

# University Spatial Competition for Students: The Italian Case

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## Abstract

The ability to attract students has progressively become a crucial factor for the survival of universities in Southern European countries, due to decreasing governmental funding. Using a competing destinations model for the population of 75 Italian universities in the period 2002-2012, this paper investigates whether they compete for students and how this rivalry has evolved in response to changing enrolment demand. First, we find that there is competition for students among Italian universities. Second, we document that the characteristics of the competition forces changed after the recent financial crisis, with universities located in close proximity to others (i.e., belonging to agglomerated “clusters”) becoming more attractive to students.

**Keywords:** University competition; student attractiveness; higher education market; Italy

**JEL codes:** I21; R23; R12

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## **1. Introduction**

In the wake of cuts to government funding for higher education systems in Southern European countries (EUA, 2013; 2014), collecting financial resources has become a priority when the universities set strategies to ensure the pursuit of their daily core activities and long-term survivability (WANGENGE-OUMA and LANGA, 2010; CHRISTOPHERSON et al., 2014). Thus, in addition to attracting more financial resources by intensifying their interactions with industry (MUSCIO et al., 2013), increasing their attractiveness to students has become a crucial activity for universities (WILKINS et al., 2013; DONINA et al., 2014; TEIXEIRA et al., 2014), especially for institutions relying on tuition fees for a significant portion of their budgets (MALTZ et al., 2007). Furthermore, university competition for students has been significantly exacerbated by the overall decrease of student populations which may result from both demographic issues and economic difficulties (EUA 2013).

The fiercely competitive environment that has consequently emerged among universities has led them to increase their focus on the determinants of their attractiveness to students. It is acknowledged that university characteristics, such as the quality (LONG, 2004; CIRIACI, 2013), the average tuition fee (ALLEN and SHEN, 1999; MITZE et al., 2014), and their image at a national and international level (MARGINSON, 2006), drive students' decisions. However, the context where universities operate inevitably shapes the extent to which such characteristics provide universities with a competitive advantage. While university competition takes primarily place at a local level, whereby universities attempt to attract additional students in competition with nearby competitors, it also extends to more distant universities due to the increased mobility of students in recent decades (HOXBY, 1997; 1998). The spatial dimension is therefore crucial to an in-depth investigation of universities' attractiveness to students in the light of the competitive environment in which they operate (SÀ et al., 2004).

Nevertheless, competition among actors is a dynamic issue, and its temporal aspect cannot be neglected, as the interactions among competitors evolve over time depending on environmental

variations (CHESSON, 2000). Consistent with the resource-advantage theory (HUNT and MORGAN, 1996), university competition is an ongoing process that consists in a continuous struggle among institutions to achieve a comparative advantage in a dynamically changing environment. Notwithstanding that universities' actions are affected by societal and economic changes (LONG, 2013), which inevitably influence the behaviour of both the consumers (students) and providers (universities) in the higher education market, this paper is the first attempt to fully explore the evolution of the competition among universities over time.

This paper analyses the presence of university competition for (first-year, first-time) students using the population of 75 universities in Italy over the period 2002-2012. As an example of a Southern European country, Italy represents an interesting setting to investigate the dynamics of university competition. The Italian higher education market has evolved over the last decade due to the increasing rivalry aroused among universities to attract more students and mitigate reduced government funding (CNVSU, 2011). Students have been regarded as primary resources who directly pay tuition fees and indirectly attract government transfers, which have been increasingly made proportional to the universities' actual expenditures per student enrolled (AGASISTI, 2009; ROSSI, 2010). The competition for additional students has consequently become a crucial activity for the sustainability of the entire Italian university system. Thus, the novelty of our research is twofold: to the best of our knowledge, this is the first paper aimed to study the evolution of university competition over time, and it is the first study that fully investigates the effect of such competition on university attractiveness to students in the Italian higher education market.

We investigate whether universities' ability to attract students is characterised by competition forces by using a competing destinations model, namely a spatial-interaction model accounting for the alternative choices students may employ for spatial decision-making (FOTHERINGHAM et al., 2001). For each university, we compute a *competitors' proximity index*, i.e. the distance-weighted characteristics of attractiveness of all university competitors, to evaluate the competition forces each university is subjected to from all other university destinations (e.g., SÀ

et al., 2004). Relying on the population of Italian universities, we examine the impact of competition forces on the student attraction to Italian universities and the evolution of competition dynamics during the period 2002-2012, with a focus on the effects of the financial crisis.

Controlling for the characteristics of university attractiveness (its image at a local and national level, average fees per student, and amount of teaching resources) and the socio-economic features of both the province (NUTS – 3 region) where each university is located and the student's province of origin (value added per capita, and quality of life), we provide evidence that Italian universities have been subject to enrolment competition over the last decade, thereby influencing their attractiveness to students. Second, by evaluating such competition over time, we document that the recent financial crisis led students and families to be more selective when choosing a university. By isolating the effects of competition forces during the period 2009-2012, we find that universities in close proximity to others, and therefore those more likely to have faced a higher level of competition, have become more attractive.

This paper is organised as follows. Section 2 presents the literature review and develops the testable hypotheses. Section 3 describes the Italian higher education market. Section 4 presents the research design. Section 5 reports the results, and Section 6 concludes the paper.

## **2. Theoretical background and testable hypotheses**

Former literature on university competition defines that there are two types of competition for students among universities, for the *best* and the *most* students (MARGINSON 2006). The former form of competition serves to increase universities' value on the higher education market based on the ability of their students, who are screened using restrictive admission standards (EPPLÉ et al., 2003; GU, 2012). From a hierarchical perspective, top-tier universities (research institutions) ensure their research capacity over time by relying on the most talented students (MARGINSON, 2006; HORTA, 2009). In contrast, competition on quantity (number of students) is

primarily intended to attract additional funds and ensure the survival of the institution over time. In this case, admission standards are quite similar across different institutions within a system (DE FRAJA and IOSSA, 2002) and are not generally restrictive (as in the case of Italy, ROSSI, 2009). Relying on the competition to attract additional students, we develop the following two hypotheses.

Drawing on a customer-input technology perspective (ROTHSCHILD and WHITE, 1995), the reason why universities compete to attract students is twofold. Students are both inputs of educational services and consumers. They provide funds to the universities by directly paying tuition fees and indirectly by leading to the transfer of proportional financial resources from the government. As the primary institutions providing tertiary education and given the need to be financially sustainable, universities consider their attractiveness to students to be a priority in their agenda (GU, 2012).

To increase their attractiveness, universities must address the several determinants that characterise students' decision-making process (for a review, see SÀ et al., 2004; 2006). This strand of the literature highlights that at an *individual* level, parents' education, income and jobs, the student's age and the type of secondary school attended are among the most important individual factors influencing the selection of a specific university. While, at the *university* level, its quality, reputation, and average tuition fee are considered to play a fundamental role when students select their best alternative for post-secondary education. Further, the socio-economic characteristics of the areas in which universities are located crucially contribute to determine the students' decision-making, primarily because of the various employment opportunities and lifestyles that regions might offer (CIRIACI, 2013).

