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Entrepreneurship as a Career Option for Information Technology Students: Critical Barriers and the Role of Motivation

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Abstract Entrepreneurial intention (EI) is attracting research interest as a valid predictor of actual entrepreneurial activity, and a growing number of articles are approaching the subject both from theoretical and experimental perspectives. Motivation is considered the major driver of EIs. However, entrepreneurial barriers may hinder the formation of EIs and even cancel the realization of EIs into entrepreneurial activity. The constraints perceived by the prospective entrepreneurs (e.g., students) and the motives forming their intentions, analyzed in the literature, up to now, deliver some disparate findings about the significance and the relative power of the effects. The need for a unified instrument for the systematic investigation of the impact of barriers and motives on EIs is imperative. On the other hand, research on the EIs of students in the field of information technology (IT) is very rare, although the field consists a fertile ground for entrepreneurial activity and innovation. In order to fill this gap, a structured questionnaire was used to reveal the perceptions of entrepreneurial barriers and motivation, in a sample of 174 tertiary IT students. The data were subjected to statistical regression in order to identify causal relations between the barriers, motives, and EIs. The results indicated that the lack of entrepreneurial knowledge and skills have a major impact on EIs of students. On the contrary, self-motivation towards entrepreneurship acts as an antidote. Finally, the differences in the perception of barriers and motivation, between the two genders and role model groups, were also examined. The findings have valuable implications for educators in the IT field, due to the opportunities expected, in the context of Industry 4.0. Additionally, there are useful implications for policy makers, due to the ongoing economic crisis.

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Introduction

Entrepreneurial activity is referred to as the backbone of a country's economy (Piperopoulos and Piperopoulos 2010) providing a number of benefits, such as growth, employment, competitiveness, and innovation (Caloghirou et al. 2016; Van Praag and Versloot 2007). Europe's economic growth heavily depends on entrepreneurial activity (Feki and Mnif 2016; Wilson 2008), which may offer a faster recovery to countries challenged by economic recession (Papaoikonomou et al. 2012). Entrepreneurial activity is not only a matter of opportunity discovery and exploitation (Shane and Venkataraman 2000), but it is also a matter of intentional planning. Before one's engagement to entrepreneurship, intentions are developed through cognitive processing of the environmental factors (Della Peruta 2014). Intention is a cognizant process prior to one's actual involvement into any kind of activity (Liñán and Chen 2009), and entrepreneurial intention (EI) is considered as one's will to get involved with entrepreneurship. EI is widely accepted as a valid predictor of entrepreneurial behavior (Bird 1988; Ferreira et al. 2012; Krueger and Carsrud 1993; Shapero and Sokol 1982) and has become a rapidly evolving field of interdisciplinary research (Liñán and Fayolle 2015). However, the realization of the intentions into entrepreneurial actions becomes complicated when entrepreneurial constraints or barriers are present (Choo and Wong 2006; Kolvereid and Isaksen 2006). The perception of barriers increases the uncertainty of the prospective entrepreneur (McMullen and Shepherd 2006) acting against entrepreneurial activity, throughout the different phases of the entrepreneurial career (Carayannis et al. 2003; Iakovleva et al. 2014).

The perceptions of the contextual environment are very critical for the EIs of tertiary students (Krueger and Brazeal 1994), and the association of the entrepreneurial barriers with students EIs is very relevant, especially for countries challenged by the economic crisis, like Greece. In these countries, entrepreneurship may offer a solution to the problem of unemployment through the creation of innovative entrepreneurial start-ups. The barriers to entrepreneurship are often studied in the literature and their negative impact on the realization of entrepreneurial activity is indisputable. However, studies analyzing the impact of entrepreneurial barriers on students' EIs are still rare (Campanella et al. 2013; Pruett et al. 2009). The ambiguity of the derived factors in combination to the differentiating power of the effects and the fuzzy role of demographics, put up an inconsistent image, requiring further examination. The necessity for further research in the domain of entrepreneurial barriers is also corroborated by Liñán and Fayolle (2015), stressing that the research on the impact of perceived barriers on EIs is underdeveloped. Additionally, the development of scales for measuring the impact of barriers and motives is suggested for the improvement of the predictive ability of the existing intentional models (Pruett et al. 2009). Finally, the incorporation of the barriers in the existing intentional theories, as possible precipitating events, could contribute to the development of a unified theory of motives, barriers, and intentions (Iakovleva et al. 2014), which could offer better interpretation of the influential factors, highlight differences between demographic groups and provide insights about the proper educational interventions.

Regarding the fruitful IT sector, an increased demand in sophisticated ICT services expected, due to the evolution of Industry 4.0 (Hynes and Richardson 2008), will boost the Greek software development market. Therefore, a new generation of inspired and motivated IT entrepreneurs is required to undertake this challenge, armed with both technical and managerial knowledge and experience, essential for high-tech entrepreneurship (Park 2005). Since information technology is among the most knowledge-intensive industries with continuously shifting barriers to entry (Butler and Murphy 2009), scholars are concerned about the proper educational approaches to instill students with the ability to recognize and chase opportunities of technology innovation, taking full advantage of the possessed scientific knowledge and skills (Del Giudice et al. 2014; Doboli et al. 2010). However, there is very little research concerning entrepreneurship education in the field (Kaltenecker et al. 2015), although researchers claim that engineering students generally, do not consider entrepreneurship as an option (Maresch et al. 2016). As a consequence, the study of the perceptions of tertiary IT students, in regard to entrepreneurial barriers, is very relevant, as it may highlight critical factors for the formation of EIs (Liñán et al. 2011; Liñán and Fayolle 2015), which might hinder the exploitation of future opportunities. To the best of our knowledge, this is the first article examining the effect of the entrepreneurial barriers on the development of EIs of tertiary IT students.

The rest of the paper is structured as follows. Firstly, a survey and categorization of the entrepreneurial barriers according to the literature is presented. Secondly, a statistical analysis of the data collected through a cross-sectional survey is conducted to identify the most influential entrepreneurial barriers regarding tertiary IT students. Thirdly, statistical regression is used in order to identify causal relations between EIs and barriers in comparison with the effect of self-motivation. Finally, possible differences in the perceptions of barriers between gender groups, and the effect of parental role models, are examined.

Entrepreneurial Intention

Intention is the basic concept of the theory of planned behavior (TPB) and denotes one's willingness to exert a certain behavior (Ajzen 1991). EI is considered the will to get involved with entrepreneurial activity and according to the TPB is predicted by three motivational antecedents, namely personal attitude (PA), perceived behavioral control (PBC), and social norms (SN). EI is widely accepted as a valid predictor of entrepreneurial behavior (Bird 1988; Ferreira et al. 2012; Kolvereid and Isaksen 2006; Krueger and Carsrud 1993; Shapero and Sokol 1982) and has become a rapidly evolving field of interdisciplinary research (Liñán and Fayolle 2015). A large number of studies already proved the predictive ability of the TPB.

Entrepreneurial Role Models

The term role model, refers to a person or group of reference, used as a successful example, shaping the aspirations of younger people (Scherer et al. 1989). The presence of an entrepreneur in the family or in the social environment generally acts as an entrepreneurial role model. Role models are considered to have a positive effect on EI through self-efficacy (Chen et al. 1998), by positively affecting the perception of

entrepreneurial abilities (BarNir et al. 2011). Although, there are some conflicts about the results (Krueger et al. 2000; Miller et al. 2009); nevertheless, the use of entrepreneurial role models is suggested for the promotion of entrepreneurial spirit of engineering students (Maresch et al. 2016).

