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International Doctorate in Entrepreneurship and Management

DOCTORAL THESIS

ANTECEDENTS AND CONSEQUENCES OF ENTREPRENEURIAL UNIVERSITIES: AN ECLECTIC MODEL FOR EMERGING ECONOMIES

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Achieving this goal seemed impossible to me several times along the way, frustration and desperation invaded me more than once, and I did not quit because I always had important, valuable people around me:

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ABSTRACT

In the new entrepreneurial economy model, the dominant production factor and prime source of competitive advantage is knowledge capital that complemented by entrepreneurship capital represent the capacity to identify opportunities and create value through innovation and entrepreneurship. As knowledge is generated and transferred by universities, both governments and communities are demanding new models where universities contribute to regional development through the generation of entrepreneurial capital and the facilitation of entrepreneurial activities.

This research provides a better understanding about the antecedents (internal and environmental factors) and consequences (students' start-ups creation and graduates' career decisions) of entrepreneurial universities' activities in emerging economies. To achieve this aim, based on an extended literature review, an eclectic model was proposed integrating the main fundaments of *Institutional Economics, Resource-Based View, Theory of Planned Behavior, Social Cognitive Theory, Endogenous Growth Theory, and Knowledge Spillover Theory* (Chapter II).

Regarding the antecedents, based on the *Institutional Economics and Resource-Based View*, Chapter III and Chapter IV analyze environmental and internal factors that could condition the development of entrepreneurial universities' activities. Concerning the consequences, Chapter V focuses on how those factors influence the entrepreneurial behaviors or actions of their students (outcomes) in light of *Theory of Planned Behavior and Social Cognitive Theory*. As a result, adopting the *Endogenous Growth Theory and Knowledge Spillover Theory*, Chapter VI also considers the socioeconomic impacts of those outcomes on graduates' career decisions.

Given the difficulties to obtain relevant data, the eclectic model was tested in three Latin American entrepreneurial universities, and the majority of the analysis was particularly based on information from a multi-campus, entrepreneurial university located in Mexico. Our findings confirm the relevant, direct and indirect, influence of certain internal and environmental factors on students' start-ups and graduates' career decisions. From these results, several implications emerged for university stakeholders (policy makers, university managers, society).

Keywords: entrepreneurial universities, entrepreneurship, environmental factors, student's startups, graduates' career choice, eclectic model, emerging economies, Latin America, Mexico.

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CHAPTER I. INTRODUCTION

1.1. Problem statement

Today, emerging economies¹ in the world need to go through a transition process in order to advance from an economic stage focused on efficiency to a new stage focused on innovation that seems to be the only way for emerging economies to reduce or even close the gap that separates them from the developed ones (World Economic Forum, 2014). Audretsch and Thurik (2004) identified two different economic models as the political, social, and economic response to an economy dictated by particular forces: the managed economy and the entrepreneurial economy (Table 1.1).

Economic model	Driving force activity	Source of competitive advantage
Managed economy	Large scale production	Capital and unskilled labour
Entrepreneurial economy	Capacity to engage in and generate entrepreneurial activity	Knowledge capital and entrepreneurial capital

Table 1.1: Two economic models

Source: Based on Audretsch and Thurik (2004)

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¹ Emerging and transitional economies are assuming an increasingly prominent position in the world economy (Hoskisson et al., 2000). These economies comprise countries with a rapid pace of development and government policies that favor economic liberalization—emerging economies—and others countries that are in transition from centrally planned economies—transition economies (Wright et al., 2005). For instance, some countries identified as emerging or transitional economies are (in alphabetical order): Albania, Argentina, Armenia, Azerbaijan, Bangladesh, Belarus, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Chile, China, Colombia, Cote d'Ivoire, Croatia, Czech Republic, Ecuador, Egypt, Estonia, Georgia, Ghana, Greece, Hungary, India, Indonesia, Israel, Jamaica, Jordan, Kazakhstan, Kenya, Korea, Kyrgyzstan, Latvia, Lithuania, Macedonia, Malaysia, Mauritius, Mexico, Moldova, Morocco, Nigeria, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Slovakia, Slovenia, South Africa, Sri Lanka, Taiwan, Tajikistan, Thailand, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Ukraine, Uzbekistan, Venezuela, and Zimbabwe.

In the managed economy, the main force is large-scale production, reflecting the predominant production factors, capital and unskilled labour, as the main sources of competitive advantage. In the entrepreneurial economy, the dominant production factor and prime source of competitive advantage is knowledge capital, complemented by entrepreneurship capital, representing the capacity to engage in and generate entrepreneurial activity. Knowledge, in its various forms, such as know-how, expertise, and intellectual property, may be treated as an asset for production or as a product by itself which can be marketed and exported for a high value return. In addition, knowledge is the base for research, development, and inventions. However, any investment in knowledge cannot be productive without some kind of entrepreneurial activity. Entrepreneurship, serving as a conduit for knowledge spillovers, is the link between investments in new knowledge and economic growth (Audretsch, 2007). Moreover, knowledge and inventions are transformed and marketed as innovations through entrepreneurship. This innovative entrepreneurship capability is now the basis of international competitiveness (Braun, 2006; Zaharia and Gibert, 2005; Audretsch, 2007).

In any economic model, institutions are created and modified to facilitate the activity that serves as the driving force towards economic growth and prosperity. Following these ideas, an increased importance and significance of the university in terms of its impact on the economy is observed within the entrepreneurial economy (Audretsch, 2014). As universities are located in the intersection of research, education, and innovation, they are considered an access key to the entrepreneurial economy (Shane 2005). In this sense, many regions in the world are demanding that their universities engage in the more challenging mission of giving a direct and significant stimulus to their communities' economic development (Zaharia and Gibert, 2005; O'Shea et al., 2007 and 2008; Audretsch, 2014).

Traditionally, universities tend to be large organizations that by nature are not very entrepreneurial in their focus; however, the incorporation of an entrepreneurial orientation into a university's missions could change this convention (Kirby et al., 2011). The core activities of universities have been universally recognized as teaching and research, but currently universities have undergone internal transformations in order to adapt to external conditions and to legitimize their role in the economy, giving place to a new kind of university: the entrepreneurial university (Figure 1.1).

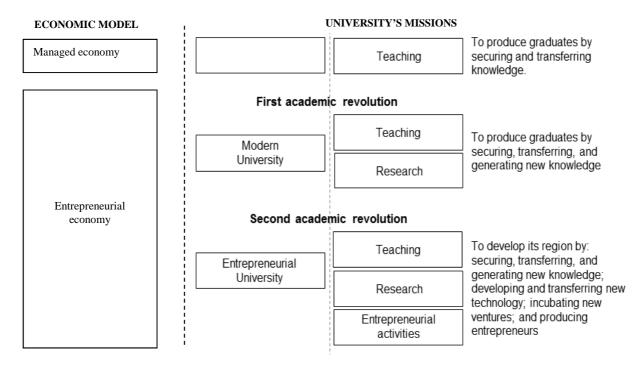


Figure 1.1: Evolution to the entrepreneurial university Source: Based on Audretsch (2014), Urbano and Guerrero (2013), and Etzkowitz (2003)

The study of the characteristics and the transformation process of entrepreneurial universities, has attracted the interest of researchers in the last three decades (Clark, 1998; Subotzky, 1999; Sporn, 2001; Etzkowitz, 2004; Guerrero and Urbano, 2012; Kirby et al., 2011; Audretsch, 2014; and others). Case studies describing entrepreneurial universities from different regions of the world, mainly Europe, Oceania, and North America (Ranga et al., 2003; Zhao, 2004; De Zilwa, 2005; Kirby, 2005; Lazzaretti and Tavoleti, 2005; Tijssen, 2006;

Yokohama, 2006; Benneworth, 2007; O'Shea et al., 2007; Ortín et al., 2008; Guerrero and Urbano, 2012; Urbano and Guerrero, 2013; Guerrero et al., 2014a, 2014b, 2014c; Guerrero et al., 2015; Guerrero and Urbano, 2015), have contributed to the understanding of the new characteristics and functions of the university.

Other studies have contributed to a better understanding of entrepreneurship education in universities (Kirby, 2004; Veciana et al., 2005; Urbano, 2006; Guerrero et al., 2008; Martin et al., 2013). Some gaps in the literature on entrepreneurial universities remain, however, especially in emerging economies contexts. There are no extent studies conducted in Latin America, where there is a great and urgent impetus for local economies to move towards a more expeditious transition into the entrepreneurial economy. Moreover, the lack of a conceptual model of this kind of university, contrasted by empirical studies, offers a great opportunity to make important contributions in this field. Thus, further research is needed on the factors impacting the development and the entrepreneurial activities of universities (Rothaermel et al., 2007), as well as their social and economic impact on their comunities (Guerrero et al., 2015).

1.2. Research objectives

The economy prevailing today in the world is in transition towards becoming one that is knowledge-based, one in which the rules and practices that determined success in the industrial era are changing. In this new economy, ideas and intellectual capital are replacing natural resources and mechanical innovations as factors of economic development (Braun, 2006). Knowledge is now a resource far more critical than land, labor, and capital. Thus, it is legitimately the basis of research, development, and inventions, and the transformation of inventions into marketable innovations is the basis of international competitiveness (Braun,

2006; Zaharia and Gibert, 2005). The gap between the developed countries, those now developing, and those still undeveloped is widened or reduced to the extent that each country manages to transform its industries, educational systems, and governance structures to be able to join the *Knowledge Economy*.

Despite great differences in economic conditions and resource availability, social structures, cultural settings, and historical backgrounds, higher education systems in most countries face similar challenges: maintaining research capacity, combining elite with mass higher education, offering lifelong education, and providing society with a space for the development and maintenance of critical knowledge, independent thinking, social identity, and values (Guerrero et al., 2015). For instance, being at the intersection of research, education, and innovation, universities have the access key to the knowledge-based economy and society, a fact for which regions will pose a new challenge of greater complexity to their universities. This challenge drives universities to directly promote the economic development of their communities (Zaharia and Gibert, 2005). The second academic revolution and the new resulting mission of universities drive them to directly promote the economic development of their communities (O'Shea et al., 2007). Entrepreneurial universities become important catalysts for regional, economic, and social development (Guerrero and Urbano, 2012; Kirby et al., 2011), particularly because they generate and exploit knowledge as entrepreneurial opportunities (Guerrero et al., 2015). This fact becomes more relevant during recessionary times and has gained the attention of academics, governments and policy makers around the world.

The existing literature on entrepreneurial universities provides insights about the entrepreneurial transformation process of universities in developed countries (e.g., the United

States by O'Shea et al., 2005; O'Shea et al., 2007; and Europe by Clark, 1998; Wright et al., 2007; Grimaldi et al., 2011; and Guerrero and Urbano, 2012) and current efforts to explore it in emerging economies (e.g. Iran by Guerrero et al., 2014b; Guerrero et al., 2014a). Studies evidenced that in emerging economies the first measure implemented to fostering entrepreneurship within the university is usually entrepreneurship educational programs. The main explanation is the positive relationship between entrepreneurship education and entrepreneurial activity (Coduras et al., 2008). However, low prevalence rate of formal and informal entrepreneurship education in developing countries (i.e., Uruguay, Latvia, Peru, Chile, Iran, Argentina and Mexico) clearly evidenced the need of other support measures for entrepreneurs starting businesses within universities (Coduras et al., 2010; Guerrero and Urbano, 2015).

Following this perspective, in emerging economies, the literature on entrepreneurial universities is somewhat limited or, more accurately, rare. This issue becomes even more relevant for economies that are in transition from focusing on efficiency to focusing on innovation, as in the case of Mexico, a country that is relevant in the global context because of the size of its economy and its leadership in Latin America (World Economic Forum, 2014). According to the World Bank Indicators, Mexico's economy, politics, and society have been rapidly transforming from an efficiency-driven economy towards an innovation-driven economy. Mexico is an emerging country characterized by investment in its productive, innovative, and entrepreneurial capacity in order to achieve a better economy and level of well-being for its population (Wright et al., 2005). In this type of contexts, universities play a relevant role in entrepreneurial innovation processes reinforcing a governmental strategy to stimulate economic development and the transition from an efficiency economy to an innovation one (Hoskisson et al., 2000).

Due to the important role that Entrepreneurial Universities currently play in the economic development of their communities and in the transition to the Knowledge Economy (Dasgupta and David, 1994; Chrisman et al., 1995; Shane, 2005; Audretsch, 2014), this doctoral thesis general objective is to contribute to a better understanding of the conditioning factors (antecedents) and impacts (consequences) of entrepreneurial universities in emerging economies such as Latin America with especial emphasis in Mexico. In this thesis, our perspective of entrepreneurial universities is focused on entrepreneurial activities associated to students and graduates. This perspective is adopted because the majority of entrepreneurial universities in emerging economies are oriented to the students more than academics. Thus, the specific objectives of the research are the following:

- SO1. To propose and test an eclectic theoretical model that allows understanding the determinant factors (environmental and internal) of entrepreneurial universities in emerging economies.
- SO2. To explore the socioeconomic impacts generated by entrepreneurial universities' activities in emerging economies.

1.3. Theoretical framework and methodological design

To achieve the research objective, and based on previous studies, this thesis adopted several theoretical approaches to explore the determinants and consequences of entrepreneurial universities in emerging countries.

First, this study adopted primarily two theoretical approaches to analyze the antecedents: *Institutional Economic Theory* (North, 1990) and *Resource-Based View* (Barney,

1991). Both approaches help us to understand which environmental and internal factors are involved in the development of universities' innovative pathways to promote and reinforce entrepreneurship among students, faculty, staff and people from their communities. These entrepreneurial pathways, such as education, training and new business incubation mechanisms, must effectively influence beliefs of potential entrepreneurs that may trigger their entrepreneurial intentions and actions.

Second, to understand how those antecedents produce certain consequences on individual behaviors and actions, some ideas from the *Social Cognitive Theory* (Bandura, 1997) and the *Theory of Planned Behavior* (Ajzen, 1991) were adopted. These approaches link the entrepreneurial university ecosystem, pathways and efforts (e.g., incubators, entrepreneurship education, etc.) with graduates' entrepreneurial outcomes strongly oriented towards their career choice (e.g., entrepreneurs, self-employed, paid-employed).

Third, to explore the socioeconomic impact of entrepreneurial universities in emerging economies, the *Endogenous Growth Theory* (Audretsch and Keilbach, 2007) provides some insights about the contribution of entrepreneurial university core activities (e.g., teaching, research, and entrepreneurship) on production function's determinants (e.g., human, knowledge, social, and entrepreneurial capital), which could be transformed into the predominant factors that contribute to social and economic development in the long term (Guerrero et al., 2015). Complementary, the *Knowledge Spillover Theory* (Acs et al., 2008) gives some ideas about how entrepreneurs identify and exploit opportunities in higher intensive knowledge environments such as universities.

Following those approaches, an eclectic model is proposed and tested combining a mix of qualitative and quantitative approaches. According to Eisenhardt (1989), Gartner and Birley (2002), and Kirby et al. (2011), this type of methodological strategy can achieve a deep knowledge and understanding of the antecedents and consequences of entrepreneurial universities.

1.4. Contributions and implications

The subject of entrepreneurial universities, as classified by the *Journal of Economic Literature* classification system, is located within two categories: Business Management and Education. The most appropriate categorization in the social sciences are specifically Entrepreneurship (M130-Entrepreneurship) and Education and Government Policy (I280-Education-Government Policy). This classification can be corroborated in special issues on Entrepreneurial Universities that have been dedicated to the topic by some academic journals of entrepreneurship, such as the *Journal of Technology Transfer* (2001, 2003, 2013. 2014), *Management Science* (2002), *Research Policy* (2003, 2004, 2005, 2011), *Small Business Economics* (2015), and *Journal of Business Venturing* (2004, 2005). Also, well recognized conferences in the entrepreneurship field (i.e.: Academy of Management Conference in USA; Babson Conference in USA; International Council for Small Business -ICSB- Conference; RENT Conference - Research in Entrepreneurship and Small Business in Europe; CLADEA Conference and *Congreso sobre el espíritu empresarial* -ICESI- in Latin-America; among others) dedicate a track regarding academic entrepreneurship, entrepreneurial universities and/or technology transfer.

The role of the university has continued to evolve along with the underlying economic forces shaping economic growth and performance (Audretsch, 2014; Guerrero et al., 2015).

Thereby, the worldwide economic downturn that began in 2008 represented a strategic game-changer for most economies. Severe resource constraints and unpredictable conditions created significant challenges for organizational survival let alone growth through innovation and venturing activities. In this context, entrepreneurial universities face strong challenges: higher rates of unemployment with higher education, the reduction of education budgets, reduction in the demand of higher education studies, and so on. Unlike prior economic situations that affected only the most interconnected countries, the current global economic recession affected all countries with different levels of intensity. Following this point of view, the relevance of this thesis is supported by the main academic and practical implications associated to its potential results. In summary, the main contributions and implications could be linked to:

(i) At the academic level, an eclectic model of entrepreneurial universities applied in emerging economies and oriented to the academic community to continue exploring this phenomenon. The study of the characteristics and process of transformation of Entrepreneurial Universities has attracted the interest of researchers in the last two decades (Clark, 1998; Subotzky, 1999; Sporn, 2001; Etzkowitz, 2004). However, there are still gaps in the literature of Entrepreneurial Universities. In addition, the literature includes no studies of Latin-American countries, where there is a great need for local economies to move expeditiously toward a transition to the knowledge economy. Moreover, the lack of a conceptual model of this type of university, contrasted by empirical studies, offers a great opportunity to make important contributions in this field. Therefore, more research is needed on the factors that impact the development and entrepreneurial activities of universities (Rothaermel et al., 2007); with special emphasis in emerging economies.

- (ii) At the policy maker level, undoubtedly, today's universities are more proactive and more interconnected with their stakeholders than in previous decades. When public resources are scarce, universities not only need to compete for funding but also must have a strong commitment to legitimize the economic and social benefits obtained with funding. It is not time to turn back; technology transfer activities and knowledge spillover need to take the relevant role as determinants of economic development while using scarce resources efficiently and transparently. Also, traditionally, university performance metrics are associated with the inputs (expenses/sources of funding) and outputs of teaching (profile of graduate and new students), research (researchers, publications, research contracts, patents, licenses, etc.), and only a few entrepreneurial activities (e.g., spin-offs). Perhaps it is time to include other indicators to measure the performance and productivity of entrepreneurial universities (e.g., last year, Stanford University published a report on the economic impact of their alumni).
- (iii) At the university authority level, even before the economic crisis, the unemployment rate for recent college graduates and experienced ones was increasing as the number of new university students was decreasing. Tuition costs were also rising (which further threatened students' ability and desire to attend college), but today's top universities are implementing novel strategies such as using social networks (i.e., free online courses) to attract students. Today's universities are also committed to providing students the knowledge, capabilities, skills, and thinking required to be able to identify or create job opportunities in the market. In summary, university authorities need to recognize their core role at this time not only in building but also in reinforcing the university environment that nurtures entrepreneurial potential (incentives, new learning tools, role models). Universities also need to stimulate skills, competences, and tools that are most

useful to creating entrepreneurial mind-sets that drive innovation (not only inside universities but also within the existing firms), thus becoming entrepreneurial organizations.

1.5. Structure of the research

Aligned to the two specific objectives, Figure 1.2 describes the structure of the research.

CHAPTER I: INTRODUCTION

Problem statement:

Further research is needed on the development of entrepreneurial universities in emerging economies

CHAPTER II: AN ECLECTIC CONCEPTUAL FRAMEWORK OF ENTREPRENEURIAL UNIVERSITIES

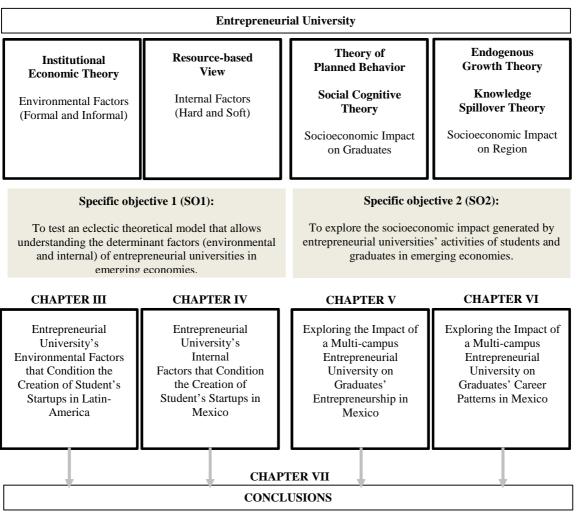


Figure 1.2: Structure of the research

More concretely, SO1 focuses on the antecedents or determinants of the entrepreneurial university on students' start-ups (Chapters III and IV) and SO2 focuses on the consequences or impact of the entrepreneurial university on graduates' career decisions (Chapters V and VI). Finally, Chapter VII presents a summary of conclusions, implications, limitations and future research lines.

CHAPTER II. AN ECLECTIC CONCEPTUAL FRAMEWORK OF ENTREPRENEURIAL UNIVERSITIES

2.1. Introduction

Chapter I provided some insights about what we do know about the transformation process of a traditional university into an entrepreneurial one and how this entrepreneurial orientation is configured by certain environmental and internal factors in developed economies. As well as insights on what we do not know about how those factors determine the entrepreneurial universities' pathways to foster entrepreneurship in their communities (students, graduates, faculty and others) and generate some consequences on individuals' actions and behaviors.

Following this research opportunity, the main objective of this chapter is to propose an eclectic model about antecedents and consequences of entrepreneurial universities in emerging economies. To achieve this objective, the basis of several theoretical approaches were adopted, such as *Institutional Economics, Resource-Based View Theory, Theory of Planned Behavior, Social Cognitive Theory, Endogenous Growth Theory, and Knowledge Spillover Theory.* A literature review was conducted, based on a selection of papers published by well recognized journals in the entrepreneurship field such as *Journal of Technology Transfer, Small Business Economics, Entrepreneurship Theory & Practice, Entrepreneurship & Regional Development, Strategic Entrepreneurship Journal, and International Entrepreneurship and Management Journal, among others.*

After this brief introduction, Section 2.2 clarifies the main elements that identify an entrepreneurial university. Section 2.3 describes the main bases adopted from each theoretical approach. Section 2.4 shows the proposed model based on the analysis of published research about the main factors involved in the development of entrepreneurial universities activities

and the consequences of those activities. Finally, Section 2.5 summarizes the structure of the thesis.

2.2. Entrepreneurial Universities

The technological, economic, social, and political factors that appeared around the world in the last decades triggered a second academic revolution (Etzkowitz, 1983, 2003, 2004, Etzkowitz and Leydesdorff, 2000). The effects of this revolution created a new category of university with a third mission in addition to the production of graduates and research: to impact the socioeconomic development of its community through entrepreneurial activities. As a result, the entrepreneurial university emerged (Kirby, 2005; Zaharia and Gibert, 2005). According to Audretsch (2014), the forces shaping economic growth and performance have also influenced the corresponding role for the university. This role has evolved over time as the economy has evolved from being driven by physical capital to knowledge, and then again to being driven by entrepreneurship.

