DETERMINANTS AND SUCCESS FACTORS OF STUDENT ENTREPRENEURSHIP: EVIDENCE FROM THE UNIVERSITY OF PADOVA

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Article info

Abstract

Studying student entrepreneurship is an innovative way of examining the impact of universities on a territory. This study of the entrepreneurial activities of the 119,347 graduates of the University of Padova between 2000 and 2010 sheds light on the determinants of student entrepreneurship and of the success of entrepreneurial action. The analysis reveals that student entrepreneurship is 1) gender-biased, 2) positively correlated with entrepreneurship education, 3) dependent on the university course attended by the entrepreneur, and 4) negatively affected by a period of study abroad. The success of entrepreneurial action is 1) positively dependent on proximity between the type of activities performed by the company and the type of university course attended and 2) not influenced by proximity between the location of a start-up and the founder's place of residence. The implications of these results for the organization of university curricula and possible actions to support student entrepreneurship are discussed.

1. Introduction

Universities contribute to the progress and economic growth of countries in many ways: by generating and diffusing knowledge, spreading culture, influencing skill development, educating and training the workforce, solving problems, and developing new instruments (Rothaermel et al., 2007). In "the era of open innovation" (Chesbrough, 2006), firms are encouraged to seek external ideas and knowledge to be more innovative, and "universities are increasingly being called upon to contribute to economic development and competitiveness" (Feller, 1990). To make this contribution effective, universities can no longer be "ivory towers," isolated and focused on internal issues; they are expected to contribute to economic development through various channels, such as technology transfer activities, patents, spin-offs, and start-ups (Etzkowitz et al., 2000). The literature has largely focused on the modalities through which universities perform technology transfer activities (Rothaermel et al., 2007; Perkmann et al., 2013). Some scholars have focused on the type of scientists that are likely to positively affect university–industry relationships and have mainly investigated co-patenting activities, which stem from collaborations between companies and universities or other public–private partnerships (Zucker and Darby, 1996; Baba et al., 2009). More recently, a stream of literature has focused on the role of academic spin-offs in stimulating new ventures and regional collaborations between universities and established companies, thereby fostering the creation of an entrepreneurial ecosystem (Mansour et al., 2018; Mathisen and Rasmussen, 2019; Rasmussen et al., 2011). Stam and Spigel (2016: 1) defined an entrepreneurial ecosystem as a set of interdependent actors and factors coordinated in such a way that they enable productive entrepreneurship within a particular territory. Less is known about student entrepreneurship, although figures show that it is impactful in shaping the development trajectories of university regions. Research on the role of university graduates in entrepreneurial activity is lacking despite the fact that it appears to be an important phenomenon. In this paper, we examine the factors that impact university graduates' decisions to pursue entrepreneurial ventures.

Existing research, such as that of Souitaris et al. (2007) and Hsu et al. (2007), has mainly studied the entrepreneurship of graduates from science, technology, engineering, and mathematics (STEM) courses, largely ignoring the wide variety of other courses offered by universities and their entrepreneurial contributions to regional economic development. We aim to fill this gap by analyzing the determinants and success factors of student entrepreneurs from all types of university courses.

We analyzed secondary data on students who graduated from the University of Padova, the second-oldest university in Europe (founded in 1222)

and one of the leading universities in Italy. The university offers a broad variety of courses in the humanities, social sciences, and STEM areas. It is located in the Veneto region, one of the most innovative and productive regions in Italy, which is home to many innovative small and medium-sized manufacturing companies and start-ups (Apa et al., 2020).

We examine the strengths and weaknesses of universities as boosters of entrepreneurship and assess the role played by individual and contextual factors. We demonstrate the importance of entrepreneurial education for encouraging student entrepreneurship and of a match between field of study and sector of a start-up's activity for establishing successful companies. We also identify theoretical and managerial implications for university managers to rethink educational plans and create entrepreneurship opportunities for graduates of all university courses.

The paper proceeds as follows. Section 2 reviews the existing research on student entrepreneurship and sets out our hypotheses. Section 3 illustrates the data, methods, and results of the analysis. Section 4 discusses the results and presents some concluding remarks.

