

POLITECNICO DI MILANO

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STUDENT ENTREPRENEURS FROM TECHNICAL  
UNIVERSITIES:  
THE IMPACT OF EDUCATION ON THE TEAM  
COMPOSITION FORMED FOR ENTREPRENEURIAL ENTRY

Supervisor: Prof. Evila Piva

MSc Thesis by:

Nicolás Amiano

ID: 850259

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# Abstract

The purpose of this work is to analyze the impact of students' education on the probability of teaming up with different types of individual and forming student start-ups. The founding team composition was analyzed from the Resource-seeking perspective and from the Interpersonal attraction perspective. These two theoretical approaches support opposite stimulus that lead to diverse team compositions. We identified that students can start businesses with family members, with other relatively unexperienced young people, with significantly more experienced individuals or as solo entrepreneurs. We distinguished various educational dimensions of the students' university education and, consistently with previous studies, suggested their potential effects on the founding team composition. To conduct our analysis, we collected information on student entrepreneurs who graduated from the Politecnico di Milano, and their cofounders. We used this data to test our assumptions through a multinomial logit model. The estimates provide statistical evidence that the university education from technical universities affect the type of individuals the student involves for new venture creation. Both a high level of specialization of the university curriculum and a study experience abroad strongly stimulate students to start a company with people of their same age. Work experience during the degree also supports, although in a weaker way, the students to start a venture right after graduation with more experienced individuals. Moreover, the study confirms that experienced individuals or relatives to the student are less likely to be influenced by signals. Nevertheless, certain signaling effects are interestingly lower than expected. The information about students' teammates is scarce and limits our work, preventing us from exploring interesting issues. Still, the study has implication for university managers as it shows that a proper design of the university curricula is able to promote entrepreneurial entry with a defined founding team composition.

# Estratto

Lo scopo di questo lavoro è quello di analizzare l'impatto dell'istruzione degli studenti sulla probabilità di collaborare con diversi tipi di individui e formare start-ups. La composizione della squadra di base è stata analizzata dalla prospettiva di ricerca delle risorse e dalla prospettiva di attrazione interpersonale. Questi due approcci teorici sostengono stimoli opposti che portano a la formazione di squadre con diverse composizioni. Abbiamo individuato che gli studenti possono iniziare le attività con membri della loro famiglia, con altri giovani relativamente inesperti, con individui molto più esperti o come imprenditori da soli. Abbiamo riconosciuto varie dimensioni educative dell'istruzione universitaria degli studenti e, in linea con gli studi precedenti, abbiamo suggerito i loro potenziali effetti sulla composizione del team di fondatori. Per condurre la nostra analisi, abbiamo raccolto informazioni sugli imprenditori studenti che si sono laureati presso il Politecnico di Milano e i loro cofondatori. Abbiamo utilizzato questi dati per testare le nostre ipotesi attraverso un modello logit multinomiale. Le stime forniscono prove statistiche che l'istruzione universitaria delle università tecniche influenzano il tipo di individui che lo studente implica per la creazione di una nuova impresa. Sia l'elevato livello di specializzazione del curriculum universitario e l'esperienza di studio all'estero stimolano fortemente gli studenti ad iniziare un'azienda con persone della stessa età. L'esperienza di lavoro durante la laurea supporta, anche se in modo più debole, gli studenti ad avviare un'impresa subito dopo la laurea con individui più esperti. Inoltre, lo studio conferma che gli individui esperti o i parenti dello studente sono meno probabili per essere influenzati dai segnali. Tuttavia, alcuni effetti di segnalazione sono interessanti inferiori a quelli previsti. Le informazioni sui compagni di squadra degli studenti sono scarse e limitano il nostro lavoro, impedendoci di esplorare temi interessanti. Comunque, lo studio ha implicazioni per i dirigenti universitari, in quanto dimostra che un corretto disegno dei programmi universitari è in grado di promuovere l'ingresso imprenditoriale con una composizione determinata della squadra di base.

# Executive summary

*“It is important for young entrepreneurs to be adequately self-aware to know what they do not know”*

Mark Zuckerberg – Facebook Co-Founder and CEO

## Research objectives

This work focuses on student entrepreneurship, a field on study becoming each time more popular, as students are each time more widely recognized as important actors to exploit business opportunities. Student entrepreneurs acquire strong competences from university education; however, they have low experience and therefore present important knowledge gaps. As entrepreneurs are not lone heroes but they tend to be part of a team or build one around them, it is interesting to analyze how students define the team composition to cover their knowledge gaps.

Numerous works have recognized that university education plays a major role on student entrepreneurial entry; however, the effect on team composition remains understudied. With the objective of covering this gap and study the implications for policy makers, the aim of this work is to analyze the impact of students' education on the probability of teaming up with different types of individual and forming student start-ups.

## Research framework

Research on student entrepreneurship investigates two main topics: the drivers of the formation of entrepreneurial intentions among students and the antecedents of students' entrepreneurial entry. For both cases, university education revealed to have important effects over the student entrepreneurs. We can identify different sources for these effects. The

university education can either be a source of signals to assess the students' quality, it can help the students develop competences that influence how students perceive and face business opportunities, and it can influence their network.

About the team formation, two main theoretical perspectives support the analysis of the founders' team: the Resource-seeking perspective and the Interpersonal attraction perspective. The first one suggest that teams should have within their founding team the crucial competences for the development of the business, and therefore promotes the creation of heterogeneous teams. The second one, supports that people closely related or with similarities tend to form teams together, thus encourages more homogeneous teams. Although these two viewpoints are not mutually exclusive, they generate opposite stimulus for the moment of the team composition.

Based on the diverse magnitudes that the two opposite forces can take, we can identify different categories of founding teams compositions. Students can start businesses with their family members, with other relatively unexperienced young people, with significantly more experienced individuals or they can start as solo entrepreneurs.

## Research method

To develop our analysis, we identified different educational dimensions and the possible effects that each one could have, based on signalling, competences and network effects. We analysed the effects of the following educational dimensions: curriculum specialization, training in economics and management, student's university performance, degree quality, study experience abroad, work experience and students taking longer to graduate.

To analyze the effects, we merged a unique dataset including information on the individuals who obtained a Laurea Magistrale Degree at Politecnico di Milano, with data about the individuals that started a venture with at least one of them as part of the founding team. Our main dataset includes the students that graduated between July 2005 and December 2009, which account for 13,661 individuals. To gather information about the other founders, we had access to the constitutive acts corresponding to the ventures founded by these alumni.

As the quantity of solo founders is small, for analysis purposes we regrouped them with the founding teams that had a company or another organization as founders.

To evaluate how the influence of the university education changes over time, we created three definitions of student entrepreneurs according to the number of years that separate entrepreneurial entry from graduation. In the specific, we looked at 1 year, 3 years and 5 years from graduation, as to observe, if any, the changes in the impact. We created the variables called TEAM\_CATEGORY1, TEAM\_CATEGORY3 and TEAM\_CATEGORY5 respectively. As we are analyzing the effect of the university educational dimensions, and it would be highly complex to do it with students that haven't graduated yet, in all the cases we excluded from the definition of student entrepreneurs students that started their first venture before graduation. Each of these variables will take the value 1 for family businesses, 2 for team composed by peers, 3 for team containing experienced members, 4 for the remaining team compositions, and 0 when the student did not found a company on the corresponding period observed. Given the nature of the dependent variable, we use a multinomial logit model.

The explanatory variables used to capture the above mentioned educational dimensions are the following:

- *Course\_Specialization*: captures the degree of specialization of the focal alumnus' university curriculum.
- *D\_Economics*: equals one for Polimi alumni who completed at least one course associated to the Educational Sector Code corresponding to Economics, Management and Management Engineering
- *Degree\_Score*: captures the alumnus' final degree score. The variable ranges from 60 to 110 for the alumni who did not graduate *cum laude* and equals 113 for the alumni who graduated *cum laude*
- *D\_Top\_Uni\_On\_Field* equals 1 when the university is ranked as the first university in Italy on the field of study of the alumni, and 0 when it's not the case.



- *D\_Study\_Abroad* dummy variable equalling 1 for the alumni who participated in study abroad programs, 0 in other cases.
- *D\_Work\_Experience*: dummy variable that equals 1 when the student did a stage in a company as part of his/her university program.
- *D\_Failing\_Alumnus*: Dummy variable equalling 1 for the alumni who took more than two years to obtain the Laurea Magistrale degree.
- *D\_Ind\_Inf\_Engineering*: a dummy variable equalling one for the alumni who attended a degree program pertaining to the School of Industrial and Information Engineering
- *D\_Highest\_Fees* is a dummy equalling 1 for the alumni who were assigned the highest contribution level and 0 otherwise.
- *D\_Prior\_Shareholder* is a dummy equalling 1 for the alumni who had acquired shares in a company before enrolling in the Laurea Magistrale degree program at POLIMI and 0 for the remaining alumni.
- *D\_Woman*, is a dummy equalling 1 for women and 0 for men
- *D\_Born\_Abroad* is a dummy equalling 1 for not Italy-born alumni and 0 otherwise.
- *Age\_Graduation* represents the age of the student at graduation.

## Main findings

The estimates provide statistical evidence that the university education does have an impact on the entrepreneurial entry path of students from technical universities. In particular, educational dimensions affect the type of individuals the student involves for new venture creation.

First, we detected that a high level of specialization of the university curriculum strongly promotes founding teams composed by people of similar age. We suggest that a highly specialized university education signals competences that can attract other potential cofounders. Young individuals lack the capabilities to properly evaluate cofounders, and therefore are more influenced by these signals. The second main conclusion evidences that a study experience abroad has a positive impact to start a company with peers. We can associate this effect to the network development that the student has due to the experience, which can take place during or after the stay abroad.

In addition, we also note that work experience during the degree supports, although in a weaker way, the students to start a venture right after graduation with more experienced individuals. Interestingly, the results show that signals originated by the students' university performance, the quality of the degree and the time taken to graduate, that mainly can inform the student's quality, do not influence the founding team composition. Finally, the study shows that signals originated by university education have no relevance for the creation of teams with experienced individuals or with family members. This confirms that experienced individuals or relatives to the student are less likely to be influenced by signals.

## Thesis outline

To conduct the analysis we will start analyzing the theoretical background to understand what the team formation drivers of student entrepreneurs are, based on which we will present the influence that the university curriculum can have on kind of team the student entrepreneur forms through influencing the signals, the competences and the network acquired by the student. Then, we will describe the data processed to realize the study and explain the methodology used. Then, the obtained results will be presented and commented. To finish, the last section presents an overview on the main conclusions of the work, its

limitations that will trigger future investigations, the theoretical contributions and practical implications.

# Chapter 1: Introduction

Technological universities are sources of knowledge that has the potential of being commercially exploited. We can recognize three main actors that can make use of these opportunities: Academic researchers and university staff, non-academic local entrepreneurs, and university students and recent alumni.

Until nowadays, the vast majority of the research on ventures that were started to exploit technological knowledge generated by academic research has focused on the startups created by academic personnel. These studies show that academic entrepreneurs have strong technical and scientific competences but need a “genetic mutation” (Colombo and Piva, 2012: 90), which is difficult to reach, to obtain the commercial competences and access to assets that they need to develop the venture (Colombo and Piva, 2008).

Non-academic entrepreneurs can leverage on the technological knowledge that spills from local universities to start their own ventures outside of the university. In doing so, this latter kind of entrepreneurs face important challenges as they often lack the “absorptive capacity” (Cohen and Levinthal, 1989) necessary to fully exploit academic knowledge by transforming it into a business, and lack the direct links to the source of knowledge (Colombo et al., 2010).

Although the literature on the topic remains underdeveloped, recent studies focus on the ventures created by current or recently graduated students (hereafter, simply referred to as students), as an interesting way of using the knowledge generated by universities for commercial purposes. This segment of potential entrepreneurs enjoy some advantages in comparison with academic and local non-academic entrepreneurs. In contrast with non-

academic entrepreneurs, students could develop, during their studies, the absorptive capacity required to fully understand the technological knowledge created and they enjoy the benefit of being insiders of the university, that provides them proximity to the source of technological knowledge. Moreover, unlike faculty members, student entrepreneurs are less related to academic research tasks and do not need a genetic transformation to face the incoming commercial challenges. Indeed, Åstebro et al. (2012) have documented that students in science or engineering are twice as likely as faculty members to start a venture. In addition, the same authors stated that “start-ups by recent graduates outperform start-ups by former university employees relative to their corresponding peers by a rather significant margin, especially if start-ups by recent graduates make use of education they received in school” (Åstebro et al., 2012).

