

University Reform in Italy: an econometric analysis of student progression

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Abstract:

As in much of Europe, and in the particular context of the Bologna Convention on tertiary education, the Italian university system is in the process of radical reform, the major aims of which include increasing the participation, progression and retention rates of students in higher education. The reform, inspired in part by the UK model, has reduced the length of undergraduate degree programmes to three years, which should enable students to graduate at an earlier age than in the past, more in line with graduates from other European countries. This paper offers a first econometric analysis of the impact of the Reform on student retention and progression, three years from its introduction. We use administrative data on students of two Italian universities in (i) a probit model of the probability that the student drops out, (ii) an ordered probit model of student progression and (iii) a corresponding OLS model of progression. The analysis suggests that although the number of entrants to university has increased, the drop-out rate is still very high and only a small proportion of students are likely to complete their studies within the institutional time. We argue that the Reform is unlikely to achieve its goals without changes to admission policies and the introduction of regulations or stronger incentives for early student completion.

Keywords: Probit and ordered probit models, student progression, university reform.

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1. Introduction

Following the Bologna Convention of the EU in 1999, the Italian university system – like many others in Europe - has been in the process of radical and ongoing reform. In the Italian context, this process has several major aims. First, there is the objective of raising the participation rate of young people in higher education (HE). OECD figures for 2001, for example, show that while the OECD mean for the percentage of the population aged 25-34 graduating from HE was 28%, the corresponding figure for Italy was just 12%. Second, there is an awareness that the drop-out rate of students from HE is very high in Italy and there is a policy objective to reduce this. Figures from MIUR (Ministero dell'Istruzione, Università e Ricerche) indicate that approximately 20% of students in Italian universities drop out in their first year alone. The equivalent figure for the UK is less than half this. Third, even for students completing their studies in HE in Italy, the time to completion is much longer than in most other countries. Prior to reform, fewer than 10% of students graduated within the typical institutional four-year degree period. A remarkable 40% graduated four years or more after the expiry of the four-year period. A chief aim of that part of the reform concerned with the introduction of a '3+2' model for undergraduate degrees is to accelerate progression and completion of studies. The difference between actual years taken to complete the studies and the institutional time established for the degree course programmes is typically higher for Italian university students than students from other European countries. On average, students in Italy graduate in their late 20s rather than in their early 20s as in other European countries. This is seen as acting as a break on labour market efficiency. An important policy objective behind reform is to enhance the efficiency of the transition of graduates into the Italian graduate labour market.

The reform has changed the length, content and structure of the degree programmes, by employing the 3+2 model, consisting of a First Degree (*Laurea di primo livello*) which lasts three years, followed by a two-year Specialised Degree (*Laurea specialistica*). The reduction in the length of undergraduate degree programmes to three years (from the original duration of four or five years), and the increased variety of

curricula offered seem to have been successful in encouraging greater participation. This is documented by recent aggregate statistics constructed by the Ministry of Education, University and Research (MIUR, 2004) which indicate that more students have been attracted to tertiary education, therefore suggesting that the new curricula offered have met the needs of a larger number of youngsters. Whether the reformed system is achieving a reduction in the drop-out rate and enabling students to complete their studies within the established three-year period, are crucial issues to be addressed in order to monitor the effects of the reform.

Studies devoted to the analysis of higher education outcomes have attracted a high level of interest in countries like the UK, where various policy initiatives have also been implemented in recent years. Major policy interventions in the UK have involved (i) shifting the financial costs of HE on to students and their families and away from general taxation, (ii) expanding HE participation hugely – from a 15% participation rate among young people in 1980 to over 40% in 2000, and (iii) introducing institutional performance indicators (PIs) and linking public financial support to performance against these criteria (which include student progression, access and transitions to the labour market). This has led to a growth in the number of academic studies evaluating issues such as the determinants of student progression through university (see, for example, Smith *et al.*, 2000, and Smith and Naylor (2001a, 2001b). This work has exploited the release of full individual records for the cohorts of students leaving UK universities. A selective survey of recent work can be found in Boero *et al.* (2001).

Contrary to other countries, especially the US and the UK where the literature on educational outcomes is well developed, the research in this area is not so well-established in Italy, where the empirical work is complicated by the fact that no consistent national data-set is available with full individual student records. However, in recent years there have been a number of studies dedicated to the performance of Italian university students. Biggeri, Bini and Grilli, (2001) focus on issues related to the transition from university to work using data from the 1995 ISTAT survey on job opportunities, on students graduating in 1992. Boero, McKnight, Naylor and Smith, (2001) use the more recent 1998 ISTAT survey on students graduating in 1995 to analyse the factors affecting graduate performance and the determinants of graduates' pay. There

are also various studies that have used data on individual students from particular universities. For example, Bulgarelli (2002) and Gori and Rampichini (1991) have conducted various analyses of the academic performance of students at the university of Florence, Checchi (2000, 2003) for the university of Milano-Bicocca, and Staffolani and Sterlacchini (2001) for four universities of the Marche.

Little work has been done on the two major problems that afflict the Italian university: high dropout rates and the excessive duration of students' academic careers. Moreover, as far as we know, there are as yet no studies devoted to the analysis of the performance of Italian university students in the reformed system.

In this paper we present a first analysis of the impact of the Reform on student retention and progression, after three years from its introduction. We begin in Section 2 with an overview of recent trends in the levels of educational achievements in Italy in comparison to experiences in other countries. In Section 3 we describe the current policy context of higher education in Italy, discuss the objectives of the university reform and analyse the first results in terms of the number of students entering higher education, drop out rates and the number of graduates. In Section 4 we conduct an econometric analysis to identify the determinants of the probability of dropping out from university and of student progression, using administrative individual-level data for two Italian universities, namely Cagliari and Viterbo. In Section 5 we close the paper with a summary of the results and address some empirical questions concerning the construction of data-bases and appropriate performance indicators.

