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UNIVERSITY STUDY PROGRAMMES AND STUDENTS DYNAMICS

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University study programmes and students dynamics

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Abstract

This paper investigates the pull factors that influence the dynamics of first-year undergraduates at university. The focus is devoted to the role of internal supply factors (e.g. course quantity and quality, fees) and external factors related to the structural characteristics of the hosting location. Three main research questions are assessed. (RQ1) Are diversification and divergence of teaching programmes good strategies to increase demand? Do these effects change with (RQ2) the internal characteristics of universities (i.e. size and quality of research) and/or (RQ3) the external characteristics of universities (i.e. geographical location, type of city, proximity of another university)? The empirical analysis employs Italian data over 2013-2019. Based on a panel data approach, the findings reveal a tendency to converge towards the typical national specialisation. Yet diversification, especially for small-sized universities, positively drives demand. Besides, interesting differences are found at a geographical level. Based on the empirical findings, policy implications are drawn.

Keywords: Diversification; Divergence; Short run dynamics; University

JEL codes: C23; I21; I23

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1 Introduction

Young people are more vulnerable to endogenous and exogenous shocks and bore a higher social and economic burden of educational and job losses. Innovation, ecological transition, and social and territorial cohesion represent the strategic pillars that will guide European public policies in the next decade (EC, 2017). The Next-Generation Youth is a recovery policy for current and future young generations (EC, 2020). These strategic objectives intersect the role of the education system - in terms of human capital formation - and of universities - in terms of human capital accumulation - in the orientation of policies within these new challenges for societies. One of the main objectives of higher education institutions (HEIs) is the reduction of the social-demographic, economic and digital breach along with territorial gaps such as North-South, centre-periphery, and small- and large-sized institutions. Looking at the medium-long run, the presence of universities in a given area not only improves the stock of local human capital through education but also makes the area attractive to potential high-quality human capital from other regions (Faggian and McCann, 2006).

Several studies find that students tend to live where they accomplished their most recent degrees (US: Groen and White, 2004; Groen, 2004; Gottlieb and Joseph, 2006; Italy: Ciriaci, 2014). However, students with a previous migration history tend to be more "footloose" and less attached to the place where they accomplished the degree (UK: Faggian et al., 2006; Faggian and McCann, 2009).

Attracting students is crucial for peripheral and small-sized regions that persistently experience outbound migration flow of highly qualified human capital. In situations where HEIs compete for students and staff, it is even more crucial to understand which pull factors play a primary role in attracting students. In 2019, on average, EU27 surpassed the target with 40.3% of young university graduates aged 30-34. Yet, several peripheral countries experienced relatively low quotas well below the EU target of 40.0% (see among the others CRENoS, 2021), namely Romania (25.8%), Italy (27.6%), Bulgaria (32.5%), and Croatia (33.1%).

The presence of HEIs and their capacity to attract demand is paramount for regional development. Indeed, HEIs are beneficial for regional economic performance by two main channels. Higher education promotes regional innovation and development (Drucker and Goldstein, 2007; Huggins and Johnston, 2009; Huggins and Kitagawa, 2009; Veugelers and Del Rey, 2015) and increases the stock of skilled human capital (Moretti, 2004; Abel and Deitz, 2012; Shapiro, 2006). Human capital accumulation augments regional economic growth thanks to the acquired knowledge and more specialised skills. Highly educated individuals are much more productive and generate positive spillovers on peers who foster further innovations and development.

A large quota of the literature has extensively studied the drivers of undergraduate mobility highlighting the role of some common factors such as individual, university, and place-related characteristics (Cattaneo et al., 2017). Regarding internal university characteristics, there is a vast consensus on the importance

of the fees and the institutions' quality in terms of research and teaching. However, the strategic role of the study programmes has not received adequate emphasis so far. Indeed, the choice of the study programmes is crucial for the future development of HEIs, and even more important is the decision of how much to invest in diversity. When defining diversity in higher education (Birnbaum, 1983), a distinction relates to internal and external diversity strategies. In the former case, the universities decide whether to propose a more or less wide range of study programmes (i.e. be more or less diversified). In the latter case, the universities choose to what extent differentiate the programmes mix from the national standard (i.e. be more or less divergent). Such competitive divergence strategies are extremely important because they represent strategic positioning tactics that allow HEIs to diverge from their main national and international competitors. Although some studies have investigated the determinants and the evolution of diversification and/or divergence of the study programmes (Rossi, 2010; Cattaneo et al., 2019), the impact of these strategic choices on student dynamic remains unexplored.

The main objective of the present study is to understand to what extent the strategic choices in the training programmes (in terms of diversification and divergence) impact universities' student dynamics. Besides, it explores how this impact changes under different internal characteristics, and external local conditions of the universities. Specifically, three main research questions are being explored: RQ1) Are programme diversification and divergence good strategies to attract more students? RQ2) How do the effects of these choices change according to internal characteristics of universities? In particular, how do they vary according to university (i) size and (ii) research quality? RQ3) How do the effects of these choices change according to external characteristics of universities? In particular, how they vary according to (i) the macro-region, (ii) the type of city in which they are located and (iii) the proximity of another university?