2. Student entrepreneurship

Perkmann and Walsh (2007) defined university–industry relationships as encompassing a portfolio of activities ranging from the transfer of intellectual property to licensing, patents and, finally, commercialization. However, the variety of university–industry relationships is wider than this definition suggests; it includes different types of collaborations, which can be classified according to intensity, formality, and time frame. University–industry links vary in terms of their nature and objectives and the role of public policy in their establishment (World Bank, 2013; Filippetti et al., 2017). However, they can be broadly divided into three groups: 1) academic entrepreneurship, 2) academic engagement, and 3) student entrepreneurship.

Academic entrepreneurship is "the attempt to increase individual or institutional profit, influence or prestige through the development and marketing of research ideas or research-based products" (Louis et al., 1989: 110). It includes a) patenting of academic inventions, b) licensing of academic inventions, and c) academic spin-offs. Academic entrepreneurship confers prestige on professors and universities and offers financial rewards (Shane, 2004; Etzkowitz, 2000). To facilitate the commercialization of intellectual property, many universities have technology transfer offices (TTOs), science parks, or incubators (Clarysse at al., 2005), which act as bridges between scientific knowledge and technology development.

Academic engagement is the "knowledge-related collaboration by academic researchers with non-academic organizations" (Perkmann et al.,

2013: 424) and is more widely practiced than academic entrepreneurship. It is closely aligned with traditional academic research activities and is pursued by academics to access resources to support their research agendas (Perkmann et al., 2013). It includes various forms of university–industry collaboration that are generally profitable and can be either formal or informal (Apa et al., 2020). The most common types of academic engagement are a) contract research, b) collaborative research for R&D projects involving dedicated research groups, c) consulting, and d) informal activities.

Mars et al. (2008) were the first to include student entrepreneurship among the types of university–industry linkages. This new and under-investigated phenomenon was defined by Colombo et al. (2015) as new ventures created by students and recent graduates. The main features of student entrepreneurs are as follows: 1) They use university knowledge to recognize opportunities and develop, launch, and operate new companies to exploit them. 2) They use their university education to develop the three core capabilities that underline venture creation: opportunity refinement, resource acquisition, and venture championing. 3) They rely on their university's reputation and networks to reach the credibility thresholds of their ventures. 4) They use their university to develop weak and strong network ties. Weak ties provide them with new knowledge and information, while strong ties provide resources, legitimacy, and sensitive information exchange. Bridging ties provide market and customer information and enable entrepreneurs to expand their capabilities (Hoskisson et al., 2011).

Student start-ups account for a significant portion of the entrepreneurial activity directly stemming from universities (Åstebro and Bazzazian, 2011; Åstebro et al., 2012; Breznitz and Zhang, 2019). Over the last decade, scholarly interest in entrepreneurship has increased. However, student entrepreneurship remains an under-investigated phenomenon that requires more in-depth analysis. Colombo et al. (2016) examined student entrepreneurship at Politecnico di Milano and identified the following elements that increase students' propensity to create one or more start-ups: a) a specialized course curriculum, b) a high final degree score (103/110 or higher), and c) graduating from a management or economics course. They also investigated the relationship between course curriculums and student entrepreneurship in technology-based universities, using Politecnico di Milano as a case study. Ruda et al. (2009) found that an entrepreneurial education and awareness of the assistance offered by colleges and universities encouraged students to become entrepreneurs. Many other studies also found that entrepreneurship education programs contribute to the development of entrepreneurial intentions among students (Gibb, 2002; Fayolle et al., 2006).

Universities can foster and support student entrepreneurship in many ways by offering entrepreneurship education (Bae et al., 2014) and assisting graduates with business ideas to start their own businesses. The re-

sults of a questionnaire administered to applicants of a graduate enterprise program sponsored by a training agency showed that 90% of the participants would have deferred their entrepreneurial activities by at least five years, if not forever, without the support of this program (Brown, 1990). The program supported student entrepreneurship by a) providing student entrepreneurs with access to university resources, such as laboratories, free office space, and telecommunication facilities (Mars and Rhoades, 2012); b) establishing networks with professors, who invest their expertise and money in student projects and boost the image of start-ups with their talent and prestige (Mars and Rhoades, 2012); and c) organizing business plan competitions, which enable students to access strategic networks of entrepreneurs and influential professionals to source funding for their projects (Mars and Rhoades, 2012). Our first hypothesis is as follows:

Hypothesis 1: Entrepreneurship education positively impacts student entrepreneurship.

