The impact of university reforms on dropout rates and students' status: Evidence from Italy*

B. d'Hombres
CRELL, Centre for Research on Lifelong Learning
European Commission, Joint Research Centre

This version: August 2007

Abstract

Following the Bologna declaration, the Italian government began in 1999 the process of reforming in depth the higher education system. The main actions implied by the Bologna process are the adoption of a university system of degree essentially based on three cycles, the establishment of a system of credits and the European cooperation in quality assurance to ease qualification comparisons across Europe. This large process of university reforms is in progress throughout Europe and so far, very few attempts have been made to assess the effect of these reforms on university effectiveness and students'mobility.
This paper provides an estimate of the impact of Italian university reforms on university dropout rates and students'status (active *versus* inactive). Italy is a particularly interesting case-study because its higher education system has been characterized by remarkable high university dropout rates and low graduation rates, both indicators of the internal inefficiency of tertiary education. The empirical results are obtained from national surveys on students who graduated before and after the reforms.

Keywords: University dropouts, Bologna process, Impact analysis

JEL: I20, C52, C21

*I am grateful to Michela Nardo and Stefano Tarantola for useful suggestions. A part of the empirical analysis was implemented at the ADELE laboratory (ISTAT) in Rome.

1 Introduction

The Bologna process, which aims to create the European Higher Education Area by 2010, suggests a series of reforms to harmonize and make more competitive and more attractive the higher education across Europe. It is the most ambitious reform of higher education in Europe over the last thirty years.[1] The main actions along the lines of the Bologna process are the adoption of a university system of degree essentially based on three cycles, the promotion of mobility through the implementation of the "Diploma Supplement" and the establishment of a system of credits, and the European cooperation in quality assurance to make easier to compare qualifications across Europe.

In most of the European countries these reforms are intensively taking place.[2] Since almost all Bologna countries have passed laws to introduce the three-cycle system, several compelling questions need now to be discussed. In particular, have these reforms had the expected impact? Have the reforms - especially the reform of the university degrees structure - improved higher education effectiveness? In this paper, we attempt to provide an estimate of the impact of Italian university reforms on university dropouts.

There are at least two reasons which make the case of Italy particulary interesting.
First, the Italian system of higher education has been widely criticized for its ineffectiveness. University graduation and survival rates were much lower in Italy than in other OECD countries.[3] As reported in Table 1, in 2000, graduation rates amount to 26.7% in Italy while the mean graduation rate

[1] While the Sorbonne declaration was initially only approved by France, Italy, Germany, UK, the commitments of the Bologna process, as expressed in the Bologna, Prague, Berlin and Bergen declarations have now been signed by 45 countries.

[2] See Eurydice (2005) for a comprehensive review of the progress of university reforms across Europe.

[3] The survival rate represents the proportion of new entrants to a specific level of education who sucessfully complete a first qualification. This is measured by the ratio of students having completed a first qualification to the number of new entrants to this level of educaton n years before, with n being the number of years its requires to complete a degree.

Table 1: Survival and graduation rates, Tertiary A programme

	Graduation rates, 2000	Survival rates, 2003
Australia	36.3	69
Austria	16.0	59
Belgium	.	60
Czech Republic	13.6	61
Denmark	.	69
Finland	40.7	75
France	24.6	59
Germany	19.3	70
Iceland	33.2	73
Ireland	31.2	85
Italy	18.1	42
Japan	30.9	94
Korea	.	79
Netherlands	.	69
Poland	34.4	.
Spain	32.6	77
Sweden	28.1	48
Turkey	.	88
United Kingdom	37.5	83
United States	33.2	.
OECD average	27.5	70

Source: OECD, www.oecd.org/edu/eag2005

in $OECD$ countries is above 40%.[4] Similary, in 2003, survival rates are equal to 42% in Italy and 70% in $OECD$ countries (Education at a Glance, 2005).

While the first objective of these university reforms is to harmonize European university systems and then to increase students'mobility, this should also have significant effects on the internal efficiency of the Italian university system. The new degrees structure based on three cycles is expected to lower the cost of graduating from university since the average time duration to get a first university degree is reduced. We therefore expect a decrease

[4] The gross graduation rate is the total number of graduates at a specified level of education divided by the population at the typical graduation age for this level of education.

in dropout rates in the post-reform period. In addition, the implementation of the Bologna process has been accompanied in Italy by an increased autonomy of universities in terms of the content of courses, which should, with the facilitated mobility across disciplines through the credit transfer system, also have an effect on the incentive to complete a tertiary degree. After the reform, the higher education supply is likely to be better adapted to the demand for tertiary education.[5]

Second, the Bologna process has implied in Italy a complete change in the university degrees structure. This is not the case for most of the signatory countries of the Berlin declaration whose university degrees structure was indeed intially based on two-cycles (Bachelor-Master). The new degrees structure, imposed by the Bologna process, is expected to have a stronger impact in countries that were originally based on one qualification. Only 10 countries - Spain, Portugal, Italy, Netherland, Norway, Estonie, Romania, Hungary, Albania, and Bosnia and Herzegovine - out of the 45 signatory countries had this type of degrees structure in the pre-reform period. Out of these 10 countries, only 3 - Italy, Estonia, Netherlands - adopted the three-cycle structure before 2004. Italy implemented the new degrees structure in the academic year 2000/2001. One can therefore already observe students that enrolled and graduated before and after the implementation of the set of university reforms.

Education at a Glance (2005) reports lower participation in tertiary education in countries offering long first tertiary-type programmes than in countries proposing shorter tertiary programmes. This tends to show that enrollment and dropout decisions are likely to be simultaneously affected by university reforms. Personal characteristics of students who enrolled at university in the pre- and post-reform are thus potentially different.

The empirical results in the paper are obtained from national surveys on students who graduated before and after the reforms. The dataset contains

[5] Between 2000 and 2004, tertiary graduation rates have more than doubled in Italy. This is a first indication that university reforms have led to a reduction in dropout rates and/or in the gap between the time to obtain a university degree and the normal completion time.

extensive information on students'family and educational backgrounds. For university students, be they active or inactive students, we also know the university attended as well as the field of study We assume that conditioning on these variables is enough to correct for the selection bias arising from the effect of the reforms on enrollment decisions and that we are therefore able to identify the causal impact of university reforms on dropout probabilities. Needless to say that the consistency of our results depends upon the validity of this assumption.