Nevertheless, students are young, have limited experience, and therefore lack certain important competences to develop a company. As entrepreneurs are not lone heroes but they tend to be part of a team or build one around them (Cooney, 2005), it is interesting to analyze how students define the team composition to cover their knowledge gaps.

Numerous works have recognized that university education plays a major role on student entrepreneurial entry; however, the effect on team composition remains understudied. With the objective of covering this gap, the aim of this work is to analyze the impact of students’ education on the probability of teaming up with different types of individual and forming student start-ups.

Policy makers are interested on how university education impacts on venture creation by student entrepreneurs, and the further success of these startups. Therefore, relating the results of this analysis with a complementary study on how founding team composition impacts startup performances created by student entrepreneurs might have important policy implications.

To conduct the analysis we will start analyzing the theoretical background to understand what the team formation drivers of student entrepreneurs are, based on which we will present the influence that the university curriculum can have on kind of team the student entrepreneur forms through influencing the signals, the competences and the network acquired by the student. Then, we will describe the data processed to realize the study and

explain the methodology used. Then, the obtained results will be presented and commented. To finish, the last section presents an overview on the main conclusions of the work, its limitations that will trigger future investigations, the theoretical contributions and practical implications.

# Chapter 2: Theoretical background

## 2.1. What we know about student entrepreneurship

Studies on student entrepreneurship provide diverse definitions. Most studies focus on business creation by current students (e.g., Luthje and Franke, 2003; Saeed et al., 2014; Bergman et al., 2016; Minola et al., 2016), while other scholars consider also recently graduated alumni. These latter can be students graduated in the previous year (Lerner and Malmendier, 2013; Premand et al., 2016), or during the previous 3 years (Åstebro et al., 2012). In addition, some studies even consider all university graduates without defining the time elapsed since graduation (Hsu et al., 2007; Jang, 2013; Isada et al., 2015; Trivedi, 2016). Research on student entrepreneurship investigates two main topics: the drivers of the formation of entrepreneurial intentions among students and the antecedents of students' entrepreneurial entry.

Regarding studies on entrepreneurial intentions, many scholars have studied the effect that university plays. Curricular activities showed to be relevant. Maresch et al., (2016) showed that entrepreneurship education is generally effective for business students and science and engineering students. In addition, scholars have presented the positive influence of extra-curricular activities and university resources, such as university incubators and venture funds, to be relevant. Likewise, other universities' characteristics appear to have impact on entrepreneurial intentions. For instance, according to Minola et al. (2016), the degree of university internationalization has a positive effect on student's intention to start a business.

Individual characteristics of the students also influence their intentions to start a venture. Studies analysed personality traits, such as risk taking propensity, perceived feasibility to carry out entrepreneurial activities (Leung et al., 2012) and social norms corresponding to different cultural groups (StJean et al., 2014). In addition, Backes-Gellner and Moog (2007) explored the impact of human and social capital and specify that students with a more balanced portfolio of human and social capital are more willing than “specialists” to turn into entrepreneurship.

Regarding the studies about the antecedents of entrepreneurial entry, the scholars focus their studies on the impact of two sources of human capital: entrepreneurship education and work experience. Studies indicate that entrepreneurship education has a positive impact on both nascent entrepreneurship (Bergmann et al., 2016), especially in case of non-research-driven venture ideas (Bergmann, 2015), and the speed of venture creation (Jang, 2013). Work experience is important for nascent student entrepreneurs as well. Industry experience makes them feel more certain about research-driven venture ideas (Bergmann, 2015) and previous entrepreneurial experience reduces the time taken to venture creation (Jang, 2013). Analysing the performance, Åstebro et al. (2012) presents that ventures created by students have greater earnings and survival forecasts when the new businesses are created in an industry related to their founders’ field of study. As mentioned before, although there is still little understanding of the role of university education as an antecedent of students’ entrepreneurial entry, it has been shown that it has significant effects, not only related to the entrepreneurship education.

## 2.2. What we know about team formation drivers

As mentioned in the introduction, entrepreneurs are not lone heroes, but they tend to be part of entrepreneurial teams (Cooney, 2005). When joining an existing organization, individuals in general have little choice on the team that they will work with, but when starting a venture, the situation is different. Entrepreneurs can choose whom they will work with. It is widely recognized that building the right team while founding a startup is crucial for firm future performance. Although, the drivers that define such an important aspect as the



team composition are not trivial: Based on what do entrepreneurs choose other founders on their team?

Two main theoretical perspectives support the analysis of the founders' team: the Resource-seeking perspective and the Interpersonal attraction perspective (Forbes et al., 2006).

When a startup starts its activity, the founding members are a key resource. Therefore, through the composition of the team, the members define some of the resources that will be at their disposal. According to the resource based view, firms should possess the valuable, rare, inimitable and non-substitutable (VRIN) resources, that are the basis of firm competitive advantage. According to the resource-dependence theory, firms could exploit also external resources but the more rare and crucial are the needed resources, the better to internalize them to reduce firm dependence on the environment. Thus, with the principal aim of always covering the critical gaps of knowledge for the development of the venture, the resource seeking perspective perspective suggests that the members of the entrepreneurial teams should have complementary competences, leading to heterogeneous teams.

On another side, previous works have showed the effect of interpersonal attraction. Based on a large sample of US entrepreneurs, Ruef, Aldrich and Carter (2003), made a study of five potential mechanisms that could influence team membership. They studied the effects of homophily, functionality, status expectations, network constraint, and ecological constraint.

“Homophily refers to the selection of other team members on the basis of similar ascriptive characteristics, such as gender, ethnicity, nationality, appearance, and the like (for a review, see McPherson, Smith-Lovin, and Cook 2001). Functional theories consider the extent to which team members possess valuable and complementary achieved competencies that help ensure the success of a collectivity (e.g., Bales 1953; Slater 1955). Drawing on lines of research in expectation states (Fisek, Berger, and Norman 1991) and structuralism (Skvoretz and Fararo 1996), theories of status variation address the greater capacity of high-status individuals (with respect to ascribed or achieved characteristics) to attract other team members, compared with low-status individuals. Network perspectives posit that team formation occurs within

a preexisting network of strong and weak ties that constrains the founding team's choice of members. Finally, ecological perspectives emphasize the importance of the spatial proximity and environmental distribution of potential group members”. (Ruef et al., 2003; pp. 196)

The results on their dataset indicate that homophily in gender, ethnicity and occupation is the most important mechanism of the ones studied. When forming an entrepreneurial team, entrepreneurs tend to look for individuals with whom they already had strong interpersonal relations, and avoid strangers that could provide different perspectives. This is interesting, as in this context, we could expect that competence heterogeneity would be a predominant factor to maximize economic forecasts, leading to functional diversification of team members, but these results shows it is not like that.

### 2.3 Effects on the kind of teams formed by students entrepreneurs

Although these two viewpoints are not mutually exclusive, they generate opposite stimulus for the moment of the team composition. When analyzing the case of student entrepreneurship, they suffer from knowledge gaps that make decisions about the composition of the entrepreneurial team are even more crucial than in other cases. Based on the diverse magnitudes that the two opposite forces can take, we can identify different categories founding teams compositions.

In some cases homophily plays the stronger force, originating teams on which interpersonal attraction prevails. In some cases, the student entrepreneur finds the other founders on the people he is more closely related with: his family (“Category 1” or “Family category” from now on). Correspondingly, with age similarity as another important characteristic for defining the composition of the team, homophily can lead to the creation of teams of founders of the same age cohort (“Category 2” or “Peers category” from now on).

In other cases, the forces promoting heterogeneous groups of founders are more important. We argue that the student entrepreneurs have developed the mayor part of their competences based on the knowledge received in the university, thus they suffer from knowledge gaps. Work experience, that students on average lack, provides knowledge about markets (Shane, 2000), that enables to understand how to commercially exploit technological knowledge (Roberts, 1991). Thus, it becomes interesting to study the founding teams that included an experienced member, that can cover this knowledge gap (“Category 3” or “Experienced category” from now on). Moreover, we can find students that found the company by themselves (named as “Category 4” or “Solo category” from now on).

## 2.4 The impact of university education on the composition of entrepreneurial teams formed by student entrepreneurs

As presented before, the university education is one of the main sources of knowledge for student entrepreneurs, and therefore it can influence the composition of entrepreneurial teams through various ways.

First, the student’s university path serves as a signal of individual’s quality to uninformed third parties (Arrow, 1973; Spence, 1973) and can influence the perception that certain potential cofounders have on him, thus affecting who the student will start the company with. The signals have a higher relevance when prospective team members are low experienced individuals that might lack the abilities to evaluate the quality of the student. Although the expected effect is lower, it can be also important when dealing with experienced individuals that are not closely related to the student entrepreneur and therefore don’t have other ways of assessing its ability. It is not the case for relatives, that do not need to rely on signals to properly evaluate his/her quality as they know the individual due to a close relationship. Otherwise, signals can simply decrease the probability of entrepreneurial entry by making the student more attractive for the labor market and then increasing the opportunity costs.

Secondly, along the university path, competences and skills that will influence how students perceive and face business opportunities are acquired. Specialized education can help to detect opportunities on the corresponding field, but present huge capability gaps that can prevent the student to exploit it by himself; while more generic education can help the student to be capable to perform many different kind of tasks, commercially exploit business opportunities and increase his communication skills. We can expect that according to the competences they possess, the students entrepreneurs will define the composition of the entrepreneurial teams formed.

Finally, the university path has influence on the student's network, which is highly relevant, as showed by previous works: "Within the entrepreneurship community, it has become a truism that 'who you know' is a critical component to new venture success – that ideas are often spawned, that opportunities are often recognized or exploited, and that funding is often provided either directly or indirectly through personal contacts." (Grossman, Yli-Renko, Janakiraman. 2007, pp. 1). Diverse networks can promote entrepreneurial entry by providing the right stimulus, decrease entrepreneurial entry by increasing employment options, or simply encourage a certain kind of team composition if the individual is in contact with a specific type of people.

To study these effects, we will analyze the different educational dimensions of the university curriculum and their expected impacts. To start, we focus on the curriculum specialization. From the perspective of the signaling effect, previous works shown that a highly specialized university curriculum makes the individual attractive in the labor market (Lazear, 2004), thus the individual has high opportunity costs when she considers the entrepreneurial career. This generates an expected negative impact on entrepreneurial entry. On another side, the effects generated by the competences acquired are diverse. With a highly specialized curriculum, the student acquires certain competences of the specific field of study that facilitates the recognition of opportunities in that field. We consider that this can have a positive effect on entrepreneurial entry, so in all the 4 categories. To finish, an individual that presents a curriculum very specialized present in consequence big knowledge gaps in other fields. As solo entrepreneurs have to be capable to perform many different kind of tasks, be a Jack-of-all-trades, a stronger negative impact on this category can be expected.

We change now the focus to analyze the possible effects of the training in economics and management that the students can receive during their university path. Even dealing with a curriculum highly specialized, this training provides competences that can have important effects. The knowledge provided by these courses, being quite generic, is highly transferable, i.e. it may have value to a greater number of firms (Sturman et al., 2008), thus increasing the employment opportunities for students, thus reducing their propensity to enter entrepreneurship. In consequence of this, a negative effect on all the categories can be expected. Besides technological knowledge, also knowledge about markets, how to serve them and customer needs is crucial to recognize entrepreneurial opportunities. Knowledge about markets is often developed from work experience (Shane, 2000), that students, on average, lack. However, the completion of courses in economics and management fields may at least partially substitute for work experience. Knowledge about markets enables to understand how to commercially exploit technological knowledge (Roberts, 1991) and, thus, influences entrepreneurial entry. A positive impact on all the 4 categories can be expected, while a stronger positive effect could be stronger for solo entrepreneurs as engineering graduates with some knowledge of economics and management are jacks-of-all-trades. In particular, these courses may provide students with basic knowledge to properly communicate with someone with different skills. As communication with more experienced people can be more difficult due to the age diversity, this may create in a positive effect in forming a team with experienced individuals.

Then, we proceed the analysis with the student's university performance, and we perceive many potential effects suggested by signals. To start, a high performing student is more attractive for employers, therefore presents high opportunity costs to start a company. This has then a negative expected effect on all the categories. Contrary, the university performance may be considered as an indicator of the student's ambition, motivation and endurance. Accordingly, this same signaling effect can have a positive impact on entrepreneurial entry as it may facilitate students' access to external resources necessary to exploit entrepreneurial opportunities by signaling nascent entrepreneurs when evaluated by resource providers as venture capitalists (Kim et al., 2006), presenting an expected positive effect on all the 4 categories. In particular, a student with a low performance might have difficulties to find a employment or teammates as his/her credentials are not good enough;

hence, he is more likely to become a solo entrepreneur or to found a venture with family members, that know the individual and don't need to rely on signals to evaluate his quality. With the same reasoning, student's high performance should have a positive effects for teaming with people that are not closely related, then on categories 2 and 3. This positive effect may be stronger for category 2 as less experienced people may find it difficult to evaluate the quality of the student, thus signals are more important for them.