2. Educational attainments: Italy and the international context

3. The Reform of the Italian University

4. Drop out rate and student progression: data and modelling

Unlike other countries (for example the UK), in Italy there is not a census of all university students, so most empirical work on tertiary education in Italy is based on specific survey data or administrative data on individual students from particular universities. The empirical analysis in this section is based upon a data set that we have constructed from the administrative archives of two Italian universities: Cagliari and

Viterbo. The data refer to all the students enrolled for the first time in the academic year 2001-2002, that is the year of effective implementation of the reform. In addition to information collected at time of application to university, the data include follow-up information about the progress of each student. Therefore, the data contain information about persistence through the university course in addition to the number of exams and credits obtained by each student for every year of enrolment. The background information provided for each student includes date of birth, type of *Maturità* and score obtained, date of achievement of *Maturità*, residence, amount of university fees paid (on the basis of declared parental income).

We concentrate our analysis on students who have entered university for the first time in 2001-02 in the reformed system. Therefore our sample excludes individuals who moved from a pre-reform course. Moreover, we did not consider those individuals who transferred to a degree course in a different university, as it was not possible to follow-up their progression.

In total we have 15 faculties, specifically 5 in Viterbo and 10 in Cagliari. The data base that we use for the drop out analysis consists of 6,438 students (1,181 for Viterbo and 5,425 for Cagliari), while the analysis of student progression is based on 4,904 students (731 for Viterbo and 4173 for Cagliari). In constructing the latter data base we considered all the students who have renewed registration up to the second year. For each student we have observed the number of credits accumulated by the end of December 2003 (end of second year). A student is assumed to have successfully progressed towards a degree if she or he had obtained 70% or more of the total credits that should have potentially been achieved at the end of the first two years, according to the institutional curriculum of the relevant degree course.

In the next sections we describe the data set and the econometric models used to identify (i) the determinants of the probability of dropping-out from university and (ii) the determinants of student progression. In the first case we use a binomial probit model, in the second we use (a) an ols regression (progression as a continuous variable), and (b) an ordered probit for the probability that an individual progresses through his/her studies regularly (categorical dependent variable with three categories: slow, medium and fast progression).

4.1 Description of the data

First of all we need to clarify the definition of drop out rate that we use in our analysis. We consider the *effective* drop out rate, rather than the *formal* drop out recognised by the universities. A drop out is recorded formally in the universities archives if a student has either explicitly (officially) withdrawn or transferred to another institution. In our definition of *effective* drop out we include also those students who have abandoned their studies either because they have formally withdrawn or because they have not renewed their registration in the second and third year.

Table 1 provides some information on the dropout rates distinguished by gender and by other specific characteristics. Table 1 (last row) shows that, in total for the two universities, more than 25.76% of new entrants have effectively dropped out during the first two years. In particular, the drop out rate is higher for male (31.87%) than for female students (21.33%).

There are however considerable differences in drop out rates between the two universities (38% overall for Viterbo, 23.08% for Cagliari). With regard to gender, 28.38% of male students drop out in Cagliari (31.37% in Viterbo), while the dropout rate for female students of Viterbo (44.9%) is more than doubled that for Cagliari (19.5%).

Most of the students who dropped out (88.4% overall in the two universities) are students who have achieved no credit (see definition of *avanz0*, *avanz1*, *avanz2* and *avanz3* in Table 1). With regard to other characteristics, Table 1 shows that the drop-out rate is inversely related with the maturity score (*Prev*) and varies with the kind of diploma (*Pret*). In particular, the dropout rate appears to be higher for students who had previously attended a professional or a technical institute (more than 40%), while students with a *maturita'* from a scientific or a classical Lyceum show a relatively low dropout rate (about 15%). Moreover, the dropout rate appears to be higher for students with an irregular performance at school. Finally, the dropout rate increases with age, especially for male students, reaching a maximum at age 30-35, and decreasing again for entrant students aged more than 35.

4.2 Econometric Models

The generic model used in the analysis that follows is of the type:

$$y_{ij}^* = X_{ij} \mathbf{b} + \mathbf{e}$$

where the observed values of y are outcomes for individual 'i' enrolled in faculty 'j' generated by the regressors. X is a vector of exogenous variables representing three distinct variable types: individual's personal characteristics independent of the faculty or degree course chosen (such as gender, age etc.); individual characteristics which relate to the faculty or degree course (such as type of school attended) and the characteristics of the faculty at which the individual enrolled (number of faculty members, number of students registered). β is a set of parameters to be estimated and ϵ is an error term.

The first model is a binomial probit for the probability of dropout rate, where $y_{ij} = 1$ if the individual drops out ($y_{ij}^* =$ registration not renewed) and $=0$ otherwise.

The second is a model for the identification of the determinants of student's progression. We estimate two versions of this model: one by OLS, where the dependent variable is continuous (number of credits achieved); the second is an ordered probit, where the dependent variable has three categories:

$$y_{ij}=1 \text{ if } y_{ij}^* = \mu_1$$

$$y_{ij}=2 \text{ if } \mu_1 < y_{ij}^* = \mu_2$$

$$y_{ij}=3 \text{ if } \mu_2 < y_{ij}^* = \mu_3$$

The ' μ 's are free parameters reflecting an ordinal ranking of the number of credits an individual has achieved. Accordingly, '1' signifies that the individual has achieved less than 30% of the total credits that should have been accumulated by the end of the first two years; '2' that the student has accumulated between 30% and 70% of the required credits; and '3' that the student has achieved more than 70% of the required credits.

