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The Academic Impact of Natural Disasters: Evidence from L'Aquila Earthquake

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ABSTRACT

The Academic Impact of Natural Disasters:
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This paper examines the effect of the L'Aquila earthquake on the academic performance of the students of the local university. Following this traumatic event, not only are students likely to have developed an acute stress disorder, but they have also experienced a significant disruption in their learning environment because of the closure of several university buildings and the relocation to temporary premises. We compare changes in educational outcomes among students of the University of L'Aquila before and after the earthquake with changes in educational outcomes during the same time period among students enrolled at other Central Italian universities. The empirical results suggest that while this natural disaster has reduced students' probability of graduating on time by 6.6 percentage points, it has had no statistically significant effect on university drop-out in the very short-term. Additionally, the on-time graduation result masks differential gender effects.

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1. Introduction

During the night of 6th April 2009 the city of L'Aquila was struck by a violent earthquake that killed 309 individuals and injured about 1,600 people. Thousands of houses and buildings were seriously damaged or destroyed. About 90 percent of the residents of L'Aquila were displaced from their homes following this natural disaster. The mediaeval centre of L'Aquila, which hosts the local University, was especially hit hard. This event was one of the most expensive natural disasters in Italy's history with an estimated total economic impact of about 540 million euro (Commissariato delegato per la ricostruzione in Abruzzo, 2011). Many accounts of the event and its aftermath also received worldwide media coverage thanks to the fact that the 35th G8 international summit was held in L'Aquila in July 2009.

This paper examines the impact that the earthquake had on the academic performance of the students of University of L'Aquila. Such an event had significant disruptions to their daily life. Housing was an immediate concern. A large number of them had to relocate to cities and villages miles away from L'Aquila. Many students moved to Avezzano, which is situated about 31 miles from L'Aquila. Additionally, about 70 percent of the infrastructure of the University of L'Aquila (including university buildings, libraries and student canteens) was closed following the earthquake (Maggiolo, 2010). Though several temporary locations were found to enable students to continue their academic studies, the quality of educational programs inevitably suffered as a result of the earthquake. There was also a transportation problem as students had to travel to the new university locations. Despite efforts to return to the pre-earthquake situation, the pattern of disruption at the university continued for several years after the natural disaster. For instance, students of the Faculty of Engineering were able to return to their original university campus only in October 2013.

Perhaps more importantly, many students of the University of L'Aquila are likely to have experienced psychological problems in the aftermath of this natural catastrophe. There are

many papers indicating the presence of post-traumatic stress disorder (PTSD) in survivors of natural disasters (see, for instance, Rowe and Liddle, 2008; Miller, 2005)[1]. PTSD symptoms include poor concentration, depression, anxiety and insomnia. In addition to PTSD, exposure to natural disasters may increase the risk of developing health issues such as cardiorespiratory and musculoskeletal problems (see, for instance, Keskinen-Rosenqvist et al., 2011). Studies on the effects of the L'Aquila earthquake are consistent with the above findings. For instance, a recent paper (Di Castelnuovo et al., 2013) compares the health status of residents of L'Aquila with the health status of people living in another region of Central Italy (i.e. Molise) in the 6 months following the earthquake. It is found that the proportion of people suffering from metabolic syndrome[2] (MS) is significantly higher among the former relative to the latter. Another study (Tempesta et al., 2013) looks at differences in sleep quality among L'Aquila citizens before and after the earthquake. The results indicate that exposure to the natural disaster resulted in a significant deterioration of sleep quality and increased incidence of disruptive nocturnal behaviours (DNB). Furthermore, it is possible that the earthquake had a profound emotional impact especially on the University of L'Aquila's student community. Ten of the victims of the earthquake were students who, during the night of the earthquake, were at a dormitory located in the historical centre of L'Aquila.