Notwithstanding all of these factors, the attractiveness of universities cannot be assessed in isolation from the local environment where they operate (HOXBY, 1998). Universities might be located in markets with a high level of competitive pressure due to the proximity of their competitors. Their capacity to attract students is strongly influenced by the presence and the activities of neighboring universities (GU, 2012). According to the theory of competitive systems

(CHESSON, 2000), which predicts that the frequency and intensity of competitive interactions among universities are primarily associated with their local spatial interactions, the higher the number of universities in close proximity, the more intense the competition universities are subjected to.

Moreover, the increased geographical integration that has characterised the higher education system over the last two decades progressively led universities to compete for a new pool of geographically dispersed students (MCMILLEN et al., 2007; GHOSH, 2010). Students are currently sorted more thoroughly among different universities based on their specific demands for education. Thus, in addition to their known local competitors, universities might face new potential competitors at the national level, losing their local power (HOXBY, 1998). In other words, competition among universities also exists among institutions that are not in close proximity. In this work, we hypothesise that, *ceteris paribus*, the presence of competition decreases the number of students that each university might attract.

**Hypothesis 1:** *The higher the level of competition a university is subjected to, the lower the number of students that a university will enroll.*

The recent financial crisis influenced both the activity of universities and students' propensity to enrol. On the supply side, universities have been increasingly financially constrained and forced to find new sources of external funding to pursue their daily activities. Consequently, in addition to the intensification of their interactions with the business sector, the scarcity of resources makes increasing student enrolment a priority for academic institutions (ROSSI, 2010; GU, 2012; DONINA et al., 2014; TEIXEIRA et al., 2014). On the demand side, families have experienced significant financial difficulties that inevitably impacted their ability to afford and willingness to pay for students' post-secondary education (LONG, 2013). Reduced income has gradually decreased households' ability to provide youths with a higher level of education, primarily because

of the impossibility to support the costs of education or the expectation of future unemployment (e.g., RIPHAWN, 2002).

In periods of economic difficulty, the fact that higher education serves as a positional good (HIRSCH, 1976), meaning that certain places offer better social status and livelihoods than others, is even more heightened. Specifically, the choice of a university is driven not only by a human capital dimension, where the value of graduating is a function of the intrinsic quality of students, teachers and the services provided by the university, but also by a relative dimension, which implies that students' choice highly depends on the recognition of a university throughout the entire system (MARGINSON 2006). Students therefore become more selective in choosing post-secondary education to increase the expectation of better opportunities in the labour market and potential to increase their social status in the future. Once families decide to provide post-secondary education to their children, the choice of a university is more selective due to the greater financial constraints they face, with the primary aim of increasing the relative advantage their children will enjoy in the future. Today, families have more concrete tools to operate more selective choices due to a faster and greater access to information (e.g., internet) facilitating information searching and decision making.

Consequently, during periods of higher uncertainty, the choice of a post-secondary education may be affected by the fact that certain universities have operated in more competitive environments. To remain competitive, the racing behaviour of competing universities leads them to develop and increase valuable services and facilities for their "stakeholders" (PORTER and KRAMER, 2002). The competitors continuously present a moving target for the other universities belonging to the same competitive environment, promoting a "*Red Queen effect*"- i.e., a university must run simply to maintain its position (e.g., BARNETT, 1997). Universities that are subject to higher levels of competition become more attractive during periods of economic/financial crisis, as students consider them to be more valuable and less risky options in the long run. Thus, while competition might decrease the number of students that rival universities can enrol in a first stage, it

contributes to create a more competitive framework wherein rival universities become more attractive for students afterwards.

**Hypothesis 2:** *Since the financial crisis, the negative effect of university competition on attractiveness to students is expected to decrease.*

### **3. The evolution of the Italian higher education market for students**

In Italy, the implementation of the two-level qualification system (bachelor's and master's degrees) occurred at the beginning of the twenty-first century, with Law no. 30, February 10, 2000 (*“Legge Quadro in materia di Riordino dei Cicli dell'Istruzione”*). This reform represented an important change in the management of universities' strategic activities, thereby affecting how universities compete for students. Indeed, at the bachelor's degree level, competition primarily arises among universities to attract additional students, while at the master's degree level, academic institutions are more focused on pursuing a higher level of quality and consequently set admissions standards to master's students.

Following this reform, the Italian framework underwent further important transformations affecting both the market structure of the university system and the demand for post-secondary education, which makes of Italy an interesting setting to empirically test our predictions. First, the system experienced declining enrolment, which required universities to formulate new strategies to foster their attractiveness to students. The total number of enrolled students in 2012 was 13% lower than that in 2002, while the higher education system evolved with the creation of 3 new traditional universities and 11 distance-learning institutions. As a direct consequence, the number of students that universities could attract decreased over the last decade. The universities' need to attract students was further exacerbated by repeated reductions in the percentage of state-allocated funds – *Fondo di Finanziamento Ordinario* (FFO) – in the universities' total income (CNVSU 2011). Moreover, the *Ministry of University and Research* (MIUR) has increasingly made the allocation of



governmental funds (FFO) proportional to the universities' actual expenditures per student enrolled (ROSSI 2010).<sup>1</sup> The importance of students as crucial factors determining universities' total incomes is also related to the fact that in the period 2001-2009,<sup>2</sup> the weight of tuition fees in the universities' total budgets increased by 20% (CNVSU 2011).

Second, the higher education market has changed; the rivalry among local universities is now supplemented by competition from numerous academic institutions at the national level. Universities have faced a new pool of potential students that has become increasingly geographically dispersed. Further, the shares of students enrolled originating from different provinces has constantly increased over time. Specifically, the concentration of student's provinces of residence decreased by nearly 10% at the national level during the period 2002-2012.

Lastly, it is noteworthy to highlight that in Italy the attractiveness to students is characterized by a peculiarity of the higher education system, that of the *legal value of a degree*. While the government developed incentives to increase the average quality of the system, the legal value of a degree limited students in selecting the highest quality universities (DONINA et al., 2014). The degrees delivered by academic institutions are considered equivalent by the law, no matter if the different institutions have different reputation. Hence, these patterns could be responsible of a distortion in the students' decision making process, where the quality of a university does not represent a main determinant in the choice.

## 4. Research design

### 4.1. The competing destinations model

To analyse the effects of university competition on universities' attractiveness to students and its evolution over time, we estimate a spatial-interaction model in the form of a gravity equation of

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<sup>1</sup> In 2013, 13.5% (K€ 819,000) of total state funding was competitively allocated, of which 66% relates to the education process.

