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Academic achievements: the effects of excess time to degree on GPA

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ABSTRACT
This paper proposes a novel approach to investigating the determinants of academic performance: GPA and time to degree. We match administrative records with questionnaire responses for a large set of undergraduate students from one Italian public university. By exploiting reforms implemented by the University, we estimate the effect of the excess time to degree on GPA and find a strong negative relationship. Our results shed light on two crucial outcomes of academic performance, which may also determine the students' bargaining power in the labor market.

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1. Introduction

This paper analyses the determinants of two key indicators of students' academic performance, namely, grade point averages (GPA henceforth) and excess time to degree, and quantifies a direct effect of excessively long academic careers on GPA using a set of exogenous instruments for students' time to degree.

Despite the expected positive effects of the 2001 Bologna university reform, the average time to degree in several EU countries is still significantly longer than the minimum legal period. In the Italian context, for instance, only 51.1% of baccalaureates in 2017 completed their studies within the standard legal time (three years) and 9.8% of graduates completed their studies four years or more beyond the standard period.[1] Delayed graduation generates concerns as it postpones entry into the labor market, which diminishes the labor supply and may induce a loss of fiscal revenue. Moreover, longer time to degree reduces the probability of finding a job and correlates negatively with the initial wage. While the effects of delayed graduation on labor market outcomes have been widely documented, to the best of our knowledge no attempt has been made to analyze the potential impact of excessively long academic careers on the overall efficiency of learning and, hence, GPA. This is an important issue since both GPA and career length represent 'signals' in a labor market which is becoming more and more specialized, and play a role in the determination of employment and wages.

We consider a sample of baccalaureates from one Italian public university and match the administrative records coded during the student's career with the information drawn from the *AlmaLaurea* questionnaires. The latter is compiled online by students the day before degree completion.[2] In such a way we obtain a rich set of covariates containing students' demographic and socio-economic characteristics, parental backgrounds, secondary school achievements, as well as academic performance while at the university, working experiences and participation in internships and international

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exchange programs. The novelty of our approach is that we can exploit a specific reform that has contributed positively to the overall reduction of excess time to degree without altering the student's performance in terms of grades. In addition, we are able to take into account the effects of students' behavior regarding the fulfillment of curricula requirements such as class attendance, number of exams and university educational credits (CFU henceforth) obtained by passing exams during the first academic year.[3]

In the Italian university system, students may influence to some extent the path of their academic careers by choosing the timing and the order of exam taking. Even though some students may actually decide to prolong their studies in order to achieve a higher GPA, if they believe that higher grades signal better quality and increase the probability of finding a good job or may be conditioned by varying parental financial and health conditions, the excess time to degree is predominantly determined by students' behavior regarding the fulfillment of curriculum requirements. Students lacking discipline in respecting the expected exam schedule for each academic year and/or in fulfilling the required objectives in terms of the minimum number of university credits per year, are more likely to end up with longer academic careers. As a consequence, irregular and excessively long academic careers may deteriorate or make the accumulated stock of knowledge out-of-date resulting in a lower GPA.

The empirical estimation of the effects of excessively long academic careers on GPA however may suffer from an endogeneity problem as both excess time to degree and GPA may be jointly determined. In order to make accurate predictions of the effects of time to degree on GPA, we make use of the following identification strategy. We consider only graduates in Economics and Management and instrument the excess time to degree through a specific 'reform' implemented at the School of Economics and Management in the academic year 2008/2009, which increased the number of *CFU* attained for each course. The 'reform' may have contributed positively to the overall reduction of excess time to degree since the total number of *CFU* at graduation has remained the same, while the total number of exams has been reduced. Our data suggest that the average post-reform delay to degree is 18.5% shorter than the pre-reform one. On the other hand, the reform does not appear to have influenced the student's performance in terms of grades since the average GPA before and after the introduction of the reform remained almost unaltered (the variation is only 0.3%). In addition, the reform has not been anticipated in any way, so it could not have had any influence on students' expectations.

As additional exogenous variables correlated with excess time to degree, we use students' residence (whether a student resides in the same province as the place of study or in some other province and/or region), and sectoral employment rate for baccalaureates in Economics and Management at the national level. Students residing closer to the location of study have lower traveling and accommodation costs with respect to those residing in other provinces and/or regions forced to commute on an every-day basis or bear the cost of renting a room/apartment. Students facing lower cost of living may experience less pressure to conclude their studies on time with respect to students with higher traveling and accommodation costs. On the other hand, high unemployment rates for Economics and Management baccalaureates may discourage the entrance in the labor market inducing them to prolong their academic careers. Whether a student resides in the province where the university is located or in other provinces and/or regions may be considered as an exogenous variation since this decision is strongly determined by the place of residence.[4] Moreover, the backgrounds of students residing in the same province compared to those from other provinces and/or regions, do not vary in a systematic way, which helps us to rule out the existence of a positive selection.

The empirical estimates suggest that there is a strong and negative direct effect of excess time to degree on GPA. Students graduating within the minimum legal period are 16.5% more likely to be among the top GPA performers. Furthermore, the results indicate that students with larger excess time to degree end up with significantly lower GPA. As for the other covariates of time to degree and GPA, the number of the first-year CFU is an important predictor of regular fulfillment of academic requirements and timely degree attainment, which in turn translates into higher GPA. Regular class

attendance significantly reduces the excess time to degree while participating in the Erasmus international exchange program correlates positively with GPA and negatively with the probability of timely degree attainment. Finally, conditionally on students' academic achievements, family's financial condition contributes positively to the reduction of the excess time to degree.

The paper is organized as follows. In the next section we present a short review of the literature on the determinants of GPA and delayed degree completion. Section 3 provides a detailed description of data used in the empirical analysis. In Section 4, we offer a first insight into factors affecting GPA and excess time to degree using the entire sample of baccalaureates, while in Section 5, we present our core results with two stage estimation on the restricted sample of students reading Economics and Management. Section 6 concludes.

2. Determinants of academic achievements

2.1. Literature review

There is a substantial literature dealing with the determinants of academic achievements both in terms of grades and excess time to degree. For instance, Dustmann (2004), Bertola and Checchi (2004), Checchi and Zollino (2001), and Bertola, Checchi, and Oppedisano (2007) find that having attended a general high school rather than a professional school or vocational studies improves academic performance at the university. Similarly, Cappellari, Lucifora, and Pozzoli (2012) investigate the factors influencing the grades in mathematics achieved by first-year students in Economics and find that high school grades and type of high school attended are significantly correlated with math grades. Boero, Laureti, and Naylor (2005), on the other hand, show that students from higher income families complete their studies more rapidly, even after controlling for demographic and socio-economic characteristics, and secondary school achievements. Regarding the potential differences in academic achievements between male and female peers, McNabb, Sarmistha, and Sloane (2002) and Aina (2011) find that the probability of obtaining a higher leaving grade is greater for females than for males. Similar evidence is found in Cappellari, Lucifora, and Pozzoli (2012) and DiPrete and Buchmann (2013).

Several empirical studies look at exogenous events after enrollment, such as labor market conditions as potential determinants of the excess time to degree. Brunello and Winter-Ebmer (2003) carry out a cross-country analysis at the European level and show that the excess time to degree is higher the higher is the country's unemployment rate for college graduates and the lower is the country-specific wage gap. Moreover, the excess time to degree is positively correlated with stricter employment protection and with the public share of expenditure for tertiary education. Aina and Casalone (2011) confirm the relevance of economic conditions for later completion and support the idea that the delay to degree may increase with unemployment. Higher unemployment, hence, reduces the incentives to graduate on time because of the poorer labor market prospects, while a more accentuated wage compression by education narrows the gap between expected benefits from education and opportunity costs of staying longer in college. This evidence is in contrast with Messer and Wolter (2010), who show that high interest or unemployment rates make refinancing more expensive, and a student is likely to substitute employment with studying which than translates in a shorter time to degree. [5]

Another strand of literature examines the role of risk and uncertainty in education decisions and outcomes. Hartog and Diaz-Serrano (2007) find a negative correlation between earnings uncertainty and investment in higher education. Similarly, Fossen and Glocker (2011) account for the risk of dropout, unemployment, and labor market returns to education, and find that higher risk-adjusted wages increase the likelihood of enrollment, while greater variance of net wages for college graduates decreases the likelihood of enrollment. As for college dropout, Braunstein, McGrath, and Pescatrice (2000) and Torres, Gross, and Dadashova (2010) find that students with lower GPA during the first academic year are significantly less likely to graduate. In addition, Dwyer, McCloud, and

Hodson (2012) and Robb, Moody, and Abdel-Ghany (2011) stress the importance of financial aid for degree completion and suggest that the relationship between financial aid and drop-out rates is non-linear. Finally, Stange (2012) estimates the importance of uncertainty and option value on college attendance in a sequential setting where students can transfer and drop-out. The author finds that the magnitude of the option value is substantial for average high school graduates. Similarly, Eide and Geetha (1998) show that option value is an important factor in the choice of major. Even though this literature has important implications in a number of different contexts, it is only indirectly related to the purposes of this study since we do not aim to analyze the determinants of college enrollment and the mechanisms underlying college completion, or eventually to formalize a fully blown model of returns to college education.

