low-SES individuals and low obstacles for high-SES individuals – parental education and occupation do not seem to exert any residual effect. As remarked in the introductory section of this chapter, the comparison is not fully "like with like", because low-SES individuals are positively selected and tend to be more endowed in terms of unobserved characteristics such as motivation and effort. In this sense, our estimates do not capture pure family background effects, but describe the differences across family backgrounds not holding constant the unobserved traits.

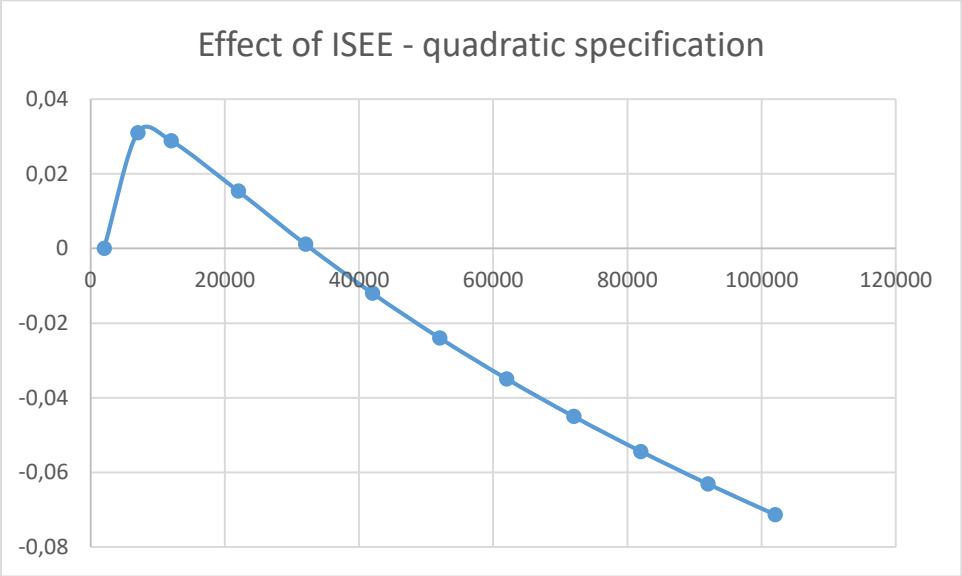
Finally, in Figure 4.2 we show the estimated effect of ISEE in a model with a quadratic term. Allowing for more flexibility, we observe that the effect of income has an inverse U shape: the dropout probability increases from 0 to 6000 euros and decreases steadily thereafter. The reason for the increasing portion of the curve is still unclear: one possible reason is that individuals declaring such a low income could be tax evaders (so their real condition is actually better that what declared) or that these students are covered by scholarships that attenuate the disadvantage due to poor economic conditions.

Table 4.4 Effect of family background variables (AME)

	ALL	ECONOMIC CONDITIONS	PARENTAL EDUCATION	PARENTAL OCCUPATION	NONE
ISEE (ln)	-0.0302***	-0.0267***			
Pared (rif upper secondary)					
Lower sec	0.0104		0.0136*		
1 parent HE	-0.0037		-0.0060		
2 parents HE	-0.0078		-0.0126		
Work father (ref clerk)					
Missing	-0.0060			0.0068	
Housework	0.0046			0.0378	
Direttivo	0.0093			0.0007	
Dirigente	-0.0049			-0.0221*	
Businessman	0.0318**			0.0234*	
School teacher	-0.0264			-0.0292*	
Self-employed	0.0067			0.0115	
Medical doctor	0.0279			0.0040	
Worker	-0.0110			0.0008	
Freelance	0.0075			0.0053	
Work mother (ref clerk)					
Missing	-0.0331*			-0.0291	
Housework	-0.0044			0.0118	
Direttivo	0.0013			-0.0062	
Dirigente	0.0597*			0.0444	
Businessman	0.0228			0.0189	
School teacher	0.0075			0.0020	
Self-employed	0.0139			0.0170	
Medical doctor	0.0303			0.0154	
Worker	-0.0081			0.0080	
Freelance	0.0124			0.0112	
Scholarship	-0.0624***	-0.0637***	-0.0417***	-0.0403***	-0.0398***
Student worker	0.1291***	0.1312***	0.1351***	0.1338***	0.1362***
N	29719	29719	29719	29719	29719
Log likelihood	-11470.9	-11505.9	-11578.1	-11562.1	-11584.8
N° variables	42	19	21	38	18
PSEUDO-R2	0.1077	0.1050	0.0994	0.1006	0.0988

NOTE: Models with ISEE, specification (7) in Table 4.3
All models include explanatory variables: gender, age at enrolment, high school type and final grade, field of study

Figure 4.2 Nonlinear effect of family economic conditions



NOTE: From estimates of a linear probability model with variables as in (6)-Table 4.2, including a quadratic term for ln(ISEE).

4.5 Conclusions

Exploiting the unique administrative database of the University of Torino, that augments the ANS data with information on mothers' and fathers' educational level and occupation since academic year 2014/15, we have been able to analyze whether and how the family economic condition, parental education and occupation influence the university students' dropout probability, and disentangle their effects. We highlight the existence of a severe missing data problem of the ISEE variable, that cannot be ignored by performing usual complete-case analyses. We deal with the endogenous missing data issue with an *ad hoc* imputation strategy, and find that at this stage of the schooling career – after a strong previous social selection operating up to university enrolment and documented by an extensive literature – parental education and occupation no longer exert a sizable effect on educational choices. Instead there is compelling evidence that despite the progressive character of tuition fees and the existence of scholarships provided to low-income students, the family economic condition has a substantial impact on university dropout.

While still preliminary, our results suggest that student aid policies, although important in preventing student dropout (as mentioned before there is the evidence of a positive effect of scholarships and financial aid for low-income students on college dropout), are not sufficient to eliminate the negative effect of a lack of economic resources on student academic careers. The reason could be related to the low take-up rate: despite full coverage of the eligible applicants in recent years, only a minority of the low-income university students apply for the aid. Further investigation is needed to gain a better understanding of why this happens and how to reduce barriers to higher education attainment among young individuals who have taken the decision to enroll in college.