The nature and source of students' knowledge is also a factor that affects their ability to recognize technological and market opportunities and thus entrepreneurship orientation (Kor et al., 2007). This is why STEM areas are traditionally associated with high-impact entrepreneurship. Graduates of STEM courses are viewed as major drivers of technological innovation, and universities tend to support STEM start-ups through organizations such as TTOs, business incubators, and science parks (Atkinson and Mayo, 2010). There are fewer measures targeted at non-STEM graduates, who are, therefore, often at a disadvantage when trying to start a new business. Thus, our second hypothesis is as follows:

Hypothesis 2: STEM education positively impacts student entrepreneurship.

Lent et al. (2004) first argued that learning experiences, which can include the attendance of university courses abroad, are a factor in determining students' interest in establishing new ventures. The integration of study abroad programs into university curriculums may positively impact self-efficacy, self-confidence, and the ability to adapt to new environments, all of which are attributes conducive to starting a business (Van Auken, 2013). Increasing globalization has intensified the need to combine entrepreneurship skills with foreign language proficiency and cultural awareness (Huebner, 1998). Students who study abroad for a period are more likely to be exposed to different cultural and social environments, learn different types of knowledge, and come up with new ways of reorganizing knowledge and ideas, all of which can drive innovation and entrepreneurship (Fatlin, 2018). Consequently, our third hypothesis is as follows:

Hypothesis 3: The integration of study abroad programs into university curriculums positively impacts student entrepreneurship.

Studies have reported significantly less interest in pursuing an entrepreneurial career among females than among males (Marlino and Wilson, 2003). Several factors may account for this disparity. Females generally report a lack of work experience and feel less confident and capable of initiating entrepreneurial activity than males, even when receiving the same education and coming from similar backgrounds (Petridou et al. 2009). Although the number of female entrepreneurs has increased in recent years (Brush et al., 2009; de Bruin et al., 2006), it is still lower than the number of male entrepreneurs (Dabic et al., 2012; GEM, 2010). This trend seems to hold for student entrepreneurship (Brezniz and Zhang, 2020; Duval-Couetil et al., 2014). Therefore, we expect a lower prevalence of female student entrepreneurs.

Hypothesis 4: Male graduate students are more likely than their female counterparts to become entrepreneurs.

Entrepreneurs show a tendency to establish new companies close to home, where they have established social networks. Proximity to family and friends is often the most important driver of the choice of location for a new venture and of its success. Sorenson and Audia (2000) and Dahl and Sorenson (2012) have argued that entrepreneurs tend to remain rooted in their regions of origin because personal relationships help them to raise capital, recruit employees and suppliers, and attract customers. Dahl and Sorenson (2009) coined the term "embedded entrepreneur" to describe this phenomenon. Michelacci and Silva (2007) also identified this tendency and found that entrepreneurs have an even stronger tendency than employees to remain in their regions of birth.

Hypothesis 5: The establishment of a start-up close to the place of residence of the founder positively affects the success of the venture.

Robust empirical evidence suggests that education is an important positive determinant of entrepreneurial performance, in terms of survival probability, revenue growth, occupation rate, profits, and propensity to innovate and to valorize human capital (Bates, 1999; Ferrante, 2005). Some studies have indicated that the poor economic performance of the Italian economy over the past 15 years can be partly ascribed to entrepreneurial styles and strategies determined by a poor endowment of human capital (Bugamelli et al., 2011; Schivardi and Torrini, 2011; Federici and Ferrante, 2014). Åstebro et al. (2012) observed that the probability of establishing a

successful venture is much higher when the founder's degree is closely related to the company's activity and when the founder is a graduate of a prestigious university. Therefore, our last hypothesis is as follows.

Hypothesis 6: A match between company activity and founder's degree positively affects firm performance.

3. Data and method

3.1. Data

Our research focuses on the University of Padova, an organization that strongly contributes to the development and innovativeness of the Veneto region by enhancing knowledge production and commercialization. The University of Padova promotes research and service activities at the request and in favor of third parties and in collaboration with outside entities.[1] In a report covering the period 2004–2010, the National Research Assessment Committee ranks this university first in Italy for the quality of its research results.[2] Padova has excellent rankings in all disciplines and is a leader in physics, earth sciences, biology, medicine, agrarian and veterinary science, industrial and information engineering, economics, and statistics.[3]