Although the entrepreneurial university was first a response to transfer technology and create knowledge-based startups, the role of the university in the entrepreneurial society has become even more complex and challenging, focusing on enhancing entrepreneurship capital and creating the conditions to prosper in an entrepreneurial society (Audretsch, 2014). A review of the literature on entrepreneurial universities in the leading journals in entrepreneurship shows that most studies consider entrepreneurial universities as organizations committed to generate a socioeconomic impact on their communities (Guerrero and Urbano, 2012; Kirby et al., 2011; Audretsch, 2014; among others) through three main forms of entrepreneurial activities:

- (i) *Training in entrepreneurship* to develop entrepreneurial leadership in the people who are in and around the university by promoting values, attitudes, and skills necessary for becoming an entrepreneur (Clark 1998; Etzkowitz 2003; Guerrero et al. 2008; Wood, 2009; Audrestsch, 2014; and others).
- (ii) *Creation of new businesses* and new jobs, accomplished by encouraging the incubation of promising business ideas by entrepreneurs and established businesses to help them accelerating their business growth (Chrisman et al. 1995; Röpke, 1998; Jacob et al., 2003; Cargill, 2007; Guerrero and Urbano, 2012; Etzkowits, 2013; and others).
- (iii) *Technology transfer*, done mainly through the sale or licensing of the patents resulting from research and development or through the launching of new companies to exploit the technology (Dill 1995; Jacob et al. 2003; Wood, 2009; Etzkowits, 2013).

Table 2.1 shows a selected sample of studies and the characteristics of the entrepreneurial university that they emphasize. In summary, an entrepreneurial university directly and significantly impacts the economic development of its community through entrepreneurship training, support for the creation and incubation of new enterprises, and the transfer of technology to be marketed through the economic use of the results of its research and development projects. Based on these arguments, in this research, entrepreneurial university will be understood as a natural incubator that: (i) fulfills simultaneously three different activities: teaching, research and entrepreneurial activities; (ii) provides an adequate atmosphere in which the university community can explore and exploit ideas; and (iii) contributes to creating a sustained competitive advantage that could be transformed into social and economic impact. In this thesis, our perspective of entrepreneurial universities is focused on entrepreneurial activities associated to students and graduates.

This perspective is adopted because the majority of entrepreneurial universities in emerging economies are oriented to the students more than academics.

		New activities			
Author, year	Definition	Entrepreneur ial education	New venture creation	Technology transfer	Socioecono mic impact on comm.
Etzkowitz, 1983	"Universities considering new sources of funds like patents, research by contracts, and entry into partnerships with private enterprises."			•	
Chrisman et al., 1995	The entrepreneurial university involves "the creation of new business ventures by university professors, technicians, or students."		•		
Röpke, 1998	" the university itself, as an organization, becomes entrepreneurial; faculty, students and employees are turning themselves somehow into entrepreneurs; and the interaction of the university with the environment, the 'structural coupling' between university and region, follows [an] entrepreneurial pattern."	•	•	•	•
Jacob et al., 2003	"An Entrepreneurial University is based [on] both commercialization and commoditization (patents, licensing or student-owned start-ups)."		•	•	
Tuunainen, 2005	"a new type of institution also integrates the economic development into the university as an academic function along with teaching and research."		•	•	•
Bennewort, 2007	"The Entrepreneurial University provides, through technology-transfer activities, new technological knowledge demanded by companies to create and exploit value for the global market"			•	
Cargill, 2007	"The antithesis of the traditional `ivory tower' of learning, a much more economically and society-focused contributing to economic development through the creation of new opportunities and the support for starting new businesses"		•		•
Guerrero et al., 2008	" a university that has the ability to innovate, recognize, and create opportunities, work in teams, take risks, and respond to challenges on its own, provides support structures for teachers and students to initiate new ventures."	•	•	•	
Wood, 2009	"A university undergoing a transformation to serve society by educating students and to foster research that can be developed into commercially viable products and technologies through university spin-offs and technology license agreements"	•	•	•	
Guerrero and Urbano, 2012	"A knowledge-producer and a disseminating organization in the entrepreneurial society, where knowledge-based entrepreneurship has emerged as a driving force for economic growth, employment creation and competitiveness"			•	•
Kirby et al., 2011	"Entrepreneurial universities where multifaceted efforts are made to ensure their contribution to regional economic development"				•
Etzkowitz, 2013	"In the entrepreneurial university exists academic involvement in (1) technology transfer, (2) firm formation and (3) regional development"		•	•	•
Audretsch, 2014	"generate technology transfer in the form of patents, silences, and university-sanctioned startups contribute and provide leadership for creating entrepreneurial thinking, actions, institutions and entrepreneurial capital to contribute to innovation, competitiveness and ultimately economic growth."	•	•	•	•

Table 2.1: Main characteristics and activities of entrepreneurial universities Source: Adapted from Guerrero et al. 2008

2.3. Theoretical Approaches

2.3.1. Institutional Economics

The *institutional approach* draws attention to institutional or contextual—cultural, social, political, and economic—factors as determinants of entrepreneurship (Veciana and Urbano, 2008; Thornton et al., 2012). According to North (1990: 3), institutions are the rules of the game in a society, or more formally, institutions are the constraints that shape human interaction. Specifically, institutions can be either formal (regulations, written rules, contracts, etc.) or informal (attitudes, values, conventions, etc. -essentially, the culture of a specific society). Based on extant studies, the environmental factors of entrepreneurial universities include:

Formal factors:

- (i) a flexible organizational and governance structure with innovative forms to help reduce the levels of bureaucracy and to support a fluid language with other agents in the region's entrepreneurial ecosystem to allow for the interaction and the definition of policies and practices to achieve their missions (O'Shea et al., 2007; Kirby et al., 2011);
- (ii) *instruments and mechanisms* developed by universities to support internal and external new firm creation as university small- business centers, research facilities, research groups or quasi firms, liaison offices, technology transfer offices, and incubators (Link and Scott, 2005; Grandi and Grimaldi, 2005);
- (iii) *adequate educational programs*, for both students and academics, that provide a wide variety of situations, aims, and methods oriented toward improving students' skills, attributes, and behaviors to develop both creative and critical thinking (Kirby, 2004);

Informal factors:

- (iv) community members' favorable attitudes toward entrepreneurship to facilitate the development of potential entrepreneurs among all university levels (Louis et al., 1989; Liñán et al., 2011);
- (v) the existence and the diffusion of successful entrepreneurs, who will become new role models to their peers, demonstrating that entrepreneurial success is more than a theory (Venkataraman, 2004) and influencing entrepreneurial intentions (Liñán et al., 2011; Kirby et al., 2011); and
- (vi) *adequate reward systems* that represent strategic actions intended to promote an enterprise that is both monetary (bonuses, use of corporate resources, profit-sharing, etc.) and non-monetary (promotion and recognition systems) (Wright et al., 2007; Kirby et al., 2011).

As a result, Figure 2.1 shows the entrepreneurial university configuration according to the Institutional Economic approach.

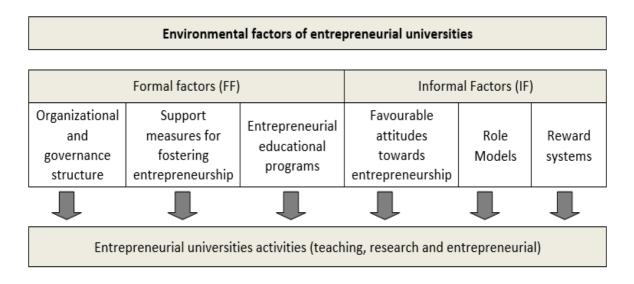


Figure 2.1: Entrepreneurial university's evironmental factors from an Institutional Economic perspective

Source: Based on North (1991) and Guerrero and Urbano (2012)

2.3.2. Resource-based View

According to Barney (1991), the *Resource-Based View (RBV)* considers an organization as a unique set of valuable, rare, and imperfectly imitable resources and capabilities. These capabilities can be viewed as bundles of tangible and intangible assets controlled by the organization to generate sustained, competitive advantages. This means each organization integrates and operates its internal resources in different ways from other organizations in order to take advantage of their potential and generate sustained, competitive advantages. This behavior of organizations is especially important within environments in which change is constantly present and moves at an accelerated pace (Wernerfelt, 1984 and 1995; Amit and Schoemaker, 1993). In the literature of entrepreneurial universities, we can identify hard and soft resources (Kirby et al., 2011). Traditionally, hard resources are differentiated as financial and non-financial. On the other hand, soft resources are associated to human skills and organizational capabilities.

Hard resources:

- (i) *Financial resources* are usually limited and might also be costly. Moreover, appropriate management of this type of resources might be complex and risky. Organizations able to get sufficient funds and excel in their management find themselves in a privileged position for pursuing almost any kind of strategy,
- (ii) *Physical resources* include facilities, equipment, and infrastructure. Nearly any strategy or organizational function demands access to a specific type of physical resources,

Soft resources:

- (iii) *Human resources* and the way these communicate and collaborate in the knowledge economy are more important than ever, and
- (iv) *Organizational capabilities* include all the different ways an organization can exploit and combine financial, physical, and human resources (Amit and Schoemaker, 1993). These consist of intangible assets, such as patents, licenses, experience, prestige, status, systems, routines, and others (Barney, 1991; Grant, 1996). Some combinations of resources may attract other types of resources. For example, a company with the combination of organizational skills and sufficient financial resources may easily attract quality human resources (Borch et al., 1999).

Following the RBV Theory, it can be concluded that organizations are bundles of hard (financial and physical) and soft (human and organizational capabilities) resources. Furthermore, the performance of organizations depends on how they respond to environmental factors, which may be considered as either threats or opportunities, based on the company's internal factors or sets of resources and capabilities (Black and Boal, 1994; Borch et al., 1999). Thus, organizations must look for the best combinations of appropriate resources and distinct capabilities that best support each strategy (Snow and Hrebiniak, 1980). In this sense, Figure 2.2 shows the internal factors of the entrepreneurial universities.

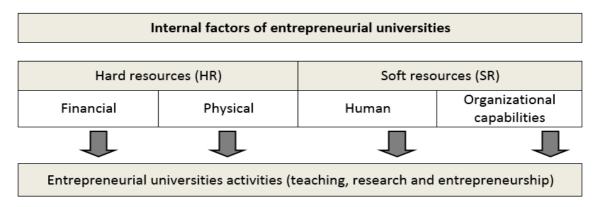


Figure 2.2: Entrepreneurial university internal factors from a RBV perspective Source: Based on Barney (1991) and Guerrero and Urbano (2012)

2.3.3. Theory of Planned Behavior and Social Cognitive Theory

The *Theory of Planned Behavior* was developed by Ajzen (1991) as an extension of the Theory of Reasoned Action (Fishbein and Ajzen, 1975), which states that intentions capture the motivational factors that influence a behavior: attitude towards behavior and subjective norm. As the original theory had been criticized for being limited when dealing with behaviors over which the individual has not complete volitional control, Ajzen (1991) added a third motivational factor to correct this limitation. This factor was adopted from Bandura's *Social Cognitive Theory* (1997), which explains that the reproduction of an observed behavior is influenced by the interaction of three determinants:

- (i) *Personal*: Whether the individual has high or low self-efficacy toward the behavior;
- (ii) Behavioral: The response individuals receive after they perform a behavior; and
- (iii) *Environmental*: Aspects of the environment or setting that influence the individual's ability to successfully complete a behavior.

To complete the *Theory of Planned Behavior*, Ajzen (1991) took the notion of self-efficacy, which represents the individuals' appraisal of their ability to perform a specific behavior, and combined it with the notion of perceived control, which represents the individuals' appraisal of the extent to which they control whether they perform the behavior. In other words, self-efficacy relates to internal restraints, such as the lack of knowledge or skills, while perceived control refers to external restraints, such as the interference of other persons or restrictive laws. With this combination, Ajzen integrated the third motivational factor that determines behavioral intention, and called it perceived behavioral control, which represents individuals' assessment of internal and/or external constraints to perform a specific

behavior. Thus, according to Ajzen's *Theory of Planned Behavior*, intention to perform a specific behavior is influenced by the interaction of these three determinants:

- (i) Attitude towards the behavior, which can be positive or negative and refers to the degree to which a person has a favorable or unfavorable evaluation of a specific behavior.
- (ii) *Subjective norm*, a social factor that predicts intention based on the perceived social pressure to perform the behavior, especially from the individuals' significant others.
- (iii) *Perceived behavioral control*, based on the individuals' perceived ease or difficulty to perform the behavior, reflecting capability, past experience, as well as anticipated impediments and obstacles.

It is important to say that the relative relevance of attitude, subjective norm and perceived behavioral control in the prediction of intention varies across behaviors and situations (Bandura, 2001). According to Ajzen (1991), behavioral intention is an indication of how hard individuals are willing to try and how much of an effort they are planning to exert, in order to perform the behavior. The stronger the intention to engage in a behavior, the more likely its performance. Thus, *Theory of Planned Behavior* offers a theoretical base to predict and explain the impact of entrepreneurial pathways of universities on potential entrepreneurs' intentions and actions, such as the intention to start up a new business and the actual creation of that new venture. Actually, several studies have based their theoretical framework on motivational factors (Ajzen, 2002; Autio et al., 2001; Kolvereid, 1996a, 1996b; Krueger and Brazeal, 1994; Meyer, 2003; Degroof and Roberts, 2004). Since the education offered by a university mostly influences the career selection of students, universities can be seen as potential sources of future entrepreneurs (Turker and Sommez Selcuk, 2009). Today,

most universities have spent significant amounts of money to design a viable entrepreneurship education for their students.

According to a wider conception, entrepreneurship education is defined as "the whole set of education and training activities – within the educational system or not – that try to develop in the participants the intention to perform entrepreneurial behaviors, or some of the elements that affect that intention, such as entrepreneurial knowledge, desirability of the entrepreneurial activity, or its feasibility" (Liñán and Chen, 2009). Wang and Wong (2004, p. 170) mainly focused on personality characteristics of students, and they also pointed out the fact that the entrepreneurial dreams of many students are hindered by inadequate preparation: "... their business knowledge is insufficient, and more importantly, they are not prepared to take risk to realize their dreams." Therefore, universities might have critical roles in the encouragement of young people to choose an entrepreneurial career. However, they are sometimes accused of being too academic and encouraging entrepreneurship insufficiently (Gibb, 1993, 1996). It is clear that an effective education on entrepreneurship can be a factor to push people towards an entrepreneurial career (Henderson and Robertson, 2000). In this sense, Figure 2.3 shows the influence of entrepreneurial university on students' behaviors (outcomes).

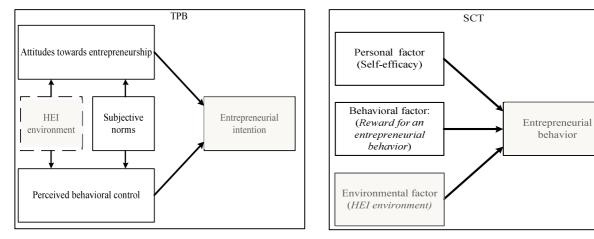


Figure 2.3: Entrepreneurial university influence on students' behaviors Source: Based on Ajzen (1991), Bandura (2001), Guerrero and Urbano (2014).

2.3.4. Endogenous Growth Theory and Knowledge Spillover Theory

The *endogenous growth theory* helps understanding the possible socioeconomic impacts of entrepreneurial universities based on the determinants of the production function, such as human, knowledge, social, and entrepreneurial capital (Audretsch and Keilbach, 2007). As mentioned earlier, these determinants of the production function are precisely the contribution of the entrepreneurial university's core activities (e.g., teaching, research, and entrepreneurship), which could be transformed into the predominant factors that contribute to social and economic development in the long term (Guerrero et al. 2012; Urbano and Guerrero, 2013; Guerrero et al., 2015). Four outcomes of the entrepreneurial university have a social and economic impact (Figure 2.4):

Impact of entrepreneurial university's outcomes		
Teaching activities	Research activities	Entrepreneurial activities
reacting activities	Nesearch activities	Littlepreneurial activities
Human capital	Human capital Knowledge capital	Social capital Entrepreneurship capital
1	Ū.	1
Social and economic impact		

Figure 2.4: Socio-economic impact according to the Endogenous Growth Theory Source: Based on Audretsch and Keilbach (2004) and Guerrero et al. (2015)

- (i) *human capital*, through the generation, attraction, and retention of job seekers, knowledge producers and entrepreneurs (graduate students, researchers and entrepreneurs);
- (ii) *knowledge capital*, generated by both prestigious and novel researchers who facilitate the innovation process and the transfer of knowledge (academic entrepreneurs);

- (iii) *social capital* through enhanced investment attraction and the promotion of partnerships in key regional clusters that identify and meet market needs;
- (iv) *entrepreneurship capital* with the attraction and creation of new enterprises that promote competition and diversity.

As a result, these elements could produce several demographic, economic, infrastructure, cultural, mobility, educational, and societal challenges that later on will be reflected on productivity, competitive advantages, regional capabilities, regional networks, regional identity, and regional innovation (Guerrero and Urbano, 2012) that produce economic growth. In this sense, the *Knowledge Spillover Theory* supporting the idea that entrepreneurial universities have a social and economic impact (Acs et al., 2009). According to this theory, entrepreneurial opportunities are expanded by the creation of new knowledge when incumbent firms and researchers do not exploit all the results of their research activities commercially. Other agents take these knowledge spillovers and endogenously pursue their exploitation through entrepreneurial activities. In this theory, entrepreneurship is a response to those opportunities.

The *Knowledge Spillover Theory* has successfully demonstrated that knowledge spillovers come from the stock of knowledge, a strong relationship between such spillovers and entrepreneurial activity, and the contribution of entrepreneurship to economic growth by acting as a conduit through which knowledge created by incumbent firms spills over to agents who endogenously create new firms (Acs et al., 2009). This theory states that entrepreneurial activity will be greater where investments in new knowledge are relatively high, such as entrepreneurial universities, as startups will exploit spillovers from the source of knowledge production. On the other hand, entrepreneurial activities decrease when they face: cultural

barriers, such as risk aversion and lack of social acceptance; greater regulation and market intervention by government, especially through legal restrictions, taxes, and labor market rigidities; administrative burden and other bureaucratic constraints. Together, the *Endogenous Growth Theory and the Knowledge Spillover Theory*, they provide a proper theoretical frame to explain the impact of entrepreneurial universities on regional development.

2.4. An Eclectic Model of Entrepreneurial Universities in Emerging Economies

Integrating the main fundaments of *Institutional Economics, Resource-Based View,*Theory of Planned Behavior, Social Cognitive Theory, Endogenous Growth Theory, and

Knowledge Spillover Theory, Figure 2.5 shows the eclectic proposed model of entrepreneurial universities.

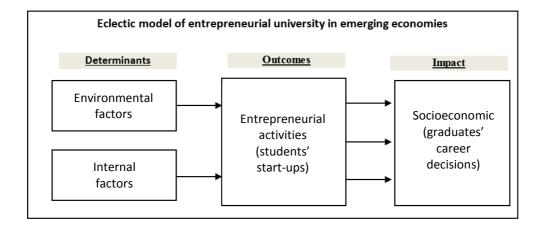


Figure 2.5: Eclectic Theoretical Model of Entrepreneurial Universities

Regarding the antecedents, based on the *Institutional Economics and Resource-Based View*, this model proposes the analysis of internal and environmental factors that could condition the development of entrepreneurial universities' activities (determinants). Particularly, supported by *Theory of Planned Behavior and Social Cognitive Theory*, this model paid attention on how those factors influence on the entrepreneurial behaviors or

actions of their students (outcomes). As a result, adopting the *Endogenous Growth Theory* and *Knowledge Spillover Theory*, the model also considers the socioeconomic impacts of those outcomes on graduates' career decisions (impacts).

Given the difficult to obtain information at the university level, this model was translated into and tested in emerging economies contexts as follows:

- (i) the environmental determinants were tested analyzing the effect of entrepreneurial universities' pathways of three Latin-American universities on their students' startup intentions and actions;
- (ii) the internal determinants were tested exploring the effect of hard and soft resources provided by a multi-campus entrepreneurial university located in Mexico on their students' startup actions;
- (iii) *socioeconomic impacts* were tested on the graduates from the multi-campus entrepreneurial university located in Mexico. Firstly, exploring the main factors involved in the incubation decision of graduates' entrepreneurs. Secondly, exploring the main factors involved on the career decision of its graduates (e.g., entrepreneurs, self-employed or paid-employed). Even if data limitations do not allow exploring several universities, the multi-campus university allows to control by the number of campus in the different regions covered by this university (practically all Mexican regions are covered).

CHAPTER III. ENTREPRENEURIAL UNIVERSITY'S
ENVIRONMENTAL FACTORS THAT CONDITION
THE CREATION OF STUDENTS' STARTUPS IN
LATIN-AMERICA: AN INSTITUTIONAL APPROACH

3.1. Introduction

According to the eclectic model of entrepreneurial university proposed in Chapter II, environmental and internal factors determine the university's entrepreneurial activities (entrepreneurial behaviors/actions of students) that also generate socioeconomic impacts (graduates' career decisions). Particularly, combining institutional (North, 1990) and planned behavior perspectives (Ajzen, 2002), this chapter pays attention to the effect of certain formal and informal environmental factors on students' intentions and start-ups.

Extant empirical studies recognize the positive influence of certain formal (policies/support measures, entrepreneurial educational programs, etc.) and informal (culture, community members' favorable attitudes, role models, etc.) entrepreneurial university pathways on students' start-ups (Degroof and Roberts, 2004; Kirby et al., 2011; Guerrero and Urbano, 2012; McMullen and Shepherd, 2006). Based on these arguments, this research aims to contribute to a better understanding of the environmental factors ² that condition the entrepreneurial activity within three Latin American entrepreneurial universities (Tecnológico de Monterrey, Mexico; Universidad de Campinas, Brazil; and Pontificia Universidad Católica, Chile). More concretely, we explore the university's role on the creation of students' startup intentions and actions.

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² Following the *Institutional Economic Approach*, in this chapter, we use the term "university environment" to refer the students' perception about the university conditions (e.g., entrepreneurship education programs and training) that support and reinforce start-up creation. In addition, according to the *Theory Planned Behavior approach*, we also included the "social environment" to refer the students' perception about how their societies reinforce/retard entrepreneurship.

After this introduction, this chapter is organized as follows: Section 3.2 explains the environmental factors that determine university entrepreneurship and then describes the influence of entrepreneurial university pathways on the creation of students' startups. Section 3.3 describes the methodological design to empirically test this section of the eclectic proposed model. Section 3.4 presents the main findings that are discussed in the light of previous studies. And Section 3.5 summarizes the main conclusions, limitations and implications.