In Table 2 we report the percentage frequency distributions of these categories (Avanz) and the definition and descriptive statistics (mean) of the explanatory variables used in the econometric models.

4.3 Empirical results

Definitions and descriptive statistics of the variables used in the econometric models are summarised in Table 2. The variables include a number of characteristics of the population under study which may exert an important influence on dropping-out choice and student performance. These include, among others, age residence, type of school attended and *maturità* score, pre-university performance in terms of number of years necessary to completion, family income.

[Include here comments on all the other *explanatory variables*, including: student academic preparedness, faculty attraction rate, distribution of maturity score of entrants by subject (as a measure of subject selectivity), matching and peer group effects (Summers and Wolfe, 1977, and Henderson, Mieskowski and Sauvageau, 1978).].

The estimates of the probability of dropping out are presented in section 4.3.1, while results on the determinants of student progression are presented in section 4.3.2.

4.3.1. The determinants of the dropout rate

The results of student dropout probability, distinguished by university, are presented in Table 3. The Table reports the coefficient estimates, the probability values and the marginal effects. The coefficients give the sign of the partial effects of each explanatory variable on the probability of dropping out (response probability), and the statistical significance of each explanatory variable (x_j) is determined by whether the null hypothesis $H_0: \beta_j=0$ can be rejected at a sufficiently small significance level. Table 1 also reports the percent correctly predicted for each of the two outcomes.

The marginal effects are obtained by multiplying the probit coefficients by the standard normal probability density function $\phi(x_j \hat{\beta})$ evaluated at the average values of the independent variables (including the average of age^2 , and averages of the dummy variables).

First of all it is interesting to note that the results confirm previous empirical research which shows that gender is one of the principal determinants of the probability of dropping out (McNabb, Pal and Sloane, 2002, Smith and Naylor, 2001). Specifically, controlling for other factors, the binomial probit estimates show that males have a higher probability of dropping out relative to the reference group of females.

Age has a significant positive effect. The variable has been entered in a quadratic form to allow the effect of age to have diminishing effect on the dropout probability.

With regard to pre-university educational qualifications, it is interesting to note the significant effect on the probability of dropping out associated with the type of school attended. Relative to the reference group of those possessing the *maturità* from the scientific lyceum, the coefficients on the dummy variables for most of the other types of schooling are positive and statistically significant, indicating a higher probability of dropping out. However, there is no statistically significant difference between those in possession of the classical lyceum maturity and the reference group. Also, as expected, the score in the *Maturità* has a significant impact on the probability of dropping out. In particular, students with a good performance at the *Maturità* have less probability to drop out from university.

Another interesting result is that related to the peers' effect which appears to be significant for the university of Cagliari. Interestingly, when an individual is enrolled in a faculty or degree course where the average peers performance is high, other things equal, this decreases the likelihood of dropping out.

This result highlights the importance of matching and peer group effects, which have been found to be important determinants of students performances in other countries (see for the US Summers and Wolfe(1977) and Henderson, Mieskowski and Sauvageau (1978), and for the UK ##)

Other differences between dropout rates across subject studied are captured using faculty dummy variables.

4.3.2. Determinants of student progression

In this section we examine the determinants of the probability that an individual progresses (proceeds) through his/her studies regularly, having accumulated the number of credits required by the degree course in each year. The cohort considered consists of students who are currently in their third year of study.

In Table 4 we report the results from the OLS model. First, age exerts a negative influence on student progression, but again, with a significant diminishing effects (age squared positive). Gender appears to be a highly significant determinant of student progression in the University of Cagliari, with a sign which suggests, in line with the results from the dropout analysis, that females are on average more successful than their male counterparts. Gender is not significant in the regression for Viterbo. Also, residence dummies are not, in general, statistically significant.

We look now at the influence of variables reflecting past educational choices and performance. type of maturita' and score school attended on subsequent performance of students at university. Relative to the reference group of those possessing the maturità from the scientific lyceum, the coefficients on the dummy variables for most of the other types of schooling, other than lyceum, indicate a worse performance in terms of credit achieved. These results are not surprising, and, combined with those obtained for the analysis of the dropout, may indicate a better academic preparedness of students who have chosen to attend a Lyceum. As already mentioned, the type of school attended can be seen as an indirect proxy for family background (see Checchi, 2001).

As expected, controlling for other factors, the score in the Maturità has a highly significant impact on university performance.

On family income, the evidence for the two universities is mixed: this variable is not significant in the regressions for Viterbo, while for Cagliari it appears that performance at university is better for students from higher income families, even after controlling for prior education and other causes of study progression. As we can see from the regressions distinguished by gender, this finding is mainly driven by the results for female students.

Parental income is a dummy variable reflecting high income ($\text{fincome}=1$) if the student paid full university fees, low income ($\text{fincome}=0$) for lower or no fees. Interpretation of the results on parental income, however, should be cautious, as this variable may not reflect correctly the actual family income.

Ordered probit model for student progression

Include here a table showing estimated coefficients and marginal effects on the predicted probabilities of (a) progressing regularly (i.e., completing at least 70% of the credits) and (b) poor performance (i.e. failing to achieve the threshold of 30% of the credits).

5. Concluding Remarks

In this paper we have presented results for two universities (Cagliari and Viterbo) on the determinants of dropout behaviour, and student progression. Major determinants of dropout behaviour and student progression include gender, age, student prior academic performance (maturity score) and kind of diploma taken. Also we have found that when an individual is enrolled in a faculty or degree course where the average peers performance is high, this may decrease the likelihood of dropping out and equally, other things equal, students seem to perform at a higher level if their fellow students are high achievers.