Appendix to Chapter 4

Characteristics of individuals with missing ISEE

Table A4.1 Individuals with ISEE missing, father education and occupation (%)

occupation	education				Total
	primary	lower sec	upper sec	high ed	
housework	0.05	0.12	0.15	0.03	0.35
executive	0.00	0.35	3.82	2.71	6.88
managerial	0.01	0.20	3.01	5.53	8.75
clerk	0.07	3.28	11.48	3.10	17.93
businessman	0.23	3.24	6.20	1.99	11.66
teacher	0.00	0.02	0.45	1.39	1.86
self-employed	0.61	8.37	7.02	0.85	16.86
medical doctor	0.00	0.00	0.02	3.94	3.96
worker	1.13	8.20	3.40	0.20	12.93
freelance	0.18	2.39	7.14	9.11	18.82
Total	2.28	26.17	42.69	28.86	100.00

Table A4.2 ISEE distribution in year 2 for individuals with missing ISEE in year 1

percentile	ISEE
5	4776
10	8320
25	18091
50	32599
75	53427
90	81883
95	98306

Family background and economic conditions: models' comparison

Table A4.3 Overall significance of family background variables (Likelihood Ratio Test-LRT)

Panel (a)	**ONLY ISEE vs NONE**	**PARENTAL EDUCATION vs. NONE**	**PARENTAL OCCUPATION vs. NONE**
LRT	157.8	13.4	45.4
N° df	1	3	20
p-value	0.0000	0.0038	0.0010
Panel (b)	**ALL vs ONLY ISEE**	**ALL vs PARENTAL EDUCATION**	**ALL vs PARENTAL OCCUPATION**
LRT	35	107,2	91,2
N° df	23	21	4
p-value	0.0520	0.0000	0.0000

NOTE. Models with ISEE, specification 7 in Table 4.4 (main text)

Panel (a) shows that all dimensions of family socioeconomic background are statistically significant when added one at a time to a model with all other individual characteristics. Panel (b) compares the full model with all family background variables with a model including only one dimensions of family background. While the models with only parental education or parental occupation result in a substantial reduction of the model likelihood, the model with ISEE only determines a weakly significant loss of fit. In other words, the family economic condition is a much stronger predictor of the higher education dropout probability than parental education or occupation.

APPENDIX

Il Progetto Passport-Unito

Valutazione di impatto (risultati preliminari)

1. TARM unico di Ateneo

1.1 L'esigenza di un TARM unico[27]

Dall'anno accademico 2000/2001, l'Università di Torino ha attivato i cosiddetti Test di Accertamento dei Requisiti Minimi (TARM), test di accesso volti a valutare particolari competenze disciplinari di base prima dell'iscrizione ad un corso di laurea ad accesso libero; poiché allora i TARM erano test non trasversali, le modalità di verifica dei requisiti variavano a seconda dei corsi di studio (CdS, d'ora in avanti). A cura dei singoli CdS, quindi, rimanevano anche l'assegnazione e la pianificazione degli OFA (Obblighi Formativi Aggiuntivi), che in genere erano dei programmi di "recupero" per gli studenti che non avevano superato il test.

I problemi che tale diversificazione comportava si possono così riassumere:

- Attivazione di diversi progetti di ricerca per valutare la predittività del TARM rispetto al successo accademico;
- Difficoltà di un monitoraggio sistematico dell'impatto degli OFA sulle carriere degli studenti;
- Difficoltà nel far comprendere agli studenti la presenza di tante tipologie di TARM con diverse soglie di accesso e diverse modalità di recupero per i vari CdS.

Le ricerche sull'impatto di quel tipo di combinazione TARM-OFA hanno restituito come risultato quello di un'efficacia modesta nel ridurre la percentuale di studenti che abbandonano o superano pochi esami nel corso del primo anno di studi.

L'ateneo ha ritenuto quindi necessario un TARM unico, avviando una Sperimentazione TARM/OFA 2018-2021.

Il test unico è stato costruito tenendo conto degli elementi particolarmente importanti per prevedere il successo accademico:

- L'abilità di leggere un testo e di isolarne concetti e asserti principali;
- L'abilità linguistica, intesa come padronanza della lingua veicolare;
- L'abilità logico-matematica di base;
- L'atteggiamento di interesse verso i principali eventi e temi dell'attualità

[27] L'intero sottoparagrafo trae le informazioni da: Incontro con Nucleo di Valutazione Università di Torino, *Sperimentazione TARM/OFA 2018-2021*, 10 aprile 2019

Il test unico ha quindi oggi l'obiettivo di verificare le competenze trasversali, ritenute più importanti di quelle disciplinari per il successo accademico.

Inoltre, il nuovo TARM è inteso come uno strumento di interazione con la scuola superiore di secondo grado, anticipando la possibilità di sostenerlo già in IV e/o in V superiore.

1.2 Struttura del TARM unico

1.2.1 Sessioni previste nel 2018

Per l'a.a. 2018/2019 sono state organizzate due sessioni per il TARM. La Tabella seguente riassume le differenze tra le due sessioni.

Sessione pilota (maggio 2018)	a) Per studenti di IV e V superiore b) Gli studenti di IV che superano il test possono immatricolarsi nell'a.a 2019/2020, mentre chi non lo supera deve seguire le indicazioni per l'a.a 2019/2020 (se invariate, richiederebbero di rifare il test) c)Gli studenti di V che superano il test possono immatricolarsi nell'a.a 2018/2019, altrimenti dovranno sostenere nuovamente il test nella sessione seguente per immatricolarsi nello stesso a.a. d)55 domande in totale, ogni domanda ha 3 possibili varianti. e) Durata di 100 minuti (130 per studenti con disabilità) f) L'USR (Ufficio Scolastico Regionale) sceglie le scuole ai cui studenti somministrare il test (circa 1000 test), in modo da avere un'eterogeneità di tipo di scuola superiore (circa 10 scuole di diverso indirizzo, provincia di Torino)
Seconda sessione (settembre 2018)	a) Per individui in possesso del diploma di maturità (che indicano quindi il titolo di diploma e relativo voto effettivi) b) Gli individui che superano il test possono immatricolarsi nell'a.a 2018/2019, chi non lo supera può immatricolarsi ma con assegnazione degli OFA, da assolvere con il completamento del programma Passport c)55 domande in totale, ogni domanda ha 6 possibili varianti. d)Durata di 100 minuti (130 per studenti con disabilità)

1.2.2 Contenuto del TARM unico

Il test oggi è suddiviso in 6 sezioni, per un totale di 55 domande:

Sezione	**N° domande**
Comprensione del testo	20
Matematica	10
Lingua Italiana	10
Cultura generale umanistica	5
Cultura generale scientifica	5
Cultura generale giuridica, economica e sociale	5
TOTALE	55

Altre informazioni sul test:

- Ogni domanda prevede 4 risposte possibili, di cui solamente una esatta;
- Ogni risposta esatta vale un punto;
- Non è prevista una penalità per le risposte sbagliate;
- Soglia minima di superamento: 30/55;
- È consigliato il percorso Passport anche a chi consegue un punteggio tra 30 e 40;
- Nessuna quota per sostenimento del test.

2. Programma Passport.Unito[28]

Per assolvere gli OFA, gli studenti devono completare il percorso on line Passport.U, un percorso (teoricamente di 40 ore) finalizzato ad aiutare gli studenti a scoprire cosa sono le soft skills, a riconoscere le proprie ed a promuoverne lo sviluppo.

La decisione di inquadrare gli obblighi formativi aggiuntivi nelle soft skills poggia su di un'ampia letteratura internazionale, che evidenzia una relazione tra il successo accademico e lavorativo e la maturazione delle soft skills dell'individuo (Andrews & Higson, 2008; Adams, 2012; Heckman & Rubinstein, 2001; Segal, 2012; Wats & Wats, 2009).

Il percorso di apre con un'autovalutazione e, dopo il percorso di e-learning, segue con:

- una nuova autovalutazione per valutare i propri progressi;
- una prova finale sulle attività svolte, al termine della quale il sistema fornirà un attestato di frequenza.