3.2. Conceptual framework

3.2.1. The environmental factors that condition university entrepreneurship: An Institutional perspective

The *institutional approach* has been used to analyze the influence of environmental factors on entrepreneurship (Thornton et al., 2012). In particular, the institutional approach has analyzed the changes in tertiary educational systems (Hanson, 2001; Witte, 2004), the impact on regional innovation systems (Cumbers et al., 2007; Doloreux et al., 2007), and in the analysis of determinants of and impacts on entrepreneurial universities (Guerrero and Urbano, 2012; Urbano and Guerrero, 2013). As it was mentioned in the previous chapter, North (1990) proposed a wide concept of "institutions that are the rules of the game in a society, or more formally, institutions are the constraints that shape human interaction" (p. 3). Therefore, institutions include any form of constraint that human beings devise to shape human interactions. Institutions can be either formal—including political rules, economic rules, and contracts—or informal—including codes of conduct, attitudes, values, norms of behavior, and the conventions or the culture of a determined society.

North (2005) also attempted to explain how institutions and institutional context affect economic and social development. Adopting these ideas, institutional economics provides a better understanding of the environmental factors (formal and informal) that contribute to an entrepreneurial university's outcomes. In this respect, the identification and exploitation of entrepreneurial opportunities within universities require a supportive climate to promote the drive for innovation and entrepreneurship among all members (Mitchell et al., 2000; Mueller, 2007). However, universities are large organizations and by nature tend not to be the most entrepreneurial organizations (Kirby, 2005). Nevertheless, the incorporation of an entrepreneurial orientation into a university's missions could change this situation.

An entrepreneurial university is characterized by organizational adaptation to environmental changes (Clark, 1998), managerial and governance distinctiveness (Subotzky, 1999), new activities oriented to the development of entrepreneurial culture at all levels (Kirby, 2002), a contribution to economic development with the creation of new ventures (Chrisman et al., 1995), and the commercialization of research (Jacob et al., 2003). Applying these parameters, an entrepreneurial university has the ability to innovate, recognize, and create opportunities; work in teams; take risks; and respond to challenges (Guerrero and Urbano, 2012). Moreover, it can devise a substantial shift in organizational character to take on a more promising posture for the future (Clark, 1998).

In the entrepreneurial society characterized in the twenty-first century, the university's role is considerably broader than simply facilitating technology transfer (Audretsch, 2014). More concretely, an entrepreneurial university is required to fulfill three missions simultaneously, which otherwise might be at odds with one another: teaching, research, and entrepreneurship. To do so, an entrepreneurial university needs to become an entrepreneurial

organization, its members need to become entrepreneurs, and its interactions with the environment need to follow an entrepreneurial pattern (Urbano and Guerrero, 2013). According to previous investigations, the key environmental factors of entrepreneurial universities include:

- (i) a flexible organizational and governance structure with innovative forms to help reduce the levels of bureaucracy and to support a fluid language with other agents in the region's entrepreneurial ecosystem to allow for the interaction and the definition of policies and practices to achieve their missions (O'Shea et al., 2007);
- (ii) measures integrated by different instruments and mechanisms developed by universities to support internal and external new firm creation as university small-business centers, research facilities, research groups or quasi firms, liaison offices, technology transfer offices, and incubators (Link and Scott, 2005; Grandi and Grimaldi, 2005);
- (iii) adequate educational programs, for both students and academics, that provide a wide variety of situations, aims, and methods oriented toward improving students' skills, attributes, and behaviors to develop both creative and critical thinking (Kirby, 2004);
- (iv) community members' favorable attitudes toward entrepreneurship to facilitate the development of potential entrepreneurs among all university levels (Louis et al., 1989; Liñán et al., 2011);

- (v) the existence and the diffusion of successful entrepreneurs, who will become new role models to their peers, demonstrating that entrepreneurial success is more than a theory (Venkataraman, 2004) and influencing entrepreneurial intentions (Liñán et al., 2011); and
- (vi) adequate rewards systems that represent strategic actions intended to promote an enterprise that is both monetary (bonuses, use of corporate resources, profit-sharing, etc.) and non-monetary (promotion and recognition systems) (Wright et al., 2007).

3.2.1. Understanding the role of entrepreneurial university environmental factors on the creation of students' startups

An entrepreneurial university generates several outcomes from teaching, research, and entrepreneurial activities. Undoubtedly, these outcomes could be transformed later into determinants of economic development based on the endogenous growth theory (Audretsch and Keilbach, 2007 and 2009; Coleman, 1988; Lucas, 1988; Romer, 1986; Solow, 1956) and could produce positive effects on the economy and society of a specific region. However, with the expansion of universities' missions, measuring the universities' outcomes has become more complex. For instance, teaching activities have been a university's universal function (Kirby et al., 2011). Universities educate and train students, who become jobseekers or job creators after graduation (Schulte, 2004).

Hence, entrepreneurial universities could have an impact on economic notions about human capital considered a factor of production by Lucas (1988), who refers to the stock of competencies, knowledge, abilities, and skills gained through education and training (Becker, 1964). Moreover, teaching activities are associated with the outcomes of entrepreneurial activities via the creation of start-ups by students. Following this perspective, an

entrepreneurial university is an organization that actively seeks to create an organizational culture that adopts an entrepreneurial attitude toward its future development (Clark, 1998). For this reason, within entrepreneurial universities, there is a strong trend toward policies and mechanisms to enhance the generation, valuation, and exploitation of entrepreneurial ideas (Guerrero and Urbano, 2012).

For university students, successful examples of entrepreneurial university pathways include entrepreneurship educational programs, which provide a wide variety of real situations, methods and strategies, knowledge, skills, and abilities (Kirby, 2004), and reinforce attributes and behaviors to develop creative and critical thinking and make individual career choices (Louis et al., 1989; Lee and Wong, 2004). A few studies have shown via control variables the positive effect of entrepreneurship education programs on the attitudes toward the behavior (the desire or attractiveness of the proposed behavior or the degree to which the individual holds a positive or negative personal valuation about being an entrepreneur) and the self-efficacy (the feasibility or the perceived ease/difficulty or individual's own capacity to carry out a specific behavior) needed by students to become entrepreneurs (Ajzen, 2002; Autio et al., 2001; Kolvereid, 1996a, 1996b; Krueger and Brazeal, 1994; Meyer, 2003; Degroof and Roberts, 2004).

Adopting the *planned behavior theory*, start-up intentions must trigger an individual's behavior to take action, which gives rise to venture creation because intentions without actions will not generate new enterprises or economic value (Bird and Schjoedt, 2009). Therefore, the influence of these university pathways on start-up intentions could be identified via motivational factors (attitudes toward behavior and self-efficacy), in particular in knowledge contexts (entrepreneurial universities), where students have the ability to innovate,

recognize, and create opportunities; work in teams; take risks; and respond to challenges (Kirby, 2005). As a consequence,

H1: Entrepreneurial university environmental factors have a positive effect on students' start-up intentions (mediated by motivational factors).

According to the entrepreneurial action perspective, entrepreneurship is fundamentally an individual phenomenon to pursue and exploit opportunities. Entrepreneurs bear the responsibility for making judgmental decisions that affect the localization, moment, form, and use of goods or scarce resources to launch a new business (Shane and Venkataraman, 2000). The entrepreneurial process involves both the perception of opportunity and the subsequent action to create a firm (Renko et al., 2012). On the one hand, the perception, identification, and assessment of entrepreneurial opportunities represent the chance for an individual to offer some new value to society, often by introducing innovative and novel products or services (Lee and Venkataraman, 2006). On the other hand, entrepreneurial actions refer to the behavior in response to a judgmental decision by creating a new firm, always with the possibility for economic gain or financial loss (Hastie, 2001). In this respect, McMullen and Shepherd (2006) argue that entrepreneurial action demands feasibility (what can be achieved in the way that is envisioned) and desirability (whether its attainment will fulfill the motive for which it is being sought).

Entrepreneurial action depends, to a large extent, on how individuals combine: (a) their motivations, which vary in how they perceive the risk of expending resources before knowing the distribution of outcomes (Arenius and Minnitti, 2005; Shane et al., 2003) and (b) their human capital (i.e., individual education, experiences, and skills), which constitutes a firmunique, intangible asset (Davidsson and Honig, 2003), and how their access to other resources

may prompt (or hamper) the decision to start a new venture (Chang et al., 2011). Therefore, the students' career choice to become entrepreneurs will be influenced by the university pathways via the direct effect observed on the students' motivational factors and the indirect effect produced on start-up intentions. As a result,

H2: Entrepreneurial university environmental factors have a positive effect on students' start-up actions (by the effect produced on start-up intentions via motivational factors).

To summarize, Figure 3.1 shows the proposed model used to explore how entrepreneurial university environmental factors affect students' start-up intentions and their start-up career choice.

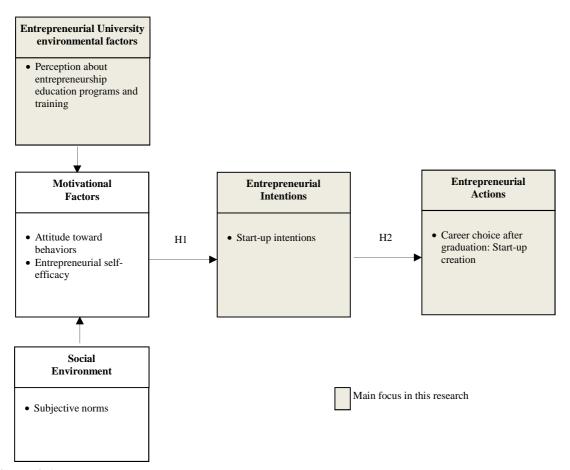


Figure 3.1: Proposed Model

Source: Based on Ajzen (1991), McMullen and Shepherd (2006), and Guerrero and Urbano (2012)

3.3. Methodology

3.3.1. Data collection

This exploratory research uses the 2011 GUESSS³ project database, which allows us to recognize three entrepreneurial universities in three Latin American countries (Mexico, Brazil, and Chile), with a representative sample of students interviewed according to their average annual student population (1,759 observations): in particular, 531 from the Tecnológico de Monterrey (ITESM, Mexico), 758 from the Universidad de Campinas (UNICAMP, Brazil), and 470 from the Pontificia Universidad Católica (UPC, Chile). These universities were selected following the criteria used to identify entrepreneurial universities (Clark, 1998; Di Gregorio and Shane, 2003; Shane, 2004; Audretsch and Lehmann, 2005; O'Shea et al., 2005 and 2007; Rothaermel et al., 2007, Wright et al., 2007; Guerrero and Urbano, 2012): (i) promoting an entrepreneurial culture by strategic actions that allow for adaptation to environmental changes; (ii) making self-instituting efforts to change its general character by developing entrepreneurial initiatives; and (iii) being located in regions characterized by higher levels of entrepreneurship measured by the number of new enterprises. Also, these universities are listed in the top 10 of universities in Latin American Rankings.⁴ Complementary, we collected qualitative information at the university level using secondary data sources such as: university websites, official documents, and other public and official databases.

³ GUESSS is an international research project using a geographical and temporal comparison to investigate the entrepreneurial intention and activity of students. The founding process and the reference frameworks for both the universities and individuals form the center of the observation. For further information, see http://www.guesssurvey.org/.

⁴ http://www.topuniversities.com/university-rankings/latin-american-university-rankings/2012

				Stand		Internal Reliability Analysis		
	Factor/ Variable	Description	Mean	Stand. Deviati on	Factorial Analysis	Cronbach's α	Item to Total Correlat ion	
		ATT01. Being an entrepreneur implies more advantages than disadvantages to me.	5.530	1.575			0.815	
	Attitudes toward	ATT02. A career as entrepreneur is attractive for me 5.470 1.602 KM					0.920	
	behavior (Liñán and Chen, 2009)	ATT03. If I had the opportunity and resources, I would become an entrepreneur.	5.790	1.604	$\chi^2 5040.59$ Sig. 0.000	0.907	0.881	
	,,	ATT04. Being an entrepreneur would entail great satisfactions for me.	5.760	1.583			0.922	
		SE01. Establish and achieve goals and objectives	6.060	1.205			0.724	
factors		SE02. Generate new ideas	5.690	1.372			0.766	
Motivational factors		SE03. Develop new products and services	5.160	1.596			0.781	
Motiva		SE04. Performing financial analysis	5.000	1.754			0.761	
	Entrepreneurial self-efficacy	SE05. Reduce risk and uncertainty	5.260	1.575	KMO 0.910		0.808	
	(Chen et al., 1998)	SE07. Make decisions under uncertainty and risk	5.340	1.562	χ^2 12557.82 Sig. 0.000	0.922	0.878	
		SE08. Manage time by setting goals	5.700	1.438			0.731	
		SE09. Take responsibility for ideas and decisions	6.020	1.386			0.703	
		SE10. Start my own firm	5.100	1.845			0.761	
		SE11. Lead my own firm to success	5.340	1.860			0.752	
ent	Subjective norms (Liñán and Chen, 2009)	SN01. Care about the opinion of parents/family	6.240	1.244	10.10.0.745	0.899	0.906	
Social Environment		SN02. Care about the opinion of friends	6.050	1.301	KMO 0.747 χ^2 3263.96 Sig. 0.000		0.911	
En		SN03. Care about the opinion of important people	6.260	1.130			0.918	
		EUE01. The university environment increased the students' attitudes, values and motivations.	4.720	1.832			0.915	
		EUE02. The university environment increased the students' entrepreneurial actions.	4.520	1.897			0.920	
eurial factors ng)	Entrepreneurial	EUE03. The university environment enhanced the students' managerial skills.	4.360	1.877			0.935	
Perception of entrepreneurial university environmental factors (education and training)	university environment (Soutaris et al.,	EUE04. The university environment enhanced the students' ability to develop networks.	4.420	1.836	KMO 0.933 χ^2 12044.59 Sig. 0.000		0.777	
tion of er ty enviro cation a	2007)	EUE05. The university environment enhanced the students' ability to identify opportunities.	4.630	1.893	Ü		0.902	
Percep universi (edu		EUE06. In the university environment the students found many entrepreneurial-mindset classmates.	4.370	2.006			0.847	
		EUE07. The university environment provided a favorable climate for becoming an entrepreneur.	4.580	1.940		0.907		
		EUE078. The university environment imparted classes and training in entrepreneurship.	4.220	2.068			0.907	

 Table 3.1: Reliability and convergent analysis

3.3.3. Data analysis

We adopted structural equation modeling (SEM) to analyze the results at the university level. SEM pinpoints causal relationships among the variables that integrate the proposed model of antecedents and consequences of entrepreneurial universities. This statistical technique has been widely used in behavioral sciences during the last decade (Shook et al., 2004) because it allows the examination of a set of relationships between one or more independent or dependent variables, either continuous or discrete (Tabachnick and Fidell, 1996). In addition, SEM allows for an estimate of the total, direct, and indirect effects among the variables proposed in the model. Based on that, we developed two models to explore the role of entrepreneurial university pathways on students' start-up via motivational factors (attitudes and self-efficacy): a construct (Model 1) as well as individual analysis of each motivational factor (Model 2). Unlike other models, the structural equation modeling does not allow for the inclusion of binary variables (the case of our control variables). Our solution is to create groups and test the model with all groups simultaneously. The sample was split into subsamples to perform the analysis by university.

3.4. Exploring the university environmental factors that condition the creation of students' start-ups in Latin America

3.4.1. Describing the Latin-American Entrepreneurial Universities' Contexts

Tecnológico de Monterrey (ITESM, MEXICO).⁵ It is a multi-campus university (33) present in 28 different cities throughout Mexico, where regional differences (economical, social, political, and geographical) are very significant. It is a private education system; thus, it must achieve financial self-sufficiency and face the characteristically highly competitive

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⁵ For further information, please visit: http://www.itesm.mx

environment of this sector in Mexico. It was founded in 1943 by a visionary group of local Monterrey businessmen, thus receiving an entrepreneurial orientation from its inception. In 2005, it redefined its mission and vision toward 2015, reflecting a clear entrepreneurial purpose. From 2005 to 2010, the Tecnológico de Monterrey created a network integrating 25 business incubators, 14 business accelerators, and 9 technological parks, becoming a leading university in entrepreneurship. Recently, its entrepreneurship ecosystem was selected as one of the six leading university-based entrepreneurship ecosystems in the world (Fetters et al., 2010) by entrepreneurship researchers from Babson College, which is recognized internationally for its entrepreneurial leadership. Nowadays, the Tecnológico de Monterrey is one of the leading private universites in Latin America, with more than 90,000 students and 4,000 professors. The institution is accredited by the United State's Southern Association of Colleges and Schools to offer undergraduate and graduate degrees. Tecnológico de Monterrey's more than 70 programs are also accredited by international and national accrediting organizations. In Mexico, the Tecnológico de Monterrey's leadership may be reflected by its alumni, who direct 18% of the country's most important companies and govern 20% of Mexican states. Tecnológico de Monterrey has a strong leadership in Latin America and is internationally recognized.

Universidad de Campinas (UNICAMP, Brazil). It is a state university established in 1966 in the city of Campinas, with the goal to become an academic center of excellence, producing world-class basic and applied research, providing high-standards undergraduate and graduate education, and serving as a catalyst for economic and social development. This university was designed to differentiate itself from other Brazilian universities—which were patterned after the French model—by emphasizing graduate studies and scientific research in

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⁶ For further information, please visit: http://www.unicamp.br

the tradition of American schools such as the Massachusetts Institute of Technology. After its creation, the university built a strong scientific base by attracting leading Brazilian scientists, many of whom were working abroad, and by concentrating massive government investments in state-of-the-art research laboratories. The university has developed an interdependent relationship with industry since its inception. Its emphasis in areas such as physics and electrical engineering has been paralleled by the development of a local telecommunications industry. Almost 20,000 students are enrolled in 125 different programs, 80 of which offer graduate degrees (including medicine, dentistry, several engineering specializations, basic natural and human sciences, applied sciences, education, and arts). Its admission process is one of the most competitive in Brazil, with nearly 52,000 candidates for 3,310 incoming students. In fact, the university boasts a higher number of top-rated graduate programs than the total of all schools in most Brazilian states (Dagnino and Velho, 1998). The university has 1,800 faculties, with a large research output—close to 10% of all indexed scientific papers in Brazil have a UNICAMP co-author. In addition, UNICAMP is the Brazilian organization with the largest technological output, with more than 50 patents requested each year since 2002. The university budget for 2011 was close to US\$1.6 million, with 80% originating from the state budget. Overall, UNICAMP is an internationally recognized center of academic excellence, with a very distinct profile among Brazilian higher education institutions as a leader in technology, health sciences, natural sciences, human sciences, and the arts.

Pontificia Universidad Católica de Chile (*UPC*, *Chile*). ⁷ It is a private university founded in 1888 by Monsignor Mariano Casanova (Archbishop of Santiago) with the goal of creating an institution capable of blending academic excellence and training based on the Christian doctrine. The relationship between the university and the Vatican began when the

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⁷ For further information, please visit: http://www.uc.cl

university was founded (Pope Leo XIII). The official juridical separation of church and state nonetheless arrived with the Constitution of 1925, but so important was the contribution of the Catholic university to the education of the elite's youth that two years later it was recognized by law as a "collaborator in the educational mission of the state" and given a monetary subsidy (Bernasconi, 2005). The university has always aimed to achieve a solid education, founded in the sciences, arts, humanities, and Catholic morals. Thus, the university aims for its students to be not only technically and scientifically prepared, but also to be open to different human realities and to the social and personal responsibilities involved in the complete development of a society. Pontificia Universidad Católica de Chile comprises 18 faculties that encompass a range of areas of study distributed across four campuses in Santiago and one in Villarrica in the south of Chile. Together, they offer applicants a wide array of undergraduate, graduate, certificate, and continuing education programs each year. In addition, to respond to complex problems that may arise across disciplines, UPC has created several research centers and programs. The combination of high academic standards, tough evaluation policies, research orientation, and significant incentives for good performance has brought about the emergence of academic entrepreneurs on campus (Bernasconi, 2005). Pontificia Universidad Católica de Chile has created a prestigious and nationally pertinent tradition that can be seen in its graduates, who have been educated to guide and provide a unique shape to the country.

Table 3.2 summarizes the descriptive analysis by university and by the main variables that define the profile of students interviewed in this sample. Interestingly, at the university level, these universities have a full comprehensive focus (cover all knowledge areas) and have similar size. By age, the UPC (private/catholic) is older than ITESM (private) and UNICAMP (public). At the student level, on average the student interviewed from ITESM is a female

(56%), 23.63 years old, enrolled, particularly, in management (33%) and engineering (20%) studies, and 1.23% of the students have entrepreneur parents. In contrast, from UNICAMP and UPC, the majority of interviewed students are male and less than 1% mentioned that their parents are entrepreneurs.

Т	Description	Universities						
Туре	Description	ITESM	UNICAMP	UPC				
General	Country	Mexico	Brazil	Chile				
	Profile	Private	Public	Private / Catholic				
	Age	68 years	45 years	123 years				
	Latin American Rankings (QS 2011)	$7^{ m th}$	$3^{\rm rd}$	$2^{\rm nd}$				
	Size (students 2011)	>= 12,000 students	>= 12,000 students	>= 12,000 students				
	Research	Moderate intensity	Very high intensity	High intensity				
	Focus	Full comprehensive (all knowledge areas)	Full comprehensive (all knowledge areas)	Full comprehensiv (all knowledge area				
	Subsample	531 students	758 students	470 students				
Students'	Gender (% male)	44.0 %	68.0 %	56.0 %				
profile in the	Age (years)	23.63 years	25.02 years	21.00 years				
sample	Years involved in the university (years)	3.45 years	2.66 years	2.20 years				
(averages)	Parents (% self-employed)	1.23 %	0.79 %	0.66 %				
	Start-up actions (index)	9.90	5.12	5.05				
	Start-up intentions (categorical)	Made an explicit decision to found a company	Repeatedly and relatively concrete	Repeatedly and relatively concrete				
	Academic Field	33.0% Management 20.0% Engineering 7.5% Economics 3.4% Medicine 36.1% Others	20.7% Management 41.8% Engineering 0.3% Economics 1.1% Medicine 36.1% Others	10.6% Management 33.4% Engineering 11.3% Economics 15.3% Medicine 29.4% Others				

Table 3.2: Descriptive analysis, 2011

Source: QS Rankings (2011), university websites, GUESSS database

3.4.2. The Role of Latin American Entrepreneurial University Environmental Factors on Students' Start-up

We estimated the theoretical model, employing the maximum-likelihood estimator. In particular, the quality of the measurement model presents adequate parameters [x² normalized 4.40; CFI 0.945; GFI 0.909 and RMSEA 0.029].8 Figure 3.2 summarizes the non-standardized

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⁸ Shook et al. (2004) argue that a good fit is showed when: the Root Mean Square Error of Approximation (RMSEA) is close or less than 0.05; the Comparative Fit Index (CFI) and Goodness

estimates and parameters for the coefficients of the main variables of our proposed model (for further details, see Figure 3.3 and 3.4).