Although in this study we have exploited administrative data for only two universities, the variety of programmes offered within each Faculty and the differences across programmes in terms of student recruitment has enabled us to obtain some interesting results. Analyses of this kind could be extended to other universities and could constitute an incentive to construct more complete and homogeneous individual level data for full cohorts of university students.

In terms of policy implications, our results suggest that the reform is likely to have limited effects in terms of reducing the age at graduation and accelerating entry into the labour market, without changes to admission policies and the introduction of regulations or stronger incentives for early student completion.

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Table 1 Definitions and Descriptive Statistics of Variables (Mean)

VARIABLE NAME	DEFINITION	MEAN					
		Cagliari		Viterbo		Total Cagliari and Viterbo	
		Overall sample	Dropout sample	Overall sample	Dropout sample	Overall sample	Dropout sample
Individual attributes							
AGE on entry							
Age1	Reference category - Aged <20 in September of the entry year (2001)	0.637	0.449	0.556	0.378	0.623	0.430
Age2	20-25	0.274	0.366	0.285	0.356	0.276	0.363
Age3	25-30	0.043	0.095	0.057	0.093	0.046	0.095
Age4	30-35	0.017	0.037	0.035	0.067	0.020	0.045
Age5	≥35	0.029	0.054	0.067	0.107	0.036	0.068
Gender	=1 if male	0.404	0.497	0.498	0.587	0.421	0.521
Entry qualifications							
PREV	Score at maturita' can vary between 60-100 (36-60) in the new system (old system)						
PREV1	=1 if prev 60-72 (36-60)	0.420	0.547	0.446	0.549	0.425	0.548
PREV2	=1 if prev 73-80 (44-48)	0.211	0.204	0.221	0.208	0.213	0.207
PREV3	=1 if prev 81-92 (49-55)	0.201	0.156	0.192	0.161	0.200	0.160
PREV4	=1 if prev 93-97 (56-58)	0.072	0.038	0.060	0.039	0.070	0.039
PREV5	=1 if prev 98-100 (59-60)	0.096	0.056	0.080	0.042	0.093	0.046
Residence							
CITY1	=1 if Resident in the city	0.180	0.192	0.156	0.153	0.176	0.182

CITY2	=1 if Resident in the district	0.553	0.567	0.375	0.322	0.521	0.502
CITY3	=1 if Resident outside district	0.267	0.241	0.469	0.524	0.303	0.316

Table Continued

VARIABLE NAME	DEFINITION	MEAN					
		Cagliari		Viterbo		Total Cagliari and Viterbo	
		Overall sample	Dropout sample	Overall sample	Dropout sample	Overall sample	Dropout sample
Type of Maturity							
PRET1	=1 if Scientific Lyceum	0.312	0.185	0.252	0.176	0.301	0.182
PRET2	=1 if Classical Lyceum	0.134	0.077	0.147	0.091	0.137	0.080
PRET3	=1 if Other Lyceum (linguistic)	0.036	0.033	0.039	0.042	0.037	0.035
PRET4	=1 Tech/Commercial	0.218	0.296	0.216	0.240	0.218	0.281
PRET5	=1 Tech Institute	0.065	0.107	0.064	0.084	0.065	0.101
PRET6	=1 Professional	0.049	0.077	0.062	0.111	0.051	0.086
PRET7	=1 Socio/Psyco/Pedagog Lyceum (ex Magistrale)	0.098	0.094	0.052	0.058	0.090	0.085
PRET8	=1 Other unspecified	0.002	0.002	0.011	0.009	0.004	0.004
PRET9	=1 Agricultural Institute	0.014	0.027	0.095	0.122	0.028	0.052
PRET10	=1 Artistic Lyceum	0.011	0.022	0.015	0.018	0.012	0.021
PRET11	= 1 Tech/surveyors (Geometri)	0.060	0.080	0.047	0.049	0.058	0.072
Pret3_10	Other lyceum+Artistic	0.047	0.055	0.054	0.060	0.049	0.056
Pret6_8	Professional + other unspecified	0.051	0.079	0.073	0.120	0.055	0.090
Pret5_9_11	Industrial/agricultural/Geometri	0.139	0.214	0.206	0.256	0.151	0.225
Regularity at school							
PRER binary indicator	=1 if irregular performance at school	0.315	0.456	0.339	0.449	0.319	0.454
Performance at university							
Averw (continuous variable)	Average of exam marks (weighted with number of credits) ¹	25.07	23.84	25.29	23.88	25.11	23.85

¹ Averages are calculated by considering only the students who have passed marked exams, that is:

Crediti	Average of crediti obtained ²	50.983	10.746	53.563	10.552	51.389	10.693
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Table Continued

