A MATTER OF CONTEXT – A MULTILEVEL STUDY ON THE EFFECTS OF SOCIAL CONTEXT ON INNOVATION AND ENTREPRENEURSHIP

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PREFACE

This dissertation was developed in co-authorship with several great researchers. Chapter 1 and 3 are authored solely by me. Chapter 2 was co-authored with Jaider Vega-Jurado. An earlier version in Spanish was presented at **COGESTEC 2014** and is currently under review at **El Trimestre Económico**. Chapter 4 was co-authored with Edward Lorenz. It was presented at the **13ᵗʰ Globelics Conference 2015,** is published in the **GREDEG Working Papers Series**, # 2015-43 and currently under revision at **Industrial and Corporate Change**. Chapter 5 was co-authored with Veneta Andonova and Luis Díaz-Serrano. It was presented at the **SMS Special Conference Startup and Restart Strategies 2014** and is currently in the process of resubmission at **Entrepreneurship: Theory and Practice**. Chapter 6 was authored solely by me.

Esta tesis está dedicada a mi familia por todo el amor, la motivación y la fuerza que me han brindado durante los últimos años.

Diese Dissertation ist meiner Familie gewidmet, für all die Liebe, Motivation und Stärke die sie mir in den letzten Jahren gegeben haben.

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"Among issues regarding the world economy today, none presents a more critical mix of promise and danger than those that reflect the wide disparities in present level of economic development and the strains that afflict societies struggling to catch up"
(Nelson and Winter, 1982:1)

CHAPTER 1

INTRODUCTION

Motivation and Aim

In the second half of the 20th century, economic processes have changed considerably: the inflexible Fordist mass production system was replaced by production structures that continuously need to adapt to changing market structures. Globalization, accelerating processes of technological change and the resulting growing importance of non-material resources are dominating in the knowledge economy of the 21st century. As a result, competitive advantages are obtained through a process of constant renewal. In this context, "knowledge is the most powerful engine of production" (A. Marshall, 1965, p. 115) and the economic development process is mainly driven by innovation (Malecki, 1997).

The close interrelationship between knowledge, innovation, and economic growth has spurred an increasing strand of literature trying to understand how exactly they are related, resulting in varying theoretical approaches. The way these theoretical approaches define the nature of the innovation process has evolved over the years. One of the major changes was marked by the introduction of the systems approach into the innovation literature (Smits & Kuhlmann, 2004) which put into question the linear model of innovation, a long prevailing view. Not only was innovation now viewed as a result of economic and social processes (Kuhn, 1962). Scholars additionally proposed - based on the concept of Innovation Systems – that learning and innovation are interactive processes which do not take place in isolation but rather are embedded in the context of a system (Edquist & Johnson, 1997; Lundvall, 1992; Nelson, 1993).

This institutional context, which social scientists had been studying for a long time, was largely overseen by economic theory up to that point (Rodríguez-Pose, 2013). It was now placed

at the center of focus. More concretely, this literature has shaped the notion that both learning and innovation are interactive and socially embedded processes which can only be fully understood when the institutional context is taken into account (Lundvall, 2008). Today, the notion of a National Innovation System (NIS) is one of the most important and most cited theoretical concepts in the innovation literature (Martin, 2012).

Despite its rising importance, recent theoretical considerations have brought forward one important missing element of the NIS approach: individual agency and as a consequence the absence of the entrepreneur (Acs, Autio, & Szerb, 2014). The NIS literature is firmly grounded on the Schumpeter Mark II tradition, which emphasizes the role of large corporation for R&D (Freeman & Soete, 1997). However, ever since the early work of Schumpeter (1934) – Schumpeter Mark I – innovation has been intimately linked with entrepreneurship. Schumpeter talked about 'gales of creative destruction' generated by the entrepreneur who implement change within markets by creating new combination. For William Baumol (2002), the entrepreneur introducing innovation and thus breaking with established paths is the source that drives the competitive advantage of nations. Despite this close relation, "the two literatures, those of NSIs and entrepreneurship, have largely developed in parallel, independent of one another, even though the concepts of innovation and entrepreneurship themselves are closely related, and both literatures trace at least some intellectual descent from Schumpeter" (Acs et al., 2014). And while the NIS literature largely ignored the individual agency, entrepreneurship literature focused almost exclusively on the individual, not considering the context (Acs et al., 2014; Welter & Smallbone, 2011; Welter, 2011). However, entrepreneurial activity does not take place in a vacuum but is rather embedded in an institutional context as well (De Clercq, Danis, & Dakhli, 2010). I place this study in the recent discussion about the shortcomings of both the NIS and entrepreneurship literature, investigating how individual/firm-related factors and characteristics of the institutional context interact in driving both entrepreneurship and innovation. Additionally, I draw on the system-idea as I evaluate how these factors work together in influencing innovation and entrepreneurship. As a result, *the aim of this research is to advance knowledge about the role of individual/firm-related characteristics (i.e. enabler and barriers) and institutional variables simultaneously play in influencing innovation and entrepreneurship.*

On the Importance of Social Capital

From the standpoint of New Institutional Economics, institutions are "an arrangement between economic units that defines and specifies the ways by which these units can co-operate or compete" (North & Thomas, 1970, p. 5). More broadly, they are "the rules of the game in a society or, more formally, are the humanely devised constraints that shape human interaction" (North, 1990, p. 3). In this context, institutions are important regulators of social life, reduce uncertainty in economic interactions, determine transaction and production costs and thus are critical determinants of economic activity (North, 1990) and economic transactions (Williamson, 1998); they therefore influence economic outcome (Bruton, Ahlstrom, & Li, 2010; Li & Zahra, 2012). One prominent distinction is made between institutions based on their degree of formalization (North, 1990). According to this author, informal institutions are not necessarily made explicit or even communicated among the social actors and include conventions or code of behaviors, whereas formal institutions are devised by humans and officially stated[1]. As such, informal institutions may be understood as a collection of social norms, conventions and moral values which guide, facilitate, and constrain economic actors in their behavior and actions and which are – contrary to formal institutions – self-enforcing.

Against this background, the concept of social capital is intimately related to informal institutions (Rodríguez-Pose, 2013). Being one of the most allusive and greatly discussed theoretical concepts[2], social capital can generally be understood as "features of social organizations such as networks, norms and social trust that facilitate co-ordination and co-operation for mutual benefit" (Putnam, 1993, p. 38). As such, "social capital refers to the internal social and cultural coherence of society, the norms and values that govern interactions among people and the institutions in which they are embedded" (Grootaert & Van Bastelaer, 2001, p. iii). Based on this definition, it becomes clear that social capital is also linked to the term social embeddedness coined by Granovetter (1985), which largely influenced the literature on inter-

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[1] Scott (2001) further differentiates institutions into more fine-grained categories; he separates regulative, normative and cognitive pillars of institutions. Regulative institutions are represented by laws and rules that are legally sanctioned and as such function as coercive mechanisms. Normative institutions are related to norms, values and code of conducts. Instead of being legally sanctioned, they are morally enforced. The cognitive dimension is based on models of realities, which are supported by every day practices and culture and as such taken for granted.
[2] For overviews on definitions refer to Adler and Kwon (2002) or Woolcock and Narayan (2000).

firm networks. Even though the literature regarding social capital and the economics literature on institutions seem to be separate, the discussion between Granovetter and Williamson shows their relatedness: Granovetter (1985) critically pointed out that the important role of social relationships in constraining opportunism and solving problems of trust was missing in Williamson's transaction costs economics. Williamson' acknowledged that "although the main predictive of transaction cost economics turns out on the attributes of transactions, this is not to say that context is unimportant" (Williamson, 1994, p. 166). In a later work, he even stated that "transaction cost economics and embeddedness reasoning are evidently complementary in many respects" (Williamson, 1996, p. 230).

As a result from this discussion, it becomes clear that the influence of the social context in general and social variables specifically cannot be ignored when analyzing behavior and performance of economic actors. This work therefore focuses on informal elements of the institutional context. More precisely, I specifically explore the role various dimensions of social capital and the social context play in influencing the innovation behavior and performance of firms as well as individual's entrepreneurial intentions. One of the most prominent frameworks for social capital in the management literature is that of Nahapiet and Ghoshal (1998). Based on the work of earlier scholars, these authors differentiate between the structural, relational and cognitive dimension of social capital. Whereas the structural dimension of the social network refers to the "overall pattern of connection between the actors" (Nahapiet & Ghoshal, 1998, p. 244), the relational dimension refers to the "kind of personal relationships people have developed with each other through a history of interaction" (ibid: 244). The third dimension, the cognitive dimension, focuses on shared representations, interpretations and meanings among the actors of a network, in other words in norms, which are often subsumed under the concept of social context facilitating the actions of individuals (W. Tsai & Ghoshal, 1998), leading to richer relationships between the connected individuals (Anderson & Jack, 2002).

Measures comprising structural dimensions of networks and trust are predominantly the ones being used in the increasing number of research evaluating the impact of social capital on economic outcomes (Dakhli & De Clercq, 2004). I adhere to this line of research and investigate the influence of the structural and the relational dimension of social capital. Chapter 2 evaluates the influence of regional levels of general trust on the adoption of an open innovation strategy of

manufacturing firms. Trust is considered to be one of the most prominent outcomes of social networks (Knack & Keefer, 1997; Nahapiet & Ghoshal, 1998). Chapter 3 analyzes the influence of active memberships in civic associations on the effectiveness of using external information sources for generating product innovation. Civil associations lie at the heart of social capital as Putnam's seminal work (Putnam, 1993) found a strong correlation between measures of civic engagement and government quality across Italian regions.

Additional to these two "typical" dimensions of social capital in the innovation and entrepreneurship literature, I assess in Chapter 4 the influence regional level of tolerance plays for the generation of product innovation. Despite tolerance traditionally not ascribed to the concept of social capital, I argue that it forms part of the cognitive dimension of social capital. Tolerance tends to increase as the knowledge about others increases; a mechanism which is driven by a direct contact with people from various, diverging groups (Pettigrew, 1998). As such, social networks may drive the level of tolerance in individuals, shaping norms which facilitate (or hinder) the action and interaction of people. Chapter 5 focuses on the influence of entrepreneurial role models in affecting the relationship between entrepreneurial self-efficacy and entrepreneurial intentions. Though not adhering to any of the mentioned dimension of social capital per se at, entrepreneurial role models are seen as forming part of the social network of entrepreneurs, thus shaping social norms of the individual.