2.2. Grades and excess time to degree

While several authors have analyzed the effects of delayed graduation on labor market outcomes, such as the probability of finding a job (Aina and Casalone 2011) and the initial wage (Monks 1997; Brodaty, Gary-Bobo, and Prieto 2009), or in general on labor supply and losses in terms of fiscal revenues (Hakkinen and Uusitalo 2003), to the best of our knowledge no attempt has been made to analyze the potential impact of excessively long academic careers on GPA. This is an important issue since both the grade point averages and academic career duration represent 'signals' in the traditional human capital approach and play a role in the determination of employment decisions and wages (Spence 1973).

As already mentioned in the introduction, excess time to degree (ETD henceforth) and GPA may be inversely related as a high excess time to degree is often associated with irregular and discontinuous academic careers which are characterized by lower GPA. Observed time to degree is the result of a cumulative process partly under students' control as exams are pre-scheduled.[6] Some students may decide to respect the pre-scheduled exam order and accumulate the expected number of credits semester after semester, while others may decide to mix up the exams doing 'retakes' in order to achieve a higher GPA or simply because they put more weight on leisure rather than on studying. As a result, the 'well-behaved' students are on-track. Stretching academic career out of the pre-scheduled path may result in lower overall efficiency in learning, which then translates into lower GPA.

In order to illustrate the mechanism linking ETD and GPA, we can assume that each student is endowed (ex ante) with a certain propensity for ETD. For any given propensity for ETD, students decide how much time to invest in studying rather than leisure activities (low effort, L versus high effort, H). As a consequence, students' GPA depends on both ETD and effort. The matrix below summarizes the link between ETD, effort and GPA.

Propensity ETD	Academic track	ETD	Effort (e)	GPA
Positive	Irregular	ETD=1	L	$GPA^{e=L}_{ETD=1}$
			H	$GPA^{e=H}_{ETD=1}$
Negative	Regular	ETD=0	L	$GPA^{e=L}_{ETD=0}$
			H	$GPA^{e=H}_{ETD=0}$

Positive propensity for ETD necessarily brings to excessively long academic careers (ETD = 1), since these students run over the minimum legal period (three years). This occurs because students mix up the order of exams, fail to accumulate 60 pre-scheduled credits at the end of the first year, and end up with less than 180 credits at the end of the third academic year. The reason for this kind of behavior may (i) lie in the willingness to do several 'retakes' in order to reach a higher average GPA, (ii) high failure rate, or (iii) stronger preference for leisure. In any case, students belonging to the first category (retakes to gain higher GPA) are expected to put more effort (i.e. invest more time in studying rather than leisure activities) end reach a higher GPA with respect to other out-of-track students

($GPA^{e=H}_{ETD=1} > GPA^{e=L}_{ETD=1}$). A regular student (ETD = 0), on the other hand, is the one who takes credits through exams in the pre-ordered sequence defined by the University, at the end of first year accumulates 60 credits and ends up with 180 credits at the end of the third year. These latter students are more efficient: they do not do 'retakes', rather at the end of each course collect the expected number of credits per exam and a grade. As a result, compared to irregular students, higher efficiency translates into higher GPA, for any level of effort invested in studying ($GPA^{e=L}_{ETD=0} > GPA^{e=L}_{ETD=1}$; $GPA^{e=H}_{ETD=0} > GPA^{e=H}_{ETD=1}$).

Regular academic careers and higher grades may signal a better quality, and translate into higher labor market remunerations (Monks 1997). For any given level of effort, students with longer academic careers may end up with lower skills and knowledge (due to the deterioration of human capital), and lower GPA on average with respect to regular students. This, in turn, may reduce their lifetime earnings potential due to a lower overall productivity and/or worse 'signaling'. Figure 1 illustrates this point. Regular students (*ETD*=0) obtain higher grades and earn more over the life cycle, no matter whether they invest low or high effort ($Z_{ETD=0}$ line lies above $Z_{ETD=1}$). Irregular students (*ETD*=1) who eventually choose to prolong their academic career in order to acquire higher grades, invest more effort and increase their earnings potential (move from (c) to (d) along the $Z_{ETD=1}$ line) with respect to irregular students who put more weight on leisure and invest less effort. Hence, both *ETD* and effort are important inputs in the production of grades. However, *ETD* rescales the effect of effort on GPA. Independently of effort, longer academic careers are associated with lower GPA and less favorable post-school labor market outcomes ($(\delta GPA/\delta ETD)\,|_{e=L,H} < 0$), *ceteris paribus*.

The above figure offers an interesting insight into a potential relationship between time to degree, GPA and labor market outcomes. Since we do not have information following up on earnings, we are not able to test empirically the relationship between time to degree and earnings potential. However, the possibility to exploit a reform as an instrument for time to degree, allows us to estimate a direct effect of excessively long academic careers on GPA for a sub-sample of graduates in Economics and Management. Indeed, our results will clearly show that longer academic careers translate into lower

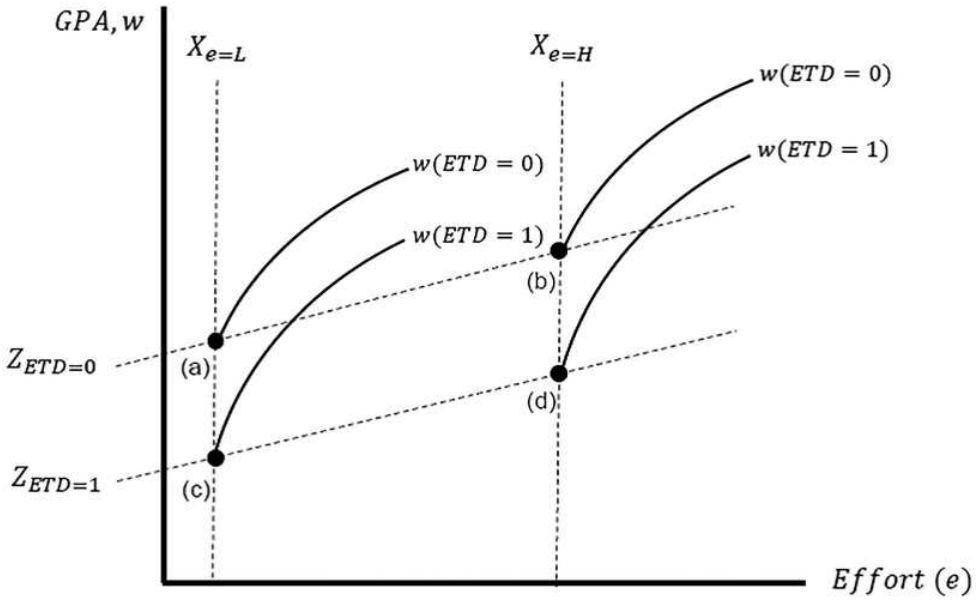

Figure 1. Wage profiles as a function of effort, GPA and ETD.

GPA, *ceteris paribus*. The next section presents a detailed description of the sample and data used in the empirical analysis.

3. Data

In order to analyze the determinants of academic achievements and the relationship between excess time to degree and GPA, we match the University's administrative data records with the information contained in *AlmaLaurea* questionnaires (AL data henceforth). The information collected from University administrative data provides students' demographics such as gender, age at enrollment, age at graduation, province of residence, and several indicators of their academic performance at the university and prior to entering the university (secondary school). All the other information derives from the AL questionnaires compiled on-line directly by students before the graduation. The AL survey collects students' social backgrounds such as the parental education and social class, studying periods abroad, working experience and other training activities (including internships) both at and out of the university. In addition to the administrative records, the AL questionnaires provide data regarding the frequency of class attendance and study grants or scholarships held. Since we do not have information on students who did not complete their studies yet as well as those who drop out at some point of their academic career, we consider only students that successfully completed their studies.

Our empirical exercise consists of two parts. In order to offer an insight into determinants of grades and time to degree, we first estimate the factors influencing GPA and excess time to degree equation by equation using *the entire sample of graduates* (sample A). The core results of the paper are presented in the second part of the analysis where we restrict our attention to *the sample of graduates in Economics and Management* since a reform which can be exploited as an instrument for the excess time to degree only affected these students (sample B).