To this aim, the present paper employs a panel data set of 75 Italian universities between 2013-2019 retrieved from the Italian Ministry of University and Research (MUR). The response variable of the empirical model is the yearly number of students enrolled in the first year of the Bachelor's degree in a given university. This choice is motivated by the fact that the universities are rational agents whose objective is to maximise their revenues. The government core funding of public and private universities is allocated based on the performance of universities in education, research, and achievements. Thus, the number of students is essential in increasing the allocated budget. For this reason, universities compete to attract the highest number of students. Controlling for internal and external drivers of student mobility, the analysis focuses on the impact of university study programmes strategies. Diversification and divergence are measured by means of two indexes. Overall, the findings indicate that diversification and divergence are relevant strategies but with specific differences according to size, research quality, and the location of the HEIs. Furthermore, the proximity to other competitors plays an important role.

The rest of the paper is structured as follows. The next section discusses the conceptual background.

Section 3 provides a description of the Italian university system. Section 4 illustrates the research design. Section 5 is devoted to empirical analysis and results. Section 6 concludes and provides some policy implications of the study.

2 Conceptual background

The literature divides into two main streams of research. The first stream addresses the drivers of student mobility (Hsing and Mixon Jr, 1996; Sá et al., 2004, 2006; Agasisti and Dal Bianco, 2007; Faggian et al., 2007; Spiess and Wrohlich, 2010; Hübner, 2012; Mitze et al., 2015) with several studies focusing on the Italian case (Ciriaci, 2014; Cattaneo et al., 2017, 2019; Beine et al., 2020). This thread of research investigates the impact of internal and external factors in the students' choice of university. Specifically, internal factors are individual/university-related drivers, while external factors are place-related drivers. Among others, at the university level, a negative impact of tuition fees emerges (Hübner, 2012; Mitze et al., 2015; Beine et al., 2020), while a positive effect relates to the quality of the institutions (Ciriaci, 2014; Mitze et al., 2015; Cattaneo et al., 2017), and the importance of the types of the study programmes as a pull/push factor (Sá et al., 2004). At a local level, GDP and the labour market condition (measured mostly by the unemployment rate) appear key determinants of student mobility (Fratesi and Percoco, 2014; Nifo and Vecchione, 2014).

The second stream of research is less dense and studies the university's efficiency and competitiveness. A set of studies focus on the internal and external sources of efficiency (McMillen et al., 2007; Van Vught, 2008; Horta, 2009; Teixeira et al., 2014; Farhan, 2016; Cattaneo et al., 2017; Caruso et al., 2020; Marrocu and Paci, 2021). Less attention is devoted to spatial competition (Cattaneo et al., 2017, 2019).

Three studies on Italy are particularly relevant to the present research. Cattaneo et al. (2017) focus on 75 Italian universities employing a competing destinations model of student flows over 2003-2012. The study confirms the rise of a spatial competition among Italian universities. A direct implication of this result is that existing universities are affected by the entry of new HEIs, especially when they are located nearby. This increased competition has started some years before as highlighted by Rossi (2010). The author provides a descriptive analysis of the 2000-2007 evolution of the Italian universities in response to the rise in the access of higher education, privatization, and competition. The findings indicate that the supply of the Italian universities has evolved toward more diversification of the study programmes, and toward a convergence of the supplied mix (i.e. more diversification but less divergence from the national standard). Conversely, Cattaneo et al. (2019), providing an econometric analysis (on the same time spell and universities as Cattaneo et al., 2017), find that the increased competition reduces rather than increases diversification but only up to a certain threshold, beyond which the effect reverses. Yet, the rise of competition increases rather than reduces divergence but only up to a certain threshold, beyond

which the effect reverses.

These findings add some piece of information to the general understanding of the process of transformation of HEIs in Italy: 1) the rise of competition; 2) the effect of this competition on the study programmes in terms of diversification and divergence from the national standard.

None of the revised studies investigate the strategies on the mix of study programmes. Hence, the present paper focuses on this further unexplored step of this line of research. Indeed, it explores how diversification and divergence of the study programmes affect university demand dynamics.

The following section presents the study's design that provides a detailed description of the research process with specific attention devoted to constructing of the indexes of diversification and divergence of study programmes.

3 The university system in Italy

In the first decade of the 2000s, several measures introduced significant changes in the Italian higher education system. On the one hand, key interventions were Minister Zecchino's regulation (1999) and Minister Moratti's ministerial decree (2004), which profoundly renewed the didactic approach. On the other hand, Minister Gelmini's law (23 December 2010, no. 240) issued a new discipline regarding management, evaluation, and staff recruitment.