VARIABLE NAME	DEFINITION	MEAN					
		Cagliari		Viterbo		Total Cagliari and Viterbo	
		Overall sample	Dropout sample	Overall sample	Dropout sample	Overall sample	Dropout sample
Averw clas	Average of exam marks (weighted with number of credits)						
Avercl0	No credit no exam	0.210	0.793	0.210	0.787	0.231	0.791
Avercl1	Exams without marks	0.011	0.019	0.011	0.022	0.012	0.020
Avercl2	18 - 21.99	0.081	0.052	0.081	0.044	0.077	0.050
Avercl3	22 - 24.99	0.279	0.062	0.279	0.071	0.267	0.064
Avercl4	25 - 26.99	0.232	0.038	0.232	0.036	0.229	0.037
Avercl5	27 - 30	0.187	0.037	0.187	0.040	0.185	0.038
Ability							
Ability0	=0 if Avercl=0/1 and Avanz=0/1	0.222	0.812	0.336	0.809	0.242	0.811
Ability1	=1 if Avercl=2/3/4/5 and Avanz=1	0.262	0.157	0.181	0.167	0.248	0.160
Ability2	=2 if Avercl=2/3 and Avanz=2/3	0.200	0.018	0.154	0.009	0.192	0.016
Ability3	=3 if Avercl=4/5 and Avanz=2/3	0.316	0.012	0.329	0.016	0.318	0.013
Avanz%	Continuous variable	34.589	3.468	32.210	3.652	34.163	3.517
Avanzcl							
Avanz0	=1 if student has no credit	0.210	0.793	0.323	0.787	0.231	0.791
Avanz1	=1 if student has got a percentage of the total credits equal to 0.01% –29.99%	0.274	0.177	0.194	0.189	0.259	0.180
Avanz2	=1 if student has got a percentage of the total credits	0.375	0.028	0.335	0.024	0.368	0.027

Overall sample: 5007 (4223 Cagliari – 784 Viterbo) **Drop out sample:** 321 (235 Cagliari – 86 Viterbo)

² Averages are calculated considering only the students with non zero crediti, that is:

Overall sample: 5083 (4284 Cagliari – 799 Viterbo) **Drop out sample:** 355 (259 Cagliari – 96 Viterbo)

	equal to 30.00% —69.99%						
Avanz3	=1 if student has got a percentage of the total credits equal to 70.00% —100.00%	0.142	0.002	0.147	0.000	0.143	0.002

Table Continued

VARIABLE NAME	DEFINITION	MEAN					
		Cagliari		Viterbo		Total Cagliari and Viterbo	
		Overall sample	Dropout sample	Overall sample	Dropout sample	Overall sample	Dropout sample
Family income	Reddito equivalente						
Faminc1	=1 if income <= 6625.00 Euro	0.205	0.115	0.062	0.051	0.180	0.098
Faminc2	=1 if income 6625.01-10600.00	0.202	0.123	0.102	0.062	0.184	0.107
Faminc3	=1 if income 10600.01-15900.00	0.155	0.117	0.146	0.127	0.154	0.119
Faminc4	=1 if income 15900.01-23850.00	0.114	0.078	0.185	0.249	0.126	0.123
Faminc5	=1 If income >23850.00	0.324	0.567	0.506	0.511	0.356	0.552
Family income	binary indicator						
Faminc 1_2_3_4	=0 if income <23850.00	0.676	0.433	0.494	0.489	0.644	0.448
Faminc5	=1 If income >23850.00	0.324	0.567	0.506	0.511	0.356	0.552
Faculty dummies							
Fac1	Agriculture (Viterbo)			0.288	0.338	0.051	0.089
Fac2	Cultural Heritage (Viterbo)			0.163	0.109	0.029	0.029
Fac3	Economics (Viterbo)			0.251	0.313	0.045	0.083
Fac4	Languages (Viterbo)			0.164	0.136	0.029	0.036
Fac5	Biology (Viterbo)			0.133	0.104	0.024	0.028
Fac6	Law (Cagliari)	0.097	0.117			0.080	0.086
Fac7	Political Science (Cagliari)	0.093	0.095			0.076	0.070

Fac8	Economics (Cagliari)	0.121	0.145			0.100	0.106
Fac9	Humanities (Cagliari)	0.086	0.070			0.071	0.052
Fac10	Education (Cagliari)	0.191	0.187			0.157	0.137
Fac11	Languages (Cagliari)	0.069	0.073			0.056	0.053
Fac12	Medicine (Cagliari)	0.037	0.006			0.030	0.004
Fac13	Pharmacology (Cagliari)	0.035	0.043			0.029	0.032
Fac14	Math& Other Sciences (Cagliari)	0.111	0.118			0.091	0.087
Fac15	Engineering (Cagliari)	0.161	0.146			0.132	0.108
VARIABLE NAME	DEFINITION	MEAN					
		Cagliari		Viterbo		Total Cagliari and Viterbo	
		Overall sample	Dropout sample	Overall sample	Dropout sample	Overall sample	Dropout sample
Faculty characteristics							
Size	Number of teaching staff	113.191	104.788	63.612	65.440	104.328	94.385
Docenti	Average number of teaching staff per student	0.026	0.024	0.050	0.050	0.031	0.031
Peer effects							
AVERPEER	Average exam marks of degree course peers (weighted by number of credits)	25.570	25.435	25.832	25.732	25.617	25.514
Averpeercl	Relative Difference (RD) between Averw and Averpeer						
Averpeercl=0	Students without marked exams	0.221	0.812	0.342	0.811	0.243	0.811
Averpeercl=1	RD<-5%	0.397	0.184	0.221	0.116	0.366	0.166
Averpeercl=2	0<RD<5	0.258	0.004	0.308	0.049	0.267	0.016
Averpeercl=3	RD>5%	0.124	0.001	0.129	0.024	0.125	0.007
Number of Students		5,425	1,252	1,181	450	6,606	1,702