In the Italian University system, students can enroll into university from any secondary school, unlike Germany, for example, where only the students with *Gymnasium* curriculum are admitted. We consider only undergraduate students enrolled for the first time after the introduction of the '3+2' reform in 2001[7] and graduated between the fall graduating session of 2004 and the fall graduation session of 2014.[8] We consider only *active* students, i.e. those with at least one passed exam of at least 3 *CFU* in their first and second academic year. We exclude students older than 35 at the moment of enrollment, as well as individuals for whom we miss data on one or more relevant category. The resulting full sample (sample A) consists of 15.397 graduates from 18 different curricula across four scientific areas: (*i*) Economics and Management, (*ii*) Literature and Philosophy, (*iii*) Languages, and (*iv*) Informatics, and Environmental and Molecular sciences, while the sub-sample of graduates in Economics and Management (sample B) counts 4416 students.

As a dependent variable we consider two main indicators of academic performance: the average grades of all courses relevant for graduation[9] and the excess time to degree.[10] Time to degree is conventionally defined as the total amount of time between the 5th November of the enrollment year and the date of degree attainment, hence the excess time to degree is defined as the total amount of time between the minimum legal course duration and the effective degree completion. According to the time employed to obtain a degree we define two categories of students: regular or 'On-Track' students, i.e. those who obtain a degree within the minimum legal period of three academic years, and the so-called 'Out-of-Track' students, i.e. those who complete their academic career after the minimum legal period. In order to analyze the probability of being 'On-Track' we define a dummy variable equal to 1 when the degree is obtained within the minimum legal period and 0 otherwise. In addition to the 'On-Track' indicator, we also consider the excess time to degree as a continuous variable.

As for the factors influencing both excess time to degree and the probability of being 'On-Track', we consider a restricted sample of students enrolled no later than 2009 (academic year 2009/2010) and with no more than 1.5 years in excess.[11] The choice to exclude graduates with more than 1.5

years in excess has been driven by the specific nature of our data which may lead to right censoring. More precisely, since we observe only students that successfully completed their academic careers before the fall graduating session of 2014, those enrolled after 2009 have, by construction, lower recorded excess time to degree and higher probability of being 'On-Track' with respect to other students enrolled before 2009. As a consequence, the recorded time to degree may depend on the year of enrollment, which introduces a selection bias. For instance, students enrolled in the academic year 2006/2007 and graduated in 2014 end up with a delay of 3.5 years, while those enrolled in 2009/2010 would not have more than 1.5 years of excess since our dataset does not contain records for students graduated after 2014. By restricting the sample each student is 'given' the same possibility to accumulate the maximum possible excess time to degree truncated at 1.5 years which corresponds to the upper limit in terms of delay to degree associated to students enrolled in 2009/2010. We are aware that the exclusion of students with longer academic careers, however, may lead to a sample selection bias since these students may differ from others in terms of demographic, socio-economic and/or pre-academic performance indicators.[12] As a robustness check, we run our regressions also on the entire sample of graduates and the results do not change.[13]

The set of explanatory and control variables is divided into three categories Table 1: (i) *Personal Characteristics and Family Backgrounds* such as gender, parental education, and study grants or scholarships held during at least one academic year, (ii) *Prior Academic Achievement* given by final high school grade and the type of high school attended (general high schools against technical, professional and teaching high schools)[14], and (iii) *Academic Performance at the University* set of variables which contains age at the moment of enrollment, field of study, course attended, number of first-year CFU and exams (proxies for academic 'discipline'), frequency of class attendance[15], periods spent abroad under the *Erasmus* exchange program, job experiences (part-time or full-time for at least one half of academic career), and internships (both at and out of the university).

As for the scholarship variable, we only have information on whether a student held a scholarship for at least one academic year and we do not have details on the number of semesters or years for which the scholarship has been received. The scholarship is paid annually and its amount depends on the student's family economic condition and his/her academic performance. Only students with Equivalent Economic Status Indicator (*Indicatore della Situazione Economica Equivalente - ISEE*)[16] below a certain threshold (23.000,00 Euro for income and 35.434,78 for estate) may apply for a scholarship. In order to maintain the scholarship, however, assigned students must accumulate at least 20 CFU during the first year, and earn a certain GPA during the second and third year (combined with the minimum required CFU). Students interested in participating in the Erasmus international exchange program, on the other hand, must fulfill some requirements in terms of CFU credits (at least 12 for those enrolled in the first year, and 36 for those enrolled in the second or third year), as well as have a certified proficiency in the language of the host institution. Finally, the information on class attendance, job experience and internships is drawn from AL and is self-assessed.

In addition, we consider several exogenous variables correlated with the excess time to degree. The set of variables includes: a reform implemented at the School of Economics and Management in the academic year 2008/2009 which increased the number of CFU *per exam* from 5 to 6 leaving the course load and the total number of CFU required for degree completion unaltered; the rate of employment at the national level for baccalaureates in Economics and Management one year after the graduation as a proxy for market conditions[17]; and a dummy variable for the province of residence (equal to 1 whenever the province of residence is the same as the one of the department of study, and 0 otherwise) as a proxy for traveling and accommodation costs. This set of variables is then used to instrument the excess time to degree in the structural model for GPA on a sample of baccalaureates in Economics and Management. In Section 5, we provide a detailed description of the instruments.

Table 1. Summary statistics: 2004–2014.

Entire Sample (Sample A)	Mean	Std. Dev.	Min.	Max.	N
Dependent Variables					
GPA	25.692	2.059	20.16	30	15397
High GPA (GPA $\geq$ 27)	0.303	0.46	0	1	15397
Excess Time to Degree*	0.243	0.392	0	1.499	12109
'On-Track'*	0.612	0.487	0	1	12109
Personal and Family Characteristics					
Female	0.695	0.461	0	1	15397
Parents: no education or elementary	0.072	0.258	0	1	15397
Parents: secondary school	0.754	0.431	0	1	15397
Parents: mother or father degree	0.112	0.315	0	1	15397
Parents: both degree	0.063	0.243	0	1	15397
Scholarship	0.214	0.41	0	1	15397
Academic Experience prior to Univ.					
High School Grade	82.299	12.027	60	100	15397
High School: general-classical	0.128	0.334	0	1	15397
High School: general-scientific	0.293	0.455	0	1	15397
High School: general-linguistic	0.142	0.349	0	1	15397
High School: general-other	0.069	0.253	0	1	15397
High School: professional	0.029	0.169	0	1	15397
High School: technical	0.333	0.471	0	1	15397
High School: other	0.002	0.044	0	1	15397
High School: foreign	0.003	0.059	0	1	15397
Academic Experience					
Age at Enrollment	19.764	1.406	18.013	34.995	15397
First Year: CFU	50.961	14.443	5	85	15397
First Year: exams	9.508	2.698	1	17	15397
Erasmus	0.08	0.271	0	1	15397
Class Attendance: $\geq$ 75%	0.748	0.434	0	1	15397
Economics and Management	0.373	0.484	0	1	15397
Literature and Philosophy	0.214	0.41	0	1	15397
Languages	0.341	0.474	0	1	15397
Science	0.072	0.259	0	1	15397
Internships and Work Experience					
Internships: University	0.122	0.327	0	1	15397
Internships: out of University	0.435	0.496	0	1	15397
Internships: none	0.443	0.497	0	1	15397
Working Experience: full-time worker	0.04	0.195	0	1	15397
Working Experience: part-time worker	0.759	0.427	0	1	15397
Working Experience: none	0.199	0.399	0	1	15397
Mobility					
Residence: same province	0.336	0.472	0	1	15397
Residence: other province, same region	0.515	0.5	0	1	15397
Residence: other region	0.147	0.354	0	1	15397
Residence: abroad	0.002	0.048	0	1	15397
Economics and Management (Sample B)	Mean	Std. Dev.	Min.	Max.	N
Dependent variables					
GPA	24.411	1.723	20.31	29.96	4416
High GPA (GPA $\geq$ 27)	0.087	0.282	0	1	4416
Excess Time to Degree	0.272	0.407	0	1.499	4416
'On-Track'	0.570	0.495	0	1	4416
Personal and Family Characteristics					
Female	0.622	0.485	0	1	4416
Parents: no education or elementary	0.06	0.238	0	1	4416
Parents: secondary school	0.768	0.422	0	1	4416
Parents: mother or father degree	0.113	0.317	0	1	4416
Parents: both degree	0.059	0.235	0	1	4416
Scholarship	0.192	0.394	0	1	4416
Academic Experience prior to Univ.					
High School Grade	83.479	11.884	60	100	4416
High School: general-classical	0.056	0.229	0	1	4416
High School: general-scientific	0.343	0.475	0	1	4416
High School: general-linguistic	0.065	0.247	0	1	4416

(*Continued*)

Table 1. Continued.