Entrepreneurial Barriers

The barriers to entrepreneurship became part of the European political agenda since 2004, when in a brochure about entrepreneurship cooperation in EU; a number of factors, such as fiscal and monetary policies, regulatory and administrative burdens, legal entry barriers for specific businesses, time-consuming business registration procedures, inflexible employment regulation, and discouraging exit costs, to name a few, were referred as serious impediments to entrepreneurship (Martins et al. 2004). The interest of academic research in issues related to entrepreneurship and the entrepreneurial barriers seems to be growing every year and especially in periods of economic crisis. The barriers to entrepreneurship, referred in the literature, can be classified into internal or external, taking in account whether their emanating source is the individual (endogenous) or some environmental factor (exogenous). This classification proposed by some scholars (Ledyaeva et al. 2008; Sesen and Pruett 2014; Stamboulis and Barlas 2014) was chosen, because of its generality and simplicity. A short reference to the two categories of barriers recorded in the literature (based on previous research by the authors) follows:

In the internal barrier category are included barriers related to the following:

- Personality traits such as lack of motivation (Iakovleva et al. 2014), lack of courage and volition (Birdthistle 2008), low self-efficacy (Boyd and Vozikis 1994; Zhao 2005), lack of confidence, and fear of risk and financial responsibilities (Finnerty and Krzystofik 1985; Giacomin et al. 2011; Sandhu et al. 2011) play a vital role on entrepreneurial start-up.
- Knowledge, entrepreneurial skills, and competencies play a vital role in entrepreneurial success (Carayannis et al. 2003). Lack of such capacities acts as inhibitory factors against the choice of an entrepreneurial career and a business start-up (Birdthistle 2008; Robertson et al. 2003; Shinnar et al. 2009). Entrepreneurial education, on the other hand, has a positive effect on the perception of barriers to entrepreneurship (Miller et al. 2009; Ribeiro et al. 2014).
- Negative attitude towards entrepreneurship is considered a barrier to entrepreneurship (Ledyaeva et al. 2008; Sandhu et al. 2011; Smith and Beasley 2011). However, personal attitude is one of the three antecedents of intentions towards entrepreneurship (Ajzen 2002), which refers to the acceptance of the idea of becoming an entrepreneur (Hui-Chen et al. 2014) and is considered a major driver of EIs. It indicates one's commitment to the aim of establishing and running a business (Kolvereid and Isaksen 2006). Personal attitude is excessively examined in the literature, and we will not examine it any further in this article.
- Gender-related stereotypical perceptions, such as "gender appropriate occupations" (BarNir et al. 2011), are negatively affecting career choices. Discriminations towards female entrepreneurs raise financial or start-up difficulties (Akehurst et al. 2012) while lack of social support to entrepreneurial initiatives, taken by females, is

met in certain cultures (Alvarez et al. 2011). Thus, gender can be also considered a barrier to entrepreneurship under certain contexts.

The internal barriers to entrepreneurship are summarized in Table 1.
In the category of external barriers are included the following factors:

- Funding is probably the most crucial problem to entrepreneurship (Finnerty and Krzystofik 1985). The lack of initial capital, financial difficulties, etc. are also referred to as barriers to entrepreneurship by students (Birdthistle 2008; Franke and Lüthje 2004; Ledyaeva et al. 2008; Shinnar et al. 2009; Smith and Beasley 2011).
- Informal factors, such as lack of entrepreneurial role models, can influence the image of entrepreneurship in certain cultures (Hawkins 1993; Pruett et al. 2009). Lack of social support (Baughn and Neupert 2003) and family obligations (Finnerty and Krzystofik 1985; Martins et al. 2004) are other informal factors affecting EI. Informal support is indirectly measured through subjective norm, a construct of the TPB (Ajzen 1991).
- The lack of institutional (formal) support is considered as a major drawback to one's entrepreneurial plans (Giacomin et al. 2011; Pruett et al. 2009; Sesen and Pruett 2014; Smith and Beasley 2011). Formal or institutional support includes institutional funding, subsidies, consulting, and service support, referred as a barrier not only by actual entrepreneurs (Akehurst et al. 2012; Hulsink and Koek 2014), but also by students.
- Resource constraints, including human resources and infrastructures, are critical to business start-up. Lack of resources is considered a barrier to entrepreneurship, referred by actual entrepreneurs (Sandhu et al. 2011) and occasionally by students (Ledyaeva et al. 2008; Stamboulis and Barlas 2014).
- Market-related barriers include the lack of social network (Sandhu et al. 2011), lack of knowledge of the market (Shinnar et al. 2009), difficulty to contact or find customers (Birdthistle 2008; Ledyaeva et al. 2008; Stamboulis and Barlas 2014), tough competition (Franke and Lüthje 2004), lack of original ideas, and finally,

Table 1 Categorization of internal barriers

Category	Barrier
Personality	Lack of motivation/direction
	Lack of courage/volition
	Self-efficacy
	Fear of risk, debt, failure
	Lack of confidence
Education and competence	Knowledge and skills
	Abilities and competencies
	Experience
Attitude	Attitude towards entrepreneurship
Gender	Gender related

difficulty of business opportunity recognition (Franke and Luthje 2003; Iakovleva et al. 2014; Miller et al. 2009; Pruett et al. 2009; Stamboulis and Barlas 2014).

- Law and regulation raise constraints, due to the complexity or the inconsistencies of the legal framework (Baughn and Neupert 2003). Time-consuming registration procedures (Iakovleva et al. 2014) and frequently changing labor regulations are frequently perceived as barriers to entrepreneurship by students (Franke and Luthje 2003; Franke and Lüthje 2004; Ledyaeva et al. 2008) and actual entrepreneurs (Choo and Wong 2006).
- Bureaucracy, administrative burden, and difficulties to comply with regulations are obstacles related to the affairs between individuals and the state (Finnerty and Krzystofik 1985) which usually cause some frictions (Martins et al. 2004). These kinds of barriers to entrepreneurship are perceived also by students affecting their EI (Franke and Lüthje 2004; Stamboulis and Barlas 2014). However, there are minor differentiations between countries (Pruett et al. 2009). Corruption (Ledyaeva et al. 2008; Stamboulis and Barlas 2014) and high taxation (Sesen and Pruett 2014) are barriers also included in the same category.
- Finally, the overall perception of the economic and political situation, expressing general business climate, stability, or uncertainty, is referred as hard reality (Finnerty and Krzystofik 1985), influencing the EIs of actual entrepreneurs, as well as students (Sesen and Pruett 2014).

The external barriers to entrepreneurship are summarized in Table 2.

A summary of the articles previously discussed, studying student perceptions of entrepreneurial barriers, is given in Table 15. However, from the nine articles examining the impact of various contextual factors on EI, only six conduct a factor analysis followed by regression in order to reveal underlying causal relations. These core articles are shown in Table 14. From the rest of the articles, eight use descriptive statistics to present the perceptions of entrepreneurial barriers, three articles use qualitative research, and two articles discuss the issue theoretically.

Studying the articles of Table 15, we encountered a series of problems. The first problem was the arbitrary selection of barriers, resulting in ambiguous combinations. Most authors examined internal factors like attitudes, self-efficacy, self-confidence, knowledge, and experience, in combination to external ones. Franke and Lüthje (2003), for example, examined bank financing, regulatory obligations and business idea in combination to attitude and risk and found an overall negative effect on EI. However, in some cases, the entrepreneurial barriers were examined in ambiguous combinations, i.e., barriers with different sources of origin that comprised common factors lacking of conceptual consistency. As an example, Miller et al. (2009) used a one-factor solution for all the barriers they examined, Akehurst et al. (2012) mixed the lack of infrastructures in a common factor with the lack of training, while Sesen and Pruett (2014) used a common factor for economic climate and entrepreneurial competencies. This arbitrary mixture of internal and external barriers can create ambiguities about the interrelations and the significance of the constraints. Additionally, only few of these researches included items for all of the 12 categories of internal and external entrepreneurial barriers aforementioned. Thus, the development of a scale for entrepreneurial barriers, suggested by Pruett et al. (2009), is mandatory for the better understanding of their effect on EIs.

Table 2 Categorization of external barriers

Category	Barrier
Finance	Funding capital, borrowing cost
	Irregular income
Informal support	Family commitments
	Role models and family background
	Social support, subjective norms
Formal support	Institutional support
	Advisory mentorship
Resources	Human resources
	Infrastructures
Market related	Networks and social capital
	Market information and knowledge
	Customer finding
	Market pressure, tough competition, property rights
	Right idea, opportunity recognition
Law and regulations	Registration procedure
	Regulations
	Legislation and structures
	Labor difficulties
State affairs	Administrative burden
	Bureaucracy
	Corruption
	Tax and fiscal
Hard reality	Political future uncertainty
	Economic climate, economic indicators

The second problem is the diversity in the effect of demographics such as gender and role models. BarNir et al. (2011) examined the lack of role model as a possible influential factor on career intention and found a significant effect; however, the hypothesized difference in the impact of role models on intentions of men and women was not confirmed. Examining a mixture of internal and external barriers using a sample of American students (Miller et al. 2009), the barriers of business knowledge and skills, finance, law, and business idea were found to have a significant negative impact on EI, whereas the impact of role models was insignificant. Thus, it becomes evident that the effect of gender and role models varies depending on the specific setup and should be further examined.