Table 2 Drop out rates by specific characteristics

VARIABLE NAME	DEFINITION	Cagliari			Viterbo			Total Cagliari and Viterbo		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Individual attributes										
AGE on entry	Age in September of the entry year (2001)									
Age1	Reference category - Aged <20	18.50	14.85	16.25	30.74	22.19	25.88	20.66	17.79	17.79
Age2	20- 25	36.63	26.27	30.86	52.94	39.10	47.48	40.49	33.94	33.94
Age3	25-30	63.11	40.91	50.64	70.59	54.55	62.69	64.96	53.31	53.31
Age4	30-35	74.42	28.57	50.00	84.21	63.64	73.17	77.42	57.14	57.14
Age5	≥35	60.94	30.43	42.95	60.42	61.29	60.76	60.71	48.94	48.94
Entry qualifications										
PREV	Score at maturita' can vary between 60-100 (36-60) in the new system (old system)									
PREV1	=1 if prev 60-72 (36-60)	37.26	24.73	30.14	53.48	36.49	46.68	41.20	26.38	33.25
PREV2	=1 if prev 73-80 (44-48)	26.61	19.94	22.83	38.28	32.33	35.25	29.01	22.05	25.14
PREV3	=1 if prev 81-92 (49-55)	21.36	16.76	18.50	38.71	25.37	30.84	24.55	18.18	20.62
PREV4	=1 if prev 93-97 (56-58)	17.07	10.53	12.60	15.00	27.45	23.94	16.78	13.25	14.35
PREV5	=1 if prev 98-100 (59-60)	7.95	11.27	10.15	22.58	28.13	26.32	10.14	13.90	12.64
Residence										
CITY1	=1 if Resident in the city	26.59	22.84	24.59	45.57	31.43	37.50	29.40	24.28	26.64
CITY2	=1 if Resident in the district	30.35	19.42	23.66	39.23	26.92	32.73	31.71	20.27	24.83
CITY3	=1 if Resident outside district	25.78	17.62	20.86	48.67	35.43	42.60	33.64	21.63	26.87
Regularity at school										
PRER	=0 if regular performance at school	21.44	16.47	18.32	37.57	27.13	31.75	24.67	18.14	20.65

binary indicator	=1 if irregular performance at school	40.27	27.30	33.43	55.37	43.04	50.50	43.76	29.65	36.67
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Table 2 Drop out rates by specific characteristics Continued

VARIABLE NAME	DEFINITION									
		Cagliari			Viterbo			Total Cagliari and Viterbo		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Type of Maturity										
PRET1	=1 if Scientific Lyceum	16.38	11.40	13.67	34.13	16.79	26.51	19.55	12.07	15.59
PRET2	=1 if Classical Lyceum	16.44	11.76	13.17	25.00	23.13	23.56	17.76	14.13	15.17
PRET3	=1 if Other Lyceum (linguistic)	27.59	19.76	20.92	66.67	35.14	41.30	36.84	22.55	24.79
PRET4	=1 Tech/Commercial	37.74	27.83	31.31	50.79	34.11	42.35	40.77	28.73	33.26
PRET5	=1 Tech Institute	39.87	22.86	38.18	50.75	44.44	50.00	41.78	27.27	40.28
PRET6	=1 Professional	43.04	32.98	35.96	68.42	68.52	68.49	47.96	40.91	42.94
PRET7	=1 Socio/Psyco/Pedagog Lyceum (ex Magistrale)	36.36	21.16	22.10	62.50	39.62	42.62	41.46	22.92	24.20
PRET8	=1 Other unspecified	60.00	0.00	27.27	25.00	33.33	30.77	44.44	20.00	29.17
PRET9	=1 Agricultural Institute	50.00	37.50	45.95	51.55	33.33	49.11	51.02	35.90	47.85
PRET10	=1 Artistic Lyceum	41.18	47.73	45.90	100.00	33.33	44.44	50.00	44.07	45.57
PRET11	= 1 Tech/surveyors (Geometri)	33.98	17.65	30.58	43.75	14.29	40.00	35.50	17.33	31.94
Pret3_10	Other lyceum+Artistic	32.61	25.59	26.85	75.00	34.62	42.19	41.38	27.38	29.91
Pret6_8	Professional + other unspecified	44.05	31.96	35.61	60.87	62.79	62.79	47.66	39.69	42.03
Pret5_9_11	Industrial/agricultural/Geometri	38.24	22.83	35.64	49.53	32.26	47.33	41.10	24.68	38.49
Performance at university										
Averw variable)	Average of exam marks (weighted with number of credits)									
Avercl0	No credit no exam	88.42	85.56	87.03	93.36	91.67	92.67	89.79	86.90	88.44
Avercl1	Exams without marks	41.18	37.04	39.34	50.00	85.71	66.67	42.86	47.06	44.74
Avercl2	18 - 21.99	12.79	16.82	14.81	26.09	30.77	27.78	15.09	18.29	16.63
Avercl3	22 - 24.99	4.64	5.40	5.10	15.50	9.84	12.75	6.56	5.92	6.19

Avercl4	25 - 26.99	4.07	3.55	3.73	7.77	5.44	6.40	4.77	3.83	4.17
Avercl5	27 – 30	4.89	4.39	4.54	11.84	6.67	8.53	6.27	4.76	5.23

