A multilevel competing risks model for analysis of university students' careers in Italy

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Abstract

This paper examines individual and institutional characteristics which may influence the outcomes of university students' careers. Withdrawals, course changes, delays and graduations of students enrolled in first-cycle degree courses in a large public university in Italy are examined. Individual longitudinal data from administrative archives were used, taking into account both the temporal dimension, and the organisational and structural characteristics of the degree courses. Results indicate that the profile of a successful student is defined by both socio-demographic factors and pre-university educational experience. At course level, restricted access to courses, study fields, and course size were important for students' university careers.

Keywords: university outcomes, survival analysis, competing risks, multilevel analysis

1. Introduction

Although international studies have shown the importance for both individuals and society of obtaining a university qualification (Eurydice 2010; EACEA 2012), entering higher education does not necessarily conclude with a degree (Lassibille 2011; Chen 2012) and thus increasingly interest has been paid to the determinants of students' outcomes during their university careers. Academic careers can in fact give rise to highly complex data, and only recently have researches highlighted the need for refined methodological tools to take this complexity into due account.

First of all, the temporal dimension cannot be neglected, due to the complex paths followed by students during their time at university (Singer and Willett 1991; Arias Ortiz and Dehon, 2013).

In addition, since the assumption that the precise time of occurrence of an event is known to be fairly unrealistic in educational contexts (Singer and Willett 1993; Scott and Kennedy 2005), a discrete framework must be considered. Although the importance of these issues is clearly recognised in the literature, the same cannot be said for the fact that different university career paths require a competing risks approach. Highly complex educational histories are indeed observed in the learning process producing competing outcomes (withdrawal, graduation, change of course), and single-risk models assuming event independence may be inappropriate (see discussion in DesJardins, Ahlburg, and McCall 2002, and Arias Ortiz and Dehon 2013). Lastly, most previous studies have focused on individual student perspectives (Smart, Feldman, and Ethington 2006), whereas very few have also addressed how university characteristics affect students' progress, although their potential importance is obvious (Berger and Milem, 2000; Patrick 2001) and consequently interesting for educational managers and policy-makers. When university characteristics affecting students' results are examined, the hierarchical nature of the data must be taken into account: students are clustered in degree courses, and degree courses are clustered in universities. Since the seminal work of Goldstein (1987), the hierarchical nature of educational phenomena has been viewed as essential if those phenomena are to be correctly understood and interpreted (Darrel 1989; O'Connell and McCoach 2008). Nevertheless, the international literature contains few studies in which the temporal approach is integrated in a multilevel framework in analysing the individual and contextual dimensions of university path (Patrick 2001; Arulampalam, Naylor, and Smith 2004; Chen 2012).

In Italy, research on these topics is still in its infancy. This is due to the lack of appropriate data (national longitudinal datasets with complete individual students' records are not available) and only recently have students' complex, multiple university paths been considered in a temporal dimension by means of a competitive risks approach (Clerici, Giraldo, and Meggiolaro 2014).

The aim of this paper is to study, in a single Italian university, how the characteristics of both degree courses and students as individuals affect students' university outcomes. With respect

to the existing literature, we integrate the discrete temporal dimension and competitive risks approach in multilevel modelling of hierarchical data on students and degree courses. Since this is one of the first studies examining the hierarchical nature of educational data within an appropriate survival approach in Italy, particular attention is paid to the effects of course-level characteristics.

Our data refer to four cohorts of students entering three-year undergraduate degree courses (tertiary education – ISCED 2011 level 6, first degree programs) at the University of Padova, a large public institution in North-East Italy. The results are indicative not only for students but also for university managers, in designing informed policies and interventions to discourage students from leaving higher education before graduating and to create support systems.

This paper is organised as follows. Section 2 reviews the literature, section 3 describes the main features of the Italian university system, and section 4 explains our methodological approach, with data and methods. Section 5 presents a multilevel competing risks model, and section 6 discusses the results and concludes.