We quantitatively analyzed secondary data retrieved from the University of Padova's statistics office and InfoCamere ScpA, the digital innovation company for the Italian Chambers of Commerce that manage the Telematic Business Register (www.registroimprese.it). The statistics office of the University of Padova provided information on 119,347 students who graduated from the University of Padova between 2000 and 2010. Personal data and information on university courses, years of enrollment and graduation, number and types of credits (ECTS), thesis titles and supervisors, final grades, and other individual and academic characteristics were collected by the administrative office through two surveys administered at the beginning and end of each student's academic life. InfoCamere ScpA provided data identifying graduates who were listed as shareholders or managers of companies on the Italian Telematic Business Register. After data cleaning, we obtained an original database containing information about graduates occupying leading positions (top managers) in companies and the entrepreneurial activity of graduates. The database consists of 6,427 companies either founded by graduates (4,172) or that employed graduates as top managers (2,255) between 2000 and 2010. For the quantitative

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analysis, we focused first on the overall database of 119,347 graduates to investigate the factors affecting student entrepreneurship. We then focused on the performance of the 4,172 companies founded by graduates at the University of Padova.

3.2. Method[4]

This work is based on a deductive research design. It uses quantitative statistical analysis to test the hypotheses derived from a review of the literature on student entrepreneurship. To identify the factors that impact entrepreneurship as a job choice and those that influence the success of the new venture, we estimated two sets of probit models. The models include independent variables, chosen for the purpose of hypotheses testing, and control variables, which reflect factors that generally correlate with graduate entrepreneurship (e.g., final grade, length of study) (Backes-Gellner and Werner, 2007) or with firm performance (e.g., age, size, and location of company) (Arend, 2014). All variables entered in the regressions are described in the sections below.

3.2.1. Dependent variables

ENTREPR is a dummy that takes a value of 1 if the owners of the company include a graduate of the University of Padova who graduated between 2002 and 2010.
COMPSTATUS is a dummy that takes a value of 1 if the company was active in 2015 and 0 if it was inactive, in liquidation, in bankruptcy, or suspended.

3.2.2. Independent variables

Place of residence of the student is captured by six dummies that indicate the place of residence of the student (northeast, northwest, center, south of Italy, islands, or foreign country).
Gender (SEX) is a dummy that takes a value of 1 if the student is male and 0 otherwise.
Experience Abroad (ExpAbroad) is a dummy variable that refers to any kind of academic experience gained by the student abroad. It takes a value of 1 if the student reported experience abroad during their university attendance and 0 otherwise.
University course is captured by 13 dummies representing specific uni-

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[3] http://unipd.it/ilbo/content/anvur-e-qualita-della-ricerca-padova-al-primo-posto-italia
[4] A list of all the variables entered in the regression analysis is available in Table A1 in the Appendix.

versity courses. They take a value of 1 if the student attended the course.

Credits in economics exams refers to the credits accumulated by the student in each economic discipline.

Total credits in economics exams (TotCredEcon) is the sum of all credits obtained by the student in exams spanning all areas of economics.

Same Province (SameProv) represents the link between the geographic location of the company and the province of residence of the student. The dummy assumes a value of 1 if the company was founded in the same province as that of the student's residence and 0 otherwise.

Degree–Company Matching (UnivInflue) represents the link between a student's degree and their final job as an entrepreneur. The dummy takes a value of 1 if the sector of activity of the company and the university course attended by the student are connected and 0 otherwise.

3.2.3. Control variables

Company during university (*CompDurUniv)* refers to companies founded by students in the period between the year of enrollment and the year of graduation. The dummy assumes a value of 1 if the company was founded while the student attended university and 0 otherwise.

Years of study (YStudy) represents the number of years spent at university. It is calculated as the difference between the year of graduation and the year of enrollment.

Graduation Mark (GradMark) is a quality indicator of the academic performance of the student at the University of Padova (the range is between 70 and 110).

Location of the company captures the location of the company and is represented by five dummies, each indicating a geographic area of Italy (northeast Italy, northwest Italy, central Italy, south of Italy, or islands).

Company sector indicates the sector in which the company operates and is represented by four dummy variables, each representing a sector in line with the Italian Ateco classification.

Company age (AgeComp) is calculated as the difference between 2015 and the year the company was founded.

Company size (TotEmpl) represents the size of a company and is calculated as the total number of employees in 2015.