Table 2 Drop out rates by specific characteristics Continued

VARIABLE NAME	DEFINITION	Cagliari			Viterbo			Total Cagliari and Viterbo		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Ability										
Ability=0	Avercl=0/1 and Avanz=0/1	85.83	83.30	84.61	91.88	91.41	91.69	87.49	85.08	86.37
Ability =1	Avercl=2/3/4/5 and Avanz=1	12.01	15.21	13.84	36.89	32.61	35.05	16.16	16.98	16.62
Ability =2	Avercl=2/3 and Avanz=2/3	2.64	1.79	2.12	0.00	4.44	2.20	2.16	2.11	2.13
Ability =3	Avercl=4/5 and Avanz=2/3	0.92	0.86	0.88	2.86	1.21	1.80	1.31	0.92	1.05
Avanz										
Avanz0	=1 if student has no credit	88.42	85.56	87.03	93.36	91.67	92.67	89.79	86.90	88.44
Avanz1	=1 if student has got a percentage of the total credits equal to 0.01% —29.99%	13.55	15.91	14.89	37.69	36.36	37.12	17.62	18.07	17.86
Avanz2	=1 if student has got a percentage of the total credits equal to 30.00% —69.99%	2.11	1.51	1.72	2.37	3.08	2.78	2.16	1.74	1.89
Avanz3	=1 if student has got a percentage of the total credits equal to 70.00% —100.00%	0.40	0.39	0.39	0.00	0.00	0.00	0.32	0.32	0.32
Family income	Reddito equivalente									
Faminc1	=1 if income <= 6625.00 Euro	19.87	10.16	12.93	26.47	35.90	31.51	20.51	11.36	14.07
Faminc2	=1 if income 6625.01-10600.00	14.21	14.00	14.08	34.48	12.70	23.14	16.81	13.89	14.98
Faminc3	=1 if income 10600.01-15900.00	19.77	15.59	17.32	37.14	30.39	33.14	22.67	18.12	20.00
Faminc4	=1 if income 15900.01-23850.00	16.34	15.60	15.91	60.58	42.98	51.38	29.09	22.20	25.18
Faminc5	=1 If income >23850.00	44.80	36.01	40.39	45.34	30.55	38.53	44.95	34.72	39.92
Family	binary indicator									

income										
Faminc 1_2_3_4	=0 if income <23850.00	17.46	13.28	14.78	44.36	32.08	37.67	21.98	15.52	17.93
Faminc5	=1 If income >23850.00	44.80	36.01	40.39	45.34	30.55	38.53	44.95	34.72	39.92

Table 2 Continued

VARIABLE NAME	DEFINITION	Cagliari			Viterbo			Total Cagliari and Viterbo		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Faculty dummies										
Fac1	Agriculture (Viterbo)				46.24	39.19	44.71	46.24	39.19	44.71
Fac2	Cultural Heritage (Viterbo)				26.42	25.00	25.39	26.42	25.00	25.39
Fac3	Economics (Viterbo)				49.06	45.65	47.47	49.06	45.65	47.47
Fac4	Languages (Viterbo)				51.22	26.14	31.44	51.22	26.14	31.44
Fac5	Biology (Viterbo)				40.58	21.59	29.94	40.58	21.59	29.94
Fac6	Law (Cagliari)	30.35	26.46	27.95				30.35	26.46	27.95
Fac7	Political Science (Cagliari)	32.35	17.67	23.61				32.35	17.67	23.61
Fac8	Economics (Cagliari)	35.90	19.88	27.47				35.90	19.88	27.47
Fac9	Humanities (Cagliari)	27.70	14.73	18.84				27.70	14.73	18.84
Fac10	Education (Cagliari)	37.79	19.61	22.63				37.79	19.61	22.63
Fac11	Languages (Cagliari)	37.97	20.82	24.46				37.97	20.82	24.46
Fac12	Medicine (Cagliari)	3.61	3.45	3.52				3.61	3.45	3.52
Fac13	Pharmacology (Cagliari)	29.85	27.64	28.42				29.85	27.64	28.42
Fac14	Math& Other Sciences (Cagliari)	25.17	24.03	24.58				25.17	24.03	24.58
Fac15	Engineering (Cagliari)	23.73	13.75	20.99				23.73	13.75	20.99

Averpeercl	Relative Difference (RD) between Averw and Averpeer									
Averpeercl=0	Students without marked exams	85.95	83.30	84.67	91.49	88.76	90.35	87.47	84.53	86.10
Averpeercl=1	RD<-5%	9.79	11.33	10.68	22.07	17.24	19.92	11.48	11.83	11.68
Averpeercl=2	0<RD<5	0.22	0.42	0.36	8.22	4.59	6.04	2.18	1.20	1.53
Averpeercl=3	RD>5%	0.00	0.22	0.15	8.06	6.67	7.24	1.82	1.27	1.45
TOTAL		28.38	19.49	23.08	31.37	44.90	38.10	21.33	31.87	25.76

Table 3
Drop-out probability

Model: Probit. Dependent Variable (dropeff=1 for dropped-out students)

	Cagliari obs 5425			Viterbo obs 1181		
	coeff.	pvalue	marg. effect	coeff.	pvalue	marg. effect
C	-1.503	0.093	-0.406	-5.548	0.010	-2.077
GENDER	0.123	0.011	0.033	0.230	0.018	0.086
AGE	0.157	0.000	0.042	0.246	0.000	0.092
AGE^2	-0.002	0.000	-0.001	-0.003	0.000	-0.001
CITY2	0.053	0.351	0.014	0.026	0.836	0.010
CITY3	-0.009	0.890	-0.002	0.299	0.020	0.112
PRET2	-0.023	0.762	-0.006	0.182	0.217	0.068
PRET3_1	0.554	0.000	0.150	0.676	0.001	0.253
0						
PRET4	0.563	0.000	0.152	0.423	0.001	0.158
PRET5_9	0.624	0.000	0.169	0.469	0.000	0.175
_11						
PRET6_8	0.723	0.000	0.195	1.012	0.000	0.379
PRET7	0.463	0.000	0.125	0.723	0.000	0.271
PREV3	-0.248	0.000	-0.067	-0.222	0.038	-0.083
PREV4_5	-0.468	0.000	-0.126	-0.493	0.000	-0.185
FINCOME	0.870	0.000	0.235	-0.090	0.271	-0.034
PRER	0.121	0.014	0.033	0.173	0.049	0.065
AVERPEE	-0.080	0.012	-0.022	0.037	0.659	0.014
R						
Faculty dummies						
FAC2				-0.302	0.040	-0.113
FAC3				0.477	0.006	0.179
FAC4				-0.144	0.443	-0.054
FAC5				-0.135	0.341	-0.050
FAC7	-0.319	0.001	-0.086			
FAC8	-0.213	0.016	-0.058			
FAC9	-0.126	0.261	-0.034			
FAC10	-0.308	0.000	-0.083			
FAC11	-0.059	0.563	-0.016			
FAC12	-0.967	0.000	-0.261			
FAC13	0.015	0.904	0.004			
FAC14	-0.080	0.372	-0.022			
FAC15	-0.255	0.004	-0.069			
f(xb)			0.2703			0.3743
Mean dependent var			0.230783			0.381033
Log likelihood			-2419.41			-670.603
Restr. log likelihood			-2930.7			-784.854
LR statistic (20 df)			1022.586			228.5023
Probability(LR stat)			0			0
McFadden R-squared			0.174461			0.14557