Economics and Management (Sample B)	Mean	Std. Dev.	Min.	Max.	N
High School: general-other	0.016	0.126	0	1	4416
High School: professional	0.022	0.145	0	1	4416
High School: technical	0.491	0.5	0	1	4416
High School: other	0.003	0.052	0	1	4416
High School: foreign	0.004	0.064	0	1	4416
Academic Experience					
Age at Enrollment	19.597	1.081	18.013	34.542	4416
First Year: CFU	49.812	12.277	5	85	4416
First Year: exams	9.252	2.236	1	16	4416
Erasmus	0.05	0.219	0	1	4416
Class Attendance: $\geq$ 75%	0.768	0.422	0	1	4416
Internships and Work Experience					
Internships: University	0.074	0.262	0	1	4416
Internships: out of University	0.498	0.5	0	1	4416
Internships: none	0.429	0.495	0	1	4416
Working Experience: full-time worker	0.028	0.165	0	1	4416
Working Experience: part-time worker	0.762	0.426	0	1	4416
Working Experience: none	0.207	0.405	0	1	4416
Mobility					
Residence: same province	0.368	0.482	0	1	4416
Residence: other province, same region	0.578	0.494	0	1	4416
Residence: other region	0.051	0.22	0	1	4416
Residence: abroad	0.002	0.045	0	1	4416
Labor Market Conditions (Instruments): School of Economics and Management					
Reform (5 to 6 CFU)	0.236	0.424	0	1	4416
Employment (employed + master)	89.496	2.084	85	92.600	4416

Notes: The statistics on time to degree refer to a restricted sample of students enrolled not later than 2009 (academic year 2009/2010) and with no more than 1.5 years in excess. The truncation was necessary in order to overcome the problem of selection bias due to the truncated nature of our data.

4. Determinants of grade point averages and time to degree

4.1. Grade point averages

In order to analyze the determinants of GPA we estimate the following regression:

$$GPA_i = \alpha + \beta D_i + \gamma HS_i + \theta A_i + \rho C_i + \zeta RES_i + \epsilon_i. \quad (1)$$

GPA_i is the student i's grade point average, D_i is the vector of demographic and socio-economic characteristics of student i, such as gender, parental education, family social status, and a binary coded variable for grants and scholarships. HS_i contains the student i's academic experience prior to entering university. A_i is the vector of academic track at the university variables. Finally, C_i contains controls for the scientific area and the academic curricula, and RES_i is the student i's province of residence equal to 1 whenever the residence coincides with the place of study, and 0 otherwise.

Since GPA is a limited or truncated variable, the standard *OLS* estimation may not be appropriate. In that case the truncation regression estimation method rather than the standard *OLS* should be applied. However, the number of the out-of-range predictions for GPA in our case is relatively small[18] which makes the standard *OLS* a fairly suitable estimation method. In addition, the White's general test rejects the assumption of homoskedasticity. In order to overcome this problem, we calculate the heteroskedasticity consistent standard errors in all model specifications.

In Table 2, we report the estimation coefficients for the effects of students' background characteristics, prior academic achievements and academic performance at the university on their GPA. In all regression models, we control for students' degree area and academic curricula. Model (1) includes only family background and high school variables, together with a gender dummy (female) and the age at the moment of enrollment. In Model (2), we consider the first two indicators of students' academic performance, namely the number of the first-year CFU and exams, while in Models (3) and (4)

Table 2. Determinants of grade point averages (2004–2014).

	Model 1 GPA	Model 2 GPA	Model 3 GPA	Model 4 GPA
Female	0.033	0.016	0.004	−0.003
	(0.027)	(0.026)	(0.026)	(0.028)
Age at Enrollment	0.057***	0.059***	0.069***	0.073***
	(0.009)	(0.009)	(0.009)	(0.010)
High School Grade	0.069***	0.058***	0.057***	0.062***
	(0.001)	(0.001)	(0.001)	(0.001)
High School: scientific	0.260***	0.201***	0.197***	0.203***
	(0.034)	(0.034)	(0.033)	(0.037)
High School: linguistic	−0.108***	−0.125***	−0.138***	−0.159***
	(0.040)	(0.039)	(0.039)	(0.043)
High School: professional	−0.988***	−0.799***	−0.801***	−0.875***
	(0.070)	(0.068)	(0.068)	(0.071)
High School: technical	−0.493***	−0.465***	−0.459***	−0.498***
	(0.035)	(0.034)	(0.034)	(0.037)
Parents: secondary school	0.014	−0.021	−0.023	−0.024
	(0.045)	(0.043)	(0.043)	(0.046)
Parents: mother or father degree	0.151***	0.086	0.053	0.057
	(0.056)	(0.055)	(0.055)	(0.059)
Parents: both degree	0.292***	0.219***	0.175***	0.220***
	(0.065)	(0.063)	(0.062)	(0.069)
Scholarships	0.129***	0.087***	0.079***	0.080***
	(0.028)	(0.027)	(0.027)	(0.029)
Residence: same province	−0.128***	−0.100***	−0.097***	−0.110***
	(0.024)	(0.023)	(0.023)	(0.025)
First Year: CFU		0.037***	0.034***	0.035***
		(0.002)	(0.002)	(0.002)
First Year: Exams		−0.040***	−0.035***	−0.033***
		(0.012)	(0.012)	(0.013)
Erasmus			0.389***	0.435***
			(0.040)	(0.045)
Class Attendance: $\geq$ 75%			0.245***	0.266***
			(0.026)	(0.027)
Internships: University			0.187***	0.175***
			(0.050)	(0.053)
Internship: not University			0.179***	0.174***
			(0.045)	(0.048)
Working Experience: none			0.104***	0.114***
			(0.028)	(0.030)
No. of observations	15542	15542	15397	15397
R^2	0.546	0.576	0.582	–
Controls:				
Scientific Area x Year of Enrollment	Yes	Yes	Yes	Yes
Course	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	OLS	Truncated

Notes: ** $p<.05$, *** $p<.01$. Robust Standard Errors in parenthesis. Reference categories: Males, Residence different from the province where the university is located, Classical High School, No Internships, Occasional and Full workers.

we add the remaining indicators of students' behavior, the participation in Erasmus international exchange program, class attendance, internships and working experiences.

The estimated coefficients suggest that there is no statistically significant difference in GPA between male and female peers of the same cohort. The type of the secondary school is important for students' GPA. Students coming from vocational high schools perform significantly worse than students from classical general high schools.[19] High school grade is positively correlated with GPA: a 10 point increase in the final high school grade translates into a 0.6 points increase in GPA. As for the effect of family background, having both parents with university degree increases GPA by roughly 0.2 points. Since family backgrounds and parental education strongly correlate with the type of high school attended, it is difficult to disentangle the effects of high school quality and parental backgrounds and education on students' GPA. For instance, Cappellari (2012) and Checchi et al.

(2000) show that students with favorable educational family backgrounds select into general high schools, and have better academic performance. A similar evidence is found in Dustmann (2004).

Finally, students residing in the same province have significantly lower GPA with respect to students from other provinces and/or regions. The interpretation of this result, however, requires some caution. Students residing in the same province may have less pressure to graduate on time with respect to students residing in other provinces and facing higher traveling and accommodation costs. This is because the opportunity cost of studying full time is the same if resident or not resident, what changes are the traveling and/or accommodation cost.[20] Hence, if there is an inverse relationship between GPA and time to degree, and if students residing in other provinces and/or regions have to sustain higher accommodation and/or traveling costs for each additional semester compared to their peers residing in the same province, the effect of residence on GPA may be spurious and indirect.

As for the indicators of academic behavior, the estimates presented in Model (2) indicate that there is a positive and significant correlation between CFU and GPA: 10 more credits during the first academic year are associated with 0.37 points higher GPA. This effect, however, may be indirect. More precisely, if GPA and time to degree are inversely related, an increase in the number of the first year CFU may directly increase the probability of being 'On-Track' (and/or reduce significantly the excess time to degree) which in turn translates into higher GPA. As for the residence variable, we will turn to this point in Section 6, where we estimate the direct effect of time to degree in the structural equation for GPA.

Estimates from Model (3) suggest that participating in the *Erasmus* international exchange program is associated with 0.4 points higher GPA. Moreover, students who declare to attend 75% or more of all scheduled lectures have roughly 0.25 points higher average grades with respect to students who attend less than 75%, while occasional and/or full-time workers earn lower average scores compared to their non-working peers. Comparing Models (1) and (3), we note that after entering the indicators of students' academic performance, the effects of individual and family characteristics, and prior academic achievements remain significant, but slightly decrease in magnitude. Family backgrounds and prior academic achievements are, hence, associated to a non-trivial degree to students' academic performance but do not explain everything that matters for students academic success -- their first-year academic experiences are important as well, *ceteris paribus*. Finally, holding a scholarship for at least one academic year correlates positively with GPA. As in the case of the first year CFU and exams, the positive association between scholarship and GPA may not entirely reflect its direct effect on GPA.