3.3 Results

We first estimated the factors that impact the choice of entrepreneurship as a job through two probit regression models (Table 1). The difference between model A1 and model A2 is that model A2 accounts for all the possible credits obtained through the attendance of courses on economics

subjects, while model A1 counts the overall credits obtained in economics subjects. We can observe that entrepreneurial activities are mainly conducted by males who completed their course of study on time. Neither grades nor experiences abroad were found to be significant drivers of entrepreneurship. Hypothesis 4 is therefore confirmed since there is a gender gap in entrepreneurial choice. However, Hypothesis 3 is not confirmed since the choice of entrepreneurship as a career is not linked to educational experience abroad.

The course of study a student attended was found to influence their probability of becoming an entrepreneur. The descriptive statistics show that engineering students founded the most companies. However, agricultural science had the highest proportion of entrepreneurs per students registered. Hypothesis 2 is therefore confirmed, as STEM students were more likely to choose to establish a new venture after graduation.

Hypothesis 1 is also confirmed, since the number of credits obtained by attending courses in economic disciplines positively impacted the probability of becoming an entrepreneur, and, as model A2 shows, the results differed across economics courses. We also found geographical differences indicating that the students' place of residence impacted their entrepreneurial actions.

Tab. 1: Estimation of the probability of becoming an entrepreneur

Probit		Model A1			Model A2	
		Robust			Robust	
Entrepr.	Coef.	Std. Err.		Coef.	Std. Err.	
_cons	-0.75909	(0.18)	***	-0.83277	(0.21)	***
SEX	0.463305	(0.02)	***	0.463843	(0.02)	***
YStudy	-0.04319	(0.01)	***	-0.04418	(0.01)	***
GradMark	-0.01541	(0.00)	***	-0.01559	(0.00)	***
ExpAbroad	-0.1362	(0.05)	***	-0.14077	(0.05)	***
AGR	0.758381	(0.09)	***	0.820203	(0.14)	***
ECON	(omitted)			(omitted)		
PHARM	0.726306	(0.11)	***	0.808747	(0.15)	***
LAW	0.163094	(0.10)		0.306443	(0.15)	**
ENG	0.029101	(0.09)		0.144748	(0.14)	
LIT	0.403623	(0.09)	***	0.484336	(0.14)	***
MED_CH	0.295991	(0.09)	***	0.377276	(0.14)	***
MED_VET	0.865248	(0.12)	***	0.94715	(0.16)	***
PSYC	0.109813	(0.09)		0.187194	(0.14)	
SC_FORM	0.153608	(0.10)		0.222827	(0.15)	

SC_MAT	0.218542	(0.09)	**	0.311524	(0.14)	**
SC_POL	0.391698	(0.08)	***	0.564432	(0.13)	***
SC_STAT	0.216877	(0.10)	**	0.293066	(0.16)	*
TotCredEcon	0.003731	(0.00)	***	-	-	
NCrIngEco	-	-		-0.00134	(0.00)	
NCrPolEcon	-	-		-0.00318	(0.00)	
NCrFinScien	-	-		-0.01894	(0.01)	*
NCrHistor	-	-		-0.02345	(0.02)	
NCrEcmetrx	-	-		-0.00332	(0.02)	
NCrAdvEcon	-	-		-0.00597	(0.01)	
NCrAccount	-	-		0.008488	(0.00)	*
NCrManag	-	-		0.013254	(0.00)	***
NCrBusinFin	-	-		-0.01305	(0.03)	
NCrCompMan	-	-		0.026895	(0.01)	***
NCrIntermed	-	-		-0.0053	(0.01)	
NCrHistEcon	-	-		-0.00843	(0.01)	
NcrProdScien	-	-		0.37313	(0.14)	***
StNW	(omitted)			(omitted)		
StNE	0.230384	(0.05)	***	0.232017	(0.05)	***
StCentre	0.648827	(0.07)	***	0.647114	(0.07)	***
StSouth	0.552411	(0.05)	***	0.553938	(0.05)	***
StIslands	0.663123	(0.06)	***	0.665544	(0.06)	***
StForeign	-0.26203	(0.14)	*	-0.24544	(0.14)	*
Number of obs		64359			64359	
Wald chi2(34)		1263.72			1311.78	
Pseudo R2		0.0792			0.0819	
Log pseudolikelihood		-8154.46			-8130.5	