We change now to another educational dimension of the university curriculum: the quality of the student's degree program. The greater the quality of the student's degree program, the higher opportunity costs, due to the signaling effect in the labor market. Indeed, individuals who graduate from universities with stronger reputations tend to obtain higher salaries (Ng and Feldman, 2014), generating a negative effect on entrepreneurial entry. Contrary, this same signaling effect can have a positive impact on entrepreneurial entry as it may facilitate students' access to external resources needed. A low degree quality might have difficulties to find a employment or teammates as his credentials are not good enough; hence, he is more likely to become a solo entrepreneur or to found a venture with family members, that know the individual and don't need to rely on signals to evaluate his quality. A high quality degree program can also have positive effects on categories 2 and 3 as prospective team mates may be attracted by this signal of quality and try to involve the individual in a venture's founding team. On another side, "the reputation of the degree program is a proxy for the quality of the social network the student can build and subsequently exploit to gain access to resources that s/he may need. Indeed, highly reputed degree programs both involve more competent professors and are likely to have more skilled students." (Colombo, Piva, Rossi-Lamastra, 2017). Given these network effects, we can expect a positive effect on the categories 2 and 3.

Then, we study the effect the fact that the student makes an international study experience can have. Signaling effects suggest that studying abroad reflects proactiveness and flexibility, making the students more attractive both on the labor market and on the market for cofounders; generating then a negative effect on all the categories, but weaker corresponding to categories 2 and 3. On another tide, the study abroad can promote making businesses with experienced people, as the student has better social skills and is more easily

open to new opportunities. In addition, the students have developed more contacts with people similar to them but from other countries, that become potential business partners. Network effects suggest then a positive effect on the categories 2 and 3.

Another curriculum educational dimension that we want to study is the fact that the student had a work experience before graduation. The work experience enriches the social contacts of the individual and allow him, on one side, to have more employment opportunities, for example on the company where he made the stage; but at the same time may allow her/him to find teammates outside the family environment, be these teammates young or more experienced. These networks effects suggest then a negative effect on any category, but weaker effect on categories 2 and 3.

The last educational dimension of the university curriculum we want to analyze is the time elapsed from enrolment to graduation. Taking longer to graduate is a bad signal for the student for the labor and for the cofounders market. The student present then low opportunity costs, but difficulties to form teams with people that don't know him/her. This signaling effect suggests then a positive effect on all categories, but weaker on categories 2 and 3.

Table 1 aims to synthetize the previously described educational dimension with its effects. Each effect is represented with its corresponding source (“S” for signal effects, “C” for competences effects and “N” for network effects).

Educational dimensions	Potential effects	Effect source	Expected impact			
			CAT 1	CAT 2	CAT 3	CAT 4
			CAT 1	CAT 2	CAT 3	CAT 4
Curriculum specialization	High specialization: High opportunity cost	S	-	-	-	-
	High specialization: Better recognition of opportunities	C	+	+	+	+
	High specialization: Big competences gaps that prevent from being solo entrepreneurs	C				-

Training in economics and management	Increased opportunity costs due to highly transferable knowledge	C	-	-	-	-
	General market knowledge enables to exploit business opportunities.	C	+	+	+	+
	Greater impact for solo entrepreneurs as they are Jack-of-all-trades	C				+
	Increased communication skills that sort communication difficulties	C			+	
Student's university performance	High performance: High opportunity cost	S	-	-	-	-
	High performance: Easier access to external resources	S	+	+	+	+
	Low performance: low opportunity costs.	S	+			+
	High performance: attractive for cofounders not closely related	S		+	+	
Degree quality	High quality: high opportunity costs	S	-	-	-	-
	High quality: Easier access to external resources	S	+	+	+	+
	Low quality: low opportunity costs.	S	+			+
	High quality: attractive for cofounders not closely related	S		+	+	
	High quality: high quality network	N		+	+	
Experience abroad	High opportunity costs	S	-	-	-	-
	Attractive for cofounders not closely related	S		+	+	
	Increased network and communication skills to further develop it	N		+	+	
Work experience	Higher opportunity costs	N	-	-	-	-
	Increased network of potential cofounders	N		+	+	
Student taking longer to graduate	Low opportunity costs	S	+	+	+	+
	Hard to find team mates	S		-	-	

Table 1 - Educational dimensions with potential expected effects.



# Chapter 3: Methodology

## 3.1. The dataset

To explore the impact of students' education on the probability of teaming up with different types of individuals and forming student start-ups, we merged a unique dataset including information on the individuals who obtained a *Laurea Magistrale* (equivalent to the Master of Science) Degree at Politecnico di Milano (hereafter, POLIMI), with data about the individuals that started a venture with them as part of the founding team.

Our main dataset includes the population of POLIMI alumni who graduated between July 2005, when the first students obtained a *Laurea Magistrale* degree in the new university system, and December 2009. This dataset was developed at mid-2014 by combining data drawn from two secondary sources.

The first source was a database developed and managed by POLIMI academic office. This database stores demographic data and any information concerning the university curriculum of the individuals who have ever been enrolled in any degree program at POLIMI. Within this database we identified the 13,661 alumni who presented a standard university curriculum, obtaining only one *Laurea Magistrale* Degree between July 2005 and December 2009. For each alumnus, we extracted the following information: individual social security number, gender, date and county of birth, name of the *Laurea Magistrale* program where the Degree was obtained and year of enrolment in this program, list of courses completed and Educational Sector Code(s)<sup>1</sup> associated to each course, final degree score and date of

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<sup>1</sup> Any courses offered in Italian universities are associated to one or more Educational Sector Codes (in Italian, "Settori Scientifico Disciplinari"). In Italy, the Educational Sector Codes have been introduced by Law no. 341

graduation, list of any other degrees obtained at POLIMI and corresponding years of enrolment in these degree programs, participation in study abroad programs.

The second source of information was the Italian Business Register,<sup>2</sup> that was used to gather information on the companies founded by the 13,661 POLIMI alumni in Italy till December 2013. Starting from the individual social security numbers of the 13,661 alumni, we retrieved the following information: the VAT codes and NACE codes of activity of all the Italian companies where POLIMI alumni have ever been listed as shareholders, the year of incorporation of each company and the year(s) when each alumnus acquired shares in the company (companies) where s/he has ever been a shareholder.

As we are interested in firms that sell products or services, we do not consider as POLIMI student entrepreneurs those who founded only companies with NACE code 7010 (Activities of head offices) or 6420 (Activities of holding companies). These codes indeed identify companies that do not sell products or services themselves, as their purpose is to own shares of and to control a number of different companies forming a group.

More recently, we had access to the constitutive acts of the ventures founded by the 13,661 POLIMI alumni. From these constitutive acts we could extract the following information regarding the members of the entrepreneurial founding team: VAT code of the venture, name of the venture, tax code, first and last name of all the founders, share of the founders, address of the founders. This helped us to identify characteristics that allowed us to categorize the ventures in the categories previously described.

We define as “POLIMI student entrepreneurs” the alumni who founded a company (i.e., became shareholders of the company in the year of incorporation) after enrolment in the Laurea Magistrale Degree at POLIMI, few years after graduation (see the following for details). Out of the 13,661 alumni included in the population, 506 (i.e., 3.7 percent) were labelled as “POLIMI student entrepreneurs”. We label these companies as “POLIMI student start-ups”. In the following, we provide descriptive empirical evidence on both POLIMI student entrepreneurs, POLIMI student start-ups and its founding team composition.

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of November 19, 1990 to classify university disciplines. The current Educational Sector Codes are 367 (for the complete list, see: <http://attiministeriali.miur.it/anno-2015/ottobre/dm-30102015.aspx>). They have been determined by the Ministerial Decree no. 855 of October 30, 2015.

<sup>2</sup> The Italian Business Register is the public register created by the Italian Chambers of Commerce to gather information (incorporation, amendments, cessation of trading) for all companies with any legal status and within any sector of economic activity, with headquarters or local branches within the country.

### 3.2. POLIMI Student entrepreneurs

To have a first and general picture of the students we will analyse, we built Tables 2 and 3 that compare students that started a business after enrolment in the Laurea Magistrale Degree at POLIMI, irrespective of the time elapsed before firm foundation, with the remaining alumni in the population along several dimensions. Table 2 focuses on individual characteristics while Table 3 on educational dimensions.

	<i>POLIMI student entrepreneurs</i> (N=506)		<i>Remaining POLIMI alumni</i> (N=13,088)		<i>Difference between the student entrepreneurs and the remaining alumni</i>
	No.	%	No.	%	
<b>Gender</b>					
Women	109	21.5	4,522	34.5	$\chi^2(1)=36.71^{***}$
Men	397	78.5	8,566	65.5	
<b>Country of birth</b>					
Italy	493	97.4	12,282	93.8	$\chi^2(1)=11.08^{***}$
Other countries	13	2.6	806	6.2	
<b>Geographical area of birth</b> (for the alumni who were born in Italy)					
North	420	83.0	11,534	88.1	$\chi^2(2)=13.76^{***}$
Centre	24	4.7	313	2.4	
South and islands	62	12.3	1,241	9.48	
<b>Exposure to entrepreneurial experiences before enrolling in the Laurea Magistrale degree program at POLIMI</b>					
Shareholders in one or more companies before enrolment	46	9.1	228	1.7	$\chi^2(1)=133.22^{***}$
Shareholders of no companies before enrolment	460	90.9	12,860	98.3	
	Mean	Std.err	Mean	Std.err	
<b>Age at enrolment</b>	23.00	0.09	23.00	0.02	t-test  = 0.032
<b>Age at graduation</b>	26.44	0.09	26.40	0.02	t-test  = 0.984

Legend: \* p-value<0.1; \*\* p-value<0.01; \*\*\* p-value<0.001.

Table 2– Individual characteristics of POLIMI alumni distinguishing between the student entrepreneurs and the remaining POLIMI alumni

Data on the gender distribution of the two groups indicate that the share of student entrepreneurs is lower among women than among men: only 2.4 percent of POLIMI alumni become entrepreneurs after enrolment in the Laurea Magistrale Degree at POLIMI vs. 4.4 percent of male alumni. This evidence is in line with the result of prior studies that fewer

women than men found new businesses (for a review on female entrepreneurship see Minniti and Naudè, 2010). As to the geographic origins of alumni, despite the large majority (i.e., more than 93 percent) of POLIMI alumni were born in Italy, the share of Italy-born individuals is significantly higher among POLIMI student entrepreneurs (more than 97 percent). However, we cannot conclude that non Italy-born alumni are less likely to become student entrepreneurs because our dataset captures only the creation of firms in Italy. Part of the non Italy-born alumni might indeed be returnee entrepreneurs who obtained a degree in Italy and later started new ventures in their native countries. Interestingly, if one focuses on Italy-born alumni, the share of student entrepreneurs is higher among the alumni born in the Centre and in the South (respectively, 7.1 and 4.7 percent vs. 3.5 percent among the alumni born in Northern regions).

No substantial differences exist between POLIMI student entrepreneurs and the remaining POLIMI alumni as to the age at enrolment and the age at graduation.