Our estimates, based on an univariate probit model, confirm that the probability of dropping out of university in the post-reform period is about 5.4% lower than in the pre-reform period. Similarly, the probability of being an active student increases by 4.6% after the implementation of the reforms. The presence of a time trend in dropout probabilities can not explain the empirical evidence. In addition, the effect of theses reforms on the status of university students (active *versus* inactive) are robust to the introduction of university fixed effects. Finaly, the conclusions do not change with non-parametric estimates (propensity score matching estimators).

The rest of the paper is organized as follows. Section 2 provides an overview of the main changes occured in the Italian university system during the academic year $2001-2002$. Section 3 summarizes the existing litterature on the impact of the Bologna process on students' behaviours. Section 4 presents the data. Section 5 and 6 discuss the empirical methodology as well as the results. Last section concludes.

2 University reforms in Italy

Following the Sorbonne and Bologna Declarations, the Italian government began, in November 1999, the process of reforming in depth the higher education. The ministerial decree (law 509/99), that came into effect during the academic year 2001-2002, has defined the new architecture of the uni-

versity degrees structure and increased university autonomy.[6] In addition, a national credit system and the issue of a diploma supplement certification was introduced. A national committee in charge of the evaluation and accreditation of the university system was also formed.

Chart 1 presents the university degrees structure in Italy, before and after the reform. Traditionally, the university in Italy was mainly based on one level : the university offered one qualification, the *Laurea*, whose duration varied according to the field (four years in scientifc and humanistic disciplines, five years in engineer, etc). From 1980, a research program was also offered to postgraduate students who were interested in an academic career. In 1990 (law 341/90), given the demand for shorter studies, university diplomas (*Diplomi Universitari*, DU), whose duration was only 3 years, were introduced. Students were thus offered the possibility, once graduated from high school, to choose between diploma courses and degree courses. However, the proportion of students enrolled in university courses was low mainly because university diplomas were offered in a limited number of fields. In addition, students could then hardly continue with a degree course if they wanted. The architecture was therefore essentially at one level with one offered qualification. In addition, this degrees structure was associated with a strong centralism in decision-making about the headings and the study-plans of the diploma courses, thus limiting the higher education supply diversity.

The reforms have implied a complete change of the degrees structure which is now based on three main cycles.[7] The first degree lasts three years and concludes with the *Laurea*.[8] *Laurea* holders may then embark on one of the fol-

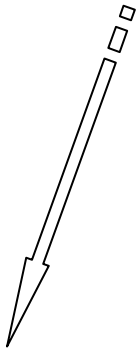
[6] Few universities introduced the new university structure in the academic year 2000/2001. Similarly, a small number of faculties puts off the implementation of the reform untill the academic year 2004/2005. Note also that the reform has been implemented in the academic year 2001/2002 first year courses. In other words, the years following the implementation of the reform, the Italian university system was offering courses based on both the old and new university degrees system.

[7] For a limited number of fields – Dentistry, Human Medicine,Veterinary, Medicine –, the degree structure is still based on one degree during 5 or 6 years. Access is through the school leaving certificate and admission is subject to an entrance examination.

[8] Enrolment in Laurea requires to have the secondary school leaving certificate. In addition, the 509/1999 decree forsees that each university has to define the specific required

OLD UNIVERSITY DEGREES STRUCTURE

Upper secondary school



UNIVERSITY DIPLOMA
3 years
Limited number of fields
Diplomas hardly recognized
(around 8 % of students)

Main degree
LAUREA
4/5 years*

DOCTORATE

* Laurea degree courses in Medicine and Surgery last six years

NEW UNIVERSITY DEGREES STRUCTURE

Upper secondary school

LAUREA
First level degrees
3 years
180 credits

1st degree

MASTER
First level
1 year
60 credits

LAUREA SPECIALISTICA
2 years
120 credits

SCHOOLS OF SPECIALIZATION
First level
2/3 years
120-180 credits

2nd degree

DOCTORATE
Minimum 3 years

MASTER
Second level
1 year

SCHOOLS OF SPECIALIZATION
Second level
1 year

3rd degree

For a limited number of fields – Dentistry, Human Medicine, Veterinary, Medicine –, the degree structure is still based on one degree during 5 or 6 years. Access is through the school leaving certificate and admission is subject to an entrance examination.

lowing second cycle degrees: (i) the *corso di Laurea Specialistica/Magistrale*, which takes additional two years, (ii) the first level of university master (*corsi di master universitario*) or (iii) the first level of a specialized degree (*corso di specializziazione*). The specialized degree lasts 2 or 3 years, while the university master implies one-year course. Admission to these second degree courses is conditional (in addition of having a *Laurea*) of being in possession of specific curricular requirements defined by each university.
Postgraduate students are offered the possibility of three third cycles, one is a research doctorate (*Dottorato di Ricerca*) whose length is at least 3 years, the second and the third ones are the second level of respectively a specialized degree (*Diploma di Specializzazione*) and a university master (*corsi di master universitario*) whose duration is usually one-year course. Access to postgraduate studies is only awarded to *Laurea specialistica* holders. Each university can demand an entrance exam or the possession of specific requirements for the admission of students.

The European Credit Transfer System (ECTS), based on student workload (including study at individual level) and used as an accumulation system, also entered under the Ministerial Decree 509/99. One year of full-time study (60 ECTS credits) is equal to 1500 hours, or equally, one credit corresponds to 25 hours of working hours. This measure aims at facilitating the mobility of students across disciplines and institutions in Italy (and abroad).

The reform has also greatly increased the autonomy of the university by transfering to each university the responsability to establish the teaching regulations of the study courses. Each university decides now the heading of the course as well as the educational curricula, conditional to operating within a framework of national standards.[9] One third of the content of the degree is let to the choice of the university and this has led to a diversification of the content of the courses.

knowlegde for admittance and may organise test procedures. If the student does not pass the test, he still can enroll at the university conditional on attending some specific training.

[9] The national framework divided the *laurea* and *laurea specialistica* courses in respectively 47 and 109 classes. For each classe, the ministry of Education chooses the main educational objectives and the minimal content in terms of disciplines of each degree.