An important change of the 1999 reform concerned the reorganisation of the study programmes, which were grouped into homogeneous degree classes [1] and aggregated in 15 disciplines [2]. In fact, together with the credit system for vocational education and training, this change represents the basis of university autonomy (Camozzi, 2005; Elevati and Lanzoni, 2004). The decisive concept in this transformation is that of the class, which constitutes an inclusive container of study programmes that are substantially homogeneous and which defines their common binding features. More specifically, the class identifies the training objectives and professional outlets, the training activities, and the students' commitment measured in terms of credits, at a national level. In practice, the class ensures congruence between the degrees of the same class awarded by different universities. This action facilitates the mobility of students and guarantees equal legal value to study programmes with different titles and curricula. Classes organisation is subject to review every three years.

The 2010 reform proceeded with a reaffirmation of university autonomy closely linked to the assignment of solid financial, scientific and teaching responsibility. The transfer of resources from the ministry to the universities is conditional on research and teaching quality criteria. The ministry will then verify and

[1] Up to date, there are 50 and 100 classes, respectively, for the undergraduate and master study programmes

[2] They are the following: Agricultural-Forestry and Veterinary Sciences; Architecture and Civil Engineering; Art and Design; Computer Science and ICT Technology; Economics; Industrial and Information Engineering; Law; Linguistics; Literature-Humanities; Medical-Health and Pharmaceutical Sciences; Motor and Sport Sciences; Natural Sciences, Physics and Mathematics; Political-Social Sciences and Communication; Psychology; Teaching.

certify the study programmes. Moreover, the National Agency for the Evaluation of the University and Research Systems (ANVUR) will assess the efficiency of the university results.

The organisation of the classes makes it possible to compare the educational offerings of Italian universities to understand the similarities and differences between them. This assessing mechanism requires universities to strategically choose the mix of study programmes, from both a market positioning and a minimum quality standard.

4 The research design

The objectives of HEIs are complex and multidimensional, ranging from promoting regional development, to economic and social improvement, and enhancing human capital in a given region. The latter objective is particularly important for reducing inequalities in accessing higher education. Universities are incentivised to achieve this goal through funds that depend, among other factors, on the number of students enrolled. Amongst the potential strategies that universities can adopt to improve student attractiveness (such as student services, research quality, fees), the spectrum of study programmes represents a key strategy.

Hence, the novel aim of this study is to investigate whether diversification and divergence of study programmes represent a lever for university demand attractiveness. We compare the dynamics of a panel of Italian universities to explore what factors explain these differences. Specifically, the number of first-year undergraduates and a set of local attractiveness proxies are collected per university over 2013-2019.

The studied underlying synthetic function is as follows:

Students = f(Study programme diversification; Study programme divergence; Other university-related characteristics; Place-related characteristics)

The number of students enrolled in a university is the result of its ability to attract demand. In turn, this ability depends on multidimensional factors related to several elements including internal characteristics of the university, its strategic actions regarding the study programme, and the local environment in which the university locates. In the rest of the section, we describe the sample creation process in detail and the variables under study.

4.1 Sample construction

The final sample consists of 75 Italian universities, of which 59 are State institutions and 16 are private institutions, observed over the time span 2013-2019. Following Cattaneo et al. (2019), the sample excludes certain categories of universities, namely the newly accredited universities (Saint Camillus and Link Campus University in Rome[3]; Humanitas University in Milan), the Distance e-learning universities, the

[3]Link Campus University is a private institution that received the accreditation in September 2011. However it has been excluded from the sample because their data were not made available until 2013.

Superior graduate schools, and the Universities oriented towards foreign students.

The Italian university system is characterised by significant size and spatial heterogeneity . Table 1 provides an overview of the sample distinguishing between large, medium and small-sized universities. The three groups follow the classification proposed in the second Italian Research Quality Assessment (VQR2) with the only difference of grouping the "mega" and "big" institutions in the category "Large universities". Furthermore, the sample distinguishes HEIs according to their geographical location in the North, Centre and South of Italy. As the Table highlights, the distribution of universities is almost equal across all macro-regions, except for the northern regions which have more medium-sized institutions with respect to the national average, and larger institutions that are more concentrated in the North and South.

Table 1: Sample distribution by university size and location

	North	**Centre**	**South**	**Total**
Large	12 (41.38%)	6 (20.69%)	11 (37.93%)	29 (100%)
Medium	10 (52.63%)	3 (15.79%)	6 (31.58%)	19 (100%)
Small	8 (29.63%)	10 (37.04%)	9 (33.33%)	27 (100%)
Total	30 (40%)	19 (25.33%)	26 (34.67%)	75 (100%)

4.2 Variables

4.2.1 Dependent variable

The response variable is the number of first year undergraduate students enrolled in each university. The universities are considered as rational agents whose objective is to maximise the number of students and specific goals revenues (Lowry, 2007). In the Italian higher education system, universities receive public funds on the basis of their performance in teaching, research and third mission. As the national budget for HEIs is given, the number of students is essential for universities to increase their allocated quota. For this reason, universities compete to attract higher number of students.