The third problem is the diversity in the power of the effects of barriers and motives. A number of papers examined different nationalities of students, seeking for cultural differences in the impact of barriers in combination to the motives towards entrepreneurship. The research on motivation was brought in the foreground of entrepreneurship research mainly by the TPB (Ajzen 1991). The authors, presented in the literature review, examined barriers along with various combinations of motives. Sesen and Pruett (2014) examined both internal

and external barriers and found lack of self-confidence, an internal barrier, to be the most influential barrier among Turkish students, whereas American students were more influenced by an external barrier, namely, lack of support structures. In a previous research, Pruett et al. (2009) had examined the effect of internal and external barriers on EI. Specifically, they examined the role of knowledge, self-efficacy and support structures, and start-up and operating risks as barriers between American, Spanish, and Chinese students. The lack of knowledge was the most important barrier, with start-up and operating risks being less important. Sesen and Pruett (2014) also examined the motives of American and Turkish students and found significant differences. Turkish students for example were motivated by their desire for creation, profit, social status, and independence, whereas Americans were mostly motivated by their desire for creation and personal development. However, the overall impact of motives was higher (in terms of beta coefficients) for the American students. On the other hand, the impact of barriers for the Turkish students was very close to that of motives. In another sample examined by Pruett et al. (2009), independence and creativity were found to be the most influential motives for students. However, the effect of motives was not as powerful as the effect of barriers. By these examples, it becomes evident that the overall effect of barriers and motives varies, depending on the methodological approach of each study or due to differences in the socio-cultural and economic environment examined (Caloghirou et al. 2016). Since research examining the role of motivation as a predictor of EI is still underdeveloped (Carsrud and Brännback 2011), this inconclusiveness in the effect of barriers compared to the effect of self-motivation should be further examined. In this study, in order to evaluate the impact of motivation versus the impact of entrepreneurial barriers, the concept of self-motivation towards entrepreneurship was employed, which is positively related to the three antecedents of the TPB (Hui-Chen et al. 2014; Solesvik 2013).

Study Aims and Hypotheses

The purpose of this article is to increase our knowledge of the entrepreneurial barriers perception of tertiary students in the IT field. This will provide better understanding of the mechanisms behind the complex phenomenon of the realization of intentions into entrepreneurial actions, under the perception of entrepreneurial barriers (Kolvereid and Isaksen 2006). Students are the ideal research group, because they are one step before crucial occupational choices. The questions seeking for answers may include the following:

- Which of the barriers are more influential for students' EIs?
- What is the role of self-motivation in the formation of EIs?
- Does the perception of entrepreneurial barriers vary by gender?
- Does the existence of entrepreneurial role models affect the perception of entrepreneurial barriers?
- Does the perception of barriers outperform the effect of self-motivation?

According to the literature review, the barriers most commonly mentioned by students are those of the internal type. Few studies suggest that students are also influenced by external barriers such as finance, regulations, and lack of business ideas (Franke and Luthje 2003), because they have limited or no experience from the actual conditions of the market, and therefore, they ignore

many of the entrepreneurial barriers reported by actual entrepreneurs. Their perceptions in many cases are based on the general perceptions regarding business creation and not on personal experience, and therefore, they cannot be considered valid (Campanella et al. 2013). However, no matter how valid they are, these perceptions influence the shaping of the students' EIs (Krueger and Brazeal 1994). Under this scope we argue that:

- H1. Students' EIs are negatively affected by the perception of barriers.
- H2. Students' EIs are affected more by the internal barriers than the external barriers to entrepreneurship.

Lack of motivation is considered as a barrier to entrepreneurship, reported by tertiary students (Iakovleva et al. 2014). Some researchers explored the causal relations between various motives and EI (Pruett et al. 2009; Sesen and Pruett 2014). However, their findings were somewhat precarious, with significant differences in the causal effects. Chang Hui-Chen et al. (2014), in an attempt to unify the TPB with the motivation-opportunity-ability theory, examined the role of self-motivation towards entrepreneurship and found it to be a major driver of the three motivational antecedents of the TPB and particularly of PA. Moreover, they acknowledged a direct effect of self-motivation on EI. Therefore, we presume the existence of a positive link between entrepreneurial self-motivation and EIs of IT students, and moreover, we argue that self-motivation towards entrepreneurship of IT students has a more powerful effect than perceived barriers do:

- H3a. Entrepreneurial self-motivation of tertiary IT students is positively related to EIs.
- H3b. Entrepreneurial self-motivation of tertiary IT students has a more powerful effect on EI than the effect of barriers.

Entrepreneurship is traditionally considered to be a field of occupation dominated by males, but in the recent decades, female entrepreneurship has dynamically evolved (Wang and Wong 2004). Nevertheless, women are still experiencing difficulties in the entrepreneurial terrain due to stereotypes and family responsibilities (BarNir et al. 2011; Del Giudice 2014). Gender is a factor attracting a considerable amount of research on EIs, with conflicting results. A number of studies suggest that female respondents actually report decreased entrepreneurial aspirations compared to their male counterparts (Hundt and Sternberg 2016; Joensuu-Salo et al. 2015; Karimi et al. 2014a; Langowitz and Minniti 2007; Ledyaeva et al. 2008; Sandhu et al. 2011; Venkatapathy and Pretheeba 2014), whereas individual studies find no differences between the genders (Pruett et al. 2009). Additionally, in certain contexts, females show more willingness towards entrepreneurship than males (Saadin and Daskin 2015). The effect of gender therefore is not straightforward, and further investigation of the role of gender in EIs is required (Liñán and Fayolle 2015). Additionally, variations depending on contextual conditions like the domain of studies (Venkatapathy and Pretheeba 2014) raise questions about the EIs of male and female IT students. Regarding Greece, despite the high educational levels and the presence of women in managerial jobs, the gender gap still remains in entrepreneurship (Apergis and Pekka-Economou 2010). The

reduced EIs of women may suggest an increased perception of barriers to entrepreneurship (BarNir et al. 2011; Liñán and Fayolle 2015; Shinnar et al. 2012), due to family responsibilities, gender stereotypes, and career breaks (BarNir et al. 2011; Del Giudice 2014; Liñán and Fayolle 2015; Shinnar et al. 2012). In order to examine the possible differentiation of the impact of entrepreneurial barriers on the EIs of male and female tertiary IT students, the next hypothesis is posed:

- H4. Female tertiary IT students have decreased EIs and increased entrepreneurial barriers perception, in comparison to their male counterparts.

Among contextual factors, entrepreneurial role models have a significant impact on EIs (Peterman and Kennedy 2003; Pruett et al. 2009; Van Auken et al. 2006) and constitute a very promising field of research in regard to EIs (Liñán and Fayolle 2015). The existence of entrepreneurial role models in the family or in the social environment has a positive effect on EIs (Carr and Sequeira 2007; Wang and Wong 2004), through the formation of positive attitudes and beliefs (Karimi et al. 2014b; Krueger et al. 2000). This effect is achieved by providing "tacit knowledge" on opportunity recognition and business creation (Campanella et al. 2013), increasing the perceived desirability and feasibility upon starting a business (Krueger and Brazeal 1994). Women tend to be affected by role models from their close environment, whereas men are influenced more by socially promoted entrepreneurial role models. This may be due to the conflicting roles women have to deal with, if they choose self-employment (BarNir et al. 2011). Furthermore, successful entrepreneurial role models, used in different educational approaches, triggered an increase of EIs (Mueller 2011; Venkatapathy and Pretheeba 2014). In order to investigate the impact of role models on the perception of barriers of tertiary IT students, the next hypotheses are posed:

- H5a. Students with entrepreneurial role models in their social environment have increased EI.
- H5b. Students with entrepreneurial role models in their social environment have decreased perception of entrepreneurial barriers.

Research Methodology

As a first step, a literature review was conducted, in order to shed some light on the barriers to entrepreneurship, recorded by previous research. The methodology of Webster and Watson (2002) was adopted because of the benefits of their concept centric approach. A full-text study of a primary set of articles by Kolvereid and Isaksen (2006), Carayannis et al. (2003), and Liñán and Fayolle (2015) provided the appropriate search terms. The titles, abstracts, and author keywords of peer-reviewed articles from three databases (Scopus, Web of Science, and EBSCO) were searched, with the following keywords: "entrepre*" for entrepreneur, entrepreneurship, entrepreneurial, etc., "barrier*" for barrier or barriers, and "constrain*" for constrain, constrains, and constraint.

A number of 247 articles, addressing issues relevant to business creation, were selected. After a careful reading of the abstracts, 132 articles of potential relevance remained and another 15 articles resulted from backward search. After removing inaccessible and irrelevant articles, a number of 81 articles remained for further study.

A number of selected articles concerning the barriers perception of students were already presented in the introduction. Moreover, these articles were used as a source of the items of the questionnaire developed for the purpose of this research.

In order to investigate the effect of entrepreneurial barriers and self-motivation along with gender and role models, on the EIs of tertiary IT students, a quantitative empirical research was conducted. In this second step, a cross-sectional survey was used as an instrument. Cross-sectional surveys provide empirical data on a research topic at a particular point in time and are frequently used in previous relative research (Kolvereid and Isaksen 2006).