<sup>2</sup> We rely on the most recent data provided by the Comitato nazionale per la valutazione del sistema universitario (CNVSU).

student flows. In other words, we model the universities' attractiveness to inter-provincial students as the forces of attraction/repulsion that arise in the trade between a pair of countries or regions (e.g., LAFOURCADE and PALUZIE, 2011). To address student origin, we rely on the province as the most detailed level of analysis. Equation (1) models student flows as a positive function of the attractive mass of the province of origin and the university of destination and a negative function of the distance between them. Specifically:

$$(1) \quad F_{i,j,t} = O_{(Prov_{i,t})} D_{(Univ_{j,t};Prov_{j,t})} f(d_{i,j})$$

where  $F_{i,j,t}$  is the flow of students from province  $i$  to university  $j$  in year  $t$ ;  $O_{(Prov_{i,t})}$  represents the socio-economic characteristics (the mass) of province  $i$  that influence students' departure from it (the population of university students, value added per capita, average quality of life of persons living there in year  $t$ );  $D_{j,t}$  represents the mass of university  $j$ , depending on both the province of destination features ( $Prov_{j,t}$ ) and the university's attractiveness to students ( $Univ_{j,t}$ ) in year  $t$ ; the latter is a multifactorial phenomenon, measured here as the number of registered students, the number of teaching resources in classes, the image of the university at a local and national level, and the average tuition fee students must pay for post-secondary education at each university in year  $t$ . As in the case of the province of origin, we control for the value added per capita and the quality of life for the province of destination. Finally,  $f(d_{i,j})$  is a decay function of the Euclidean distance between province  $i$  and university  $j$  for each flow of students. All variables are defined in detail in sub-section 4.4.

The model described in equation (1) assumes that individuals have a flat information processing strategy, namely they are unable to make decisions from restricted choice sets rather than the complete set. However, we acknowledge that a hierarchical information processing system is in place during the students' decision-making process (MOOGAN et al., 1999; DAWES and

BROWN, 2005). Students are acknowledged to ex-ante select spatial clusters of universities and gradually limit their choice to a specific set of destinations (e.g., SÀ et al., 2004). To consider how students process spatial information, we employ a competing destinations model (e.g., FOTHERINGHAM, 1983; 1985; 2001) which allows to identify the presence of competition or agglomeration forces among universities. Following SÀ et al. (2004), equation (1) is therefore calibrated with the inclusion of a *Competitors' proximity index* ( $CPI_{j,t}$ ) that accounts for the extent to which a university is distant, both in physical (km) and operative terms, from its competitors:

$$(2) \quad F_{i,j,t} = O_{(Prov_{i,t})} D_{(Univ_{j,t}; CPI_{j,t}; Prov_{j,t})} f(d_{i,j})$$

where:

$$(3) \quad CPI_{j,t} = \sum_{\substack{m=1 \\ m \neq j}}^N (Univ_{m,t}) f(d_{j,m})$$

$CPI_{j,t}$  is the *Competitor's proximity index* for university  $j$  in year  $t$ ;  $N$  stands for all other universities  $m$  in the higher education system except for university  $j$ ;  $(Univ_{m,t})$  reflects the characteristics of students' attraction to the university destination  $m$ ;  $f(d_{j,m})$  is a decay function of the Euclidean distance between university  $j$  and university  $m$ . As highlighted by Fotheringham et al. (2001), the sign of the estimated *Competitors' proximity parameter* provides important information on the destinations' interactions. In case that the estimated coefficient is negative, competition forces among universities exist, while agglomeration effects are present when it is positive.

As educational programmes change from university to university influencing, *ceteris paribus*, the distribution of students among various universities (SEEBER et al., 2012), we employ a more detailed *Competitor's proximity index* to corroborate the estimations. Based on the assumption that the more specialised the disciplines of institutions are (niche-seeking strategy), the lower the level of competition to which they are subjected (ROSSI 2009; 2010), we weight the

*Competitors' proximity index* with respect to the department<sup>3</sup> overlap that exists between different universities. We consider the department as the level of analysis to make the investigation clearer and objective due to the presence of a large variety of degree programmes in Italy, each of which is characterised by its own peculiarities<sup>4</sup>. Our rationale is that two or more universities can be geographically proximate but may not compete against one another because they have different departments. The *Competitors' proximity index* is corrected for the set of feasible choices students face given the universities' department types. For each pair of universities, we first identify the departments in common as in equation (4). Specifically,  $DEP_{OV_{i-j}}$  is the department overlap between university  $i$  and university  $j$ , where  $DEP_i$  stand for the departments of university  $i$  and  $DEP_j$  those in place at university  $j$ :

$$(4) \quad DEP_{OV_{i-j}} = (DEP_i \cap DEP_j)$$

Second, we compute the overlapping index between universities  $i$  and  $j$  by multiplying the relative shares of students enrolled in the departments of university  $i$  that also exist at university  $j$ :

$$(5) \quad IDEP_{OV_{i-j}} = \left( \frac{\sum StudUniv_i \in DEP_{OV_{i-j}}}{\sum StudUniv_i} \right) X \left( \frac{\sum StudUniv_j \in DEP_{OV_{i-j}}}{\sum StudUniv_j} \right)$$

As an example, we consider two universities in the North of Italy, the University of Bergamo and the Polytechnic University of Milan; they both offer Engineering. However, Law, Foreign Languages, Literature and Communication Studies, Human and Social Sciences, and Letters and Philosophy are only offered at Bergamo, while the Polytechnic University of Milan offers Architecture and Design. The first ratio is equal to 0.14, as the number of students that Bergamo

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<sup>3</sup> Law 240/2010 profoundly affected the structure of Italian universities. A structure composed by two internal organizational units, namely the faculties and the departments, were replaced by a single internal scientific structure with new roles: the departments (DONINA et al., 2014).

<sup>4</sup> Italian universities' freedom to establish courses of study increased after 1993, while highly restrictive quality standards for the creation of new programmes were implemented in 2007 (Ministerial Decree 554/2007).

enrols in Engineering (which is also offered by Milan) (344) over the total number of student flows (2,449). Similarly, the second ratio is equal to 0.67 after excluding the students belonging to the departments of Architecture and Design (4,415) in Milan. The product of these two ratios ( $DEP_{OV_{m-j,t}}$ ) is used to weight the *Competitors' proximity index* as follows:

$$(6) \quad CPI_{j,t} = \sum_{\substack{m=1 \\ m \neq j}}^N (Univ_{m,t} DEP_{OV_{m-j,t}}) f(d_{j,m})$$

#### 4.2. Econometric models

To linearise equation (2), we employ *Poisson pseudo maximum likelihood (PPML)* technique<sup>5</sup> developed by SILVA and TENREYRO (2006)). As highlighted by MIGUÉLEZ and MORENO (2014), this methodology makes it possible to address the problems associated with the log-transformation of the gravity model when using an Ordinary Least Squares model. An OLS approach is indeed inappropriate because: 1) the error terms might be heteroskedastic, thereby violating the assumption that the  $\ln(\varepsilon_{i,j})$  are not correlated with the covariates, and 2) the presence of zero values on the flows of students from provinces to universities requires the use of specific procedures (e.g., dropping observations or using  $\ln(1 + F_{i,j})$ ), which generally produce inconsistent estimates of the parameters of interest. Equation (2) is therefore linearised as follows:

$$F_{i,j,t} = \underbrace{\sum_{k=1}^K \alpha_{k,t} \ln Pr ov_{k,i,t}}_{O_{(Prov_{i,t})}} + \underbrace{\sum_{p=1}^P \beta_{p,t} \ln Univ_{p,j,t} + \sum_{l=1}^L \beta_{l,t} \ln Pr ov_{l,j,t}}_{O_{(Prov_{i,t})} D_{(Univ_{j,t}, CPI_{j,t}, Prov_{j,t})}} + \underbrace{\ln f(d_{i,j})}_{f(d_{i,j})}$$

where  $K$  is the number of characteristics observed at the origin (province level), while  $P$  denotes the number of characteristics of the university of destination and  $L$  for those of the province of

<sup>5</sup> The iteratively reweighted least squares (IRLS) algorithm is used to maximize the objective function in the PPML model.

destination (university and province level). The model includes fixed effects for provinces and years to capture unobservable factors affecting students' flows across areas and over time.

