

Time-to-Degree: Students' Abilities, University Characteristics or What Else?

Carmen Aina, Eliana Baici* and Giorgia Casalone
SEMeQ, Università del Piemonte Orientale, Italy

8th June 2009

The elapsed time taken to earn a degree is analyzed with data from a representative sample of Italian graduates. Besides students' abilities, parental background and labour market conditions, we include additional controls measured at the university level, namely colleges' dimensions and human capital endowments. The main goal is to investigate whether there are some colleges that are more efficient than others once controlled for their students' characteristics. A duration model indicates that the elapsed time to degree is the result not only of students' ability or of their choices and efforts during university experience but that it depends on the availability of colleges' infrastructures and on the external options in the labour market, too.

Jel Classification: J24, I23

Keywords: Tertiary education system, elapsed-time-to-degree, duration models, unobserved heterogeneity, Almalaurea.

* Corresponding author: Dipartimento di Scienze Economiche e Metodi Quantitativi, Università del Piemonte Orientale "A. Avogadro", Via Perrone 18, 28100 Novara. Tel: +390321375316, email: eliana.baici@eco.unipmn.it

We are very grateful to Consorzio Almalaurea for providing us with their dataset and their assistance. Financial support came from the Fondazione Alfieri CRT and from PRIN 2007. Opinions, conclusions, or recommendations in this paper are those of the authors and do not necessarily reflect the views of the Consorzio Almalaurea and of the Fondazione Alfieri CRT.

1. Introduction and motivation

Italian university system has been traditionally characterized by an average time to bachelor's degree completion longer than time required. Although reduction in time-to-degree was one of the objectives of the 3+2 reform, recent data provided by CNVSU (National Committee for the Evaluation of the Italian University System) show that post-reform students still remain at university beyond the legal duration of their courses¹.

Staying at university more than the time required to graduation is not only a specific trait of the Italian higher education system. According to Brunello and Winter-Ebmer (2003) in many other European countries such as Sweden, Denmark, France and Germany the time taken on average to earn the bachelor's degree exceeds the legal duration. Besides Garibaldi and al. (2008) collect a wide evidence showing that even in the US, notwithstanding the unlike higher education system model, time-to-degree has been rising in the last decades turning out to be a noteworthy concern for the policy makers.

Time-to-degree can be interpreted as an indicator of the universities "internal efficiency". The delay in college completion represents indeed a waste of resources both at the individual and the collective level. At the individual level there is a double loss in terms of opportunity cost of taking additional years to earn a bachelor degree and in terms of wage penalization once students find a job (Brodaty 2008) From the collective viewpoint, students who did not achieve their degree on time represent a waste of resources if they can keep on using universities' assets (classrooms, libraries, professors' time, discounted food and books, etc.) without restrictions, thus contributing to congest university sites. Moreover longer times-to-degree deprive the economics system of new and up-to-date competences as graduates enter in the labour market with obsolete skills.

Time-to-degree can be the result of several factors such as students' characteristics and preferences, labour market conditions and universities' endowments. Individual ability is certainly a relevant aspect which affects the time taken to earn a degree. Lack of abilities and of motivations reduce the probability of getting a degree on time. Nevertheless if labor market conditions are bad, individuals could rationally choose to stay longer at university as they are not encouraged at seeking a job. Finally, universities' characteristics such as classrooms' availability, accommodations to host non resident students, rooms devoted to study, but also exams' rules and the level of tuition fees could affect the time spent at university.

Our goal in this paper is to convey information about the actual elapsed-time-to-degree for Italian graduates enrolled at university after the introduction of the 3+2 reform. We analyze how differences in elapsed-time-to-degree vary with their personal characteristics,, educational

¹ 9th Survey on the National University System, CNVSU (2009)

background, labour market conditions, and characteristics of the university in which they have been studying. The idea of considering also information related to university is mainly due to a widespread expansion of the Italian higher education system in the latest 90s. During this period, Italy was interested by a notable increase of university sites which reached its peak in 1998 when several new colleges were established. The prime purpose of this expansion has been the reduction of the overcrowd, especially widespread in the oldest institutions, in order to improve the efficiency of the entire university system². Even if according to the law, which permitted the establishment of new universities, they do not differ *de jure* in terms of organization, structure, goals and type of degree provided, they probably *de facto* vary in terms of human and infrastructural resources available, nature of students enrolled, relations with the local territory, etc.