Table 3 reports the quantile regression estimates for Equation (1). We consider four quintiles: 0.25, 0.5, 0.75 and 0.9. The results suggest that the effect of first-year credits has a larger positive impact for the highest quintiles of GPA. The effect of having attended the Erasmus international exchange program is almost twice as high for the lowest quintile of GPA than for the highest one, while holding a scholarship is particularly important for the highest quintiles of GPA. Finally, residing in the same province as the place of study have a strong negative effect on GPA for the highest two quintiles of the distribution compared to the lowest quintile.

4.2. Time to degree

We consider two indicators of academic career duration: the excess time to degree defined as the total amount of time between the minimum legal course duration and the effective degree completion, and a binary coded variable equal to 1 whenever a student obtains a degree within the minimum legal period ('On-Track') and 0 otherwise ('Out-of-Track'). In such a way we are able to estimate both the factors influencing the probability of obtaining a degree withing the minimum legal period and the determinants of the delay to degree.

Our first set of regressions considers the factors influencing the probability of being 'On-Track'. The dependent variable OT_i is a student obtained a degree within the minimum legal period. The

Table 3. Quintile regression: determinants of grade point averages (2004–2014).

	Model1 Qt25	Model2 Qt50	Model3 Qt75	Model4 Qt90
Female	0.018	0.003	0.008	−0.068
	(0.034)	(0.034)	(0.037)	(0.043)
Age at Enrollment	0.047***	0.077***	0.104***	0.093***
	(0.011)	(0.010)	(0.011)	(0.013)
High School Grade	0.058***	0.061***	0.060***	0.055***
	(0.001)	(0.001)	(0.001)	(0.002)
High School: scientific	0.206***	0.212***	0.148***	0.157***
	(0.044)	(0.043)	(0.048)	(0.055)
High School: linguistic	−0.090	−0.142***	−0.223***	−0.197***
	(0.051)	(0.050)	(0.056)	(0.064)
High School: professional	−0.794***	−0.840***	−0.983***	−0.772***
	(0.091)	(0.089)	(0.098)	(0.113)
High School: technical	−0.452***	−0.520***	−0.557***	−0.548***
	(0.045)	(0.044)	(0.049)	(0.056)
Parents: secondary school	−0.050	−0.046	0.026	−0.093
	(0.058)	(0.057)	(0.063)	(0.072)
Parents: mother or father degree	0.010	0.011	0.183**	0.082
	(0.072)	(0.070)	(0.078)	(0.089)
Parents: both degree	0.105	0.133	0.210**	0.155
	(0.082)	(0.080)	(0.089)	(0.102)
Scholarships	0.052	0.098***	0.126***	0.168***
	(0.036)	(0.035)	(0.039)	(0.044)
Residence: same province	−0.075**	−0.101***	−0.141***	−0.140***
	(0.031)	(0.030)	(0.034)	(0.039)
First Year: CFU	0.024***	0.036***	0.042***	0.048***
	(0.003)	(0.003)	(0.003)	(0.003)
First Year: Exams	0.014	−0.039***	−0.082***	−0.130***
	(0.014)	(0.014)	(0.015)	(0.017)
Erasmus	0.392***	0.358***	0.315***	0.206***
	(0.054)	(0.053)	(0.059)	(0.067)
Class Attendance: $\geq$ 75%	0.226***	0.251***	0.283***	0.326***
	(0.035)	(0.034)	(0.038)	(0.043)
Internship: University	0.178***	0.201***	0.180**	0.222***
	(0.066)	(0.065)	(0.072)	(0.082)
Internships: not University	0.165***	0.175***	0.131**	0.249***
	(0.060)	(0.059)	(0.065)	(0.075)
Working Experience: None	0.121***	0.110***	0.127***	0.080
	(0.037)	(0.036)	(0.040)	(0.046)
No. of observations	15397	15397	15397	15397
Controls:				
Scientific area x year of enrollment	Yes	Yes	Yes	Yes
Course	Yes	Yes	Yes	Yes

Note: * $p<.1$, ** $p<.05$, *** $p<.01$. Robust Standard Errors in parenthesis. Reference categories: Males, Residence different from the province where the university is located, Classical High School, No Stage, Occasional and Full workers.

empirical problem consists of estimating the following equation:

$$P(OT_i) = \Psi(r_i), \tag{2}$$

where:

$$r_i = \alpha + \beta D_i + \gamma HS_i + \theta A_i + \rho C_i + \zeta RES_i + \eta_i,$$

and Ψ is the cumulative density function of the normal distribution. Equation (2) defines the Probit model. As in the case of GPA, D_i is the vector of demographic and socio-economic characteristics of student i while HS_i contains the student i's academic experience prior to entering university (secondary school track). A_i is the vector of academic track at the university variables. Finally, C_i contains controls for the degree area and the academic curricula, and RES_i is the student i's province of residence equal to 1 whenever the residence coincides with the place of study, and 0 otherwise. As in

the case of GPA estimation, we control for the student's scientific area and academic curricula. We report heteroskedasticity corrected standard errors in all model specification.

Our second set of regressions examines the determinants of the excess time to degree by means of the following empirical model:

$$ETD_i = \alpha + \beta D_i + \gamma HS_i + \theta A_i + \rho C_i + \zeta RES_i + \epsilon_i, \quad (3)$$

where the dependent variable ETD is the total amount of time (continuous, in years) passed between the first feasible graduating session and the date of the student *i*'s effective course completion.

Table 4 shows the results of the estimation of Equations (2) and (3). Students from a professional school or technical studies are less likely to be 'On-Track' with respect to students coming from general high schools. Compared to students with a general high school experience, they invest on average more time to obtain a degree. As in the case of GPA, higher high school grade is an indicator

Table 4. Excess time to degree and 'OnTrack' (2004–2014), marginal effects.

	Model1 Excess	Model2 Excess	Model3 On-Track	Model4 On-Track
Female	−0.038***	−0.020***	0.031***	0.011
	(0.009)	(0.008)	(0.010)	(0.009)
Age at Enrollment	−0.000	−0.005	0.002	0.007**
	(0.003)	(0.003)	(0.003)	(0.003)
High School Grade	−0.008***	−0.003***	0.011***	0.004***
	(0.000)	(0.000)	(0.000)	(0.000)
High School: scientific	−0.036***	−0.012	0.043***	0.007
	(0.010)	(0.009)	(0.013)	(0.011)
High School: linguistic	0.004	0.016	−0.023	−0.041***
	(0.011)	(0.010)	(0.015)	(0.014)
High School: professional	0.158***	0.089***	−0.152***	−0.064***
	(0.026)	(0.024)	(0.027)	(0.024)
High School: technical	0.043***	0.030***	−0.065***	−0.048***
	(0.010)	(0.009)	(0.013)	(0.012)
Parents: secondary school	−0.073***	−0.030	0.106***	0.058***
	(0.018)	(0.016)	(0.019)	(0.017)
Parents: mother or father degree	−0.093***	−0.044**	0.107***	0.057***
	(0.020)	(0.018)	(0.022)	(0.020)
Parents: both degree	−0.105***	−0.057***	0.129***	0.079***
	(0.021)	(0.019)	(0.025)	(0.023)
Residence: same province	0.033***	0.022***	−0.053***	−0.039***
	(0.007)	(0.007)	(0.009)	(0.008)
First Year: CFU		−0.009***		0.013***
		(0.001)		(0.001)
First Year: Exams		−0.028***		0.023***
		(0.003)		(0.004)
Erasmus		0.025**		−0.056***
		(0.011)		(0.014)
Class Attendance: $\geq$ 75%		−0.086***		0.100***
		(0.008)		(0.009)
Scholarships		−0.025***		0.016
		(0.007)		(0.009)
Internship: University		−0.244***		0.230***
		(0.019)		(0.021)
Internship: not University		−0.210***		0.198***
		(0.019)		(0.020)
Working Experience: none		−0.029***		0.038***
		(0.007)		(0.009)
No. of observations	12249	12109	12249	12109
R^2 / Pseudo R^2	0.105	0.296	0.086	0.267
Scientific area x year of enrollment	Yes	Yes	Yes	Yes
Course	Yes	Yes	Yes	Yes
Estimation method	OLS	OLS	Probit	Probit

Notes: ** $p<.05$, *** $p<.01$. Robust Standard Errors in parenthesis. Reference categories: Males, Residence different from the province where the university is located, Classical High School, No Stage, Occasional and Full workers.

of better academic performances also in terms of the excess time to degree and the probability of being 'On-Track'. The academic performance during the first academic year is an important correlate of career duration: ten more CFU translates into a 0.1 years less excess time to degree and 13% higher probability of regular course completion. Participation in the Erasmus international exchange program decreases the probability of being 'On-Track' by 6%. On the other hand, a regular course attendance increases the probability of finishing on time by 10%. Similarly, having no full-time or part-time working experience for at least one half of the academic career duration significantly reduces the excess time to degree. Residing in the same province of residence is negatively associated with the probability of regular course completion, and positively to the excess time to degree. Holding a scholarship for at least one academic year, on the other hand, does not have a significant effect on the probability of being 'On-Track'.