To evaluate whether the competition forces characterising the rivalry among universities have remained unchanged in recent years, we further analyse the impact of the financial/economic crisis on the universities attractiveness to students. In practice, because the consequences of the financial crisis cannot be readily identified with respect to the time of impact, we did not arbitrarily select a break date, but we assess the stability of the *Competitors' proximity index* coefficient, adapting the structural break test described in ANDREWS (1993) to the PPML Model. We conduct a Chow breakpoint test over a range of dates (from 2002 to 2012) and calculate the F-statistic from each Chow breakpoint test. The most likely date for a breakpoint is the date that produces the highest F-statistic. The sample was "trimmed" such that our tests were conducted over the interior 70% of the sample period 2002-2012. The test reveals that a structural break occurred in 2009. We therefore create a step dummy variable equal to 1 for the years after 2008 (*Financial crisis*). Additionally, to isolate the marginal effects of university competition after the structural change, we interact the *Competitors' proximity index* with the dummy *Financial crisis*.

### 4.3.Data and sources

We investigate university competition considering the population of Italian universities during the period 2002-2012<sup>6</sup>. After excluding 11 long-distance-learning institutions, 6 doctoral universities (e.g., IMT Institute for Advanced Studies Lucca, Sant'Anna School of Advanced Studies) and 3 universities for foreigners (University of Foreigners of Perugia, of Reggio Calabria, and of Siena), as these institutions fill specific niches in the higher education market<sup>7</sup>, our hypotheses are tested considering 75 universities. Figure 1 depicts the geographical distributions of

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<sup>6</sup> Three universities were established during the period of investigation: *Kore - University of Enna* (2004); *Bra - University of Gastronomic Sciences* (2004); *European University of Rome* (2005).

<sup>7</sup> The *Rome – Link Campus University* is also excluded because it was accredited as a university in the second half of 2011 (decree no. 374 of September 21, 2011).

universities in 2012 using the coordinates of the university's legal place of residence<sup>8</sup>. As far as Italy is acknowledged to be characterised by an important social-economic divide we rely on the ISTAT (*The Italian National Institute of Statistics*) classification of macro-areas (North, Centre and South of Italy) to highlight the regions where universities are located. 30 universities are established in the North (darker grey areas), 19 in the Centre (light grey areas), and there are 26 academic institutions in the South, including the Islands (white areas).

[FIGURE 1]

Data on Italian universities are gathered from the online database made available by the MIUR. It provides specific data for each university over time: students, professors, technical staff and courses. At the province level, we collect data using the statistics provided by ISTAT and the main Italian financial newspaper, *Il Sole 24 Ore*.

#### **4.4. Variables description**

This section presents the variables employed in the empirical analysis. We first list the dependent and independent variables of our model and the distance-decay parameter. Second, the measures impacting student mobility are described for the province of origin, the university and the province of destination.

*Flows of students:* As a *dependent variable*, we consider the flows of first-year enrolled students for the bachelor's and 5-year degree ("*Ciclo Unico*") level from all Italian provinces to each university. International students are excluded from our analysis, as our aim is to assess the spatial dimension of university competition with respect to national resources.

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<sup>8</sup> In Italy, the average distance among the campuses of a given university is less than 6 km.

*Competitors' proximity index:* The parameter (*independent variable*) included in equation (3) for the universities' attractiveness to students ( $Univ_{m,t}$ ) relies on the size of each university, measured as the total number of registered students (bachelor's and master's) (SÀ et al., 2004). This measure represents a catchall variable for all the types of services (HARMAN, 2000), greater diversity in faculties (BONACCORSI et al., 2006), networks and national and international visibility (LEPORI et al., 2013) that larger universities are supposed to offer their students. Large universities are also more equipped to attract EU-funding projects (GEUNA, 1998), which contributes to improving their reputation in the eyes of potential students and external stakeholders.

*Distance between the province of origin and the university of destination:* The distance represents a physical barrier to student mobility with respect to new university destinations (e.g., GIBBONS and VIGNOLES, 2012). Here, the distance-decay parameter is measured by considering the legal residence of the university (destination) and the capital of each province (origin) for the percentage of population of students living in the capital city. In contrast, for the share of the student population living in intrazonal areas, we calculate the university-province distance by relying on the formula used by RIETVELD and BRUINSMA (1998)<sup>9</sup>, where provinces are assumed to be circular and all areas homogeneously intensively used. As no reliable data on travel time can be obtained for different modes of transportation (e.g., bicycles, buses, cars, etc.) and due to the high correlation between travel time and road distance (RIETVELD et al., 1999), we refer to road distances. The functional form considered is an inverse of the distance  $d_{i,j}$ .<sup>10</sup> The same decay function is considered when computing the distance among universities in equation (6).

#### 4.4.1. The characteristics of the university of destination

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<sup>9</sup>  $d_{intra-regiona} = \frac{(\pi-1)}{\pi} \left( \sqrt{\frac{s_p}{\pi}} \right)$

Where  $s_p$  = area of province p, measured in square metres.

<sup>10</sup> The results are consistent when we consider a negative exponential distance decay function.



*University size:* As in any typical gravity model, we capture the effects of destination size, measured by the total number of registered students in each university.

*University teaching resources:* Students consider the overall quality of a university in their decision-making process, primarily with respect to the resources available for teaching (DREWES and MICHAEL, 2006). We control for university teaching resources using the faculty-student ratio, measured as the number of professors per student. This indicator represents a good proxy for teaching resources in general (e.g., HUANG, 2012) and captures the opportunities for student learning in classes. An increase in the ratio indicates an increase in university inputs, in the quality of the academic programme and, more generally, of institutions, which is one of the determinants of the students' university decisions (TAVARES and CARDOSO, 2013).

*University's average tuition fee:* The demand for higher education varies with the costs of schooling (e.g., HÜBNER, 2012; WILKINS et al., 2013). We consider the average tuition fee that students must pay to attend courses at a specific university. To account for the large differences across Italian provinces, primarily between those located in the South and in the North, we use the ratio of the total contribution of bachelor's & master's students to the total number of students attending university  $i$ , scaled by the value added per capita of the student's province of origin.<sup>11</sup>

*University legitimacy:* The students' selection of a university might refer to the evaluation of the image of a university at the national level, as the legitimacy of its actions— i.e., that they are appropriate and acceptable to society (SUCHMAN, 1995). Institutions are known to develop multiple interorganisational relationships to increase their legitimacy (see BARRINGER and HARRISON, 2000), which, in the higher education context, could enhance the value of an academic degree in the job market. Employability is one of the primary reasons to attend higher education. We measure the legitimacy of a university by relying on its public endorsement in

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<sup>11</sup> GDP per capita is collected at the regional level in the period 2002-2012 using Eurostat data.

articles in national, regional and local newspapers (DESAI, 2008). The number of articles pertaining to each university for each year is collected using the Factiva news media database<sup>12</sup>.