[28] Il paragrafo trae le informazioni da: www.passport.unito.it

L’esito del test è “superato/non superato” e finché non si consegue con successo la prova finale non è possibile compilare il piano carriera.

Il percorso può essere svolto solo una volta, ma lo studente può rivedere quanto fatto.

2.1 Contenuto del percorso

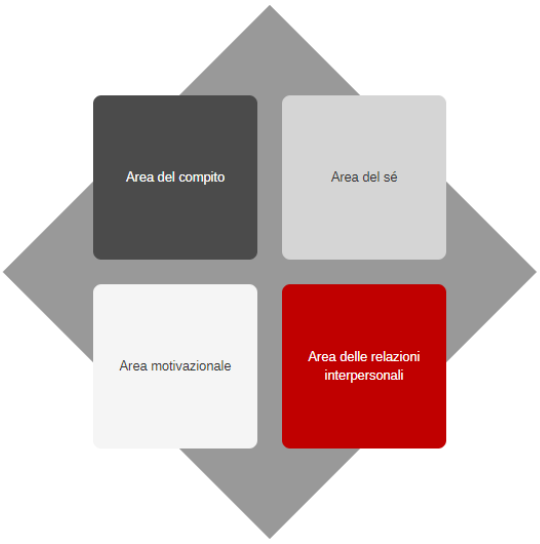


Figura 1: Il modello di soft skills di Passport.Unito

Il modello di soft skills Passport Unito è composto da 4 macro-aree di soft skills individuate a partire dalla letteratura sul tema[29].

2.1.1 Area del compito

Le soft skills di questa macro-area sono:

- **Problem solving e decision making**: affrontare i problemi e le decisioni usando strategie di ragionamento razionale e logico e considerando vincoli e possibilità, anche in situazioni complesse e poco conosciute;
- **Gestione del tempo e degli spazi**: pianificare, organizzare e controllare il tempo utilizzato per specifiche attività, utilizzando spazi adeguati alla concentrazione;
- **Adozione strategie adeguate nell’affrontare il compito**: adottare strategie adeguate nell’affrontare il compito per sostenere la propria efficacia ed il raggiungimento dei risultati.

[29] (Bennet, 1999; Gallivan, 2004; Luzzatto, 2015).

2.1.2 Area del sé

Le soft skills di questa macro-area sono:

- **Valorizzazione di sé**: riflettere, accettare e valorizzare sé stessi e le proprie caratteristiche, conoscenze e competenze;
- **Autoregolazione emotiva**: riconoscere e comprendere le emozioni (proprie e altrui) ed esprimerle;
- **Intraprendenza:** agire anche se non sollecitati, intervenire e modificare consapevolmente la realtà.

2.1.3 Area motivazionale

Le soft skills di questa macro-area sono:

- **Orientamento all'obiettivo**: dare il meglio di sé e spendere tempo ed energie per il raggiungimento dei propri obiettivi;
- **Attribuzione causale**: spiegare la causa del comportamento proprio e altrui e in particolare attribuire la causa di ciò che accade a sé o all'esterno;
- **Resilienza**: Affrontare eventi stressanti o difficoltosi e riorganizzare in maniera positiva la propria vita dinanzi alle difficoltà.

2.1.4 Area delle relazioni interpersonali

Le soft skills di questa macro-area sono:

- **Lavoro in gruppo**: collaborare positivamente con altre persone al raggiungimento di un obiettivo comune;
- **Comunicazione**: comunicare efficacemente a tutti i livelli, sia in forma orale che scritta;
- **Gestione del conflitto**: riconoscere, comprendere e gestire le dinamiche del conflitto nella relazione con gli altri.

3. Valutazione dell'impatto di Passport[30]

3.1 Preliminarietà dei risultati

I risultati sulla valutazione d'impatto del programma che di seguito verranno presentati sono preliminari per due ordini di motivi:

i. Stiamo considerando un solo tipo di percorso di ingresso tra i vari possibili;
ii. Disponibilità di dati sugli outcome della performance accademica.

[30] I grafici e le tabelle presentati in questo paragrafo rappresentano nostre elaborazioni sui dati.

i) Percorso considerato. Nella sua decisione di immatricolarsi ad un CdS dell'Università di Torino, lo studente può mettere in atto una serie di comportamenti che attivano a loro volta percorsi diversi. La Figura 2 illustra le diverse alternative che si presentano ad un individuo che, dovendo immatricolarsi per la prima volta al sistema universitario, sceglie l'Università di Torino come primo ateneo. Tralasciando il *Percorso 1* ed il *Percorso 2*, l'analisi qui proposta si concentra sugli individui che intraprendono il *Percorso 3*, e la Figura 3 ne illustra lo sviluppo. Per cui, nell'analisi sugli outcome degli studenti si confronteranno:

- Studenti che hanno sostenuto esclusivamente (e con successo) il TARM a settembre e si sono iscritti ad Unito ad un corso ad accesso libero;
- Studenti che hanno sostenuto esclusivamente (non superandolo) il TARM a settembre, hanno sostenuto il Programma Passport e sono iscritti ad Unito ad un corso ad accesso libero.

ii) Disponibilità di dati sugli outcome della performance accademica. L'analisi proposta utilizza dati aggiornati al 19 settembre 2019, ma le iscrizioni al secondo anno possono pervenire fino ad ottobre. Quindi, lo studio sugli abbandoni al primo anno sarà uno sviluppo futuro del presente lavoro.

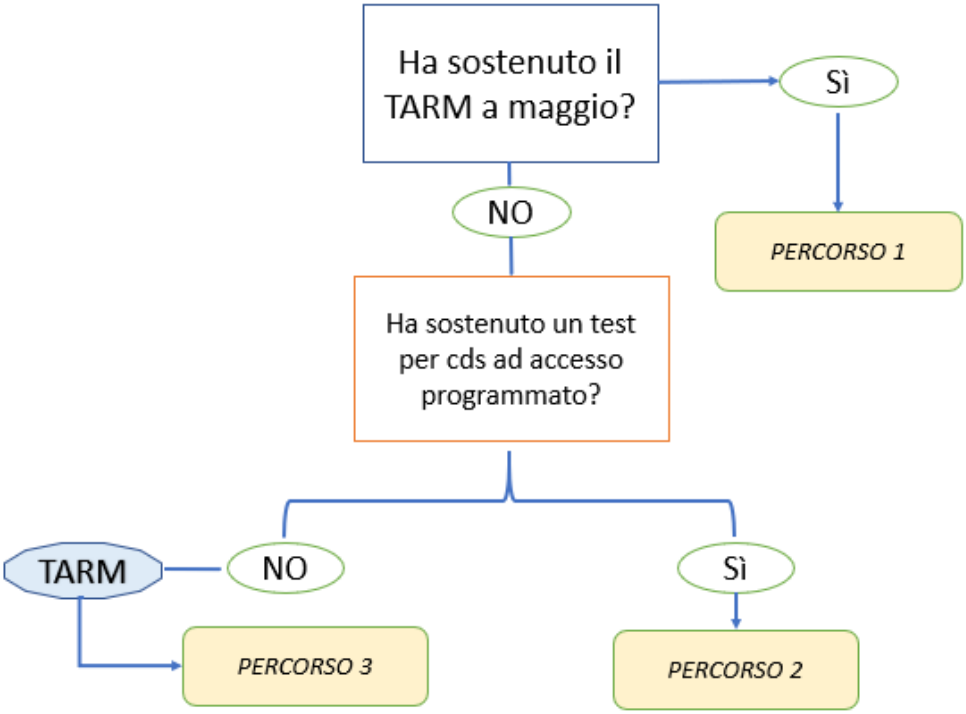


Figura 2. Alternative di percorso per un individuo che sceglie Unito per la prima immatricolazione al sistema universitario