The paper is organized as follows. Paragraph 2 presents a brief review of the relevant literature. Paragraph 3 describes the structure of the data set and paragraph 4 provides some descriptive statistics. Paragraph 5 describes the empirical strategy used to identify the determinants of the time-to-degree. Paragraph 6 presents the results of the analysis. Finally paragraph 7 concludes.

2. Literature review

Over the recent years the elapsed-time-to-degree has aroused a growing interest among researchers and policy makers. In Italy in particular this issue represents a major concern as Italian students traditionally do not comply with the legal duration of their bachelor degrees. Nevertheless, the empirical evidence on this subject is not widespread. An extensive work that covers also this aspect has been presented by Checchi et al. (2000). Using administrative data on students enrolled in some public departments and in a private one, they attempt to analyse both college choices and subsequent students' performance. Their major findings is that progression toward a degree is positively related to educational records, in other words they show that academic aptitude is an important factor that affects the likelihood of completion, along with parental background. An *ordered probit* approach has been employed by Boeri, Laureti and Naylor (2005) to assess the effects of students' abilities prior to their college enrolment and family income on the progression toward the degree, using data of two Italian universities (i.e. Cagliari and Viterbo). They find that, in general, having attended a general high school increases the probability of completion in comparison with other students who have obtained a different high school diploma. Bratti, Broccolini and Staffolani (2006), then, using a sample of students who graduated in the Economics Faculty of Marche Polytechnic University and applying a propensity score technique, investigate the effect of the new university reform on students' behaviour and their performance. They

²Often new universities sites have been established under local policy maker pressures to boost the economy of the areas.

highlight that this policy intervention has led to a reduction of drop-out rates, whereas the new organisation of degree programmes does not affect the time needed to complete the degree.. Garibaldi et al. (2006), using administrative data of Bocconi University – a private university of Economics located in Milan - evaluate the effect of tuition fees on the time spent at university before obtaining a degree. Their most remarkable result is that an increase in tuition fees level during the last academic year decreases the probability of expanding time-to-degree.

The issue of elapsed-time-to-degree has been analysed then by Brunello and Winter-Ebmer (2003) using data drawn from a survey conducted at European level. This study finds that excess time to graduation is higher in countries characterized by a great share of public expenditure for tertiary education, high unemployment rates and stricter employment protection. In particular they argue that when entry into the labour market is difficult individuals are discouraged from completing in time their studies. The paper of Messer and Wolter (2007) supports the last result mentioned above, as they find that the economic situation – which can be expected to influence individual consumption benefit and the costs of studying – has a significant impact on individual time-to-degree. To be more precise, a low unemployment rate and high real interest rate shorten the time-to-degree by directly increasing the cost of a university education. Light and Strayer (2000) attempt to determine whether college quality and students' ability have causal effects on university completion. Their main conclusion is that ability is an important, positive determinant of college success. In addition, they find that, at the lowest quality colleges - where the relatively low academic standards should facilitate progression toward a degree - graduation is mainly hampered by the paucity of other high-ability students, financial aid, and other positive environmental factors. Furthermore, several researchers have focused on graduate students' behaviour³ as, especially in the US, the high drop-out rate and the increasing time to complete Ph.D. programmes represent growing concerns for academics and policy makers (Ehrenberg et al., 2005). Findings of these contributions to the elapsed time taken to earn a Ph.D are not relevant to our final goals, as we are aware of the fact that the characteristics of a student enrolled in a post-graduate course differ from those associated with an individual who attends an undergraduate degree programme. Nevertheless a few studies on graduates performances (Siegfried and Stock, 2001; Stock and Siegfried 2006) are particularly useful to our goal from a methodological point of view as the type of dataset and the econometric approach used are very similar to those adopted in the present paper.