	<i>POLIMI student entrepreneurs</i> (N=506)		<i>Remaining POLIMI alumni</i> (N=13,088)		<i>Difference between the student entrepreneurs and the remaining alumni</i>
	Mean	Std.err	Mean	Std.err	
<i>Degree of curriculum specialization</i>	5.24	3.52	5.03	3.30	t-test = 1.392
<i>Final degree score</i>	103.7	7.42	103.42	7.33	t-test = 0.741
	No.	%	No.	%	
<i>Completion of courses that may qualify students for an entrepreneurial career</i>					
Yes	266	52.6	6,223	47.6	$\chi^2(1)=4.92^{**}$
No	240	47.4	6,865	52.4	
<i>Participation in study abroad programs</i>					
Yes	45	8.9	1,187	9.1	$\chi^2(1)=0.02$
No	461	91.1	11,901	90.9	
<i>Exposure to other universities</i>					
Yes	36	7.1	1,329	10.2	$\chi^2(1)=4.98^{**}$
No	470	92.9	11,759	89.8	

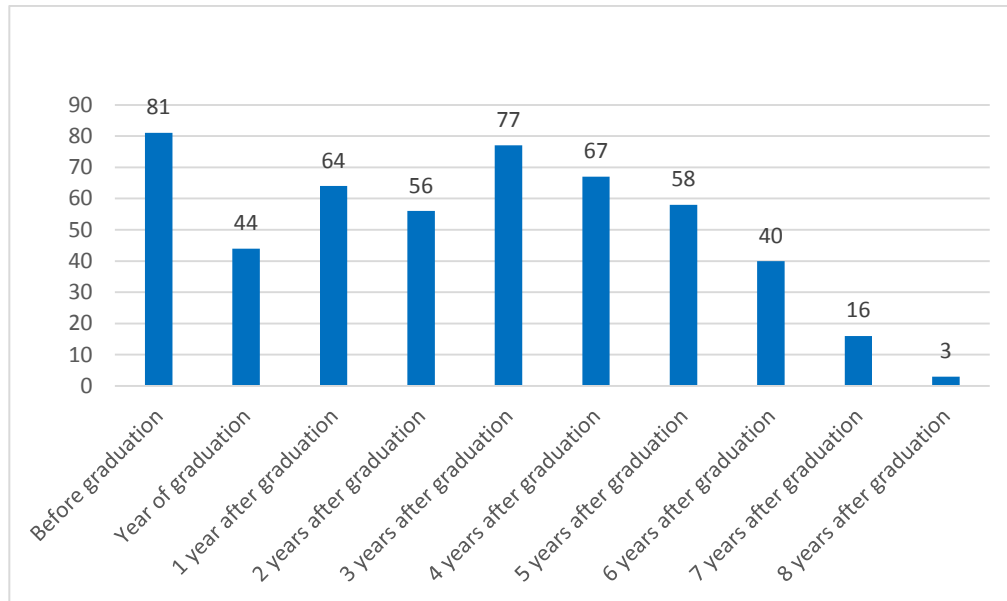
Legend: \* p-value<0.1; \*\* p-value<0.01; \*\*\* p-value<0.001.

Table 3– Educational dimensions of POLIMI alumni distinguishing between the student entrepreneurs and the remaining POLIMI alumni.

It is now interesting to compare POLIMI student entrepreneurs and other POLIMI alumni with respect to some educational dimensions (see Table 3). To compare the degrees

of curriculum specialization of the two groups of alumni, we used a variable taking inspiration from the variable *Special*, used by Lazear (2004: 210). The larger is the value, the less general is the university curriculum. There are no significant differences between the level of specialization of the university curriculum between the two categories. Likewise, we found no mayor differences as to the final degree score. A difference between the two groups exists as to the shares of alumni who completed courses that may qualify for an entrepreneurial career. At POLIMI, no entrepreneurship courses had been launched since 2009, however several courses in economics and management fields were offered. The share of alumni who completed courses in these latter fields is greater among POLIMI student entrepreneurs than among other POLIMI alumni (more than 52 percent vs. less than 48 percent). Respectively, students entrepreneurs and the rest of the students do not present relevant differences when it comes to observe the participation in programs to study abroad.

In addition, we compare the shares of alumni who did not obtain the Bachelor degree from POLIMI. Quite interestingly, this share is significantly lower among student entrepreneurs (around 7 percent vs. 10 percent among the remaining POLIMI alumni). However, we urge caution in the interpretation of this negative association between having gained educational experiences in other universities and becoming a student entrepreneur. We noted that more than 40 percent of the alumni who did not obtain the Bachelor degree from POLIMI were born abroad. Maybe, as we mentioned above, part of these alumni are returnee entrepreneurs, that we cannot identify using our data.



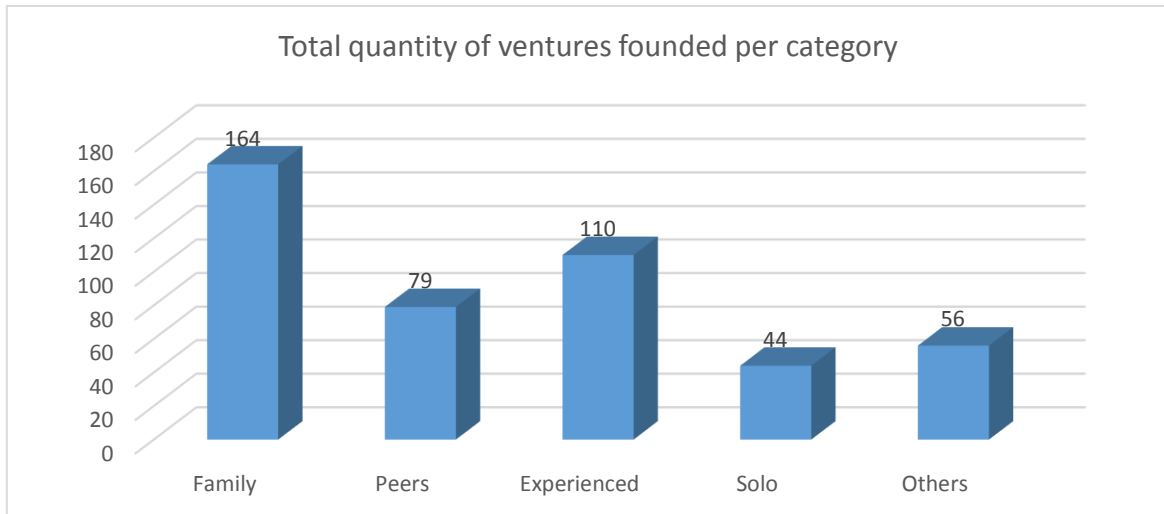
*Figure 1 – Lag time of first time entrepreneurs*

Now we focus on POLIMI student entrepreneurs. Figure 1 documents the lag from graduation to the foundation of the first student start-up. 81 students (16 percent of POLIMI student entrepreneurs) founded the first student start-up during university studies. Examining the effect of the university education on entrepreneurial entry for these individuals is complicated: it would require to consider only the education obtained before the foundation of the first student start-up and some of the theoretical arguments presented in section 2 may not apply. Therefore, we decided to focus the analyses presented in the following sections on entrepreneurial entry in the period that follows graduation. Hence, for the sections 4 and 5 we will exclude from the analyses the 81 student entrepreneurs who founded new ventures before graduation. For most of the remaining POLIMI student entrepreneurs (366 alumni; 72.33 percent) the first student start-up was founded between the graduation year and the fifth year after graduation.

### 3.3. POLIMI student start-ups

As we want to analyze the impact of the university education probability of teaming up with different kind of individuals, based on the information gathered from the constitutive acts we created a variable capturing the type of founding team of the formed ventures. We analyzed 926 constitutive acts of companies that had alumni of the Politecnico di Milano as founders. From this total number, only 453 had as founders at least one of the student entrepreneurs that we are analyzing, while the remaining contained alumni graduated in another period.

The variable has six possible values, defining different categories: The value 1 is reserved for family businesses, and is given when at least 50% of the shares is owned by members of the same family. To assess if that the members were of the same family, we considered that this was the case when they have the same last name or they live on the same address, both data that we had available. The value 2 is given when all the members of the founding team are part of the same age cohort and thus can be considered as peers. To define which individuals can be considered as part of the same age cohort, we relied on the way the Integrated Statistical System of Milan defines people of the same age category, and on the measure used by previous works on the field (i.e. Rocha, Van Praag, 2016). In both cases, and therefore in our work, individuals are considered of the same age cohort when the age difference is 5 years or less. Following this logic, value 2 is given when the older team member has a difference of 5 years or less with the focal student. Value 3 was to be assigned if there were team members who were 6 years (or more) older than the focal student. This 3<sup>rd</sup> category is then given to the student entrepreneurs that start businesses with experienced individuals. Then, the value 4 is reserved to solo entrepreneurs. For the category number 5, the ventures that count with the participation of an existing company, or other organization, as part of the shareholders since their first day. Value 0 corresponds to the alumni who did not start any business in the period under investigation.



*Figure 2 - Total ventures founded divided by team composition*

Regardless of the time of foundation, we register 453 new ventures created by the 506 entrepreneurs previously presented. On the Figure 2, we can see the distribution of the ventures on the categories defined for the analysis. We perceive that the family businesses are the most frequent ones, representing more than 35%. These figures may suggest that attracting cofounders is difficult for students, maybe because of their competence gaps or the information asymmetries between students and cofounders that make it difficult for the latter to evaluate the unobserved quality of students. Hence, students tend to found companies with family members who are better able to evaluate their quality. Another interesting observation is that starting businesses with individuals significantly more experienced is more common than starting businesses with peers. We can suppose that maybe this difference relates to the fact that the former are better able to fill the competence gaps that inexperienced students suffer from. The solo entrepreneurs are the less frequent category, we can suggest that this is also due to the competences gaps that the student have, that prevent them from facing the challenge of entrepreneurship by themselves.



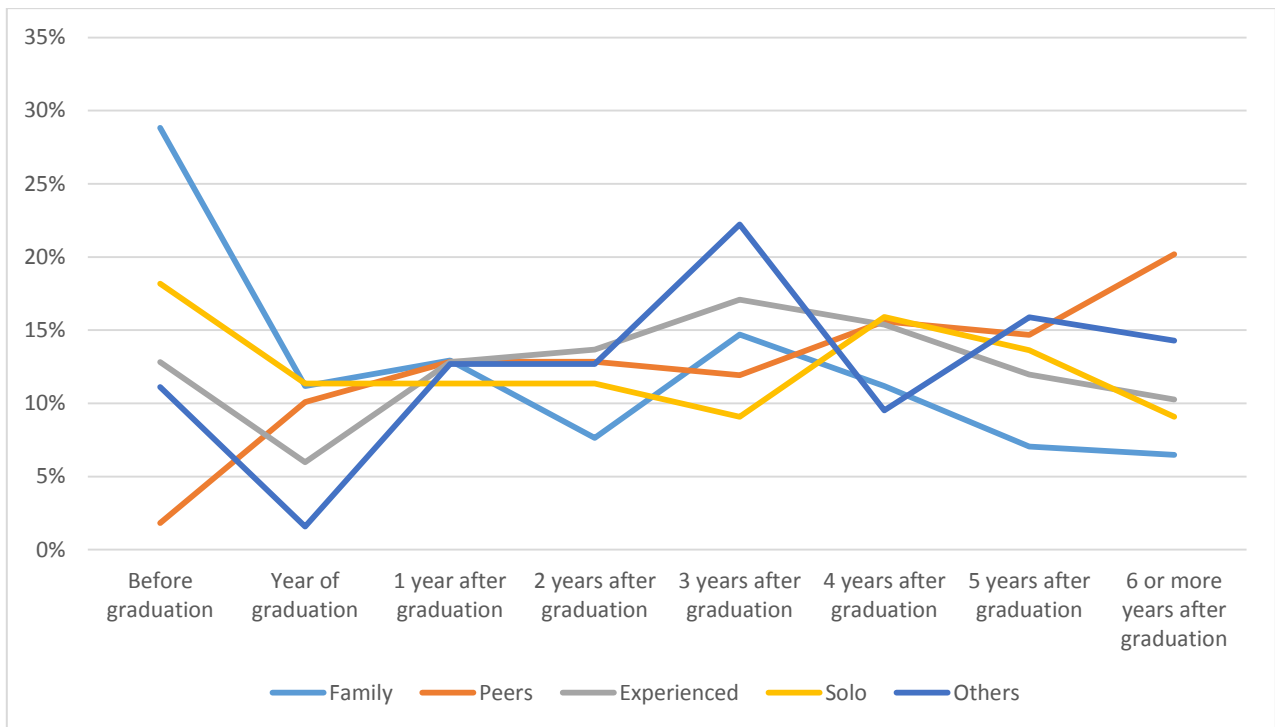


Figure 3 - Time elapsed before firm foundation, according to the category of the business.

The figure 3 presents an interesting measure that represents the portion of the startups within each category that are founded in function of the time in relation to the moment of graduating. We can see that almost 30% of the family businesses in which the student entrepreneur takes part, are founded before graduation, while only 2% of the companies started with peers are created before graduation. As presented above, before graduation students find it more difficult to find cofounders because of the high information asymmetries, hence they tend to team up with family members. Teaming up with peers is particularly difficult because both focal students and their peers are also young and inexperienced that they lack the competences necessary to identify and pursue business opportunities.

It is interesting to mention the strong contrast between the trends corresponding to the Family category and the peers category. The trend of the family business is decreasing while the one with peers is increasing. This means that after graduation, as the years to through, the students are each time less likely to start a business with family members while

each time more likely to start it with others individuals of similar age. In the following table, we can perceive detailed numbers about this trend.