2. Literature review

The literature on success and failure in higher education is huge and well-established (e.g., Thomson 2002; Lassibille 2011; Chen 2012). From both empirical and theoretical points of view, scholars explore the individual, social and organisational factors which determine students' outcomes at university. From Tinto's Student Integration Model (Tinto 1975), the most famous theory on student attrition, student performance and departure from university are the consequences of interactions between students' personal and social characteristics and universities' institutional practices. This view opens up the attractive possibility of effective intervention by academic institutions to reduce withdrawals. Nevertheless, there is not much empirical evidence indicating "support for the main elements in Tinto's model" (Braxton, Shaw Sullivan, and Johnson 1997), since empirical works on institutional characteristics affecting student retention rates are quite rare

(see, among others, Pascarella and Terenzini 1991; Ethington 1997; Patrick 2001; Titus 2004; Chen 2012), and there are even fewer analyses examining how these characteristics can also affect successful students compared with non-continuing ones (see, e.g., Titus 2004, and Christie, Munro, and Fisher 2004).

With reference to a single institution (Patrick 2001; Christie, Munro, and Fisher 2004), the hypothesis is that students who enrol in the same degree course face the same organisational context, teaching methods and levels of academic support. In addition, activities such as tutoring, contacts with faculty members and other services (e.g., support for working students) can be offered in different ways for each degree course. Lastly, the social environment surrounding degree courses (percentage of working students, class sizes, compulsory attendance, etc.) can greatly influence peer relationships and thus, indirectly, students' performance.

Important institutional factors having significant associations with student persistence versus drop-out are the structural characteristics of institutions, such as size and selectivity. In particular, both university size (Ryan 2004; Titus 2004) and selectivity (Kim 2007; Titus 2004, 2006; Gansemer-Topf and Schuh 2006) are negatively related to student drop-out. As regards size, Ryan (2004) suggests that, in large universities, due to scale economies, several academic services and types of support can be offered to students, thus enhancing persistence and leading to degree attainment. Conversely, highly selective universities have higher retention and graduation rates (Gansemer-Topf and Schuh 2006).

3. An overview of higher education in Italy

Italy has one of the largest higher educational systems in the European Union (Eurostat 2012) and was one of the first countries which created what is now called the "European Area of Higher Education".

The Italian university system (based on the "3+2" reform, which came into force from

academic year 2001/2002) is organised in three cycles, offering three consecutive programme levels: the first-cycle academic degree (*laurea triennale*) allows access to the second cycle (*laurea magistrale*) which, in turn, grants access to third-cycle courses for research doctorate degrees.

First-cycle degrees, which are the focus of this study, give students basic theoretical preparation and an adequate command of general scientific methods and contents, in addition to specific professional skills. They normally last three years, but there are no regulations limiting the length of time in which students must complete their studies: provided they pay the fees, they can continue to be enrolled at the university as long as they wish. Admission to first-cycle degrees may involve a restricted number of places (with compulsory assessment tests) or admission requirements (but without limited places) depending on the type of degree courses. Foreign students can also apply, but must have foreign school-leaving qualifications satisfying requirements for access to university education in Italy and must be competent in the Italian language.

For this study, we used data from the University of Padova, which is one of the ten largest public institutions in the country, and also one of the oldest and most prestigious in Europe. It is highly multidisciplinary, with courses covering all the study fields and thus it is therefore very unlikely that our results reflect differences in the nature of programmes offered at this one institution, and this point is essential to the external validity of our estimates.

4. Data and methods

4.1 Data

Data were obtained from the administrative archives of the University of Padova. The academic careers of 32,201 newly enrolled students in academic years 2002/03 to 2005/06 in 81 first-cycle degree courses were examined. Information on each student's career is available for a maximum period of five years, and, in any case, not after December 2009. In particular, three events which students may experience are considered: course change (transfer to another University of Padova course), withdrawal (formal withdrawal from a degree programme, without re-enrolment

at the University of Padova[1]), and graduation. Clearly, if students are still enrolled in the first or second year out-of-course (since observations are censored at the fifth year at most, further delays cannot be considered), they have not yet experienced any of these events. In the following, this situation is called "delay".