While conventional wisdom suggests that a disruption in the learning environment caused by natural disasters negatively affects students' academic achievement, several papers (see, for instance, Smilde-van den Doel, et al., 2006) indicate that the direction and the magnitude of this effect are complex to evaluate as they depend on various factors. In particular, interventions in favour of the affected students in the aftermath of natural catastrophes can play an important role in this context. Students may not experience a performance decline or

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[1] Some papers (e.g. Carter et al., 2014) find evidence of these problems among university students.
[2] Metabolic syndrome is a cluster of conditions — increased blood pressure, high blood sugar level, excess body fat around the waist and abnormal cholesterol levels — that occur together, increasing a person's risk of heart disease, stroke and diabetes.

may experience a lesser decline if measures are taken to help them deal with post-natural disaster issues.

Several such measures were taken shortly after the L'Aquila earthquake in an attempt to mitigate some of the negative effects that this event had on students. Students were given a fee exemption for three academic years[3]. They were also entitled to receive discounts on study-related equipment like textbooks and computers. Additionally, to help students address transportation issues caused by relocation, they benefited from free public transport. Finally, more scholarships were awarded to students thanks to the donations of several national and international institutions.

We focus our attention on the impact of the L'Aquila earthquake on university drop-out and on-time graduation (i.e. within 3 years after initial enrolment). These are very important educational attainment measures in Italy where a large proportion of university students abandon their studies before graduation (Schnepf, 2014) and many of those who manage to complete a degree do not do this within the prescribed time (Aina et al., 2011).

Our empirical strategy is to examine the differences in drop-out and on-time graduation between students enrolled at the University of L'Aquila (the treated group) and those enrolled at other universities located in central Italy (the control group)[4], and then look at how these differences changed in the post-earthquake period relative to the pre-earthquake period. This comparison, which generates a difference-in-differences (DiD), allows us to control for time-varying unobservables affecting drop-out and on-time graduation across students at both the University of L'Aquila and other central Italian universities. This strategy hinges on the assumption that in the absence of the earthquake the difference in our educational outcomes

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[3] The fee exemption was successively extended for three more academic years.
[4] Students enrolled at universities located in the regions of Molise, Marche and Abruzzi (apart from L'Aquila) comprise the control group. The dataset used does not include the specific name of the university, but does provide information about the province where the university is located.

between students of the University of L'Aquila and those enrolled at other central Italian universities would have been the same as the one in the pre-earthquake period.

Students of other universities located in central Italy constitute a credible control group for three reasons. First, as reported in Section 4, these students are similar to those of the University of L'Aquila in most observable characteristics. Second, as shown in Section 5, in the pre-earthquake period, conditional on controls, the trend in on-time graduation across students at the University of L'Aquila is similar to that across students at other central Italian universities. Third, geographical proximity implies that treated and control students are embedded in the same socio-cultural-economic environment. For example, the cost of living of these students is similar and they also tend to share similar cultural traits.

The remainder of the paper is as follows. Section 2 reviews the findings of those studies investigating the effects of natural disasters on the academic performance of university students. Section 3 outlines the empirical strategy, while Section 4 describes the data. Section 5 presents and discusses the results of the empirical analysis. Section 6 concludes.

2. Literature review

A relatively large number of studies investigate the impact of natural disasters on students' progression and attainment. However, only a few of them examine the impact that these events had on the academic performance of university students. Two papers study how earthquakes have affected the achievement of students at Canterbury University, New Zealand. The first one is by Helton et al. (2011) and looks at the effect of an earthquake that occurred in 2010. It finds that this natural disaster had a negative effect on cognition. However, one needs to be cautious about the conclusion of this study as it is based on a small sample (i.e. 18 students), participants are self-selected and no control group was used. Some of these problems are addressed in the second paper (Wilkinson et al., 2013) that compares

the disruptions caused by the 2010 earthquake with those related to an earthquake that took place in 2011. Focusing on medical students, the authors find that the former had a greater impact on assessment performance relative to the latter. An explanation for this result is that, while the 2011 earthquake happened at the beginning of the academic year therefore giving students and the institution time to develop adaptive or coping strategies before exams, this did not occur with the 2010 earthquake, which took place at the end of the academic year.