<b>1 year after graduation</b>	<b>Percent</b>
<b>Family</b>	48%
<b>Peers</b>	14%
<b>Experienced</b>	20%
<b>Solo</b>	9%
<b>Others</b>	9%

<b>3 years after graduation</b>	<b>Percent</b>
<b>Family</b>	40%
<b>Peers</b>	17%
<b>Experienced</b>	23%
<b>Solo</b>	12%
<b>Others</b>	8%

<b>5 years after graduation</b>	<b>Percent</b>
<b>Family</b>	36%
<b>Peers</b>	19%
<b>Experienced</b>	24%
<b>Solo</b>	12%
<b>Others</b>	9%

*Table 4 – Founding team composition of the companies founded 1, 3 and 5 years after graduation*

Table 4 shows out of the total number of start-ups founded 1, 3 and 5 years after graduation, how many, in percentage, belonged to the five categories. Regardless of the period studied, in line with previous results, we first remark that the family businesses are the most frequent founding team chosen. One year after graduation, 48% of the firms had this team composition; while peers started only 14%, 20% included experienced members, 9% were started by a solo founder and 9% had other team compositions. Nevertheless, the share corresponding to the companies founded by family members presents a decreasing trend, moving from 48% to 36% if we consider companies founded until 1 year or 5 years after graduation. We can say that as time passes, students are better able to find cofounders outside the family maybe because they have a wider and wider network or because the above mentioned information asymmetries become lower.

It is also interesting to note that the solo category present the weakest variations. This could be explained because to start a company by themselves, students entrepreneurs do not depend on signals sent to potential cofounders, or on having a wider network to find them, but only on their own competences and motivation.

## 3.4 The econometric analysis

In this section, we present the econometric model used and describe its main variables involved.

### 3.4.1 The dependent variables and the econometric model

To define the dependent variable of the model, for analysis purposes, it was necessary to reorganize some categories. As the registered number of solo entrepreneurs is not too large, we regrouped in only one category the ventures founded by solo entrepreneurs and the ones that had another company or organization as shareholder since its foundation. As this new category regroups two kinds of founding teams with compositions that are too diverse, we will not be able to test our assumptions on this category, but only on the remaining ones.

To evaluate how the influence of the university education changes over time, we created three definitions of student entrepreneurs according to the number of years that separate entrepreneurial entry from graduation. In the specific, we looked at 1 year, 3 years and 5 years from graduation, as to observe, if any, the changes in the impact. We created the variables called TEAM\_CATEGORY1, TEAM\_CATEGORY3 and TEAM\_CATEGORY5 respectively. As we are analysing the effect of the university curriculum, and it would be highly complex to do it with students that haven't graduated yet, in all the cases we excluded from the definition of student entrepreneurs students that started their first venture before graduation. Each of these variables will take the value 1 for family businesses, 2 for team composed by peers, 3 for team containing experienced members, 4 for the remaining team compositions, and 0 when the student did not found a company on the corresponding period observed. Given the nature of the dependent variable, we use a multinomial logit model.

### 3.4.2. The independent variables

The explanatory variables capture a series of educational dimensions of POLIMI alumni. The first explanatory variable, *Course\_Specialization*, captures the degree of specialization of the focal alumnus' university curriculum. The larger is *Course\_Specialization*, the less general is the university curriculum. To build *Course\_Specialization*, taking inspiration from the variable by Lazear (2004: 210), we first computed the difference between the number of courses completed in the alumnus' field of specialty and the average number of courses completed in other fields. We define as "field of specialty" the Educational Sector Code associated to the largest number of courses completed by the alumnus, while the "other fields" are identified by the Educational Sector Codes associated to the remaining courses. As the number of courses completed by POLIMI alumni may vary depending on the degree program in which the alumni were enrolled and on the choices the alumni made in structuring their study plan, for each alumnus *Course\_Specialization* is obtained as the difference described above divided by the total number of courses completed by the alumnus.

Then, we decided to include in the estimates a variable capturing whether the university curriculum of the alumnus included any courses associated to the Educational Sector Codes in the areas of Economics, Management and Management Engineering. The dummy variable *D\_Economics* equals one for Polimi alumni who completed at least one course associated to the above mentioned Educational Sector Codes.

In order to measure the quality of the university education, we built the variable *Degree\_Score*, that captures the alumnus' final degree score. The variable ranges from 60 to 110 for the alumni who did not graduate *cum laude* and equals 113 for the alumni who graduated *cum laude*. In addition, we added a dummy variable to measure when the university is the best Italian university of the field of study of the alumni. *D\_Top\_Uni\_On\_Field* equals 1 when the university is ranked as the first university in Italy on the field of study of the alumni, and 0 when it's not the case.

To continue the analysis of the effects previously presented, we built the dummy variable *D\_Study\_Abroad* equalling 1 for the alumni who participated in study abroad programs. The dummy variable *D\_Work\_Experience* was added to study the potential effects of work experience. The variable took the value 1 when the student did a stage in a company

as part of his/her university program, although, we must note that students might have work experiences that we cannot capture with our data. One dummy variable was added equalling 1 for the alumni who took more than two years to obtain the Laurea Magistrale degree. *D\_Failing\_Alumnus* is included to identify the quality of individual human capital, as the alumni who took only two years to obtain the degree are probably more talented than those who took more than two years.

As control variables, we first included *D\_Ind\_Inf\_Engineering*, a dummy variable equalling one for the alumni who attended a degree program pertaining to the School of Industrial and Information Engineering, as previous studies indicate that this is the School where the share of alumni in the student entrepreneur group is lower than the share in the remaining alumni group. Then, *D\_Highest\_Fees* is a dummy equalling 1 for the alumni who were assigned the highest contribution level and 0 otherwise, and thus capturing students in a very favourable economic condition. We can expect a positive impact on entrepreneurial entry as prior studies (e.g. Evans and Jovanovic, 1989) have shown that a good economic situation is positively associated to a higher propensity of starting a new venture. *D\_Prior\_Shareholder* was included as proxy for exposure to entrepreneurial experience before enrolling to the degree. It is a dummy equalling 1 for the alumni who had acquired shares in a company before enrolling in the Laurea Magistrale degree program at POLIMI and 0 for the remaining alumni. As before the enrolment the student is very young, we associate that if he had entrepreneurial experience, it was because he/she took part of a family business, therefore we expect that this could happen again, generating a positive impact on category 1. *D\_Woman*, is a dummy equalling 1 for women and 0 for men. Women have been recognized as being more risk adverse than men, therefore we can expect a negative effect on entrepreneurial entry. The effect expected on the family category can be weaker as it can be related to a familiar environment, less risky than starting with people that are not closely related to the individual. *D\_Born\_Abroad* is a dummy equalling 1 for not Italy-born alumni and 0 otherwise. As previous works have reflected, we expect on foreigners a lower tendency to start a company in Italy. We do must note that we only have register of companies started in Italy, therefore we expect a negative effect on the entrepreneurial entry we register. Finally, *Age\_Graduation* represents the age of the student at graduation. It was inserted because several studies have suggested that age may play a role in the decision to start a new venture

(e.g., Levesque and Minniti, 2006), suggesting that younger individuals are more likely to start companies.

Table 5 Reports the descriptive statistics on the variables included in the econometric estimates. Table 6 Reports the correlation matrix.

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<b>Course_Specialization</b>	5.04	3.31	0	4
<b>D_Economics</b>	0.48	0.50	0.33	21
<b>Degree_Score</b>	103.44	7.34	0	1
<b>D_Study_Abroad</b>	0.09	0.29	68	113
<b>D_Work_Experience</b>	0.47	0.50	0	1
<b>D_Failing_Alumnus</b>	0.35	0.48	0	1
<b>D_Ind_Inf_Engineering</b>	0.36	0.48	0	1
<b>D_Highest_Fees</b>	0.17	0.37	0	1
<b>D_Prior_Shareholder</b>	0.20	0.14	0	1
<b>D_Woman</b>	0.34	0.47	0	1
<b>D_Born_Abroad</b>	0.06	0.24	0	1
<b>Age_Graduation</b>	25.16	1.70	22	60

Table 5 - Descriptive statistics of the used variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) <i>Course_Specialization</i>	1.00											
(2) <i>D_Economics</i>	-0.21	1.00										
(3) <i>Degree_Score</i>	-0.02	-0.02	1.00									
(4) <i>D_Study_Abroad</i>	-0.04	0.03	0.08	1.00								
(5) <i>D_Work_Experience</i>	-0.10	0.09	0.16	-0.01	1.00							
(6) <i>D_Ind_Inf_Engineering</i>	0.31	-0.33	-0.10	-0.00	-0.54	1.00						
(7) <i>D_Failing_Alumnus</i>	0.02	-0.04	-0.11	0.05	0.14	0.03	1.00					
(8) <i>D_Highest_Fees</i>	-0.02	-0.01	0.02	0.03	-0.03	-0.01	-0.03	1.00				
(9) <i>D_Prior_Shareholder</i>	-0.03	0.03	-0.01	0.02	0.01	-0.03	-0.01	0.11	1.00			
(10) <i>D_Woman</i>	-0.10	0.12	0.18	0.01	0.30	-0.30	0.00	0.00	-0.01	1.00		
(11) <i>D_Born_Abroad</i>	0.04	0.02	-0.09	-0.03	0.01	-0.02	-0.10	0.19	-0.02	0.04	1.00	
(12) <i>Age_Graduation</i>	-0.00	0.04	-0.25	-0.05	0.15	-0.06	0.28	0.02	0.05	-0.06	0.22	1.00

Table 6 - Correlation matrix of the used variables

# Chapter 4: Results

In this section, we show and discuss the results of the estimates on the data described in chapter 3. As the literature on student entrepreneurship lacks a clear definition of the phenomenon, we first observed the effects of the various educational dimensions considering the first year after graduation. Then, to check the robustness of our results, we extended the time threshold, considering 3 and 5 years after graduation. The variables built corresponding to these effects are TEAM\_CATEGORY1, TEAM\_CATEGORY3 and TEAM\_CATEGORY5 respectively.

## 4.1 Results

On table 7 we can see the distribution of the dependent variables TEAM\_CATEGORY1, TEAM\_CATEGORY3 and TEAM\_CATEGORY5. The distribution are in line with the descriptions provided in section 3, but updated according to the new constraints of the variables. The 4<sup>th</sup> category gathers students that became entrepreneurs with different types of founding teams, therefore during the remaining part of the work it is not worthwhile to analyze it.

<b>TEAM_CATEGORY1</b>	<b>Freq.</b>	<b>Percent</b>
<b>0</b>	13 554	99.22
<b>1</b>	41	0.30
<b>2</b>	25	0.18
<b>3</b>	22	0.16
<b>4</b>	19	0.14

<b>TEAM_CATEGORY3</b>	<b>Freq.</b>	<b>Percent</b>
<b>0</b>	13 422	98.25
<b>1</b>	179	0.58
<b>2</b>	52	0.38
<b>3</b>	58	0.42
<b>4</b>	50	0.37

<b>TEAM_CATEGORY5</b>	<b>Freq.</b>	<b>Percent</b>
<b>0</b>	13 297	96.34
<b>1</b>	110	0.81
<b>2</b>	85	0.62
<b>3</b>	90	0.66
<b>4</b>	79	0.58

*Table 7 - Total number of companies founded 1, 3 and 5 years after graduation*

On these variables, we will analyze now a model including only control variables, mainly related to the individual characteristics of the alumni. The results can be seen on table 8.