The empirical evidence offered in Tables 2–4 suggests that a more complete model is needed in order to estimate the effects of students' behavior in terms of 'regularity' in the fulfillment of academic requirements (which then translates in shorter or longer academic careers) on GPA. Indeed, the fact that almost all explanatory and control variables are highly significant casts doubts about the validity of the empirical specification and the results go exactly in the direction of supporting our view that these two indicators of academic achievements are not independent and may be simultaneously determined.

5. Effects of excess time to degree on GPA

Since grades and career duration are to some extent a matter of individual choice and there may be several variables that simultaneously determine both GPA and time to degree, the estimation of the effect of excessively long academic careers on GPA by means of a standard estimation techniques would lead to biased and inconsistent results. In order to obtain accurate estimation of a direct causal effect of excess time to degree on GPA, we need reliable exogenous instruments for student's choice over the optimal career duration. To this end, we identify three exogenous factors that may directly influence the choice of the optimal career duration net of grades.

We first exploit a reform implemented at the School of Economics and Management (sample B) in the academic year 2008/2009 which increased the number of CFU *per exam* from 5 to 6 leaving the course load unaltered. The 'reform' may have contributed positively to the overall reduction of excess time to degree since the total number of *CFU* at graduation has remained the same while the total number of exams has been reduced. For instance, the pre-reform exam schedule for students reading Economics and Commerce consisted of 33 exams of 5 CFU each.[21] After the introduction of the reform, some exams were pooled into one single exam, such as Microeconomics I and II that became one single subject (Microeconomics) of 12 CFU. Moreover, students enrolled according to the pre-reform schedule had to take 4 exams at their own choice for a total of 20 CFU credits. The reform boiled down the number of free-choice exams to 3, for a total of 18 CFU. As a consequence, the total number of exams was reduced from 33 in the pre-reform period to 21 starting from the academic year 2008/2009.[22] Hence, we want to stress that this restructuring reduced the total amount of exams but did not change the total amount of credits (180) and the overall course load. As a consequence, the post-reform graduates in Economics and Management had to take less exams with more CFU each with respect to their pre-reform peers.

According to our data, the average post-reform excess time to degree is 18.5% shorter than the pre-reform one while the variation of the average GPA is only 0.3%. Given that the average demographic and socio-economic characteristics of graduates did not significantly change between the pre-reform and the post-reform period, we can rule out the potential joint effect of the reform on time to degree and GPA. Moreover, the reform has not been anticipated in any way, so it may not have had any influence on students' expectations. Since the reform affected only students reading Economics and Management while those from other three majors did not experience any variation in CFU and the number of exams, our sample reduces to 4416 baccalaureates for which we have

complete information on all the explanatory and control variables (sample B). One fourth of these baccalaureates have been fully affected by the reform, while the remaining part enrolled and graduated following the pre-reform schedule.

In order to proxy labor market conditions faced by students one year after graduation, we consider the sectoral employment rate for baccalaureates in Economics and Management at the national level. In line with the empirical literature (Brunello and Winter-Ebmer 2003; Messer and Wolter 2010; Aina, Baici, and Casalone 2011), lower employment may discourage and postpone the entrance in the labor market, *ceteris paribus*. Sectoral employment rates and excess time to degree, hence, should be negatively correlated.[23] Since we consider only one degree area, possible systematic alignments between degree areas and sectoral national employment rates do not represent a relevant concern in this context.

Finally, as a proxy for students' traveling and/or accommodation costs, we consider a dummy variable for the province of residence equal to 1 whenever a student resides in the same province as the the location of study ('in-town' student), and 0 otherwise ('non-in-town' student). The residence variable refers to the student's family geographical settlement since Italian college students typically tend to reside with their parents, differently from the other European or US students. Students residing in the same province have lower traveling and/or accommodation costs and, hence, experience less pressure to obtain a degree on time, *ceteris paribus*. According to a research conducted by the University Administration in 2015 on more than 3000 students, students residing in other provinces but permanently settled in the city, spend on average 350/400 Euro per month for rent, while those commuting on a daily basis run a cost of approximately 90 Euro per month and spend on average slightly more than one hour to reach the School mostly by train.[24] These costs, compared to an average tuition fee and other administrative enrollment costs (around 1.200,00 Euro per year for students non-eligible for scholarships) may significantly affect the total cost of studying.[25]

The choice of the geographical location as an instrument for students' time to degree may rise some concerns about its exogenous nature. Whether a student's family resides in the province where the university is located or in other provinces and/or regions may be considered as an exogenous variation since it is a decision strongly determined by the parental place of residence. Moreover, the validity of our instrument would be undermined if the 'non-in-town' students enrolled in our University are characterized by some unobservable factors favorable to shorter time to degree or if the choice to attend our University over local options is systematically correlated with cost-saving decisions, i.e. if the fees in our University were lower with respect to other similar local options, then the traveling and accommodation costs would not represent an additional burden to non-in-town students with respect to their 'in-town' peers. We believe that the 'in-town' IV idea should not generate concerns for several reasons. First, 78% of graduates in Economics and Management originates from the same province or from provinces without college/university. Second, the 'in-town' students do not differ significantly in terms of observable socio-demographic and pre-academic characteristics from their 'non-in town' peers.[26] Third, the majority of students in Economics and Management coming from an adjacent province which has a college/university of its own, come to attend Marketing, Consulting and Revision, and Tourism courses. These specific academic degrees are not offered by their in-province university. Finally, the cost of studying in our University is not lower with respect to alternative local options as tuition fees are basically the same across Italy.

The empirical problem consists of estimating the following causal relationship:

$$GPA_i = \alpha + \beta_1 ETD_i + \beta_2 D_i + \beta_3 HS_i + \beta_4 A_i + \beta_5 C_i + \epsilon_i. \tag{4}$$

In the first stage we estimate the effects of socio-economic characteristics, parental backgrounds, academic performance at the university variables, and our instruments on students' excess time to degree (and on the probability of being 'On-Track'):

$$ETG_i = \alpha + \pi_1 RES_i + \pi_2 EM_i + \pi_3 REF_i + \pi_4 D_i + \pi_5 HS_i + \pi_6 A_i + \pi_7 C_i + \zeta_i, \tag{5}$$

where RES_i denotes the student i's residence, EM_i is the rate of employment of baccalaureates in Economics and Management at the national level, and REF_i is a binary variable equal to 1 whenever a student has been affected by the reform introduced in the academic year 2008/2009. By plugging the first stage fitted values in the second stage equation we obtain the reduced form model for GPA:

$$GPA_i = \alpha + \beta_1 \widehat{ETG_i} + \beta_2 D_i + \beta_3 HS_i + \beta_4 A_i + \beta_5 C_i + \eta_i. \quad (6)$$

Empirical estimation of (5) is presented in Table 5. In Models (1)–(4) we consider the 'On-Track' dichotomous variable for time to degree and a binary coded variable equal to 1 whenever a student obtains a high GPA (i.e. GPA equal or higher than 27 out of 30) and 0 otherwise, as an indicator for the students' performance in terms of grades.[27] In addition, in Models (5)–(8), we consider the excess time to degree (delay) as a continuous variable and estimate its impact on the entire range of GPA. All the coefficients are marginal effects and standard errors are corrected for heteroskedasticity. For the sake of comparison, in Table 6, we display a simple Probit and OLS regressions where time to degree is not instrumented.

For the two-stage empirical model in (5) and (6) to work, the instruments must satisfy three basic requirements: a) good correlation with the endogenous variable, b) not correlated with the error term, and c) no direct impact on GPA other than through its first stage impact on the excess time to degree (*exclusion restriction*). The first stage test statistics in Table 5 confirm the strength of our instruments, in all model specifications, the *F*-statistic is significantly higher than a commonly used threshold of 10 or 16. Moreover, the Hansen *J* statistics confirm that our models are correctly specified and that all the instruments can be regarded as exogenous, except in Model (7) where the null on valid identification is rejected. Even though the exogeneity property cannot be directly tested, there is no reason to suspect that there is any reverse effect of GPA on instruments. As clearly explained at the beginning of this section, the exclusion restriction requirement should not be violated, and the instruments should not be correlated with any other determinant of GPA.