Source: our elaboration

Second, we investigated the factors affecting the success of the new ventures through another two probit regression models (Table 2). The main difference between model B2 and model B1 is that model B2 accounts for the sector of activity of the company. We found that success is not linked to gender or to the quality of the students (measured as graduation mark). Surprisingly, we found a negative relationship between venture success and experience abroad. This raises questions regarding students' motivations for embarking on an Erasmus program. Another unexpected result was a negative impact of credits in economics subjects, which might be explained by the fact that students without an economics background may engage in master's courses or network with more experienced people to fill

gaps in their skill set. It appears that the entrepreneurial education currently offered to students is not enough to guarantee a successful future as an entrepreneur. It was also surprising to find that, in contrast to Hypothesis 5, proximity between the founder's place of residence and the location of the firm was not correlated with a company's success.

However, the fitness between the company activities and the type of university course attended does appear to positively affect the success of entrepreneurial ventures. Therefore, Hypothesis 6 is confirmed.

Tab. 2: Estimation of the probability of founding a successful company

Probit		Model B1			Model B2	
		Robust			Robust	
CompStatus	Coef.	Std. Err.		Coef.	Std. Err.	
_cons	1.780838	(0.96)	*	1.929639	(0.99)	*
SEX	0.044668	(0.12)		0.044109	(0.12)	
YStudy	0.006909	(0.04)		0.006868	(0.04)	
GradMark	-0.0053	(0.01)		-0.00498	(0.01)	
ExpAbroad	-0.41837	(0.25)	*	-0.3985	(0.25)	
TotCredEcon	-0.00672	(0.00)	**	-0.00678	(0.00)	**
AGR	0.247669	(0.30)		0.316624	(0.31)	
ECON	(omitted)			(omitted)		
PHARM	0.19673	(0.33)		0.198663	(0.33)	
LAW	0.065761	(0.39)		0.085902	(0.39)	
ENG	0.307066	(0.26)		0.313182	(0.26)	
LIT	0.246319	(0.30)		0.249823	(0.30)	
MED_CH	0.200057	(0.27)		0.228199	(0.27)	
MED_VET	0.310078	(0.30)		0.331405	(0.30)	
PSYC	0.239956	(0.28)		0.247039	(0.28)	
SC_FORM	0.473272	(0.38)		0.477989	(0.38)	
SC_MAT	-0.04552	(0.29)		-0.03318	(0.29)	
SC_POL	0.233352	(0.28)		0.249325	(0.28)	
SC_STAT	0.309216	(0.42)		0.306825	(0.42)	
SameProv	-0.05944	(0.13)		-0.05285	(0.13)	
UnivInflue	0.589779	(0.15)	***	0.588111	(0.15)	***
CompDurUniv	0.422644	(0.30)		0.422813	(0.30)	
AgeComp	0.038934	(0.02)	**	0.040005	(0.02)	***
TotEmpl	-0.00312	(0.01)		-0.00375	(0.01)	
CoNE	(omitted)			(omitted)		
CoNW	0.056981	(0.22)		0.050959	(0.22)	
CoCentre	-0.47702	(0.22)	**	-0.48086	(0.21)	**
CoSouth	-0.38362	(0.19)	**	-0.39017	(0.19)	**

CoIslands	-0.34528	(0.23)	-0.33653	(0.23)
A			-0.43309	(0.31)
X			-0.08533	(0.31)
SO			-0.20194	(0.26)
Number of obs	1735		1735	
Wald chi2(34)	48.97		57.83	
Pseudo R2	0.0936		0.0971	
Log pseudolikelihood	-302.105		-300.949	

Source: our elaboration

4. Discussion and conclusions

The aim of this work was to analyze the factors affecting the choice of entrepreneurship as a career among graduates of the University of Padova (student entrepreneurs) and identify the drivers of successful company foundation by student entrepreneurs. We performed a quantitative analysis on a secondary database built for the purpose of this study, which includes information on 119,347 students who graduated from the University of Padova between 2000 and 2010 and identifies those who became entrepreneurs. We discovered that 4,172 graduates founded a company in Italy. By estimating two sets of probit models, we obtained insights that are relevant for theory and practice. Based on our investigations, we profiled student entrepreneurs and identified the determinants of a successful start-up.

The analysis revealed the following features of student entrepreneurship: 1) It is gender-biased, as the majority of entrepreneurs are male. 2) It is positively correlated with entrepreneurship education. 3) It is dependent on the university course attended by the student, with STEM courses producing more entrepreneurs. 4) It is negatively affected by a period of study abroad.