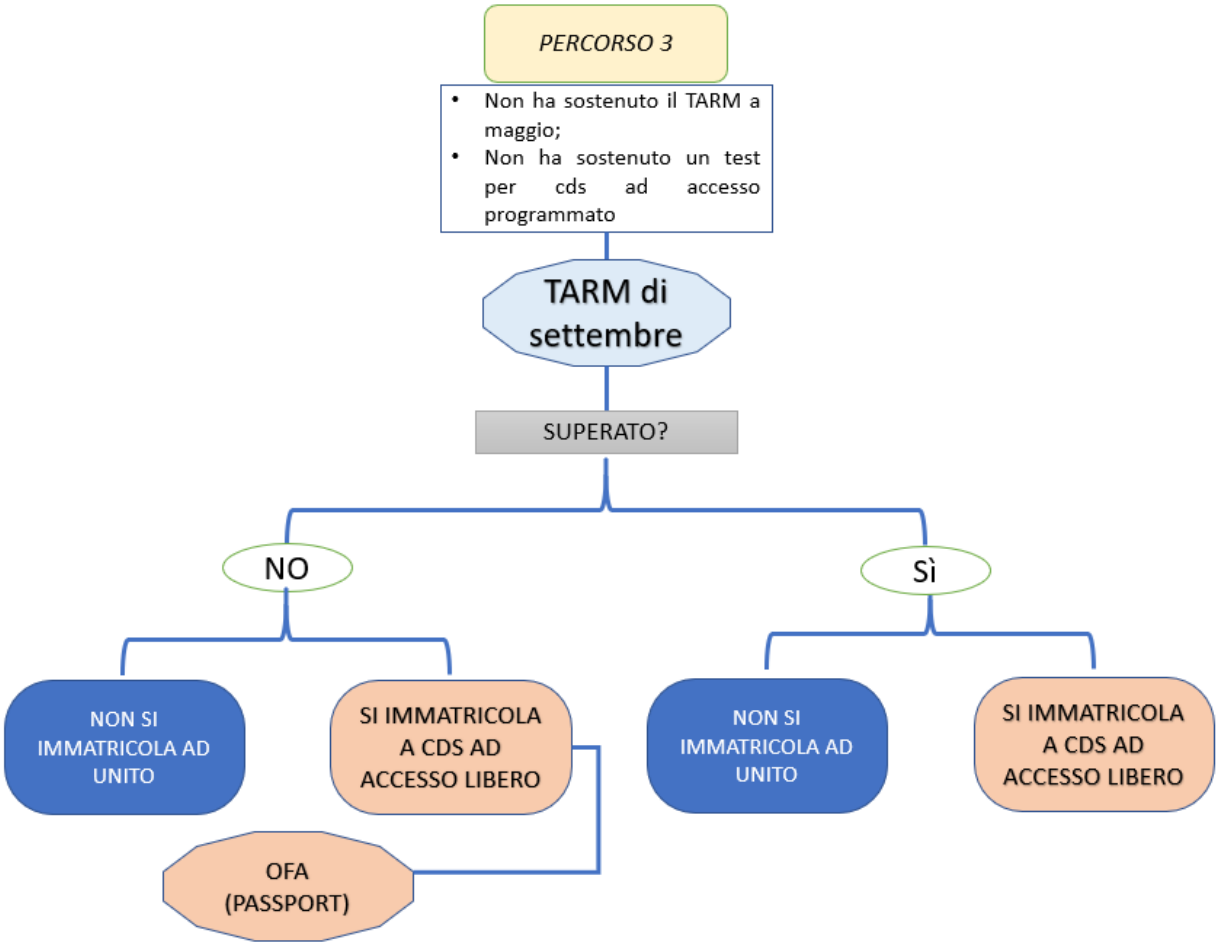


Figura 3. Percorso 3: Possibili eventi per un individuo che sostiene il TARM di settembre, ma non quello di maggio né un test per CdS ad accesso programmato

3.2 Descrizione del campione

Il sottocampione individuato per l'analisi sugli outcome è inizialmente composto da 6.099 studenti iscritti ad un corso ad accesso libero dopo aver sostenuto esclusivamente, tra i possibili test per accedere all'offerta formativa dell'Università di Torino, il TARM a settembre; hanno un'età non superiore ai 30 anni e sono iscritti alla prima carriera universitaria.

In Tabella 1 sono riportate le numerosità di ciascuna combinazione TARM-Passport.

Ha superato il TARM?..	Ha sostenuto e terminato percorso Passport?		
	No	Sì	Totale
No	173	1443	1616
	10.71%	89.29%	100%
Sì	4465	18	4483
	99.60%	0.40%	100%
Totale	4638	1461	6099
	76.05%	23.95%	100%

Tabella 1. Tabella di contingenza superamento TARM/ sostenimento Passport; in prima riga, le frequenze, in seconda riga, le percentuali di riga.

Degli studenti che non hanno superato il TARM, circa l'11% non ha ancora sostenuto Passport; non consideriamo questi casi, non avendo per loro dati sugli outcome, in quanto non hanno potuto ancora sostenere esami.

Inoltre, ci sono 18 studenti che hanno portato a termine il programma Passport, pur avendo superato il TARM; riportano un punteggio tra il 30 ed il 43 ed un punteggio medio di 33,82. Rappresentando questi lo 0.3% degli iscritti, decidiamo di escluderli dall'analisi preliminare.

La variabile outcome è la somma dei CFU con voto (esclusi, quindi, i riconoscimenti di crediti e le idoneità) conseguiti entro il 19 settembre 2019. Nella Tabella 2 sono mostrate delle statistiche descrittive per questa variabile.

Variabile	n	Media	Dev.st.	Min	Max	p25	p50	p75	p99
CFU con voto	5926	26.312	20.671	0	81	0	27	45	60

Tabella 2. Statistiche descrittive per la variabile CFU con voto.

Eliminiamo la coda destra della distribuzione e quindi le osservazioni oltre il 99° percentile. Per cui, in Tabella 3 si mostrano le numerosità definitive delle combinazioni TARM-Passport nel sottocampione di iscritti oggetto dell'analisi sugli outcome.

Ha superato il TARM?	Ha sostenuto e terminato percorso Passport?		
	No	Sì	Totale
No	0	1440	1440
	0%	100%	100%
Sì	4442	0	4442
	100%	0%	100%
Totale	4465	1461	5862
	75.44%	24.56%	100%

Tabella 3. Tabella di contingenza superamento TARM / sostenimento Passport; in prima riga, le frequenze, in seconda riga, le percentuali di riga.