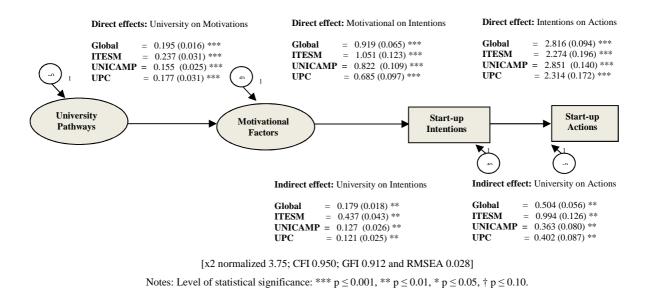


Figure 3.2: Direct and indirect effect of entrepreneurial university pathways

The sample was also controlled by the length of the students' involvement in the university. Interestingly, the coefficient of this variable is significant only in the entire sample (0.170 at p< 0.001) and in the Mexican university (0.168 at p< 0.010). In general, the results showed that internal entrepreneurial university pathways have a positive and significant effect on motivational factors but lower than 1 (Global: 0.195 at p< 0.001; ITESM: 0.237 at p< 0.001; UNICAMP: 0.155 at p< 0.001; UPC: 0.177 at p< 0.001). Moreover, the indirect effect of entrepreneurial university pathways on students' start-up intentions—mediated by motivational factors—is 0.179 at p< 0.001 in the entire sample.

By university, the indirect effect observed is higher in the Mexican university (0.437 at p< 0.001) than in the Brazilian university (0.127 at p< 0.001) and Chilean university (0.121 at

of fit index (GFI) are at least 0.80 or higher; and the x2 normalized is low as 2 indicates a reasonable fit.

p< 0.001). Therefore, the mediating effect⁹ of motivational factors is proximally 16% in the entire sample, 34% in the ITESM, 13% in the UNICAMP, and 15% in the UPC (see Figure 3.3). In other words, the evidence confirms the relevant role of the perception of entrepreneurial education and training provided by the university on the students' start-up intentions via motivational factors (reinforcing the attitudes toward entrepreneurship and individual self-efficacy).

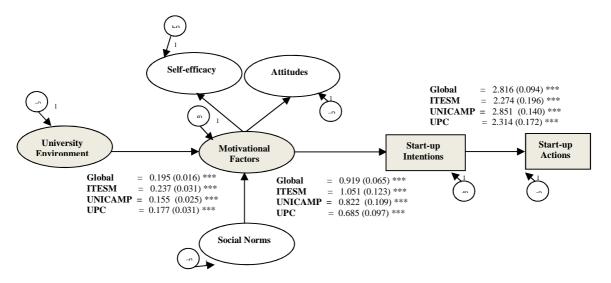
It is interesting to mention that by university the higher effects are observed in the ITESM, evidencing the positive results behind all the innovative university pathways implemented in this university as well as influenced by the student's profile because a higher percentage of its students are part of entrepreneurial families. But there are other university factors that also need to be taking into account in future research, such as the relevance of traditions, organizational culture, and other support measures like incubators and technology transfer centres (Bernasconi, 2005; Guerrero and Urbano, 2012). As a consequence, these results support our H1, which states that entrepreneurial university environmental factors have a positive effect on students' start-up intentions (mediated by motivational factors).

Figure 3.2 also shows the positive effect of motivational factors on start-up intentions (Global: 0.919 at p< 0.001; ITESM: 1.051 at p< 0.001; UNICAMP: 0.822 at p< 0.001; UPC: 0.685 at p< 0.001). Indirectly, the motivational factors produced a mediated effect on entrepreneurial action in all universities. In other words, more than 45% of the relation between start-up intentions and start-actions is attributed to motivational factors. Based on that, it was possible to estimate the simultaneous indirect effect of entrepreneurial university

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⁹ A related measure of mediation is the proportion of the effect that is mediated, or the indirect effect divided by the total effect (ab/c) (Sobel, 1982)

pathways on start-up actions. We observed a strong indirect effect (Global: 0.504 at p< 0.001; ITESM: 0.994 at p< 0.001; UNICAMP: 0.363 at p< 0.001; UPC: 0.402 at p< 0.001).

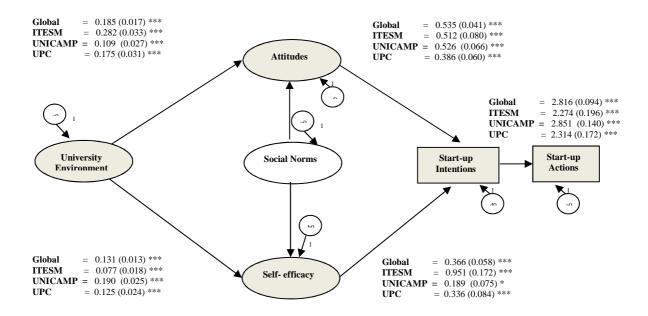


[x2 normalized 3.75; CFI 0.950; GFI 0.912 and RMSEA 0.028]

Main relations				Global		ITESM			UNICAMP			UPC		
			Coef.	S.E.	P	Coef	S.E.	P	Coef	S.E.	P	Coef	S.E.	P
Startup_actions	<	Startup_intentions	2.816	0.094	***	2.274	0.196	***	2.851	0.140	***	2.314	0.172	***
Startup_intentions	<	Motivations	0.919	0.065	***	1.051	0.123	***	0.822	0.109	***	0.685	0.097	***
Attitudes	<	Motivations	1.000			1.000			1.000			1.000		
Self_Efficacy	<	Motivations	0.538	0.036	***	0.425	0.051	***	0.728	0.078	***	0.509	0.060	***
Motivations	<	EU_environment	0.195	0.016	***	0.237	0.031	***	0.155	0.025	***	0.177	0.031	***
Motivations	<	Social Norms	0.417	0.026	***	0.416	0.053	***	0.374	0.035	***	0.402	0.058	***
$Startup_intentions$	<	years_school	0.170	0.028	***	0.174	0.062	**	0.069	0.043		0.057	0.045	
EUE02	<	EU_environment	1.053	0.019	***	0.971	0.031	***	1.099	0.040	***	1.021	0.031	***
EUE03	<	EU_environment	1.068	0.022	***	1.009	0.034	***	1.151	0.045	***	1.020	0.036	***
EUE04	<	EU_environment	0.969	0.022	***	0.914	0.037	***	1.035	0.046	***	1.028	0.037	***
EUE05	<	EU_environment	1.017	0.023	***	1.021	0.037	***	1.057	0.047	***	0.998	0.039	***
EUE06	<	EU_environment	1.016	0.026	***	0.991	0.040	***	1.029	0.051	***	0.928	0.042	***
EUE07	<	EU_environment	0.873	0.026	***	0.915	0.044	***	0.909	0.049	***	0.794	0.045	***
EUE08	<	EU_environment	0.961	0.027	***	0.918	0.045	***	0.987	0.052	***	0.897	0.047	***
EUE01	<	EU_environment	1.000			1.000			1.000			1.000		
Att2	<	Attitudes	1.283	0.036	***	1.211	0.056	***	1.481	0.073	***	1.212	0.060	***
Att3	<	Attitudes	1.197	0.035	***	1.084	0.055	***	1.374	0.072	***	1.177	0.061	***
Att4	<	Attitudes	1.288	0.035	***	1.160	0.052	***	1.541	0.075	***	1.179	0.058	***
Att1	<	Attitudes	1.000			1.000			1.000			1.000		
SE02	<	Self_Efficacy	1.295	0.046	***	1.238	0.110	***	1.320	0.064	***	1.315	0.085	***
SE03	<	Self_Efficacy	1.576	0.061	***	1.521	0.147	***	1.573	0.088	***	1.661	0.114	***
SE04	<	Self_Efficacy	1.752	0.067	***	1.769	0.169	***	1.717	0.093	***	1.872	0.128	***
SE05	<	Self_Efficacy	1.608	0.059	***	1.769	0.165	***	1.554	0.080	***	1.679	0.109	***
SE08	<	Self_Efficacy	1.212	0.045	***	1.149	0.108	***	1.205	0.063	***	1.300	0.086	***
SE09	<	Self_Efficacy	1.060	0.043	***	0.864	0.089	***	1.078	0.065	***	1.109	0.078	***
SE10	<	Self_Efficacy	1.664	0.071	***	1.795	0.171	***	1.536	0.100	***	1.810	0.135	***
SE01	<	Self_Efficacy	1.000			1.000			1.000			1.000		
SE11	<	Self_Efficacy	1.582	0.068	***	1.587	0.161	***	1.489	0.096	***	1.715	0.130	***
SN2	<	Social Norms	1.043	0.025	***	1.023	0.042	***	1.051	0.038	***	0.993	0.050	***
SN1	<	Social Norms	1.000			1.000			1.000			1.000		
SN3	<	Social Norms	0.975	0.021	***	1.054	0.041	***	0.970	0.032	***	0.936	0.044	***

Notes: Level of statistical significance: *** $p \le 0.001$, ** $p \le 0.01$, * $p \le 0.05$, † $p \le 0.10$.

Figure 3.3: Regression weights (All universities—Model 1)



[x2 normalized 4.04; CFI 0.945; GFI 0.909 and RMSEA 0.029]

Main relations			Global			ITESM			UNICAMP			UPC		
			Coef.	S.E.	P	Coef	S.E.	P	Coef	S.E.	P	Coef	S.E.	P
Startup_actions	<	Startup_intentions	2.816	0.094	***	2.274	0.196	***	2.851	0.140	***	2.314	0.172	***
Startup_intentions	<	Self_Efficacy	0.366	0.058	***	0.951	0.172	***	0.189	0.075	*	0.336	0.084	***
Startup_intentions	<	Attitudes	0.535	0.041	***	0.512	0.080	***	0.526	0.066	***	0.386	0.060	***
Attitudes	<	EU_environment	0.185	0.017	***	0.282	0.033	***	0.109	0.027	***	0.175	0.031	***
Self_Efficacy	<	EU_environment	0.132	0.013	***	0.077	0.018	***	0.190	0.025	***	0.125	0.024	***
Attitudes	<	Social Norms	0.447	0.027	***	0.399	0.054	***	0.411	0.036	***	0.446	0.060	***
Self_Efficacy	<	Social Norms	0.231	0.020	***	0.218	0.033	***	0.266	0.029	***	0.190	0.043	***
Startup_intentions	<	years_school	0.170	0.028	***	0.168	0.061	**	0.060	0.042		0.056	0.045	
EUE02	<	EU_environment	1.053	0.019	***	0.971	0.031	***	1.099	0.040	***	1.021	0.031	***
EUE03	<	EU_environment	1.068	0.022	***	1.009	0.034	***	1.151	0.045	***	1.020	0.036	***
EUE04	<	EU_environment	0.969	0.022	***	0.914	0.037	***	1.035	0.046	***	1.028	0.037	***
EUE05	<	EU_environment	1.017	0.023	***	1.021	0.037	***	1.057	0.047	***	0.998	0.039	***
EUE06	<	EU_environment	1.016	0.026	***	0.991	0.040	***	1.029	0.051	***	0.928	0.042	***
EUE07	<	EU_environment	0.873	0.026	***	0.915	0.044	***	0.909	0.049	***	0.794	0.045	***
EUE08	<	EU_environment	0.961	0.027	***	0.918	0.045	***	0.987	0.052	***	0.897	0.047	***
EUE01	<	EU_environment	1.000			1.000			1.000			1.000		
Att2	<	Attitudes	1.283	0.036	***	1.211	0.056	***	1.481	0.073	***	1.212	0.060	***
Att3	<	Attitudes	1.197	0.035	***	1.084	0.055	***	1.374	0.072	***	1.177	0.061	***
Att4	<	Attitudes	1.288	0.035	***	1.160	0.052	***	1.541	0.075	***	1.179	0.058	***
Att1	<	Attitudes	1.000			1.000			1.000			1.000		
SE02	<	Self_Efficacy	1.295	0.046	***	1.238	0.110	***	1.320	0.064	***	1.315	0.085	***
SE03	<	Self_Efficacy	1.576	0.061	***	1.521	0.147	***	1.573	0.088	***	1.661	0.114	***
SE04	<	Self_Efficacy	1.752	0.067	***	1.769	0.169	***	1.717	0.093	***	1.872	0.128	***
SE05	<	Self_Efficacy	1.608	0.059	***	1.769	0.165	***	1.554	0.080	***	1.679	0.109	***
SE08	<	Self_Efficacy	1.212	0.045	***	1.149	0.108	***	1.205	0.063	***	1.300	0.086	***
SE09	<	Self_Efficacy	1.060	0.043	***	0.864	0.089	***	1.078	0.065	***	1.109	0.078	***
SE10	<	Self_Efficacy	1.664	0.071	***	1.795	0.171	***	1.536	0.100	***	1.810	0.135	***
SE01	<	Self_Efficacy	1.000			1.000			1.000			1.000		
SE11	<	Self_Efficacy	1.582	0.068	***	1.587	0.161	***	1.489	0.096	***	1.715	0.130	***
SN2	<	Social Norms	1.043	0.025	***	1.023	0.042	***	1.051	0.038	***	0.993	0.050	***
SN1	<	Social Norms	1.000			1.000			1.000			1.000		
SN3	<	Social Norms	0.975	0.021	***	1.054	0.041	***	0.970	0.032	***	0.936	0.044	***

Notes: Level of statistical significance: *** $p \le 0.001$, ** $p \le 0.01$, * $p \le 0.05$, † $p \le 0.10$.

Figure 3.4: Regression weights (All universities—Model 2)

		Direct effects			Indirect	effects	- c1'/	c2' /	
Sample	Variables	Motivational	Intentions	Actions	Intentions	Actions	(b1 + ab1)	(b2+ab2)	
		a	b1	b2 2.816	c1	c2			
	Intentions			(0.094)					
	Motivations		0.919 (0.615) ***	***		2.589 (0.215) **		48%	
GENERAL	University	0.195 (0.016) ***			0.179 (0.018) **	0.504 (0.056) **	16%	15%	
	Subjective norms	0.417 (0.026) ***			0.383 (0.032) **	1.079 (1.000) **	29%	27%	
	Intentions			2.274 (0.196) ***					
	Motivations		1.051 (0.123) ***			2.391 (0.484) **		51%	
ITESM	University	0.237 (0.031) ***			0.437 (0.043) **	0.994 (0.126) **	34%	35%	
	Subjective norms	0.416 (0.053) ***			0.437 (0.086) **	0.994 (0.249) **	29%	31%	
	Intentions			2.851 (0.014) ***					
	Motivations		0.822 (0.109) ***			2.344 (0.349) ***		45%	
UNICAMP	University	0.155 (0.025) ***			0.127 (0.026) **	0.363 (0.080) **	13%	11%	
	Subjective norms	0.374 (0.035) ***			0.308 (0.039) **	0.877 (0.139) **	27%	22%	
	Intentions			2.314 (0.172) ***					
	Motivations		0.685 (0.097) ***	<u> </u>		2.272 (0.385) **		58%	
UPC	University	0.177 (0.031) ***			0.121 (0.025) **	0.402 (0.070) **	15%	15%	
	Subjective norms	0.402 (0.058) ***			0.276 (0.048) **	0.914 (0.181) **	29%	28%	

Table 3.3: Indirect effects of entrepreneurial university environment (All universities—Model 1)

In these cases, the mediating effect represents proximally 15% in the entire sample, 35% in the ITESM, 11% in the UNICAMP, and 15% in the UPC (see Table 3.3). Interestingly, with exception of ITESM, where the effects are almost the same, the indirect effect of university pathways on start-up is lower than the effect of subjective norms on start-

⁽¹⁾ Level of statistical significance: *** $p \le 0.001$, ** $p \le 0.01$, * $p \le 0.05$, † $p \le 0.10$.
(2) Total effect(c) = direct effect (c') + indirect effect (ab). A related measure of mediation is the proportion of the effect that is mediated, or the indirect effect divided by the total effect (ab/c) (Sobel 1982)

up actions. This means that the students are more influenced by the society or reference people than the actions promoted by their universities. Therefore, these results support our H2, which states that entrepreneurial university environmental factors have a positive effect on students' start-up actions (by the indirect impact observed on start-up intentions).

3.5. Conclusions

Entrepreneurship is a phenomenon observed among all university levels: management, academicians, researchers, and undergraduate and postgraduate students. According to Audretsch and Keilbach (2007), entrepreneurship is another element in the production function because entrepreneurship contributes to output and growth by serving as a conduit for knowledge spillovers, increasing competition, and injecting diversity. Thus, an entrepreneurial university could attract or generate new enterprises that promote competition and diversity (Clarysse et al., 2005; Shane, 2004; Vohora et al., 2004; Wright et al., 2007). These effects could then produce several externalities in terms of demography, economy, infrastructure, culture, mobility, education, and societal challenges that will later be reflected in productivity, competitive advantages, and regional capacities, networks, identity, and innovation (Powers and McDougall, 2005; Guerrero et al., 2015).

For all these reasons, universities develop innovative pathways to reinforce entrepreneurship in their university community. This chapter explores the role of entrepreneurial university pathways (education and training) on students' startup intentions and actions. Adopting the institutional economics, this research proposed a conceptual model that was tested with a sample integrated with students enrolled in three entrepreneurial universities (ITESM, UNICAMP, and UPC) in Latin America. The results confirm the

relevant effect of entrepreneurial university pathways on startup creation (Guerrero and Urbano, 2015).

The main limitations of this study include that it is a cross-sectional study. The database only covers the effect during one year. However, as there are still too few universities in Latin America with entrepreneurial activity and no other database exists in this field, the GUESSS database currently represents an interesting opportunity to conduct an empirical, quantitative study on this subject. Several future research opportunities can be identified. A first option may be the conducting of a deeper, qualitative study on these three Latin American universities (ITESM, UNICAMP, and UPC). A second possibility, in addition to analyzing the impact of internal factors on the amount of new ventures created, may be to address questions regarding the effect of specific configurations of resources and capabilities on better, more successful new ventures. Other natural extensions could be the economic and social impact of these universities in the region where they are located.

In general, the empirical evidence clearly shows the positive impact of entrepreneurial university environmental factors on the number of new ventures created. These findings could also contribute to the design of policies needed to develop entrepreneurial universities in Latin America. These results evidenced the effect of environmental factors of entrepreneurial university but also there are other internal factors that are explored in the next chapter.

CHAPTER IV. ENTREPRENEURIAL UNIVERSITY'S INTERNAL FACTORS THAT CONDITION THE CREATION OF STUDENTS' STARTUPS IN MEXICO: A RESOURCE-BASED VIEW

4.1. Introduction

According to the eclectic model of entrepreneurial university proposed in Chapter II, environmental and internal factors determine the university's entrepreneurial activities (entrepreneurial behaviors/actions of students) that in turn generate socioeconomic impacts (graduates' career decisions). Particularly, adopting the *Resource Based View* as the theoretical framework, this chapter pays attention to the effect of internal resources on students' start-ups.

Many regions in the world are demanding that their universities engage in the more challenging mission of giving a direct and significant stimulus to their communities' economic development (Zaharia and Gibert, 2005; O'Shea et al., 2007 and 2008). As a result, an entrepreneurial university faces a highly competitive environment when trying to achieve its new mission of enhancing its community economically through the development of an entrepreneurial culture (Clark, 1998; Guerrero and Urbano, 2012).

Therefore, a correct identification of internal factors, which might represent strengths or weaknesses, becomes crucial, as an entrepreneurial university needs to design and implement better strategies for combining current as well as new resources (Antoncic and Hisrich, 2001). Based on those arguments, the main purpose of this research is to explore the major entrepreneurial university's internal resources that condion the creation of students' start-ups. Given the difficulties to obtain information from different universities, we analyze the case of a multi-campus university distributed in more than 20 different cities, with prescence in practically all regions of Mexico. Therefore, this chapter considers a set of 25 campuses from the same university. It allows us to explore the effect of internal resources provided by one organization located in different regions.

After this introduction, this chapter is organized as follows: Section 4.2 explains the internal resources that determine university entrepreneurship. Section 4.3 describes the methodological design to empirically test this section of our proposed eclectic model. Section 4.4 presents the main findings that are discussed in the light of previous studies. Section 4.5 summarizes the main conclusions, limitations and implications.

4.2. Conceptual framework

Reviewing the literature on entrepreneurship, one can find several studies (Borch et al., 1999; Mathews 2002; Hayton, 2005; Newbert et al., 2008; Powers and McDougal, 2005; Chadwick and Dabu, 2009) using the RBV Theory to explain and predict the entrepreneurial activities of organizations, mainly those for-profit. The outcomes of these activities are consequences of the resource sets that organizations possess and their capabilities to organize them and generate synergy or advantages from those resources. Although the resource-based view of the firm was largely developed from studies of the for-profit sector, its application in higher education is useful for sharpening an understanding of organizational phenomenon, such as the new venture creation that occurs there. The conceptualization of universities from within a competitive environment of peer institutions is valid, given their current reality, which is the competetive environment in which they operate. Moreover, higher education organizations have been characterized as confronting a revolutionary change (Kennedy, 1995).

Today, higher education organizations compete for research and entrepreneurship funds, quality faculty, and top students. Competition for these financial and human capital resources has become especially sharp in light of the fact that more institutions are seeking a share of limited federal and state funds, proselytizing each other's best faculty, and trying to attract the

brightest students. Furthermore, a culture of competition has also emerged, attributable to annual rankings published by different sources (McDonough et al., 1998). The environment in which the university is immersed has become increasingly competitive and market-like (Zemsky et al., 1997).

Given the tenets of the resource-based view as applied to entrepreneurial universities, certain resources may provide a university with entrepreneurial activity advantages. As the entrepreneurship outcome of universities is focused on their contribution to their regions development, the outcome of entrepreneurial universities may be related to the number of new ventures generated (Mian, 1996 a,b; Clarysse et al., 2005; Bøllingtoft and Ulhøi, 2005; Del Palacio et al., 2006). This study examines the two types of internal factors and hypothesizes that individuality may be a significant predictor of university entrepreneurial activity in the form of new venture creation.

4.2.1. Hard resources: financial and physical

Several authors emphasize the importance of both the amount and the source-diversity of funds for entrepreneurial activities of universities, such as large-scale science projects with industry, government, or others (Doutriaux, 1991; Klofsten and Jones-Evans, 2000). Powers and McDougall (2005) find a positive and statistically significant relationship between annual university-wide RandD expenditure and spin-off activity. Lazzareti and Tavoletti (2005) mention the capability of the University of Twente to get money from both government and market as one of its success factors as an entrepreneurial university. Benneworth (2007) says the same for the University of Newcastle, Kirby (2005) for the University of Surrey, O'Shea et al. (2007) for MIT, and others (Clark, 1998; Zaharia and Gibert, 2005; Vestergaard, 2007) for entrepreneurial universities in general.