The diversification of higher education into three levels of courses leading to degrees, the introduction of a credit system and the additional autonomy of universities, should all affect the supply of higher education. My working hypothesis is that this supply shift has had a significant impact on the dropout decision of students.

3 University reforms and dropouts

While there is a huge interest in UK and US on the determinants of university dropouts, the literature on this issue has been more limited in Italy. In addition, to the best of our knowledge, there are only 2 empirical papers that have investigated the effect of Italian higher education reforms on students'performances.

Di Pietro and Cutillo (2006) compare academic performances of three cohorts of university students who enrolled for the first time in 1995, 1998 and 2001. To that end, they estimate, separately for each of the three cohorts, a bivariate probit model of enrollment and dropout decisions. Then, the authors carry out an Oaxaca-Blinder decomposition (Blinder, 1973, Oaxaca, 1973, 1994) in order to decompose dropout rate differences observed over the three years into a first component that depends upon the students characteristics that affect academic performances and another component associated with changes in students'behaviours. They simulate what would have been the dropout rate for the 2001 cohort of students if this cohort had had the same characteristics (educational background, family environment, etc) than the 1998 (or 1995) cohorts of students. Their results tend to show that the university reforms have reduced university dropouts, once we control for student's characteristics. While this study is the first one that provides, on a national basis, a statistical analysis of the impact of HE reforms, they do not include as covariates the university attended by the student as well as his field of study. Their results face a potential omitted variable bias. In addition, the Oaxaca-Blinder decomposition might lead to misleading conclusions (see Barsky et al (2002), Nopo (2004)). This is

Table 2bis Definition of variables

Dependant variable	
Dropout	Indicator taking on the value one if the individual gave up studying without having completed a diploma three years after having enrolled at university or if this individual is still enrolled at university but has not attended a main course during the last academic year.
Inactive	Indicator taking on the value one if the individual is still enrolled at university three years after having enrolled at university but did not attend a main course during the last academic year.
Control variables	
REFORM	Indicator taking on the value one if the student enrolled at university when the new degree structure was already prevailing, zero otherwise
Educational background	
Ever repeated	Indicator taking on the value one if the individual has repeated at least one grade while in secondary school, zero otherwise
Score: School leaving examination	Higher secondary school diploma score (scale 0-20)
Score: Lower secondary school	Lower secondary school graduating score (0-4 point scale, 0=lowest score, 4=highest score)
Higher secondary school type	
Private school	Indicator taking on the value one if the attended a private secondary school zero otherwise
Technical school	Indicator taking on the value one if the individual is graduated from a technical secondary school, zero otherwise
Vocational school	Indicator taking on the value one if the individual is graduated from a vocational secondary school, zero otherwise
General school	Indicator taking on the value one if the individual is graduated from a general secondary school, zero otherwise
Students' characteristics	
Age	Indicator taking on the value one if the individual is 22 years old, zero otherwise
Sex	Indicator taking on the value one if the individual is a male, zero otherwise
Marital status	Indicator taking on the value one if the individual is married or living in couple, zero otherwise
Family background (when the student was 14 years old)	
Father occupied	Indicator taking on the value one if the father was working, zero otherwise
Father education: tertiary	Indicator taking on the value one if the father has a university degree, zero otherwise
Mother education: tertiary	Indicator taking on the value one if the mother has a university degree, zero otherwise
House wife	Indicator taking on the value one if the mother was an housewife, zero otherwise
Region of residence	
Broad regional region of residence	5 dummies (Northern, Centre, Western. Isle, Southern)
Region of residence	20 dummies
Field of study and university attended	
Field of study	14 field of study dummies (Sciences, Chemistry/Pharmacy, Geo-Biology, Medicine, Engineer, Architecture, Agrarian, Economics/Statistics, Political Sciences, Literature, Linguistic, Teaching, Psychology
University attended	84 university dummies

because this decomposition implies comparing dropout rates between individuals with projecting the conditional dropout probability for the 2001 (1998 and 1995) cohort into regions where the conditional dropout probability for the 1998 (2001) cohort does not exist. In other words, comparisons are not restricted to individuals with comparable characteristics (some combinations of individual characteristics might exist in one cohort and not in the second one). Matching procedures allow to overcome this problem.

Bratti et al. (2006) estimate, for a sample of graduated students of the Faculty of Economic Marche Polytechnic University, the impact of university reforms on students'behaviours and performance outcomes. Using propensity score methods, the authors show that the reform has had a differentiated effect on students'performance, according to the "difficulty" of the course before the reform. Their results suggest that courses with high workloads before the reforms, and constrained in the number of hours after the reform, have seen a significant decrease in workloads, and an increase in the probability of passing the exam in the first year. The opposite effect is observed for courses with low workloads before the reform. However, since this study is restricted to the Faculty of Economic Marche Polytechnic University, it is difficult to draw any conclusions on a national basis.

Finally, Cardoso (2006) investigates in Portugal the impact of the new degrees structure implied by the Bologna process. Higher education institutions had the choice to implement the reform in the academic year 2005/2006 or to pospone it of one or two years. Results show that degree courses whose curricula was modified in order to comply with the Bologna principles were subject to an increase in demand by students.

4 Data

The data are drawn from surveys realized, by the Italian National Institute of Statistics (ISTAT) in 1998, 2001 and 2004 and on students who graduated their secondary school degree respectively in 1995, 1998 and 2001. The surveys provide extensive information on family and educational backgrounds,

Table 2: Summary statistics

	Full sample $n = 21,676$	Dropout students $n = 4,774$	Inactive students $n = 1,327$
Academic performance (%)			
Score: lower secondary school			
1 Enough	16.12	33.49	
2. Fair	25.69	32.51	
3. Distinct	26.18	19.13	
4 Very good	32.00	14.86	
Score: school leaving certificate [0-20]	16.24	15.14	15.45
Ever repeated	11.95	23.16	20.19
Private school	10.91	21.21	11.68
Type of secondary school (%)			
Technical school	23.32	37.64	31.19
Vocational school	7.07	17.51	12.28
General school	35.14	19.89	30.97
Family characteristics (%)			
Father: tertiary education	17.04	8.79	15.38
Mother: tertiary education	14.05	7.05	12.64
Housewife	48.13	54.54	51.21
Father occupied	95.40	93.98	95.66
Individual characteristics (%)			
Male	40.17	49.58	43.10
Age=22	74.41	61.10	63.2
Couple	0.94	3.47	2.63
Region of residence (%)			
Southern	21.12	28.06	29.83
Isle	11.56	15.77	13.18
Northwestern	22.94	19.43	21.85
Northern	18.27	13.55	15.17
Centre	24.34	19.52	19.97

Source: Percorsi di studio e di lavoro dei diplomati, 1998, 2001 and 2004.