3.3 Metodologia dell'analisi preliminare

3.3.1 Il *Regression Discontinuity Design*

Il contesto di analisi nel quale ci si è trovato ad operare è quello classico di applicazione di un *Regression discontinuity design*: si vuole studiare l'effetto causale di un trattamento su di un outcome, laddove l'assegnazione al trattamento dipende deterministicamente dal fatto che un certo predittore dell'outcome (la cosiddetta *forcing variable*) assuma valori a sinistra o a destra di una certa soglia (Imbens e Lemieux ,2010). Nel nostro caso, come si evince dalla Tabella 2, chi ha sostenuto Passport può aver ottenuto un punteggio massimo di 29 al TARM, infatti, studenti con un simile punteggio avevano l'obbligo di seguire il corso di e-learning per poter compilare il piano carriera; vogliamo, quindi, studiare l'effetto causale di Passport sulla performance accademica del primo anno, in un contesto in cui è lecito ipotizzare che, ceteris paribus, mediamente questa sia migliore per studenti con punteggi più alti al test d'accesso.

Utilizzando l'approccio degli outcome potenziali di Rubin (Rubin, 1974), l'assunzione fondamentale dell'RDD è la seguente:

Definiti Y(0) e Y(1) rispettivamente come l'outcome potenziale in caso di non trattamento e l'outcome potenziale in caso di trattamento e X la forcing variable, le due funzioni di regressione condizionate $E[Y_i(0)|X_i = x]$ *e* $E[Y_i(1)|X_i = x]$ *sono continue in corrispondenza della soglia.*

L'assunzione è necessaria perché, se la relazione tra gli outcome potenziali e X è continua *in corrispondenza della soglia*, allora una qualche discontinuità nell'outcome osservato può essere interpretata come effetto causale del trattamento su Y.

Nella nostra analisi, quindi, si ipotizza che gli individui nell'intorno destro e sinistro della soglia di punteggio 29 per l'assegnazione a Passport siano confrontabili e l'eventuale "salto" nell'outcome in corrispondenza della soglia verrà interpretato come effetto del programma Passport sui CFU con voto conseguiti.

Per evidenziare la presenza di un "salto" si procede come segue:

- Per una certa ampiezza di banda *h* e per un certo numero di intervalli K_0 *e* K_1 a sinistra ed a destra della soglia *c*, si divide il supporto della variabile *punteggio* (che indica il punteggio dell'individuo al TARM) in intervalli $(b_k, b_{k+1}]$, tali che

$$b_k = c - (K_0 - k + 1) * h \qquad \text{Per } k = 1,2, \dots, K_0 + K_1$$

- Si calcola l'outcome medio per ogni intervallo in tal modo:

$$\bar{Y} = \frac{1}{N_k} * \sum_{i=1}^{N} Y_i * 1_{b_k < X_i \leq b_{k+1}}$$

  Dove :
  - *N*= Numerosità del campione
  - N_k=Numerosità dell'intervallo $(b_k, b_{k+1}]$

3.4 Risultati dell'analisi preliminare

3.4.1 Presenza di un "salto" nell'outcome?

In Figura 4, sono presentati i risultati relativi alla ricerca di un "salto" nell'outcome in corrispondenza della soglia 29 del punteggio al TARM. Si interpreta di seguito quanto riportato in figura.

Avendo diviso il supporto della variabile punteggio in intervalli per *h* pari a 1, viene presentato:

Il grafico della media dei CFU con voto per intervallo di punteggio al TARM; all'interno delle due bande gialle vi sono le medie dei CFU per gli intervalli dal (26,27] al (31,32], mentre la banda rossa divide gli studenti che hanno sostenuto Passport (con un punteggio massimo di 29), da chi non lo ha sostenuto (con un punteggio minimo di 30); le ordinate evidenziate rappresentano la minima e la massima media di CFU per gli intervalli dal (26,27] al (31,32];

Nel caso in cui l'aver sostenuto Passport avesse avuto un effetto positivo sulla performance accademica del primo anno, avremmo registrato delle medie di CFU più alte negli intervalli di punteggio a sinistra e al ridosso della soglia e un più o meno evidente "salto" verso il basso nel passare oltre la soglia. Per valori di *h* maggiori, i risultati non cambiano.

In conclusione, non si evidenzia un effetto dell'aver sostenuto Passport sui CFU con voto conseguiti entro settembre 2019.

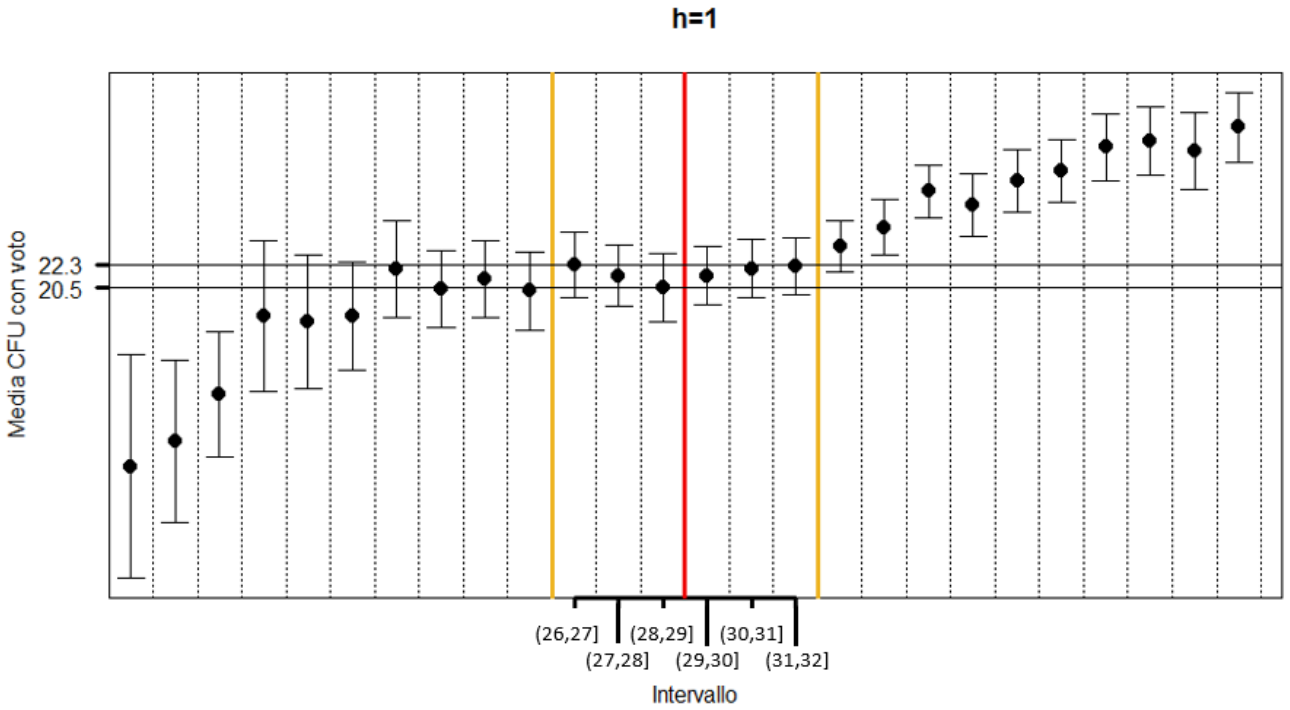


Figura 4. Grafico della media di CFU con voto per intervallo di punteggio al TARM; in ordinata, evidenziate la minima e massima media per gli intervalli dal (26,27] al (31,32]; intervalli di confidenza per la media al livello di confidenza del 95%.