4.2.2 Main explanatory variables

In highly centralised systems such as the Italian one, universities have little margin to compete because the ministry sets the maximum fees and recruitment rules based on the institution's parameters and

territorial economic indicators. Nevertheless, it is worth noting that, as reported by Rossi (2010) and Cattaneo et al. (2017), with the transformations of the last twenty years, the level of competition has increased considerably compared to previous decades.

In this framework, it is relevant for a university to change and adapt its study programme in order to attract students, especially in the short run. We collect data on all programmes by field of study for the whole sample of universities. The MUR identifies 15 disciplines into which these programmes can be divided. On this basis, following Rossi (2010), we construct an index of Diversification and an index of Divergence of these study programmes.

Diversification

The diversification index measures the width of the range of disciplines offered by a university. It is the inverse of the concentration index by Herfindahl-Hirschman. It is calculated as follows:

$$Diversification_{jt} = \frac{1}{\sum_i (\frac{x_{jit}}{X_{jt}})^2} \tag{1}$$

where x_{jit} is the number of study programmes offered by university j in each discipline i at time t, and X_{jt} is the total number of study programmes offered by university j at time t. The index ranges between 1 and n (=15): low values indicate that the university concentrates in few disciplines, while high values indicate a high degree of diversification.

Divergence

The divergence index measures the extent to which the mix of disciplines offered by a given university diverges to that offered at a national level. It is calculated as follows:

$$Divergence_{jt} = \sum_i \left(\frac{x_{jit}}{X_{jt}} - \frac{x_{it}}{X_t} \right)^2 \tag{2}$$

where, at time t, x_{jit} is the number of the study programmes offered by university j in each discipline i, X_{jt} is the total number of programmes offered by university j, x_{it} is the number of programmes in discipline i offered by all universities nationwide, and X_t is the total number of programmes offered by all universities nationwide.

Hence, it represents the squared Euclidean distance between the study programmes portfolio of a given university j and the national study programmes portfolio. Values close to zero indicate low divergence compared to the national average, while high values indicate high divergence from the national average.

4.2.3 Control variables

The study accounts for a number of university and place-related drivers that has been already identified as relevant by the related literature. University-related factors considers three dimensions: quality, price and reputation. The first is the $Student - teacher\ ratio_{jt}$ (Source: MUR, Cineca) that is the ratio of the total number of students enrolled to the total number of teaching staff in university j at time t, . The second dimension is represented by the average fees paid in university j at time t (Source: MUR). The third element, $Shanghai$, is a binary variable that takes value of one if a given university is classified on the renowned Shanghai ranking at time t and zero otherwise. Place-related factors, collected at NUTS3 level, represent the environment in which a university operates. The rationale is that local environment could magnify or inhibit university's ability to attract students. Four groups are identified: the cost of life, the economic performance, the population size and the institutional quality. First, the value added (VA) per inhabitant expressed in current prices in the province of the university j at time t is a proxy for the local cost of life (Source: ISTAT). Second, the economic performance is a driver of students mobility as they prefer going to areas with higher job opportunities. It is measured by the unemployment rate of people aged 15+ years in the province of the university j at time t (Source: ISTAT). Third, population density in the province of the university approximates potential local demand (Source: Eurostat). Four, the quality of local institutions is a further motivating factor for students attraction. The Institutional Quality Index (IQI) comes from Nifo and Vecchione (2015).

5 Empirical analysis

5.1 Econometric model

The descriptive analysis shows that universities exhibit different patterns, as confirmed by the preliminary econometric model[4]:

$$y_{jt} = \beta x_{jt} + \delta_j t + \epsilon_j + \epsilon_t + \epsilon_{jt} \tag{3}$$

where y_{jt} indicates first-year enrolment in university j at time t; x_{jt} is a set of covariates; δ_j coefficients represent the specific individual patterns; ϵ_t and ϵ_j are the fixed effects and ϵ_{jt} are the idiosyncratic errors. In order to reduce the number of parameters to be estimated, one possible solution is to employ the first difference of both sides of Equation (3). Furthermore, the tests displayed in Table 2 confirm the presence of unit root for the dependent and many independent variables in level while the null hypothesis of non-stationarity is rejected when all variables are expressed in first difference.

Therefore, the variables must be used in first-difference as in Equation (4):

[4]The F-statistic test suggests individual patterns are jointly significant at the 1%.