Table 3: Distribution by field of study, active versus inactive students

Fields of study	**Enrolled students** $n = 18,229$	**Inactive students** $n = 1,327$
Sciences	2.89	2.19
Chemistry-Pharmacy	3.11	0.98
Geo-Biology	4.42	2.88
Medicine	4.78	1.89
Engineer	10.86	6.82
Architecture	3.97	2.12
Agrarian	4.00	3.56
Economics-Statistics	13.63	12.50
Political Sciences	11.04	12.13
Law	14.42	26.15
Literature	10.75	13.57
Linguistic	7.59	5.30
Teaching	4.59	7.35
Psychology	3.87	2.50

Source: Percorsi di studio e di lavoro dei diplomati, 1998, 2001 and 2004

academic and labor market experiences during the 3 years after graduation at secondary schools. The target sample approximatively represents 5% of the population of students graduated from secondary schools. The responses rates (the Computer Assisted Telephone Interview ($C.A.T.I.$) was the technique used to carry out the survey) reach 70.2%.

Tables $2, 2bis$ and 3 present the independent variables of the model and descriptive statistics of each variable. The controls include variables related to the educational background, family environment, personal characteristics and region of residence of each univeristy student. Table 2 displays summary statistics for the full-sample as well as for the restricted sample of dropout and inactive students. We pool the three years of observations together.

We consider that a student dropouts if he/she declares to have (i) enrolled at university the year following graduation from a secondary school and (ii) giving up studying, without having completed any diploma three years

later or if he/she is an inactive student.[10] A student is considered inactive if he/she declares to be still enrolled at university but without having attended a main course during the last academic year. Given that the the information on the field of study is not available for students that dropout of university without having completed a degree, we report, in Table 3, the distribution of students by field of study, be they active or inactive students.

The percentage of dropout and inactive students respectively reaches 23.49% and 9.21% in the pre-reform period and 19.53% and 3.91% in the post-reform period. Inactive students represent 27.79% of the sample of dropout students. They are not uniformly distributed across fields of study: faculties of law and chemistry/pharmacy respectively register the lowest and highest percentage of inactive students.

Even if these figures tend to show that university reforms have induced a reduction in dropout rates, this would be misleading to draw any conclusions. Indeed students who enrolled at university in 2001 are likely to not be comparable with those who enrolled at university in 1995 and 1998. Raw figures on the evolution of dropouts hide two separate effects: (i) a composition effect (student characteristics) and (ii) the net impact, holding students characteristics constant.

5 Empirical analysis

5.1 Univariate probit

We model the probablity to dropout from university as follows:

$$P_i = X_i\alpha + \text{REFORM}_i\gamma + \epsilon_i \tag{1}$$

where P_i is the probability to dropout from university for individual i, REFORM is a dummy variable taking on the value 1 if the student enrolls at university after the university reform and 0 otherwise, X_i is the set of con-

[10] Note that the definition of dropouts used by MIUR or OECD does not take into account inactive students.

trol variables and ϵ_i is the disturbance term of equation (1).

Univariate probit estimates of equation (1) are presented in Table 4, columns $1-3$.[11] We report the marginal effects at the average values of the independent variables in the sample. In column 2, X_i includes variables related to the educational background, family environment, broad-current region of residence (country divided in 5 broad regions) and personal characteristics of the individual i. In column 3, we control for the current region of residence (20 regions) while column 4 additionally takes into account an eventual time trend in dropout rates.

Before examining the impact the reform, we briefly discuss the effect of the educational background, family environment and other individuals characteristics on the probablity of dropping out of university. We mainly base this discussion on the results displayed in column 1 of Table 4.

Educational background and the probability of dropping out
According to our results, the score abtained at the end of upper secondary schools (*maturita*) is negatively correlated with withdrawal decisions: students who got a low score at the *maturita* are 2.2% more likely to dropout of university. The score obtained at the end of the lower secondary school is also negatively correlated with dropout decisions but the quantitative impact is lower. Students having repeated a grade during the secondary school are more likely to dropout of university. The type of secondary school is also strongly correlated with the probability of dropping out: a student graduated from a general school is 8.9% less likely to withdraw than a student having graduated from a technical school. Similarly, students having completed a vocational school are 10.9% more likely of dropping out with respect to students having completed a technical school.

Family background and the probability of dropping out
The dropout probability is also decreasing with the father's education and father's employment status. These results are in line with Cingano and

[11] Results are not significantly different when one relies on lineary probability models. The results are available upon request.

Table 4: The effect of university reforms on the probability of dropping out of university

	−1−	−2−	−3−
REFORM	−0.054	−0.058	−0.080
	(9.23)	(9.65)	(12.12)
Educational background			
Score: lower secondary school	−0.035	−0.035	−0.036
	(11.35)	(11.46)	(11.61)
Score: school leaving examination	−0.022	−0.023	−0.023
	(17.03)	(17.24)	(17.07)
Ever repeated	0.059	0.059	0.057
	(7.22)	(7.30)	(7.02)
Private school	0.006	0.004	0.002
	(0.69)	(0.40)	(0.16)
High school type	Excluded category: Technical school		
Vocational school	0.109	0.105	0.114
	(10.59)	(10.16)	(10.84)
General school	−0.089	−0.090	−0.092
	(13.04)	(13.20)	(13.57)
Other school	0.006	0.005	0.005
	(0.72)	(0.58)	(0.59)
Individuals characteristics			
Male	0.048	0.048	0.048
	(8.22)	(8.25)	(8.22)
Age=22	−0.040	−0.036	−0.028
	(5.06)	(4.62)	(3.54)
Age>22	−0.042	−0.045	−0.016
	(3.77)	(4.04)	(1.27)
In couple	0.254	0.253	0.251
	(10.15)	(10.12)	(10.05)
Family background			
Father: tertiary education	−0.063	−0.064	−0.063
	(7.02)	(7.17)	(7.07)
Mother: tertiary education	−0.037	−0.038	−0.038
	(3.62)	(3.74)	(3.68)
Mother: Housewife	0.014	0.012	0.012
	(2.37)	(2.13)	(2.07)
Father occupied	−0.038	−0.036	−0.035
	(2.92)	(2.78)	(2.69)
Region of Residence	Excluded category: Northwestern		
Northestern	−0.020		
	(2.27)		
Centre	0.035		
	(3.97)		
Southern	0.034		
	(4.27)		
Isle	0.058		
	(5.84)		
Regional dummies (20)	*NO*	*YES*	*YES*
Time Trend	14		0.052
			(7.67)
Number of observations	21,676	21,676	21,676