Verifichiamo di seguito la presenza di un "salto" sulla soglia di punteggio 29 per altri 3 outcome:

- Quota di studenti che hanno conseguito un numero di CFU superiore a 40;
- Quota di studenti che hanno conseguito un numero di CFU superiore a 20;
- Quota di studenti che non hanno conseguito CFU.

I primi due outcome sono costruiti come media di due variabili dummy che valgono 1 se lo studente ha conseguito rispettivamente più di 40 e più di 20 CFU; il terzo outcome è costruito, invece, come media di una variabile dummy che vale 1 se lo studente non ha conseguito CFU.

L'approccio è lo stesso di quello adottato per la media di CFU per intervallo di punteggio.

In Figura 5, è mostrato come la quota di studenti con più di 40 CFU non "salta" in basso nell'oltrepassare la soglia. Negli intervalli delimitati dalle bande gialle, con un minimo di 0,18 a sinistra della soglia ed un massimo di 0,26 a destra, la statistica conserva il trend crescente che si osserva sull'intero supporto della variabile *punteggio*. Un effetto positivo di Passport sull'outcome avrebbe generato quote più alte a sinistra della soglia.

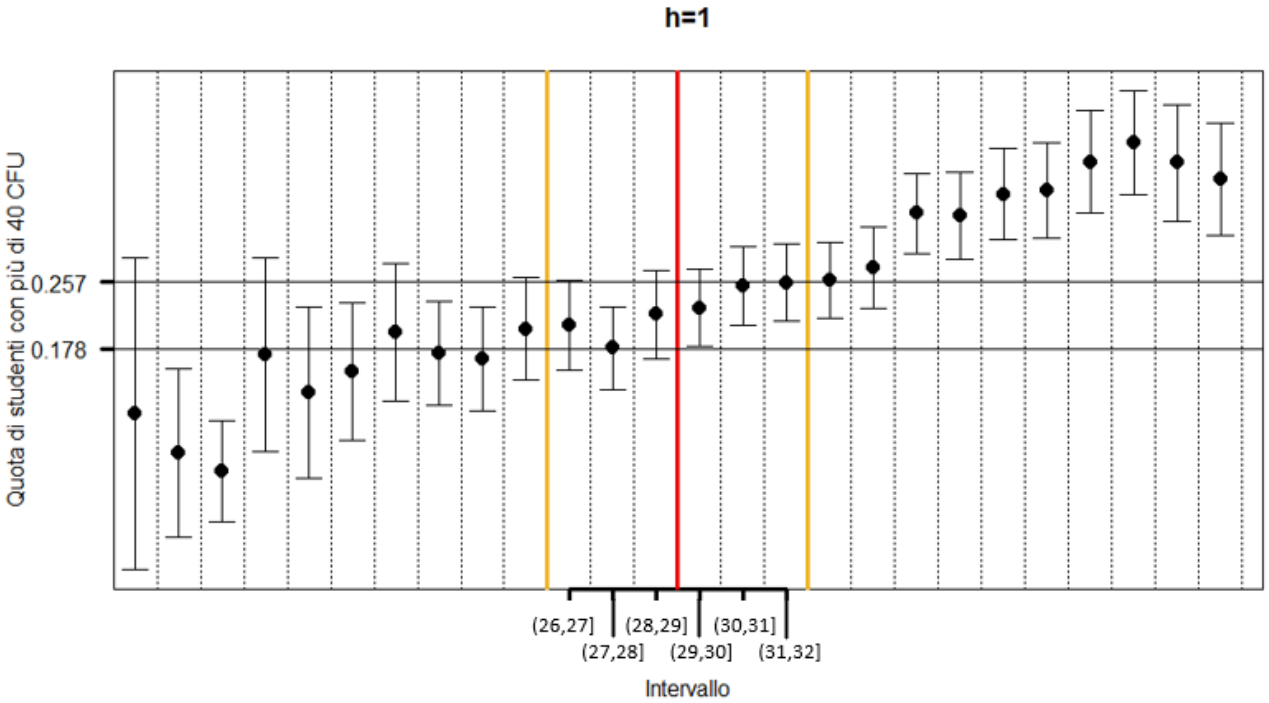


Figura 5. Grafico della quota studenti con più di 40 CFU con voto per intervallo di punteggio al TARM; in ordinata, evidenziate la minima e massima quota per gli intervalli dal (26,27] al (31,32]; intervalli di confidenza per la quota al livello di confidenza del 95%.

Si traggono le stesse conclusioni per la quota di studenti con più di 20 CFU, illustrate graficamente in Figura 6. Non si evidenzia un "salto" della quota di studenti con più di 20 CFU lungo la soglia. Anche in questo caso, si nota una relazione positiva tra l'outcome ed il punteggio al TARM.