3. Data

The sample is drawn from Consorzio AlmaLaurea which collects information on graduates of 46 Italian Universities, namely 65% of the Italian graduates. In particular the sample used in this paper

³ See Ours and Ridder (2002), Ehrenberg and Mavros (1995), Ehrenberg et al. (2005), Stock and Siegfried (2001).

is composed by individuals graduated in 2007 and enrolled in the period 2001-2004, namely after the reform that suppressed the most 4 or 5 years degree courses introducing the so called “3+2 system.” Therefore, in order to work with homogeneous individuals we focus only on people who enrolled in a 3-years bachelor's degree, excluding then students who earned an “old type” degree (4 or 5 years of duration), as well as those who shifted from an “old” to a “new” type degree. We also exclude graduates in Medical studies which preserved the pre-2001 organization providing a single-cycle degree (*laurea a ciclo unico*). We finally focus our analysis on graduates from public universities, thus excluding those who awarded their degree from private ones or from universities financed and managed at a regional level⁴. The final sample is then composed by 62.390 students graduated from 38 universities⁵.

Concerning the dependent variable, namely the students' time-to-degree, its construction needs some attention. Almalaurea data set report both the enrollment and the graduation dates for each individual and, as a consequence, we can calculate for each graduate the exact number of days spent at university. Nevertheless we do not use this information in the analysis. The exact day when a student graduates in Italy does not only depend on student's ability, but also on the organization of the graduation sessions provided by each university. Since there is not a rule set at a national level, each university can organize the graduation sessions autonomously, thus affecting students' time-to-degree and introducing a bias in the dependent variable. In order to improve the comparability of the durations among different universities we have grouped graduation dates into “graduation sessions”, according to the academic calendar year. In each academic year the first graduation session starts the 1st May and ends the 31th August, the second graduation session is from the 1st September to the 31th December and the third session from the 1st January to the 30th April. For each student we have then calculated the number of sessions needed to graduate starting from the 1st May of their third enrollment year, namely from the date when the student is entitled to graduate. As reported in the table 1 the medium number of sessions needed to graduate is 5 which corresponds to a medium delay longer than one year.

There is another problem affecting data when time-to-degree is considered. Almalaurea data are organized by year of graduation (outflow sample), independently from when students enrolled in their degree course. This implies that in 2007 we do not observe two types of individuals: those who enrolled at university in the years 2001-2004 and who took their degree before 2007 as well as

⁴ In Italy there are two regional universities, Università della Valle d'Aosta and Università di Bolzano, which are located in two regions with specific rules (*Regioni a statuto straordinario*). This status allows these regions to keep in their territory the most part of the taxes locally collected thus entailing a greater availability of financial resources.

⁵ Bari, Basilicata, Bologna, Cagliari, Camerino, Cassino, Catania, Catanzaro, Ferrara Firenze, Foggia, Genova, Messina, Modena and Reggio Emilia, Padova, Parma, Perugia, Piemonte Orientale, Roma La Sapienza, Roma Tre, Molise, Napoli II, Sassari, Siena, Torino, Torino Politecnico, Reggio Calabria, Trento, Trieste, Udine, Venezia Ca' Foscari, Venezia IUAV, Viterbo Toscana,

those who are not yet graduate⁶. Nevertheless, if the number of students enrolled at university and their time-to-degree distribution did not significantly change during the whole period 2001-2004, the time-to-degree observed in the 2007 graduates' cohort is not different from that which would be observed if one could follow one entire freshmen's cohort of whatever year⁷. In our case both the conditions are satisfied and we can consider the observed time-to-degree distribution as representative of the distribution of the time-to-degree of students enrolled in any academic year from 2001 to 2004⁸.

4. Descriptive statistics

Descriptive statistics are reported for the whole sample in table 1, which includes mean and standard deviation of elapsed time to degree of 67921 graduates students.

[TABLE 1 AROUND HERE]

The overall mean is 4.97 sessions.

As regards previous educational experiences, students with general high school diploma seem to finish undergraduate studies faster than those with other high school degree. We notice also a negative relation between time spent to get a degree and the final mark at high school, namely those who achieved higher scores (more than 90) are definitely more quicker. The same relationship persists when we look at the parental background, in general parents with tertiary education reduce their offspring' chances of achieving a degree beyond the legal length.