Source: Percorsi di studio e di lavoro dei diplomati, 1998, 2001 and 2004

T-statistics below the coefficients

Cipollone (2003) and Di Pietro and Cutillo (2006). Individuals whose father has a tertiary education are 6.3% less likely to dropout from university. The effect of the educational level of the mother is lower but still negative and significantly associated with withdrawing probabilities. Finally, males are 4.8% more likely to dropout than females.

Regional location and the probability of dropping out

We observe significant regional differences in dropout probabilites: results reported in column 1 suggest that the probability of dropping out is 3.5% and 3.4% higher respectively in the Centre and Southern than in the Northwestern. When we instead introduce 19 regional dummies (instead or 4 "broad region" dummies), the estimated effect of the reform is not modified. Note that university students in Sicily are, for instance, 7% more likely to dropout of university than those living in Lombardia. This result could be in part the consequence of regional differences in the quality of education at university but also in primary and secondary schools.[12] The results of the program $PISA$ (Program for International Student Assessment) have indeed underlined that the reading ability of 15 years old students widely varies across region, the North being performing much better than the South.[13] Variations in labor market opportunities may also explain the higher incentive to dropout of university in Sicily than in Lombardia.

The impact of university reforms on the probability of dropping out

Our main interest lying in the impact of the university reforms on university dropouts, we now turn to the analysis of the coefficient associated with the REFORM dummy. In line with our hypothesis, the coefficient is positive and strongly different from zero, irrespective of the procedure of estimation. Students having enrolled at university after the reform are 5.4% less likely to dropout of university. The positive effect of the reform on university dropouts is consistent with the self-evaluation of the reform by students themselves. In the 2004 survey, students, still enrolled at the university, were

[12] Note that the regional dummies (the coefficients are not reported in the interest of conciseness) are jointly significantly different from zero in columns 2 and 3.

[13] The PISA survey, sponsored by the OECD, is carried out every three years in more than 30 countries.

asked to provide a global assessment of the university reform as well as its specific impact on (i) dropout rates and (ii) the relevance of the knowledge and skills acquired at university for labour market needs.While, on the one hand, only 37.98% of students expect a positive effect of university reforms on HE institutions capacities to offer the set of skills demanded on the labor market, on the other hand, more than 52% of students are optimistic about their effect on dropout rates.

As shown in Table 4, the estimated effect of the reform is robust to the inclusion of additional covariates.[14] However,care is required before giving a causal interpretation to the results. The coefficient $\widehat{\gamma}$ associated with the REFORM dummy is an unbiased estimate of the reform on dropout rates if and only if $E(reform_i;\, \epsilon_i \mid X_i) = 0$. There are mainly three reasons why the orthogonality condition could fail.

First, the estimated effect of the reform might be the result of a time trend in dropout rates. Our results could be driven by unobserved time variations in the university funding scheme. Actually, around 90% of university funding is allocated between universities on historical basis (*Fondo Finanziamento Ordinario, FFO*). The remaining part of the budget, the Equalization component (*Quota di Riequilibrio*, QR) is assigned to each university according to the number of students enrolled at this university and the number of exams passed by those enrolled students.[15] This way of allocating funds between universities may have the perverse incentive to inflate grades and lower standards. The part of the Equalization component should increase every year, until it fully replaces the FFO, in around 30 years. In other words, variations over years in dropout probabilities might be due to the fact that the incentive of each university to lower standards (which in turn affect withdrawal decisions) increases with the QR getting larger over time. To control for this possibility, we include a time dummy, d_{1998}, taking the value one 1 if the students enrolled at university in the academic year 1998/99

[14] Actually, the inclusion of additional covariates tends to reinforce the impact of the reform on dropout rates.

[15] See Perotti (2002, 2004) and Bagues *et al* (2006) for additional information.

Table 5: The effect of university reforms on the probability of being an inactive student

		−3−	−4−	−5−
REFORM	−0.055	−0.049	−0.046	−0.046
	(13.50)	(11.20)	(11.41)	(11.41)
Field of Study	Excluded category: Medicine			
Sciences		0.024	0.031	0.032
		(1.38)	(1.74)	(1.77)
Chemistry-Pharmacy		−0.025	−0.022	−0.022
		(1.67)	(1.53)	(1.74)
Geo-Biology		0.005	0.010	0.009
		(0.37)	(0.36)	(0.64)
Engineer		0.015	0.031	0.031
		(1.16)	(2.20)	(2.19)
Architecture		0.003	0.020	0.019
		(0.20)	(1.14)	(1.13)
Agrarian		0.023	0.029	0.029
		(1.47)	(1.79)	(1.80)
Economics-Statistics		0.039	0.046	0.046
		(2.86)	(3.31)	(3.31)
Political/Sciences		0.058	0.067	0.067
		(3.95)	(4.40)	(4.41)
Law		0.097	0.099	0.098
		(6.24)	(6.30)	(6.28)
Literature		0.067	0.075	0.075
		(4.43)	(4.83)	(4.82)
Linguistic		0.020	0.031	0.031
		(1.43)	(2.11)	(2.12)
Teaching		0.071	0.082	0.081
		(4.10)	(4.51)	(4.47)
Psychology		0.012	0.017	0.017
		(0.79)	(1.04)	(1.07)
Univeristy fixed effects	*NO*	*NO*	*YES*	*YES*
Time Trend				−0.006
				(1.60)
Other covariates				
Educational background	*YES*	*YES*	*YES*	*YES*
High school type	*YES*	*YES*	*YES*	*YES*
Individuals characteristics	*YES*	*YES*	*YES*	*YES*
Family Background	*YES*	*YES*	*YES*	*YES*
Regional dummies (20)	*YES*	*YES*	*YES*	*YES*
Number of observations	17,705	17,705	17,705	17,705

Source: Percorsi di studio e di lavoro dei diplomati, 1998, 2001 and 2004.