The Context of Developing Countries

Emerging and developing countries are characterized by underdeveloped, highly volatile and unreliable formal institutions, leading to market inefficiencies and thus posing a strong barrier for economic development. North (1990), for example, stated that the "inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and contemporary underdevelopment in the Third World" (p. 54). In such a context, individuals and enterprises tend to rely on personal ties in order to achieve success (Manimala & Wasdani, 2015). Despite some mixed results, most micro studies point towards the strong influence of social capital in contexts where formal institutions are weak (Ahlerup, Olsson, & Yanagizawa, 2009). Therefore, studying informal institutions and its influence on economic behavior in this context is especially important.

At the same time, innovation and entrepreneurship contribute to higher levels of economic output. The entrepreneur can reallocate resources from less productive to more productive processes (Acs & Storey, 2004), generating economic development through the generation of employment, innovation and welfare effects (Acs & Audretsch, 1988; Baumol, 2002; Schumpeter, 1934; Wennekers & Thurik, 1999). However, the nature of entrepreneurial processes and their impact on economic development largely depend on the institutional context in which it takes place, as for example the distinction between opportunity- and necessity entrepreneurship and its impact on economic development shows (Acs & Varga, 2005).

The same is true for the innovation process. Not only is the commercialization of inventions closely linked with economic progress and as such the improvement of living conditions: "People living in the first decade of the twentieth century did not know modern dental and medical equipment, penicillin, bypass operations, safe births, control of genetically transmitted diseases, personal computers, compact discs, television sets, automobiles, opportunities for fast and cheap worldwide travel, affordable universities, central heating, air conditioning…technological change has transformed the quality of our lives" (Lipsey, Carlaw, & Bekar, 2005, p. 5). The important distinction in the innovation literature between innovations that are new to the firm, new to the domestic market or new to the world (Fagerberg, 2006) hints at the importance context may play for understanding both the innovation process as well as its impact. Firms in emerging markets differ substantially from their counterparts in developed countries both in terms of weaknesses and strengths (West III & DeCastro, 2001). Historically, they have paid relatively low attention and thus invested relatively less in formalized R&D activities (Malik & Kotabe, 2009). Instead, firms in developing countries have relied to a greater extent on technology acquisition from developed countries, resulting in mechanisms to form technological capabilities that are fundamentally different from firms in developing countries (Henderson and Cockburn, 2000). As a result, in this context, innovation has been described as a process by which firms master and implement the design and production of goods and services which are new to them, irrespective of whether they are new to their competitors, clients, their countries or the world (Mytelka, 2000); putting at the heart of the innovation process minor and incremental changes (Goedhuys, 2007). However, despite the importance of entrepreneurship and innovation for economic development and the impact a weak institutional setting may have

for its understanding, by and large, literature analyzing these phenomena has focused on developing countries (Szirmai, Naudé, & Goedhuys, 2011).

Chapter 2, 3, and 4 of the present thesis focus on developing country settings. Whereas chapter 2 and 3 analyze the impact of certain social context variables at the regional level for Colombia, Chapter 4 is placed in the context of Latin America, evaluating the impact of regional levels of tolerance for a total of 24 different regions in 6 Latin American countries. Latin America has been characterized by a relatively prolonged period of economic growth during the first decade of this century. Yet, the region overall still lags behind industrialized countries; a situation which has already began to worsen as the example of Brazil's Itaboraí vividly exemplifies ('Learning the lessons of stagnation', 2015). Instead of two refineries, other petrochemical plants and related firms which were supposed to generate employment for 220,000 people, the project has been limited to a small-scale refinery due to plummeting commodity prices and a project-burdened and corruption-affected state-owned monopoly firm called Petrobas. While this may be an extreme example, it echoes the economic situation in Latin America. Different than Asian developing countries, the recent economic boom of Latin America primarily rested on commodities (Perry & Forero, 2014) with productivity rates not increasing accordingly. Against this backdrop, a recent study for Latin American countries confirming the impact of knowledge investments on the level of productivity, reporting productivity gaps between innovative and non-innovative manufacturing firms in these countries that are more than twice as high as in industrialized countries (Crespi & Zuñiga, 2012), becomes even more important. Understanding determinants of innovation behavior and performance in this context is therefore very important.

While Chapter 4 focuses on Latin America in general, Chapter 2 and 3 consider Colombia as a specific case. Colombia is an interesting case within the context of Latin America. Formerly known for the drug-related cartels such as that lead by Pablo Escobar in Medellín, and violence related to the ongoing civil war, Colombia is nowadays seen as the new economic powerhouse in Latin America (Shan, 2015). Geographically well situated in the northeastern part of Latin America, a relatively long period of stable politics during the four consecutive governments of Alvaro Uribe and now Juan Manuel Santos have improved business climate.

This is reflected, for example, by Colombia's recent ascend in the World Bank's "Doing Business" Indicator. Colombia climbed up from position 53 in 2013 to position 34 in 2014.

At the same time, the ongoing peace talks between the Colombian government and the largest left-wing guerrilla rebel group, the Revolutionary Armed Forces of Colombia, in Havana not only could end what is one of the longest-lasting civil wars in history and cause for Colombia placing among the countries in the world with the largest numbers of internally displaced people ("Global Numbers," 2015). It also paces the way for further economic optimism. In 2006, the Colombian state spent about 6.3% of its GDP in security-related issues, with an armed force of about 450,000 soldiers (Isaza & Campos, 2005). While it remains unclear exactly how much the end of the armed internal conflict may boost Colombia's GDP[3], it seems clear that it will have a positive impact. Despite these positive news, Colombia's investments in R&D has for decades remained well below average (Lederman & Maloney, 2003; OECD, 2012), which triggers the questions whether and how manufacturing firms innovate in Colombia if not through R&D investments. It is therefore an interesting setting to evaluate what are factors that determine innovation behavior and performance of manufacturing firms, analysis on which Chapter 2 and 3 are focused.

A Multilevel Methodology for a Multilevel Phenomena

A wide array of scientific disciplines - sociologists, geographers, and biologists – have recognized for several decades that many kinds of data have a hierarchical structure and, therefore, should be analyzed in a multilevel framework (Burstein, 1980; Diez-Roux, 1998; Kozlowski & Klein, 2000; Sampson, 1997). For example, students' performance is not only influenced by characteristics of the student such as intelligence, capabilities or study time. It will also be affected by the teacher, the school or even the national school system in which the student is embedded. The same teacher, school or national education system, however, will also influence other students to a point where students from one class in one specific school in one

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[3] Some scholars tried to estimate the impact of the civil war on economic growth. Mauricia Cardenas (2007), for example, came to the conclusion that between 1980 and 2005, the worker's annual productivity declined in comparison with the period between 1950 and 1980 and attributes this decline to the increased rate of criminality.

specific country might be more similar to each other than students drafted from a random sample.

Similarly, innovation and entrepreneurship are multilevel phenomena. Not only individual characteristics or the capabilities of firms but also the context in which the economic actor is embedded determine success. Already Schumpeter pointed towards the importance of context for the entrepreneur: "the reaction of the social environment against one who wishes to do something new ... manifests itself first of all in the existence of legal or political impediments" (Schumpeter, 1934, pp. 86–87). Entrepreneurship is a process taking place at different, intertwined levels and as such should be studied (Davidsson & Wiklund, 2001). This has led to constant calls for multi-level approaches (Davidsson & Wiklund, 2001; Low & MacMillan, 1988) for the study of entrepreneurship. Similarly, innovation, especially when viewed from the systemic approach, is explicitly a multilevel phenomenon (Edquist & Johnson, 1997; Lundvall, 2010; Nelson, 1993) according to which firms need to be understood as embedded in a broader innovation system.

Despite these theoretical arguments, empirical research adopting a multilevel design are very recent and remain scarce; most research in the entrepreneurship literature and even more so in the innovation literature focus on one specific level. In both the entrepreneurship (De Clercq, Lim, & Oh, 2013; Estrin, Korosteleva, & Mickiewicz, 2013; Klyver, Nielsen, & Evald, 2013; Stenholm, Acs, & Wuebker, 2013) and innovation literature (Goncalves Taveira, Goncalves, & da Silva Freguglia, 2014; Lorenz, 2015; Srholec, 2010, 2011), these type of studies are increasing. The importance of adopting an adequate econometric approach for the study of multilevel phenomena is twofold. On the hand side, statistical reasons urge the adoption of multilevel models. As a result of the hierarchical structure of data, when applying a traditional regression model based on partial least square method the assumption of independent observations would be violated (Hox, 2010; Snijders & Bsoker, 2012), leading to biased standard errors and inefficient coefficients (Raudenbusch & Bryk, 2002). Additionally, multilevel models avoid both ecological and individual fallacy. The ecological fallacy occurs when assuming that attributes at the higher level (i.e. region or nation) are directly reflected in the behavior of firms (Robinson, 2009). The individualistic fallacy results by incorrectly imputing behavior of economic actors (level 1) to level 2, e.g. region or nation (Seligson, 2002). On the other hand

side, theoretical reasons advocate the use of multilevel models. While using a set of "fixed-effect" dummy variable has been applied as a solution to control for contextual variables such as that of a country (e.g. Mairesse & Mohnen, 2002; Srholec, 2009), they are of little help if one would like to investigate the effects of contextual conditions themselves. Only multilevel models allow the researcher to evaluate the extent to which specific differences between different contexts are accountable for outcomes at the level of the economic actor. The focus of this dissertation lies on the assessment of how contextual variables influence the outcome of economic actor's behavior. I evaluate these influences by adopting multilevel models in each of the empirical chapters.