Table 4
Student Progression

Model: Least Squares - Dependent Variable: AVANZ%

Variable	Cagliari						Viterbo					
	Total Coeff.	Prob.	Females Coeff.	Prob.	Males Coeff.	Prob.	Total Coeff.	Prob.	Females Coeff.	Prob.	Males Coeff.	Prob.
C	-13.854	0.315	11.170	0.508	-36.814	0.135	-90.283	0.025	-47.198	0.350	-181.969	0.009
GENDER	-2.295	0.002					1.117	0.532				
AGE	-1.678	0.001	-1.761	0.005	-1.476	0.108	-1.851	0.043	-1.562	0.248	-1.825	0.160
AGE^2	0.027	0.001	0.026	0.008	0.029	0.041	0.023	0.099	0.014	0.507	0.024	0.222
CITY2	0.601	0.494	0.747	0.515	0.304	0.824	-1.680	0.459	-1.463	0.610	0.761	0.839
CITY3	3.007	0.003	2.209	0.088	4.181	0.007	-0.151	0.949	0.532	0.861	0.286	0.940
PRET2	0.793	0.424	2.134	0.075	-3.143	0.075	-3.159	0.180	-6.164	0.028	0.554	0.901
PRET3_10	-3.094	0.057	-3.504	0.050	-1.583	0.682	-2.065	0.576	-6.248	0.112	23.766	0.051
PRET4	-4.552	0.000	-6.008	0.000	-2.034	0.220	-3.255	0.179	-6.279	0.058	-3.280	0.372
PRET5_9_11	-3.475	0.002	-6.584	0.003	-2.331	0.098	-5.351	0.028	-13.684	0.005	-2.346	0.439
PRET6_8	-4.040	0.013	-5.265	0.006	-0.344	0.912	-9.649	0.015	-13.585	0.004	0.124	0.987
PRET7	-3.132	0.010	-3.438	0.008	0.326	0.944	-4.302	0.254	-8.057	0.045	19.890	0.103
PREV3	8.887	0.000	8.776	0.000	8.874	0.000	8.103	0.000	6.287	0.009	11.314	0.000
PREV4_5	18.351	0.000	16.618	0.000	21.563	0.000	12.626	0.000	11.155	0.000	14.646	0.000
FINCOME	1.025	0.173	2.617	0.008	-0.816	0.484	-1.560	0.309	-1.270	0.531	-1.706	0.479
PRER	-4.398	0.000	-4.094	0.000	-5.333	0.000	-2.859	0.118	-0.077	0.976	-6.047	0.025
AVERW	1.764	0.000	1.776	0.000	1.738	0.000	1.973	0.000	2.125	0.000	1.735	0.000
AVERPEER	1.120	0.019	0.186	0.753	1.844	0.026	4.497	0.005	2.602	0.183	8.189	0.003
Faculty dummies												
FAC2							1.912	0.473	4.753	0.214	-0.912	0.830
FAC3							5.722	0.099	8.904	0.087	7.677	0.132
FAC4							14.154	0.000	18.010	0.000	11.292	0.077
FAC5							3.619	0.165	6.023	0.127	1.467	0.699
FAC7	16.486	0.000	20.028	0.000	11.008	0.000						

FAC8	11.399	0.000	12.622	0.000	9.189	0.000		
FAC9	-8.844	0.000	-7.511	0.000	-9.651	0.002		
FAC10	14.608	0.000	15.078	0.000	13.793	0.000		
FAC11	-6.375	0.000	-5.760	0.002	-7.091	0.041		
FAC12	-2.093	0.279	-1.532	0.535	-2.691	0.387		
FAC13	3.797	0.060	3.966	0.108	3.299	0.342		
FAC14	1.823	0.207	1.957	0.297	0.634	0.781		
FAC15	9.420	0.000	14.534	0.000	6.089	0.004		
R-squared	0.409		0.420		0.403	0.444	0.453	0.447
Adjusted R-squared	0.405		0.414		0.393	0.427	0.424	0.410
S.E. of regression	19.961		19.617		20.252	19.832	19.259	20.276
Sum squared resid	1651993		991681.7		633245	278869	143176.4	124564
Log likelihood	-18400.80		-11427.97		-6937.56	-3209.81	-1770.63	-1423.93
Mean dep var	43.9		45.8		40.7	49.8	53.8	44.8
S.D. dependent var	25.9		25.6		26.0	26.2	25.4	26.4
Number of obs	4173		2603		1570	731	407	324