With regard to the area where students are studying, we denote that students enrolled in a college based in the South stay longer at university rather than those studying in the North, on average more than one session. It is noteworthy that mobility, identified by students who studied in a different province or region, are faster than those who stay in the same province where they were used to live.

⁶ Table A1 in appendix represent the structure of our data.

⁷ On the representativeness of data arising from outflow samples on this issue see Bowen and al. (1991) and Sigfried and Stock (2001).

⁸ As showed in table A2 in appendix the number of students enrolled at university in Italy during the period 2001-2004 is rather steady, with a small increase in 2002 and 2003. The greatest jump in university enrollment in the last decades indeed occurred in 2001 with respect to 2000, with the introduction of the 3+2 reform. With regard to time-to-degree, table A3 report its distribution for the years 2004-2007 according to Almalaurea data on graduates. These four years are those in which students enrolled in 2001-2004 are entitled to earn their bachelor degree. Obviously, in 2004 all the graduates are on time because they are those students enrolled in 2001 who took their degree just after three years. In 2005 then we only observe graduates on time (those enrolled in 2002) or graduates with a delay of one year (those enrolled in 2001) in 2006 only graduates in time or with a one or two years delay and so on. The table also reports the time-to-degree distribution that had to be observed in 2005 and in 2006 we could observe the same distribution as in 2007.

With respect to the overall mean session, we underline then that individuals who already failed during past academic experiences are slower (6.29) compared to the overall mean. Within the field of specialization we note that it does exist a bit of heterogeneity, probably due to the diverse levels of effort required and different job opportunities associated to each field. Furthermore students enrolled in universities with more facilities reduce the elapsed time to degree.

Finally, also being a student of a small or medium universities reduces the time spent at university in order to get a degree.

5. Empirical strategy

We want to estimate the impact of university and students' characteristics on time-to-degree by controlling for a number of other confounding factors. In particular, given the discrete nature of our time variable (sessions needed to graduate) and of the corresponding event of interest (graduation may occur at any particular year), we use a duration model with a discrete hazard setting based on a complementary logistic model (*cloglog*): for each graduation session, the dependent variable takes value 0 when individuals are still enrolled at University and 1 when they graduate (Jenkins, 2004). In our data for each individual we observe a complete duration spell as the sample is composed by only graduates.

Moreover, the use of a model with a proportional hazard allows to transform the coefficients of this analysis into hazard ratios, which makes easier the interpretations of results⁹. For any given covariate, the hazard ratio is:

$$HR = \frac{\chi(x = a)}{\chi(x = a - 1)} = \exp(\beta_x)$$

where χ is the continuous time hazard rate. This is the relative risk associated with a one unit change in the value of the corresponding explanatory variable, holding everything else constant.

Obviously it is questionable whether all students with the same set of observed covariates face the same expected hazard of graduating. Due to the unobservable factors, there might be some students who are "intrinsically" more or less likely to graduate in any session. Ignoring unobserved heterogeneity may then produce a bias in the results.

As a consequence, we also present results obtained controlling for unobserved heterogeneity issues. Denoting with ν the unobserved component shifting schooling duration (where ν is independent from the covariates X and time t), according to Jenkins (2004) it can be integrated out from the survivor function once a specific functional form for ν is specified. This is convenient as it allows writing the unconditional survivor function in terms of this distribution. For the discrete time

⁹ Indeed, under the "proportional hazard" assumption, the duration profile of the hazard is only function of the time variable and, therefore, it is the same for all the individuals, where this profile is shifted upwards or downwards by the explanatory variables.

models, a popular choice is the Gamma distribution, which nests other familiar functional forms such as the normal one.

6. Main Results

In this section, we use the statistical framework discussed in the previous paragraph to investigate the determinants of the probability to graduate in any session. In particular we aim at verifying to what extent students' characteristics affect the time necessary to take the degree and whether college characteristics do matter as well.

Table 2 presents the results with controls for unobserved heterogeneity for a specification which includes the characteristics observed at the individual level, the type of field of study attended and a set of covariates describing college characteristics. We report both coefficients and hazard ratios. For each covariate, the latter represents the complement to one of the probability of graduating¹⁰.