A Note on the Data Bases employed

I have relied on a variety of different data sources. Chapter 2 and 3 build upon the fourth wave of the Colombian Innovation Survey (Encuesta de Desarrollo e Innovación Tecnológica – EDIT) which follows the Bogotá Manual (RICYT, OEA, & CYTED, 2001). It resembles in many aspects the widely used European Community Innovation Survey (CIS) as the Bogotá Manual was established based on the Oslo Manual (OECD, 2005), the official guidelines for the CIS. Empirical studies based on EDIT are very recent (Alvarado, 2000; Anlló & Suárez, 2009; Arbeláez & Torrado, 2011; Bogliacino & Naranjo Ramos, 2008; Crespi & Zuñiga, 2012; Juliao Rossi, Aguirre Barrios, Schmutzler, & Sánchez Manchola, 2013; Lambardi & Mora, 2014; Langebaek & Vásquez Escobar, 2007; Sánchez, Juliao Rossi, & Zuluaga Jiménez, 2013). This dissertation extends findings from these studies by focusing on different aspects of the innovation process and performance. Additionally, the empirical results of Chapter 2 and 3 complement previous research carried out based on CIS (Arundel, Lorenz, & Lundvall, 2007; Bodas Freitas, Clausen, Fontana, & Verspagen, 2011; D'Este, Iammarino, Savona, & von Tunzelmann, 2012; de Marchi, 2012; Heidenreich, 2009; Hölzl, 2009; Schmidt & Faria, 2008; Tether, 2002).

I combine these firm-level data containing information about the innovation process and performance of Colombian manufacturing firms with data derived from the second wave of the Barometro de Capital Social (BARCAS) which contains, among others, data regarding different dimensions of social capital (Sudarsky, 2004). This data is representative at the regional level and is the basis for the Colombian data contained in the international data bases World Value

Survey (WVS) ('World Value Survey Wave 6', n.d.), though the questionnaire is adjusted to the Colombian context containing variables which are not contained in the WVS. The empirical results of chapter 2 and 3 therefore complements research which relied on the WVS (e.g. Beugelsdijk & Smulders, 2003; Beugelsdijk & van Schaik, 2005; De Clercq et al., 2013; Doh & Acs, 2010a; Knack & Keefer, 1997).

Chapter 4 of this thesis makes use of the mentioned WVS which is combined with data from the World Bank's Enterprise Survey for Latin America, allowing a comparative study for different Latin American regions. The World Bank's Enterprise Survey for Latin America has been used for empirical research before (e.g. Almeida & Ronconi, 2015; Busso & Madrigal, 2013; Hallward-Driemeier & Pritchett, 2015; Lederman, Messina, Pienknagura, & Rigolini, 2013). However, few of these studies focus on the innovation process. However, some empirical research focusing on innovation has relied the World Enterprise Survey for regions other than that of Latin America (e.g. Ayyagari, Demirgüç-Kunt, & Maksimovic, 2012; Chadee & Roxas, 2013).

Chapter 5 relies on the Global Entrepreneurship Survey (GEM), which is likely to be one of the most widely used data sources for cross-country studies regarding entrepreneurial behavior and success (Aidis, Estrin, & Mickiewicz, 2008; Anokhin & Schulze, 2009; Autio, Pathak, & Wennberg, 2013; De Clercq et al., 2013; Estrin, Korosteleva, et al., 2013; Estrin, Mickiewicz, & Stephan, 2013; Klyver et al., 2013; Kwon & Arenius, 2010; Stenholm et al., 2013; Thai & Turkina, 2014; Wennberg, Pathak, & Autio, 2013). Recent empirical research relying on this database is the one that extensively has adopted a multilevel framework, evaluating the impact of countries' characteristics in combination with determinants at the individual level. This dissertation extends findings in this line of research. I combine the data derived from GEM with data on the cultural dimensions of the different countries from the GLOBE project (House & Javidan, 2004), hereby following recent research on entrepreneurship(Autio et al., 2013; Thai & Turkina, 2014; Wennberg et al., 2013). The GLOBE study is a multi-phase and multi-method research program which collected data in the mid-1990s from middle managers in 62 countries. The study yielded nine distinct cultural dimensions (House & Javidan, 2004), extending earlier research by Hofstede (Hofstede, 1980).

Outline

This thesis consists of four self-containing chapters which deal with different aspects of how specific dimensions of the social context and social capital influence the innovation behavior and performance of firms and entrepreneurial intentions of individuals, mainly in the context of developing countries. Chapter 2 focuses on the influence of regional level of general trust have on the use of external information sources for the innovation process of Colombian manufacturing firms. For this purpose, I differentiate between exploitive and explorative use of external information sources. Chapter 3 evaluates the influence of regional civic engagement on the effectiveness of using external information sources for the generation of product innovations. We differentiate between active memberships at the regional level in Putnam-type and Olson-type civic associations. Both chapters focus on Colombian regions. Chapter 4 assesses the influence of regional levels of tolerance for the innovation success of firms in various Latin American regions. Finally, chapter 5 investigates the influence of two contextual variables, namely the presence of entrepreneurial role models and the national cultural dimension of individualism/collectivism on the relationship between entrepreneurial self-efficacy and entrepreneurial intentions.

"Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence."

Arrow, 1972: 357

CHAPTER 2

TRUSTING REGIONS – OPEN REGIONS? REGIONAL TRUST AS AN ADDITIONAL DETERMINANT OF FIRM'S OPEN INNOVATION STRATEGY

Abstract

This chapter explores the factors which influence the usage of external information sources for the development of innovation activities in the context of the Colombian manufacturing sector. For this purpose, two different information sources (explorative versus exploitive) are taken into consideration. Making use of the Colombian National Innovation Survey and the Colombian Social Capital Barometer, firm-level variables as well as the regional level of general trust are analyzed by means of multi-level analysis. The results show that the decision to use external information sources for the innovation process are determined by factors both at the firm- and regional-level, even though the effect of these variables changes according to the type of external information sources considered. Additionally, we show that regional trust is a main driver of the decision to make use of external information sources.

Introduction

The complexity and velocity of technical change (Steensma, 1996), the technological standardization and the resulting emergence and growth of specialized service markets (Arora, Fosfuri, & Gambardella, 2004), as well as the design of public policies which are aimed at intensifying collaboration between productive and academic agents (e.g. Ballesteros & Rico, 2001) have increased the pressure on firms to integrate external knowledge into their innovation

processes. As a consequence, formal and informal cooperation[4] are nowadays considered to be one of the central aspects for firms when designing an innovation strategy (Srholec & Verspagen, 2008). The increasing propensity during the past years to collaborate (Hagedoorn, 2002) was accompanied by a new understanding of firm's innovative activities. In contrast to earlier conceptions of a linear innovation process, innovation is now understood as an interactive process, where the reliance on external agents for information and knowledge is fundamental (Chesbrough, 2003; von Hippel, 1988).

Despite its importance, the propensity to cooperate differs greatly among firms (Belderbos, Carree, Diederen, Lokshin, & Veugelers, 2004; Bönte & Keilbach, 2005; Keupp & Gassmann, 2009), industries (Bodas Freitas et al., 2011), regions (Fritsch, 2001, 2003) and nations (Bodas Freitas et al., 2011). The question of why these differences emerge has been subject of research. Most of the empirical contributions focus on determinants at the firm or industry level. However, theoretical contributions such as the concepts of Innovative Milieu (Camagni, 1995; Koschatzky & Sternberg, 2000), the National (Lundvall, 2007, 2010) or Regional Innovation System (Asheim, Smith, & Oughton, 2011; P. N. Cooke, Uranga, & Etxebarria, 1997; Isaksen, Asheim, & Isaksen, 2002) and the Learning Region (Florida, 1995; Morgan, 2007)[5] point towards the importance of the socio-institutional context in which these firms operate. Even though this contention finds theoretical support, empirical studies evaluating the impact of the socio-institutional context on the use of external information sources for the innovation process of a firm are scarce.

We try to fill into this gap by advancing current understanding regarding the use of external information sources taking into consideration the regional socio-institutional context. Particularly, we study the influence of regional general trust on the use of external information sources as this variable not only constitutes a central element of the social-institutional context.

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[4] The use of external information sources, often interpreted as informal innovation cooperation, has increasingly been linked with the concept of open innovation (J. Chen et al., 2011; Laursen & Salter, 2006; Leiponen & Helfat, 2010). Subsequently, we use informal cooperation and open innovation interchangeably, fully acknowledging that it represents only one aspect of open innovation, the outside-in practice. For a good review on open innovation and its different dimensions, see for example Dahlander and Gann (2010) or Huizingh (2011).
[5] In some cases, these concepts and theories are subsumed under the concept of territorial innovation models (Knoben & Oerlemans, 2012).

Trust represents a key variable in regulating cooperative behavior (Williamson, 1979). While empirical research evaluating the influence of inter-firm or inter-personal trust on information sharing (e.g. Dyer & Chu, 2003) or cooperative behavior (e.g. Aalbers, 2010; Bönte, 2008; Laaksonen, Jarimo, & Kulmala, 2009) has a long tradition, general trust at the regional level has been largely overlooked. This is relatively surprising, as general trust constitutes a main element of social capital (Nahapiet & Ghoshal, 1998) and regional social capital is argued to be important not only for innovation[6] but also for cooperative behavior conducing to innovation (Malecki, 2012).

Our contribution goes further as this study makes use of a multi-level model, taking into consideration the hierarchical character of our data. The empirical analysis therefore responds to constant calls of scholars who view innovation in a systemic way (Lundvall, 2010) and urge for a a multi-level design to the study of innovation (Beugelsdijk, 2007; Srholec, 2010, 2011). Despite this call, the majority of empirical research in this area still focuses only on one level or does not take into consideration the hierarchical characteristics of the data when choosing their econometric methodology (Beugelsdijk, 2007; Srholec, 2010, 2011). The applied multi-level model avoids the ecological fallacy which occurs when assuming that attributes at the regional (or national) level are directly reflected in the behavior of firms (Robinson, 2009). Additionally, the individualistic fallacy by incorrectly imputing firm-level innovative behavior to the regional or national level (Seligson, 2002) is foregone as well. Furthermore, the decision to make use of external information sources is a choice situation, potentially prone to violate the assumption of independence of irrelevant alternatives (Hausman & McFadden, 1984). The introduction of random terms through the multi-level model employed in this study, we allow to partially relax this assumption (Grilli & Rampichini, 2007).