Several studies have identified a university's facilities and infrastructure as key factors for the success of entrepreneurial activities (Etzkowitz, 1998; O'Shea et al., 2005 and 2007; Benneworth, 2005). In the case of Surrey University, Kirby (2005) emphasizes the importance of physical resources, such as infrastructure, for the pre-incubator, the incubator, and the scientific park. In the case of Twente, Lazzareti and Tavoletti (2005) also recognize the importance of appropriate infrastructure to effectively incubate spin-offs until they are ready to enter the Science and Business Park, which occupies more than 140 hectares and houses almost 200 new ventures. Based upon the evidence cited above, it is likely that hard resources for business incubation, specifically funding and physical resources, represent critical factors to universities as would be predicted by the resource-based view. Therefore, the following hypothesis can be proposed:

H1: Hard resources of a university (HR), including funding received for business incubation and physical resources available for entrepreneurs will be positively related to the number of new ventures created by the university.

4.2.2. Soft resources: human and organizational

Human resources are associated with the university community: administrators, academics, specialized experts, other non-academic staff, and students (Dill, 1995; Henkel, 1997; Sporn, 2001; Sotirakou, 2004; Powers and McDougall, 2005; Di Gregorio and Shane, 2003). Bercovitz and Feldmann (2006) observed that the number of the teaching and research staff is one of the metrics used by governments when reporting key resources of entrepreneurial universities. Several authors also included as key resources the other experts with specialized skills, such as technology transfer officers and business development

managers (Benneworth, 2007), as well as innovation network managers and intellectual property advisors (Kirby, 2005). Lazzeroni and Piccaluga (2003) emphasized the importance of having enough students, especially in graduate programs and in scientific and technological disciplines, as a crucial resource for the success of entrepreneurial universities.

According to this evidence, therefore, a university with sufficient human resources, including academics, specialized experts, and students, would be expected to conduct better entrepreneurial activities than would a university with a reduced staff. As mentioned previously, organizational resources include intangible assets, such as experience, prestige, status, and other factors (Grant, 1996). A critical organizational resource for the success of entrepreneurial activities in the university is access to persons with expert knowledge and talent as well as entrepreneurship experience as business owners. Attracting and retaining high-quality faculty and staff, however, require considerable time, effort, and financial investment. Hence, it is a likely source of competitive advantage (Powers and McDougal, 2005). Previous research on the value of university researchers and business experts provides evidence of this fact, relating experience, talent, and reputation to entrepreneurship success (Rosenberg and Nelson, 1994; Narin et al., 1997; Deeds et al., 1999; Bozeman, 2000).

The literature suggests that institutions with older entrepreneurship-related departments often outperform those with newer, perhaps due to the longer period needed to develop the resource of specific skill sets useful to facilitating the entrepreneurial activities of the university (Matkin, 1990; Roberts and Malone, 1996). Other studies describe quality of entrepreneurship experts in terms of: radical innovation ability, project management skills, risk taking capacity, and experience in new venture creation (Lazzeroni and Piccaluga, 2003; Kirby, 2005; Zaharia and Gibert, 2005; Benneworth, 2007; O'Shea et al., 2007). Given this

evidence, a university that has built a high-quality faculty and business-expert team, an acheivement that takes considerable time, effort, and resources, will likely be more successful in its entrepreneurship education efforts than will be a university with a faculty and staff of lesser quality. Based on the evidence presented from the literature on the relevance of soft resources, including both human resources and organizational capabilities, hypothesis 2 is proposed.

H2: Soft resources of a university (SR), including human resources dedicated to entrepreneurial activities and their experience as business owners, will be positively related to the number of new ventures created by the university.

Integrating the two proposed hypothesis with the RBV perspective of the entrepreneurial university, the conceptual model shown in Figure 4.1 is proposed.

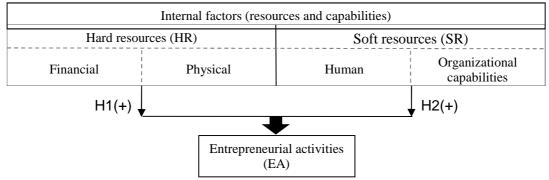


Figure 4.1: A proposed conceptual model

4.3. Methodology

4.3.1. Tecnológico de Monterrey

To analyze the relationship between internal factors and entrepreneurial activities of universities, the case of the *Tecnológico de Monterrey* has been selected. Several

characteristics of the *Tecnológico de Monterrey* could be of special interest and differentiate this research from others.

- (a) It is a case from an economy in transition in Latin America, while most studies of the entrepreneurial university have been conducted in Europe and some developed countries from other regions.
- (b) It is a multi-campus university (33) present in 28 different cities throughout Mexico, where regional differences (economical, social, political, and geographical) are very significant.
- (c) It is a private education system; thus, it must achieve financial self-sufficiency and face the characteristic high-competition environment of this sector in Mexico.

This university was founded in 1943 by a visionary group of local Monterrey businessmen, thus receiving an entrepreneurial orientation from the beginning. In 2005 it redefined its mission and vision towards 2015, reflecting a clear entrepreneurial purpose. From 2005 to 2010, the *Tecnológico de Monterrey* created a network integrated into 25 business incubators, 14 business accelerators, and 9 technological parks, becoming a leading university in entrepreneurship. Recently, its entrepreneurship ecosystem has been selected as one of the six leading university-based entrepreneurship ecosystems in the world (Fetters et al. 2010) by entrepreneurship researchers from Babson College, which is recognized internationally for its entrepreneurial leadership. Today, the *Tecnológico de Monterrey* is one of the leading private universites in Latin America, with more than ninety thousand students and four thousand professors. The institution is accredited by the United State's Southern Association of Colleges and Schools to offer undergraduate and graduate degrees. *Tecnológico de Monterrey*'s more than 70 programs are also accredited by international and

national accrediting organisms. In Mexico, the *Tecnológico de Monterrey*'s leadership may be reflected by its alumni, who direct 18% of the country's most important companies and govern 20% of Mexican states. *Tecnológico de Monterrey* has a strong leadership in Latin America and is internationally recognized.

4.3.2. Data collection and analysis

A database with 50 observations containing information on the entrepreneurial activity of all the *Tecnológico de Monterrey*'s 25 campuses that operate a business incubator is the source for the empirical analysis. Observations correspond to the annual periods 2008-2009 and 2009-2010. This database was built and provided by the *Vicerrectoría Asociada de Emprendimiento*, an centralized entity in charge of monitoring the university's entrepreneurial efforts occurring in all 25 campuses enrolled in this program. From this database, the source for the university's entrepreneurial activity measure (EA, the dependent variable) is the number of new ventures created by the campus' business incubator (Table 4.1).

	Type	Variable	Description
	ependent ariable	Entrepreneurial activity (EA)	Number of new ventures created.
		Financial resources (FR)	Funds obtained from federal government programs for business incubation (in thousand \$USD).
		Physical resources	
··	Hard	Incubation offices (OI)	Number of available offices for business incubation.
ariable	resources (HR)	Staff offices (OS)	Number of available offices for staff in the incubator.
ident va		Meeting/lecture/ rooms (MR)	Number of rooms for meetings, lectures, and office services in the business incubator.
Independent variables	Soft	Human resources (HU)	Number of entrepreneurship instructors and specialized business consultants available to support business incubation.
	resources (SR)	Organizational resources (OR)	Average experience as business owner of instructors and specialized consultants.
Cont	rol variable	State's GDP (GDP)	Per capita GDP of the Mexican state where the incubator is located.

Table 4.1: Variables description

Independent variables are defined as follows. Regarding hard, financial resources (FR), data source is the amount of funds obtained from federal government programs for business incubation during the year. In reference to hard, physical resources, variables are the number of available offices for business incubation (OI), number of offices for staff (OS), and number of rooms for meetings, lectures and office services (MR) in the business incubator. To measure soft, human resources conducting or supporting university entrepreneurial activities (HU), the number of entrepreneurship instructors and specialized business consultants are considered. In regard to soft, organizational resources or capabilities (OR), the variable used is the average experience as business owners of entrepreneurship instructors and specialized business consultants (in years). The control variable is the incubator state's *per capita* GDP, taken from the Bank of Economic Information of the National Institute of Statistics and Geography of Mexico (INEGI, 2009). GDP may be a proxy to regional wealth, and has previously been used as control variable in other entrepreneurship studies.

As mentioned before in this research, university entrepreneurial activity is conditioned by internal factors (hard and soft resources). Thus, the following model may be stated:

$$EA = \alpha + \beta_1 HR + \beta_2 SR + \beta_3 GDP + \varepsilon$$
.

Where: EA represents the university entrepreneurial activity; HR is hard resources, financial and physical, for the university entrepreneurial activity; SR represents soft resources (human resources and organizational capabilities) for entrepreneurship; GDP is the state's per capita GDP; ε represents the error in the model. In this study, descriptive statistics is used to calculate the model's variables, and factor analysis is used to group variables in hard and soft resources and to avoid high correlation measures between two or more independent variables.

Linear regression and correlation analysis are used to determine the relationships between the dependent variable and independent variables, as well as their statistical significance.

4.4. Results and discussion

Table 4.2 shows the descriptive statistics of the model's variables before the factor analysis. The mean of university entrepreneurial activity (EA) is 58.04, with a standard deviation of 41.16. This table reflects the high variability of entrepreneurial activity among the different campuses of the *Tecnológico de Monterrey*. The average values of independent variables show financial resources (FR) is \$100.52 (USD); the number of incubation offices (OI) is 9.94; the number of staff offices (OS) is 2.94; the number of meeting, lecture, and service rooms (MR) is 1.94; the instructors and business consultants (HU) is 18.38; the experience of instructors and consultants (OR) is 7.86; and the *per capita* GDP is \$8,340 (USD).

		I	Hard re	sources	Soft res			
Descriptives	EA	FR	OI	OS	MR	HU	OR	GDP
Mean	58.04	100.52	9.94	2.94	1.94	18.38	7.86	8.34
Std. Dev.	41.16	121.71	8.06	1.97	1.98	11.34	8.00	3.87
N	50	50	50	50	50	50	50	50

Table 4.2: Descriptive statistics

All these independent and control variables also have large standard deviations, as does the dependent variable, confirming the significant differences between the *Tecnológico de Monterrey*'s campuses. The result of the factor analysis performed to integrate variables into hard and soft resources and eliminate correlation among independent variables is satisfactory, as KMO measure of sample adequacy is 0.688 and Chi-square of Bartlett's test of sphericity is 84.4, with a significance of 0.000. As can be observed in Table 4.3, independent variables

are grouped into components "Hard resources" and "Soft resources", explaining 64% of the total variance of the model. Table 4.4 shows the descriptive statistics and the correlation matrix of the model's variables. Correlation coefficients among independent variables are very low, indicating there are not multicollinearity problems.

	Component				
Variable	Hard Res.	Soft Res.			
Financial resources (FR)	0.876	_			
Incubation offices (OI)	0.808				
Meet/lect/serv rooms (MR)	0.791				
Staff offices (OS)	0.753				
Human resources (HU)		0.714			
Organizational resources (OR)		0.707			

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.

 Table 4.3: Rotated Component Matrix

	Descript	ive statistics	Correlation matrix - Pearson correlation				
Variables	Mean	StdDev	EA	HR	SR		
EA	58.04	41.16					
HR	0.00	1.00	0.525 (0.000)				
SR	0.00	1.00	0.301 (0.017)	0.000 (0.500)			
GDP	8.34	3.87	0.012 (0.466)	0.380 (0.003)	-0.094 (0.258)		

Significance value in parenthesis

Table 4.4: Descriptive statistics and correlation matrix

According to Table 4.5, the R Square of the model is 0.601, which means the model explains 60% of the university's entrepreneurial activity's total variability. Confirming this result on the model's validity, the ANOVA analysis shows an F value of 10.0, with a significance of 0.000. The result for hard resources (HR), with a standardized coefficient of 0.596 at a significance level of 0.000, confirms H1 (HR→EA). As most case studies on entrepreneurial universities emphasize (Kirby, 2005; Benneworth, 2005; Lazzareti and Tavoletti, 2005; Powers and McDougall, 2005), the analysis of the empirical evidence of this study demonstrates hard resources such as funding and physical facilities are resources of

very high importance in the new venture creation efforts of universities. This positive impact of financial and physical resources might be of greater importance in developing countries, as most of their entrepreneurs need financial support to pay for assistance with the design of business models, development of business plans, office infrastructure to initially operate their new ventures, and other services provided by business incubators.

	Standardized Coefficients	Significance
HR	0.596	0.000***
SR	0.284	0.018 **
GDP	-0.187	0.140***
(Constant)		0.000***
\mathbb{R}^2	0.601	
ANOVA-F	16.9	0.000***
Observations	50	

^{***} p < 0.01; ** p < 0.05; * p < 0.10

Table 4.5: Regression model, dependent variable: EA

Entrepreneurial universities must design effective strategies and develop personnel skills intended to obtain sufficient financial resources in order to increase the number of new ventures created by entrepreneurs in their business incubators. Lowering the cost of incubation services is also a way of increasing the availability of financial resources. Universities may design and implement innovative, less expensive incubation schemes. For instance, incubation models based on the use of effective on-line and virtual resources rather than more expensive business consultants can enable universities' incubators to serve a much greater number of entrepreneurs, even with a limited amount of funds and facilities. On-line and virtual resources may include electronic tutorials, handbooks, formats, rubrics, web pages, e-mail communication and feedback, quick guides, worksheets, tools for business plan evaluation, virtual offices, and many others.

The result for soft resources (SR), with a standardized coefficient of 0.284 at a significance level of 0.018, confirms H2 (SR \rightarrow EA). This empirical evidence states the greater the number of members in the staff supporting the new venture creation effort and the greater the experience as business owners of the staff members, the greater the number of new enterprises created in an entrepreneurial university, as suggested by several authors of case studies on the entrepreneurial university (Lazzeroni and Piccaluga, 2003; Benneworth, 2005). This significant, positive relationship between soft resources and the entrepreneurial activity of the university confirms that having an adequate size staff allows a business incubator to support all the potential entrepreneurs demanding assistance in their new venture projects. It also allows the experience of staff members as business owners to make them more effective in guiding the new venture creation projects of entrepreneurs. However, having a large and experienced staff might be very expensive. Thus, business incubators must design effective strategies to overcome this disadvantage and ensure that the size and experience of their staff do not have a negative impact on the number of new ventures created. For instance, the integration of boards of advisors, formed by volunteer, successful business owners, represents a non-expensive alternative to grow an incubator's experienced staff. These usually very busy volunteers dedicate just a few hours of their time each month to listen and give feedback on entrepreneurs' reports of their new ventures.

In addition, the organization of staff members in hierarchically structured groups enables a small number of experienced consultants to impact a larger number of entrepreneurs than the number impacted by a one-to-one approach. Each experienced consultant guides and supervises a group of less experienced staff members, each one supporting a certain number of entrepreneurs. It is interesting to note the difference between the coefficients of hard and soft resources (see Table 4.5). The coefficient of hard resources is 0.596 and the soft

resources' is 0.284, resulting in a 2:1 ratio. This means that each additional unit of hard resources has double the effect of an additional unit of soft resources on the amount of new ventures created by a university's business incubator. Decision making in the entrepreneurial university, therefore, should favor funding and facilities for incubation over the number of specialized and experienced staff. These results of the empirical evidence analysis confirm the importance of internal factors of universities on their entrepreneurial activity, as stated in the RBV Theory.

The control variable GDP, with a standardized coefficient of -0.187, has a negative relationship with the entrepreneurial activity of the university. However, this relationship cannot be confirmed, as its significance level is 0.140. A negative relationship would reflect the higher need of regions with a lower *per capita* GDP to create new ventures as a means of generating new jobs and enhancing their economic performance. On the other hand, regions with higher *per capita* GDP would conduct more complex actions to maintain or enhance their economy, such as promoting the development of economic clusters and radical innovation in current businesses. These more competitive regions also might focus on improving factors such as governmental and businesses efficiency, instead of emphasizing new venture creation, to improve their economy. Other empirical studies, using wealth as the control variable measured by the regional or national GDP, have also demonstrated a negative, significant relationship with university entrepreneurial activity.

4.5. Conclusions

The existing literature provides evidence for demonstrating the relevance of the entrepreneurial university. Using the *Resource-based View* as the theoretical framework, a model of the entrepreneurial university has been proposed and tested using empirical data

gathered from the *Tecnológico de* Monterrey. The results of the regression analysis confirm that hard (financial and physical) and soft (human resources and organizational capabilities) resources of a university increase its entrepreneurial activity. However, the results of this study show that hard resources exert a much higher impact on the university's entrepreneurial activity than do soft resources. The main academic implication of this study is the contribution to the understanding of the entrepreneurial university through the proposed model based on the resource-based view, since no previous research has offered and tested such a model empirically and quantitatively. The results of this study imply that universities trying to develop their entrepreneurial profile and grow their entrepreneurial activity must develop effective strategies to ensure they obtain sufficient funds. Adequate capital is vital for supporting entrepreneurs and providing them with access to appropriate and sufficient physical resources, specifically business incubation facilities, to perform their activities. Universities also should integrate enough experienced faculty and instructors as business owners into their business incubation teams.

Empirical evidence clearly shows that this kind of organizational capability positively impacts the number of new ventures created. The main limitations of this study include the small number of observations in the data base, the limited number of annual records, and the simplicity of the variable set. These limitations are difficult to overcome at the moment, as the number of annual observations correspond to the number of business incubators the *Tecnológico de Monterrey* operates (25). The university just started measuring data on the entrepreneurial activity of its campuses two years ago, and only on a limited set of variables. As there are still too few universities in Mexico with entrepreneurial activity and no other data base exists in this field, the *Tecnológico de Monterrey* currently represents the sole opportunity to conduct an empirical, quantitative study on this subject.

Several future research opportunities can be identified. A first option may be the conducting of a deeper, qualitative study based on the case of three to four campuses, including one from each major geographical zone, or of groups of campuses classified according to size. A second possibility, in addition to analyzing the impact of internal factors on the amount of new ventures created, may be to address questions regarding the effect of specific configurations of resources and capabilities on better, more successful new ventures. Another research opportunity may be to consider the integration and empirical testing of a model including not only internal but also environmental factors, which would complement the theoretical framework with the Institutional Economy Theory (North, 1990 and 2005). A fourth alternative line of research could incorporate the quantitative analysis of the university's entrepreneurial activity's impact on regional economic development. Finally, a panel study may be conducted in the short term, gathering data from at least 3 years and additional information from other sources. The two previous chapters were centered on studying the effect of environmental and internal determinants on the entrepreneurial university's outcomes. Chapter V focus on the socioeconomic consequences on entrepreneurial university' graduates.

CHAPTER V. EXPLORING THE IMPACT OF A
MEXICAN MULTICAMPUS ENTREPRENEURIAL
UNIVERSITY ON GRADUATES
ENTREPRENEURSHIP

5.1. Introduction

According to the eclectic model of entrepreneurial university proposed in Chapter II, environmental and internal factors determine the university's entrepreneurial activities (entrepreneurial behaviors/actions of students) that also generate socioeconomic impacts (graduates' career decisions). Particularly, adopting the *Social Cognitive Theory* as main theoretical framework, this chapter focuses on the socioeconomic impact of entrepreneurial universities on their graduates.

Traditionally, universities provide a range of supports development opportunities for students, including the development of skills, knowledge, and the willingness/awareness of the need to continue learning (Harvey, 2001). Over the past few decades, universities have been transformed into fertile, knowledge-intensive environments for entrepreneurship (Audretsch, 2014). As was evidenced in the last two chapters, entrepreneurial universities invest resources/capabilities to provide adequate infrastructures, mechanisms, and programs to support the university community's ¹⁰ exploration and/or exploitation of entrepreneurial ideas (Grandi and Grimaldi, 2005; Grimaldi and Grandi, 2005; Guerrero and Urbano, 2012; Wright et al., 2007).

One effective support during the creation and survival of new ventures is an incubation infrastructure based on the provision of facilities such as offices, administrative staff, access to university research, and external grant support (McAdam and McAdam, 2008; Mian, 1994; 1996). More advanced services include business planning, contact platforms with potential investors, and seed funding and financial support from the university and external sources (Alsos and Kolvereid, 1998; Scillitoe and Chakrabarti, 2010). These changes have also

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¹⁰ The university community comprises academics, staff, students and alumni.

occurred in the toughest job market conditions since the global financial crisis. The aim of this paper is to explore the factors that condition the incubation of university graduates' startups.

After this introduction, this chapter is organized as follows: Section 5.2 develops the conceptual framework, particularly the factors involved in the graduate students' decisions to incubate their entrepreneurial initiatives using the university's incubation infrastructures. Section 5.3 describes the methodology used in the study. Section 5.4 addresses the results obtained in this exploration of the ITESM. Finally, Section 5.5 presents the main conclusions of the study, the implications for decision makers, and future research lines.

5.2. Conceptual Framework

The decision to become an entrepreneur or to work with the support of a university incubator, however, will depend on the graduates' opportunity cost. Taking into account social cognitive perspective, individuals' decisions are the result of the interaction of behavioral, personal, and environmental factors (Bandura, 1991). In this perspective, the incubation decision of entrepreneurial graduates can be defined by their aspirations (behavioral factors), which are influenced by their capabilities and skills to organize and execute the courses of action required to manage their entrepreneurial initiatives (cognitive factors) and by the context of the university incubator (environmental factors). Therefore, this section explores the links between graduate entrepreneurship and university business incubators in terms of the graduates' self-efficacy (applicability of their knowledge, continuing learning), behaviors (income, market aspirations), and university context (perceptions about the university environment and the business incubator's resources and capabilities).

5.2.1. Graduates' human capital

Human capital is a key production factor (Becker, 1964) and is an important determinant of any entrepreneurial action (McMullen and Shepherd, 2006; Shane et al., 2003). Human capital may include generic knowledge/skills (i.e., skills developed during their time at the university) and specific experiences (i.e., as an employee, a manager, etc.) or other attributes that enhance an individual's productivity and earnings (Becker, 1964). A large proportion of the entrepreneurship literature suggests that, besides formal education, different types of personal experiences are important human capital assets that seem to trigger firm start-up (Parker, 2011). In other words, to be entrepreneur requires considerable and diverse abilities relative to those required to be paid employee. In terms of cognitive social theory, self-efficacy is what a graduate student believes he or she can accomplish using his or her skills under certain circumstances (Bandura, 1995). As a consequence, human capital is the reflection of the cognitive ability of graduate students that helps them understand and implement knowledge in job activities (Hanushek and Kimko, 2000), resulting in greater competitiveness and performance (Agarwala, 2003; Marimuthu et al., 2009). Following this idea, graduate students could use their university education and continued education inside an entrepreneurial university as a way to survey the job market and demand knowledge that meets worldwide job standards

Responding to this demand, entrepreneurial universities are restructuring their educational and business incubation activities, which apply quality standards across the learning and entrepreneurship processes, to build a presence in international markets. Through incubation infrastructures, an entrepreneurial university provides a wide variety of real situations and knowledge, skills, and abilities (Kirby, 2004), as well as reinforcing attributes and behaviors to help develop creative and critical thinking and make individual career

choices (Lee and Venkataraman, 2006; Louis et al., 1989). As a result, students can benefit from a pool of resources that help them evaluate business ideas and develop these ideas into ventures (Souitaris et al., 2007). For instance, while carrying out business-planning activities, students can receive advice from lecturers and technology transfer officers and use a business plan competition to test their venture ideas. Additionally, students can apply the knowledge acquired during their university formation and reinforce any weak areas as needed. As a result, graduate students who decide to incubate their ventures in the university's incubation ensure the development of human capital, which leads to the development of self-efficacy (Al-Dajani et al., 2014; Bandura, 1995; Mian, 2014). Thus,

H1: Greater opportunities to develop human capital (e.g., knowledge applicability and continuing training) increase the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.