T-statistics below the coefficients.

and 0 otherwise. Results are reported in column 3. It turns out that the marginal effect of $\left(\widehat{\gamma}-\widehat{\theta}\right)$, with $\widehat{\theta}$ being the estimated coefficient associated with d_{1998}, is equal to -0.028 and is strongly different from zero. When we control for time changes in dropout rates, students who enrolled at university after the reform are significantly less likely to dropout of university. However, the estimated effect of the reform is lower than previously.

Second, we do control neither for the university attended, nor for the field of study. If the repartition of students across universities and fields of study has changed uniformly over years, then the dummy d_{1998} is enough to control for the omission of these variables. Needless to say, that if this is not the case, the coefficient associated with the REFORM dummy is likely to be biased. Although the information on the subject degree and the university is not available for dropout students, we do have it for students still enrolled at university at the time of the interview, be they active or inactive students. In other words, it is still possible to investigate whether the reform has had a significant effect on the probability of being an inactive student while simultaneously controling for dropout rates differences by degree subject and university. Results are reported in Table 5.[16] As reported in column 1, the probability of being an inactive student has decreased by 5.5% in the post-reform period when the control variables are those corresponding to the specification 2 of Table 4. Interestingly, the inclusion of degree subject fixed effects (columns $2-4$) and university-fixed effects (columns $3-4$) only very sensibly reduces the coefficient associated with the dummy REFORM. Column 4 also includes d_{1998}. The time trend is not significantly different from zero. After including a very extensive list of covariates, students who enrolled at university after the implemtantion of university reforms are significantly less likely to be inactive than those who enrolled in the pre-reform period. This provides evidence that our results are not driven by omitted variables.

Third, there is still the possibility of failing to control for relevant factors

[16] Recall that our definition of dropout students counts inactive students as dropout students.

which are both correlated with dropout probabilities and enrollment decisions in the post and pre-reform periods. For instance, we do not observe the intrinsic ability or the motivation of students. Regarding the ability bias, we assume that educational background related covariates (scores obtained both at the lower and higher secondary school diplomas, type of secondary schools, number of repeated grades) are already capturing the effects of both human capital accumulation and individual innate ability. In addition, we see no reasons why the distribution of innate ability by educational background should be different in pre- and post-reform periods. On the other hand, the motivation of students is closely related to the impact of the reform. In other words, since the motivation of students to complete a first university degree is likely to be influenced by study duration, this is precisely the type of unobserved individual variables that we do not want to include in the set of covariates X_i.

As a final check of the robustness of our results, we present in the next section the estimated effect of the reforms on dropout rates and on the probability of being an inactive student when we rely on matching procedures. Matching procedures also assume that the selection bias, due to the impact of the reform on enrollment decisions, is only based on observable characteristics. However, matching estimators produce consistent estimates under weaker assumptions than those required in the standard univariate probit model.

5.2 Propensity score methods (PSM)

Consider for a student i, $P_{ij} = P_{0i}$ the probability of dropping out from university before the "3+2" university system was introduced and $P_{ij} = P_{1i}$, the probability to dropout under the new university system. $D = [0; 1]$ is an indicator of exposure to university reforms. We observe P_{1i} when $D = 1$ i.e., when the student took university enrollment decisions while the new university system came already into effect (*treated* student) while we only observe P_{0i} when $D = 0$, i.e., if the student enrolled while the old university system was still prevailing (*untreated* student). As we do not

observe both P_{1i} and P_{0i} for the same student i, it is not possible to estimate $P_{1i} - P_{0i}$. If university reforms have had an impact on enrollment decisions, then characteristics of students who enrolled at university before and after the reform are not identical. In these conditions, $E(P_{1i} \mid D = 1) - E(P_{0i} \mid D = 0)$ is not a consistent estimate of $E(P_{1i} - P_{0i})$, the average effect of the treatment (ATE). This sample selection bias comes from the fact that the outcomes of treated and untreated would differ if none got treated.

Matching procedures consist in comparing dropout probabilities between individuals who are as similar as possible, along a n-dimensional vector of pre-treatment characteristics, X_i while assuming that:

$$P_{1i}, P_{0i} \perp D \mid X_i \tag{2}$$

Under the *unconfoundness* assumption, the exposure to the treatment is random, i.e, the only difference between treated and untreated students is that the former group enrolled at university in the post-reform period while the other group enrolled at university in the pre-reform period. In other words, once we condition for X_i differences in dropout rates between treated and untreated university are assumed to be due to the impact of university reforms on withdrawal decisions.[17] Matching procedures can only by applied under the support condition, which assumes that for each treated unit, there are control units with the same set of covariates X_i.: $0 < P(D = 1 \mid X_i) < 1$ for all X_i.[18]

Matching directly the vector of covariates X_i could be computationally demanding, especially when the number of covariates is large. A commonly used matching procedure, for solving the "curse of dimensionality", consists in summarizing X_i with a single variable, the propensity score $P(X_i) = P(D = 1 \mid X_i) = E(D \mid X_i)$, i.e., the probability of being enrolled in the post-reform period given the set of covariates X_i (Rosenbaum and Rubin

[17] See Ichino and Becker (2002) and Calinendo and Kopeinig (2005) for a comprehensive review of the litterature.

[18] Note that matching and OLS estimators require the stable unit treatment value (SUTVA) assumption to be valid. The impact of the reform for a specific student does not depend on the impact of the reform on other students.