We additionally contribute to current research on the influence of trust as well as firm-level characteristics on cooperative behavior by differentiating two types of external information sources. Early research has often treated collaboration for innovation as a homogeneous strategy. However, firms are more and more heterogeneous (Gaillié & Roux, 2010) and therefore the

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[6] For a discussion on the relationship between social capital and regional innovation capabilities see for example Tura and Harmaakorpi (2005).

variety of collaboration patterns needs to be recognized (Idrissia, Amara, & Landry, 2012; Keupp & Gassmann, 2009). At the same time, determinants for innovation collaboration strongly depend on the type of partner and its governmental form (Belderbos, Carree, Diederen, et al., 2004; Bodas Freitas et al., 2011; Bönte & Keilbach, 2005; Gaillié & Roux, 2010; Srholec & Verspagen, 2008), thus calling for a differentiated look upon innovation collaboration. We subscribe to this line of research and apply March's (1991) dichotomy of exploration versus exploitation to differentiate between two types of external information sources firms tap into in order to evaluate the differential impact of firm-level determinants and general trust at the regional level on them.

Our third contribution is to place this study in the context of a developing country; a context which has not only been largely overlooked by empirical research. The few empirical studies in these countries point to a lack of interaction among actors in the respective Innovation System (M. Bosch, Lederman, & Maloney, 2005). Advancing the understanding of collaboration drivers for innovation may provide policy makers actionable knowledge for public policy. Furthermore, by placing the study in this context, the currently limited understanding of open innovation in small and medium-sized firms (van de Vrande, de Jong, & Vanhaverbeke, 2009) is advanced, as most firms in this study fall into this category.

<div align="center">

Theory Development

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External information sources – explorative versus exploitative

When technological knowledge is assumed to be dispersed among different organizations and actors (Cohen & Levinthal, 1989), a firm can generate new knowledge only through a multiplicative process which involves internal learning processes, internal R&D processes, and access to external knowledge (Antonelli, 2000). As a result, a strategy that is closely linked to a successful development of new products and processes comprise both the use of internal research and development and external knowledge sources (Cohen & Levinthal, 1990; Veugelers, 1997). Data derived from Community Innovation Surveys based on the Oslo Manual (OECD, 2005) in various countries has pointed out the growing use of external information sources and their often positive influence on the innovation performance of firms (Amara & Landry, 2005; Bodas

Freitas et al., 2011; J. Chen, Chen, & Vanhaverbeke, 2011; Hagedoorn & Duysters, 2002; Laursen & Salter, 2006)[7].

Arguments which favor the use of specific kinds of external agents have been brought forward. For example, clients are generally seen as a way to reduce risk and uncertainty associated with the innovation process (Miotti & Sachwald, 2003). Additionally, the collaboration with clients can be an important strategy to establish itself in the marketplace (Appiah-Adu & Ranchhod, 1998). Pavitt (1984) points out that in many industries the technological change obtained is based on the knowledge inherent in the machinery and equipment; in other words knowledge infused through providers. Competitors can be an alternative way to reduce costs of the innovation process or to obtain complementary resources and capacities (Tether, 2002), particularly with ever-rising R&D expenditures (Mowery, 1998). Summing up, these external agents usually seem to be a way to maximize the exploitation of complementary assets, allowing the firm to incrementally build upon the firm's existing knowledge (Bercovitz & Feldman, 2007). Agents that provide scientific information such as universities or research institutes usually constitute a much lower commercial risk as they do not primarily seek to commercially exploit their knowledge. Instead, they are generally focused on basic R&D-based research (Miotti & Sachwald, 2003). As such, these agents usually sought for exploring new opportunities or aiding to define new trajectories (Bercovitz & Feldman, 2007).

This differentiation goes in line with the exploration – exploitation dichotomy introduced by Levinthal and March (1993). According to these authors, organizational exploration is the search for new knowledge, the use of unfamiliar technologies, and the creation of products with unknown demand. Exploitation, on the other hand, involves the use of existing knowledge, technologies and products as well as its refinement. As a result, while exploring knowledge from external agents usually involves a desire to discover new opportunities, exploiting knowledge from external agents rather involves the joint maximization of complementary assets (Koza & Lewin, 1998). Relying on these arguments and following earlier research (Faems, van Looy, & Debackere, 2005), we therefore content that exploitative external agents comprise agents which

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[7] Some empirical studies evaluating the impact of open innovation on performance evidenced no significant correlation or even a negative one (e.g. Lhuillery & Pfister, 2009; Un, Cuervo-Cazurra, & Asakawa, 2010).

provide market-related knowledge, such as suppliers, providers, competitors, and sectorial associations. Explorative external agents, on the other hand, comprise agents which provide information and knowledge related to new technologies or new scientific knowledge, such as universities and research institutes. Based on this distinction, we develop our theoretical discussion in the following section of varying drivers for each type of external agent.

What drives the use of external information sources?

Firms may adopt formal or informal collaborative arrangements for a variety of reasons[8], supported by theoretical arguments stemming from mainly three different streams of literature: the transaction cost theory, strategic management and industrial organization. The aim of this paper is not to provide a comprehensive overview on all these determinants. We rather focus on a set of variables which can be expected to drive the use of external information sources and discuss their differential impact on explorative versus exploitive information agents.

Openness drivers internal to the firm

One of the most analyzed aspects in the recent literature for the level of openness is the degree of absorptive capacity, a multidimensional construct which determines the ability of a firm to find, access, assimilate and commercially exploit new information (Cohen & Levinthal, 1990). It is argued that absorptive capacity drives the firm's ability to identify available information and knowledge external to firm (Cohen & Levinthal, 1990; Zahra & George, 2002) and as such is an important driver of the firm's openness. Despite the concept's widespread use, there is no general consensus on how to measure absorptive capacity; instead proxies for determinants of absorptive capacity are usually employed in empirical research (Schmidt, 2010; Vega-Jurado, Gutiérrez-Gracia, & Fernández de Lucio, 2008). Various firm-internal factors have been identified as determinants of absorptive capacity: (prior) organizational and individual knowledge and skills, organizational structures enabling information exchange within an organization and formalization in forms of procedures, rules and instructions which govern organizational processes.

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[8] See, for example, Belderbos et al., (2004) Bönte and Keilbach (2005), Cassiman and Veugelers, (2002), Lopéz, (2008), Keupp and Gassmann, (2009), Miotti and Sachwald (2003), (2002).

In their paper, Cohen and Levinthal (1990) bring forward the argument that absorptive capacity is path dependent as existent knowledge, skills and prior experience facilitate the use of new knowledge. Against this background, the concept of absorptive capacity for R&D intensive firms is well understood as the underlying hypothesis is that the ability to acquire and exploit available knowledge results from the firm's own engagement in R&D (Spithoven, Clarysse, & Knockaert, 2011). As such, most empirical studies find a positive correlation between R&D efforts and the propensity to collaborate both with exploitive and explorative external agents (Belderbos, Carree, & Lokshin, 2004; Bönte & Keilbach, 2005; Fritsch & Lukas, 2001; Tether, 2002)[9]. However, due to the mentioned path dependency, R&D investments are likely to be correlated with the ability to access explorative external knowledge sources rather than exploitative external knowledge sources.

Hypothesis 1a: The firm's R&D efforts are positively related with the use of external information sources, with a stronger effect for the case of explorative knowledge sources.

Aside from R&D investments, other knowledge-based drivers of absorptive have been brought forward, especially for the case of small- and medium-sized firms which often do not dispose of the necessary capital for R&D investments (e.g. Chun & Mun, 2011). The employee's level of education, training, and experience contribute to a firm's absorptive capacity (Schmidt, 2010; Vega-Jurado, Gutiérrez-Gracia, & Fernández de Lucio, 2008); highly qualified staff is more likely to recognize the value of external knowledge and is more likely able transform external knowledge (Lund Vinding, 2000). Additionally, the diversity of employees' knowledge plays an equally important role as the knowledge level. Usually, the positive effect of knowledge diversity is attributed to a greater functional diversity (Hong & Page, 2001) inducing creativity, thus facilitating the interaction with a broader spectrum of external information sources.

Both knowledge base and diversity are key to finding problem solutions and exploring new technological areas (Quintana-García & Benavides-Velasco, 2008; Zahra & George, 2002). Both the employee's knowledge base and diversity are likely to be of lower importance for the

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[9] Some empirical research which have used the persistence of R&D as a proxy for absorptive capacity have not confirmed a significant correlation with a firm's propensity to collaborate (e.g. Cassiman & Veugelers, 2002; Miotti & Sachwald, 2003).

case of exploitive external agents whose knowledge is directly linked with the firm's routine work and its practical necessities (Vega-Jurado, Gutiérrez-Gracia, Fernández de Lucio, & Manjarrés-Henríquez, 2008). Information deriving from this type of external source has a higher applicability and is easier to assimilate for the organization (Cohen & Levinthal, 1990), requiring a potentially lower level of knowledge base and diversity. On the contrary, the explorative information sources offer knowledge which in most cases does not have a direct applicability, demanding the development of new organizational capabilities. As a result, a greater knowledge base and diversity is required.

Hypothesis 1b: The firm's knowledge base and diversity are positively related with the use of external information sources, with a stronger effect for the case of explorative knowledge sources.

The ability of an organization to stimulate and organize for knowledge transfer is shown to be another determinant of a firm's absorptive capacity (F. Van Den Bosch, Volberda, & De Boer, 1999). For example, the ability to communicate across different functions within an organization is likely to enhance the organization's capability of absorbing external knowledge (Daghfous, 2004; Lane & Lubatkin, 1998). Integrating the sales and production department into the innovation process, as a result, is expected to reflect a higher absorptive capacity for exploitive knowledge whereas the integration of the R&D department is likely to augment this capacity for explorative knowledge as each one increases the ability to interact, communicate and thus exploit knowledge specific to these functional areas.

Hypothesis 1c: The existence of firm's social integration mechanisms is positively related with the use of external information sources.