Krane et al. (2007) analyse the disruptions caused by Hurricane Katrina to Tulane University School of Medicine and Louisiana State University School of Medicine at New Orleans. Following this event, these Schools were relocated to temporary locations and training for students was re-established one month later. Hurricane Katrina seems to have had no effect on student performance. Mean final course average, standardized National Board of Medical Examiners course examination scores and scores for US Medical Licensing Examination Steps 1 and 2 were all unchanged. This result, however, contrasts with that of Watson et al. (2011,) who investigate the effect of Hurricane Ilke on students of the University of Texas Medical Branch (UTMB). Using a representative sample of the UTMB student population, the authors find that about half of the respondents reported that this natural disaster had negatively affected their academic performance. A significant proportion (24%) of the students interviewed considered that the size of the negative effect was 'substantial'.

In sum, the findings of these studies indicate that, though natural disasters have the potential to exert a considerable negative effect on student academic achievement, this does not always happen. Some institutions are able to handle the disruptions of the disaster relatively well, thereby mitigating or even completely offsetting the negative consequences on students' performance.

3. Empirical strategy

We pool data from 3 cohorts of students who enrolled at universities located in central Italy in 2001, 2004 and 2007. Data allow us to follow these students during their first 3/4 years of study. In order to evaluate the effect of the L'Aquila earthquake on drop-out and on-time graduation, we use a DiD strategy. The first difference contrasts students of the University of L'Aquila and students enrolled at other universities of central Italy, assuming therefore that the latter were unaffected by the earthquake. The second difference concerns the timing of the earthquake. In our data, while students of the University of L'Aquila who started their studies in 2007 were hit by this natural disaster, those who enrolled at the same institution in 2001 and 2004 were not exposed to the earthquake. The difference in these differences can be interpreted as the causal effect of the earthquake, under the assumption that in the absence of the earthquake, the change in our outcome measures would have not been systematically different across students at the University of L'Aquila and those at other universities in central Italy.

The following model is estimated:

$$Y_{ijt} = \beta_0 + \beta_1' X_{ijt} + \beta_2 Aquila_j + \beta_3 Earthquake_t + \beta_4 Aquila_j * Earthquake_t + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} is a dichotomous variable that is equal to 1 if student i enrolled at university j in year t drops out /graduates on time, and 0 otherwise. *X* is a vector of individual and family characteristics that are thought to influence these outcomes. *Aquila* is a dummy variable that takes the value 1 if the student was enrolled at the University of L'Aquila, and 0 otherwise. *Earthquake* is a dummy taking the value 1 if the student started university in 2007, and 0 otherwise; ε is the error term.

The coefficients of this DiD framework have the following interpretation. β_2 captures the average permanent differences in the outcomes between students enrolled at the University of L'Aquila and those enrolled at other central Italian universities . β_3 accounts for pre and post-earthquake differences that are common to both the treated and control groups. Our parameter of interest is β_4. It tests whether the difference in average outcomes between students enrolled at the University of L'Aquila and those enrolled at other central Italian universities in the post-earthquake period is different from the same difference in the pre-earthquake period. The key identifying assumption is that β_4 would be zero in the absence of the L'Aquila earthquake. β_4 identifies the true impact of the earthquake assuming that, conditional on X , trends student in drop-out and on-time graduation between the University of L'Aquila and other central Italian universities would be identical if the earthquake had no occurred.

Although the dependent variable of Equation (1) is dichotomous, this equation can be estimated by ordinary least squares (OLS) as this allows us to estimate the parameter of interest directly[5]. As pointed out by Angrist (2001), the problem of causal inference does not significantly differ between limited dependent variables and continuous outcomes. This means that if there are no covariates or the covariates are sparse and discrete, then linear models can be used to estimate models with limited dependent variables as well as models with other types of dependent variables.

4. Data

Data come from three waves (i.e. 2004, 2007 and 2011) of a national cross-sectional survey (*Percorsi di studio e di lavoro dei diplomati*) conducted by the Italian National Statistical

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[5] As shown by Ai and Norton (2003), the interpretation of the marginal effect of an interaction term in nonlinear models can be problematic and in some cases it can lead to a misleading conclusion.