[TABLE 2 AROUND HERE]

We first notice that the logarithm of the duration has a positive and statistically significant effect on students' withdrawal. This is a standard result and suggests that students are more likely to graduate as time elapses. Looking at students' characteristics we observe that females are slightly slower in achieving their bachelor degree. This result, which appears in contrast with the huge empirical literature on women's educational performances, probably depends on the fact that women prefer to stay at university longer to achieve a higher leaving grade. Concerning previous education we find that students with technical or professional diploma take more time to achieve their degree with respect to those with general backgrounds (licei). Interestingly also, students who graduated abroad, independently of the high school diploma, face a greater probability to get their bachelor degree beyond the legal length (about 90%) with respect to the reference category (general Italian high school diploma). Still focusing on previous educational performances, high school leaving grades are a good predictor for college outcomes, too. Namely, any grade over 70¹¹ increases the probability to graduate in any session from 28%, for those with a leaving grade ranging from 70 to 80, to 183% for those with a leaving grade over 90. Another proxy for ability is represented by previous not successful college experiences. According to our estimates students who experienced a drop out from a foregoing bachelor degree have a lower probability to graduate in any session by 45%. Looking at parental background, we find that parents' education affects students' outcomes in the expected ways even if their effect is quite small. This result is in line with the empirical

¹⁰For instance, if the estimated hazard ratio for a characteristic j is 0.6, then the individuals with that characteristic have a 40% lower probability of exiting the educational system than the reference group; instead, if the hazard ratio is 1.5 the individuals have a 50% higher probability of exiting from educational system.

¹¹ In Italy high school leaving grades range from 60 to 100.

literature which shows that parental education affects children outcomes mainly at the beginning of their educational path

A variable which strongly influence students' performance in terms of time-to-degree is represented by the macro-area of study. In particular students living in Centre regions are less likely to graduate in any session by 26% and, those living in Southern regions by about 42% with respect to the reference category (North Western area). According to our estimates students from North Eastern regions are the most time-savings. These results seem in line with the real business cycle explanation introduced in previous studies (Brunello and Winter-Ebmer, 2003; Messer and Wolter, 2007) according to which students' performances at university are strongly affected by the labour market conditions: in presence of good job opportunities students face higher cost opportunities in staying at university and, as a consequence, they are encouraged to earn their degree on time.

With regard to students experiences at college we find that students working part-time are less likely to graduate in any session by 25%. Subtracting time to the study, on the one hand increases financial resources, on the other hand it enlarges the time required to graduate, thus nullifying the positive effect on students' economic conditions.

Furthermore, not living with parents slightly decreases the probability to graduate in any session. This negative result could depend on the fact that living on one's own again reduces the time devoted to study and it probably calls for a job to support studies.

Students receiving scholarships from their university are more likely to graduate faster but this is the result of a merit-based system of students' grants.

As expected then, effort is positively correlated with the compulsory time to graduation: students who have attended more than 75th of the classes of their study plans are more likely to graduate in any session by more than 70%. This result is not remarkable *per se* but because the effect of the other covariates is "cleaned out" by the students' effort by including this variable in the estimates¹².

When we look at the departments we find that students in any fields apart from sociology, political sciences, teaching, psychology and sport sciences experience a lower probability to graduate in any session with respect to the reference category - students in business administration, economics and statistics. For some fields (scientific or engineering) this result is likely due to a greater difficulty associated with such studies, while for the remaining it is probably the effect of less job opportunities.

With regard to college characteristics in order to capture differences among colleges two alternatives are available. First, it is possible to include 38 dummies, one for each college included in the analysis. We decided not to adopt this specification as it is not very informative from a policy

¹² In a previous version of the estimates, that did not include any control for effort, we found that the coefficient associated to women was not statistically significant. The comparison of these results suggests that probably women are more likely to attend classes regularly and that, once controlled for their effort, their performances are worst.

point of view: colleges' dummies indeed do not provide any information about their characteristics in terms of resources and organization. We have then decided to adopt an alternative specification including the "tier" in which colleges are included according to two different ranks. The first rank takes into account colleges' endowment in terms of structures for students such as seats in the classrooms, in the libraries and in the laboratories. This rank is provided by the first edition (2005) of the Grande Guida dell'Università by Repubblica/L'Espresso and it is based on data from the Italian Ministry of University (Nuclei di Valutazione, MIUR). In particular we have defined 5 tiers where the Tier 1 and the Tier 5 - the reference category - respectively represent the "richest" and "poorest" colleges in terms of structures available to students. The second rank considered in the analysis concerns colleges' endowment in terms of teachers and it is based on the average student per teacher ratio in the period 2001-2004. Again we have defined 5 tiers where the Tier 1 and the Tier 5 - the reference category - respectively contain the colleges which have the lowest and the highest student per teacher ratio. Finally we have included an additional dummy for the colleges with less than 20.000 students enrolled.