Openness drivers external to the firm

Incoming and outgoing knowledge flows. The industrial organization literature for a long time has pointed towards inward and outward knowledge flows as one important incentive for innovation collaboration (Cassiman & Veugelers, 2002; d'Aspremont & Jacquemin, 1988; Jaffe, 1986). Already Alfred Marshall's (1890) concept of 'Industrial District' brought forward the idea that firms may benefit from knowledge and ideas that are created outside the firm. The common

theoretical argument in economic theory is that formal R&D collaborations allow firms to internalize knowledge spillovers (d'Aspremont & Jacquemin, 1988).

However, informal collaborations as considered in this study differ in one important aspect. They are not based on contractual agreements and instead include – among others – informal communication among employees.[10] As such, they are unlikely to be an effective mechanism for internalization of spillovers but rather generate outgoing spillovers (Bönte & Keilbach, 2005). Nevertheless, general knowledge spillovers such as public information sources (Bönte & Keilbach, 2005; Cassiman & Veugelers, 2002) could also be expected to have a positive effect on firm's probability to use external information sources as they create a greater scope for learning (López, 2008). Lopéz's (2008) empirical analysis confirms this proposition for the case of universities. At the same time, both López (2008) and Bönte and Keilbach (2005) find no empirical support that generic spillovers influence the probability of informal collaboration with customers or suppliers. The above results point towards the greater influence of the potential scope for learning generated by general spillovers for informal collaborations with explorative external agents and we therefore suggest:

Hypothesis 2a: Generic spillovers are positively related with the use of external information sources. The relationship will be stronger for explorative external agents.

Appropriability conditions are related to the firm's capacity to capture the benefits derived from innovation activities without information leaking or spilling-over to other actors in the market (Cassiman & Veugelers, 2002; Teece, 1986). They can be achieved either through formal methods, such as patents and trademarks or informal ones, such as secrecy or lead times. There is no consensus in the literature with regard to its impact on the use of external information sources. Based on the premise that "proprietary know-how is only a subject for trading if free diffusion can be prevented" (von Hippel, 1987, p. 295), some authors argue that existing strong legal protection mechanisms may reduce the fear of opportunistic behavior, increase the level of trust and as such favor knowledge exchange (Teece, 2002). As a result, a lack of protection mechanisms which enable the firm to capture the maximum value for their

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[10] See Hagedoorn et al. (2000) for a taxonomy of research partnerships.

innovation activities may lead to a lower level of openness towards external actors (Baum, Calabrese, & Silverman, 2000).

At the same time, strong protection mechanisms may pose a barrier to information exchange between economic actors. Von Hippel (2005), for example, advocates that overly protective firms are likely to miss out on opportunities of information exchange, as reciprocity in information sharing is expected (von Hippel, 1987). These firms might scare off potential external agents (Laursen & Salter, 2014). Additionally, legal and bureaucratic processes may deter employees from informally engaging with external actors (Liebeskind, 1997). Laursen and Salter (2014) empirically show that those two arguments lead to a concave relationship between appropriability conditions and the use of external information sources. However, for the specific case of not having competitors among the sources of external information, the potential downsides of strong appropriability conditions seem to fade. At the same time, Bönte and Keilbach (2005) do not provide empirical evidence for a higher probability of informally cooperating with customers or suppliers in light of strong appropriability conditions. In light of including competitors among the exploitive information sources and based on these arguments, we propose the following:

Hypothesis 2b: Strong appropriability conditions are positively related with the use of external information sources, with a stronger positive relationship for exploitive information sources.

Regional trust - a regulating mechanism. The innovation process is – as mentioned above – increasingly understood as a social and interactive learning process (Lundvall, 2007). As a result, the necessity of the firm to relate to other economic agents has been highlighted. However, this understanding carries another important implication. Economic interactions aimed at the exchange of knowledge do not take place in a vacuum. Instead, economic actors are embedded in and shaped by a social and institutional context (Granovetter, 1985; Lundvall, 2007; Scott, 2001) which inevitably influences the innovation process. As a consequence, the question whether the reliance on external agents for the innovation process is specific to the socio-institutional context arises.

Institutions, understood as the rules of game, determine the behavior of economic actions, resolve cooperation problems and coordinate activities by shaping perceptions and dictating

payoffs for engaging in different activities (North, 1990). As a result, they not only strongly influence regional development (e.g. Rodríguez-Pose, 2013). More specifically, they play a key role in the process of interactive learning (Lundvall, 1992), serve as a regulating mechanism for collaborative agreements (Edquist & Johnson, 1997) and as such affect the networking behavior of firms (Saxenian, 1991) by influencing the degree of networking and openness (Asheim & Gertler, 2005). Trust has been put forward as one prominent type of informal institutions, forming part of social capital (Knack & Keefer, 1997; Nahapiet & Ghoshal, 1998). At the same time, economics, organization theory and sociology attribute general trust the ability to efficiently govern transactions, cooperation, social relationships or any other kind of interaction (Arrow, 1974; Blau, 1964; Garfinkel, 1963; Ouchi, 1980; Parsons, 1951).

The basis of trust lies in the individual (Bönte, 2008). Therefore, regional trust does not exist; it rather needs to be interpreted – similar to inter-organizational trust (Zaheer, McEvily, & Perrone, 1998) – as a general trust orientation of individuals towards others within a specific region. So why should it matter? Institutions are place specific (Rodríguez-Pose, 2013); not only do they shape but are also shaped by the regional environment (Gertler, 1997); place-specific forms of trust emerge. At the same time, the regional geographical scope is relevant for cooperative behavior because a substantial part of external knowledge derives from regional networks (de Jong, Vanhaverbeke, Kalvet, & Chesbrough, 2008) and geographical proximity is advantageous for open innovation (P. N. Cooke, 2007). In other words, open innovation is spatially organized (Teirlinck & Spithoven, 2008). Additionally, it is often argued that institutional arrangements operate more efficiently at the regional level, as the national level may be too distant and detached in order to incite specific behavior in firms (Rodríguez-Pose, 1999).

We content that trusting individuals living in one region will contribute to a general trust orientation among employees and as such can influence collaborative behavior among firms within a region. The most basic mechanism for establishing general trust among individuals within a region is the generation of trust through existing networks. Zucker (1986) labeled this mechanism the process-based mode of trust production, tied to past or expected exchanges. Its basis is "systemic or part of the society within which individuals act and is therefore shaped by political and historical background" (Lyon, 2000, p. 673). Continuous (information) exchanges among business partners have long been argued to positively contribute to the construction of

trust among these partners (Fisman & Khanna, 1999; Sako, 1998). However, networks also exist outside of professional relationships among business partners. The origin of social networks can span from family, to churches, communities, and ethnicities, civil or professional associations. Through these social networks, social-control measures arise. General trust therefore enhances the enforcement of norms; in high-trust societies informal peer-pressure punishment is much more effective than in low-trust societies (Balliet, Van Lange, & Balliet, 2013). Additionally, general trust also limits opportunistic behavior in interfirm-collaboration (Laaksonen et al., 2009). Transaction cost theory has introduced the notion that collaborations may be hindered by opportunistic behavior (Williamson, 1985). Trust and contracts are the main mechanisms to safeguard against it (Jap & Ganesan, 2000). By definition, informal collaborations which are the focus of this study, lack contracts as potential regulating mechanisms. In such conditions, trust may act as a substitute for contracts (Madhok, 2005; L. Wang, Yeung, & Zhang, 2011; Williamson, 1979). Lastly, higher general trust lowers transaction costs (Fukuyama, 1995), such as those for monitoring possible non-compliance or malfeasance of partners (Knack & Keefer, 1997) and as a result spurs collaboration despite the inherent risk associated with it (L. Wang et al., 2011).

A wide array of empirical research has linked inter-firm or personal trust with a higher incidence of collaboration agreements (Aalbers, 2010; Balliet et al., 2013; Bönte, 2008). Additionally, Westergren and Holmström (2012) provide first empirical evidence that personal trust between different actors is also an important driver of an open innovation strategy. Based on these arguments, we expect that regional trust acts as a safeguard mechanism and drives informal collaboration for innovation. This effect is likely to be more pronounced for collaborations with exploitative partners with the danger of opportunistic behavior being more pronounced in the case of market-related existing knowledge, technologies and products.

Hypothesis 3: A higher regional level of general trust is positively related with the use of external information sources. The relationship will be stronger for exploitive external agents.

Data Description and Methodology

The Colombian context

This study is placed in Colombia, a Latin American country which – according to the OECD – is classified as upper-middle-income. Despite significant economic growth during the last decade, Latin America in general and Colombia in particular have been characterized by an "innovation failure" (Marotta, Mark, Blom, & Thorn, 2008). The country and its firms lack behind in innovation input (i.e. any type of innovation-related investments) and in innovation outputs as measured in commercial patents and scientific publications (Lederman & Maloney, 2003). Additionally, its National Innovation System[11] shows signs of inefficiencies. For example the elasticity of patents with respect to R&D investments lies below the world's average (Marotta et al., 2008).

One of the reasons cited for these inefficiencies is the lack of collaboration between the private sector, research organizations and universities; a situation common in Latin America (M. Bosch et al., 2005). Furthermore, studies of Innovation Systems in less-developed countries recurrently point to a general lack of interaction among the actors (Arocena & Sutz, 2001; Bernardes & Albuquerque, 2003; Cassiolato & Lastres, 2000; Melo, 2001). At the same time, developing countries are usually characterized by weak institutions (Meyer, Estrin, Bhaumik, & Peng, 2009). In such contexts, trust becomes particularly important (Lyon, 2000).

Data description

The present research relies on different datasets in order to analytically evaluate the proposed hypotheses. The firm-level data was derived from the Colombian Innovation Survey (Encuesta de Desarrollo e Innovación Tecnológica - EDIT), which is carried out by the Colombian National Statistics Department (Departamento Administrativo Nacional de Estadistica – DANE) every two years. The objective of this survey is to characterize the technological dynamics and analyze activities regarding innovation and technological development of Colombian manufacturing firms as well as to realize an evaluation of public innovation policies (DANE, 2010, p. 16). For this purpose, the EDIT follows the Bogota Manual

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[11] For an overview on the Colombian National Innovation System, please refer to Arbeláez & Torrado (2011).