The University of Padova's administrative database also collects data on students' secondary education (type of secondary school attended, results of secondary school final examination, school career regularity) and some personal characteristics (gender, age, year of university enrolment, place of residence, nationality). Students are required to furnish all this information at the time of their application. Thus, our database does not contain missing data and is not affected by problems of non-response bias, which may affect survey data. Some information on the organisational (admission with or without restricted number of places, with or without compulsory attendance) and structural characteristics (study fields, number of enrolled students, percentages of working students) of degree courses are also available.

4.2 Methods

Although students may change course, withdraw or graduate at any time during the academic year, the exact date when such an event occurs is not known, so that time was measured as the number of years from the first year of enrolment to the year of the first of these events. Discrete-time hazard models were consequently used: the data were examined in the person-period format (Allison 1984; Singer and Willett 1991; Scott and Kennedy 2005). In addition, since multiple outcomes at university (course changes, withdrawals, graduation) are of interest, a competing risks approach was used. In this framework, students "in delay" - those still enrolled at

[1] Students who transferred to another university before graduating at the University of Padova were thus considered as withdrawals. This definition is due to the local dimension of our study: if it had been conducted at national level, some of these withdrawals would have been classified as "change of university".

the university without having graduated by the time of our last observation - are considered as censored.

In general, assuming that there are K outcomes of interest (in our case, $K = 3$) and the non-outcome 0 (in our case, delay) for each discrete point in time t, we can compute hazard $h_i(k,t)$ which, here, is the conditional probability that student i transfers ($k = 1$), withdraws ($k = 2$) or graduates ($k = 3$) in time t, if that student has not yet left the educational system (thus, non-outcome 0 happens in every period before t). To combine the discrete-time base and the competing risks context, hazard $h_i(k,t)$ is modelled through the discrete-time analogue of the continuous-time proportional hazards model with multinomial logistic regression (following the methodology presented by Scott and Kennedy 2005):

$$log\left(\frac{h_i(k,t)}{h_i(0,t)}\right) = \alpha_{k0} + \alpha_{k1}D_{1i} + \alpha_{k2}D_{2i} + \alpha_{k3}D_{3i} + \alpha_{k4}D_{4i} + \beta_k x_i \qquad k = 1, 2, 3 \qquad (1)$$

where $h_i(0,t)$ is the hazard of the non-event (delay), x_i is a vector of individual characteristics of student i, and β_k is the corresponding vector of regression coefficients for outcome k ($k = 1, 2, 3$), which captures the effect of the predictors on the baseline profile[2]. α_{k0} is a constant term representing the intercept and the D_{li} ($l = 1,...,4$) are dummy variables corresponding to each time-point (in our case, years) – thus, in this specification, year 5 of enrolment is the reference category

[2] In this specification, the effect of each predictor is to shift the outcome-specific hazard ratio vertically at every point in time, which requires an assumption of proportionality; i.e. we are assuming that the relationships between a regressor and the dependent variable are constant over time. This choice was made not only for reasons of parsimony and convenience, but also because we were interested in an overall effect and, in particular, in the effect of course (level 2) covariates. Another assumption of the discrete-time hazard model is that of linearity, but it was not relevant in our case because, as following sections will show, explanatory variables were all categorical, also for avoiding convergence problems of the models.

and the year coefficients α_{kl} must be interpreted as differences from year 5 for outcome k. In this specification, the outcome-specific hazard ratio $log\left(\frac{h_i(k,t)}{h_i(0,t)}\right)$ measures the relative risk of experiencing event k with respect to the risk of experiencing the non-event

One further point which must be made, in view of the hierarchical nature of our dataset, is the problem of possible clustering within degree courses. In this analysis, students (level-1 unit of analysis) are clustered within courses (level-2 unit of analysis). Ignoring this nested nature of the data is equivalent to assuming that the timing of different outcomes at university is independent of the courses in which students have enrolled: this assumption may lead to incorrect estimates (Raudenbush and Bryk 2002).