Sample and Data Collection

The sample was chosen between graduate and postgraduate students in the field of IT. An invitation e-mail was sent, with a cover letter explaining the importance of the research and the anticipated results and a link to the online questionnaire. A reminder e-mail was sent after 1 week. A number of 174 respondents completed the questionnaire, anonymously and in a voluntarily basis. The low effective response rate of about 20% is justified by the fact that the survey was administered right before the semester examination. The data was screened for missing values, and 162 valid questionnaires were retained for further analysis.

The sample characteristics are summarized in Table 3.

Measures

The questionnaire consisted of a series of self-reporting items measuring the EI and the perception of entrepreneurial barriers, along with demographic data, chosen from quality journal articles. The selection of each item was based on the correlation coefficients and reliability coefficients. The items were translated into Greek by native speakers, and a reverse translation was used to verify the accuracy of notations (Harkness and Schoua-Glusberg 1998). Additionally, the appropriateness of the measures was confirmed by a panel of academic experts from entrepreneurship related disciplines. The final form of the questionnaire, including the suggested improvements, was checked for clarity by a group of students.

Dependent Variable Entrepreneurial intention (EI) was measured using five items, chosen from the Entrepreneurial Intention Questionnaire (EIQ) introduced by Liñán and Chen (2009).

Independent Variables The motivation towards entrepreneurial career was measured using three items introduced by previous research (Hui-Chen et al. 2014; Pruett et al. 2009). Finally, the items examining the entrepreneurial barriers were measured by a series of negatively worded items introduced mainly in the articles that resulted in the literature review. All measures were assessed on a 5-point Likert scale (1 = "Fully disagree", 5 = "Fully agree"). The descriptive statistics are presented next to each questionnaire item in Table 4.

Student's gender, age, and entrepreneurial role models in the family were used as control variables. Previous research suggests that demographic characteristics appear to influence EIs of students (Liñán and Chen 2009; Pruett et al. 2009).

Table 3 Sample characteristics

Student group	Number	Percent
Gender		
Male (1)	102	63.0
Female (2)	60	37.0
N	162	100.0
Parental role model		
No (0)	88	54.3
Yes (1)	62	38.3
N	150	
Age (years)		
18–24 (1)	125	77.2
25–34 (2)	24	14.8
35–44 (3)	7	4.3
45–55 (4)	5	3.1
55+ (5)	1	0.6
N	162	100.0

A factor analysis was conducted on the data, in order to reveal any underlying latent factor structure, useful for data reduction and scale optimization.

After extraction, the communalities of all the items were above the 0.3 rule of thumb (Hair et al. 2009), except for the B16_GOVSUP item, which was chosen to be excluded from the analysis. The communality of the B17_POLECON (0.431) was also above 0.3, but the item failed to load on a single factor and it was also excluded. This decision had a positive effect on the common variance and the reliability measures of the scale. The high communality values of the rest of the items indicate an adequate amount of variance for the common factors (Costello and Osborne 2005). All factors satisfied the criterion of initial Eigenvalues greater than 1.0. The Kaiser-Meyer-Olkin (KMO) measure of sampling was calculated, with a "middling" value of 0.754 (Beavers et al. 2013), of common variance among the observed variables.

The Bartlett's test of sphericity ($df = 253$, $p < 0.001$) attests that the intercorrelation matrix comes from a population in which the variables are non-collinear. Both tests, presented in Table 5, indicate that the data were appropriate for factor analysis, with a substantial amount of variance expected.

After rotation, the first component accounted for 22.2% of the variance, the second component accounted for 11.6% of the variance, the third component accounted for 9.3% of the variance, the fourth component accounted for 7.4% of the variance, the fifth component accounted for 6.2% of the variance, the sixth component accounted for 5.4% of the variance, and the seventh accounted for a 4.9% of the variance. The total cumulative variance explained by the seven factors sums up to a 67.2% of variance, which is acceptable for the social sciences (Sparkman et al. 1979).

The results of the factor analysis are as shown in Table 6. The loadings of all items on each factor show a simple structure, with no cross-loadings. The cutoff value for cross-loadings was set to 0.35 in order to improve clarity. From the loadings of items, it becomes

Table 4 Descriptive statistics of the measurement items

Item ID	Item description	Mean	SD	Range
EI1	I am determined to create a firm in the future	3.06	1.151	1–5
EI2	My professional goal is to become an entrepreneur	3.03	1.233	1–5
EI3	I have very seriously thought of starting a firm	3.15	1.312	1–5
EI4	I will make every effort to start and run my own firm	3.11	1.216	1–5
EI5	I am ready to do anything to be an entrepreneur	2.76	1.194	1–5
MOTIV1 (Hui-Chen et al. 2014)	Entrepreneurship inspires me	3.65	1.071	1–5
MOTIV2 (Hui-Chen et al. 2014)	I am interested in finding more information about entrepreneurship	3.72	1.076	1–5
MOTIV3 (Pruett et al. 2009)	Entrepreneurship will give me the chance to implement my own ideas	3.88	0.922	1–5
B1_KNOWLEDGE (Reynolds et al. 2005)	I do not have the knowledge required to start a business	3.12	1.122	1–5
B2_EXPERIENCE (Reynolds et al. 2005)	I do not have the experience needed to start a business	3.66	1.143	1–5
B3_SKILLS (Miller et al. 2009)	I do not have the required skills to start a business	2.80	1.141	1–5
B4_FAMILYCONC (Finnerty and Krzystofik 1985)	Family commitments are a barrier to start an enterprise	2.40	1.253	1–5
B5_GOVFNC (Franke and Lüthje 2004)	The subsidies available for new companies are not sufficient	3.67	0.762	2–5
B6_BANKFNC (Franke and Lüthje 2004)	Banks do not readily give credit to start up companies	3.59	1.028	2–5
B7_STARTFNC (Franke and Lüthje 2004)	Access to start-up capital is restrained for new business start-up	3.75	1.017	1–5
B8_LEGSL (Saleh 2014)	The law is a barrier to starting a business	3.67	0.997	2–5
B9_TAX (Choo and Wong 2006)	High taxes is a problem in running a business	4.27	0.977	2–5
B10_FINANCRISK (Sesen and Pruett 2014)	Personal and financial risk is a barrier to entrepreneurship	3.78	1.046	1–5
B11_BUREAU (Franke and Lüthje 2004)	The bureaucratic procedures for founding a new company are unclear	4.42	0.847	2–5
B12_HARDCOMP (Franke and Lüthje 2004)	Start-ups face immediately high competitive pressures	3.91	0.791	2–5
B13_ACCMARKT (Giacomin et al. 2011)	A new firm is difficult to access the market	3.28	0.960	1–5
B14_BUSOPPORTY (Franke and Lüthje 2004)	It is hard to find a business idea for a business that hasn't been realized before	3.14	1.128	1–5
B15_TIMECONC (Stamboulis and Barlas 2014)	Entrepreneurship is excessively binding and time-consuming	3.11	1.109	1–5
B16_GOVSUP (Franke and Lüthje 2004)	The government support for the new firms is not sufficient	3.67	0.945	1–5
B17_POLECON (Giacomin et al. 2011)	The political and economic situation does not assist the business creation	4.40	1.005	1–5

Table 5 The KMO and Bartlett's measures

KMO and Bartlett's test		
Kaiser-Meyer-Olkin measure of sampling adequacy		0.754
Bartlett's test of sphericity	Approx. chi-square	1462.8
	Df	253
	Sig.	0.000

evident that the first factor corresponds to EI, introduced by (Liñán and Chen 2009), the second factor corresponds to motivation (MO) towards entrepreneurship used by Hui-Chen et al. (2014), the third factor corresponds to knowledge and skills (KS), the fourth factor corresponds to market constraints (MC), the fifth factor corresponds to regulation constraints (RC), the sixth corresponds to time and risk (TR), and the seventh corresponds to financial constraints (FC). The extracted factors represent barriers to entrepreneurship met in the articles presented previously in the literature review. All factors are considered "significant" as the average of the loadings of each factor is greater than 0.5 (Hair et al. 2009), showing satisfactory convergent validity (Swisher et al. 2004), and high discriminate validity, with all factor correlations less than 0.8 (Costello and Osborne 2005) as shown in Table 7.

The reliability of the factors was assessed using the Cronbach's alpha coefficient in Table 7. The three first factors, EI, KS, and MO, have a high degree of internal consistency, with Alpha coefficients greater than 0.8, while EI has a coefficient greater than 0.9 which is "excellent" (Litwin 1995). For the other four items, namely MC, RC, TR, and FC, the suggestion of (Clark and Watson 1995) was followed, stressing that when selecting items targeting the generality versus the specificity of a scale measurement, the goal is unidimensionality rather than internal consistency. Additionally, in early stages of research especially when developing measurement instruments, lower reliability estimates are tolerable (Brim 1962, p. 43). Only the TR factor has an alpha value marginally below the 0.6 rule of thumb proposed for exploratory research (Hair et al. 2009).