Institute (ISTAT). Each wave consists of a nationally representative sample of high school leavers who were surveyed 3/4 years after successfully completing their studies. As one of the possible destinations of recent high school leavers is university enrolment[6], these data enable us to identify three cohorts of students who began university in 2001 (from the 2004 wave), 2004 (from the 2007 wave) and 2007 (from the 2011 wave). As the earthquake occurred in April 2009, while the 2001 and 2004 cohorts were not exposed to this natural disaster, those students of the University of L'Aquila who began their studies in 2007 were affected by it. More precisely, they were hit by the earthquake while they were in their second year of study[7].

We employ two measures of student outcome in this study. The first is university drop-out. Unfortunately, for this analysis we can only use data from the 2007 and 2011 waves. While the 2004 wave does not provide information on the university attended for those students who have dropped out, such information is reported in later waves. Our second measure is whether or not the student has successfully completed a First-level degree. Following the European framework of the Bologna Process, in 2001 the Italian higher education system embarked on a process of reform that led to the introduction of the so-called '3+2' model. This consists of a First-level degree (*Laurea di primo livello*) that lasts three years, followed by a Second-level degree (*Laurea specialistica*) of two years length. For this outcome, data from all three waves can be employed as the 2004 wave does give information on the university attended for those students who completed a First-level degree or were still enrolled at the time of the survey.

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[6] In Italy, all individuals who have successfully completed five years at any type of upper secondary school gain the automatic right to enrol at university.

[7] In Italy, the academic year runs between the beginning of October and the end of July the following year.

One issue with merging data from the three waves of this survey is that, while in the 2004 and 2007 waves high school leavers were surveyed three years after successfully completing their studies, in the 2011 wave students were contacted four years following the end of high school. This poses a problem in creating harmonised outcome measures as university students need to be observed for the same amount of time across cohorts. Such a problem can be easily solved with respect to our second measure of student outcome as the 2011 wave reports information on the year students successfully completed the First-level degree. Therefore, in all three cohorts we can observe whether the student earned a First-level degree within three years following his/her initial enrolment. However, what of the drop-out indicator? Given the purpose of this study, our only viable option is to see whether the student has withdrawn from university at the end of his/her second year of study. While information on third-year drop-out is available in the 2004 cohort, in the 2007 cohort data do not allow us to separate third-year drop-out from fourth-year drop-out. Second-year drop-out captures the immediate effect of the earthquake on drop-out since, as mentioned above, students of the University of L'Aquila were in their second year of study when the natural disaster occurred.

The survey contains information on many individual characteristics that are likely to influence the probability of dropping out of university as well the probability of earning a First-level degree within three years after initial enrolment. We are therefore able to control for gender, age, region of residence[8], type of upper secondary school (academic versus technical and private versus public), academic ability (proxied by lower and upper secondary school final marks) and parental education. The unemployment rate (among people aged between 20 and 24 and broken down by province) is also included in our specification in an

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[8] Though we focus our attention only on students enrolled at universities located in three regions, several of these students indicated their residence in many other different Italian regions. Some of the students may have been commuting. Additionally, university attendance is generally not compulsory in Italy.

attempt to study the impact of local labour market conditions on our student outcome measures.

To construct the final samples, we eliminated those high school leavers who did not enrol at the university within 3/4 years following successful completion of their studies, those high school leavers who enrolled at university but did not do so straight after the conclusion of their studies[9], those high school leavers who were living abroad at the time of the survey and those high school leavers with missing information of interest. Table 1 reports the summary statistics for our final samples. The sample used to investigate the effect of the L'Aquila earthquake on on-time graduation comprises 2,570 students. Among those students who were still enrolled at university after 3 years, 8.9 percent obtained a First-level degree. On the other hand, our drop-out sample, which only includes students from the 2004 and 2007 cohorts, consists of 2,041 individuals. Conditional on not having dropped out previously, the proportion of university students who abandoned their studies in the second year is 2.4 percent.