According to our estimates colleges' endowments in terms of structures positively affect students' outcomes. Any dummy associated with tier 1 to tier 4 is higher than one and statistically significant at 1% level thus suggesting that the richer are the structures available to students the lower is the elapsed time-to-degree. Interestingly then this effect is not linearly increasing with the structure rank as the highest coefficient is associated with tier 2. Concerning colleges' endowments in terms of students per teacher the result is quite odd and needs further investigations. According to our estimates we find that students enrolled in those colleges which rank better in terms of students per teacher ratio (lower ratios) need more time to achieve their degree, once controlled for the other individual characteristics and the structures endowments. This result seems to suggest that students' performances are affected more by the availability of physical than of human resources. Finally the coefficient of the dummy representing the small and medium universities is not statistically significant, thus suggesting that dimension is not relevant once controlled for the colleges' endowments.

7. Concluding remarks

This paper investigates the determinants of elapsed time to get a bachelor degree in Italy. By this analysis we evaluate whether such duration, which often goes beyond the legal duration, depends only on the abilities and the motivations of students or if labour market conditions and colleges' characteristics matter as well. As far as we know, the current paper is the first attempt to analyze time-to-degree on a sample representative of the Italian university system, trying to control also for University characteristics.

According to our results time-to-degree is affected by individual ability, students' effort, field of study, working status, labor market and living conditions. University characteristics in terms of human and physical resources provided to students affect their time-to-degree, too. Assuming that the difficulty level of the degree courses is homogeneous along with universities, this result could be interpreted as the effect of better studying conditions provided by those colleges which can rely on richer infrastructures. Old universities attract on average better quality students than those enrolled in recently established universities. In Italy, as well as in other countries, such universities are playing the role of leading up to tertiary education students from poorest backgrounds. Once controlled for students' characteristics differences among universities narrow but still remain significant thus stressing that universities organization and, probably, their resources, can influence students' performances as well as individual abilities.

References

- Boero, G., Laureti, T. and R. Naylor (2005), "An econometric analysis of student withdrawal and progression in post reform Italian universities", CRENOS Working Paper 2005-04.
- Bratti, M., Broccolini, C. and S. Staffolani. (2006), "Is 3+2 equal to 4? University reform and student academic performance in Italy", Dipartimento di Economia – Università Politecnica delle Marche, Quaderni di ricerca 251,.
- Bowen, W.G., Lord, G. and J.A. Sosa (1991), "Measuring Time to the Doctorate: Reinterpretation of the Evidence", *Proceedings of the National Academy of Sciences of the United States of America*, 88(3), 713-717.
- Brunello, G. and R. Winter-Ebmer (2003), "Why do students expect to stay longer in college? Evidence from Europe", *Economic Letters*, 80, 247-253.
- Checchi, D., Franzoni F., Ichino A., and A. Rustichini (2000), "College choice and academic performance", mimeo Department of Economics University of Milan Italy.
- Ehrenberg, R.G. and P. Mavros (1995), "Do doctoral students' financial support patterns affect their times-to-degree and completion probabilities?", *The Journal of Human Resources*, 30, 581-609.
- Ehrenberg, R.G., Jakubson, G., Groen, G., So, E. and J. Price. (2005), "Inside the Black Box of Doctoral Education: What Program Characteristics Influence Doctoral Students' Attrition and Graduation Probabilities?", NBER W.P, 12065.
- Evan, W. N. and R.M. Schwab (1995), "Finishing High School and Starting College. Do Catholic Schools make a difference?", *The Quarterly Journal of Economics*, 940-974.
- Garibaldi, P., Giavazzi, F. Ichino, A. and Rettore E. (2008), "College cost and students' performance: evidence from tuition discontinuities", NBER W.P. 12863..
- Jenkins, S.P. (2004), "Survival analysis", mimeo, Institute for Social and Economic Research, University of Essex.
- Light, A. and W. Strayer (2000), "Determinants of college completion: school quality or student ability?", *The Journal of Human Resources*, 35, 229-332.
- Messer, D. and S.C. Wolter. (2007), "Time-to-degree and the business cycle", IZA Discussion Paper 2787.
- Ours, J.C. and G. Ridder. (2001), "Fast track or failure: a study of the graduation and dropout rates of Ph D students in economics", *Economics of Education Review*, 22, 157-166.
- Siegfried, J. and W.A. Stock (2001), "So you want to earn a Ph.D. in Economics? How long do you think it will take?", *The Journal of Human Resources*, 36, 364-378.
- Stock, W.A. and J. Siegfried. (2006), "Time-to-Degree for the Economics Ph.D. Classes of 2001 and 2002" *AEA Papers and Proceedings*, 96(2), 467-474.