#### **4.4.2. The characteristics of the province of origin and the province of destination**

*Size of the province of origin:* The size of the origin is included as one of the two attractive masses in the gravity model. It represents the population of university students located in the province of origin (*Student population*). In particular, we consider the total number of first-year, first-time-enrolled students from each province of origin.

*Value added per capita:* The value added per capita of both the province of origin and the destination province are included to capture the effects of economic disparities between areas (e.g., GLAESER, 2008).<sup>13</sup> The effects of different economic conditions, such as wage levels and the employment rate, influence the mobility of students to and from a specific area. ISTAT provides data on the per capita value added for each province until 2008 (*Sistema di Indicatori Territoriali*). We use Eurostat regional data to estimate the remaining values and complete our panel dataset.

*Quality of life:* As students' decision to move may be driven not only by economic reasons but also by consumer amenities such as theatres, museums and higher levels of tolerance (FLORIDA, 2002), we consider the annual position of each province in the quality of life ranking produced by the Italian financial newspaper *Il Sole 24 Ore* as in CIRIACI (2013). Both the province of origin and that of destination have been scored as (*Quality of life ranking*)<sup>1</sup>. We expect that the higher the quality of life in the province of destination, the greater the attractiveness of a university located in that province. Conversely, when the province of origin is characterised by a high level of quality,

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<sup>12</sup> See CATTANEO et al. 2014 for a description of the data collection procedure.

<sup>13</sup> Despite the creation of three new provinces (Fermo, Monza-Brianza, Barletta-Andria-Trani) in 2004, which became active in 2009, data on their value added per capita are aggregated at the level of the former provinces (<http://dati.italiainformazioni.it/i-dati/per-territorio.aspx>). In particular, the data on the province of Ascoli-Piceno include those of the new province of Fermo, the data on the province of Milan include those of Monza-Brianza and, similarly, the province of Bari aggregates the data of Barletta-Andria-Trani. As the student flows data provided by the Ministry of University and Research are disaggregated among these new provinces beginning in the 2004-2005 academic year, we re-distributed the value added per capita between the new and original provinces according to their level of population (Geo Demo Istat). This is intended to increase the accuracy of our analysis.

this is, all other things being equal, reduces the propensity of student to migrate to attend university in another province.

In the Appendix, we report the correlation matrix for all variables.

#### **4.5.Descriptive statistics**

Table 1 reports the descriptive statistics at the university level in the period 2002-2012, disaggregating the data by macro-regions due to the regional economic divide that has thus far characterised Italy (VAONA and ASCARI, 2010): the North, the Centre and the South (including Islands).

[TABLE 1]

An overall decrease in the university student flows was observed in each macro-region over the last decade. Southern academic institutions suffered to a greater extent (-22% South vs. -18% in the Centre and -8% in the North), as students have higher expectations of obtaining better job opportunities and expect a lower likelihood of being unemployed after graduation in the Northern regions (BACCI et al., 2008). The scenario is somewhat different when considering the total number of students registered in the system. Universities located in the central regions were affected by a larger loss of students (-7%) than that observed in the South (-4%). Nevertheless, Northern universities did not experience a loss of students because of the more pronounced interregional migration of students towards Northern regions (CIRIACI, 2013). The total number of professors grew by 8% in the Centre, with a consequent increase in the teaching resources available to students attending classes there. In contrast, Southern universities reported a loss of teaching staff (-5%), while a small decrease occurred in the North (-1%). On average, the cost to attend post-secondary education increased throughout the Italian peninsula by nearly 50% in each macro-area. Students seeking to attend a university in the North were required to spend one thousand euros more

than those in the South in 2012, despite the smaller difference that characterised the system in 2002 (a six hundreds euros gap between the North and the South).<sup>14</sup> In terms of national recognition, universities increasingly focused on their images. The annual number of press citations received from the local, national and international print media increased substantially over the last decade (by more than 200%). Northern universities were generally more frequently cited (704 press citations in 2012), especially in comparison to the universities located in the South (259 press citations in 2012). Furthermore, Table 1 shows that our parameter for competitors' proximity is constant for Northern universities, while it decreased by 5% in the Centre. However, the index indicated that universities in the South suffered to a lesser extent from competition with universities in close proximity over time (-10%).

[FIGURE 2]

To understand how university competition is distributed at the national level, Figure 2 plots the average value of the log of the *Competitors' proximity index* over the last decade. Universities in the areas of Milan, Naples and Rome exhibit the highest levels of competition. In contrast, the competition among academic institutions is quite limited in the South and the Islands, and the latter are also characterised by geographic barriers.

Finally, we plot the log of the average competition among universities against log university size, measured by the average number of students in the period 2002-2012<sup>15</sup>. Circles represent universities in the North, triangles stand for those located in the Centre, while crosses indicate Southern universities. Three groups of universities are identifiable: 1) small universities, facing different levels of competition and medium-large sized universities facing 2) low and 3) high levels of competition. Among small universities, those in the Centre, mainly located in the area in and

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<sup>14</sup> In regression analyses we rely on the ratio between universities' tuition fees and the GDP of the province of origin of students in order to consider the different market power of families across different areas in Italy.

<sup>15</sup> We plot 74 universities excluding the *BRA - University of Gastronomic Sciences* (log of competition = 5.26; log of size = 8.92) to make the plot more readable.

around Rome, were subject to greater competition, while those in the North tend to cover specific geographical markets with no other universities in close proximity, as in the case of the Valle D'Aosta University. The largest fraction of medium- and large-sized universities located in southern Italy is subject to low levels of competition. The only exception is those operating in the Naples area, which exhibits a high level of competition (e.g., Orientale University, Second University). On average, competition affected the medium and large universities located in the North to a greater extent than those in the Centre, where university markets are characterised by the same level of competition irrespective of the universities' size.

[FIGURE 3]

## 5. Results

Table 2 reports the estimates of our competition destinations model for the population of Italian universities over the period 2002-2012. Model 1 tests Hypothesis 1 and presents the results of estimations performed using the entire population of universities. The coefficient of the *Competitors' proximity index* is negative and highly significant at the 1% level. Consistent with the literature on competition destinations models, this reveals the presence of strong competition forces among universities, which negatively affect the number of students that universities are consequently able to enrol. These findings are consistent with our expectations.

[TABLE 2]

Regarding the other variables included in the model, all those reporting significant coefficients have the predicted signs. The variables capturing the emission and the absorption capacity of origins and destinations (*Student population*, *University size*) are positive and highly significant. Accordingly, the value added per capita of the province in which the university of

destination is located is positive and highly significant. The higher the expectation of students' future success in the labour market in more advanced provincial economies, the higher the attractiveness of the universities located in those areas. Predictably, the greater the distance between the province of origin and a university, the lower the likelihood that students will choose that institution. This might be due to both social factors, such as the unfamiliarity of students with the culture of more distant places, and economic factors, such as the higher costs students incur in terms of housing and food when far from home (DESJARDINS et al., 1999). Our findings also suggest that having a larger number of faculty members per student leads to greater learning opportunities for students, which are accorded substantial weight in students' decision-making processes. After scaling universities' fees with respect to the value added per capita of the students' province of origin, direct investment in higher education does not seem to affect the universities' attractiveness to students.