(RICYT et al., 2001), a guide constructed by the RICYT (Red de Indicadores de Ciencia y Tecnología Iberoamericana e Interamericana) in order to adapt the Oslo Manual (Hu & Mathews, 2005) to the Latin American context.

We rely on the 4th wave of the Colombian innovation survey, covering the period 2007-2008. It contains more than 7.500 observations[12]. However, the information regarding the location of the firm's headquarter in Colombia is only available for those firms which have participated in the innovation survey since 2003-2004. We therefore rely on a total of 5,272 of Colombian manufacturing firms. Despite all its limitations, the various innovation surveys have been widely used for industrialized countries (Heidenreich, 2009; Hölzl, 2009; Lhuillery & Pfister, 2009; Segarra-Blasco & Arauzo-Carod, 2008; Vega-Jurado, Gutiérrez-Gracia, & Fernández de Lucio, 2009a, 2009b) as well as – more recently – for Latin America (Arza, 2010; Cassoni & Ramada-Sarasola, 2012; Cimoli, Primi, & Rovira, 2011; Crespi & Zuñiga, 2012). Additionally, empirical research making use of the EDIT is increasing with several studies being published during the past years (Alvarado, 2000; Anlló & Suárez, 2009; Arbeláez & Torrado, 2011; Bogliacino & Naranjo Ramos, 2008; Crespi & Zuñiga, 2012; Juliao Rossi et al., 2013; Lambardi & Mora, 2014; Langebaek & Vásquez Escobar, 2007; Sánchez et al., 2013).

We combined these data with regional-level data derived from the Social Capital Barometer for Colombia (Barometro de Capital Social - BARCAS). That survey was developed by John Sudarsky (1998, 2004, 2007) following the World Value Survey (Inglehart, Basanez, & Menendez Moreno, 1998). The first wave of BARCAS, which aims to measure social capital and social participation for the different Colombian regions, was carried out in 1997. We rely on the second wave carried out in 2005 carried out by the Fundación Restrepo. The lag of two years between the measurement of regional general trust and the firm-level variables (based on the EDIT 2007-2008) is of no concern when one considers that trust as part of social norms take time to change. In fact, recent studies confirm that social trust can be transmitted from generation to generation (Dohmen, Falk, Huffman, & Sunde, 2012). Even though BARCAS has been used

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[12] The National Statistical Department (DANE) applies this survey every two years to all manufacturing enterprises which either have 10 or more employees or which register a production level above a certain threshold which is defined for each wave. Therefore, this survey is not a representative sample but instead a census of the manufacturing enterprises in Colombia of a certain size.

little in empirical research, the World Value Survey which forms its basis is a widely used survey to link elements of social capital with economic development (Beugelsdijk & Van Schaik, 2005; Knack & Keefer, 1997), entrepreneurship (De Clercq et al., 2010, 2013) or innovation performance (Dakhli & De Clercq, 2004; Doh & Acs, 2010b). We relied on this survey as it has the great advantage to be representative at the regional level (Sudarsky, 2007). We therefore matched data from EDIT at the regional level. Additionally, the data were complemented with regional data derived from the Colombian statistical department DANE. Appendix A lists the departments of Colombia and its respective classification into the different regions. We excluded the case of the only firm whose headquarter is located in Casanare. Casanare in 2007 had a GDP per capita 2.5 times higher than that of the capital Bogotá; a result deriving from the very low population density which is coupled with one of the most active mining activities. As such, this case is an extreme outlier for the Orinoquía region and would distort our results.

Variable description

Dependent variable

Our dependent variable reflects a firm's usage of external information sources for the development of its innovation activities. Firms needed to respond whether or not a specific information source was important as a source of idea generation for the development or the implementation of any kind of innovation (product, process, organizational or commercial). In the affirmative case, the variable takes the value of 1; otherwise the value is 0. As we have extensively discussed above, factors that influence the use of external information sources may differ depending on the type of agent. As a consequence, we constructed a categorical variable which takes into consideration the two types of external agents discussed: exploitative and explorative. This categorical variable takes the value of 0 if the firm did not use any external information sources, 1 if it relied on exploitative agents, 2 if it relied on explorative agents and 3 if it used both types. Table 1 presents descriptive statistics for the external agents included in each the categories and the respective Alpha Cronbach, indicating that the set of items have a high degree of internal consistency.

Table 1
Descriptive statistics and Cronbach alpha for the two types of external information sources.

Exploitive External Information Sources	Mean	St. Dev.	Cronb. Alpha
Clients	0.23	0.42	
Competitors	0.13	0.33	
Suppliers	0.18	0.38	
Firm of the same sector	0.06	0.23	
Firm from other sectors	0.05	0.23	
Total	**0.30**	**0.46**	**0.75**

Explorative External Information Source	Mean	St. Dev.	Cronb. Alpha
Universities	0.07	0.25	
R&D Centers	0.03	0.17	
SENA*	0.04	0.21	
Centers for Technological Development	0.02	0.15	
Consultants	0.12	0.32	
External R&D Departments	0.04	0.20	
Total	**0.17**	**0.38**	**0.71**

*The national public institution for technical and technological education

Firm-specific independent variables

Our independent variables are represented in two different vectors, reflecting the firm- and regional level. As discussed above, we include various measures for drivers of absorptive capacity. The EDIT survey does not contain sales or revenues figures. Instead, we included a measure which represents the percentage of R&D investments with regard to the total amount of investments made for innovation activities (*investrdpct*). This variable maybe interpreted in two distinct ways: it represents one dimension of the knowledge base but it also provides us with an indicator regarding its innovation strategy as it reflects the importance of R&D versus other innovation investments such as machinery acquisition, training or the purchase of technological licenses. Its inclusion relies on the assumption that the ability to make use of externally acquired knowledge depends on previous R&D activities of the firm (Spithoven et al., 2011). Additionally, we include a variable that reflects the percentage of people actively involved in the realization of scientific, technological, or innovation activities as a percentage of the total personal (*persinovpct*).

Additionally, several variables measuring the firm's existent knowledge base and diversity are included. Human capital is argued to drive innovation as those who are better educated and are equipped with more work experience will spur the firm's knowledge base (Schmidt, 2010). The variable *persdegreepct* measures the percentage of employees having

obtained a university degree. The percentage of employees which have received a formal training of 40 hours or more during one of the two years considered is reflected in the variable *perstrainpct*. Both measures follow earlier research on knowledge-based drivers of absorptive capacity (Schmidt, 2010; Vega-Jurado, Gutiérrez-Gracia, & Fernández de Lucio, 2008). We include a measure for employee's knowledge diversity. This measure has been calculated in diverse ways depending on the employee's characteristics such as age, gender, nationality, experience and academic training (Østergaard et al., 2011). In the present research, we concentrate on the employee's diversity of academic formation; it reflects the possibility for creating more space for experimentation and knowledge search and is likely to make the firm more open towards external knowledge. We measure diversity in a reverse way, calculating a concentration index (*Indexconc*) which takes values ranging from 0 to 1 with the upper limit representing the maximum level of concentration (or minimum level of diversity)[13].

Finally, we include three binary variables which reflect the importance of internal information sources for the development of innovation activities: a) the internal R&D department (*intsourcerd*), b) the production department (*intsourceprod*), and c) the sales department (*intsourcesales*). These potentially reflect the organizational ability to stimulate and organize internally for knowledge transfer. Not only has recent empirical research highlighted the importance of work organization for innovation (Lorenz, 2015). Additionally, the ability to communicate across different functions within an organization is likely to enhance the organization's capability of absorbing external knowledge (Daghfous, 2004; Lane & Lubatkin, 1998).

For a general spill-over measure (*spillover_scale*), we relied on earlier research regarding the firm's perception of how important publicly available knowledge is (Bönte & Keilbach, 2005; Cassiman & Veugelers, 2002). These general information sources are characterized by providing information at a relatively low or even no cost (OECD, 2005). In the EDIT survey, firms had to indicate whether or not various sources of idea were important for the development or the implementation of any kind of innovation (product, process, organizational or

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[13] In the EDIT survey the potential academic formations are grouped into the following categories: a) Chemistry, Physics, Mathematics and Statistics; b) Health science; c) Engineering, Architecture and Urban Studies; d) Agronomy, Veterinary Studies and alike; e) Social Science; f) Human Science and Arts.

commercial). The publicly available information sources were the following: Chamber of Commerce, Seminars and Conferences, Fairs & Expositions, Books & Journals, Patent Information, Information on Copyrights, Scientific & Technological Databases, and Databases on Technical Norms. We generated an index ranging from 0 to 1, with 1 indicating that the firm used all of the available general information sources. The Alpha Cronbach for these general data sources is 0.8255, indicating a high internal consistency.

Information regarding firm's appropriability conditions contained in EDIT IV is somewhat different than in the Community Innovation Surveys (CIS). As a result, instead of measuring the effectiveness of strategic and legal protection mechanisms (Bönte & Keilbach, 2005; Schmidt, 2007) we include one variable which represent the perceived lack of appropriability conditions as a barrier for innovation. Firms surveyed had to indicate on a 3-point Likert scale the following two barriers were for their innovation process: "ease of imitating third parties" and "insufficient capacity of the intellectual property system for the protection of innovations". We generate a general index, ranging from 1 - 3 (*approp_scale*), indicating the strength of appropriability conditions as a barrier for innovation.[14]

Firm-specific control variables

In order to empirically evaluate our hypothesis, we need to include control variables both at the firm and the regional level. At the firm-level, we include the percentage of investment made in machinery and equipment (*investmachinpct)* as it potentially controls for investments which conduce to the creation of absorptive capacity for experience-based learning which relies on doing, using and interacting; often referred to as the DUI mode of innovation (Jensen, Johnson, Lorenz, & Lundvall, 2007). We include the number of employees (*perstotal*) which controls for effects of the firm size which has been found to be relevant for cooperation (Cassiman & Veugelers, 2002). The presence of foreign capital is included in form of a binary variable which takes the value of 1 in case that 25% or more of the capital is of foreign origin

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[14] All firms – independent of whether they undertook any innovation activities or achieved any kind of innovation – had to respond to these questions.