Table 2: Harris-Tzavalis unit-root test

Variables	(1) Level	(2) First difference
Students	0.718	-0.149***
Diversification	0.618***	-0.044***
Divergence	0.619**	-0.106***
Student-teacher ratio	0.796	0.176***
Fees	0.855	-0.108***
Shanghai	0.580***	-0.135***
VA pc	0.628***	0.012***
Density	0.725	-0.404***
Unemployment	0.623***	-0.011***
IQI	0.536***	-0.124***

*** p<0.01, ** p<0.05, * p<0.1

$$\Delta y_{jt} = \beta \Delta x_{jt} + \delta_j + \Delta \epsilon_t + \Delta \epsilon_{jt} \tag{4}$$

or, in other form,

$$\Delta y_{it} = \beta \Delta x_{jt} + u_t + u_j + u_{jt} \tag{5}$$

The above model is estimated using a fixed effects panel econometric framework (as suggested, in all the cases, by the Hausman test [5]). All continuous variables are expressed in log. Furthermore, to reduce potential problems of endogeneity and reverse causation, all independent variables are lagged as much as possible.

5.2 Results

5.2.1 General effects

Table 3 exhibits the findings related to the first research question (RQ1). Both programmes diversification and divergence have a positive impact on universities' student dynamics. Looking at the column (1), a variation of one percentage point in diversification and divergence increases, ceteris paribus, students growth rate by 0.18 and 0.09 percentage point, respectively. The results are consistent in all the specifications.

As expected, an increase in fees and student-teacher ratio negatively affects demand. It means that students dislike higher tuition costs and teaching quality reduction. Both coefficients are highly significant. Variations in per capita value added and population density are negatively correlated to universities growth. This could be related to cost effects since, other things being equal, students tend to avoid most

[5] The χ^2 test is equal to 45.54 (p-value < 0.01).

expensive areas.

Table 3: Q1: Overall diversification and divergence

Dep. var: ΔStudents (# obs.: 525)	(1) **Baseline**	(2) **No control**	(3) **Int. control**	(4) **Ext control**
Δ Diversification (t-1)	0.180**	0.206**	0.188**	0.196**
	(2.500)	(2.431)	(2.513)	(2.390)
Δ Divergence (t-1)	0.0871*	0.0792*	0.0843**	0.0808
	(2.045)	(1.742)	(2.096)	(1.692)
Δ Student-teacher ratio (t-1)	-0.302***		-0.300***	
	(3.246)		(3.258)	
Δ Fees (t-1)	-0.124***		-0.116***	
	(3.490)		(3.009)	
Δ Shanghai (t-1)	0.0355		0.0379*	
	(1.697)		(1.785)	
Δ VA pc (t-2)	-0.392*			-0.429*
	(1.739)			(1.760)
Δ Density (t-2)	-0.473**			-0.459**
	(2.660)			(2.424)
Δ Unemployment (t-2)	-0.0302			-0.0224
	(1.297)			(0.888)
Δ IQI (t-2)	0.00796			0.00257
	(0.211)			(0.0616)
Constant	-0.00633	0.000366	-0.0133	0.00747
	(0.560)	(0.0371)	(1.177)	(0.694)
R-squared	0.080	0.036	0.068	0.048
Year dummies	YES	YES	YES	YES

Clustered t-statistics presented in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

5.2.2 The role of internal characteristics

Previous analysis confirms the importance of the study programmes diversification and divergence on university's dynamics. It is also relevant to understand whether the effects of such strategies change according to internal characteristics (RQ2), and in particular to the size. Indeed, dimension is an important university feature since it proxies its market power. To this aim, a set of interaction indexes for diversification and divergence are based on the size category (i.e. small-, medium- and large-sized universities). Table 4 shows the main results. Interestingly, programmes diversification and divergence seem to "pay more" for small-sized universities. These findings have important policy implications since it confirms that having a strategic behaviour is more crucial for small entities due to their limited market power.

Furthermore, the analysis focuses on the relationship between the effects of programmes diversification and divergence and the research quality of the institution. The rational here is that research and teaching

Table 4: Q2.1: Diversification and divergence by size

Dep. var: ΔStudents (# obs.: 525)	(1) **DV.× Size**	(2) **DG.× Size**
Δ Diversification (t-1)X Small	0.172**	
	(2.327)	
Δ Diversification (t-1)X Medium	0.112	
	(0.332)	
Δ Diversification (t-1)X Large	0.321	
	(1.686)	
Δ Diversification (t-1)		0.352**
		(2.525)
Δ Divergence (t-1)X Small		0.267*
		(1.837)
Δ Divergence (t-1)X Medium		0.191
		(1.062)
Δ Divergence (t-1)X Large		0.0444
		(1.366)
Δ Divergence (t-1)	0.0897*	
	(2.038)	
Constant	-0.00603	-0.00619
	(0.532)	(0.558)
R-squared	0.081	0.085
Year dummies & Control Variables	YES	YES

DV.: Diversification; DG.: Divergence; Other control variables: Δ Student-teacher; Δ Fees; Δ Shanghai; Δ VA pc; Δ Density; Δ Unemployment; Δ IQI. Clustered t-statistics presented in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

are two mutually reinforcing aspects of academic practice. In this analysis research performance is proxied by the average score on research quality obtained by the university in the first evaluation exercise (the so-called VQR 1) over the period 2004-2010. Universities are split into three groups according to their research performance, i.e. low (first quartile of the distribution), median (second and third quartiles) and top (fourth quartile).