In Model 2, presented in Table 2, we repeat the analysis but consider the department overlap in the *Competitors' proximity index*. The empirical evidence again demonstrates the presence of competition for students among Italian universities in the period 2002-2012. While the index is still significant at the 1% level, the magnitude of the coefficient decreases relative to that observed in Model 1, from 0.242 to 0.087. With respect to the control variables, all coefficients take the expected signs, and the quality of life in the destination province becomes significant at the 5% level.

Table 3 reports the results of the PPML regression that includes the structural break in 2009 to evaluate whether the effects of competition have changed since the financial crisis (Hypothesis 2). Our findings indicate that the period after 2009 is negatively related to the overall attractiveness of universities to students throughout the higher education system. This corroborates the evidence that enrolments have significantly decreased following with the financial/economic crisis. More important, the interaction term (*Competitors' proximity index X Financial crisis*) is positive and highly significant, suggesting that agglomeration forces have begun to characterise the Italian

higher education system since 2009. Although the coefficient of the *Competitors' proximity index* still suggests that, on average, competition forces are present among universities, a dynamic transformation of their attractiveness to students has occurred. These results therefore confirm Hypothesis 2.

[TABLE 3]

Beginning in 2009, when the effects of the recession had begun to influence both the demand for and supply of higher education (LONG 2013), a selective loss of students occurred. The decrease of student enrolments did not affect the university system homogeneously. Universities that had already operated in more competitive environments were generally more prepared to strategically react than others, and consequently experienced the smallest declines in enrolment rates following the crisis. In particular, observing the change in the market share of enrolled students between 2007 and 2012, universities in close proximity to others performed better, holding all other factors determining attractiveness equal. In the areas characterised by higher levels of competition (Milan, Rome and Naples) universities increased their attractiveness over the last 4 years despite the ongoing decline in student enrolment at a system level. For example, considering the universities within a radius of 50 km from the centre of Milan, they, on average, increased their market share (e.g., Polytechnic University of Milan +0.5%, University of Milan +0.5%, Catholic University of the Sacred Heart +0.3%, University of Milan Bicocca +0.3%, University of Bergamo +0.1%). Conversely, the greatest decrease in market share occurred among those universities operating under the least competition, which are primarily located in the South (e.g., University of Palermo -1.2%, University of Lecce -0.7%, University of Catania -0.6%).

We argue that during periods characterised by lower levels of demand for higher education, families and students electing to spend on post-secondary education are more selective in choosing strategic university poles. The overall decline in well-being and economic stability associated with

the decrease in incomes and, in some cases, the loss of employment leads families and students to make a more accurate selection. To the extent that making an investment in education has become more demanding, universities located in more competitive environments become more attractive being more equipped to offer greater income and employment opportunities to students after graduation.

## **6. Robustness checks**

In this section, we report the results of additional analyses performed to check the robustness of our results. First, due to characteristics that differentiate private universities from public ones (LACH and SCHANKERMAN, 2008; MINELLI et al., 2012), such as the ability to select students, their greater freedom in selecting the tuition fees per student and their higher average faculty salaries, we perform a PPML regression when excluding such universities from our investigation. The results suggest that competition forces characterised public universities' attractiveness during the period 2002-2012 (Model 1, Table 4).

[TABLE 4]

Second, we exclude the courses offered by universities characterised by a limited number of available places (e.g., Architecture; Medicine and Surgery; and Veterinary Medicine). Although the presence of such courses is only limited to certain departments and is recognised to be a marginal phenomenon in Italy (ROSSI 2009), the dynamics underlining the universities' attractiveness to students might be different in these cases. Such departments impose different admissions standards. Although all Italian faculties were required by law (Ministerial Decree 270/2004 - art.6) to introduce entry tests with the sole objective of providing students with specific indications of abilities without invalidating their admission, courses with a limited number of available places require students to pass certain selective admission tests prior to enrolment. While the former



permits admission regardless of the test score, the failure to achieve the score threshold in selective courses revokes student admission. Model 2, presented in Table 4, indicates that the coefficient of the *Competitors' proximity index* is negative and highly significant after excluding these types of courses. The only difference is that the average fee per student turns becomes significant. After excluding selective programmes, which account for small share of student flows, students are significantly attracted by universities with higher tuition fees. The cost to attend a university is perceived as a proxy for the quality of a university's services.

## 7. Conclusion

This paper examined the presence of university competition for students over the period 2002-2012 in the Italian higher education system. By using a competing destinations model, we first provided empirical evidence that universities have competed with one another to attract a larger number of students over the last decade. Our results are robust to different model specifications, namely those addressing the overlap of departments across different institutions, excluding private universities and limiting the analysis to non-selective courses. Second, our dynamic perspective allowed us to investigate the evolution of university competition over time. We found significant evidence that the recent financial crisis affected the students and families' selection of a university. Universities in close proximity to others have been considered more attractive and are responsible for the development of clusters of higher education.

This paper highlights how university competition for students might impact the universities' attractiveness to students when the market for students changes due to external conditions. Specifically, in periods of high demand for post-secondary education, the presence of competitors in close proximity decreases the number of potential students that each university can enrol. However, the competitive environment in which a university operates can positively influence the number of students it might enrol during periods with scarce demand for higher education. As the

choice of a university is guided by an investment decision, after the recent financial crisis it has become increasingly important to not only to attend university but also to attend a university operating in a competitive environment, where the institution's racing behaviour is expected to increase its quality over time.

The results of our paper have important implications for understandings of the migration of highly skilled human capital and its associated positive externalities. To the extent that university competition might be responsible for the attraction of students towards specific areas, this might affect, *ceteris paribus*, the distribution of human capital in different regions, thereby affecting their growth and competitiveness over time. A more competitive environment might lead universities to offer students better services, characterised by higher quality and additional interactions with industry during their educational careers. Departing from recent contributions seeking to study the evolving role of universities as “catalysts” for local development (e.g., AUDRETSCH, 2013) and the different distribution of human skills in affecting economic activities (BOSCHMA et al., 2013), addressing the economic impact of the competition among universities might be a promising avenue for future research.