In a multilevel framework, we consider a random intercepts model[3] (Steele, Diamond, and Wang 1996; Kreft and de Leeuw 1998; Snijders and Bosker, 1999; Steele, Goldstein, and Browne 2004), starting from an average baseline level of hazard for course j (with $j = 1,..., 81$, corresponding to the 81 first-cycle degree courses of our data) indicated by α_{k0j}:

$$\alpha_{k0j} = \gamma_{k00} + u_{k0j} + \delta_k z_j \qquad (2)$$

$$log\left(\frac{h_{ij}(k,t)}{h_{ij}(0,t)}\right) = \gamma_{k00} + \alpha_{k1}D_{1i} + \alpha_{k2}D_{2i} + \alpha_{k3}D_{3i} + \alpha_{k4}D_{4i} + \beta_k x_{ij} + \delta_k z_j + u_{k0j} \quad k = 1, 2, 3 \qquad (3)$$

In this model, z_j is a vector of the characteristics of course j, with its corresponding vector of regression coefficients δ_k for outcome k. γ_{k00}, α_{kl} ($l = 1, 2, 3, 4$), β_k and δ_k are fixed effects. For

[3] A random effects model was preferred to a fixed effect one, since our sample does not cover the full population of degree courses in Italy. Nevertheless, estimates obtained with fixed effects models are very similar. More complex models with random slopes were not estimated, due to convergence problems of estimates and to the difficulty of interpreting them.

random intercepts u_{k0j}, varying among courses, we assume multivariate normal distribution with zero expectation and covariance matrix Σ. For simplicity[4], we restrict covariances to zero, so that Σ is a diagonal matrix.

4.3 Individual level and course level covariates

As noted above, both individual-level and course-level characteristics may influence the different outcomes of university careers, and in this paper particular attention is paid to the course-level features.

As regards individual-level variables, two sets of aspects of students, which the literature has found to be important for university outcomes (Smith and Naylor 2001; Lassibille and Gómez 2008, 2009; Belloc, Maruotti, and Petrella 2011; Lassibille 2011; Clerici, Giraldo, and Meggiolaro 2014) are considered in the analyses. The first includes all students' main personal characteristics: gender, age at enrolment (whether immediately after secondary school or not), year of enrolment, place of residence (distinguishing students residing in Padova as their home town, commuting students, and "live-in" students - those living in Padova for study reasons), and nationality (whether foreign or Italian). The second refers to their secondary education: type of secondary school (high school, polytechnic and vocational school), grades for secondary school final examinations (for simplicity, lower or greater than 70), and school career regularity (regular or not). The impact of these individual-level covariates has already been studied elsewhere (in particular, for Italy, see Author identifying reference), and here, particular attention is paid to the course's characteristics, which literature has shown to be important for students' outcomes (Patrick 2001; Titus 2004; Kim 2007; Chen 2012).

[4] Models were estimated by PROC NLMIXED in SAS; estimation is very time-consuming, due to the complexity of the model. Maximum likelihood estimation of the parameters is indeed difficult, as the likelihood function consists of a product of 81 integrals (one for each course defining level-2 units), that cannot be solved in closed form. Here, an estimation based on adaptive quadrature was used.

In the current analysis, course-level characteristics concern on one hand organisational aspects, such as criteria for admission (whether restricted access or not) and attendance (compulsory or not) and, on the other, structural factors such as study fields (professional health studies, humanities, social sciences, and scientific studies), number of enrolled students (fewer than 50 students each year, 50-99, 100-179, more than 179 students[5]), and the proportion of working students (fewer than 10%, 10-15%, more than 15%).