Tables

Table 1 Descriptive statistics

	All	Mean sessions	Standard Deviation
Observations	67921		
Duration		4.97	2.77
Female	0.611	4.90	2.73
<i>High school track</i>			
General	0.580	4.78	2.74
Technical	0.289	5.16	2.78
Professional	0.023	5.40	2.76
Teaching	0.076	5.21	2.24
Other	0.032	5.31	2.75
Foreign	0.012	5.01	2.75
<i>High school leaving grade</i>			
60-70	0.131	4.99	2.74
70-80	0.222	5.53	2.80
80-90	0.217	4.99	2.71
90-100	0.373	4.11	2.49
<i>Father and mother education</i>			
Father primary school	0.097	5.32	2.80
Father lower secondary	0.287	5.03	2.75
Father upper secondary	0.411	4.92	2.76
Father university degree	0.180	4.91	2.76
Mother primary school	0.103	5.43	2.81
Mother lower secondary	0.287	5.04	2.76
Mother upper secondary	0.430	4.88	2.75
Mother university degree	0.157	4.69	2.73

Table 1 Descriptive statistics (continues)

	All	Mean sessions	Standard Deviation
Observations	67921		
<i>Geographical area</i>			
North West	0.136	4.52	2.65
North East	0.358	4.34	2.64
Centre	0.239	5.35	2.68
South and Islands	0.268	5.69	2.84
<i>Mobility</i>			
Study in the same province	0.518	5.14	2.78
Study in another province of the same region	0.271	4.79	2.75
Study in another region	0.211	4.77	2.71
<i>Other characteristics</i>			
Working during studies	0.681	5.09	2.78
Living in a rented flat	0.322	4.90	2.77
Grant from ISU	0.264	4.73	2.63
Accommodation from ISU	0.044	4.68	2.59
Previous university experiences	0.056	6.29	2.97
Effort	0.682	4.51	2.65
<i>Field of study</i>			
Economics-statistics	0.166	4.79	2.81
Scientific	0.038	5.05	2.90
Chemical-Pharmaceutical	0.015	4.45	2.68
Geological-Biological	0.051	4.71	2.82
Engineering	0.123	4.78	2.77
Architecture	0.050	4.84	2.57
Agricultural Sc.	0.021	5.08	2.71
Political-Sociological	0.162	5.08	2.76
Law	0.056	5.49	2.89
Humanistic	0.110	5.17	2.70
Language	0.079	4.88	2.56
Teaching	0.048	5.32	2.70
Psychology	0.064	4.81	2.89
Sport	0.017	4.93	2.66
Tier 1_structures	0.157	4.58	2.69
Tier 2_structures	0.157	4.37	2.60
Tier 3_structures	0.317	4.58	2.71
Tier 4_structures	0.147	5.65	2.72
Tier 5_structures	0.222	5.75	2.77
Tier 1_teachers	0.148	4.85	2.71
Tier 2_teachers	0.305	4.70	2.73
Tier 3_teachers	0.204	5.11	2.80
Tier 4_teachers	0.213	5.05	2.78
Tier 5_teachers	0.129	5.35	2.77
Colleges with less than 20000 enrolled	0.179	4.72	2.72