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**Table 1. Descriptive statistics by Italian macro-region**

| <i>Geographic areas and university characteristics</i> |      | 2002      | 2012      | $\Delta\%$<br>(2002-20012) |
|--|------|-----------|-----------|----------------------------|
| <i>North</i>   |      |           |           |                            |
| Flows of first-year, first-time enrolled students      | Tot. | 116,716   | 107,800   | -7.64%                     |
| No. of students (BA & Masters)                         | Tot. | 691,749   | 690,519   | -0.18%                     |
| No. of professors                                      | Tot. | 23,350    | 23,131    | -0.94%                     |
| University's average tuition fee                       | Avg. | 1,085.43  | 1,624.86  | 49.70%                     |
| University legitimacy                                  | Avg. | 214.93    | 703.93    | 227.52%                    |
| Competitors' proximity index                           | Avg. | 21,955.35 | 21,606.36 | -1.59%                     |
| Obs.   |      | 29        | 30        |                            |
| <i>Centre</i>  |      |           |           |                            |
| Flows of first-year, first-time enrolled students      | Tot. | 74,673    | 61,268    | -17.95%                    |
| No. of students (BA & Masters)                         | Tot. | 456,103   | 424,484   | -6.93%                     |
| No. of professors                                      | Tot. | 13,698    | 14,836    | 8.31%                      |
| University's average tuition fee                       | Avg. | 750.93    | 1,063.28  | 41.60%                     |
| University legitimacy                                  | Avg. | 116.55    | 494.68    | 324.44%                    |
| Competitors' proximity index                           | Avg. | 24,823.08 | 23,694.53 | -4.55%                     |
| Obs.   |      | 18        | 19        |                            |
| <i>South</i>   |      |           |           |                            |
| Flows of first-year, first-time enrolled students      | Tot. | 106,356   | 83,479    | -21.51%                    |
| No. of students (BA & Masters)                         | Tot. | 633,801   | 609,522   | -3.83%                     |
| No. of professors                                      | Tot. | 17,430    | 16,618    | -4.66%                     |
| University's average tuition fee                       | Avg. | 433.12    | 670.99    | 54.92%                     |
| University legitimacy                                  | Avg. | 60.09     | 258.92    | 330.89%                    |
| Competitors' proximity index                           | Avg. | 38,028.78 | 34,181.25 | -10.12%                    |
| Obs.   |      | 25        | 26        |                            |

**Table 2. University competition for students in Italy**

This table reports the results of the PPML model estimated to examine the presence of competitive forces among Italian universities. The sample consists of 75 universities observed during the period 2002-2012. Model (1) considers all student flows towards Italian universities; Model (2) adjusts the *Competitors' proximity index* for the overlap in the universities' departments. The number of observations changes with respect to the student flows excluded by the different models. Each regression controls for time and province fixed effects. Standard errors are reported in brackets. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

|  | (1)                  | (2)                  |
|--|----------------------|----------------------|
| Distance (province $j$ - university $i$ )                    | -1.903***<br>(0.058) | -1.511***<br>(0.064) |
| <b><i>Origin (Province features)</i></b>                     |                      |                      |
| Quality of life ranking                                      | 0.006<br>(0.008)     | -0.012<br>(0.007)    |
| Value added per capita                                       | -0.886***<br>(0.136) | -0.453**<br>(0.192)  |
| Student population   | 0.975***<br>(0.041)  | 0.435***<br>(0.054)  |
| <b><i>Destination (Province and University features)</i></b> |                      |                      |
| Quality of life ranking                                      | 0.017<br>(0.034)     | 0.090**<br>(0.045)   |
| Value added per capita                                       | 1.789***<br>(0.219)  | 1.553***<br>(0.235)  |
| University size  | 0.827***<br>(0.044)  | 0.655***<br>(0.044)  |
| University teaching resources                                | 0.162**<br>(0.079)   | 0.125**<br>(0.055)   |
| University legitimacy  | 0.022<br>(0.025)     | 0.033<br>(0.027)     |
| University's average tuition fee                             | 0.527<br>(0.663)     | 0.503<br>(0.522)     |
| Competitors' proximity index                                 | -0.242***<br>(0.060) | -0.087***<br>(0.028) |
| Constant   | -9.353***<br>(1.723) | -8.853***<br>(2.541) |
| Observations   | 84,519               | 84,519               |
| R-squared  | 0.887                | 0.517                |

**Table 3. The changing impact of university competition over time**

This table reports the results of the PPML model estimated to examine the presence of competitive forces among Italian universities. The sample consists of 75 universities observed during the period 2002-2012. The analysis replaces the analysis of Model 1 in Table 2 in examining the structural break identified using the Chow breakpoint test. The interaction term between the *Competitors' proximity index* and the structural break in 2009 is also included. Each regression controls for time and province fixed effects. Standard errors are reported in brackets. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

|   |                       |
|---|-----------------------|
| Distance (province $j$ - university $i$ )             | -1.904***<br>(0.058)  |
| <b>Origin (Province features)</b>                     |                       |
| Quality of life ranking                               | 0.022<br>(0.034)      |
| Value added per capita                                | -0.724***<br>(0.117)  |
| Student population                                    | 0.931***<br>(0.047)   |
| <b>Destination (Province and University features)</b> |                       |
| Quality of life ranking                               | 0.007<br>(0.008)      |
| Value added per capita                                | 1.787***<br>(0.220)   |
| University size                                       | 0.827***<br>(0.044)   |
| University teaching resources                         | 0.162**<br>(0.079)    |
| University legitimacy                                 | 0.021<br>(0.025)      |
| University's average tuition fee                      | 0.512<br>(0.663)      |
| Competitors' proximity index                          | -0.258***<br>(0.060)  |
| Financial crisis                                      | -0.442***<br>(0.146)  |
| Competitors' proximity index X Financial crisis       | 0.046***<br>(0.010)   |
| Constant  | -10.452***<br>(1.842) |
| Observations  | 84,519                |
| R-squared   | 0.887                 |

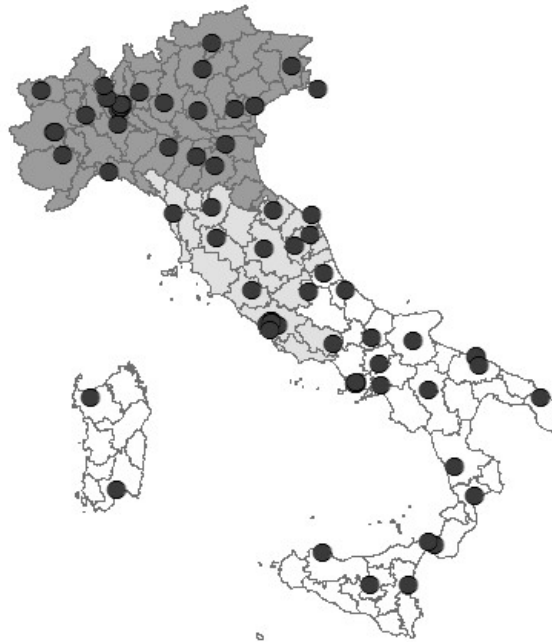
#### Table 4. Robustness checks

This table reports the results of the PPML gravity model estimated to examine the presence of competitive forces among Italian universities. The sample consists of 75 universities observed during the period 2002-2012. Model (1) excludes student flows toward private universities; Model (3) does not include student flows from selective courses (e.g., Architecture; Medicine and Surgery; and Veterinary Medicine). The number of observations changes with respect to the student flows excluded by the different models. Each regression controls for time and province fixed effects. Standard errors are reported in brackets. \*\*\*, \*\* and \* indicate statistical significance at the 1%, 5% and 10% levels, respectively.