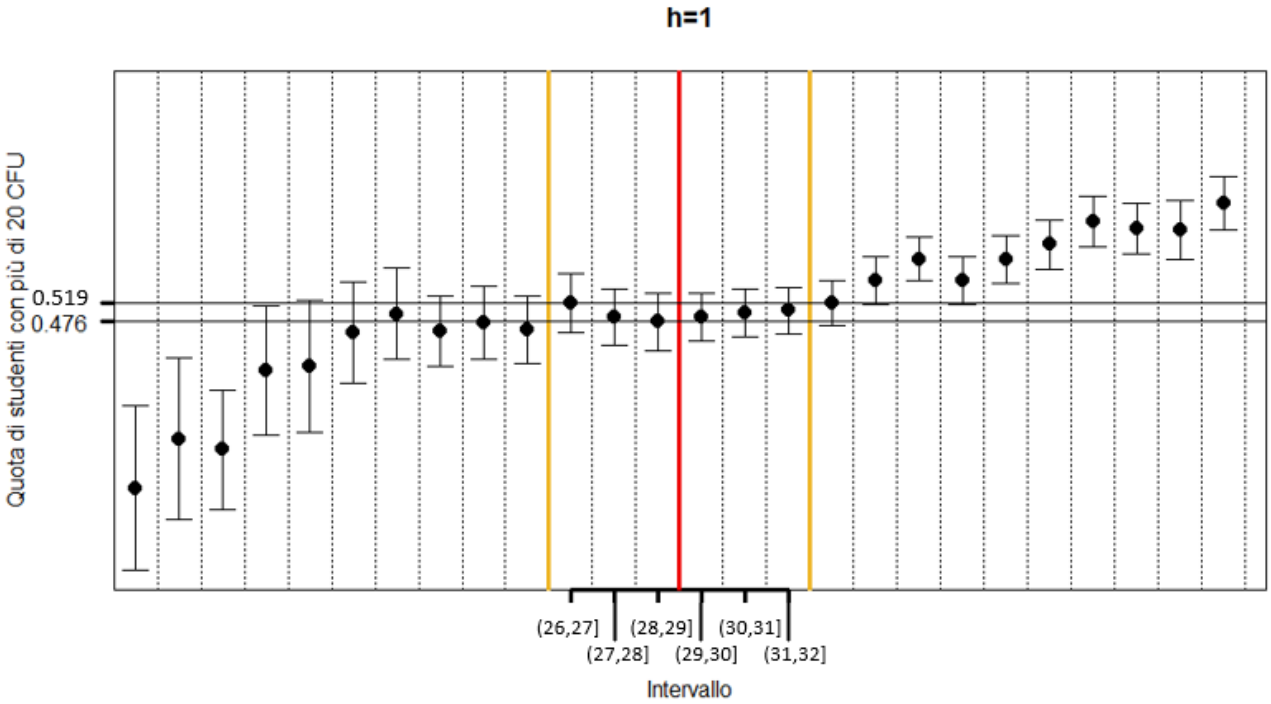


Figura 6. Grafico della quota studenti con più di 20 CFU con voto per intervallo di punteggio al TARM; in ordinata, evidenziate la minima e massima quota per gli intervalli dal (26,27] al (31,32]; intervalli di confidenza per la quota al livello di confidenza del 95%.

Nel grafico presentato in Figura 7, all'interno delle bande gialle, si nota la presenza di una discontinuità nella quota di studenti che non hanno conseguito CFU.

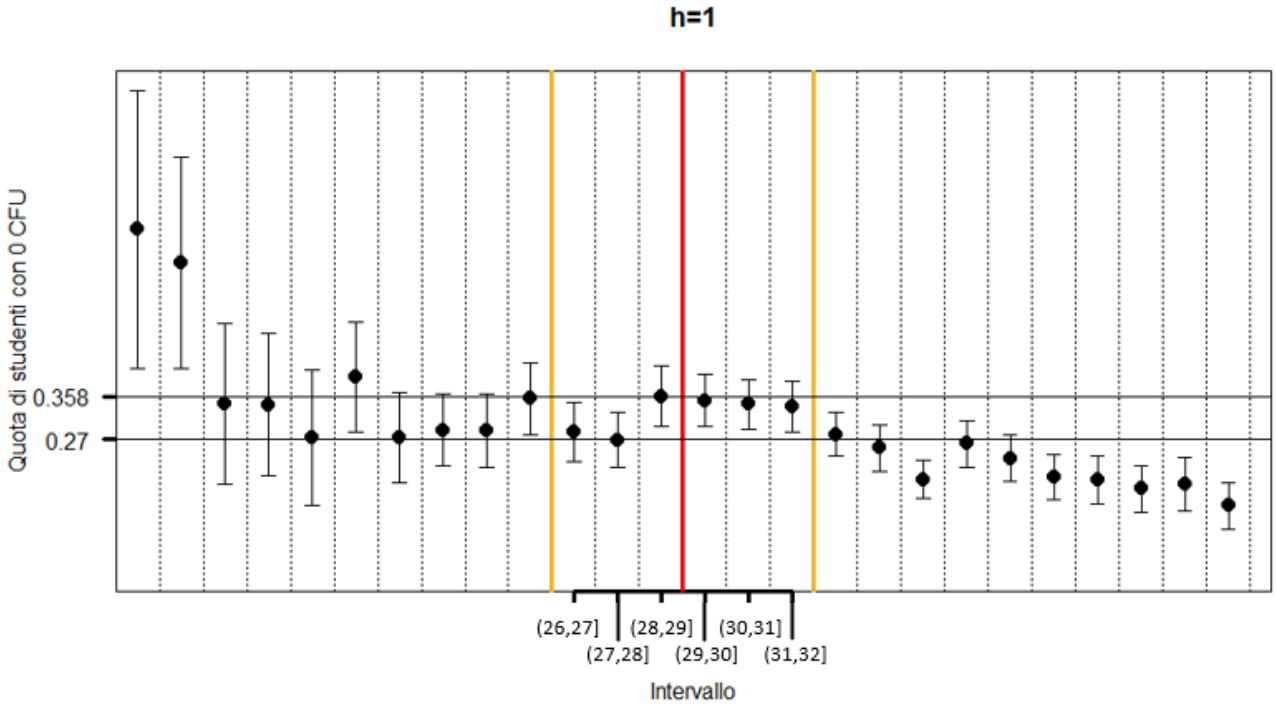


Figura 7. Grafico della quota studenti con 0 CFU con voto per intervallo di punteggio al TARM; in ordinata, evidenziate la minima e massima quota per gli intervalli dal (26,27] al (31,32]; intervalli di confidenza per la quota al livello di confidenza del 95%.

Si potrebbe quindi dire che a sinistra della soglia diminuiscono gli studenti che non conseguono crediti, per aumentare a destra. Ciò indirizza gli sviluppi di questa analisi preliminare ad indagare l'ipotesi che il programma Passport agisca sul margine estensivo, piuttosto che su quello intensivo; in altre parole, Passport riesce ad estendere la platea degli studenti che superano almeno un esame al primo anno (margine estensivo), mentre tra questi non sembra avere anche un effetto sulla quantità di CFU conseguiti (margine intensivo).[31]

3.4.1 Il problema dell'autoselezione

Nel precedente paragrafo, si è visto come Passport sembri aver avuto un effetto positivo nel far diminuire la quota di studenti che non conseguono CFU. Nell'interrogarsi sull'eventuale distorsione da autoselezione di questa stima, ci si è chiesto: nonostante l'aver controllato per il punteggio al TARM, sono stati confrontati individui simili?

Per rispondere a questa domanda, si presenta la Figura 8, dove è mostrata la quota di iscritti per intervallo di punteggio al TARM.