Regarding the gender imbalance, our results align with those of previous studies, which have emphasized the gender gap in entrepreneurial activities in general and in student entrepreneurship in particular (Brezniz and Zhang, 2020; Duval-Couetil et al., 2014). Similarly, with respect to the impact of entrepreneurship education on student entrepreneurship, our results support previous research, which has indicated a positive effect (Gibb, 2002; Fayolle et al., 2006). Regarding the type of course attended, our findings help to clarify the inconsistent results of previous research with respect to the links between STEM education and entrepreneurial action. In fact, some scholars have suggested that the high demand for STEM students in the job market hampers student entrepreneurship (Delmar and Wennberg, 2010; Alves et al., 2019). Surprisingly, in contrast to the findings of previous research on combining entrepreneurship education with a period of study abroad, we found experience attending university courses abroad did not support student entrepreneurship.

Our analysis of the determinants of a successful business revealed other relevant factors: 1) Venture success is positively associated with the proximity between the type of activities performed by the company and the type of university course attended. 2) Success is not influenced by the proximity between the place of residence of the founder and the location of the start-up.

In line with the findings of Åstebro et al. (2012), we found that the success of a graduate's business is associated with a match between the field of activity of the company and the type of university course attended. Although proximity to family and friends is known to be the main driver for choosing the location of a start-up, our work provides evidence that this is not a factor that determines the success of start-ups.

We contribute to previous literature on the topic by extending our analysis beyond STEM courses and considering a broad range of factors not only to identify the drivers of entrepreneurship as a career choice but also to understand the main determinants of successful student entrepreneurship. Only by combining these two important aspects (the choice to become an entrepreneur and venture performance) is it possible to obtain a complete picture of the student entrepreneurship phenomenon.

Regarding managerial implications, this research can contribute to the creation of a portfolio of solutions to improve university offerings in terms of new events, courses, and meta-organizations to support students in establishing new businesses and extend them beyond the science and technology area. Specific initiatives for female graduates would ensure inclusiveness. Furthermore, student experiences abroad should not be limited to university courses but should extend to study tours to foreign companies and internships. University managers should radically rethink universities' educational offerings and the objectives of university–industry interventions.

Successful graduate start-ups are strongly influenced by a match between the company's field of operations and the university course attended by the founder. Students' exposure to business opportunities close to their field of study might increase the probability of them establishing successful companies. Therefore, universities should think about developing new ways of interacting with the industry that extend beyond the services provided by traditional TTOs. They should explore new informal channels based on personal relationships and customized research projects, with the participation of soft science university courses.

Before concluding, we acknowledge a few limitations of the study and propose avenues for future research. First, our analysis is based on student start-ups at a single university. Therefore, caution should be used when generalizing the findings. However, to the best of our knowledge, no other study has gathered comparable data from other universities.

Further research could extend the analysis of this study to other Italian universities to obtain a deeper understanding of the student entrepre-

neurship phenomenon. This would provide a high-resolution panoramic picture of the national situation. As entrepreneurship is one of the main engines of national development, it would be useful to understand why only 3% of students who graduated from the University of Padova between 2000 and 2010 decided to establish a firm, while 97% decided to work for other firms. Although this percentage is largely reflective of similar for other universities, it is still not clear why it is so low. Since one of the aims of both universities and governments is to study and promote entrepreneurship, we must find a way to change this scenario. The literature on university entrepreneurship widely recognizes its importance but, to date, has offered little data on student start-ups. This research offers some food for thought regarding urgent actions to foster student entrepreneurship to facilitate university–industry collaborations more generally.