(*capi*). The percentage of own resources over the total amount of investments in innovation activities (*finownpct*) was included as well.

A high technological level and innovation dynamics and the resulting pressure to innovate within an industry may drive informal cooperation. While some authors (Bayona, Garc, & Huerta, 2001; Belderbos, Carree, Diederen, et al., 2004; J.-C. Wang, 1994) demonstrated a positive relationship between the industry's technological level and the number of technological alliances established, others (Miotti & Sachwald, 2003) could not confirm this relationship. In fact, Tether (2002) argues that when taking into consideration other factors, it is far from clear that firms operating in high technology sectors will be more likely to use external information sources. Some suggest that this hypothesis is actually driven by a bias generated through a reliance on studies with firms operating only in these high-technology sectors (Chesbrough & Crowther, 2006; Pittaway, Robertson, Munir, Denyer, & Neely, 2004). The Colombian innovation survey does not contain information regarding the industry dynamics. However, at least some of these are captured when including dummy variables for the industry. We therefore define four binary variables which indicate the sector to which the firm belongs: a) supplier-dominated sectors (*pavitt_supp);* b) scale-intensive sectors *(pavitt_scale*); c) specialized supplier sectors (*pavitt_special*) and d) science-based sectors *(pavitt_science*)[15]. Additionally, including the sectorial taxonomy proposed by Pavitt (1984) controls for other sectorial aspects potentially driving the use of external information sources. For example, legal protection mechanism are likely to be industry-specific (Bönte & Keilbach, 2005).

Regional independent variable

The vector representing regional variables includes one of our main explanatory variables which was constructed based on the question "In general terms, would you say that you can trust in the majority of people or that you cannot be that trusting when interacting with other people?"[16]. Each person participating in the BARCAS questionnaire had to answer with either

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[15] Pavitt's (1984) taxonomy has proved to be a fruitful analytical framework to understand in an adequate way technological behavior at the sectorial level. It has been used in numerous empirical studies as a firm classification variable (Arundel, van de Paal, & Soete, 1995; Cesaratto & Mangano, 1993).

[16] The question is originally in Spanish: "En términos generales, ¿diría usted que se puede confiar en la mayoría de las personas o que no se puede ser tan confiado al tratar con la gente?". The translation above is a translation of the authors which was not used as such in the survey.

yes (taking the value of 1) or no (taking the value of 0). Provided that the questionnaire is representative at the regional level, we took the regional mean of this binary variable and constructed an index ranging from 0 to 100 with the maximum value representing perfect general trust in the region. Despite critics regarding this general trust measure, recent experimental research has found that it is correlated with the expectation regarding other people's behavior (Sapienza, Toldra-Simats, & Zingales, 2013) and as such measures what Gambetta (2000) referred to as trusting in other which is when "we implicitly mean that the probability that he will perform an action that is beneficial … is high enough for us to consider in engaging in some form of cooperation with him".

Regional control variable

At the regional level, we rely on several recent empirical investigations which evaluate the influence of social capital on innovation as a reference for including several control variables (Doh & Acs, 2010b; Kaasa, 2009; Laursen, Masciarelli, & Prencipe, 2012). We therefore include the GDP per capita (*gdpercap*), the number of researchers (*researcher*) and the number of higher education institutes (*higheredu*) for each region.

Methodology

Given the hierarchical nature of the data (firm-level data and regional-level data), it is necessary to use an analytical approach which reflects this. On the contrary, we would be violating the OLS assumption of independent observations (Snijders & Bsoker, 2012), leading to inefficient regression coefficients and negatively biased standard errors (Rabe-Hesketh & Skrondal, 2014; Raudenbusch & Bryk, 2002). Applying a multi-level method overcomes this problem by explicitly taking into account the social context, thus differentiating between the effects on the use of external information sources at the two levels proposed for this research (Goldstein, 1995; Snijders & Bsoker, 2012). A common approach to model unordered choices such as in our example the firm's choice between the different types of external information source is the multinomial logit model (MNL), known in econometrics under the label choice model (McFadden, 1973). Skrondal and Rabe-Hasketh (2003) provide a detailed theoretical description of its multi-level version. The multilevel multinomial logit model is a Generalized Mixed Model (McCullagh & Nelder, 1989) with linear predictors:

$$\eta_{ij}^{(m)} = \beta_{0j}^{(m)} + \sum_{k=1}^{K} \beta_{kj}^{(m)} X_{ijk}^{(m)} + \varepsilon_{ij}^{(m)} \tag{1}$$

with x_{ijk} representing individual characteristics, β_{0j} and β_{kj} being the coefficients to be estimated and ε_{ij} being a random error term. Assuming a multinomial logit link then:

$$P(Y_{ij} = m \mid x_{ijk}, \varepsilon_j, \delta_{ij}) = \frac{\exp[\eta_{ij}^{(m)}]}{1 + \sum_{l=3}^{M} \exp[\eta_{ij}^{l}]} \tag{2}$$

where m = 1, 2, … , M denotes the response category (type of external information source), j = 1, 2, …, J denotes the cluster (region) and i = 1, 2, … , η_j denotes the subject (firm) which is embedded in the j-the region. The response variable Y_{ij} has a multinomial distribution, taking values from the set of alternatives {1, 2, …, M}, with m = 1 being the reference category (not relying on any external information sources).

The application of a multilevel regression allows $\beta_{0j}^{(m)}$ and $\beta_{kj}^{(m)}$ to be modeled as outcome that depend on contextual factors of the regional-level. They are therefore treated as random variables. In this model, we assume the simplest case where the slopes $\beta_{kj}^{(m)}$ are assumed to be fixed but the intercepts $\beta_{0j}^{(m)}$ are assumed to be random, leading to the linear relationship expressed in (2) to be read as follows:

$$\eta_{ij}^{(m)} = \gamma_{00}^{(m)} + \sum_{q=1}^{Q} \beta_{0q}^{(m)} Z_{jq}^{(m)} + \sum_{k=1}^{K} \beta_{0k}^{(m)} X_{ijk}^{(m)} + \left(u_{0j}^{(m)} + \varepsilon_{ij}^{(m)} \right) \tag{3}$$

where $\gamma_{00}^{(m)}$ are fixed intercepts, $Z_{jq}^{(m)}$ are a set of contextual factors that vary at the regional level, and $u_{0j}^{(m)}$ and $\varepsilon_{ij}^{(m)}$ are vectors of random errors representing observed heterogeneity at regional and individual level. The last property is especially important as it partially relaxes the Independence of Irrelevant Alternatives (IIA) assumption (Grilli & Rampichini, 2007) by allowing for correlation in individual random effects across alternatives. The property of independence of irrelevant alternatives for choice models assumes that disturbances are uncorrelated over alternatives, therefore implying that adding or removing an alternative outcome does not influence the odds of the remaining alternatives (Greene, 2003). However, in some situations this assumption may be inappropriate as unobserved factors related to one alternative may be similar to those related to other alternatives. This is true especially in

our case where the firm's choice may be influenced by its location, thus generating dependence between choice situations by firms located in the same region. Following Skrondal and Rabe-Hesketh (2003), the adopted model captures unobserved heterogeneity at the regional level by introducing random effects. In particular, a correlated alternative-specific random intercept model with dependence within regions is introduced, thus relaxing the IIA. For our analysis, we relied on the user-written STATA command Generalized Linear Latent and Mixed Models (GLLAMM) (Rabe-Hesketh, Skrondal, & Pickles, 2004). These models are multilevel latent variable models for mixed responses, including unordered categorical responses, and are estimated via maximum likelihood using adaptive quadrature to determine the log-likelihood (Rabe-Hesketh et al., 2004).

Econometric Analysis and Results

Descriptive results

We report in Table 2 the descriptive statistics of the independent variables employed in this research as well as the correlation coefficients. The obtained values for the latter suggest a potential problem of multicollinearity for the regional variables, a problem that has been encountered by other research as well (e.g. Laursen et al., 2012). Among other things, such multicollinearity may cause greatly inflated parameters. Evaluating the Variance Inflation Factors for these variables, we can denote that they are above the well-accepted level of 10 (Belsley, 1991) for the number of researchers in the region as well as for the percentage of higher education graduates. We therefore exclude the two control variables *researcher* and *highereduc* from our regression analysis.

The descriptive statistics reveal that the average manufacturing enterprise in Colombia makes relatively little use of the variety of publicly available information sources, direct a relatively large share of their investments into the acquisition of machinery and technology (25%) whereas investments in R&D make up a share of only 3% of the total investments. Only a very low portion of the employees are formally trained by the manufacturing firms or participate in innovation-related activities (2% each). The internal collaboration seems to be relatively low as well, with innovation activities involving marketing or production departments in approximately 30% of the cases. Combined with the fact that only 15% of the manufacturing firms make use of their R&D department, this may also be an indicator that Colombian firms do

not have – for various reasons being size one of them – different departments on which they can rely for their innovation process.

Figures 1 through 3 provide us with information at the regional level. From these data we can observe that about two thirds of the Colombian manufacturing enterprises do not rely on external information sources, a large proportion when compared for example to the UK (Laursen & Salter, 2006). According to these authors, only 32% did not rely for example on suppliers as an external information source. We can additionally observe that the pattern for using external information sources varies according to the region: not only are there stark differences in using any kind of external information (52% in the region of Sucre-Guajira-Magdalena compared to 86% in the region of Norte de Santander). Additionally, whether a manufacturing firm relies only on exploitive external information sources or on explorative differs from region to region. Whereas on average 47% of those firms which rely on at least one kind of external information source rely exclusively on exploitive and 43% on both exploitive and explorative, in the region of Norte de Santander the reliance on only exploitive external information sources strongly dominates (71%).