Insert Table 1 about here

Table 2 presents summary statistics for students of the University of L'Aquila and those of other Central Italian universities in the pre-earthquake period. While for the drop-out analysis this period includes only the 2007 cohort, it comprises both the 2004 and 2007 cohorts for the on-time graduation analysis. In the latter, the only relevant statistically significant differences (at 1% and 5%) between the treated and control groups are some dummy variables related to lower and upper secondary school final marks. Looking at the drop-out sample, in the pre-disaster period the proportion of students from academic upper secondary school (liceo) is

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[9] Students who went to university one or more years following high school completion are observed for a shorter period of time relative to those who began university immediately after the end of high school. In each wave the large majority of high school leavers (i.e. more than 85%) started university straight after successfully completing their school studies.

found to be larger at the University of L'Aquila relative to other Central Italian universities. The only other relevant statistically significant difference is the proportion of students who achieved "good" as a lower secondary school final grade.

Insert Table 2 about here

5. Results

Table 3 presents the DiD estimates from Equation (1), which examines the effect that the L'Aquila earthquake had on our two university performance measures. While the first half of Table 3 reports the on-time graduation results, the second half of Table 3 presents the drop-out findings. In both regressions we include all our control variables.

Insert Table 3 about here

Academic ability is, as expected, an important predictor of the probability of obtaining a First-level degree within 3 years after initial enrolment. Performing very well both at upper and lower secondary school significantly increases the probability of graduating on time. There is also a gender effect, as women are found to be 2.9 percentage points more likely to graduate on time relative to men.

Turning to the primary purpose of this paper, it should be noted that the DiD coefficient has a negative sign and is statistically significant at the 5% level. Our result indicates that the change in the probability of on-time graduation between L'Aquila students and those enrolled at other central Italy universities is about 6.6 percentage points lower in the post-earthquake period relative to the pre-earthquake period.

Moving to the second half of Table 3, our estimates are seen to be broadly in line with those obtained by previous studies (see, for instance, Di Pietro, 2006). Having studied at an

academic track upper secondary school (liceo) decreases the likelihood of dropping out of university. The pattern of coefficients on age groups is monotonic, so that drop-out is highest, other things being equal, for students in the highest age category. Unsurprisingly, students with a higher final grade at upper secondary school are found to have a lower propensity to abandon university, *ceteris paribus*.

In the second half of Table 3, the DiD coefficient has a positive sign as expected but is statistically indistinguishable from zero (p=0.125). A potential explanation why the earthquake did not have any immediate effect on university drop-out is that, following the natural disaster, all students of the University of L'Aquila received a fee exemption for the next 3 academic years. In light of this, students may have had no interest in formally abandoning their studies in the academic year 2009/2010 even if, after the earthquake, they were reluctant to continue studying at the university. As they did not have to pay any fee, these students may have taken some time before taking the decision to drop out of university. Additionally, even though we include local unemployment rate among the explanatory variables of our model, perceived future unfavourable labour market conditions could have discouraged students of the University of L'Aquila from abandoning their studies. Worsening labour market prospects reduces the opportunity cost of studying thereby increasing the relative attractiveness of university education.

Two different tests are carried out to check the validity of our on-time graduation DiD results. First, we look at the identifying assumption of parallel trend in this outcome in the absence of the earthquake[10]. A similar trend in student on-time graduation across the University of L'Aquila and other universities located in central Italy should be observed prior to the earthquake. If this assumption is violated, then our estimated effect of the earthquake might

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[10] Unfortunately, the parallel trend assumption cannot be checked for our drop-out analysis as we only have data on one student cohort before the earthquake. For the same reason no placebo test can be performed for the drop-out analysis

be spurious as it could be the result of a diverging trend in on-time graduation that existed even before the occurrence of the natural disaster. To test the parallel trend assumption, Equation (1) is re-estimated using data only for the 2001 and 2004 student cohorts. The results, which are shown in the first half of Table 4, indicate that in the pre-earthquake period the student on-time graduation trend was similar across the treated and untreated universities as the coefficient on the relevant interaction term is statistically insignificant.