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APPENDIX

Tab. 1: List of variables included in the secondary data analysis

Name	Label	Type	Description
Entrepreneur	Entrepr	Dependent Variable	Dummy(0,1): Assumes value 1 if the student became an entrepreneur
Company Status	CompStatus	Dependent Variable	Dummy(0,1): Assumes value 1 if the company is active in 2015 and 0 otherwise (inactive, in liquidation, in bankruptcy or suspended)
Male	Male	Independent variable	Dummy(0,1): Assumes value 1 if the student is a male
Years of study	YStudy	Independent variable	Difference between the year of graduation and the year of enrolment at the university
Graduation mark	GradMark	Independent variable	Graduation mark
Experience abroad	ExpAbroad	Independent variable	Dummy(0,1): Assumes value 1 if the student made an experience abroad during the university
University course	AGR		Dummy(0,1) that assumes value 1 if the student is enrolled in the Agronomy course
	ECON		Dummy(0,1) that assumes value 1 if the student is enrolled in an Economics course
	PHARM		Dummy(0,1) that assumes value 1 if the student is enrolled in the Pharmacy course
	LAW		Dummy(0,1) that assumes value 1 if the student is enrolled in the Law course
	ENG		Dummy(0,1) that assumes value 1 if the student is enrolled in an Engineering course
	LIT		Dummy(0,1) that assumes value 1 if the student is enrolled in a Philosophy and Letters course
	MED_CH	Independent variable	Dummy(0,1) that assumes value 1 if the student is enrolled in the Medicine and Surgery course
	MED_VET		Dummy(0,1) that assumes value 1 if the student is enrolled in the Veterinary medicine course
	PSYC		Dummy(0,1) that assumes value 1 if the student is enrolled in the Psychology course
	SC_FORM		Dummy(0,1) that assumes value 1 if the student is enrolled in the Education Sciences course
	SC_MAT		Dummy(0,1) that assumes value 1 if the student is enrolled in a Physical and Natural Sciences course
	SC_POL		Dummy(0,1) that assumes value 1 if the student is enrolled in a Political Science course
	SC_STAT		Dummy(0,1) that assumes value 1 if the student is enrolled in a Statistical Sciences course

Location of the company	CoNW		Dummy(0,1): Assumes value 1 if the company is located in the northwest of Italy
	CoNE		Dummy(0,1): Assumes value 1 if the company is located in the northeast of Italy
	CoCentre	Independent variable	Dummy(0,1): Assumes value 1 if the company is located in the centre of Italy
	CoSouth		Dummy(0,1): Assumes value 1 if the company is located in the south of Italy
	CoIslands		Dummy(0,1): Assumes value 1 if the company is located in Sicily or in Sardinia
Place of residence of the student	StNW		Dummy(0,1): Assumes value 1 if the student lives in the northwest of Italy
	StNE		Dummy(0,1): Assumes value 1 if the student lives in the northwest of Italy
	StCentre	Independent variable	Dummy(0,1): Assumes value 1 if the student lives in the centre of Italy
	StSouth		Dummy(0,1): Assumes value 1 if the student lives in the south of Italy
	StIslands		Dummy(0,1): Assumes value 1 if the student lives in Sicily or in Sardinia
	StForeign		Dummy(0,1): Assumes value 1 if the student lives in a foreign country
Same province	SameProv	Independent variable	Dummy(0,1): Assumes value 1 if the company was founded in the same province of residence of the student
University influence (consistency)	UnivInflue	Independent variable	Dummy(0,1): Assumes value 1 if the sector of activity of the company and the university course attended by the student are consistent
Company created during university	CompDurUniv	Independent variable	Dummy(0,1): Assumes value 1 if the company was founded during the university
Age company	AgeComp	Independent variable	Difference between 2015 and the year of foundation of the company
Total employees	TotEmpl	Independent variable	Total number of employees of the company at 2015
Company sector	A		Dummy(0,1): Assumes value 1 if the company operates in the agriculture, forestry and fishing sector
	C	Independent variable	Dummy(0,1): Assumes value 1 if the company operates in the manufacturing sector
	X		Dummy(0,1): Assumes value 1 if the company operates in an unclassified sector
	SO		Dummy(0,1): Assumes value 1 if the company operates in all the other sectors

Credits received in economics exams	NCrIngEco		Credits in Economic Engineering
	NCrPolEcon		Credits in Economic Policy
	NCrFinScien		Credits in Financial Science
	NCrHistor		Credits in History of economic thought
	NCrEcmetrx	Independent variable	Credits in Econometrics
	NCrAdvEcon		Credits in Applied Economics
	NCrAccount		Credits in Business administration
	NCrManag		Credits in Economics and business management
	NCrBusinFin		Credits in Corporate finance
	NCrCompMan		Credits in Corporate organization
	NCrIntermed		Credits in Economics of Financial Intermediaries
	NCrHistEcon		Credits in Economic history
	NcrProdScien		Credits in Product science
Total credits in economics exams	TotCredEcon	Independent variable	Sum of the credits in all the exams listed above