5.2.2. Graduates' aspirations

Undoubtedly, human capital affects the performance of graduate entrepreneurship in terms of the goals that they choose, the effort that they exert on their start-ups, and in the persistence, they demonstrate in the face of challenges or difficulties (Bandura, 1982). According to Hessels et al. (2008), we can observe graduate entrepreneurship's diversity in aspirations and aim to survive in the market based on several consequences (novel products, growth, export activities, etc.) and causes (policy drivers, macroeconomic conditions, individual motivations, etc.). A number of previous studies have positively related individual motives to their aspirations, such as growth ambitions (Kolvereid, 1992, 1996a, 1996b), expected outcomes in terms of financial rewards and independence (Davidsson 1989), and the strong predictor of well-being (Wiklund et al., 2003; Wiklund and Shepherd, 2003).

Conversely, if graduate students fear a loss of control or expect that their well-being will be reduced in the case of growth, their growth ambitions tend to be limited. Thus, university business incubators try to create a dynamic environment in which new enterprises can flourish and grow (Al-Dajani et al., 2014).

A study developed by Galloway and Brown (2002) has shown that entrepreneurship training programs help to increase not only the quality and growth of graduate businesses but also the range of industry sectors in which those businesses are represented. Similarly, we could expect that graduate entrepreneurs who have higher skill levels and greater income aspirations are more likely to incubate their entrepreneurial initiatives in university business incubators to achieve those aspirations. This dynamism, however, will depend on the services of the university business incubators. It is important to take into account the main role of university business incubators in which new entrepreneurial firms can be nurtured from their initial conception through to commercial viability, usually over a period of approximately three years (Battisti and McAdam, 2012). Therefore, if the incubator does not provide strong support for entering new markets, developing new products, or achieving the expected growth rate, the graduate entrepreneur may prefer to take the risk by him or herself to avoid limiting their expectations. In other words, higher entrepreneurial aspirations (e.g., a greater probability of sufficiently remunerative opportunities) are associated with higher positive attitudes to assume risks and preferences for decision-making control (Douglas and Shepherd, 2002). Thus,

H2: Higher aspirations (e.g., market and income) decrease the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.

5.2.3. Entrepreneurial university environment

According to Bandura (1997), environmental factors influence individuals' motivations and aspirations. In the university context, entrepreneurial activity is also constrained by both formal (educational programs, support mechanisms [incubators], the availability of financial resources, etc.) and informal factors (favorable entrepreneurial attitudes, positive role models, etc.) (Thornton et al., 2012). In particular, in an entrepreneurial university, an incubator is a non-profit organization that not only provides services for students, scholars, staff, and alumni—such as rent reductions, access to capital, shared office or laboratory space, technology transfer services, and faculty acting as consultants (Mian, 1997)—but also reinforces the entrepreneurial culture at all levels of the university (Urbano and Guerrero, 2013). To be competitive, each entrepreneurial university provides a unique set of valuable, rare, and imperfectly imitable resources and capabilities (Amit and Schoemaker, 1993; Barney, 1991; Katz and Gartner, 1988) to develop those services. In general, those resources and capabilities can be viewed as bundles of tangible and intangible assets controlled by an entrepreneurial university to generate sustained, competitive advantages through the creation of technology-based firms (Clarysse et al., 2005).

Undoubtedly, the quality, effectiveness, and diversity of services and support provided by university business incubators may depend on the availability of financial, physical, commercial, and social capital (Di Gregorio and Shane, 2003; O'Shea et al., 2008). Several authors have emphasized the positive and statistically significant relationship between business incubators' financial resources and the university's entrepreneurial activity (Powers and McDougall, 2005). In this sense, holding opportunity and resources constant, graduate students do not change over time and therefore a career decision will only be changed when the attributes of the decision change (Douglas and Shepherd, 2002). Therefore, if graduate

students perceive a university environment that responds to their aspirations and reinforces their self-efficacy, graduate students will have a positive attitude toward their abilities coupled with environmental change that promotes success and improves long-term motivation (Bandura, 1997). Otherwise, a graduate student with lower self-efficacy in an unresponsive environment will decrease his or her efforts toward change. Thus,

H3: A positive perception of the university context increases the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.

5.3. Methodology

5.3.1. Data collection

Adopting the theoretical criteria to identify entrepreneurial universities, ¹¹ the *Tecnológico de Monterrey* was selected to analyze this contemporary phenomenon in-depth within its real-life context, especially when the boundaries between this phenomenon and the university context in emerging markets are not clearly evident (Eisenhardt, 1989; 2007; Yin, 1984). The *Tecnológico de Monterrey* is a multi-campus (33) university located in 28 different cities across Mexico, where regional differences (economic, social, political, and geographical) are very significant and capture the main markets at the country level.

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¹¹ The main criteria used in previous studies to identify entrepreneurial universities (Audretsch and Lehmann, 2005; Clark, 1998; Di Gregorio and Shane, 2003; Guerrero and Urbano, 2012; O'Shea et al., 2008; Shane, 2004; Wright et al., 2007). For instance, (i) promoting an entrepreneurial culture by strategic actions that enable adaptation to environmental changes; (ii) making self-instituting efforts to change its general character by developing entrepreneurial initiatives (incubator infrastructures and support mechanisms); (iii) being located in emerging countries characterized by higher levels of entrepreneurship as measured by the number of new enterprises; and (iv) being listed in the top 10 regional university rankings.

The *Tecnológico de Monterrey*'s business incubator model is an integrated platform pioneer in Latin America comprising three subnetworks: (1) a technology-based incubator network that drives the transformation of ideas and innovative projects in advance sectors (agricultural, biotechnology, biotechnology, development of information technology, pharmaceuticals, biomedical engineering, energy, aerospace and automotive, among others) into high value-added businesses; (ii) an intermediate technology-based incubator network that supports the creation, development, and consolidation of new businesses that incorporates some elements of innovation (telecommunications, franchise, agribusiness, among others); and (iii) a social incubator network that promotes the creation and strengthening of microenterprises.

This exploratory research uses the *Tecnológico de Monterrey*'s 2014 graduate students' follow-up database. The sample includes 333 graduate entrepreneurs from the different campuses who have created their own enterprises and some of whom have done so with the support of the ITESM's incubation system. We also used other databases, including: (i) the *Tecnológico de Monterrey*'s incubator database provided by the Vicerrectoría Asociada de Emprendimiento, to gain access to the resources and capabilities of university business incubations; and (ii) secondary data regarding the economic conditions in the area where the incubator is located, provided by the Mexican Statistic Institute (INEGI).

5.3.2. Description of variables

In this sense, our dependent variable is the *incubated enterprises*, which is a binary variable that takes a value of 1 when graduates students have created their enterprise with the support of one of *Tecnológico de Monterrey*'s incubators, and 0 otherwise. Based on previous studies (Al-Dajani et al., 2014; Douglas and Shepherd, 2002; Galloway and Brown, 2002;

Hessels et al., 2008; Parker, 2011; Wiklund et al., 2003), our main independent variables are based on graduates' (i) human capital, (ii) aspirations, and (iii) university context (Table 5.1).

	Variable	Description	Source	
Dependent	Entreprises incubated	Binary: (1) enterprise-incubated (0) otherwise		
	Graduate human capital		•	
	Knowledgeapplicability	Binary: (1) higher frequency; (0) lower frequency		
	Continuingtraining	Binary: (1) yes; (0) no		
	Graduate aspirations			
	LnIncome	Log natural of the income of graduate students	Tecnológico de Monterrey's graduate students' follow-up	
	Marketaspirations	Categorical: (1) local; (2) national; (3) international		
Independent	University environment		ronow up	
	Universitycontext	Factor composed by the perception about: work team, research capability, communication skills, networking, knowledge, leadership, global perspective,		
		ethics, regional problems, social engagement		
	RandC of incubators	Factor composed by: financial, physical, commercial, and organizational resources	T de M's incubator database	
	Gender	Binary: (1) male; (0) female	Tecnológico de	
Control	Sector	Categorical: (1) industry; (2) commerce; (3) services	Monterrey's graduate students'	
Variables	Enterprise size	Log natural of number of employees	follow-up	
	LnEntrepreneurialdensity	Log natural of entrepreneurial density in the region	INEGI	

Table 5.1: Description of variables.

Concerning human capital, we used two variables measured by the frequency of applying the knowledge acquired in their careers (*Knowledgeapplicability*) and, when reinforced, their individual limitations through continuing training (*Continuingtraining*). Regarding aspirations, we used two measures: (i) the natural logarithm of graduates' income (*LnIncome*) and (ii) entrepreneurial aspirations to entry in local, national, or international markets (*Marketaspirations*). Relating to the university context, we adopted two measures based on the individual perception of the university context (*Universitycontext*) and the estimation of a proxy based on the resources and capabilities used by the university business incubator in terms of financial, physical, and commercial resources (*resources and capacities of incubators*). Finally, we also included some control variables at the individual level

(gender), at the new venture level (sector, enterprise size), and at the regional level (entrepreneurial density in the region).

5.3.3. Data analysis

Because the dependent variable is dichotomous, a binominal logistic regression method was used. The binominal logistic regression estimates the probability of an event happening, in this case, engaging in a firm created by graduate students with the support of the university incubator. The predicted proportion follows the logistic model of Ln P/(1 – Pi)= β Xi, where Pi is the probability of being a graduate student involved in the creation of a new business with the support of a business incubator (Hosmer and Lemeshow, 1989). The logarithmic odds of these events are held to be linearly affected by a vector of covariates Xi with a coefficient vector β . Maximum likelihood estimations were used to calculate the *logit* coefficients, which denote changes in the *log odds* of the dependent variable (Greene, 2003). Assessment of the goodness of fit of the models using Pearson Chi-square test, the rate of correct classification, and the pseudo R-square was conducted. The significance of each graduate student's independent variable was tested using Wald statistics (see the correlation analysis in Table 5.2).

	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Enterprises incubated	0.20	0.40	1										
(2) Knowledgeapplicability	0.89	0.32	0.104	1									
(3) Continuing training	0.32	0.47	0.122	0.076	1								
(4) LnIncome	9.48	0.68	-0.023	-0.049	0.039	1							
(5) Marketaspirations *	1.63	0.72	0.131	0.052	0.105	0.165	1						
(6) University context	0.00	1.00	0.050	0.156	0.015	0.040	-0.056	1					
(7) RandC of incubators	0.00	1.00	-0.069	-0.022	-0.080	-0.009	0.028	-0.112	1				
(8) Gender	0.69	0.46	0.054	-0.116	0.081	0.163	0.157	-0.105	-0.032	1			
(9) Enterprise size	1.91	1.14	0.018	0.063	0.180	0.293	0.237	0.222	-0.033	0.094	1		
(10) Sector *	2.32	0.79	-0.037	-0.027	0.045	-0.067	-0.073	-0.047	0.017	-0.068	-0.085	1	
(11) LnEntrepredensity	2.20	0.83	0.040	0.061	0.104	-0.015	0.093	-0.034	-0.025	0.021	0.008	-0.003	1

Note: *Categorical variables; the correlations were corroborated using the T-Test.

Table 5.2: Descriptive statistics and correlation matrix.

5.4. Results and discussion

Table 5.3 shows the results that were obtained. The evidence shows that the control variables included in our analysis do not have a statistically significant effect on the graduate entrepreneurship incubated in the *Tecnológico de Monterrey's* incubator (Model I).

Variables	Graduate entrepreneurship incubated							
	Model I	Model II						
	Coefficient (SE)	Odds	Coefficient (SE)	Odds				
Graduate human capital								
Knowledgeapplicability			1.792 (0.780) †	6.000				
Continuingtraining			0.447 (0.200) **	1.563				
Graduate aspirations								
LnIncome			-0.624 (0.306) †	0.536				
Marketaspirations: local			*					
National			-1.299 (0.605)**	0.273				
International			-0.327 (0.615)	0.721				
University environment								
Universitycontext			0.262 (0.221)	1.299				
RandC of incubators			0.076 (0.229)	1.079				
Control variables								
Gender	0.202 (0.383)	1.224	0.630 (0.484)	1.878				
Sector: Industry								
Commercial	0.276 (0.421)	1.318	-0.242 (0.566)	0.785				
Services	-0.158 (0.402)	0.854	-0.177 (0.501)	0.838				
Enterprise size	0.007(0.148)	1.007	-0.157 (0.202)	0.855				
LnEntrepreneurialdensity	0.179 (0.183)	1.196	0.157 (0.237)	1.170				
Constant	-1.700(0.611)**	0.183	3.443 (3.583)	31.27				
N	333		333					
-2Log. Likelihood	219.988		151.537					
Cox and Snell R square	0.011		0.140					
Nagelkerke R square	0.016		0.270					
LR chi2	2.158		23.334					
Prob > chi2			**					

Note: Level of statistical significance: *** $p \le 0.000$, ** $p \le 0.05$, † $p \le 0.10$.

Table 5.3: Logistic regression.

In other words, the probability that a graduate student incubated his/her start-up in this university does not vary by gender, sector, start-up size, or the entrepreneurial density observed in the region in which the university campus is located. Therefore, the range of industry sectors in which those businesses are represented does not vary (Galloway and Brown, 2002). In addition, when we analyze the three determinants (graduates' human capital, aspirations, and perception of university context) of graduate entrepreneurship

incubated in the entrepreneurial university's business incubator (Model II), the effect of control variables is the same as the previous model.

Regarding graduates' human capital, the results show that the probability that a graduate entrepreneur incubates his/her entrepreneurial initiative in the university incubator increases five times when he/she frequently applies the knowledge acquired during his/her career [1.792; 0.100], and almost one time when they must reinforce their individual limitations through continuing training [0.447; 0.050]. Adopting Bandura's ideas (1995), the graduate student reinforces his/her self-efficacy through the services provided by the *Tecnológico de Monterrey's* incubator associated with the implementation of knowledge and/or skills in his/her entrepreneurial initiatives (Al-Dajani et al., 2014; Hanushek and Kimko, 2000). On this basis, the evidence supports H1, which states that greater opportunities to develop human capital (e.g., knowledge applicability and continuing training) increase the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.

Concerning graduates' aspirations, the results shows that the probability that a graduate entrepreneur incubates his/her entrepreneurial initiative in the *Tecnológico de Monterrey's* incubator decreases less than one time when he/she aspires to greater remuneration opportunities [-0.624; 0.100]. In addition, the probability also decreases when the graduate entrepreneur aspires to enter national [-1.299; 0.050] or international markets rather than the local market. Interestingly, we expected to find strong support for the *Tecnológico de Monterrey's* incubator regarding the unique characteristics of this university, which is localized in different regions of Mexico; therefore, the networking and connections across the country, could help incubated ventures to enter national or international markets. Instead, this

unique characteristic is a barrier to the selection of the university incubator rather than a success factor (Al-Dajani et al., 2014). Our results do show that graduate entrepreneurs of *Tecnológico de Monterrey* prefer to take risks by themselves to avoid limiting their entrepreneurial aspirations (Douglas and Shepherd, 2002). Based on that, the evidence supports H2, which states that higher aspirations (e.g., market and income) decrease the probability that graduate students incubate their entrepreneurial initiatives in the university's business incubator.

Regarding the university environment, results do not provide strong evidence to support H3, which states that a positive perception of the university context increases the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator. One plausible explanation is that the perception of the Tecnológico de Monterrey does not vary among this particular group of graduate students. In particular, this university has a strong entrepreneurial vision and culture, and its graduates are proud of the Tecnológico de Monterrey. Another interpretation of this result might be that the entrepreneurs' choice regarding their start up mode (in the university's incubator vs. any other option) depends on the type and characteristics of their new ventures, and not on their perception of the university's context. Even a great perception of the university's context would not change their decision to start up outside the university's incubator if they think it is not the right place for the operation of their specific new ventures. In addition, our results do not provide evidence concerning a positive and statistically significant relationship between the business incubators' resources (financial, physical, commercial, and organizational) and the preference of entrepreneurs to incubate their new ventures in the university's incubator (Powers and McDougall, 2005). This result might seem inconsistent with previous sections, as the study presented in Chapter IV that confirmed a positive relationship between hard/soft resources of incubators and the number of new ventures that they incubate. However, though both relationships involve the incubators' resources, they mean and represent two different things. According to results in Chapter IV, if an incubator had fewer resources, it would not be able to incubate the number of startups it actually incubates, but this is a relationship regarding lower productivity caused by the lack of resources, not a relationship regarding preference or choice of entrepreneurs, as it is in this chapter.

5.5. Conclusions

Recent studies have analyzed the enabling factors influencing the success of university business incubators (Phillips, 2002; Sternberg, 2014), the evolution and types of university business incubators (Bakkali et al., 2014; Barbero et al., 2014; Mian, 2014; Miller et al., 2014), the influence of university business incubators on students' entrepreneurial intentions (Guerrero et al., 2014c; Saeed et al., 2015), and the influence of university business incubators on development via knowledge transfer (Guerini and Rossi-Lamastra, 2014; Lundqvist, 2014). Some studies have explored the effect of university business incubators on graduate entrepreneurship (Al-Dajani et al., 2014; Carayannis, 2014). This phenomenon has attracted the attention of academics and policy makers because major changes have recently occurred in higher education, including substantial cuts to university funding, steep increases in tuition fees payable by graduates (generally funded by means of low-interest, long-term personal loans) in conjunction with proposals to slash the cost of higher education, and universities being required to publish statements about their activities and the services offered to ensure that students are hired upon graduation (Al-Dajani et al., 2014).

There is a general consensus that entrepreneurial universities provide a support for development opportunities for graduate students, including job-seeker, self-employed, or

entrepreneurial-employed. This exploratory study contributes to the literature by seeking to provide a better understanding of the main factors (behavioral, cognitive, and environmental) involved in the incubation decision of graduate entrepreneurs according to the social cognitive perspective. Our results show that in a well-recognized entrepreneurial university in Latin America (ITESM), graduates' decisions to incubate their entrepreneurial initiatives will basically depend on whether the university incubators provide services that reinforce individuals' self-efficacy (knowledge, skills, abilities, experiences, attitudes, etc.) and help them to achieve their entrepreneurial aspirations (growth, market orientation, innovation, income, etc.). For the *Tecnológico de Monterrey's* managers, this study exhibits good practices as well as the necessity to further exploit the unique resources and capabilities of the university (distribution of 33 campuses across Mexico and other campuses located in other countries of Latin America) to reinforce the networks and support for new incubated ventures (e.g., investors, internationalization process, etc.).

This study does have several limitations that provide good opportunities for future research. The first limitation is that the sample is oriented to analyze only graduate entrepreneurs. Thus, future venues should be oriented to explore graduates' later career choices (employed vs. self-employed), with more emphasis on the main drivers of graduates' decisions and the maximization of their incentives. With this aim, longitudinal data will be helpful to understand this phenomenon and improve the statistical analysis with other techniques (panel data or a structural equation model). Another limitation is associated with the proxies used to test the model. In future research, we must improve these measures and include other relevant variables associated with the regional perspective, as well as focusing on the different types of incubators. Other theoretical perspectives, such as the knowledge

spillover theory, could also be used to understand the main individual, organizational, and environmental filters during the entrepreneurial process.

Although these results cannot be extrapolated, the conceptual and methodological design could be adopted or replicated by other researchers and universities. The more the entrepreneurial universities' incubators satisfy self-efficacy and aspirations-related needs of entrepreneurs, the more entrepreneurs these universities would attract to incubate their new business ideas. And the more student and graduate entrepreneurs choose self-employment and an entrepreneurial career over a career as employees, the deeper the socioeconomic impact the universities generate in their regions. Based on this study, next chapter explores the socioeconomic impact of a multi-campus entrepreneurial university on graduates' career profile.

CHAPTER VI. EXPLORING THE IMPACT OF A MEXICAN MULTICAMPUS ENTREPRENEURIAL UNIVERSITY ON GRADUATES' CAREER CHOICE

6.1. Introduction

According to the eclectic model of entrepreneurial university proposed in Chapter II, environmental and internal factors determine the university's entrepreneurial activities (entrepreneurial behaviors/actions of students) that also generate socioeconomic impacts (graduates' career decisions). Particularly, Endogenous Growth Theory and Knowledge Spillover Theory provide some theoretical elements to explain the universities' impacts, this chapter focuses on the socioeconomic impact of entrepreneurial universities on the graduates' career decision. According to those theoretical frameworks, entrepreneurial activity will be greater where investments in new knowledge are relatively high and human capital is abundant, as it occurs in the entrepreneurial university, where faculty and students' startups exploit spillovers from the source of knowledge production, taking advantage of social and entrepreneurial capital present in the university's environment (Acs et al., 2009). Complementary, prior empirical research into individuals' career choices has investigated primarily macro-economic and demographic conditions but lower emphasis have been paid on individual motivations (Douglas and Shepherd, 2000; Feldman and Bolino, 2000). Entrepreneurship literature targets occupational choice models subject to heterogeneous, specific individuals' characteristics (Carter et al., 2003; Feldman and Bolino, 2000), and based on the utility-maximization that individuals expect to derive from their best employment option (Douglas and Shepherd, 2000 and 2002; Martiarena, 2013).

However, environment also matters in the occupational decision process because entrepreneurs act at a given time and place depending on the rewards structure, as well as, the rules of the game from the institutional environment (Baumol, 1990). In case of graduates from universities, they are involved into fertile and knowledge-intensive environments for entrepreneurship/innovation that could influence their career choices (Audretsch, 2014).

Traditionally, universities have provided a range of employability development opportunities for students, including the enlargement of skills, knowledge, and the willingness/awareness of the need to continue learning (Harvey, 2001).

Over the past few decades, universities have been transformed into entrepreneurial environments providing them several employability alternatives such as self-employment (entrepreneurs) or entrepreneurial employees (intrapreneurs) (Guerrero et al., 2015). As a result, entrepreneurial universities invest resources and capabilities to generate adequate infrastructure, mechanisms, and programs to support the university community's (students, academics, graduates) exploration and/or exploitation of entrepreneurial ideas (Grandi and Grimaldi, 2005; Guerrero and Urbano, 2012; Shane, 2004; Wright, 2007). For instance, incubation infrastructure provides traditional facilities (McAdam and McAdam, 2008) and advanced services with potential investors, networks, and external collaborators (Scillitoe and Chakrabarti, 2010; Ebbers, 2014). Adopting the Douglas and Shepherd's utility-maximizing function¹², the aim of this chapter is to explore the influence of the entrepreneurial university on graduates' career choice (e.g., entrepreneur, self-employed or paid employee).