Results

The items of each factor were averaged into a single composite measure resulting in a new summating scale, for the subsequent analysis (Hair et al. 2009). Control variables were also used for gender (female = 0, male = 1), parental role models in the family (yes = 1, no = 0), and age groups ("18–24" = 1, "25–34" = 2, "35–44" = 3, "45–55" = 4). The descriptive statistics of the control variables and the composite measures are illustrated in Table 8.

From the correlation matrix presented in Table 9, there was evidence of a statistically significant correlation between EI and GENDER ($r = -.178$, $p < 0.05$) showing a reduced EI for female students. There was also a significant correlation between EI and RM ($r = .172$, $p < 0.05$), showing a positive effect of parental role models (RM) on EI. A stronger correlation was revealed between AGE and EI ($r = -.268$, $p < 0.01$), showing that the EI of

Table 6 Rotated factor matrix of the questionnaire items

	Pattern matrix[a] Factors						
	EI	KS	MO	MC	RC	TR	FC
EI1	0.975						
EI3	0.864						
EI2	0.864						
EI4	0.858						
EI5	0.695						
B1_KNOWLEDGE		0.908					
B2_EXPERIENCE		0.872					
B3_SKILLS		0.787					
MOTIV2			0.882				
MOTIV3			0.855				
MOTIV1			0.750				
B13_ACCMARKT				0.766			
B14_BUSOPPORTY				0.746			
B12_HARDCOMP				0.724			
B8_LEGSL					0.771		
B9_TAX					0.764		
B11_BUREAU					0.734		
B4_FAMILYCONC						0.784	
B15_TIMECONC						0.736	
B10_FINANCRISK						0.628	
B5_GOVFNC							0.783
B6_BANKFNC							0.679
B7_STARTFNC							0.586

Extraction method: principal component analysis. Rotation method: Promax with Kaiser normalization

[a] Rotation converged in six iterations

the students increases with their AGE. The stronger correlation coefficient was that between motivation (MO) and EI ($r = .583$, $p < 0.01$), which shows that those students, with greater perceived motivation towards entrepreneurship, have also the strongest entrepreneurial aspirations. Regarding the barriers to entrepreneurship, only two of the factors proved to be related with EI, namely KS ($r = -.314$, $p < 0.01$) and TR ($r = -.192$, $p < 0.05$), expressing that student EIs are negatively influenced by two categories of barriers, namely barriers related to knowledge and experience and barriers related to time commitments and risk.

Regression Model Test

Multiple hierarchical regression was used for the study of the effect of the independent variable and the control variables on the EIs. Two models were developed for the purposes of the research. Model 1 ($R^2 = 0.152$, $p = 0.001$) is the base-line model and

Table 7 Factor correlations

Factor	Reliabilities and factor correlation matrix								
	Cronbach's alpha	Items	EI	KS	MO	MC	RC	TR	FC
EI (entrepreneurial intention)	0.911	5	1000						
KS (knowledge and skills)	0.827	3	−0.282	1000					
MO (motivation)	0.832	3	0.532	−0.123	1000				
TR (time and risk)	0.595	3	0.004	0.123	−0.021	1000			
RC (regulatory constraints)	0.645	3	0.084	0.000	0.168	0.149	1000		
MC (marketing constraints)	0.626	3	−0.104	0.077	−0.032	0.141	0.264	1000	
FC (financial constraints)	0.630	3	−0.009	−0.047	0.017	−0.090	0.170	0.258	1000

includes only GENDER, AGE, and RM as independent variables and the dependent variable EI. The full research model, model 2 ($R^2 = 0.448$, $p < 0.001$), includes additionally the MO, KS, TR, RC, MC, and FC as independent variables for motivation and entrepreneurial barriers. The tolerances were well above the threshold value of 0.10 (Hair et al. 2009), and all the variance inflation factors (VIF) were well below 10 as shown in Table 9.

These indications are acknowledged also by the regression analysis shown in Table 10. According to the results of model 1, the GENDER has a significant negative effect on EI ($B = -0.219$, $p < 0.01$). Additionally, from the other two control variables, AGE has a strong positive causal effect ($B = 0.244$, $p < 0.01$) and RM have a positive causal effect ($B = 0.193$, $p < 0.05$). In model 2, when the barriers and self motivation are entered, the effects of AGE and RM are becoming statistically insignificant, meaning that these variables loose predictive power when motives and barriers come in the foreground. However, the effect of GENDER remains statistically significant and in the expected direction ($B = -.250$, $p < 0.01$). Motivation has a powerful positive

Table 8 Descriptive statistics

Control/score variable name	Number	Mean	Std. deviation
GENDER	162	1.37	0.484
AGE GROUP	162	1.35	0.760
RM (role models)	150	0.41	0.494
EI (entrepreneurial intention)	162	3.023	1.049
MO (motivation)	162	3.753	0.887
KS (knowledge and skills)	162	3.193	0.978
TR (time and risk)	162	3.097	0.846
RC (regulation constraints)	162	4.117	0.720
MC (market constraints)	162	3.442	0.733
FC (financial constraints)	162	3.654	0.674

Table 9 Correlation matrix

	EI	GEN	AGE	PAR	MO	KS	TR	RC	MC	FC	VIF
EI	1.00										
GENDER	− 0.178*	1.00									1.069
AGE	0.268**	− 0.135	1.00								1.261
RM	0.172*	0.087	− 0.022	1.00							1.069
MO	0.583**	− 0.026	0.183*	0.206*	1.00						1.144
KS	− 0.314**	− 0.042	− 0.376**	− 0.112	− 0.209*	1.00					1.184
TR	− 0.192*	− 0.172*	0.067	− 0.142	− 0.153*	0.086	1.00				1.195
RC	0.107	− 0.007	0.234**	0.030	0.190*	− 0.093	0.216**	1.00			1.177
MC	0.078	0.036	0.033	− 0.061	0.028	0.025	0.149	0.031	1.00		1.089
FC	0.067	− 0.066	0.209**	0.098	0.034	− 0.011	0.322**	0.302**	0.069	1.00	1.109

*$p < 0.05$ (two-tailed); **$p < 0.01$ (two-tailed)

contribution on EI ($B = 0.478$, $p < 0.01$), whereas the barriers of knowledge and skills (KS) ($B = -0.191$, $p < 0.01$) and that of time and risk (TR) have a negative contribution ($B = -0.149$, $p < 0.05$) on students' EIs.

The associations between EI, KS, and TR barriers resulting from model 2 support the first hypothesis H1, suggesting that "Students' EI are negatively affected by entrepreneurial barriers." The variance, explained by the model, increased by almost 30%, when motivation and barriers were entered in the model. Regarding the second hypothesis H2, suggesting that "students' EIs are affected more by the Internal barriers than the external barriers," it is also supported, because of the same significant causal relations. This is justified by the fact that the KS and TR barriers are classified under the category of the internal barriers to entrepreneurship presented in Table 1. These include knowledge, skills, abilities, competencies, and experience expressed as KS and negative attitude towards entrepreneurship and fear of risk, debt, or failure, expressed as TR. The other three factors, namely RC, MC, and FC, express external barriers to entrepreneurship, and they are not associated to the EIs of the students at least in this sample.

The third hypothesis H3, suggesting that "the perceived motivation of students towards entrepreneurship is positively related to EI" is also supported, because, as it is already discussed, the perceived self-motivation factor MO has the most powerful positive effect on EIs.

In order to examine the two last hypotheses H4 and H5, group difference analysis was conducted. Two independent samples *t* tests were used, one using GENDER as the group variable and the other using RM as a group variable. The first of the two tests indicated that there were no significant differences neither in the perception of entrepreneurial barriers between the two genders nor in self-motivation. The results are illustrated in Table 11.

Table 10 Hierarchical regression

	Model 1	Model 2
Variables entered		
GENDER	−0.219**	−0.250**
AGE	0.244**	0.115
RM	0.193*	0.096
MO		0.478**
KS		−0.191**
TR		−0.149*
RC		0.020
MC		0.094
FC		−0.016
R^2	0.152	0.448
Adj. R^2	0.134	0.412
ΔR^2	0.152	0.286
F value	8.70**	12.50**

Dependent variable EI

*$p < 0.05$ (two-tailed); **$p < 0.01$(two-tailed)

According to the results of Table 11, only the level of EIs is significantly different between male ($M = 3.21$, SD = 1.06) and female students ($M = 2.70$, SD = 0.96). Therefore, hypothesis H4 suggesting that "female students have decreased EI and increased entrepreneurial barriers perceptions," in comparison to male students, is partially supported. The non-significant result of the Levene's test $F(1,160) = 1.148$, $p = 0.286$, presumes the equality of variances between the two groups in the case of EI. Female students have a decreased EI mean compared to their male counterparts $t(160) = 3.054$, Sig. < 0.05.