The coefficients from the first stage estimation indicate that higher employment is associated with higher probability of being 'On-Track' and lower excess time to degree since favorable economic conditions may facilitate the transition from university to labor market. Students residing in the same province as the location of study have a significantly lower probability of regular course completion and higher excess time to degree compared to students from other provinces and/or regions. On the other hand, the reform aimed to increase the number of CFU credits per exam increased significantly the probability of regular course completion and reduced the number of semesters in excess. This effect is reduced but remains significant when we control for academic regularity variables (Models (3) and (7)). A similar evidence is found for the regular class attendance and the absence of working experiences. As for the other determinants of time to degree, additional credits during the first academic year increases the probability of being 'On-Track' and significantly reduces the excess time to degree.

Finally, the coefficients on time to degree variables in Models (2) and (4) indicate a positive direct effect of regular course completion on GPA. Regular academic tracks and course completion within the minimum legal period increase the probability of ending up with high average grades by 16.5% (Model 4). Similarly, the coefficients in Models (7) and (8) indicate that students with larger excess time to degree end up with significantly lower GPA. Even though in this model specification the null on valid identification cannot be accepted, the results are in line with a strong positive effect of regular graduation on GPA (Model (4)).

Moreover, the comparison with the coefficients from Table 6 reveals that the OLS underestimates the true effect of the excess time to degree on GPA (Models (3) and (4)) due to the presence of omitted variables that simultaneously affect both the delay and some other covariate(s) correlated with the GPA variable.[28] Similarly, the 'true' effect of regular degree completion on GPA (Table 5, Model (4)) is roughly seven times larger compared to the case in which the variable 'On-Track' is not instrumented (Table 6, Model (2)).

Table 5. Two stage estimation: GPA – school of economics and management (2004–2014).

	Model 1 1ST Stage On-Track	Model 2 2ND Stage High GPA	Model 3 1ST Stage On-Track	Model 4 2ND Stage High GPA	Model 5 1ST Stage Delay	Model 6 2ND Stage GPA	Model 7 1ST Stage Delay	Model 8 2ND Stage GPA
Residence	−0.069***		−0.047***		0.047***		0.029***	
	(0.015)		(0.013)		(0.012)		(0.011)	
Employment	0.070***		0.044***		−0.072***		−0.049***	
	(0.005)		(0.005)		(0.004)		(0.004)	
Reform	0.252***		0.079**		−0.265***		−0.173***	
	(0.023)		(0.034)		(0.019)		(0.030)	
'On-Track'		*0.146****		*0.165****				
		(0.020)		(0.013)				
Delay						*−1.724****		*−1.699****
						(0.211)		(0.361)
Female	0.031**	0.006	0.016	0.006	−0.036***	0.041	−0.026**	0.028
	(0.015)	(0.005)	(0.013)	(0.006)	(0.013)	(0.049)	(0.011)	(0.049)
Age At Enrollment	−0.001	0.003	0.004	0.004	0.002	0.033	−0.002	0.043*
	(0.008)	(0.002)	(0.006)	(0.003)	(0.006)	(0.024)	(0.005)	(0.024)
High School Grade	0.011***	0.005***	0.004***	0.004***	−0.009***	0.057***	−0.003***	0.050***
	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.003)	(0.001)	(0.002)
High School: scientific	0.048*	0.033***	−0.010	0.033***	−0.058**	0.345***	−0.016	0.282***
	(0.027)	(0.009)	(0.024)	(0.011)	(0.023)	(0.097)	(0.020)	(0.095)
High School: linguistic	−0.039	−0.005	−0.051	−0.003	0.001	−0.141	0.014	−0.154
	(0.036)	(0.012)	(0.032)	(0.014)	(0.029)	(0.128)	(0.026)	(0.126)
High School: professional	−0.134**	−0.053**	−0.043	−0.043*	0.119**	−0.508***	0.049	−0.462***
	(0.056)	(0.022)	(0.049)	(0.026)	(0.050)	(0.162)	(0.044)	(0.163)
High School: technical	−0.066**	−0.016*	−0.058**	−0.010	0.033	−0.243**	0.026	−0.234**
	(0.027)	(0.009)	(0.024)	(0.011)	(0.022)	(0.095)	(0.020)	(0.095)
Parents: secondary school	0.130***	0.030**	0.067**	0.025*	−0.094***	0.035	−0.040*	0.048
	(0.030)	(0.012)	(0.027)	(0.014)	(0.026)	(0.090)	(0.023)	(0.089)
Parents: mother or father degree	0.133***	0.046***	0.061*	0.041*** *	−0.128***	0.040	−0.061**	0.052
	(0.036)	(0.014)	(0.032)	(0.016)	(0.030)	(0.113)	(0.027)	(0.113)
Parents: both degree	0.134***	0.055***	0.038	0.047***	−0.123***	0.186	−0.042	0.173
	(0.042)	(0.015)	(0.039)	(0.017)	(0.035)	(0.135)	(0.032)	(0.133)
Scholarships	0.032*	0.015***	0.008	0.004	−0.046***	0.022	−0.026**	−0.012
	(0.018)	(0.006)	(0.016)	(0.003)	(0.014)	(0.059)	(0.012)	(0.058)
First Year: CFU credits			0.015***	0.003***			−0.010***	0.000
			(0.001)	(0.000)			(0.001)	(0.006)
First Year: Exams			0.024***	0.002			−0.028***	0.098***
			(0.008)	(0.001)			(0.007)	(0.023)
Erasmus			0.009	0.006			−0.062***	0.438***
			(0.029)	(0.005)			(0.020)	(0.105)
Class Attendance: $\geq$ 75%			0.114***	0.022***			−0.094***	0.085
			(0.016)	(0.003)			(0.014)	(0.060)
Internship: University			0.088***	0.012**			−0.146***	−0.298**
			(0.034)	(0.006)			(0.030)	(0.121)
Internship: not University			0.135***	0.022***			−0.180***	−0.229**
			(0.030)	(0.005)			(0.029)	(0.111)
Working Experience: none			0.035**	0.007**			−0.022*	−0.007
			(0.015)	(0.003)			(0.012)	(0.055)
No. of observations	4453	4453	4416	4416	4453	4453	4416	4416
Course	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.138	–	0.360	–	0.143	–	0.312	–
Strong instruments	*81.54*	–	*30.83*	–	*101.80*	–	*44.32*	–
Endogenous excess	*0.000*	–	*0.000*	–	*0.000*	–	*0.000*	–
JH over-identification	*0.6414*	–	*0.6808*	–	*0.0458*	–	*0.0002*	–
Estimation method	Linear	Bi -- Probit	Linear	Bi -- Probit	Linear	Linear	Linear	Linear

Notes: * $p<.1$, ** $p<.05$, *** $p<.01$. Robust standard errors in parenthesis. Reference categories: Males, Residence different from the province where the university is located, Classical High School, No Internships, Occasional and Full workers.

The empirical findings presented in this section may have an important policy implication, considering that both time to degree and GPA represent signals for the labor market. Policy interventions aimed to increase the regularity in academic completion within the minimum legal period of three

Table 6. Determinants of grade point averages, school of economics and management (2004–2014).