Table 2 Probability of graduation (discrete time duration models with control for unobserved)

	Coeff.	Z	Hazard ratios
Female	-.0409	-3.36	.9598
Technical	-.2689	-20.54	.7642
Professional	-.5372	-14.05	.5843
Teaching	-.3212	-14.91	.7252
Other high school	-.5279	-13.4	.5898
Foreign high school diploma	-2.543	-3.97	.0785
High school leaving grade 70-80	.2521	14.88	1.2867
High school leaving grade 80-90	.5382	30.96	1.713
High school leaving grade 90-100	1.0417	60.95	2.834
No answer high school leaving grade	3.1863	4.99	24.199
Father low.sec.	.0224	1.16	1.0227
Father high sec.	.0550	2.77	1.0566
Father univ. Degree	.1198	5.10	1.1273
Mother low. Sec.	.0946	4.88	1.0992
Mother high sec.	.1456	7.34	1.1567
Mother univ. Degree	.1825	7.62	1.2003
North East	.2211	9.75	1.2475
Centre	-.2972	-11.10	.74287
South and Islands	-.5350	-18.56	.58565
Study in the same region	.0795	6.02	1.0827
Study in another region	-.0116	-0.71	.9884
Working while studying	-.2865	-23.85	.7508
Living outside family	-.0432	-3.28	.9576
Grant from ISU	.1855	14.42	1.2038
Accomodation from ISU	.0182	0.68	1.0184
Previous univ. exp.	-.5883	-25.45	.5552
Effort	.5397	43.77	1.7155
Scientific	-.3420	-11.64	.71034
Chemical-Pharmaceutical	-.0293	-0.67	.9711
Geological-Biological	-.1228	-4.69	.8844

Engineering	-.4690	-22.78	.6256
Architecture	-.0998	-3.67	.9050
Agricultural sciences	-.1932	-5.01	.8242
Sociology and Political sciences	.0712	3.80	1.073
Law	-.3200	-12.47	.7261
Humanities	-.1758	-8.45	.8387
Language	-.2124	-9.39	.8085
Teaching	.1765	5.89	1.1931
Psychology	.3692	14.06	1.446
Sport sciences	.1845	4.23	1.2026
Tier 1_structures	.3228	11.50	1.381
Tier 2_structures	.4688	16.52	1.5980
Tier 3_structures	.3356	17.05	1.3988
Tier 4_structures	.2024	9.04	1.2244
Tier 1_teachers	-.1949	-7.25	.8228
Tier 2_teachers	-.2090	-8.96	.8113
Tier 3_teachers	-.1540	-7.76	.8572
Tier 4_teachers	-.266	-11.74	.7656
Colleges with less than 20000 enrolled	-.0140	-0.76	.9860
Lnt	0.984	122.35	4.2529
LR test of rho=0 chi2	1044		
Observations	306709		
Groups (Individuals)	62390		

Appendix

Table A1 Structure of the data

		Graduation year						
		2004	2005	2006	2007	2008	2009	2010 and after
Enrolment year	2001	X	X	X	X	X	X	X
	2002		X	X	X	X	X	X
	2003			X	X	X	X	X
	2004				X	X	X	X

In grey years not observed. In yellow year observed

X : when an individual potentially graduates

X : when an individual graduates on time

Table A2 Students enrolled at the Italian Universities in the period 2001-2004

Ac. Year 2001/2002	Ac. Year 2002/2003	Ac. Year 2003/2004	Ac. Year 2003/2004
319.264	330.802	338.036	331.893

Source: MIUR Official Statistics.

Table A3 The distribution of graduates' time-time-to degree according to Almalaurea dataset

	Graduates in 2004	Graduates in 2005	Graduates in 2006	Graduates in 2007
On time	100%	65% (60%)	49.5% (49%)	44.7%
1 year later		35% (40%)	35.5% (32.5%)	30.2%
2 years later			14.2% (19%)	17.4%
3 years later				7.4%

Distribution of graduates' time-to-degree if their distribution was the same as in 2007 in brackets.