In the literature, when studying retention behaviour by comparing various institutions, a negative relationship between restricted admission and withdrawal has been found (Titus, 2004; Kim, 2007). A similar pattern may be plausible within a single university. In particular, peer groups in courses with limited access tend to be better prepared academically and more highly motivated and, for students who may be at risk of an interrupted career, the presence of such peers may cause these students to try to invest more in their careers (Kim 2007).

A similar peer group effect may hold, if the course requires compulsory attendance at lectures. Many studies have shown the positive relationship between students' lecture attendance and their performance (Lockwood, Guppy, and Smyth 2006; Newman-Ford et al. 2008; Delaney, Harmon, and Ryan 2011). Unfortunately, in this work, we could not control for individual students' attendance at lectures (student-level characteristic), due to lack of appropriate data. However, peer groups in courses with compulsory attendance are expected to have more successful careers at university and to motivate students at risk of interrupting their careers to improve their performance.

A similar observation holds for the presence of working students: having a job while enrolled at university is associated with a lower probability of retention and graduation (Thomas 2002; Dolton, Marcenaro, and Navarro 2003; Kim 2007; Lassibille and Gómez 2011). Again, we

[5] These thresholds are defined according to the requirements for study courses defined in Ministerial Decree 17/2010, available at http://attiministeriali.miur.it/anno-2010/settembre/dm-22092010.aspx.

cannot control for the individual-level variable, but information on course-level counterparts is available. It is also possible that courses with high percentages of working students have particular services and support schemes for such students, so that (in this hypothesis), a higher proportion of working students should be associated with more successful university careers.

Significant differences also exist across study fields (Patrick 2001; Lassibille 2011; Arias Ortiz and Dehon 2011). This may be due either to differences in the effectiveness of educational inputs in various fields, or to the specific subject matter, which may be more or less difficult according to the field of study.

The literature also indicates that course size is important for students' outcomes at university, and the fact that it is also one of the simplest variables for policy-makers to manipulate makes programme size potentially a key variable in the learning process. It is expected to have a negative impact on students' successful careers, because, for example, larger courses imply fewer personal interactions between students and teachers. Course size may also affect how much teachers can invest in individual students and their specific needs, rather than on the group as a whole: the smaller the course size, the more likely individual attention can be given. In fact, larger courses may also offer better academic and support services (Ryan 2004), offsetting the potential negative effect of student isolation and the lack of integration typical of larger courses (Kim 2007). Some studies have found no influence of size, probably due to these opposite effects (Montmarquette, Mahseredjian, and Houle 2001; Arulampalam, Naylor, and Smith 2004; Titus 2006).

4.4. Descriptive analyses

Table 1 lists the proportion of students in each of the four outcomes in each subgroup defined by individual-level and course-level characteristics.

The first part of Table 1 describes the process of students' departure from university according to individual characteristics. Women and students with Italian nationality have more

successful careers than men and foreign students, respectively. Students who enrolled in the university immediately after leaving high school, with better grades and after a regular school career, have the highest proportion of degrees and, conversely, the fewest withdrawals. In general, students who transferred to other courses do not show highly differentiated distributions according to individual characteristics.

The second part of Table 1 refers to course-level characteristics. As regards type of admission, students enrolled in courses with restricted access have more successful careers. Compulsory attendance also defines courses with students with better performance. Confirming findings from the literature (see review by Lassibille 2011), students in professional health studies perform better than students in other courses; students enrolled in humanities are in the opposite end of the scale. As regards course size, Table 1 does not show great differences in the process of students' departure from university: students in less frequented courses are more advantaged, with more graduations and fewer withdrawals, but the differences are not very high. Similarly, the presence of working students does not lead to great differences in students' careers, and the trend is not monotonic.

Clearly, a multivariate analysis should be used to obtain the net effect of each individual and course characteristic. Multivariate models were estimated in the discrete-time competing risks multilevel approach (with random intercepts) described above. Covariates are those described above and listed in Table 1.

Insert Table 1 here

5. Results

Table 2 lists the coefficient estimates of individual and contextual covariates in a multilevel competing risks model: column 1 compares course changes and no event (i.e., censored

information/delay), column 2 compares withdrawals and no event, and column 3 graduation and no event.