Insert Table 4 about here

Second, we perform a placebo test assuming that the earthquake affected students of the University of L'Aquila who began their studies in 2004 instead of those who enrolled at this institution in 2007. For this falsification exercise, we chose our middle cohort because it corresponds to the mid-point of the pre-earthquake period. Results are quite similar if students of the University of L'Aquila in the 2001 cohort are the ones artificially assumed to have been exposed to the earthquake. The second half of Table 4 reports results from the corresponding DiD model that is based on this mis-coded earthquake dummy. The DiD coefficient is found not to be statistically significant at conventional levels. Such a finding indicates that the estimated effect found in the first half of Table 3 is a genuine causal effect of the earthquake and not a an artefact of the statistical approach.

Next, we examine whether the effect of the L'Aquila earthquake on academic performance varies by gender. Given that several studies (see, for instance, Cairo et al., 2010; Hashmi, et al., 2011; Zhang, et al., 2011) conclude that women are more likely to suffer from PTSD after an earthquake than men, it is possible that the L'Aquila earthquake had a detrimental effect especially on the academic performance of women. To test this hypothesis, we estimate our DiD model separately for men and women. While the first half of Table 5 shows the on-time graduation findings, the second half of Table 5 reports the drop-out estimates. Our estimates

show that the effect triggered by the earthquake on the probability of on-time graduation differs across gender. Although, as expected, the estimated DiD coefficient has a negative sign for both sexes, not only is its size larger for women but is also statistically significant only for women. Specifically, our result implies an 11.9 percentage point decline in the probability of women earning a First-level degree in three years. This finding suggests that the overall effect found in the first half of Table 3 is basically driven by women.

Insert Table 5 about here

Estimates reported in the second half of Table 5 indicate that the L'Aquila earthquake had no immediate effect on university drop-out neither for men nor for women. Though the DiD coefficients have the expected positive sign, none of them is found to be statistically significant at conventional levels.

6. Conclusions

On 6th April 2009 the city of L'Aquila was hit by a violent earthquake that caused hundreds of victims and considerable damage to buildings, road and other infrastructures. In this paper, we investigate the impact that this natural disaster had on the academic performance of the students of the local university. Not only has the earthquake led to significant disruptions in the learning environment (e.g. closure of university buildings), but students of the University of L'Aquila are likely to have suffered from physiological and psychological stress following this event.

In order to evaluate the effect of the earthquake on student academic performance, we use a difference-in-differences methodology. Changes in outcomes for students at the University of L'Aquila before and after the earthquake are compared to changes in outcomes for students at other central Italian universities over the same period of time. The key identifying assumption

of this approach is that trends in student outcomes across these two groups of universities would have been identical in the absence of the earthquake.

The empirical results suggest that the L'Aquila earthquake has significantly reduced the probability that a student will graduate on time. Specifically, our estimates indicate that this natural disaster led to a decline of about 6.6 percentage points in the likelihood of earning a First-level degree within three years of initial enrolment. On the other hand, we find no evidence that the L'Aquila earthquake had any statistically significant effect on university drop-out during the academic year following this natural disaster. This finding could be explained by perceived unfavourable future labour market conditions as well as by the fee exemption policy introduced by the University of L'Aquila following the earthquake.

Our results also show that the overall negative effect exerted by the L'Aquila earthquake on the probability of graduating on time masks significant differences across gender. While this natural disaster has considerably decreased the likelihood that female students of the University of L'Aquila will graduate in three years, no corresponding statistically significant effect is found for male students. This finding is consistent with the conclusions of several papers according to which, following an earthquake, women, relative to men, are more likely to experience mental problems such as depression, anxiety and insomnia.