Table 5 provides the main findings. Diversification index shows a positive impact for low and median performers, while higher performance universities are negatively affected by diversification choice. Diversifying the study programmes represents a value added for universities with a low research performance. In their case, increasing the portfolio of programmes could reduce the risk with the result of attracting more students. The programmes divergence does not play a role for this type of universities.

Top research performance universities exhibit a different incentive. Because of their research profile, it seems that they would benefit more if they proposed less diversified study programmes. On the contrary, these institutions have a clear advantage in diverging the range of their programmes from the national average.

Table 5: Q2.2: Diversification and divergence by research quality

	(1)	(2)
Dep. var: ΔStudents (# obs.: 525)	**DV.×Research quality**	**DG.× Research quality**
Δ Diversification (t-1) × Low Perf	0.645***	
	(3.670)	
Δ Diversification (t-1) × Median Perf	0.265**	
	(2.444)	
Δ Diversification (t-1) × Top Perf	-0.640***	
	(3.312)	
Δ Diversification (t-1)		0.198**
		(2.279)
Δ Divergence (t-1) × Low Perf		-0.143
		(1.677)
Δ Divergence (t-1) × Median Perf		0.0585
		(1.010)
Δ Divergence (t-1) × Top Perf		0.518***
		(4.925)
Δ Divergence (t-1)	0.0845*	
	(2.019)	
Constant	-0.00330	-0.00853
	(0.300)	(0.728)
R-squared	0.119	0.118
Year dummies & Control variables	YES	YES

DV.: Diversification; DG.: Divergence; Other control variables: Δ Student-teacher; Δ Fees; Δ Shanghai; Δ VA pc; Δ Density; Δ Unemployment; Δ IQI. Clustered t-statistics presented in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

5.2.3 The role of external characteristics

The last part of the analysis investigates whether diversification and divergence strategies pay differently according to the characteristics of the location in which the University operates (RQ3). As presented in the previous section, Italy shows a very high heterogeneity in university patterns. For this reason, the analysis tests whether the impact of internal decisions on study programmes is different according to the macro-region in which the institution locates. To do so, five macro-regions have been considered: North-West, North-East, Centre, South, and Islands. Table 6 shows that on the one hand, programmes diversification pays more in the central, and mostly, in island regions. On the other hand, divergence is significant in northern and central regions only.

Another important test refers to the heterogeneity in terms of strategies responses according to the economic vocation of a territory, the so-called dichotomy "centre-periphery". Indeed, the best programmes strategy may vary according to the location of a given university in an economically strong area or in a peripheral area. Three groups of provinces are identified: metropolitan provinces in mainland,[6] islands

[6] According to the ISTAT definition: Rome, Milan, Naples, Turin, Bari, Bologna, Florence, Venice, Genoa, Reggio Calabria.

Table 6: Q3.1: Diversification and divergence by macro-region

Dep. var: ΔStudents(# obs.: 525)	(1) **DV.× Region**	(2) **DG.× Region**
Δ Diversification (t-1) × North-West	0.115	
	(0.929)	
Δ Diversification (t-1) × North-East	-0.156	
	(1.070)	
Δ Diversification (t-1) × Centre	0.178**	
	(2.610)	
Δ Diversification (t-1) × South	0.808	
	(1.709)	
Δ Diversification (t-1) × Islands	0.598***	
	(4.007)	
Δ Diversification (t-1)		0.270**
		(2.195)
Δ Divergence (t-1) × North-West		0.183*
		(1.976)
Δ Divergence (t-1) × North-East		0.218***
		(4.371)
Δ Divergence (t-1) × Centre		0.213**
		(2.141)
Δ Divergence (t-1) × South		-0.0634
		(0.634)
Δ Divergence (t-1) × Islands		-0.0311
		(1.558)
Δ Divergence (t-1)	0.102**	
	(2.594)	
Constant	-0.00799	-0.00858
	(0.688)	(0.750)
R-squared	0.093	0.091
Year dummies & Control Variables	YES	YES

DV.: Diversification; DG.: Divergence; Other control variables: Δ Student-teacher; Δ Fees; Δ Shanghai; Δ VA pc; Δ Density; Δ Unemployment; Δ IQI. Clustered t-statistics presented in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

and other provinces. The first group represents densely populated areas characterised by high levels of economic activity and high connection with the main transport networks. Island group and other provinces are the peripheral areas of the country with a limited capacity of students attraction. Table 7 shows the main outcomes. As before, weak environments incentive universities to increase programmes diversification. Furthermore, divergence exhibits a positive effect in metropolitan provinces while the effect is negative in the islands: diverge from the national standard does not seem to be a good strategy to attract more students for peripheral regions.