As regards the individual-level covariate, net of other factors, men more frequently interrupt their university careers than women, are more likely to withdraw, and less likely to graduate[6]. Other at-risk students are not Italian: they show significantly higher probabilities of course change and withdrawal, and are less likely to graduate than Italian students. Live-in students have higher risks of withdrawal than students resident in Padova, but are also more likely to graduate. Being a commuting student does not appear to decrease graduation rates directly, but it does so indirectly by increasing the probability of withdrawal. As expected, enrolling at university immediately after leaving secondary school significantly increases the probability of graduation and decreases the risk of withdrawal; such students are also less likely to change course.

As regards the characteristics of secondary school experience, students entering university with qualifications other than high school diplomas (in particular, those from vocational schools), and those with low secondary school grades or with irregular school careers are more prone to withdrawal and less likely to graduate than other students. However, those from high schools, with good secondary school grades and regular careers, are at greater risk of course changes. Belloc, Maruotti, and Petrella (2010, 2011) believe that this mixed evidence is due to the fact that students with a better educational background are more sensitive to course contents and, when they realise they do not enjoy them and/or are not satisfied, they change.

As regards course-level variables, results generally show evidence of variations in intercepts across courses (intercepts' variances are significantly different from zero) and course characteristics are important in students' outcomes.

Although there is evidence that the probability of withdrawal and course changes is lower in

[6] In particular, the estimated odds of withdrawing in any given year are 1.08 (= *exp(0.08)*) times greater for men than for women; the odds of graduating are 13% (= *100*[exp(-0.14)-1]*) lower for men than for women.

courses open to all students, students following courses with restricted access are more likely to graduate (as expected). Instead, students in courses with compulsory attendance have a lower risk of withdrawal than others, but do not have different profiles in terms of graduation.

Study fields are particularly important as regards withdrawals and graduation: students following professional health programmes have a higher probability of graduating than students in other courses, although they are at higher risk of course changes and withdrawal. Conversely, students in social studies have a (weak) lower probability of graduating than those following scientific programmes, and also lower risks of withdrawal and course change: thus, they are more likely to make consecutive enrolments without actually obtaining their degrees. Students enrolled in humanities are more similar to those in scientific studies, but have a weak lower probability of withdrawal.

Course size does not completely influence students' careers in the expected direction: courses with many students (more than 100) lower the probability of graduation, but those of intermediate size have higher risks of withdrawal. In some cases, these opposite potential effects of course size probably compensate each other.

Lastly, the significant effects of students with jobs are observed, not always in the expected direction. Although students enrolled in courses with low numbers of working students have lower risks of withdrawal, they also have a lower probability of graduating, particularly when numbers are under 10%.

Insert Table 2 here

6. Discussion

This paper analyses both individual and course factors influencing students' behaviour throughout their university careers. Course changes, withdrawals and graduations are considered in a multilevel discrete-time competing risks survival setting. Examining the multiple outcomes of

university careers is clearly a very realistic way of treating student behaviour. In addition, as multilevel event history models are not common, the possibility of having individual longitudinal data on student outcomes and course characteristics creates a unique opportunity to study students' careers at university.

The analysis is worthy of note for its implications for individuals and institutions, in view of the rising human and financial costs of attendance and the increased importance of higher education in Western societies, thanks to its crucial role in human capital development.

At individual level, students' characteristics show expected effects in the opposite direction as regards the risk of withdrawal and that of graduation. The profiles of successful students are defined from a socio-demographic viewpoint as being women, of Italian nationality, and living in a university city - in this case, Padova - for study reasons. As regards pre-university education, graduating students had enrolled at university immediately after leaving high school, which they had regularly attended, and had good grades in their final school examinations.