<b>TEAM_CATEGORY1</b>	<b>Family - Category 1</b>		<b>Peers - Category 2</b>		<b>Experienced - Category 3</b>		<b>Others - Category 4</b>					
<i>D_Woman</i>	-0.066	(0.352)	-0.797	(0.514)	-1.166	(0.635)	*	-0.834	(0.577)			
<i>D_Born_Abroad</i>	-1.295	(1.027)	-15.18	(1292)	-14.10	(814.2)		-14.69	(1437)			
<i>D_Highest_Fees</i>	1.021	(0.339)	**	0.861	(0.446)	0.806	(0.512)	0.806	(0.512)			
<i>D_Prior_Shareholder</i>	1.498	(0.506)	**	-15.26	(2284)	1.419	(0.780)	*	1.420	(0.780)		
<i>Age_Graduation</i>	0.049	(0.060)		0.056	(0.092)	-0.115	(0.044)	**	-0.212	(0.210)		
<i>D_Ind_Inf_Engineering</i>	-0.058	(0.346)		-0.389	(0.441)	-0.330	(0.474)		-0.668	(0.534)		
<i>_cons</i>	-7.294	(1.559)	***	-7.460	(2.375)	**	-9.150	(1.190)	***	-1.046	(5.232)	
<hr/>												
<b>TEAM_CATEGORY3</b>												
<i>D_Woman</i>	-0.431	(0.269)		-1.131	(0.394)	**	-0.564	(0.327)	*	-1.016	(0.378)	**
<i>D_Born_Abroad</i>	-0.936	(0.602)		-13.46	(465.1)		-1.721	(1.019)	*	-0.904	(1.024)	
<i>D_Highest_Fees</i>	1.122	(0.241)	***	0.057	(0.389)		0.720	(0.302)	**	0.584	(0.330)	*
<i>D_Prior_Shareholder</i>	1.078	(0.419)	**	-0.127	(1.022)		1.017	(0.511)	**	1.524	(0.495)	**
<i>Age_Graduation</i>	0.073	(0.039)	*	-0.001	(0.089)		0.123	(0.033)	***	-0.350	(0.145)	**
<i>D_Ind_Inf_Engineering</i>	-0.209	(0.249)		-0.350	(0.300)		-0.220	(0.292)		-0.442	(0.312)	
<i>_cons</i>	-7.070	(1.028)	***	-5.066	(2.263)	**	-8.485	(0.880)	***	3.367	(3.582)	
<hr/>												
<b>TEAM_CATEGORY5</b>												
<i>D_Woman</i>	-0.663	(0.235)	**	-1.303	(0.318)	***	-0.908	(0.277)	**	-0.956	(0.304)	**
<i>D_Born_Abroad</i>	-0.345	(0.435)		-0.897	(0.732)		-2.105	(1.013)	**	-0.751	(0.731)	
<i>D_Highest_Fees</i>	0.879	(0.212)	***	0.285	(0.279)		0.724	(0.243)	**	0.599	(0.264)	**
<i>D_Prior_Shareholder</i>	1.801	(0.294)	***	0.498	(0.601)		0.629	(0.489)		1.091	(0.479)	**
<i>Age_Graduation</i>	0.028	(0.040)		-0.084	(0.083)		0.084	(0.034)	**	-0.258	(0.108)	**
<i>D_Ind_Inf_Engineering</i>	-0.477	(0.220)	**	-0.507	(0.239)	**	-0.576	(0.242)	**	-0.128	(0.238)	
<i>_cons</i>	-5.475	(1.025)	***	-2.503	(2.085)		-6.608	(0.876)	***	1.462	(2.690)	

Table 8 - The effect of individual characteristics on founding team composition - Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001

To start, we analyze the effect of these characteristics of the individual on the determinants to build a family business, be 1 year, 3 years or 5 years after graduation. Two characteristics are the ones that reflect to have more relevance and are significant on the tree cases. First, we observe the positive coefficient of *D\_Highest\_Fees* that evidences a positive effect of the family wealth. In order to establish a company, entrepreneurs need money. The family, together with friends and fools, are the key sources of funds at new venture creation. When most entrepreneurs come from the same family, family wealth is much more crucial than in case of ventures founded by entrepreneurs who have no family links, which explains the result perceived. Secondly, we can assume that when the student was a shareholder of a company before enrolling to the Laurea Magistrale course, he took part in a company within the family frame. Therefore, the positive coefficient of *D\_Prior\_Shareholder* reflects that when the student had previous entrepreneurial experiences with other family members, he is likely to repeat it. This can be related to a family entrepreneurial mindset that is not significantly variant over time. Previous studies also show the impact of exposure to entrepreneurial experience through household or personal experience (Carroll and Mosakowski, 1987; Roberts, 1991; Sørensen, 2007). Another result on this first category of founding teams show that the age at the moment of graduation has a positive coefficient when we look at the ventures founded within the first 3 years from graduation. It is interesting to acknowledge that there is no evidence of a lower propensity of women to found ventures with their relatives immediately after graduation. The gender gap emerges only some years after graduation. Students of the School of Industrial and Information Engineering present the same behaviour. The reduced tendency to start a business with their family is evidenced only some years after graduation. Immediately after graduation, the individual characteristics that make the student less likely to start a venture do not have a relevant effect on preventing him from starting a business with his relatives.

We focus now on the second category, corresponding to the entrepreneurial entry through new venture creation with peers. If we observe only the ventures founded by the alumni during their first year after graduation, the only significant variable corresponds to the financial resources of the family. We perceive again a positive impact associated to a high level of financial wealth. However, the effect weaker than in the case of the family ventures, and it presents a low level of significance. When we look at the first three years,

the only characteristic that evidences to be relevant reflects once again a decrease among women. Similarly the case of the family businesses, looking to 5 years after graduation arises interesting results. Women and students of School of Industrial and Information Engineering, show to be less likely to start a venture with peers. These two aspects show again their need of time to develop their effect. We must note that in this case, the effects of *D\_Woman* are stronger than for the creation of family businesses. We can suppose that this is because a team made by peers can offer less support to face risks than a family team, and therefore are less attractive for women due to their lower risk aversion.

When we consider entrepreneurial entry through new venture creation with more experienced individuals, we observe more variables that are significant. Observing the first year after graduation, *D\_Woman* and *D\_Prior\_Shareholder* appear with their usual effect, while the impact of *Age\_Graduation* is positively correlated with the creation of teams with more experienced people. Older individuals probably have work experience gained before graduating, that provided them with contacts with more experienced people to involve in the team. When we look at the 3 years after graduation, all the included variables have significant effects, apart from *D\_Ind\_Inf\_Engineering*. The negative effect of being born outside Italy is perceived for the first time in our analysis, confirming the lower likelihood of non-Italy-born alumni to found student start-ups in Italy. This is present again when we look at all the firms founded within 5 years from graduation date. In this case, having been previously a shareholder is the only variable that doesn't have a significant effect.

## 4.2. The effect of the university education dimensions

In the following tables we can observe the results of the analysis conducted on the studied educational dimensions. Table 9a. presents the results on the variable *TEAM\_CATEGORY1*. Respectively, tables 9b. and 9c. show the corresponding results of variables *TEAM\_CATEGORY3* and *TEAM\_CATEGORY5*. In addition, we checked if there is an interactive effect between the student performance and the level of specialization of the course, but we found no significant results.

<b>TEAM_CATEGORY1</b>	<b>Family - Category 1</b>	<b>Peers - Category 2</b>	<b>Experienced - Category 3</b>	<b>Others - Category 4</b>
<i>Course_Specialization</i>	0.087 (0.047) *	0.331 (0.061) ***	-0.009 (0.073)	-0.035 (0.087)
<i>D_Economics</i>	0.448 (0.347)	0.683 (0.429)	0.730 (0.481)	0.997 (0.588) *
<i>Degree_Score</i>	-0.005 (0.023)	0.017 (0.033)	0.000 (0.031)	-0.022 (0.034)
<i>D_Top_Uni_On_Field</i>	0.380 (0.554)	0.598 (0.890)	-0.118 (0.644)	0.750 (0.863)
<i>D_Study_Abroad</i>	-0.267 (0.606)	0.705 (0.558)	-0.050 (0.753)	-0.828 (1.035)
<i>D_Work_Experience</i>	-0.572 (0.514)	0.080 (0.830)	1.007 (0.596) *	-0.938 (0.826)
<i>D_Failing_Alumnus</i>	-0.262 (0.363)	0.100 (0.440)	0.164 (0.455)	0.926 (0.574)
<i>D_Ind_Inf_Engineering</i>	-0.177 (0.468)	-0.916 (0.833)	0.404 (0.648)	-0.276 (0.685)
<i>D_Highest_Fees</i>	1.054 (0.340) **	0.874 (0.453) *	0.733 (0.490)	0.815 (0.515)
<i>D_Prior_Shareholder</i>	1.509 (0.506) **	-15.60 (3157)	1.457 (0.701) *	1.432 (0.779) *
<i>D_Woman</i>	-0.017 (0.367)	-1.090 (0.539) **	-1.320 (0.647) *	-0.803 (0.601)
<i>D_Born_Abroad</i>	-1.530 (1.037)	-15.90 (1587)	-14.86 (1244)	-15.23 (2070)
<i>Age_Graduation</i>	0.056 (0.057)	0.012 (0.104)	0.096 (0.047) *	-0.435 (0.301)
<i>_cons</i>	-7.461 (2.941) **	-10.94 (4.511) **	-9.810 (3.558)	5.978 (8.923)

Table 9a - The effect of educational dimensions on founding team composition, considering ventures founded within 1 year after graduation. -

Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001

<b>TEAM_CATEGORY3</b>	<b>Family - Category 1</b>	<b>Peers - Category 2</b>	<b>Experienced - Category 3</b>	<b>Others - Category 4</b>
<i>Course_Specialization</i>	0.058 (0.035) *	0.251 (0.040) ***	0.059 (0.040)	-0.051 (0.054)
<i>D_Economics</i>	0.259 (0.246)	0.362 (0.301)	0.228 (0.290)	0.279 (0.322)
<i>Degree_Score</i>	-0.003 (0.016)	0.030 (0.022)	-0.004 (0.019)	0.003 (0.021)
<i>D_Top_Uni_On_Field</i>	0.351 (0.385)	0.182 (0.516)	0.058 (0.427)	0.064 (0.483)
<i>D_Study_Abroad</i>	-0.216 (0.431)	0.909 (0.361) **	-0.291 (0.524)	-0.304 (0.528)
<i>D_Work_Experience</i>	-0.249 (0.358)	-0.104 (0.491)	-0.011 (0.400)	-0.303 (0.451)
<i>D_Failing_Alumnus</i>	-0.150 (0.254)	-0.083 (0.315)	0.196 (0.281)	-0.251 (0.387)
<i>D_Ind_Inf_Engineering</i>	-0.186 (0.341)	-1.003 (0.476) **	-0.279 (0.400)	-0.319 (0.390)
<i>D_Highest_Fees</i>	1.146 (0.242) ***	0.029 (0.391)	0.743 (0.303) **	0.573 (0.331) *
<i>D_Prior_Shareholder</i>	1.101 (0.420) **	0.005 (1.024)	1.080 (0.510) **	1.496 (0.497) **
<i>D_Woman</i>	-0.448 (0.278)	-1.283 (0.407) **	-0.572 (0.337) **	-0.946 (0.389) **
<i>D_Born_Abroad</i>	-1.061 (0.611) *	-14.74 (792.4)	-1.713 (1.026) **	-0.995 (1.036)
<i>Age_Graduation</i>	0.071 (0.040) *	0.020 (0.087)	0.114 (0.035) **	-0.267 (0.166)
<i>_cons</i>	-7.141 (2.095) **	-10.40 (3.425) **	-8.317 (2.240) ***	1.267 (5.118)

Table 9b – The effect of educational dimensions on founding team composition, considering ventures founded within 3 years from graduation. -

Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001

<b>TEAM_CATEGORIES</b>	<b>Family - Category 1</b>			<b>Peers - Category 2</b>			<b>Experienced - Category 3</b>		<b>Others - Category 4</b>			
<i>Course_specialization</i>	0.058	(0.030)	*	0.174	(0.032)	***	0.044	(0.033)	-0.039	(0.040)		
<i>D_Economics</i>	0.380	(0.210)	*	0.326	(0.239)		0.109	(0.232)	0.126	(0.254)		
<i>Degree_Score</i>	0.000	(0.014)		0.046	(0.018)	**	0.004	(0.015)	-0.002	(0.016)		
<i>D_Top_Uni_On_Field</i>	0.231	(0.316)		0.163	(0.386)		-0.185	(0.320)	0.086	(0.400)		
<i>D_Study_Abroad</i>	-0.302	(0.374)		0.679	(0.292)	**	-0.203	(0.399)	-0.489	(0.467)		
<i>D_Work_Experience</i>	-0.091	(0.298)		-0.228	(0.372)		0.342	(0.311)	-0.478	(0.369)		
<i>D_Failing_Alumnus</i>	-0.023	(0.216)		0.429	(0.249)		0.153	(0.227)	-0.310	(0.301)		
<i>D_Ind_Inf_Engineering</i>	-0.410	(0.291)		-0.972	(0.350)	**	-0.573	(0.320)	*	-0.146	(0.306)	
<i>D_Highest_Fees</i>	0.901	(0.212)	***	0.246	(0.279)		0.732	(0.244)	**	0.600	(0.266)	**
<i>D_Prior_Shareholder</i>	1.827	(0.295)	***	0.596	(0.601)		0.676	(0.489)		1.061	(0.481)	**
<i>D_Woman</i>	-0.708	(0.244)	**	-1.462	(0.328)	***	-0.947	(0.284)	**	-0.847	(0.313)	**
<i>D_Born_Abroad</i>	-0.406	(0.442)		-0.800	(0.737)		-2.031	(1.017)	**	-0.929	(0.743)	
<i>Age_Graduation</i>	0.024	(0.042)		-0.091	(0.098)		0.077	(0.036)	**	-0.170	(0.119)	
<i>_cons</i>	-5.921	(1.912)	**	-8.318	(3.361)	**	-7.506	(1.959)	***	-0.163	(3.774)	

Table 9c – The effect of educational dimensions on founding team composition, considering ventures founded within 5 years from graduation. -

Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001

The analysis of the information present in tables 9a., 9b. and 9c. will let us go through the principal results of the model studied. To structure the analysis we will go through the different categories of founding teams previously defined, evaluating the results obtained.