Finally, the optimal strategy of a university may change depending on its proximity to other universities. Indeed, local competition might affect optimal university's strategy. To increase its market power, a

Table 7: Q3.2: Diversification and divergence by type of city

Dep. var: ΔStudents(# obs.: 525)	(1) **DV.× Type of city**	(2) **DG.× Type of city**
Δ Diversification (t-1) × Metro	0.0223	
	(0.171)	
Δ Diversification (t-1) × Islands	0.583***	
	(4.030)	
Δ Diversification (t-1) × Other	0.284**	
	(2.685)	
Δ Diversification (t-1)		0.250***
		(3.176)
Δ Divergence (t-1) × Metro		0.239**
		(2.832)
Δ Divergence (t-1) × Islands		-0.0329**
		(2.099)
Δ Divergence (t-1) × Other		0.0949
		(1.693)
Δ Divergence (t-1)	0.0941*	
	(1.988)	
Constant	-0.00869	-0.00855
	(0.790)	(0.791)
R-squared	0.086	0.086
Year dummies & Control Variables	YES	YES

DV.: Diversification; DG.: Divergence; Other control variables: Δ Student-teacher; Δ Fees; Δ Shanghai; Δ VA pc; Δ Density; Δ Unemployment; Δ IQI. Clustered t-statistics presented in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

university may have an interest in being more divergent from the standard when another university is nearby. This effect has been measured by a binary variable taking value of one if there exists another university: (i) in the same city; (ii) within a 50km distance (i.e. bird's eye); (iii) within a 100km (bird's eye) distance. Table 8 summarises the main results. Diversification is always a good strategy, especially for more "isolated" universities, while divergence seems to be an effective strategy in presence of local competitors.

5.2.4 Robustness check

In the Italian university system, changes in study programmes and the proposal of new programmes require bureaucratic and administrative steps that take a few years to complete. This makes it unlikely that study programmes will adapt simultaneously to changes in student numbers. Nevertheless, exogeneity between students dynamics and study programme strategies remains an important issue to check. The empirical model partially addresses this potential issue by lagging the variables $Diversification$ and $Divergence$ by one year. A further check employs instrumental variables technique to test the exogeneity of the two variables. The challenge is to identify instrumental variables correlated with the study programmes

Table 8: Q3.3: Diversification and divergence by proximity to another university

Dep. var: ΔStudents (# obs.: 525)	(1) City	(2) < 50km	(3) < 100km	(4) City	(5) < 50km	(6) < 100km
Δ Diversification (t-1) × Proximity (=1)	-0.00366	0.125*	0.148**			
	(0.0346)	(1.768)	(2.169)			
Δ Diversification (t-1) × Proximity (=0)	0.324**	0.463*	1.605**			
	(2.576)	(1.922)	(2.509)			
Δ Diversification (t-1)				0.262**	0.218**	0.220**
				(2.728)	(2.536)	(2.526)
Δ Divergence (t-1) × Proximity (=1)				0.291***	0.134**	0.126**
				(3.524)	(2.167)	(2.411)
Δ Divergence (t-1) × Proximity (=0)				0.0591	0.0125	-0.128
				(1.297)	(0.176)	(0.869)
Δ Divergence (t-1)	0.0908*	0.0848*	0.0922*			
	(1.943)	(1.917)	(1.970)			
Constant	-0.00792	-0.00869	-0.00776	-0.00833	-0.00785	-0.00718
	(0.723)	(0.753)	(0.672)	(0.781)	(0.680)	(0.623)
R-squared	0.086	0.084	0.093	0.087	0.082	0.084
Year dummies & Control variables	YES	YES	YES	YES	YES	YES

Other control variables: Δ Student-teacher; Δ Fees; Δ Shanghai; Δ VA pc; Δ Density; Δ Unemployment; Δ IQI.
Clustered t-statistics presented in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

strategies but uncorrelated with the residuals. As instruments, we compute indices of diversification and divergence of researchers by discipline. The intuition is that the distribution of researchers impacts the university's strategic choices: an increase in research diversity or convergence is an important prerequisite for defining the university's study programmes strategy. The procedure implies two steps. First, for each year and university, we collect the number of researchers by discipline (source: Cineca-MUR). In the second step, we calculate, by year and university, (1) the inverse of the Herfindahl-Hirschman concentration index of researchers, which proxies for the diversification of the range of research disciplines (*Research diversification*); and (2) the squared Euclidean distance between the researchers disciplines distribution of a given university and the national average distribution, which proxies for the divergence of the mix of research disciplines between a given university and the national average (*Research divergence*).

The two instruments are then transformed into first difference and lagged. We use lags from two to six periods. Table 9 summarises the main tests performed using the four specifications as in Table 3. The F and the two Angrist-Pischke first-stage statistics are tests of weak identification and underidentification, respectively, of individual endogenous regressors. Both null hypotheses of weak identification and underidentification can be rejected in all four specifications. The Kleibergen-Paap Wald F statistic provides sufficient evidence to reject the null hypothesis of weak instruments. The Hansen test fails to reject the null hypothesis confirming instruments validity. Finally, the endogeneity test is built under the

null hypothesis that the specified endogenous regressors are exogenous. The test statistic clearly indicates that the endogenous regressors under study can actually be treated as exogenous.