31 I risultati per questi tre outcome non cambiano per valori maggiori di h.

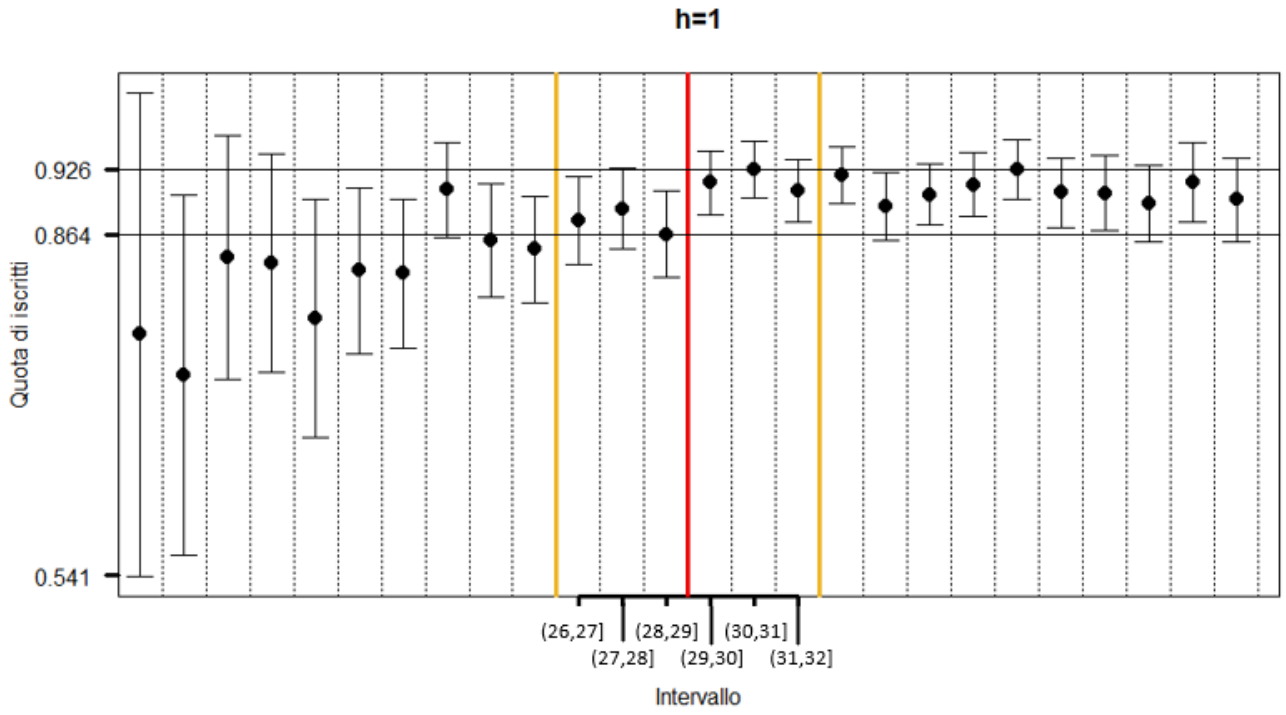


Figura 8. Grafico della quota di iscritti per intervallo di punteggio al TARM; in ordinata, evidenziate la minima e massima quota per gli intervalli dal (26,27] al (31,32]; intervalli di confidenza per la quota al livello di confidenza del 95%.

Dalla figura si evince che, a ridosso della soglia, le quote di iscritti sono maggiori per gli intervalli a destra. Ciò porta ad approfondire l'ipotesi che il dover sostenere Passport o, più in generale, il non superamento del TARM scoraggi l'iscrizione; se ciò fosse vero, nelle analisi degli outcome sarebbe stato fatto un confronto tra individui più motivati a sinistra della soglia, quelli che non avendo superato il TARM si sono iscritti superando lo scoraggiamento, ed un gruppo più eterogeneo a destra, fatto di studenti più o meno motivati.

In conclusione, la stima dell'effetto di Passport che sembrava manifesto in Figura 7 potrebbe essere distorta: è lecito aspettarsi che studenti più motivati conseguano un numero di CFU maggiore di 0.

Se quanto detto è vero e se, quindi, cade l'ipotesi che Passport agisca sul margine estensivo, andrebbero riviste a ribasso anche le stime sugli altri outcome: le medie di CFU, le quote di studenti con più di 40 CFU e di studenti con più di 20 CFU per intervallo di punteggio sarebbero più basse e ciò andrebbe ad evidenziare maggiormente l'assenza di un "salto" in giù degli outcome dopo la soglia, o, in altre parole, di un netto miglioramento di essi per studenti che hanno sostenuto il programma Passport.

Conclusioni

L'analisi qui presentata sull'impatto del programma Passport sulle carriere degli studenti ha carattere di preliminarietà. Da una parte, ciò è dovuto all'aver considerato studenti che hanno sostenuto esclusivamente il TARM a settembre; dall'altra, il ritardo di aggiornamento dei dati rende impraticabile la via dell'analisi sugli abbandoni al primo anno. Inoltre, l'analisi sui CFU non ha tenuto conto dell'eterogeneità dei CdS in termini

di numerosità ed estensione delle sessioni di esami. Infine, bisogna considerare che non è stata utilizzata ancora un'ottica multivariata, ma per valutare gli outcome ci si è concentrati sull'unica dimensione del punteggio al TARM.

Per il momento, le analisi sembrano indicare che Passport riesce ad estendere la platea degli studenti che superano almeno un esame al primo anno (margine estensivo), mentre tra questi non sembra avere anche un effetto sulla quantità di CFU conseguiti (margine intensivo).

Però, a minare l'ipotesi ulteriore che Passport sia riuscito ad agire sul margine estensivo, c'è il rischio di una duplice tipo di autoselezione, una sull'iscrizione (come abbiamo visto, le quote di iscritti sono più basse per punteggi sotto la soglia) e l'altra sul completamento di Passport in seguito all'iscrizione, che porta a considerare solo gli iscritti che completano il percorso, forse perché con abilità e motivazioni maggiori. Quest'ultima scelta è in particolare dovuta all'individuazione dell'outcome: non è possibile rilevare l'outcome dei CFU per coloro che non hanno potuto sostenere esami.

Le future stime sugli effetti di Passport saranno effettuate mediante l'utilizzo di un *Fuzzy RDD* piuttosto che di uno *Sharp RDD*. Quest'ultimo metodo si utilizza quando la ricezione del trattamento è funzione deterministica della *forcing variabile* (nel nostro caso, il punteggio al TARM), mentre al primo approccio sono affidati i casi in cui la relazione tra ricezione del trattamento e *forcing variabile* è descritta da un modello stocastico, per il quale a sinistra della soglia non tutti gli individui assegnati al trattamento in realtà lo ricevono, così come non tutti gli individui a destra se ne dispensano. Il nostro caso di studio è esattamente questo: in Tabella 1, si vede come 173 studenti iscritti (ovvero il 10% degli iscritti che non hanno superato il TARM) non hanno sostenuto e terminato il percorso pur dovendo farlo, mentre 18 studenti iscritti (lo 0.4% di quelli che hanno superato il TARM) completano Passport, pur non dovendo farlo. L'esclusione fatta in questo studio preliminare degli individui che non seguono l'assegnazione al trattamento – in particolare degli studenti sotto la soglia minima che non hanno dato Passport– è stata una scelta obbligata dal fatto che non esistono vincoli temporali entro i quali completare Passport, e quindi l'identificazione di questa platea sarà possibile in modo completo solo quando saranno disponibili anche i dati definitivi sulle reiscrizioni. Questa esclusione però implica i citati possibili problemi di selezione in termini di un diverso livello di motivazione dei gruppi di confronto, e che saranno appunto affrontati passando a un disegno *fuzzy*.

In conclusione, le estensioni di tale lavoro comprenderanno:

- L'utilizzo di un'ottica multivariata;
- L'analisi degli abbandoni al primo anno, che rappresentano la variabile di maggior interesse;
- Il controllo delle due fonti di autoselezione;
- L'implementazione di un *Fuzzy RDD*.

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