The profiles of students who withdraw is the complete opposite. The weakness of their secondary school careers is thus a clear indication of a higher risk of educational failure. In this case, institutional planners should pay more attention to these students: on one hand, by discouraging students whose chances of not graduating are high and, on the other, by organising support activities and services in the various forms of tutoring, counselling and coaching. It is interesting to note that, in comparison with students in delay, those who change courses have pre-university educational experience similar to that of successful students. This similarity leads us to consider course changes as only partial failure, rather as re-orientation directed to educational success. However, our results suggest that university management should apply some kind of pre-enrolment orientation, focusing particularly on students from high schools. These students may not have complete information on educational offers or, more simply, they may be re-oriented by an interest in some study fields they only discovered during their university experience, since the subjects in question were not taught during their pre-university education.

Considering the results at course level, besides the effect of each covariate, it is interesting to note a macro-uniformity in the results: course characteristics tend to operate in the same direction for the three outcomes of interest. This suggests that some contexts may favour events, whatever they might be, in comparison with extending a delay condition. For example, courses with restricted admission lead to a higher probability of graduation, but they also have higher risks of withdrawal and course change, in comparison with delay. As regards study fields, there is evidence that students enrolled in certain disciplines have significantly different outcomes with respect to others. This may be connected with the fact that the "match" between students and the subjects they study is easier in these fields than in others, or simply because in some fields academic requirements are lower or have a more supportive learning environment. In particular, similarity in outcomes is observed for students enrolled in scientific studies and humanities. Instead, the university careers of those enrolled in professional health studies and social sciences are quite opposite: the former being more likely to lead to graduation, course changes and withdrawal, and the latter to a static delay condition. More in general, our results highlight several contextual factors which should be considered by those responsible for educational practices and policies: actions and support services should be appropriately differentiated according to context, as well as to students' individual characteristics. In courses characterised by higher risks of delay, both support and counselling services for individual study and development of educational methods (for example, blended learning) should be provided. In courses with higher risks of change, more detailed orienting sessions at enrolment and psycho-pedagogical counselling during student careers could be organised.

Unfortunately, the administrative data at our disposal did not provide information on students' family social and economic background, which has been found to be important in students' progress (Arias Ortiz and Dehon 2013; Lassibille 2011; Chen 2012). Similarly, another aspect which could not be taken into account was a subjective perspective, because of the nature of the administrative data source. Future research should consider family backgrounds, and attitudes,

motivations and feelings about university study, in order to be able to propose comprehensive ways of improving the effectiveness of the educational process in higher education.

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Tables

Table 1: Students' academic career outcomes by individual and course level characteristics (percentage values).

	Course change	Withdrawal	Graduation	Delay	Total =100	%
STUDENT-LEVEL CHARACTERISTICS						
Academic year of enrolment						
2002/03	7.0	25.3	55.0	12.7	8,005	24.9
2003/04	8.1	23.5	56.3	12.1	8,269	25.6
2004/05	9.6	21.7	48.6	20.1	8,006	24.9
2005/06*	10.5	20.5	27.6	41.4	7,921	24.6
Gender						
Female	9.1	19.9	51.1	19.9	17,623	54.7
Male	8.5	26.2	42.1	23.2	14,578	45.3
Nationality						
Italian	8.6	22.3	47.8	21.3	31,113	96.6
Other	14.6	35.0	24.8	25.6	1,088	3.4
Residence						
Resident students	8.9	22.4	46.0	22.7	16,395	50.9
"Live-in" students	9.0	24.5	48.9	17.6	6,745	21.0
Commuting students	8.5	22.2	47.3	22.0	9,061	28.1
Enrolment after graduation						
Immediately after	8.9	20.1	49.5	21.5	27,256	84.6
Not immediately after	8.2	37.4	33.4	21.0	4,945	15.4
Type of secondary school						
High school	9.8	18.1	52.2	19.9	19,359	60.1
Polytechnic	7.1	28.6	40.5	23.8	10,660	33.1
Vocational school	8.1	35.5	33.3	23.1	2,182	6.8
Secondary school final score						
Mean score (/100)	79.2	75.8	84.3	77.4	80.4	
Median score (/100)	78.0	74.0	85.0	76.0	80.0	
Regularity of school career						
Irregular	8.9	37.2	28.8	25.1	5,914	18.4
COURSE-LEVEL CHARACTERISTICS						
Restricted admission						
No	7.5	25.9	41.3	25.3	22,492	69.8
Yes	11.7	15.5	60.2	12.6	9,709	30.2
Attendance						
Compulsory attendance	9.3	19.9	53.4	17.4	12,575	39.1
Not compulsory attendance	8.5	24.6	42.9	24.0	19,626	60.9
Study fields						
Professional health studies	8.9	15.6	68.2	7.3	2,662	8.3
Humanities	7.5	27.7	38.5	26.3	6,370	19.8
Social sciences	9.2	20.9	48.2	21.7	10,766	33.4
Scientific studies	9.1	23.4	45.7	21.8	12,403	38.5
Course size						
< 50 students	9.3	20.8	51.8	18.1	3,279	10.2
50-99 students	6.3	22.4	48.1	23.2	6,360	19.8
100-179 students	9.2	22.8	43.9	24.1	7,803	24.2
> 179 students	9.5	23.4	47.1	20.0	14,759	45.8
% working students						
Under 10%	9.3	21.1	48.9	20.7	14,114	43.8