The results of the second t test, using RM as the group variable, are summarized in Table 12.

Significant differences in EI between the two groups are observed, according to the results of Table 12. Those students having an entrepreneurial role model in their family, are more entrepreneurial ($M = 3.18$, SD = 1.07) compared to those not having parental role models ($M = 2.83$, SD = 1.00), with a t test statistic of $t(148) = -2.095$, Sig. < 0.05. The insignificance of the Levene's test $F(1,148) = 0.613$, $p = 0.435$, assumes the equality of variances of the two groups in the case of EI. According to these findings, the hypothesis H5a, suggesting that "students with entrepreneurial role models have increased entrepreneurial intentions," is supported. However, the hypothesis H5b, suggesting that "students with entrepreneurial role models in their close environment have decreased perception of entrepreneurial barriers," is not supported.

Furthermore, we observe significant differences in self-motivation (MO) between those students having a parental role model in their family environment ($M = 3.88$, SD = 0.82) and those not ($M = 3.59$, SD = 0.92). Students having no parental role

Table 11 Independent sample t test for gender

Gender		Number	Mean	Std. deviation	Std. error mean	Levene's test		t test Independent samples		
						F	Sig.	t	df	Sig**
EI	1 Male	102	*3.2118**	1.05786	0.10474	1.148	0.286	3.054	160	0.003
	2 Female	60	*2.7033**	0.96128	0.12410			3.131	133,443	0.002
MO	1 Male	102	3.7843	0.82006	0.08120	3.159	0.077	0.583	160	0.561
	2 Female	60	3.7000	0.99660	0.12866			0.554	105,574	0.581
KS	1 Male	102	3.2059	0.96363	0.09541	0.407	0.524	0.211	160	0.833
	2 Female	60	3.1722	1.01122	0.13055			0.208	119,028	0.835
TR	1 Male	102	3.1993	0.76540	0.07579	6.397	0.012	2.031	160	0.044
	2 Female	60	2.9222	0.95149	0.12284			1.920	103,688	0.058
RC	1 Male	102	4.1144	0.75415	0.07467	0.916	0.340	−0.067	160	0.947
	2 Female	60	4.1222	0.66657	0.08605			−0.069	136,194	0.945
MC	1 Male	102	3.4281	0.71350	0.07065	0.936	0.335	−0.322	160	0.748
	2 Female	60	3.4667	0.77192	0.09965			−0.316	116,078	0.753
FC	1 Male	102	3.6732	0.70043	0.06935	1.683	0.196	0.463	160	0.644
	2 Female	60	3.6222	0.63325	0.08175			0.476	133,952	0.635

*$p < 0.05$; **Sig. (two-tailed)

models in their family environment seem to have decreased self-motivation towards entrepreneurship compared to those students having an entrepreneurial parental role model $t(148) = -1.95$, Sig. < 0.1. The insignificance of the Levene's test $F(1,148) = 0.353$, $p = 0.554$, presumes the equality of variances between the two groups in the case of self-motivation. However, the significance of the t test is marginal and therefore the relation between self-motivation and entrepreneurial role models needs further examination.

The multiple hierarchical regression indicated that, when self-motivation and barriers are entered, the effect of role models on EI diminishes. One explanation, given by previous research, is that entrepreneurial role models influence EI indirectly through the motivational antecedents of EI (Karimi et al. 2014b). It is logical to assume that self-motivation, in this case, acts as a mediator. In order to clarify this possibility, a mediation analysis was conducted (Baron and Kenny 1986), utilizing the process plug-in (Hayes 2013; Preacher and Hayes 2004). The results of the mediation analysis confirmed once more the significant total effect of role models on EI (Fig. 1, path c) $F(1,148) = 4.36$, $p < 0.05$, $R^2 = 0.29$ with a coefficient of $b = 0.34$, $t(148) = 2.08$, $p < 0.05$. Next, the interaction between role models and self-motivation was tested (Fig. 1, path a) and a significant relation was found $F(1,148) = 3.96$, $p < 0.05$, $R^2 = 0.26$ with a coefficient of $b = 0.327$, $t(148) = 1.99$, $p < 0.05$. As a third step, the effect of self-motivation on EI was tested, when controlling for role models (Fig. 1, path b) and a significant relation was also found $F(2,147) = 33.3$, $p < 0.01$, $R^2 = 0.31$ with a coefficient of $b = 0.54$, $t(2,147) = 7.78$, $p < 0.01$. Finally, the direct effect of role models on EI was found to be lesser and insignificant when self-motivation was entered in the equation (Fig. 1, path c′), with $b = 0.17$, $t(2,147) = 1.18$, $p =$ n.s., proving that self-motivation acts as a full mediator of the role models effect. All coefficients given are unstandardized.

Discussion

The factor analysis resulted in five factors for barriers, namely, knowledge and skills, time and risk, regulation constraints, market constraints, and financial constraints, one factor for self-motivation and one factor for EI. The effect of barriers on EI was examined, in comparison to the effect of self-motivation towards entrepreneurship. The results indicated that students' EIs are actually negatively affected by the barriers, confirming hypothesis H1. This finding is consistent with previous research (Carayannis et al. 2003; Franke and Luthje 2003; Giacomin et al. 2011; Pruett et al. 2009; Sesen and Pruett 2014; Shinnar et al. 2012), arguing that EIs are influenced by the perception of entrepreneurial barriers and justifies the suggestion that these barriers can be considered as precipitating events, with negative impact on the implementation of intentions into actions (Fayolle et al. 2014; Iakovleva et al. 2014). The second hypothesis H2 suggesting that students' EIs are mostly affected by the internal barriers to entrepreneurship is also confirmed. The most influential barriers proved to be those of knowledge and skills and time and risk, whereas the external barriers did not have any statistically significant impact on EIs. These findings are consistent with previous research suggesting that the internal barrier of knowledge and experience has a major negative impact

Table 12 Independent sample *t* test for parental role model

RM		Number	Mean	Std. deviation	Std. error mean	Levene's test		*t* test Independent samples		
						F	Sig.	*t*	df	Sig.**
EI	0 No	88	*2.8273**	1.00536	0.10717	0.613	0.435	− 2.095	148	0.038
	1 Yes	62	*3.1871**	1.07787	0.13689			− 2.070	125,609	0.041
MO	0 No	88	3.5947	0.92427	0.09853	0.353	0.554	− 1.952	148	0.053
	1 Yes	62	3.8817	0.82999	0.10541			− 1.989	139,495	0.049
KS	0 No	88	3.2955	0.98187	0.10467	0.669	0.415	1.635	148	0.104
	1 Yes	62	3.0215	1.05041	0.13340			1.616	125,795	0.109
TR	0 No	88	3.1477	0.86931	0.09267	0.017	0.897	0.724	148	0.470
	1 Yes	62	3.0430	0.87774	0.11147			0.722	130,683	0.471
RC	0 No	88	4.0530	0.75622	0.08061	0.079	0.779	− 0.722	148	0.471
	1 Yes	62	4.1398	0.67629	0.08589			− 0.736	139,763	0.463
MC	0 No	88	3.4659	0.77730	0.08286	1.318	0.253	0.636	148	0.526
	1 Yes	62	3.3871	0.70179	0.08913			0.648	139,137	0.518
FC	0 No	88	3.6098	0.71692	0.07642	0.099	0.753	− 1.239	148	0.217
	1 Yes	62	3.7527	0.66375	0.08430			− 1.255	137,402	0.211

*$p < 0.05$; **Sig. (two-tailed)

on students' EIs (Pruett et al. 2009) and that limited experience is a common handicap for firm founders (Caloghirou et al. 2016). Cognitive barriers are also identified as having a significant impact on EIs in a multi-country study (Iakovleva et al. 2014) and a previous study in central Greece (Vliamos and Tzeremes 2012). Further analysis of the means, presented in Table 4, indicates that the biggest drawback for students is the lack of experience (B2, $M = 3.62$). The lack of knowledge, required to start a business (B1, $M = 3.10$), comes second and the lack of the required skills (B3, $M = 2.74$) comes third in the perceptions of IT students. Regarding time and risk, the mean values of the items in Table 4 indicate that the most important item is financial risk (B10, $M = 3.82$), with time constraints being second (B15, $M = 3.15$) and family commitments coming third (B4, $M = 2.51$). This finding is consistent with previous studies, suggesting that the perception of risk has a negative impact either directly on EIs (Franke and Luthje 2003; Pruett et al. 2009; Sesen and Pruett 2014) or indirectly through the attitude towards entrepreneurship (Franke and Luthje 2003). These results fully justify the aspect that knowledge, skills, and risk handling are more important for the manifestation of entrepreneurial activity than risk capital and credit (Del Giudice et al. 2014; Maresch et al. 2016).