Table 9: Testing for endogeneity

	(1) **Baseline**	(2) **No control**	(3) **Int. control**	(4) **Ext. control**
First Stage: Diversification				
F test of excluded instruments	14.37***	12.75***	11.94***	12.26***
Angrist-Pischke multivariate F	29.13***	3.27**	3.17**	2.67**
Angrist-Pischke Chi-sq	2.96**	31.87***	31.11***	26.22***
First Stage: Divergence				
F test of excluded instruments	21.60***	20.05***	21.09***	16.92***
Angrist-Pischke multivariate F	7.96***	10.45***	12.07***	8.58***
Angrist-Pischke Chi-sq	78.22***	101.91***	118.39***	84.34***
First Stage Results				
Kleibergen-Paap statistic test	52.753***	42.504***	35.457***	44.775***
Hansen test	8.070	7.685	7.765	7.277
Rob. test of endogeneity	0.787	0.195	0.244	0.135

$N = 525$. Dependent variable is ΔStudents. The instrumented variables: Δ Diversification (t-1); Δ Divergence (t-1). The (internal) included instruments: Δ Student-teacher; Δ Fees; Δ Shanghai. The (external) included instruments: Δ VA pc; Δ Density; Δ Unemployment; Δ IQI. The excluded instruments: ΔResearch diversification (t-2); ΔResearch diversification (t-3); ΔResearch diversification (t-4); ΔResearch diversification (t-5); ΔResearch diversification (t-6); ΔResearch divergence (t-2); ΔResearch divergence (t-3); ΔResearch divergence (t-4); ΔResearch divergence (t-5); ΔResearch divergence (t-6). *** p<0.01, ** p<0.05, * p<0.1.

6 Discussion and concluding remarks

The present paper focuses on a unexplored line of research in HEIs studies that is the role of study programmes on the universities demand dynamics. Specifically, it highlights the role of diversification and divergence of the study programmes, as strategic choices for universities. Diversification measures the range of the offered study programmes, while divergence indicates how the mix differs from the national standard. In this context, three main research questions have been addressed: Are programme diversification and divergence good strategies to attract more students? (RQ1); How do the effects of these choices change according to internal characteristics of universities? (RQ2); How do the effects of these choices change according to external characteristics of universities? (RQ3).

A panel data set of 75 Italian universities over 2013 and 2019 was retrieved from MUR. The response variable of the empirical model is the yearly number of students enrolled in the first year of the Bachelor's degree in a given university. Following previous literature, a number of internal and external controls have been also considered.

As shown by Rossi (2010), and confirmed in the descriptive analysis of this paper, in the last twenty

years the Italian university system has moved towards greater diversification and convergence of the educational offer (i.e. less divergence). It is possible that this trend is the result of the incentives created by the various reforms of the system over time. However, this work highlights how these strategies are not necessarily successful for all types of universities.

Findings clearly indicate that, overall, increasing diversification and divergence are good strategies to attract students (RQ1). Yet, these strategies are particularly important for small-sized universities (RQ2). For this type of institutions, diversification is rewarding because it broadens their offering to cover as many disciplines as possible. A diversified range increases the attractiveness of a small-sized university. At the same time, divergence has a relevant effect for small institutions because in composing the offer mix they have to take into account the local context and/or the disciplines in which they have a comparative advantage. For these reasons, it may be also rewarding for small-sized universities to deviate from the national average mix.

When strategies on study programme interact with other characteristics, two different profiles emerge (RQ2-RQ3). Diversification is successful for universities of medium-low quality in terms of research, peripheral (i.e. non-metropolitan areas and islands), and isolated (i.e. without local competitors). On the contrary, diversification is detrimental for top-research universities. Divergence has a particularly beneficial effect for high quality universities located in the North, in metropolitan areas and in presence of local competitors. These findings reveal the existence of a monopolistic competition mechanism in the Italian university system. In this framework, disadvantaged universities should diversify their study programmes in order to strengthen their dominant position at local level; while the most competitive universities should reinforce the divergence from the national standard by opting for a greater specialisation of the study programmes.

This research can be expanded in several directions enriching further the present investigation. Firstly, the results could be further developed using micro-data instead of employing meso-data. Secondly, more sophisticated indicators could be defined to further capture details about the differences in the analysed strategies. Yet, in this study we decide to use the indicators as already proposed by the literature (Rossi, 2010) in order to increase findings comparability and monitor the process. Finally, a further development could be to replicate the analysis at European level to see whether and to what extent these results are confirmed in other countries. It could be also interesting to study the effect of these strategies at the Master degree level.

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