10%-15%	6.2	25.4	44.6	23.8	8,756	27.2
Over15%	10.5	22.8	46.3	20.4	9,331	29.0
N	2,832	7,334	15,132	6,903	32,201	
%	8.8	22.8	47.0	21.4	100	

* censored.

Table 2: *Coefficient estimates of covariates in a multilevel competing risks model with three destinations.*

	Course change (1)	Withdrawal (2)	Graduation (3)
STUDENT-LEVEL FIXED EFFECTS			
Intercept	-1.57***	-3.54***	-0.39
Year (*ref: 5)*			
1	1.51***	2.78***	1.81***
2	1.17***	1.88***	1.81***
3	0.95***	1.19***	1.78***
4	0.70***	0.68***	1.18***
Academic year of enrolment (*ref:2005/06)*			
2002/03	1.18***	1.46***	2.20***
2003/04	1.45***	1.50***	2.25***
2004/05	0.87***	0.84***	1.49***
Gender (*ref: female*)			
Male	-0.05	0.08**	-0.14***
Nationality (*ref: Italian*)			
Other	0.08	0.31***	-0.94***
Place of residence (*ref: resident students*)			
Live-in students	-0.00	0.37***	0.19***
Commuting students	-0.05	0.09***	0.03
Enrolment after graduation (*ref: immediately*)			
Not immediately after	-0.13**	0.54***	-0.34***
Secondary school (*ref: high school*)			
Polytechnic	-0.38***	0.26***	-0.33***
Vocational school	-0.29***	0.29***	-0.70***
Secondary school score (*ref: 70 or higher*)			
Under 70	-0.28***	0.13***	-0.91***
School career (*ref: regular*)			
Irregular	-0.15***	0.26***	-0.61***
COURSE-LEVEL FIXED EFFECTS			
Access (*ref: restricted access*)			
No restrictions	-0.90***	-0.22***	-0.99***
Attendance (*ref: not compulsory*)			
Compulsory	-0.20	-0.17***	-0.08
Study fields (*ref: scientific studies*)			
Professional health studies	1.06**	0.64***	1.28***
Humanities	-0.30	-0.07*	-0.26
Social sciences	-0.75**	-0.33***	-0.48*
Number of students (*ref: < 50*)			
50-100	-0.45**	-0.10**	-0.19
100-180	-0.03	-0.01*	-0.37**
> 180	-0.01	0.05	-0.41**
% working students (*ref: > 15%*)			
> 10%	-0.24	-0.24***	-0.45**
10%-15%	-1.04**	-0.19***	-0.43*
Random effects (course level)			
Variance (intercept)	0.43***	0.15***	0.22***

***= p<.001; **=p<0.05; *=p<0.10