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Table 1: Summary statistics

	On-time graduation sample		Drop-out sample	
	Mean	Std. Dev.	Mean	Std. Dev.
Graduated on-time (conditional on still being enrolled at university after 3 years)	0.089	0.285		
Dropped-out in the second year (conditional on not having dropped out in the first year)			0.024	0.154
Aquila (Enrolled at the University of L'Aquila)	0.145	0.352	0.166	0.372
male	0.371	0.483	0.385	0.487
Age				
-21 years or less	0.046	0.209	0.039	0.193
-22 years	0.847	0.360	0.866	0.341
-23 years or more	0.107	0.309	0.096	0.294
Upper secondary school final mark				
- between 60 and 69	0.191	0.393	0.197	0.398
-between 70 and 79	0.267	0.443	0.254	0.435
-between 80 and 89	0.205	0.404	0.205	0.404
-between 90 and 100	0.337	0.473	0.345	0.475
Lower secondary school final mark				
-pass	0.114	0.318	0.104	0.305
-good	0.271	0.445	0.290	0.454
-very good	0.292	0.455	0.302	0.459
-excellent	0.323	0.468	0.304	0.460
Academic upper secondary school (liceo)	0.479	0.500	0.450	0.498
Private upper secondary school	0.026	0.160	0.032	0.176
Father's highest education is university degree	0.148	0.355	0.145	0.352
Mother's highest education is university degree	0.141	0.348	0.130	0.336
Unemployment rate	17.066	7.021	15.583	6.038
Number of observations	2,570		2,041	

Sampling weights used

Table 2: Pre-earthquake summary statistics for the treated and untreated

	On-time graduation sample			Drop-out sample		
	University of L'Aquila	Other central Italian universities	Diff	University of L'Aquila	Other central Italian universities	Diff
Graduated on-time (conditional on still being enrolled at university after 3 years)	0.053 (0.225)	0.070 (0.255)	-0.017 (0.18)			
Dropped-out in the second year (conditional on not having dropped out in the first year)				0.025 (0.156)	0.024 (0.154)	-0.001 (0.013)
male	0.378 (0.486)	0.359 (0.480)	0.019 (0.034)	0.350 (0.478)	0.375 (0.484)	-0.025 (0.040)
Age						
-21 years or less	0.045 (0.209)	0.051 (0.221)	-0.006 (0.016)	0.041 (0.199)	0.046 (0.210)	-0.005 (0.017)
-22 years	0.822 (0.384)	0.832 (0.374)	-0.010 (0.027)	0.835 (0.372)	0.848 (0.359)	-0.013 (0.030)
-23 years or more	0.133 (0.340)	0.117 (0.322)	0.016 (0.023)	0.124 (0.330)	0.106 (0.308)	0.018 (0.026)
Upper secondary school final mark						
- between 60 and 69)	0.256 (0.438)	0.177 (0.381)	0.079*** (0.028)	0.137 (0.345)	0.198 (0.399)	-0.061* (0.032)
-between 70 and 79	0.235 (0.425)	0.285 (0.452)	-0.050 (0.032)	0.245 (0.431)	0.270 (0.444)	-0.025 (0.037)
-between 80 and 89	0.222 (0.417)	0.193 (0.395)	0.029 (0.029)	0.201 (0.402)	0.184 (0.387)	0.017 (0.032)
-between 90 and 100	0.286 (0.453)	0.345 (0.476)	-0.059* (0.034)	0.418 (0.495)	0.348 (0.477)	0.070* (0.040)
Lower secondary school final mark						
-pass	0.123 (0.330)	0.131 (0.337)	-0.008 (0.024)	0.139 (0.347)	0.123 (0.329)	0.016 (0.027)
-good	0.354 (0.479)	0.263 (0.440)	0.091*** (0.032)	0.248 (0.433)	0.325 (0.469)	-0.077** (0.038)
-very good	0.292 (0.456)	0.283 (0.450)	0.009 (0.032)	0.293 (0.457)	0.295 (0.456)	-0.002 (0.038)
-excellent	0.230 (0.422)	0.324 (0.468)	-0.094*** (0.033)	0.321 (0.468)	0.256 (0.437)	0.065* (0.037)
Academic upper secondary school (liceo)	0.475 (0.501)	0.477 (0.500)	-0.002 (0.036)	0.526 (0.501)	0.410 (0.492)	0.116*** (0.041)
Private upper secondary school	0.034 (0.181)	0.025 (0.158)	0.009 (0.012)	0.023 (0.149)	0.039 (0.194)	-0.016 (0.016)
Father's highest education is university degree	0.121 (0.327)	0.149 (0.356)	-0.028 (0.025)	0.103 (0.305)	0.144 (0.352)	-0.041 (0.029)
Mother's highest education is university degree	0.125 (0.332)	0.144 (0.351)	-0.019 (0.025)	0.166 (0.373)	0.114 (0.317)	0.052* (0.027)
Number of observations	192	1,438		152	905	