#### 4.2.1 Entrepreneurial entry through the creation of a Family business

We will start with the first defined category, corresponding to a family founding team. Regardless of the period considered after graduation, the curriculum specialization has a positive impact. This result evidences that the increased capacity for recognition of opportunities in the fields of specialization has a positive effect on entrepreneurial entry with a family team. This effect reveals to be more important than the negative effect created by the high opportunity costs due to attractiveness on labor market. However, the coefficient is weakly significant in all the cases.

Another educational dimension that has a significant impact on entrepreneurial entry through the creation of a family company is the education in economics and management fields. The positive and (weakly) significant coefficient of *D\_Economics* in the model considering the first 5 years after graduation suggests that. The predominance of the increased business opportunities is observed not right after graduation, but some years later. This is interesting, as we could expect that university education had a decreasing effect over time. However, the effect created by the general market knowledge reveals to be stronger than effect of the increased attractiveness on the labor market. This could be explained as the entrepreneur needs time to capture the right opportunity to exploit and therefore this effect takes time to materialize; while the relevance for the labor market is immediate after graduation and doesn't need time to happen.

Other educational dimensions studied as the student's performance, the university rank or the student taking longer to graduate don't show any significant effects. These dimensions present their main effects due to signaling effects. Signals are not useful for people that are close related to the alumni, thus, not surprisingly, don't have mayor impact on the formation of family founding teams.

#### 4.2.2 Entrepreneurial entry through the creation of a new venture with peers

The variable that exhibits the strongest effect is `Course_Specialization`. This variable has a positive and significant (at 1%) coefficient. This indicates that POLIMI alumni with a highly specialized curriculum are more likely to enter entrepreneurship by creating ventures with people of similar age. The conclusion is strong, as we can perceive the positive relation when we analyze the ventures founded during 1, 3 or 5 years after graduation. In all the cases, the positive correlation is highly significant. It is interesting to highlight that the coefficient of the variable becomes smaller the higher the year threshold considered, showing the decreasing effect of university education over time. A highly specialized curriculum has greater effect on the creation of business with peers than in any other category. The specialization of the curriculum is related to a better recognition of opportunities in the fields of specialization. Thus, based on a signaling effect, students with a highly specialized university curriculum can attract other young potential cofounders, who mainly lack from capabilities to evaluate cofounders.

Another interesting result appears when we observe the effect on the study experience abroad. No results are perceived when looking at the first year after graduation, but when looking at companies founded 3 or 5 years after graduation, the significant positive effect is evidenced. A study experience abroad improves student's social skills, encourages him to be more open to new opportunities, and help with the development of a network of people similar to them but from other countries, that can become potential business partners. These positive effects need a few years to materialize.

In this case, we do have to say that educational dimensions that base their effect on signals have lower effects than expected to start a business with individuals of the same age. Between the student's performance, the university rank and if the student takes longer to graduate, only the student's performance represents a significant positive coefficient, that is only present when we consider all the ventures founded on the 5 following years to graduation. The absence of more important results on the tests we did can be explained because of two reasons: All these educational dimensions origin signals that have opposite effects on the results expected (i.e. a good university performance leads to higher opportunity



costs to entrepreneurial entry, but also makes the individual more attractive for fellow students to start a business with them) that are individually relevant but as they are opposites cancel their effect; or simply those educational dimensions don't show signals strong enough as to influence the formation of this kind of ventures.

#### 4.2.3 Entrepreneurial entry through the creation of a new venture with experienced members

To start, we see that work experience during the degree is positively correlated with venture creation with experienced members. This effect is perceived only when we analyze the companies created during the following year after graduation. During the work experience, the student has the opportunity to enlarge his network, knowing experienced people. These new contacts may become then cofounders. It is interesting to observe that this effect is relevant only for companies founded right after graduation. After graduation, most of alumni gain work experience and enlarge their network. Thus, the effect of working during the degree loses relevance.

Once again, we remark the lack of results on the educational dimensions that mainly create effects based on signals. The student's university performance, the university rank and the students failing and taking longer to graduate don't have significant correlations with the formation of teams with experienced members on board. More experienced people might have a lower need for signals of quality. They rather can understand whether a recent graduate could be a good teammate by shortly interacting with him.

### 4.3 Robustness check

To test how the results were affected by how the limit between the "Peers category" and the "Experienced category" was set, we did a robustness analysis changing this definition. We looked for other ways of capturing students that entered entrepreneurship by founding a venture with people of same age cohort. An alternative way used by previous works (Grossman, Yli-Renko and Janakiraman, 2007; Delmar and Davidsson, 2000) consists

in considering a maximum of 10 years difference between members of the same age cohort. Based on these previous works, we defined the new limit between the categories 2 and 3 on a maximum of 10 years of difference between the older team member and the focal student. Specifically, if the difference between the POLIMI student and his/her teammates is lower we consider them of the same age cohort.

On the results regarding the formation of ventures with peers, most of the results obtained are similar to the ones of the previous analysis. First, the level of specialization shows a strongly significant correlation with starting a company with peers. Secondly, a study experience abroad has a positive effect when we consider companies the companies started during the following 3 or 5 years to graduation. Correspondingly, the signals effect reflect to have a lower influence than expected. However, we can perceive a new effect. The training on economics and management shows a positive significant effect, which can be explained by an increased knowledge about markets. Nevertheless, we can perceive it strongly only when considering ventures founded until 1 year after graduation, and weakly when considering all the ones founded during the following 5 years from graduation.

Regarding ventures founded with experienced individuals as cofounders, the positive effect of the work experience is no longer visible. We can suggest that the potential cofounders the student met on the work environment are just some years older than the student. This difference in the results show that the experienced members with whom the students teamed up with were 5 to 10 years older than he was. Once again, the educational dimensions that base their potential effect on signals show that they are not relevant for experienced members.

From the results we can perceive that the main conclusions of the study don't depend on how the limit is set between these two categories, and reveal the robustness of the results. The detailed results of this test can be seen on Appendix 1.

# Chapter 5: Conclusion

## 5.1 Discussion of the results

The aim of this study is to analyze the impact of students' education on the probability of teaming up with different types of individual and forming student start-ups. Student entrepreneurs acquire strong competences from university education; however, they have low experience and therefore present important knowledge gaps. As entrepreneurs are not lone heroes but they tend to be part of a team or build one around them, it is interesting to analyze how students define the team composition to cover their knowledge gaps. Numerous works have recognized that university education plays a major role on student entrepreneurial entry; however, the effect on team composition remains understudied. To conduct our analysis, gathered data including information on the individuals who obtained a Laurea Magistrale Degree at Politecnico di Milano between 2005 and 2009, with data about the individuals that started a venture with at least one of them as part of the founding team. Then, we identified different educational dimensions and the possible effects that each one could have, based on signaling, competences and network effects.

The analysis we conducted led us to reach some interesting conclusions. First, we show that the university education does have an impact on the entrepreneurial entry path of students from technical universities. Specifically, educational dimensions differently affect the type of individuals involved in new venture creation. We found that both a highly specialized university curriculum and an international study experience lead to building a founding team with people of a similar age. Moreover, the university educational dimensions that essentially base their effect on signaling the quality of the individual have a low effect on the kind of team formed.

First, we detected that a high level of specialization of the university curriculum strongly promotes founding teams composed by people of similar age. Interestingly, this effect is perceived immediately after graduation and lasts for at least the following 5 years. On one side, Lazear suggested that a highly specialized curriculum increases the opportunity costs as the individual is more attractive on the labor market as a specialist. On the other side, the specialized curriculum facilitates the recognition of opportunities in the fields of specialization. However, these aspects also apply for other categories of founding teams, as teaming with more experienced people, but the strong effect is only present for category 2. We suggest that a highly specialized university curriculum signals competences the student has, and can attract potential cofounders. Young individuals lack from capabilities to properly evaluate cofounders and then are more influenced by signals. Thus, we can perceive this effect only in the formation of ventures with young cofounders.

The second important conclusion evidences that a study experience abroad has a positive impact to start a company with peers. This effect may be created by the enlarged network, the increased risk propensity and the social skills development that the student has due to the experience. However, as the positive impact is not perceived for founding teams started with more experienced people, we can suppose that the stronger effect is due to the relations and the network created between students, and not because of the increased risk propensity and social skills, that would promote other founding teams compositions too. Nevertheless, it would be interesting to develop a deeper analysis to understand if the network expansion during the study abroad is the cause, or the social skills development led to future development of the network.

Then, we detected that the educational dimensions that have their main effects based on signals that inform about the quality of the individual, present minor effects. The expected effects of three of the variables studied are due to signaling the quality of the students: the student's university performance, the degree quality and when students took longer than expected to graduate. Two of these variables reflected to have no significant effect on the kind of team formed, regardless of the period analyzed. Only the student's academic performance had a positive significant effect, but only when looking at all the ventures founded during the 5 years after graduation. As this effect emerges after many years, we can

suppose it is not because of a signaling effect, but because students who get higher degree scores tend to have a need of achievement, a psychological trait that is positively associated to a higher propensity to prefer entrepreneurship to working in paid employment (McClelland, 1961; Amit et al., 1993).

## 5.2 Limitations & future research development

This study has several limitations that offer directions for future research. First, the main limitation is that we have scarce information on the students' teammates. We know whether they are family members and their age, but we have no information about their competences. This prevents us from exploring interesting issues. Future studies might analyze the curricula of the individuals who teamed up with POLIMI students. For example, whether some characteristics of university education are conducive to a more, or less, homogeneous team in terms of competences.

Second, here we focus on one university only, hence we cannot investigate the effects of institutional characteristics on the composition of founding teams. To be able to address these issues, one may extend the research to a representative sample of universities.

Finally, here only study the initial founding team composition, without evaluating the future success of the ventures founded. It would be interesting to develop this further analysis to understand if there is a specific founding team composition that present a bigger success rate. Thus, antecedents of successful team formation could be assessed.

## 5.3 Contributions to student entrepreneurship research & policy implications

Regardless of these limitations, our work contributes to academic research about student entrepreneurship, and provides implications for policy makers and university managers. As mentioned before, the research conducted so far about the influence of university education

on student entrepreneurs still present gaps. Our work reveals that the education provided on technical universities has significant effects on the probability of teaming up with different types of individual and forming student start-ups. As the strongest contributions, we mention that a highly specialized university curriculum and study abroad programs encourage students to start a venture with individuals of the same age cohort. Moreover, the signals originated by the students' university performance, the quality of the degree and the time taken to graduate do not influence the founding team composition. In addition, we also note that work experience during the degree supports the students to start a venture right after graduation with more experienced individuals. Finally, the study shows that signals originated by university education have no relevance for the creation of teams with experienced individuals or with family members. This confirms that experienced individuals or relatives to the student are less likely to be influenced by signals.

As consequence, the study conducted suggest concrete implications for university managers that want to stimulate student entrepreneurship, and in particular, with certain founding team compositions. A proper design of the university curricula is able to promote entrepreneurial entry with a defined founding team composition. For instance, entrepreneurial entry with team members of the same age cohort is stimulated by a strong curriculum specialization and by study abroad programs. Additionally, immediate entrepreneurial entry by teaming with more experienced individuals can be increased by supporting work experience during the degree. Family businesses can be also promoted, but in a lower measure, by a high curriculum specialization.