(1985)). If treatment and control groups have identical propensity scores, then the treatment assignment is, conditional on the propensity score, ignorable.[19]

Under the unconfoundness assumption and the support condition, the average treatment effect on treated individuals (ATT) is given by $E(P_{1i} - P_{0i} \mid D = 1) = E\left[E(P_{1i} \mid P(X_i)) - E(P_{0i} \mid P(X_i)) \mid D = 1\right]$ where the outer expectation is over the distribution of X_i in the subpopulation.[20]

Although, the best would be to match individuals with the same propensity score, it is not feasible in practice. Indeed, it is very unlikely to find individuals with exactly the same propensity score. Several matching estimators have been proposed in the literature to come over this problem. These different estimators differ in terms of the weight attributed to each control unit. For all the estimators, $\widehat{E}(P_{0i} \mid \widehat{P}(X_i))$, the estimated counterfactual for observation i is a weighted average of a selection of control units and has the following form $\sum_{j=1}^{J} f(\widehat{P}(X_i), \widehat{P}(X_i)) P_{0j}$, with $f(\widehat{P}(X_i), \widehat{P}(X_i))$ being the weight given to control unit j. The weight depends on the distance in terms of the propensity score between i and j.

In the interest of conciseness, in the remainder of the paper, we only present results based on the nearest neighbor (NN).[21] This NN matching estimator consists in matching each treated person with the nearest untreated person. For a given treated individual i with a propensity score $\widehat{P}(X_i)$, the nearest neighbor j is the one whose propensity score $\widehat{P}(X_i)$ is the closest from

[19] If $E\left[D = 1 \mid W_i\right] = E\left[D = 0 \mid W_i\right]$, then $E\left[D = 1 \mid p(W_i)\right] = E\left[D = 0 \mid p(W_i)\right]$. See Rosenbaum and Rubin (1983) for additional details.

[20] The average treatment effect (ATE) of the reform on dropout rates is given by $E(P_{1i} - P_{0i}) = E(P_{1i} \mid P(W_i)) - E(P_{0i} \mid P(W_i))$. If the effect of the reform is heterogeneous within the population, then $ATE \neq ATT$. In our case, the parameter of interest is the ATT: we want to measure the impact of the reform on students that enrolled at university after the reform.

[21] See Heckman, Ichimura and Todd (1997) or Becker and Ichino (2002) for more information on the alternative matching estimators. In theory, all matching estimators should give similar results when the sample is large. The choice of the matching estimator should be guided in part by the distribution of treated and untreated individuals. In our case, since the respective number of treated and untreated individuals is that different, this makes sense to rely on the NN matching.

$\widehat{P}(X_i)$.[22]

Matching is preferred to standard regressions for three reasons.
First, estimating equation (1) produces unbiased estimates of the coefficient associated with the REFORM dummy if and only if $E(reform_i;\, \epsilon_i \mid X_i) = 0$ while matching methods produce unbiased estimates of the impact of university reforms if $E(reform_i;\, \epsilon_i \mid X_{ii}) = E(P_i; \epsilon_i \mid X_i)$. This last assumption is weaker than the previous one: the PS estimator allows us to control for unobservable characteristics whose correlation with both P_i and $P(X_i)$ is identical. In the words of Altonji et al. (2005), the PS estimator is consistent if "the selection on unobservables is the same as selection on the observables".
Second, matching estimators do not assume that simply conditioning linearly on X_i is enough to eliminate the selection bias.
Third, matching estimators estimate the effect of the reform only for individuals falling within the common support. If the effect of the reform is heterogeneous along X_i, then OLS estimators give a biased estimate of the ATT because of the bias arising from the non-overlapping support of the observables (Heckman, Ichimura, Smith and Todd (1998)).[23]

Results are reported in Table 6. The propensity score is estimated through a probit model. For the matching, we impose the common support condition which consists in dropping observations in the treated group whose propensity score value is lower (higher) than the minimum (maximum) propensity score value in the control group.

The estimated effect of the reform on dropout probabilities is displayed in the first two columns of the table. The X_i variables used for the matching procedure correspond to the X_i covariates that have been included in the parametric model reported column 2, Table 4. While these variables are significantly associated with dropout probabilities, they are also expected to be

[22] In the case of NN matching with replacement, an untreated individual can be used more than once as a match while with NN matching without replacement, an untreated student can be used only once.

[23] Note also that the weighting schemes of least squares and matching estimators are different. See Blundell, Dearden and Sianesi (2005) for a very clear explanation.

Table 6: Impact of university reforms, robustness of the results

	Dropout rates		Students' status	
	NN estimator with replac.	Matched pair fixed effects Control d_{1998}	NN estimator with replac.	Matched pair fixed effects Control d_{1998}
Reforms	-0.062 5.09	-0.037 6.58	-0.057 5.09	*REDO*

Source: Percorsi di studio e di lavoro dei diplomati, 1998, 2001 and 2004.
Columns 1 and 2: Number of treated individuals which have been matched: 8046
Columns 3 and 4: Number of treated individuals which have been matched: 6403
Bootstrapped standard errors (500 replications). t-statistics below the coefficients

correlated with the treatement status. We cannot condition on d_{1998} since this variable perfectly classify students in treated and non treated students.

The difference in the mean propensity score between the treated and untreated individuals is equal to 0.0007. Imposing the common support reduces the number of treated individuals being matched with control individuals.[24]

The estimated impact of the reform is not different from what we previously obtained. The probability of dropping out of university after the reform is 6% lower than before the reform. When we do not impose the common support condition, the estimated effect is sensibly equal. This suggests that the impact of the reform is quite homogeneous over the treated population. The conclusions are not altered when we use a kernel matching estimator.

While on one hand matching procedures are more flexible than regression-based estimates, on the other hand they do not permit to take into account the potential bias induced by the presence of a time trend. We work out this problem by estimating the following equation $P_i = \text{REFORM}_i\gamma + d_{1998}\theta +$

[24] If the effect of the reform is heterogeneous within the treated population, then we are actually estimating the average treatment on treated individuals that fall within the common support.

$f_M + \epsilon_i$ with f_M being a fixed effect for each matched pair. Treated and untreated individuals are matched according to the results obtained with a NN estimator without replacement. Results are displayed in column 2. The reform has led to a decrease in dropout rates by 3.7%.

The last two columns of Table 6 display the impact of university reforms on the probability of being an inactive student and the set of covariates used for estimating the propensity score is the one included in the specification displayed in column 3 of Table 5 (with university-fixed effects and field of study dummies). Our results suggest that the reform has significantly reduced the probability of being an inactive student. The quantitative effect ranges between 2.5% and 5.7%.