|  | (1)                  | (2)                  |
|--|----------------------|----------------------|
| Distance (province $j$ - university $i$ )                    | -1.934***<br>(0.057) | -1.853***<br>(0.055) |
| <b><i>Origin (Province features)</i></b>                     |                      |                      |
| Quality of life ranking                                      | 0.006<br>(0.008)     | -0.001<br>(0.009)    |
| Value added per capita                                       | -0.860***<br>(0.157) | -0.855***<br>(0.170) |
| Student population   | 1.003***<br>(0.040)  | 0.973***<br>(0.039)  |
| <b><i>Destination (Province and University features)</i></b> |                      |                      |
| Quality of life ranking                                      | 0.026<br>(0.033)     | 0.042<br>(0.036)     |
| Value added per capita                                       | 1.664***<br>(0.231)  | 1.517***<br>(0.226)  |
| University size  | 0.798***<br>(0.058)  | 0.797***<br>(0.041)  |
| University teaching resources                                | 0.171<br>(0.171)     | 0.072<br>(0.060)     |
| University legitimacy  | 0.029<br>(0.024)     | 0.006<br>(0.024)     |
| University's average tuition fee                             | 1.131<br>(0.820)     | 1.156**<br>(0.553)   |
| Competitors' proximity index                                 | -0.253***<br>(0.068) | -0.222***<br>(0.057) |
| Constant   | -7.900***<br>(1.864) | -7.392***<br>(1.817) |
| Observations   | 70,826               | 83,188               |
| R-squared  | 0.890                | 0.798                |

**Figure 1. Geographical distribution of Italian universities**

Macro-areas are identified by different colours. Northern provinces are in darker grey; central provinces are in light grey; and southern provinces are reported in white. Circles represent the geographical distribution of the 75 universities at the national level.



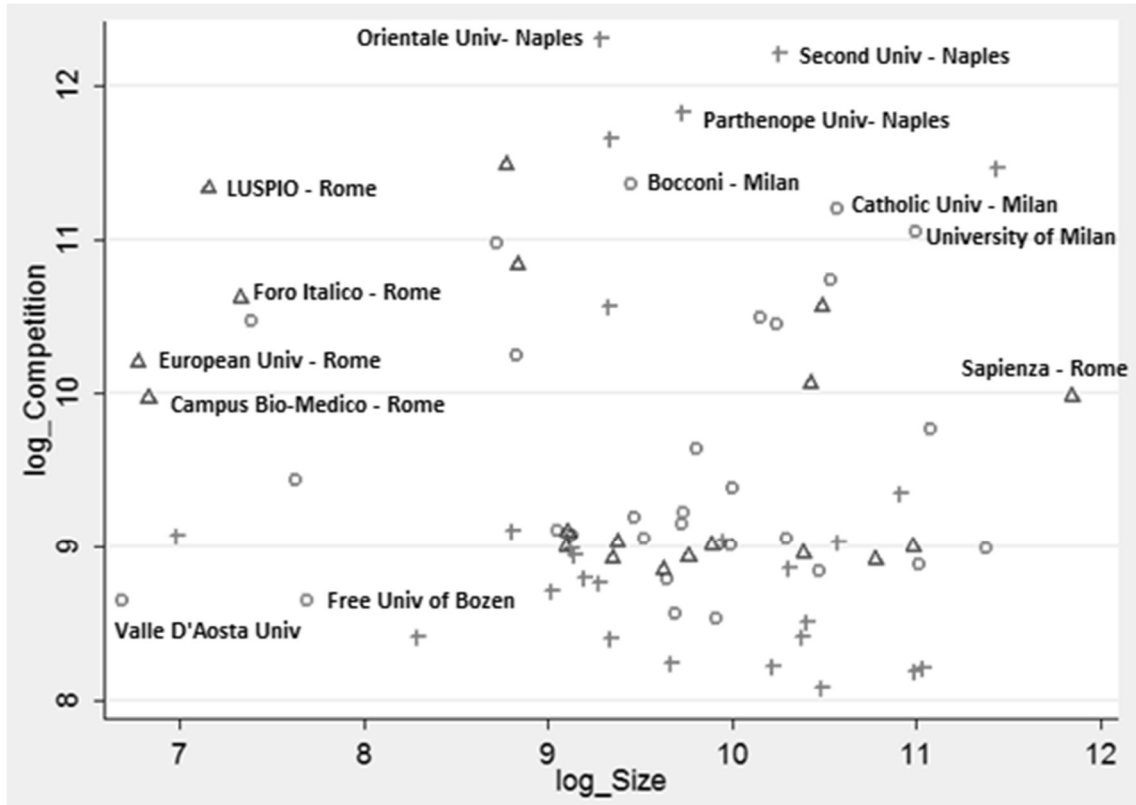
**Figure 2. Map of university competition**

The sizes of the circles represent the level of competition to which each university is subjected.



### Figure 3. Scatter plot of university competition and university size

The figure plots the log of university competition against the log of university size. Circles represent universities in the North of Italy; triangles indicate universities in the Centre; and southern universities are identified by crosses.



### Appendix A. Correlation matrix.

The table reports correlation coefficients among the independent variables employed in the regressions. (*O*) indicates the variables for the origin, while (*D*) stands for the variables for the destination. Significant correlations at less than 1% are identified with an \*.

| Variables                                    | 1        | 2        | 3        | 4       | 5        | 6        | 7        | 8        | 9        | 10      | 11 |
|--|----------|----------|----------|---------|----------|----------|----------|----------|----------|---------|----|
| 1 Distance ( <i>O-D</i> )                    | 1        |          |          |         |          |          |          |          |          |         |    |
| 2 Quality of life ranking ( <i>O</i> )       | -0.0202* | 1        |          |         |          |          |          |          |          |         |    |
| 3 Value added per capita ( <i>O</i> )        | -0.2373* | 0.2658*  | 1        |         |          |          |          |          |          |         |    |
| 4 Student population ( <i>O</i> )            | 0.0021   | -0.0614* | 0.0119*  | 1       |          |          |          |          |          |         |    |
| 5 Quality of life ranking ( <i>D</i> )       | -0.0430* | -0.0172* | -0.0081  | 0.0057  | 1        |          |          |          |          |         |    |
| 6 Value added per capita ( <i>D</i> )        | -0.1835* | 0.0174*  | 0.0273*  | -0.0086 | 0.3381*  | 1        |          |          |          |         |    |
| 7 University size ( <i>D</i> )               | 0.0011   | -0.0043  | -0.0032  | 0.0023  | 0.0228*  | 0.0269*  | 1        |          |          |         |    |
| 8 University teaching resources ( <i>D</i> ) | -0.0385* | 0.0019   | 0.0017   | -0.0004 | 0.0125*  | 0.1446*  | -0.1005* | 1        |          |         |    |
| 9 University legitimacy ( <i>D</i> )         | -0.0538* | -0.0453* | -0.0260* | 0.0262* | 0.1700*  | 0.2035*  | 0.5262*  | -0.0472* | 1        |         |    |
| 10 University student fees ( <i>D</i> )      | -0.0735* | 0.0134*  | 0.0205*  | -0.0085 | 0.1153*  | 0.5638*  | -0.2691* | 0.2089*  | -0.0377* | 1       |    |
| 11 Competitors' proximity index ( <i>D</i> ) | -0.0424* | -0.0027  | -0.0029  | 0.0014  | -0.0341* | -0.0432* | -0.0193* | 0.1121*  | -0.0741* | 0.1888* | 1  |