Sampling weights used; Standard deviations/errors are in brackets
*** statistically significant at 1%
** statistically significant at 5%
* statistically significant at 10%

Table 3: Effect of the L'Aquila earthquake on academic performance: DiD estimates

Dependent variable	On-time graduation	Drop-out
Constant	-0.002	0.050
	(0.368)	(0.176)
Earthquake (cohort of students enrolled at the time of the L'Aquila earthquake, i.e. 2007 cohort)	0.083***	-0.005
	(0.014)	(0.008)
Aquila (Enrolled at the University of L'Aquila)	0.040*	0.012
	(0.021)	(0.014)
Earthquake*Aquila	-0.066**	0.028
	(0.032)	(0.018)
male	-0.029**	0.005
	(0.012)	(0.007)
Age (omitted is 23 years or more)		
-21 years or less	-0.033	-0.050**
	(0.032)	(0.021)
-22 years	-0.050***	-0.023*
	(0.019)	(0.013)
Upper secondary school final mark (omitted is between 60 and 69)		
-between 70 and 79	0.001	-0.025**
	(0.017)	(0.010)
-between 80 and 89	0.027	-0.046***
	(0.018)	(0.011)
-between 90 and 100	0.082***	-0.037***
	(0.018)	(0.011)
Lower secondary school final mark (omitted is pass)		
-good	0.005	-0.011
	(0.020)	(0.013)
-very good	0.018	-0.021
	(0.021)	(0.013)
-excellent	0.054**	-0.017
	(0.023)	(0.014)
Academic upper secondary school (liceo)	-0.011	-0.019**
	(0.013)	(0.008)
Private upper secondary school	0.025	0.035*
	(0.035)	(0.020)
Father's highest education is university degree	-0.001	0.011
	(0.017)	(0.011)
Mother's highest education is university degree	-0.008	-0.014
	(0.018)	(0.011)
Unemployment rate	-0.001	0.001
	(0.001)	(0.001)
Dummies for region of residence	Yes	Yes
R squared	0.074	0.045
Number of observations	2,570	2,041

Sampling weights used; Standard errors are in brackets
*** statistically significant at 1%
** statistically significant at 5%
* statistically significant at 10%

Table 4: DiD estimates on on-time graduation- Checks

Dependent variable	Parallel trend assumption	Placebo test
Constant	-0.061	-0.007
	(0.724)	(0.371)
2004 student cohort	0.061***	0.014
	(0.015)	(0.014)
Aquila (Enrolled at the University of L'Aquila)	0.036	0.020
	(0.028)	(0.022)
2004 student cohort*Aquila	-0.041	-0.008
	(0.037)	(0.034)
Controls	Yes	Yes
R squared	0.067	0.061
Number of observations	1,630	2,570

Sampling weights used; Standard errors are in brackets

*** statistically significant at 1%

** statistically significant at 5%

* statistically significant at 10%

Table 5: Effect of the L'Aquila earthquake on academic performance: DiD estimates by gender

	On-time graduation		Drop-out	
Dependent variable	Women	Men	Women	Men
Constant	-0.021	1.042***	0.022	0.100
	(0.388)	(0.396)	(0.148)	(0.262)
Earthquake (cohort of students enrolled at the time of the L'Aquila earthquake, i.e. 2007 cohort)	0.108***	0.043**	-0.003	-0.011
	(0.019)	(0.021)	(0.008)	(0.016)
Aquila (Enrolled at the University of L'Aquila)	0.068**	-0.006	0.007	0.025
	(0.028)	(0.032)	(0.014)	(0.029)
Earthquake*Aquila	-0.119**	-0.007	0.022	0.039
	(0.048)	(0.047)	(0.020)	(0.036)
Controls	Yes	Yes	Yes	Yes
R squared	0.082	0.114	0.041	0.081
Number of observations	1,647	923	1,307	734

Sampling weights used; Standard errors are in brackets

*** statistically significant at 1%

** statistically significant at 5%

* statistically significant at 10%