6 Conclusion

While the university reforms, implied by the Bologna process, are in progress throughout Europe, so far, very few attempts have been made to assess the effect of these reforms on university effectiveness and students' mobility. In this paper, we conduct an analysis of the impact of Italian university reforms on university dropouts and students' status. We show that the probability of dropping out of university in the post-reform period is significantly lower than in the pre-reform period. This result remains robust whatever the procedure of estimation. Similarly, the probability of being an inactive students has significantly decreased in the post-reform period. We believe that the higher education supply shift resulting from the set of university reforms implementing in the academic year 2001/2002 has had a significant impact on students'motivation to complete a university degree.

References

[1] Altonji, J., T. Elder, and C. Taber (2005): "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools,"

Journal of political economy, 113(1), 151–184.

[2] Bagues, M.F., Labini, M.S. and N. Zinovyeva (2006): "The Endogeneity of University Grading Standards. and Labour Market Mismatch: Evidence from Italy," http://www.nek.lu.se/ryde/25symp06/Papers/Zinovyeva.pdf

[3] Barsky, R., J. Bound, K. Charles, and J. Lupton (2002): "Accounting for the Black-White Wealth Gap: A Nonparametric Approach," *Journal of the American Statistical Associatio*n, 97(959), 663–673.

[4] Becker, S., and A. Ichino, (2002): "Estimation of average treatment effects based on propensity scores,", *Stata Journal 2*, 358–377.

[5] Blinder, A. (1973): "Wage Discrimination: Reduced Form and Structural Estimates," *Journal of Human Resources*, 8(4), 436–455.

[6] Boero, G., T. Laureti, and R. Naylor (2005): "An Econometric Analysis of Student Withdrawal and Progression in Post-Reform Italian Universities," Working Paper CRENoS 200504, Centre for North South Economic Research, University of Cagliari and Sassari, Sardinia.

[7] Bratti, B., Broccolini, C., and S. Staffolani (2006): "Is '3+2' Equal to 4? On the Effects of University Reform in Italy," Universita' Politecnica delle Marche, Dipartimento di Economia Working Papers 251.

[8] Cardoso, A.R., Portela, M., Sá, C. and F. Alexandre (2006): "Demand for Higher Education Programs: The Impact of the Bologna Process," IZA Discussion Papers 2532, Institute for the Study of Labor (IZA).

[9] Chatterji, P., and J. DeSimone (2005): "Adolescent Drinking and High School Dropout,"NBER WP 11337.

[10] Cingano, F., and P. Cipollone (2003): "Determinants of University Drop-Out Probability in Italy,"Working Paper, Bank of Italy.

[11] Dehejia, R.H and Wahba, S. (1999), "Causal Effects in Non-Experimental Studies: Re-Evaluating the Evaluation of Training Programmes," *Journal of the American Statistical Association* 94, 1053-1062.

[12] Di Pietro, G., and A. Cutillo (2006): "The Impact of Supply Side Policies on Unviersity Drop-Out: The Italian Experience," Available at http://www.eale.nl/conference2006.

[13] Eurydice (2005): "Focus on the Structure of Higher Education in Europe. National Trends in the Bologna Process 2004/05 Edition," Avalaible at http://www.eurydice.org.

[14] Gagliarducci S., A. Ichino , G.Peri and R. Perotti (2005): "Lo Splendido Isolamento dell' Universita' Italiana," Working Paper, Fondazione Rodolfo De Benedetti, Milano, Available at www.igier.uni-bocconi.it/perotti.

[15] Hanushek, E. (2005): "Why Quality Matters in Education," *Finance and development*, 42(2), 15–19.

[16] Johnes, G., and R. McNabb (2004): "Never Give Up on the Good Times: Student Attrition in the UK," *Oxford Bulletin of Economics and Statistics*, 66(1), 23–47.

[17] Heckman, J. J., Ichimura, H. and Todd, P. E. (1997): "Matching as an econometric evaluation estimator: evidence from evaluating a job training program," *Review of Economic Studies*, 64, 605-654.

[18] Heckman, J.J., Ichimura, H. and Todd, P.E. (1998), "Matching as an Econometric Evaluation Estimator", *Review of Economic Studies* 65, 261-294.

[19] Ichino, A. (2006) : "The Problem of Causality in the Analysis of Educational Choices and Labor Market Outcomes," European University Institute and CEPR, February.

[20] Ichino A., F. Mealli and T. Nannicini (2006a), " From Temporary Help Jobs to Permanent Employment: What Can we Learn from Matching Estimators and their Sensitivity?, CEPR Discussion Paper 5736.

[21] Imbens, G. (2000), "The Role of Propensity Score in Estimating Dose-Response Functions," *Biometrika* 87(3), 706-710.

[22] Montmarquette, C., S. Mahseredjian, and R. Houle (2001): "The Determinants of University Dropouts: A Bivariate Probability Model with Sample Selection," *Economics of Education Review*, 20(5), 475–484.

[23] Nopo, H. (2004): "Matching as a Tool to Decompose Wage Gaps," IZA Discussion Papers 981, Institute for the Study of Labor (IZA).

[24] Oaxaca, R. (1973): "Male-Female Wage Dierentials in Urban Labour Markets," *International Economic Review*, 14(3), 693–709.

[25] Oaxaca, R., and M. Ransom (1994): "On Discrimination and the Decomposition of Wage Dierentials," *Journal of Econometrics*, 61(2), 5–21.

[26] Perotti, R. (2002): "The Italian University System: Rules vs. Incentives," Available at www.igier.uni-bocconi.it/perotti

[27] Rumberger, R. (1983): "Droppint Out of High School: The In‡uence of Race, Sex and Family Background," *American Educational Research Journal*, 20(2), 199–220.

[28] Rosenbaum, P.R. and D.B. Rubin (1983), "The Central Role of the Propensity Score in Observational Studies for Causal Effects", *Biometrika* 70, 1, 41–55.

[29] Rosenbaum, P.R. and D.B. Rubin (1984), "Reducing Bias in Observational Studies using Subclassification on the Propensity Score", *Journal of the American Statistical Association* 79, 387, 147–156.

[30] Smith, J., and R. Naylor (2001): "Dropping Out of University: A Statistical Analysis of the Probability of Withdrawal for UK University

Students," *Journal of the Royal Statistical Society: Series A* (Statistics in Society), 164(2), 389–405.