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¹² Douglas and Shepherd (2000 and 2002) model the individual's choice of career path out to the individual's time horizon by defining a career path as one or more jobs over that same planning period. Thus they state: Uij = F (Yij, Wij, Rij, Iij, Oij) where Uij represents the utility anticipated in the ith period from the jth job; Yij represents the income anticipated in the ith period from the jth job; Wij represents the work effort anticipated in the ith period from the jth job; Rij represents the risk anticipated in the ith period from the jth job; Iij represents the independence anticipated in the ith period from the jth job; i = 1, 2, 3, ... represents the different periods out to the time horizon (n), and j = 1, 2, 3, ... represents the different jobs available in any period.

After this introduction, this chapter is organized as follows: Section 6.2 develops the conceptual framework to explore the graduate students' professional decisions. Section 6.3 describes the methodology used in the study. Section 6.4 addresses the results obtained in this exploration of the ITESM. Finally, Section 6.5 presents main conclusions of the study, implications for decision makers, and future research lines.

6.2. Conceptual framework

Entrepreneurial universities play a relevant role in the graduates' decision process to enter an occupation as a wage or salaried individual or as entrepreneur/self-employment status. Entrepreneurial university's managers are interested on providing skills/abilities that reinforce an (intra)entrepreneurial lifestyle of their students (Guerrero et al., 2015). In this sense, these universities have introduced transversal programs oriented to generate certain students/graduates' benefits in terms of learning, inspiration and incubation that have changed their attitudes/motivations towards (intra)entrepreneurship (Souitaris et al., 2007). In this line, Blanchflower and Meyer (1994) identified a relationship between young self-employed and certain university qualifications.

6.2.1. Influence of entrepreneurial universities on graduates' career choices

Influence on tolerance to work effort

Linked to the concept of work effort introduced in the utility-maximizing Douglas and Shepherd's function, if a graduate acquires skills/capabilities that facilitate his/her professional activities, he/she will have a higher tolerance to work effort by the relatively little marginal disutility from additional hours and/or intensity of his/her job activities. In this sense, this tolerance for work effort will reflect the differing utilities of graduates that have been derived from their remuneration (Douglas and Shepherd, 2002). Following these ideas,

graduates that possess skills/abilities such as the identification of opportunities and work under uncertainty will be more tolerant to the intensive work effort that demands an entrepreneurial career in comparison to other occupational choices (Arenius and Minnitti, 2005; Martiarena, 2013; Parker, 2004). The utility gained by entrepreneurial graduates will be greater when the marginal rates of substitution between income and work hours are lower in absolute terms (Douglas and Shepherd, 2000). Therefore, we tested the following hypotheses:

H1: Graduates that tolerate intensive work effort (e.g., recognize opportunities and work under stress) are more likely to be self-employed, lower than entrepreneurs but higher than paid employees

Influence on tolerance to risk

Occupational options vary according to their level of risk. Kihlstrom and Laffont (1979) suggested that more risk-averse individuals become employees and more risk-tolerance individuals become entrepreneurs. According to this assumption, while an employee typically receives a salary/wage, self-employment typically represents a riskier endeavor (Knight, 1921). A positive tolerance to risk may expand the effort and variance of earnings (Douglas and Shepherd, 2000). In the context of the entrepreneurial university, an increased number of studies have identified that incubators are an effective university support across the entrepreneurial and innovation process (Barbero et al., 2014; McAdam and McAdam, 2008). A university incubator provides the availability of access to invaluable resources/networks (Aaboen, 2009; Ebbers, 2014) and knowledge/technology from university (Rothaermel and Thursby, 2005a, 2005b). Therefore, students/graduates can benefit from a pool of resources that help them explore business ideas and exploit these ideas into ventures (Souitaris et al., 2007).

The impact of incubation services (e.g., infrastructure, coaching and networking) has been explored in the graduation rates of tenants in the incubation centers (Peters et al., 2004). At this level of analysis, these empirical studies have evidenced the significant impact on entrepreneurial rates based on the quality of services offered by the incubators. Therefore, under the incubators' umbrella, the perception of students/graduates about risk considerably varies in comparison with the perception of those graduates that have not received this support (Di Gregorio and Shane, 2003; O'Shea et al., 2008). Based on their experience, the relationship between entrepreneurial graduates and incubators will be across the progression of the start-up's lifecycle and will face the challenges in management, innovation and survival (McAdam and McAdam, 2008). In this assumption, graduates who have received support from the university incubator will be more tolerant to risk than others graduates (Douglas and Shepherd, 2000; Levesque et al., 2002). Similarly, graduates that decide to become paid employees in an aligned occupation where they apply the knowledge acquired in their bachelor degree will be less tolerant to risk (Al-Dajani et al., 2014). Therefore, we tested the following hypotheses:

H2: Graduates that tolerate risk (e.g., supported by university incubator) are more likely to be self-employed, lower than entrepreneurs but higher than paid employees

6.2.2. Influence of graduates' motivations on their career choice

Influence on independence

Carter et al. (2003) explored several reasons of individuals for starting business, such as innovation, independence, recognition, roles, financial success, and self-realization. They evidenced that, in comparison with no entrepreneurs, nascent entrepreneurs have similar

impact in the majority of those reasons but a few differences associated to roles, recognition, and gender perspectives. However, these differences/similitudes will be noted when the utility-maximizing function is introduced. According to Douglas and Shepherd (2000 and 2002), the preference for decision-making control will determine individuals' occupational choice. This fact is linked with the degree of independence/autonomy desired by the individual. Even if entrepreneurs or self-employed are answerable to stakeholders such as financiers, and their level of independence varies, independence is typically higher in the self-employment career option. In the case of graduates, prior experiences will evidence their decision-making control based on their occupational patterns (Shane et al., 2003; Segal et al., 2005). Typically, individuals that have lived an interesting entrepreneurial experience where they also have experimented higher levels of independence and income will be interested to continue in this pattern (Levesque et al., 2002). On the other hand, by nature, individuals with prior experience such as employees in public/private sectors are highly averse to independence.

H3: Graduates oriented to having levels of independence (e.g., who experimented prior entrepreneurial experience) are more likely to be self-employed and entrepreneurs than paid employees.

Influence on economic expectancy

According to Gatewood et al. (2002), the main premise of the expectancy theory is that behavior is a function of individuals' expectations based on the perceived value of their achievements (e.g., if their set of skills/abilities are adequate or not), of the particular level of performance (e.g., if their outcomes are motivated to their performance), and the attractiveness of the reward (e.g., if the valence and personal goals relationship exists). Under

this perspective, individuals seek to maximize their utility from their work choices (Douglas and Shepherd, 2002) and it will be influenced by their perceived desirability (Krueger et al., 2000). It follows that the utility incentive to become self-employed is greater for the person who is more tolerant to decision-making autonomy (Douglas and Shepherd, 2000). Therefore, we tested the following hypotheses:

H4: Graduate entrepreneurs are more likely to demand higher income, lower than self-employed but higher than paid employees

6.2.3. Proposed conceptual model

As it was mentioned before, adopting the utility-maximizing function (Douglas and Shepherd, 2000 and 2002), we proposed a conceptual model to explore the role of the entrepreneurial university on graduates' occupational choice. Figure 6.1 shows the different dimensions of this function linked to influence of university and individual motivations.

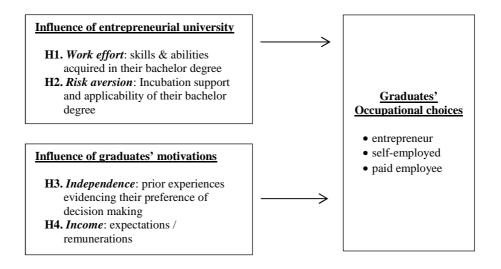


Figure 6.1: Proposed Model

Source: Based on Douglas and Shepherd (2000 and 2002)

6.3. Methodology

6.3.1. A multi-campus entrepreneurial university

Based on the objective of this study and adopting the theoretical criteria to identify entrepreneurial universities, ¹³ the Monterrey Institute of Technology and Higher Education (Instituto Tecnológico y de Estudios Superiores de Monterrey, ITESM) was identified as one of the most entrepreneurial universities in Latin-America (Guerrero et al., 2014). Since its foundation by a group of businessman, the ITESM has lived a continuous innovation process to respond to the educational demands that emerge from social, economic, scientific, labor and technological changes, and to the challenges that the country development faces. The main purpose of the ITESM is "to offer education that transforms lives through educative experiences, we develop persons who become change makers, willing to be even more competitive on everybody's benefit."

As a result, the ITESM's vision is oriented to develop entrepreneurial leaders, with human sense and internationally competitive. The ITESM's Directive Board is integrated by twenty members that represent civil society and the business sector, most of them CEOs of well-recognized Mexican enterprises. Interestingly, the ITESM has adopted an organizational structure of a multi-campus university distributed by 33 campuses located in different cities¹⁴

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¹³ The criteria used in exant studies (Audretsch and Lehmann, 2005; Clark, 1998; Di Gregorio and Shane, 2003; Guerrero and Urbano, 2012; Guerrero et al., 2015; O'Shea et al., 2008; Shane, 2004; Wright et al., 2007) to identify entrepreneurial universities consider: the promotion of an entrepreneurial culture across the university community; (ii) making self-instituting efforts to develop an entrepreneurial ecosystem and fostering innovative/entrepreneurial initiatives; (iii) socioeonomic impact on the regions/countries; (iv) continued and sustained transformation process, and (iv) involvement of several socioeconomic actors in the decisions, activities and objectives.

¹⁴ Aguascalientes, Central de Veracruz, Chiapas, Chihuahua, Ciudad de México, Ciudad Juárez, Ciudad Obregón, Cuernavaca, Estado de México, Guadalajara, Hidalgo, Irapuato, Laguna, León,

across Mexico. In this sense, the ITESM also faces the influence of regional characteristics at economic, social, political, and geographical levels. In addition, the ITESM has an international presence in 15 other countries through 22 international liaisons offices.

Based on this multi-campus system, the ITESM promotes teaching, research and entrepreneurial activities. Concerning to teaching activities, the ITESM has implemented a novel educational system with transversal entrepreneurship training. Nowadays, the ITESM has a strong, mandatory curricula of entrepreneurship courses/programs across disciplines/campuses. Regarding research activities, the ITESM's researchers are organized in over 41 research groups that conduct basic/applied research in strategical national areas¹⁵. Concerning to entrepreneurial activities, the ITESM has created the Eugenio Garza Lagüera Entrepreneurship Institute that enhances students' entrepreneurial spirit in order to propose/implement solutions to social, economic and environmental development. With this aim the ITESM has celebrated strategic alliances with other universities such as Babson College, Stanford, UC Berkeley, etc.

Based on these experiences, the ITESM has implemented a business incubator model integrated by a platform that comprises three subnetworks: (1) a technology-based incubator network that drives the transformation of ideas and innovative projects in advanced sectors into high value-added businesses; (ii) an intermediate technology-based incubator network that supports the creation, development, and consolidation of new businesses that incorporates

1

Mazatlán, Monterrey, Morelia, Puebla, Querétaro, Saltillo, San Luis Potosí, Santa Fe, Sinaloa, Sonora Norte, Tampico, Toluca, Zacatecas

¹⁵ Biotechnology and food, social sciences, regional development, social development, sustainable development, education, entrepreneurship, government, humanities, manufacturing and design, mechatronics, nanotechnology, business, health, and information and communications technologies.

some elements of innovation; and (iii) a social incubators network that promotes the creation and strengthening of micro-enterprises. All the entrepreneurship initiatives contribute to the generation of jobs and the strengthening of the national economy by means of knowledge transfer to create, develop, and grow companies.

6.3.2. Data collection and description of variables

Based on previous studies¹⁶, this research uses the database from the ITESM's 2011-2013 Professional Trajectory of ITESM Graduates Survey¹⁷. The population size of graduates associated with a generational cohort between five to fifteen years was 50301 ITESM's graduates. Our database includes 11512 graduates from the different campuses/knowledge areas. This sample represents a response rate of 23% with a margin of error of 0.80% at 95% confidence level. Nevertheless, after missing values, our final sample is integrated by 8948 ITESM's graduates with a margin of error of 0.94% at 95% confidence level.

The *dependent variable* was measured with a categorical that captures the current career choices of ITESM's graduates: (1) *entrepreneur* who has created, organized, and operated an entrepreneurial initiative taking greater risks in order to do so; (2) *self-employed* who has worked for oneself as a freelancer; and (3) *paid employee* who has been employed by an employer to develop certain tasks in an established organization. We were interested to distinguish entrepreneurs and self-employed in order to explore similitudes or differences in an emerging economy (Parker, 2004). In addition, this paper does not open to explore for the

¹⁶ Douglas and Shepherd (2002) used a sample of 300 graduates from one university between two to ten years after graduation from business degree. They applied a survey and the response rate was around 31%.

¹⁷By confidential agreements, we are not able to include a copy of the questionnaire.

possibility that graduates can choose to be unemployed or unemployable even than database provide the information (Kolvereid and Isaksen, 2006).

We included a set of *independent variables* associated to the university influence on work effort and risk aversion, as well as individuals' motivations of independence and income expectations. Regarding the *entrepreneurial university influence*, we introduced *work effort* associated to the skills and capabilities acquired by the graduates during their studies in the university. Based on extant studies (Arenius and Minnitti, 2005; Davidsson and Honig, 2003; Martiarena, 2013; Parker, 2004), we selected the skills/abilities associated to generation of ideas, work under uncertainty, auto-learning, and ethics. Based on the ITEMS' survey, these perceptual variables were measured with a 1-4 Likert scale. Linked to *risk aversion*, we use the variable that captures if graduates have or have not used the *assistance/support of university incubator* (Di Gregorio and Shane, 2003; Clarysse et al., 2005; O'Shea et al., 2008; Powers and McDougall, 2005); concretely, it is a dichotomous variable that takes value 1 when the graduates mentioned that received support from the university incubators, and 0 otherwise; and *the applicability of their bachelor degree* in their occupation measured with a 1-4 Likert scale (Al-Dajani et al., 2014).

Concerning the *individuals' motivation*, linked to *independence*, we introduced *prior experience* measured by three dummy variables that capture if the graduate has experiences such as entrepreneur or employee in public and private sectors (Davidsson and Honig, 2003; Feldman and Bolino, 2000; Tkachev and Kolvereid, 1999); and (ii) *graduates' aspirations* measured by their level of income (Autio and Acs, 2010; Gatewood et al., 2002; Hessels et al. 2008). As the survey asked the income using a categorical variable, we include a set of eight dummy variables taking as reference the lowest category (less than 10,000 Mexican pesos).

Regarding *control variables*, we controlled by certain individual/university characteristics: (a) *gender*, which is a binary variable that takes value 1 for male and 0 for female. Extant studies have evidenced the significant differences in career choices based on gender (Carter et al., 2003; Wilson et al., 2007); (b) years after *graduation*, which is a continue variable that captures the number of years after the graduation (Davidsson and Honig, 2003); (c) *knowledge area*, measured with a categorical variable that allows us control the knowledge area where the graduate developed his/her bachelor degree and taking as reference business studies (Douglas and Shepherd, 2002; Levesque et al., 2002); (d) the *generational cohorts* (Pekala, 2001); and (e) dummy variables to control by the effect of *each university campus* where the graduates studied their bachelor (Heriot and Simpson, 2007).

6.3.3. Data analysis

Given the nature of our dependent variable, a multinomial logistic regression was used with a categorical dependent variable that has three collaboration categories to predict the likelihood of an individual choosing a career (entrepreneurs, self-employed or employed) followed by a set of control variables denoted by Z. Adopting the utility-maximizing function (Douglas and Shepherd, 2000 and 2002), we estimate the occupational choice as follows:

$$\begin{split} &U_i = \alpha + \beta_o \text{ work tolerance} + \ \beta_1 \text{ risk tolerance} + \ \beta_2 \text{ independence} + \ \beta_3 \text{ expectatives} + \ \beta_4^{'} \ Z_{ij} + \ \epsilon_i \end{split}$$
 $&U_i = \alpha + \beta_o \text{ skills\&abilities} + \ \beta_1 \text{ incubation support} + \ \beta_2 \text{ prior experience} + \ \beta_3 \text{ income} + \ \beta_4^{'} \ Z_{ij} + \ \epsilon_i \end{split}$

Using STATA 13.0, we estimated the multinomial logistic model as follows (Greene, 2003):

$$\Pr(y = k) = \frac{\exp(\alpha + \beta' X_{ij})}{\sum_{j=1}^{3} \exp(\alpha + \beta' X_{ij})} \ k = 1,2,3.$$

No.	Variables	Entire sample					Entrepreneurs				
110.	variables	N	Mean	S.D.	Min	Max	N	Mean	S.D.	Min	Max
1	Career choice		2.03	0.75	1	4[1]					
2	Gender [male]		0.60	0.49	0	1	2127	0.73	0.44	0	1
3	Entrepreneurial	11512	0.04	0.19	0	1	2127	0.04	0.20	0	1
4	Public sector	11512	0.22	0.41	0	1	2127	0.04	0.20	0	1
5	Private sector	11512	0.08	0.27	0	1	2127	0.08	0.26	0	1
6	Income	9588	4.04	1.85	1	9	1827	4.32	2.03	1	9
7	Applicability of their bachelor degree	10614	1.80	0.82	1	4	2119	1.84	0.82	1	4
8	Knowledge area	11512	1.66	0.63	1	4	2127	1.58	0.60	1	4
9	Idea/opportunity generations	10782	3.28	0.83	1	4	2007	3.40	0.81	1	4
10	Work under uncertainty	10783	3.63	0.73	1	4	2011	3.63	0.72	1	4
11	Learning by themselves	10778	3.42	0.81	1	4	2003	3.38	0.83	1	4
12	Ethics	10784	3.42	0.83	1	4	2010	3.39	0.83	1	4
13	Incubator support received	11512	0.02	0.14	0	1	2127	0.03	0.18	0	1
14	Years after graduation	11512	8.29	4.04	5	15	894	8.52	4.17	5	15
15	Years after graduation square	11512	85.07	78.96	25	225	894	89.90	82.04	25	225

Note: [1] Includes one category associated to 937 unemployed graduates that were not included in the analysis

No.	Variables		Paid employee								
No.	v at tables		Mean	S.D.	Min	Max	N	Mean	S.D.	Min	Max
1	Career choice										
2	Gender [male]	698	0.52	0.50	0	1	7750	0.60	0.49	0	1
3	Entrepreneurial	698	0.13	0.33	0	1	7750	0.02	0.15	0	1
4	Public sector	698	0.53	0.50	0	1	7750	0.23	0.42	0	1
5	Private sector	698	0.16	0.37	0	1	7750	0.06	0.24	0	1
6	Income	626	3.13	1.70	1	9	7135	4.04	1.79	1	9
7	Applicability of their bachelor degree	693	1.74	0.86	1	4	7728	1.80	0.82	1	4
8	Knowledge area	698	1.78	0.71	1	4	7750	1.69	0.62	1	4
9	Idea/opportunity generations	655	3.32	0.83	1	4	7236	3.25	0.82	1	4
10	Work under uncertainty	655	3.66	0.70	1	4	7234	3.62	0.73	1	4
11	Learning by themselves	651	3.38	0.85	1	4	7240	3.44	0.80	1	4
12	Ethics	654	3.37	0.85	1	4	7237	3.43	0.82	1	4
13	Incubator support received	698	0.02	0.12	0	1	7750	0.02	0.13	0	1
14	Years after graduation	698	8.85	4.18	5	15	7750	8.14	3.98	5	15
15	Years after graduation square	698	95.85	82.60	25	225	7750	82.01	77.53	25	225

Note: [1] Includes one category associated to 937 unemployed graduates that were not included in the analysis

Table 6.1: Descriptive statistics

The categorical dependent variable is defined so that it takes one of three levels (1 for entrepreneurs, 2 for self-employed, and 3 for employed). Multinomial logistic regression does necessitate careful consideration of the sample size and examination for outlying cases. Table 6.1 reports the main descriptive analysis of all the variables, and Table 6.2 the correlation matrix.