	Model 1 High GPA	Model 2 High GPA	Model 3 GPA	Model 4 GPA
'On-Track'	0.086***	0.025**		
	(0.010)	(0.011)		
Delay			−1.160***	−0.699***
			(0.053)	(0.062)
Female	0.007	0.008	0.066	0.060
	(0.009)	(0.009)	(0.047)	(0.046)
Age At Enrollment	0.004	0.005	0.030	0.043*
	(0.004)	(0.004)	(0.025)	(0.023)
High School Grade	0.007***	0.005***	0.062***	0.053***
	(0.000)	(0.000)	(0.002)	(0.002)
High School: scientific	0.051***	0.040**	0.379***	0.299***
	(0.016)	(0.016)	(0.095)	(0.093)
High School: linguistic	−0.001	−0.014	−0.136	−0.169
	(0.020)	(0.020)	(0.126)	(0.123)
High School: professional	−0.074*	−0.066*	−0.572***	−0.499***
	(0.040)	(0.040)	(0.158)	(0.159)
High School: technical	−0.017	−0.016	−0.259***	−0.256***
	(0.016)	(0.016)	(0.093)	(0.091)
Parents: secondary school	0.037*	0.033*	0.083	0.077
	(0.020)	(0.019)	(0.086)	(0.086)
Parents: mother or father degree	0.065***	0.057**	0.110	0.104
	(0.023)	(0.022)	(0.108)	(0.108)
Parents: both degree	0.082***	0.067***	0.257**	0.207
	(0.025)	(0.025)	(0.130)	(0.129)
Scholarships	0.022**	0.020**	0.049	0.012
	(0.009)	(0.009)	(0.058)	(0.056)
First Year: CFU		0.003***		0.012***
		(0.001)		(0.004)
First Year: Exams		0.009***		0.117***
		(0.003)		(0.021)
Erasmus		0.049***		0.500***
		(0.014)		(0.101)
Class Attendance: $\geq$ 75%		0.053***		0.181***
		(0.013)		(0.049)
Internship: University		0.025		−0.054
		(0.020)		(0.084)
Internship: not University		0.032		−0.027
		(0.020)		(0.082)
Working Experience: none		0.002		0.016
		(0.009)		(0.053)
N. Observations	4453	4416	4453	4416
Controls:				
Scientific Area x Year of Enrollment	Yes	Yes	Yes	Yes
Course	Yes	Yes	Yes	Yes
Estimation Method	Probit	Probit	OLS	OLS

Notes: ** $p<0.05$, *** $p<0.01$. Robust Standard Errors in parenthesis. Reference categories: Males, Residence different from the province where the university is located, Classical High School, No Internships, Occasional and Full workers.

academic years may contribute to an optimal allocation of time and effort yielding a more efficient outcomes, which in turn may translate into higher wage paths benefiting both the graduates and the society as a whole.

6. Concluding remarks

This paper shows that the excess time to degree has a strong and negative impact on GPA. The interpretation of this result may lie in the fact that excessively long academic careers deteriorate the accumulated stock of knowledge and generate negative externalities in terms of academic discontinuity. Since GPA and time to degree are not independent and may be simultaneously determined, we instrument the excess time to degree using a set of variables strongly correlated with

academic career duration while at the same time exogenous to students' behavior, their socio-economic characteristics and parental backgrounds. The empirical results suggest that there is a strong negative effect of delayed graduation on GPA. This is an important evidence since grades and time to degree represent 'signals' and according to widely accepted theories and in practice, may directly determine the students' bargaining power in the labor market.

In general, the results show that a regular fulfillment of academic requirements is a good predictor of successful degree attainment, both in terms of time to degree and GPA. More disciplined students have higher probability of obtaining a degree within the minimum legal period. Shorter academic careers, in turn, increase the grade point average, generating a double positive effect on students' bargaining power in the labor market. As shown in the literature, lower time to degree increases the probability of finding a job and correlates positively with the initial wage. Some useful policy conclusions can be drawn from our empirical evidence: policy makers (universities) should foster more efficiently the fulfillment of scheduled didactic activities and leave less freedom to students to choose their own 'agenda' regarding the fulfillment of scheduled didactic activities and exams. In particular, they should enhance the fulfillment of the first-year CFU achievements. Moreover, since excessively long academic careers may deteriorate the acquired stock of skills and knowledge, enhancing the timely degree completion may have implications for the earning distribution in the post-school period.

Notes

1. For more details, see the 20th AlmaLaurea 2018 Report on Graduates' Profile: https://www.almalaurea.it/sites/almalaurea.it/files/docs/universita/profilo/profilo2018/almalaurea_reports_2018.pdf.
2. The *AlmaLaurea* is a service providing on-line graduates' curricula. It was set up in 1994 following an initiative of the Statistical Observatory of the University of Bologna and is run by a consortium of Italian universities with the support of the Ministry of Education, University and Research. For more details see, http://www.almalaurea.it/.
3. CFU are a tool used to measure the workload undertaken by a student (quantity of learning, including individual study, classroom educational activities, internships, etc.), required in order to acquire knowledge and skills in the learning activities. One credit usually corresponds to 25 h of work, including lessons and exercises, as well as individual home study.
4. Italian college students typically tend to reside with their parents, differently from the other European or US students. Indeed, 95% of students in our sample reside in the same region as the location of study.
5. The authors underline that a high unemployment rate increases the cost of a university education since most students in Switzerland (the reference country in their sample) have to rely on additional financial resources to finance their studies and their consumption needs. Moreover, their results are not directly comparable with Brunello and Winter-Ebmer (2003), and Aina, Baici, and Casalone (2011) since the latter are based on a cross-sectional analysis comparing students living in countries (or regions) with different structural unemployment rates.
6. In several majors (like in Economics and Management) students have a significant freedom to choose their own 'agenda' regarding the fulfillment of scheduled didactic activities and exams. Only for few exams, there are prerequisites in terms of other related exams. For instance, students who have not passed Microeconomics are not given the possibility to take the exam in Macroeconomics.
7. The reform introduced in 2001 reduced the duration of the course programs from four or five to three academic years. Since we consider only students enrolled for the first time after the introduction of the reform, all those enrolled before 2001 and subsequently switched to the post-reform system are excluded from the analysis.
8. Actually, there are two ordinary (summer and winter) and one extraordinary graduation session (spring).
9. Grades in the Italian education system are numerical and range from 18 (sufficiency) to 31 over 30 where 31 refers to '30 *cum laude*'.
10. Checchi et al. (2000) combine GPA and time to degree in one single measure. The students' overall performance is measured as a product of GPA and the ratio between the number of passed exams and the number of years of active enrollment (with the latter ratio denominated as the 'speed' at which a student is undertaking the exams). Here we consider them separately because we are interested in the effect of the excess time to degree on GPA.
11. A more appropriate analysis of time to degree would require the estimation by means of a duration model. However, given the characteristics or our data, this kind of analysis would not be an optimal solution since we do not have information on students who still did not complete their studies as well as enrolled students who drop out at some point of their academic career.
12. Indeed, graduates with more than 1.5 years of delay have, for instance, significantly lower high school grades, participate more frequently in the Erasmus exchange program, have lower overall parental level of education,

and are more likely to reside in the same province as the place of study. The excluded graduates represent 12.46% of the entire sample.

13. These additional results are available upon request from the authors.
14. Unfortunately, we do not have a complete information on whether a particular high school is private or public.
15. The following question has been used in student survey (AlmaLaurea) regarding lecture attendance: 'How many courses have you regularly attended during your academic career?' The answering options are the following: (i) 75% or more, (ii) between 50% and 75%, (iii) between 25% and 50%, (iv) less than 25%. In order to define a student with regular attendance, we use a dummy variable equal to 1 whenever s/he declares to have attended 75% or more, and 0 otherwise.
16. ISEE is a tool used in 'means testing' to asses the economic situation of individuals applying for social services or public benefits.
17. These data originates from the AL surveys conducted one year after the graduation for a representative sub-sample of Italian graduates. See: http://www.almalaurea.it/universita/occupazione
18. There are very few predicted values above the upper truncation point (30).
19. General high schools (classic, scientific, linguistic) are secondary schools with a more pronounced academic orientation. In the UK, for instance, this type of school corresponds to 'grammar schools'.
20. Note, moreover, that working part-time while studying would earn very little money for any type of students' educational attainment before college. In Section 6, we provide estimates of travel and accommodation costs and argue that these additional costs may significantly affect the total cost of studying.
21. In addition to 33 regular exams, one 5 CFU requirement was not graded, additional 5 CFU referred to the final graduation exam (thesis), and the remaining 5 CFU were earned from internships.
22. Moreover, out of 33 pre-reform exams, seven have been joined into one single exam of 12 CFU credits.
23. The indicator of employment contains also the share of students enrolled in (one or two-years) master programs. In such a way we control for general trend towards a continuation of the education process.
24. For more details see: https://www.unive.it/pag/14024/?tx_news_pi1%5Bnews%5D=938&tx_news_pi1%5Bcontroller%5D=News&tx_news_pi1%5Baction%5D=detail&cHash=483bfebdc0c68db233546288b840a046
25. The total amount of tuition fees increases with delayed graduation by approximately 200 Euro per year.
26. In particular we look at a simple statistical comparison based on several characteristics of the samples, such as the parental background, and academic experience prior to university (type of high school and high school grade). Evidence on this point is available upon request.
27. The choice of GPA $\geq$ 27 as an indicator for top-performing students has mainly be driven by the existing practices at the University to use this particular GPA threshold for the purposes of admission to various degree programmes. Moreover, the same threshold is used to assign to the students one extra point in the final score at the graduation. This grade has been set as a threshold following some simple statistical investigations of the distribution of GPA.
28. If for instance, the excess time to degree negatively correlates with the number of CFU earned during the first academic year and both are affected by the unobserved level of student's ability, and first-year CFU is positively correlated with GPA, the OLS will underestimate the true effect of delay to degree on grades.

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