In this study, we also examined the effect of self-motivation on EI, lack of which is frequently mentioned as a serious barrier to entrepreneurship among students (Iakovleva et al. 2014). The findings indicate a positive effect of self-motivation on EIs, in the expected direction and are in line with previous research suggesting a positive connection of motives and intentions (Carsrud and Brännback 2011; Hui-Chen et al. 2014). The need for achievement through the implementation of one's ideas is the most important motive towards entrepreneurship (MOTIV3, $M = 3.90$), with the interest in entrepreneurship (MOTIV2) coming second ($M = 3.70$) and inspiration from entrepreneurship (MOTIV1) coming third ($M = 3.66$). Therefore, intrinsic motives like the need for achievement are scoring higher than general interest and inspiration, a finding which is consistent with previous research (Sesen and Pruett 2014). Additionally, self-motivation has a significantly positive relation to entrepreneurial career choice (Solesvik 2013) and is considered a link between intention and action (Carsrud and Brännback 2011; Fayolle et al. 2014). In the current sample, the composite self-motivation factor towards entrepreneurship has an impressive positive impact on EI, confirming the third hypothesis H3a. The effect is so overwhelming that it surpasses the effect of the biggest barrier. Hypothesis H3b about the power of the effect of self-motivation, in comparison to the effect of barriers, is confirmed. This means that the cultivation of the right motives towards entrepreneurship may serve as a powerful antidote to the negative effect of barriers on EIs towards an effective start-up (Fayolle et al. 2014). Entrepreneurship education should stimulate the desire for entrepreneurial action and create the right conditions for the development of EI, "regardless of the adverse contextual conditions" (Carayannis 2014).

Regarding the effect of gender on EIs, the results suggest that male students are more positively oriented towards entrepreneurship than female students. This differentiation of EI among the two genders is consistent with previous studies (Joensuu-Salo et al. 2015; Karimi et al. 2014b; Shinnar et al. 2012; Sweida and Reichard 2013; Wang and Wong 2004). The influence of gender is not related to

the other background variables (Wang and Wong 2004), and this may justify the finding that gender remains a statistical significant predictor of EIs when the motives and barriers are entered in the model, whereas the other two control variables, age and role models, become insignificant. The hypothesized existence of differences in the perception of barriers between the genders, however, was not confirmed. A slight difference was indicated in the time and risk barrier in favor of female respondents; nevertheless, the equality of variance between the two groups could not be assumed. This finding should be further examined in future research. The students of the two genders exhibited equal perceptions of barriers and self-motivation, leading to the conclusion that the entrepreneurial barriers and motives alone cannot sufficiently explain the different levels of EI between the genders. These differences can probably be justified by differences in other attitudinal factors (Solesvik 2013). These findings are in opposition to other studies suggesting that women's perceptions of barriers to entrepreneurship are different than the perceptions of men (Shinnar et al. 2012) and that women's perceptions of their environmental factors play a greater role in their behavior (Langowitz and Minniti 2007). On the contrary, the results of this research denote that despite the apparent difficulties due to the entrepreneurial barriers set by economic situation, the differences in EIs, between the two genders, are relatively small. These findings partially confirm the hypothesis H4, only for the part suggesting that female IT students have decreased EIs, in comparison to their male counterparts. The second part of hypothesis H4, suggesting a higher perception of entrepreneurial barriers for female than male IT students is not supported, which might be a sign of reduced differences between males and females in the field of IT (Bae et al. 2014).

Regarding the effect of the entrepreneurial role models, the examination of the base model in Table 10, makes evident that role models have a positive impact on EIs. This finding is in favor of previous research claiming that students with entrepreneurial role models in their close social environment, are more positively oriented towards entrepreneurship, than students who lack such paradigms (BarNir et al. 2011; Carr and Sequeira 2007; Karimi et al. 2014b; Wang and Wong 2004). Additionally, even though role models do not have predicting power on entrepreneurial activity (Mueller 2011), they have a powerful influence on attitudes towards entrepreneurship, in certain environments (Franke and Luthje 2003). This finding confirms hypothesis H5a suggesting that the existence of entrepreneurial role models positively affect students' EI.

The fact that the positive effect of entrepreneurial role models diminishes in the presence of self-motivation and barriers, and the absence of the hypothesized reduction in the perceptions of barriers, should not lead to the misconception that role models are totally ineffective. The mediation analysis clearly highlighted the link between role models and self-motivation, indicated by the *t* test examined in Table 12, meaning that students with entrepreneurial role models in the family have increased self-motivation for entrepreneurship. These findings extend the existing theoretical models of EIs by confirming the implications of other studies, in which the exposure to entrepreneurial role models helps the development of the right incentives towards entrepreneurship (Carr and Sequeira 2007) and increases the belief in one's ability to successfully follow an entrepreneurial career (BarNir et al. 2011).

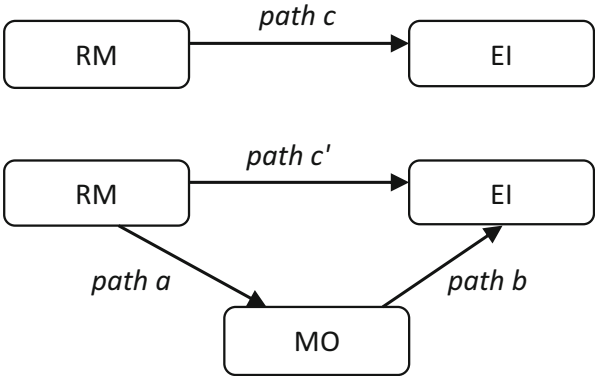

Fig. 1 Direct effect of RM on EI—mediation of MO in the effect of RM on EI (Hayes 2013)

Conclusions

All things considered, this article contributes to the research of entrepreneurial intentions, through the study of the perceptions of barriers and self-motivation towards entrepreneurship. An attempt is made for the development and pilot testing of an instrument for the measurement of entrepreneurial barriers based on tertiary IT students' data. Additionally, some inconsistencies found in the existing literature of the entrepreneurial barriers are addressed: Firstly, the ambiguity of factors used by previous research, due to the arbitrary mixing of internal and external barriers, resulting in misconceptions and controversies about their significance. Secondly, the diversity of arguments concerning the effects of gender and role models about the perception of barriers and motives and their role on EIs, in the existing literature, which required an in depth investigation. Thirdly, the instability regarding the power of barriers in comparison to that of motivation. Finally, useful recommendations for educators and policy makers are provided.

The findings confirm that the barriers to entrepreneurship act as constraining forces against the development of students' EIs, whereas self-motivation towards entrepreneurship has a powerful positive effect. Additionally, the internal barriers have a more forceful impact against students' EIs than the external ones. The most influential barriers for tertiary IT students proved to be the perceived lack of entrepreneurial experience, knowledge, and skills. This finding points out the responsibility of contemporary education in IT-related faculties to provide students with the means to cope with entrepreneurial activity. The provision of valuable entrepreneurial knowledge and experience can serve as a pivot for success for the individual (Park 2005), as well as a springboard for development for the IT sector and the whole society, on the long run (Izzrech et al. 2013). The second more influential barriers were those of time constraints and risk associated with entrepreneurial activity, which also has valuable implications. The large amount of time usually required by the entrepreneurial activity and the risks one has to take are the main caveats of entrepreneurship. It is very important for students to learn how to handle risk in their academic or professional career (Kuratko 2011). Additionally, failure should be considered as a chance for retrospection,

comprising valuable entrepreneurial experience, rather than being stigmatized (Caloghirou et al. 2016).

The overwhelming positive impact of self-motivation on EIs proved that the cultivation of the right motives towards entrepreneurship may serve as a powerful antidote to the negative effect of barriers (Fayolle et al. 2014). By an increased self-motivation as a stepping stone, students could reach higher levels of EI and easily mitigate the adversity of the contextual factors. So, it is important for instructors, above all, to be convinced about the significance of entrepreneurship for economic development, in order to promote the right motives (Carayannis et al. 2003; Piperopoulos 2012).