# References

- Arrow, K. J. (1973). Information and economic behavior (No. TR-14). *HARVARD UNIV CAMBRIDGE MA*.
- Åstebro, T., Bazzazian, N., & Braguinsky, S. (2012). Startups by recent university graduates and their faculty: Implications for university entrepreneurship policy. *Research Policy*, 41(4), 663-677.
- Bergmann, H., Hundt, C., & Sternberg, R. (2016). What makes student entrepreneurs? On the relevance (and irrelevance) of the university and the regional context for student start-ups. *Small Business Economics*, 47(1), 53.
- Carroll, G. R., & Mosakowski, E. (1987). The career dynamics of self-employment. *Administrative science quarterly*, 570-589.
- Cohen, W. M., & Levinthal, D. A. (1989). Innovation and learning: the two faces of R & D. *The economic journal*, 99(397), 569-596.
- Colombo, M. G., D'Adda, D., Piva, E. (2010). The contribution of university research to the growth of academic start-ups: An empirical analysis. *The Journal of Technology Transfer*, 35(1), 113-140.
- Colombo, M. G., Piva, E. (2008). Strengths and weaknesses of academic startups: a conceptual model. *IEEE Transactions on Engineering Management*, 55(1), 37-49.
- Colombo, M. G., & Piva, E. (2012). Firms' genetic characteristics and competence-enlarging strategies: A comparison between academic and non-academic high-tech start-ups. *Research Policy*, 41(1), 79-92.

- Cooney, T. 2005. Editorial: What is an Entrepreneurial Team? *International Small Business Journal*, 23(3), 226-235.
- Evans, D. S., & Jovanovic, B. (1989). An estimated model of entrepreneurial choice under liquidity constraints. *Journal of political economy*, 97(4), 808-827.
- Forbes, D. P., Borchert, P. S., Zellmer-Bruhn, M. E., & Sapienza, H. J. (2006). Entrepreneurial team formation: An exploration of new member addition. *Entrepreneurship Theory and Practice*, 30(2), 225-248.
- Grossman, E., Yli-Renko, H., & Janakiraman, R. (2007). Homophily and resource-seeking behavior in new venture network formation. *Frontiers of Entrepreneurship Research*, 27(11), 1.
- Hsu, D. H., Roberts, E. B., & Eesley, C. E. (2007). Entrepreneurs from technology-based universities: Evidence from MIT. *Research Policy*, 36(5), 768-788.
- Isada, F., Lin, H. C., & Isada, Y. (2015). Entrepreneurship of university students in Taiwan and Japan. *Management Research Review*, 38(12), 1251-1266.
- Jang, Y. (2013). Modeling student entrepreneurship: A longitudinal study. *Journal of entrepreneurship education*, 16, 93.
- Kim, P. H., Aldrich, H. E., & Keister, L. A. (2006). Access (not) denied: The impact of financial, human, and cultural capital on entrepreneurial entry in the United States. *Small Business Economics*, 27(1), 5-22.
- Lazear, E. P. (2004). Balanced skills and entrepreneurship. *American Economic Review*, 208-211.



- Lerner, J., & Malmendier, U. (2013). With a little help from my (random) friends: Success and failure in post-business school entrepreneurship. *The Review of Financial Studies*, 26(10), 2411-2452.
- Leung, K. Y., Lo, C. T., Sun, H., & Wong, K. F. (2012). Factors influencing engineering students' intention to participate in on-campus entrepreneurial activities. *Journal of Entrepreneurship Education*, 15, 1.
- Levesque, M., Minniti, M. (2006). The effect of aging on entrepreneurial behavior. *Journal of Business Venturing*, 21(2), 177-194.
- Lüthje, C., Franke, N. (2003). The 'making' of an entrepreneur: testing a model of entrepreneurial intent among engineering students at MIT. *R&D Management*, 33(2), 135-147.
- Maresch, D., Harms, R., Kailer, N., & Wimmer-Wurm, B. (2016). The impact of entrepreneurship education on the entrepreneurial intention of students in science and engineering versus business studies university programs. *Technological forecasting and social change*, 104, 172-179.
- Ng, T. W., & Feldman, D. C. (2014). A conservation of resources perspective on career hurdles and salary attainment. *Journal of Vocational Behavior*, 85(1), 156-168.
- Premand, P., Brodmann, S., Almeida, R., Grun, R., & Barouni, M. (2016). Entrepreneurship education and entry into self-employment among university graduates. *World Development*, 77, 311-327.
- Roberts, E. B. (1991). *Entrepreneurs in high technology: Lessons from MIT and beyond.* Oxford University Press.
- Ruef, M., Aldrich, H. E., & Carter, N.M.(2003). The structure of founding teams: Homophily, strong ties, and isolation among US entrepreneurs. *American Sociological Review*, 68(2), 195-222.

- Saeed, S., Muffatto, M. & Yousafzai, S. (2014). A Multi-level Study of Entrepreneurship Education among Pakistani University Students. *Entrepreneurship Research Journal*, 4(3), pp. 297-321.
- Shane, S. (2000). Prior knowledge and the discovery of entrepreneurial opportunities. *Organization Science*, 11(4), 448-469.
- Sørensen, J. B. (2007). Bureaucracy and entrepreneurship: Workplace effects on entrepreneurial entry. *Administrative Science Quarterly*, 52(3), 387-412.
- Spence, M. (1973). Job market signaling. *The quarterly journal of Economics*, 87(3), 355-374.
- St-Jean, É., Nafa, A., Tremblay, M., Janssen, F., Baronet, J., & Loué, C. (2014). Entrepreneurial intentions of university students: an international comparison between African, European and Canadian students. *International Journal of Entrepreneurship and Innovation Management*, 18(2-3), 95-114.
- Sturman, M. C., Walsh, K., & Cheramie, R. A. (2008). The value of human capital specificity versus transferability. *Journal of Management*, 34(2), 290-316.
- Trivedi, R. (2016). Does university play significant role in shaping entrepreneurial intention? A cross-country comparative analysis. *Journal of Small Business and Enterprise Development*, 23(3), 790-811.

# APPENDIX

## APPENDIX 1 – Robustness check

### Appendix 1.a. – Robustness check considering 1 year after graduation

<b>TEAM_CATEGORY1_10</b>	<b>Family - Category 1</b>		<b>Peers - Category 2</b>		<b>Experienced - Category 3</b>		<b>Others - Category 4</b>	
<i>Course_Specialization</i>	0.079	(0.047) *	0.309	(0.056) ***	-0.057	(0.084)	-0.034	(0.087)
<i>D_Economics</i>	0.484	(0.343)	0.951	(0.406) **	0.257	(0.506)	0.997	(0.588) **
<i>Degree_Score</i>	-0.001	(0.023)	0.011	(0.030)	0.012	(0.033)	-0.022	(0.034)
<i>D_Top_Uni_On_Field</i>	0.399	(0.547)	0.860	(0.856)	-0.431	(0.677)	0.750	(0.863)
<i>D_Study_Abroad</i>	-0.304	(0.605)	0.526	(0.550)	0.104	(0.760)	-0.828	(1.035)
<i>D_Work_Experience</i>	-0.555	(0.507)	0.154	(0.768)	0.872	(0.619)	-0.938	(0.826)
<i>D_Failing_Alumnus</i>	-0.181	(0.353)	0.170	(0.408)	0.080	(0.497)	0.926	(0.574)
<i>D_Ind_Inf_Engineering</i>	-0.145	(0.466)	-0.588	(0.798)	0.392	(0.660)	-0.276	(0.684)
<i>D_Highest_Fees</i>	1.017	(0.337) **	0.867	(0.422) **	0.650	(0.534)	0.814	(0.515)
<i>D_Prior_Shareholder</i>	1.498	(0.504) **	-16.39	(4296)	1.616	(0.721) **	1.429	(0.779) **
<i>D_Woman</i>	0.035	(0.358)	-1.350	(0.523) **	-1.007	(0.661)	-0.803	(0.601)
<i>D_Born_Abroad</i>	-1.519	(1.036)	-16.63	(2135)	-14.87	(1419)	-15.981	(3005)
<i>Age_Graduation</i>	0.057	(0.057)	-0.010	(0.105)	0.114	(0.049) **	-0.435	(0.300)
<i>_cons</i>	-7.803	(2.923) **	-9.882	(4.340) **	-11.00	(3.848) **	5.974	(8.922)

Table 10 - Robustness check considering 1 year after graduation Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001

Appendix 1.b. – Robustness check considering 3 years after graduation

<b>TEAM_CATEGORY3_10</b>	<b>Family - Category 1</b>		<b>Peers - Category 2</b>		<b>Experienced - Category 3</b>		<b>Others - Category 4</b>	
<i>Course_Specialization</i>	0.054	(0.034)	0.247	(0.037) ***	0.033	(0.045)	-0.051	(0.054)
<i>D_Economics</i>	0.278	(0.245)	0.435	(0.276)	0.059	(0.311)	0.279	(0.322)
<i>Degree_Score</i>	-0.001	(0.016)	0.032	(0.020)	-0.012	(0.020)	0.003	(0.021)
<i>D_Top_Uni_On_Field</i>	0.361	(0.383)	0.240	(0.476)	0.018	(0.453)	0.064	(0.483)
<i>D_Study_Abroad</i>	-0.237	(0.430)	0.694	(0.354) **	-0.121	(0.528)	-0.304	(0.528)
<i>D_Work_Experience</i>	-0.245	(0.356)	-0.216	(0.453)	0.062	(0.422)	-0.303	(0.451)
<i>D_Failing_Alumnus</i>	-0.111	(0.251)	0.003	(0.282)	0.044	(0.306)	-0.251	(0.387)
<i>D_Ind_Inf_Engineering</i>	-0.170	(0.340)	-0.998	(0.437) **	-0.135	(0.423)	-0.319	(0.390)
<i>D_Highest_Fees</i>	1.126	(0.241) ***	-0.038	(0.367)	0.856	(0.319) **	0.573	(0.331) *
<i>D_Prior_Shareholder</i>	1.095	(0.419) **	-0.178	(1.020)	1.205	(0.515) **	1.495	(0.497) **
<i>D_Woman</i>	-0.409	(0.274)	-1.474	(0.398) ***	-0.314	(0.348)	-0.946	(0.389) **
<i>D_Born_Abroad</i>	-1.055	(0.611) *	-16.010	(1344)	-1.628	(1.030)	-0.995	1.036
<i>Age_Graduation</i>	0.071	(0.040) *	0.057	(0.063)	0.112	(0.037) **	-0.267	(0.166)
<i>_cons</i>	-7.281	(2.089) ***	-11.285	(2.794) ***	-7.448	(2.383) **	1.262	5.118

Table 11 - Robustness check considering 3 years after graduation Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001

Appendix 1.c. – Robustness check considering 5 years after graduation

<b>TEAM_CATEGORY5_10</b>	<b>Family - Category 1</b>			<b>Peers - Category 2</b>			<b>Experienced - Category 3</b>			<b>Others - Category 4</b>		
<i>Course_Specialization</i>	0.055	(0.030)	*	0.171	(0.029)	***	0.029	(0.036)		-0.039	(0.040)	
<i>D_Economics</i>	0.392	(0.209)	*	0.361	(0.218)	*	-0.004	(0.249)		0.126	(0.254)	
<i>Degree_Score</i>	0.001	(0.014)		0.046	(0.016)	**	-0.004	(0.017)		-0.002	(0.016)	
<i>D_Top_Uni_On_Field</i>	0.239	(0.314)		-0.114	(0.336)		0.048	(0.358)		0.086	(0.400)	
<i>D_Study_Abroad</i>	-0.317	(0.373)		0.540	(0.279)	*	-0.150	(0.402)		-0.489	(0.467)	
<i>D_Work_Experience</i>	-0.090	(0.297)		0.024	(0.323)		0.161	(0.346)		-0.479	(0.369)	
<i>D_Failing_Alumnus</i>	0.003	(0.214)		0.455	(0.221)	**	-0.025	(0.245)		-0.311	(0.300)	
<i>D_Ind_Inf_Engineering</i>	-0.399	(0.291)		-0.999	(0.316)	**	-0.419	(0.346)		-0.145	(0.306)	
<i>D_Highest_Fees</i>	0.888	(0.211)	***	0.245	(0.256)		0.801	(0.254)	**	0.600	(0.266)	**
<i>D_Prior_Shareholder</i>	1.821	(0.294)	***	0.397	(0.599)		0.848	(0.492)		1.060	(0.481)	**
<i>D_Woman</i>	-0.675	(0.240)	**	-1.564	(0.311)	***	-0.751	(0.297)	**	-0.847	(0.313)	**
<i>D_Born_Abroad</i>	-0.406	(0.442)		-1.027	(0.732)		-1.948	(1.019)	*	-0.930	(0.743)	
<i>Age_Graduation</i>	0.025	(0.041)		-0.041	(0.077)		0.077	(0.038)		-0.170	(0.119)	
<i>_cons</i>	-6.039	(1.909)	**	-9.322	(2.780)	**	-6.745	(2.101)	**	0.167	(3.773)	

Table 12 - Robustness check considering 5 years after graduation Legend: \* p-value<0.1; \*\* p-value<0.05; \*\*\* p-value<0.001