No.	Variables	1	2	3	4	5	6	7	8
1	Career choice	1							
2	Gender [male]	-0.1866*	1						
3	Entrepreneurial	0.0427*	0.0066	1					
4	Public sector		0.0584*	0.3267*	1				
5	Private sector		-0.0426*	0.6090*	0.1503*	1			
6	Income	-0.1248*	0.2907*	-0.0246	-0.0001	-0.0402*	1		
7	Applicability of their bachelor degree	-0.0189	0.0086	-0.0349*	-0.0254	-0.0269	0.0134	1	
8	Knowledge area	0.0305	0.0883*	0.0011	-0.0040	0.0023	-0.0270	0.0409*	1
9	Idea/opportunity generations	-0.0675*	-0.0740*	0.0251	0.0423*	0.0138	-0.0578*	-0.1099*	-0.0719*
10	Work under uncertainty	0.0027	-0.1075*	0.0061	0.0081	0.0038	-0.0804*	-0.0964*	0.0117
11	Learning by themselves	-0.0135	-0.0663*	-0.0047	0.0139	-0.0134	-0.1002*	-0.1209*	0.0124
12	Ethics	-0.0062	-0.0903*	-0.0086	0.0126	-0.0120	-0.0747*	-0.1137*	-0.0748*
13	Incubator support received	-0.0345*	0.0416*	0.0361*	0.1577*	0.0063	-0.0154	-0.0143	0.0070
14	Years after graduation	0.0023	0.0374*	0.0813*	0.1234*	0.0688*	0.3351*	-0.0219	-0.0508
15	Years after graduation square	0.0040	0.0392*	0.0804*	0.1215*	0.0676*	0.3283*	-0.0230	-0.0515
N	Variables		9	10	11	12	13	14	15
N	0.		9	10	11	12	13	14	15
-	1 Career choice		9	10	11	12	13	14	15
-	Output Career choice Gender [male]		9	10	11	12	13	14	15
	Career choice Gender [male] Entrepreneurial		9	10	11	12	13	14	15
	Career choice Gender [male] Entrepreneurial Public sector		9	10	11	12	13	14	15
	Career choice Gender [male] Entrepreneurial Public sector Private sector		9	10	11	12	13	14	15
	Career choice Career choice Gender [male] Entrepreneurial Public sector Private sector Income	e	9	10	11	12	13	14	15
	Career choice Gender [male] Entrepreneurial Public sector Private sector Income Applicability of their bachelor degree	e	9	10	11	12	13	14	15
	Career choice Gender [male] Entrepreneurial Public sector Income Applicability of their bachelor degree Knowledge area	e	9	10	11	12	13	14	15
	Career choice Gender [male] Entrepreneurial Public sector Income Applicability of their bachelor degree Knowledge area Idea/opportunity generations	e	1		11	12	13	14	15
	Career choice Gender [male] Entrepreneurial Public sector Income Applicability of their bachelor degree Knowledge area Idea/opportunity generations Work under uncertainty	е	1 0.3926*	1	11	12	13	14	15
1	Career choice Gender [male] Entrepreneurial Public sector Income Applicability of their bachelor degre Knowledge area Idea/opportunity generations Work under uncertainty Learning by themselves	e	1 0.3926* 0.3897*	1 0.5342*	1		13	14	15
1 1 1	Career choice Gender [male] Entrepreneurial Public sector Income Applicability of their bachelor degre Knowledge area Idea/opportunity generations Work under uncertainty Learning by themselves Ethics	e	1 0.3926* 0.3897* 0.3946*	1 0.5342* 0.3972*	1 0.4090*	1			15
1 1 1 1	Career choice Gender [male] Entrepreneurial Public sector Frivate sector Income Applicability of their bachelor degre Knowledge area Idea/opportunity generations Work under uncertainty Learning by themselves Ethics Incubator support received	e	1 0.3926* 0.3897* 0.3946* 0.0254	1 0.5342* 0.3972* -0.0038	1 0.4090* 0.0028	1-0.0218	1		
1 1 1 1 1	Career choice Gender [male] Entrepreneurial Public sector Income Applicability of their bachelor degre Knowledge area Idea/opportunity generations Work under uncertainty Learning by themselves Ethics	e	1 0.3926* 0.3897* 0.3946*	1 0.5342* 0.3972* -0.0038 -0.0027	1 0.4090* 0.0028 -0.0255	-0.0218 0.0348*	1-0.0043		

Table 6.2: Correlation matrix

6.4. Results and discussions

Table 6.3 shows the results of the multinomial logistic regression. The model covers the statistical specifications for this kind of models [Chi2 = 1954.74; Prob > Chi2 = 0.001; Pseudo R2= 0.2519]. Focusing on the influence of entrepreneurial university, paid employees are less tolerant to intensive work effort than self-employed and entrepreneurs. Respect to entrepreneurs, the probability to become paid employee (-0.392; p<0.001) as well as to become self-employed (-0.290; p<0.001) decrease for those ITESM's graduates that identify ideas/opportunities. Respect paid employees, ITESM' graduates that work under uncertainly are more likely to become entrepreneurs (0.094; p<0.100) and self-employed (0.161; p<0.050) than paid employees. In addition, those ITESM's graduates that possess

skills/abilities such as learning by themselves or ethics are more likely to be paid-employees than entrepreneurs.

Relationships		preneur (ba aid employe			oreneur (b elf-employ		self-employed (base vs paid employees		
	Coef.	Std.	P> z	Coef.	Std.	P> z	Coef.	Std.	P> z
INFLUENCE OF ENTREPRENEURIA UNIVERSITY	L								
Work effort [skills/abilities acquired at u	iniversity]:								
Idea/opportunity generations	-0.392	0.043	***	-0.290	0.076	***	-0.102	0.067	
Work under uncertainty	-0.094	0.051	*	0.066	0.092		-0.161	0.082	**
Learning by themselves	0.147	0.044	***	-0.080	0.078		0.227	0.069	***
Ethics	0.156	0.041	***	0.037	0.075		0.119	0.067	*
Risk aversion [university support]:									
Applicability of their bachelor degree	-0.113	0.036	***	-0.228	0.065	***	0.115	0.057	**
Support received from university incubator	-1.966	0.237	***	-2.880	0.414	***	0.914	0.362	**
INFLUENCE OF GRADUATES' MOTIVATIONS									
Independence [prior experiences]:									
Entrepreneurial	-3.399	0.284	***	-2.750	0.375	***	-0.649	0.285	**
Public sector	3.659	0.225	***	4.916	0.244	***	-1.257	0.102	**
Private sector	0.061	0.137		0.297	0.259		-0.235		
Expectative [income less than 10,000 Me				0.277	0.237		0.233	0.23)	
10,000-19,999 Mx	0.894	0.163	***	-0.184	0.211		1.078	0.175	***
20,000-19,999 Mx	1.040	0.163	***	-0.184	0.211	***	1.728	0.175	***
30,000-29,999 Mx	1.040	0.162	***	-1.069	0.219	***	2.089	0.103	***
40,000-59,999 Mx	0.914	0.163	***	-1.302	0.233	***	2.216	0.200	***
60,000-79,999 Mx	0.863	0.181	***	-1.784	0.307	***	2.647	0.216	***
80,000-100,999 Mx	0.723	0.187	***	-2.014	0.340	***	2.737	0.270	***
110,000-139,999 Mx	0.723	0.187	***	-2.229	0.340	***	3.026	0.310	***
more than 140,000 Mx	0.143	0.246		-2.626	0.537	***	2.769	0.505	***
CONTROL VARIABLES									
Gender [male]	-0.794	0.069	***	-0.910	0.117	***	0.116	0.101	
Years after graduation	-0.142	0.147		0.133	0.243		-0.275	0.214	
Years after graduation square	0.006	0.007		-0.004	0.012		0.010	0.011	
Knowledge Area [Business]									
Enlivening	0.449	0.064	***	0.570	0.117	***	-0.121	0.104	
Social Science	0.473	0.134	***	0.792	0.196	***	-0.318		**
Health	1.936	0.662	***	3.111	0.766	***	-1.175		**
Campuses [dummies]		Controlled			ontrolled			controlled	
Generational cohorts [dummies]		Controlled		-	ontrolled			controlled	
_cons	2.740	0.726	***	0.141	1.210		2.598	1.053	**
N	8948								
chi2(68)	1954.74								
Prob > chi2	***								
Pseudo R2	0.2519								
Log likelihood	-54573,6								

Note: Mx means Mexican pesos; Level of statistical significance: *** $p \le 0.001$, ** $p \le 0.05$, * $p \le 0.10$.

Table 6.3: Multinomial regression analysis

Our findings are consistent to previous studies that recognized that individuals with skills/abilities such as the identification of opportunities and work under stress will be more tolerant to intensive work effort and therefore will fit with the demands of an entrepreneurial career (Arenius and Minnitti, 2005; Douglas and Shepherd, 2000; Martiarena, 2013; Parker, 2004). Based on these results, we confirm our H1 that states that graduates that tolerate intensive work effort (e.g., recognize opportunities and work under stress) are more likely to be self-employed, lower than entrepreneurs but higher than paid employees.

Regarding the role of university on graduates' *risk aversion*, ITESM's graduates that have received the support of ITESM's incubators are more likely to become entrepreneurs (1.966; p<0.001) and self-employed (0.914; p<0.001) than paid employees. Interestingly, graduates that apply their bachelor in their occupational decision are more likely to become entrepreneurs (0.113; p<0.001) but not self-employed (-0.115; p<0.050). The support provided by university incubators reduces potential risks in the most critical steps of entrepreneurial processes (e.g., access to financial resources, market penetration, innovation, etc.). Similar to corporate entrepreneurship, the university incubator is an umbrella where graduates have access to unique resources and networks that transform their perception of risk and reinforce their entrepreneurial behavior (Aaboen, 2009; Barbero et al., 2014; Ebbers, 2014; McAdam and McAdam, 2008; Rothaermel and Thursby, 2005a, 2005b). These results support our H2, which states that graduates who tolerate risk (e.g., supported by university incubator) are more likely to be self-employed, lower than entrepreneurs but higher than paid employees.

Focusing on the influence of graduates' motivations, based on prior experience we explored the level of independence associated to their prior occupational choices. The

evidence shows that graduates with prior entrepreneurial experience are less likely to become paid employee (-3.399; p<0.001) and self-employed (-2.750; p<0.001). Analyzing the entrepreneurs and self-employed profiles, it is important to understand that a self-employed tries to do everything by his/herself for security, while an entrepreneur knows that he/she cannot do or control everything, therefore delegates responsibilities. However, those profiles also have a similar level of independence because in both cases the individual is his/her own boss. These findings confirm extant studies that evidenced the preferences of occupational decision-making based on the degree of independence/autonomy (Douglas and Shepherd, 2000 and 2002; Shane et al., 2003; Segal et al., 2005) and also linked to higher tolerance to risk, work effort and higher income expectative (Levesque et al., 2002). Interestingly, ITESM's graduates with prior experience such as paid employees in public or private organizations are more likely to continue being paid employees than entrepreneurs (3.659; p<0.001) but are opened to become self-employed (-1.257; p<0.050). These results support our H3 that states that graduates oriented to have levels of independence (e.g., who experimented prior entrepreneurial experience) are more likely to be self-employed and entrepreneurs than paid employees.

In terms of *graduates' expectancies*, taking as reference the lowest category of income that is less than 10,000 Mexican pesos, our results show that paid employees prefer to receive a wage or salary than becoming entrepreneurs or self-employed. These results confirm the premise of the expectancy theory where individuals' expectations are based on the perceived value of their achievements, of the particular level of performance, and the attractiveness of the reward (Gatewood et al., 2002). Therefore, ITESM's graduates seek to maximize their utility from their work choices. This evidence supports our H4 that states that graduate' entrepreneurs are more likely to demand higher income, lower than self-employed but higher

than paid employees. Finally, our models evidence the relevant role of gender, knowledge areas and campuses (Carter et al., 2003; Davidsson and Honig, 2003; Douglas and Shepherd, 2002; Heriot and Simpson, 2007; Levesque et al., 2002).

6.5. Conclusions

There is a general consensus that entrepreneurial universities provide a range of employability opportunities for graduates, including job-seekers, self-employed, or entrepreneurs. Given the nature of our unit of analysis and available data, we adopted the Douglas and Shepherd's utility-maximizing function. The hypotheses tested in this study that explored the contribution of entrepreneurial universities and individual motivations on graduates' occupational decisions (entrepreneurs or self-entrepreneurs or paid employed). Based on these analyses, we found two interesting conclusions.

Firstly, our results evidenced the significant role of educational programmes on the acquisition of certain skills/abilities that delighted the level of tolerance of graduates' work effort, as well as, the contribution of incubation support reinforcing the graduates' risk tolerance. These findings show that entrepreneurial university environments provide key elements involved in the graduates' decision to become entrepreneurs or self-employed or paid employees. Modestly, this finding contributes to the debate about the value of university incubators (Peters et al., 2004; Ebbers, 2014) on graduates' employability (Al-Dajani et al., 2014), as well as the socio-economic impact of entrepreneurial universities (Guerrero et al., 2015). Secondly, our results also confirm the relevant role of individuals' levels of independence based on their prior experiences, as well as the income aspirations in the graduates' occupational choices. Modestly, these findings also contribute to the debate about

the individual motivations and conditions that are behind a career decision (Douglas and Shepherd, 2000, 2002; Levesque et al., 2002).

This study has several limitations that provide good opportunities for future research. Similar to previous studies, the main challenge of this type of studies is the difficult to obtain information (e.g., Douglas and Shepherd, 2002 used a sample of 300 graduates of one university between two to ten years after graduation from business degree). Our first limitation is that this paper only explored the occupational patterns from different graduates' generations (e.g., covering all bachelor degrees) of one entrepreneurial university organized in 31 campuses covering the majority of Mexican territory. A natural extension of this paper should be exploring in depth graduates' occupational decisions in different university contexts (Guerrero et al., 2015). Also, future research avenues could use longitudinal data to understand this phenomenon and improve our statistical analysis with other techniques (data panel or a structural equation model) and with other theoretical frameworks that allow us to understand similitudes/differences across countries/regions (e.g., institutional economics). Our second limitation is associated to the proxies used to test the proposed model. Even when those proxies have been used in extant studies it is important to explore other dimensions to cover the impact of entrepreneurial university business incubators. For instance, exploring the value added by university incubators for all graduates that used their services, or understanding why other graduates do not used those services (Peters et al., 2004). In this sense, theoretical perspectives such as the knowledge spillover theory could be required to understand the main individual, organizational, and environmental filters across the entrepreneurial process, as well as their influence on the occupational decision process.

This study also provides some implications. For the ITESM's managers, this study exhibits good practices as well as the necessity to further exploit the unique resources and capabilities of the university (distribution of 31 campuses across Mexico and other campuses located in several countries of Latin America) to reinforce the networks and support for new incubated ventures (e.g., investors, internationalization process, etc.). For decision makers involved in Latin-America, the ITESM's incubation model is a good example of best practices across national regions and the stages of the entrepreneurial process, and could serve as a benchmarking reference to develop similar strategies.

CHAPTER VII. CONCLUSIONS

7.1. Introduction

Conclusions, implications, limitations and future research lines have already been presented and discussed in each chapter. In this final section, an integrated summary of main conclusions and implications is offered. Limitations and related future research lines also are summarized and integrated.

7.2. Conclusions and implications

Chapter I described the main purpose of this thesis that was to provide a better understanding about the antecedents and consequences of entrepreneurial universities in emerging economies. Aligned to this purpose, two specific objectives were achieved in this thesis:

- SO1. To propose and test an eclectic theoretical model that allows understanding the determinant factors (environmental and internal) of entrepreneurial universities in emerging economies.
- SO2. To explore the socioeconomic impacts generated by entrepreneurial universities' activities in emerging economies.

In this sense, Table 7.1 summarizes the main findings obtained in each chapter of this thesis. *Firstly*, the literature review recognized the relevance of the entrepreneurial university's role in the new economic model, the entrepreneurial economy, in which knowledge and entrepreneurial capital are the keys to the creation and capitalization of economic growth opportunities. *Implication*: this conclusion implies that government, private

economic sector and university's authorities should be interested in developing entrepreneurial universities to directly and significantly contribute to regional development.

	Variables	Hypotheses	Findings
	Environmental	H1: Entrepreneurial university environmental factors have a positive effect on students' start-up intentions (mediated by motivational factors).	Supported
erminants		H2: Entrepreneurial university environmental factors have a positive effect on students' start-up actions (by the effect produced on start-up intentions via motivational factors).	Supported
Antecedents (determinants)		H1: Hard resources of a university (HR), including funding received for business incubation and physical resources available for entrepreneurs will be positively related to the number of new ventures created by the university.	Supported
	Internal factors	H2: Soft resources of a university (SR), including human resources dedicated to entrepreneurial activities and their experience as business owners, will be positively related to the number of new ventures created by the university.	Supported
	Graduates' entrepreneurs	H1: Greater opportunities to develop human capital (e.g., knowledge applicability and continuing training) increase the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.	Supported
		H2: Higher aspirations (e.g., market and income) decrease the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.	Supported
npacts)		H3: A positive perception of the university context increases the probability that graduate students will incubate their entrepreneurial initiatives in the university's business incubator.	Supported
Consequences (impacts)		H1: Graduates that tolerate intensive work effort (e.g., recognize opportunities and work under stress) are more likely to be self-employed lower than entrepreneurs but higher than paid employees.	Supported
Conseq	Graduates'	H2: Graduates that tolerate risk (e.g., supported by university incubator) are more likely to be self-employed lower than entrepreneurs but higher than paid employees.	Supported
	career decisions	H3: Graduates oriented to have levels of independence (e.g., who experimented prior entrepreneurial experience) are more likely to be self-employed and entrepreneurs than paid employees.	Supported
		H4: Graduate entrepreneurs are more likely to demand higher income lower than self-employed but higher than paid employees.	Supported

Table 7.1: Main findings

Secondly, this study has proposed and tested an eclectic theoretical model of the entrepreneurial university in emergent economies. Three representative Latin American universities from three different countries have been included, and the one from Mexico has been studied at a deeper level using a mixed approach of quantitative and qualitative methodologies and following the suggested eclectic theoretical model, adopting several complementing conceptual perspectives. More specifically, this study has approached the entrepreneurial university in emergent economies adopting several theoretical perspectives: Institutional Economic Theory, Resource-based View, Theory of Planned Behavior, Social Cognitive Theory, Endogenous Growth Theory and Knowledge Spillover Theory. This eclectic approach has allowed a richer explanation and understanding of the antecedents or determinants of entrepreneurial activities of the entrepreneurial university in emergent economies, as well as its consequences or socioeconomic impact on students, graduates and regional development. Implications: this conclusion implies an interesting opportunity for agents interested in developing the entrepreneurial university to follow a reviewed, comprehensive model.

Thirdly, following the eclectic theoretical model, this study first explored the role of entrepreneurial university pathways (education and training) on students' startup intentions and actions. Adopting the institutional economics and theory planned behavior, this research confirmed the relevant effect of entrepreneurial university pathways on startup creation, demonstrating that: entrepreneurial university environmental factors have a positive effect on students' start-up intentions, mediated by motivational factors; and entrepreneurial university environmental factors have a positive effect on students' start-up actions, by the effect produced on start-up intentions via motivational factors. *Implications: this conclusion implies*

special attention of universities on the development of an attractive and effective environment oriented to promote entrepreneurial spirit, intentions and actions.

Fourthly, after exploring environmental factors, internal factors were studied from a resource-based view perspective with a quantitative approach, demonstrating that: financial resources of a university, such as funding received for business incubation, is positively related to the number of new ventures created by entrepreneurs with the support of the university; and non-financial resources, such as facilities, infrastructure and human resources also have a positive impact on the number of new ventures created. The effect of incubator's staff experience as business founders could not be confirmed. Implications: major implications for entrepreneurial universities are the need for strategies to get and manage funds to support the creation of students and faculty startups, as well as provide proper non-financial support. For government and policy makers in Latin American emerging economies, implications are the design of accessible and practical initiatives to fund business incubators, universities' startups and other entrepreneurship development efforts.

Fifthly, once the determinants were studied, this research directed attention to the consequences of the entrepreneurial university, focusing on socioeconomic impact on students, graduates and regional development. The study demonstrated that: greater opportunities to develop human capital increase the probability that students and graduates will incubate their entrepreneurial initiatives in the university's business incubator; and higher aspirations of students and graduates decrease the probability that they incubate their entrepreneurial initiatives in the university's business incubator. <u>Implications</u>: important implications are the design of attractive value propositions of university business incubators, based on expectations of potential entrepreneurs regarding individual's human capital

enhancement, profitability and growth goals. Also, business incubators at the university need less regulatory incubation rules, allowing entrepreneurs to make decisions in a freer environment. These measures would provoke a deeper socioeconomic impact as more students and graduates choose an entrepreneurial career over an employment.

Sixthly, our results evidenced the significant role of educational programmes on the acquisition of certain skills/abilities that delighted the level of tolerance of graduates' work effort, as well as the contribution of incubation support reinforcing the graduates' risk tolerance. These findings show that entrepreneurial university environments provide key elements involved in the graduates' decision to become entrepreneur or self-employed or paid employee. Also, our results also confirm the relevant role of individuals' levels of independence based on their prior experiences, as well as, the income aspirations in the graduates' occupational choices. *Implications: for the ITESM's managers, this study exhibits good practices as well as the necessity to further exploit the unique resources and capabilities of the university (distribution of 31 campuses across Mexico and other campuses located in other countries of Latin America) to reinforce the networks and support for new incubated ventures (e.g., investors, internationalization process, etc.). For decision makers involved in Latin-America, the ITESM's incubation model is a good example of best practices across national regions and the stages of the entrepreneurial process, and could serve as a benchmarking reference to develop similar strategies.*

In summary, the *Tecnológico de Monterrey* provided a complete mapping and illustration of the eclectic theoretical model through one of the most representative entrepreneurial universities from emergent economies in Latin America, and the exploration of the socioeconomic impact on regional development. The relevant impact on socioeconomic

is one of the most important challenges in emerging economies through innovative entrepreneurial solutions. Education, health, security, employment, and economic growth can be positively and significantly impacted by students, graduates and faculty of entrepreneurial universities. Important implications for government, policy makers, industry and universities are strategies for identifying regional needs and priorities, a consequent alignment of entrepreneurial activities, and effective ways to increase innovative, replicable, and scalable startups related to strategic, regional economic sectors.

7.3. Limitations and future research lines

Regarding the study of environmental factors as determinants of entrepreneurial universities, main limitation is the cross-sectional nature of the study, based on a database that only covers the effect during one year. However, as there are still too few universities in Latin America with entrepreneurial activity and no other database exists in this field, the GUESSS database currently represents an interesting opportunity to conduct an empirical, quantitative study on this subject. Several future research opportunities can be identified. A first option may be the conducting of a deeper, qualitative study on these three Latin American universities (ITESM, UNICAMP, and UPC). A second possibility, in addition to analyzing both environmental and internal factors on the amount of new ventures created. Other natural extensions could be the socioeconomic impact of these universities in the region where they are located.

Concerning the study of internal factors as determinants of the entrepreneurial university presents limitations regarding the number of observations and the set of variables analyzed, as they are very simple and do not provide richer information on incubators (incubation models and methodologies, strategic alliances, other income sources, etc.) and

startups (sales, employment, economic sector, type of strategy, founders' profiles, level of innovation, etc.). There is a huge opportunity area in the creation of relevant and reliable data bases on entrepreneurial activities. Future viable research opportunities are multiple-case studies and qualitative approached studies.

Regarding the socio-economic impacts, the first limitation is that the sample is oriented to analyze only graduate entrepreneurs. Thus, future venues should be oriented to explore graduates' later career choices (employed vs. self-employed), with more emphasis on the main drivers of graduates' decisions and the maximization of their incentives. With this aim, longitudinal data will help us to understand this phenomenon and improve our statistical analysis with other techniques (panel data or a structural equation model). Another limitation is associated with the proxies used to test the model. In future research, we must improve these measures and include other relevant variables associated with the regional perspective, as well as focusing on the different types of incubators. Other theoretical perspectives could also be used to understand the main individual, organizational, and environmental filters during the entrepreneurial process.

Finally, similar than previous studies, the main challenge of this type of studies is the difficult to obtain information (e.g., Douglas and Shepherd, 2002 used a sample of 300 graduates of one university between two to ten years after graduation from business degree). Our first limitation is that this paper only explored the occupational patterns from different graduates' generations (e.g., covering all bachelor degrees) of one entrepreneurial university organized in 31 campuses covering the majority of Mexican territory. A nature extension of this paper should be exploring in depth graduates' occupational decisions in different university contexts (Guerrero et al., 2015). Also, future research avenue could use

longitudinal data to understand this phenomenon and improve our statistical analysis with other techniques (panel data or a structural equation model) and with other theoretical frameworks that allows us to understand similitudes/differences across countries/regions (e.g., institutional economics). Our second limitation is associated with the proxies used to test the proposed model. Even than those proxies have been used in extant studies it is important to explore other dimensions to cover the impacts of entrepreneurial university business incubators. For instance, exploring the value added by university incubators for all graduates that used their services or understanding why other graduates do not used those services (Peters et al., 2004). In this sense, theoretical perspectives such as the knowledge spillover theory could be required to understand the main individual, organizational, and environmental filters across the entrepreneurial process, as well as, their influence on the occupational decision process.

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