The gender gap appears to be reduced among students of the IT field. The slight differences between male and female students observed and the insignificant differences found in the perception of barriers and self-motivation, indicate that women in the field of IT consider themselves equally capable to their male counterparts, in contesting the opportunities in the entrepreneurial terrain. However, this finding should not be overestimated and special care should be taken for the development of female entrepreneurship, since the representation of females in computer science courses is significantly lower than that of their male counterparts (Beyer 2014). On the other hand, the direct effect of entrepreneurial role models on EIs diminishes when barriers and motives enter in the foreground. Role models have an indirect effect on EIs, through self-motivation, indicating that the existence of entrepreneurial role models in the social environment of students is essential for the development of positive incentives towards entrepreneurship. Consequently, the lack of successful entrepreneurial role models from the Greek IT sector could impel IT students imagining themselves more as employees rather than as entrepreneurs, a scenario that should be avoided. Finally, entrepreneurial role models do not offer a reduced perception of barriers, neither increase one's knowledge and ability regarding entrepreneurship as it was suggested by previous research (Krueger and Brazeal 1994; BarNir et al. 2011) and therefore, they do not offer an increased perception of feasibility of starting a business at least for IT students.

The issue of the entrepreneurial intentions of IT students is very timely, firstly because IT has a leading role in the evolution of Industry 4.0, and secondly because of the increased demand for ICT services expected to create enormous opportunities for the Greek IT sector (European IT Observatory 2016; Hynes and Richardson 2008). The barriers hindering the development of EI of IT students, examined for the first time, point out the key role of education to create the appropriate conditions in order to help IT graduates believe in their entrepreneurial capabilities. The development of the right incentives through the promotion of role models from the IT sector, in combination to a mixture of live experience, can help IT students become more enthusiastic about entrepreneurship. Entrepreneurial activity is successful when it is addressing opportunities created by market niches rather than when it is driven out of necessity (Dutta et al. 2015; Ioannides et al. 2016).

Implications

Although, IT scientists are not heavily depending on particular knowledge, due to the quick change of technology (The Engineer of 2020: Visions of Engineering in the New

Century 2005), it is essential for those involved in entrepreneurship, not only to rely on their knowledge in order to identify opportunities (Dutta et al. 2015), but also to create new knowledge and innovations based on apparently disparate existing information (Izzrech et al. 2013). For these reasons, the incorporation of entrepreneurial courses into the IT curriculum is welcome. Instructors' efforts should focus on the development of students' self-motivation towards entrepreneurship through the cultivation of creativity and need for achievement, as well as, the promotion of successful male and female role models from the IT sector in order to eliminate the gender gap. The use of real entrepreneurial experiences through the collaboration with firms of the IT sector, in common projects or internships, could provide valuable entrepreneurial experience and skills to participating students, transforming them from simple knowledge assimilators into knowledge originators. Moreover, the use of realistic scenarios of business venturing in entrepreneurship courses could help IT students become familiar with the cognitive processes required in undertaking calculated risks (Nabi and Liñán 2013). However, this is only the first step and IT education needs to go beyond the typical business plan development and adapt the entrepreneurship curricula to the actual needs of students (Potocan et al. 2016; Pruett and Şeşen 2017). Since the exposure to entrepreneurial role models is not capable of decreasing the students' perception of entrepreneurial barriers, entrepreneurship education is the only actor shaping students' perceptions of feasibility towards entrepreneurial start-up. Therefore, more sophisticated interventions are needed from educationists in entrepreneurship courses, including personalized coaching and counseling on the first steps of business creation.

Last but not least, policy ought to create a supportive climate for entrepreneurship, by improving the public image of entrepreneurship (Del Giudice et al. 2014) and by eliminating the external barriers possibly hindering the transformation of intentions into actual entrepreneurial behavior.

Limitations and Future Research

This study has some limitations. The barriers scale introduced proved to adequately measure the perceptions of barriers to entrepreneurship in a sample of tertiary IT students. However, it did not highlight any differences between the gender and role models groups. The barriers scale should be further tested in other samples of student and nascent entrepreneurs in future research, with bigger sample sizes, for validity verification. The convenience sampling method used in this research may have added some bias to the results, since the respondents in this sample are highly motivated towards entrepreneurship ($M = 3.753$, $SD = 0.887$). Future research should control for these effects, with more balanced representation of the less motivated students towards entrepreneurship, in order to find possible differentiations in the perceptions of entrepreneurial barriers. The differences previously reported in the predicting ability of the motivational antecedents of the intentional theories (Varamäki et al. 2016), between students and nascent entrepreneurs, could also entail significant differences in the perception of barriers, if the barriers and motives were incorporated into the existing intentional models. The evaluation of the predictive ability of the resulting models could lead to a unified theory of entrepreneurial intentions and barriers. Furthermore, empirical examination of the motivational factors

and barrier perceptions before and after specific educational interventions could improve the effectiveness of educational approaches.

Appendix

Table 13 Hypotheses evaluation summary

Hypotheses	Description	Result
H1	Students' EIs are negatively affected by the perception of barriers.	Confirmed
H2	Students' EIs are affected more by the Internal barriers than the external barriers to entrepreneurship.	Confirmed
H3a	Entrepreneurial self-motivation of tertiary IT students is positively related to EIs.	Confirmed
H3b	Entrepreneurial self-motivation of tertiary IT students has a more powerful effect on EI than the effect of barriers.	Confirmed
H4	Female tertiary IT students have decreased EIs and increased entrepreneurial barriers perception, in comparison to their male counterparts.	Partially confirmed
H5a	Students with entrepreneurial role models in their social environment have increased EI.	Confirmed
H5b	Students with entrepreneurial role models in their social environment have decreased perception of entrepreneurial barriers.	Not confirmed

Table 14 Core articles on entrepreneurial barriers

Authors	Internal				External									
	Personality	Education and competence	Negative attitude	Gender related	Finance	Informal support	Formal support	Resources	Market related	Law and regulations	State affairs	Hard reality	Number of barriers	Factors
BarNir et al. (2011)	*					*							2	Self efficacy, role models
Franke and Lüthje (2003)	*		*		*				*	*			5	Attitude, risk, locus of control, perceived barriers, perceived support
Miller et al. (2009)	*	*	*		*	*			*	*			7	Attitudes, business knowledge, role model, finance, law, skills, business idea
Pruett et al. (2009)		*	*			*	*		*		*		6	Self efficacy, knowledge, operating risks, start-up risks, support structures
Sandhu et al. (2011)	*		*					*	*				4	Stress, risk, failure, social network, resources
Sesen and Pruett (2014)	*	*					*				*		4	Self-confidence, knowledge and experience, support structure and fiscal or administrative costs, economic climate and lack of entrepreneurial competencies

* denotes that the concept is examined by the specific research

Table 15 Table of selected articles

Authors	Internal				External								Analysis				
	Personality	Education and competence	Attitude	Gender related	Finance	Informal	Formal	Resources	Market related	Law and regulations	State affairs	Hard reality	Number of barriers	Student sample	Factor analysis	Dependent EI	Regression analysis
Akehurst et al. (2012)				*		*	*		*				4	*	*		*
Alvarez et al. (2011)		*		*	*	*	*	*	*				7				
BarNir et al. (2011)	*					*							2	*	*	*	*
Baughn and Neupert (2003)						*				*			2		*		
Birdthistle (2008)	*	*			*				*				4	*			
Carayannis et al. (2003)		*											1				
Choo and Wong (2006)										*			1		*	*	
Finnerty and Krzystofik (1985)	*				*						*	*	4		*	*	
Franke and Lüthje (2003)	*		*		*				*	*			5	*	*	*	*
Franke and Lüthje (2004)					*				*	*	*		4	*			
Giacomin et al. (2011)	*						*						2	*			
Boyd and Vozikis (1994)	*												1				
Hawkins (1993)						*							1				
Hulsink and Koek (2014)							*						1				

Table 15 (continued)

Authors	Internal				External							Analysis				
Iakovleva et al. (2014)	*								*	*		3	*			
Ledyaeva et al. (2008)			*		*			*	*	*	*	6	*			
Martins et al. (2004)											*	1				
Miller et al. (2009)		*	*						*			3	*	*	*	*
Pruett et al. (2009)		*	*			*	*		*		*	6	*	*	*	*
Ribeiro et al. (2014)	*	*			*		*					4	*			
Robertson et al. (2003)	*	*			*	*						4	*			
Sandhu et al. (2011)	*		*					*	*			4	*	*	*	*
Sesen and Pruett (2014)	*	*					*				*	4	*		*	*
Shinnar et al. (2009)		*			*	*	*			*		5	*		*	
Smith and Beasley (2011)			*		*		*					3	*			
Stamboulis and Barlas (2014)								*	*		*	3	*			
Zhao (2005)	*											1				

* denotes that the concept is examined by the specific research

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