Figure 1. Regional level of general trust

(.1384335,.2189349]
(.1283761,.1384335]
(.1016949,.1283761]
[.092537,.1016949]
No data
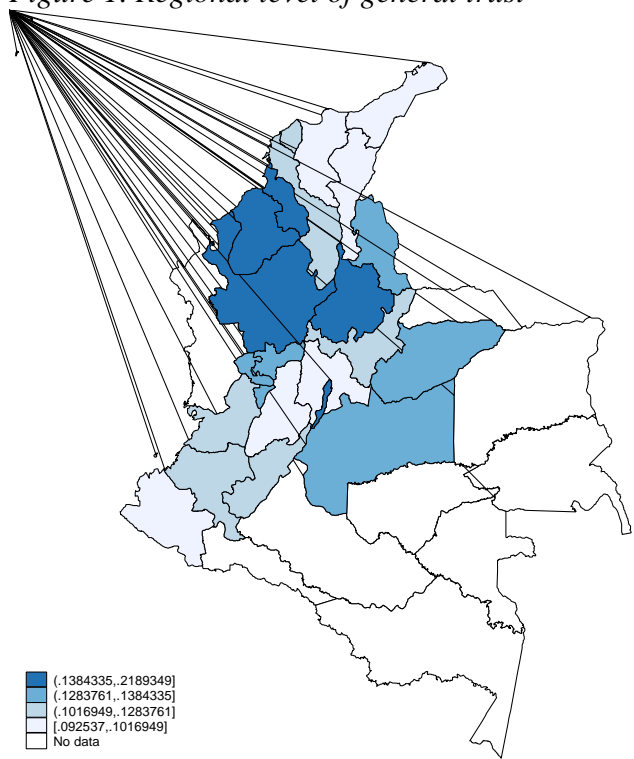
Figure 2. Regional distribution of the usage of external information

(.3672481,.48]
(.3275692,.3672481]
(.296578,.3275692]
[.1386139,.296578]
No data
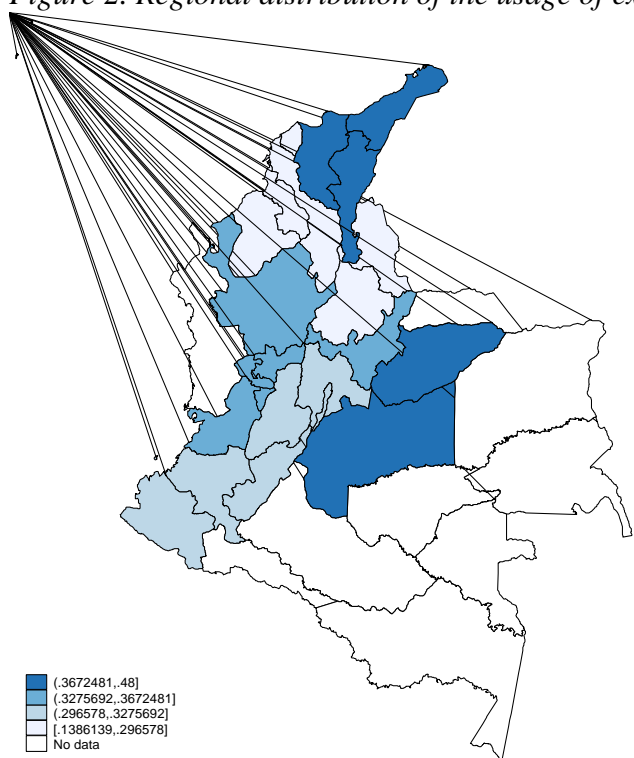
Figure 3. Regional distribution of using only exploitive, only explorative and exploitive and explorative information sources
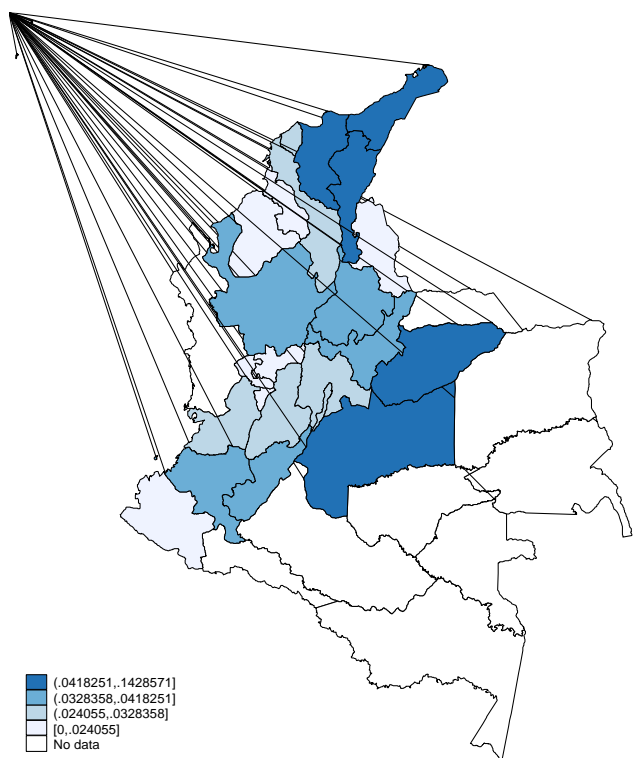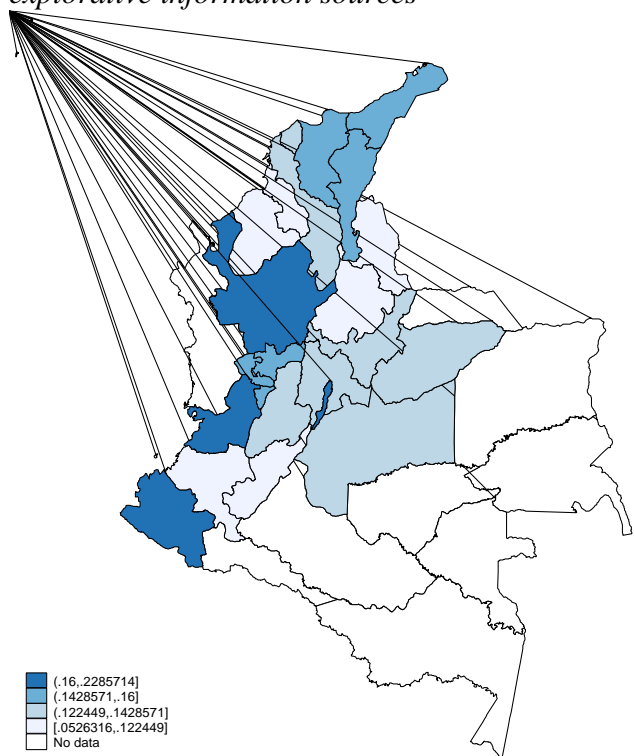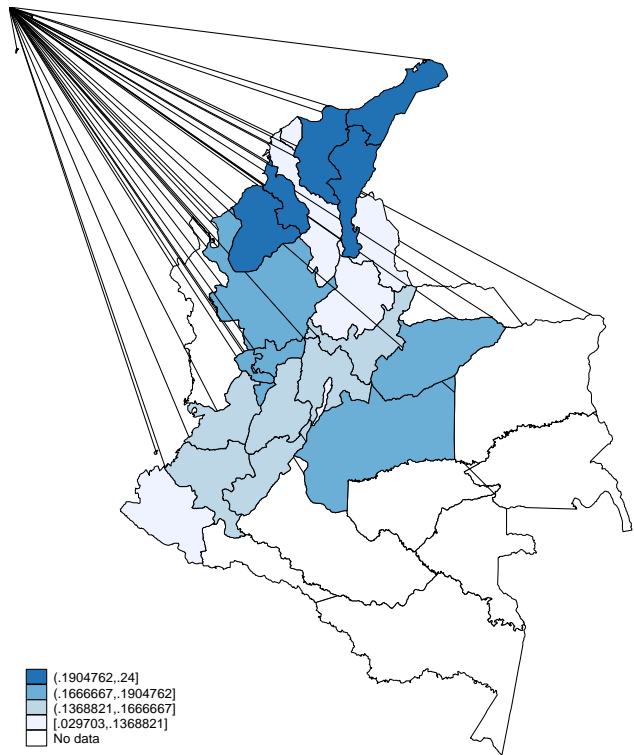
(.16,.2285714]
(.1428571,.16]
(.122449,.1428571]
[.0526316,.122449]
No data

(.0418251,.1428571]
(.0328358,.0418251]
(.024055,.0328358]
[0,.024055]
No data

Legend:
- (.1904762,.24]
- (.1666667,.1904762]
- (.1368821,.1666667]
- [.029703,.1368821]
- No data

Note: The data for the generation of the maps was retrieved from https://www.arcgis.com, the official Geoportal of the Geographical Institute Augustín Codazzi (IGAC) and were combined with data retrieved from BARCAS 2005.

Regression analysis

In order to investigate the effect of regional general trust on the use of external information sources for Colombian manufacturing firms, we conduct a multilevel multinomial regression analysis, differentiating between the use of exploitive, explorative and both exploitive and explorative information sources in comparison with the base category of not using any information sources. Our empirical results of a two-level random-intercept MNL specification using the variables stated above are presented in Table 3. We report regression coefficients in the multinomial multi-level regression for the three categories of our dependent variable. The response option of not using any kind of external information sources was used as the base category, i.e. the coefficients for each response category need to be interpreted as vis-à-vis the default option of not using an external information source. We first estimate an empty model, not including any of the covariates. We then add the individual-level variables and in the third model we add the regional-level variables. As we can observe, results for the individual-level control

variables do not change considerably across the three model specification, indicating the robustness of our results.

As a first step of analysis, we estimated the intra-class correlation (ICC) based on the empty model (Snijders & Bsoker, 2012). Compared with the reference category, obtained ICCs are 0.1% for exploitive information sources, 28.5% for exploitive and 7.2% for explorative & exploitive information sources. These results provide evidence that differences in the categories of the dependent variable between regions exists. However, most of the differences among firms to use one or another type of external agents are explained by firm-level drivers. Based on the regional-level variance and the covariance estimates, we can observe positive correlations between the three categories, with an especially strong correlation for category 2 and 3 indicating that regions with above-average odds of using exploitive information sources also tend to have above-average odds of using exploitive and explorative information sources.

For Model 2, we can evidence a statistically significant positive correlation between the percentage of personnel involved in R&D and the use of both exploitative and explorative external information sources. However, the percentage of R&D investments (of the total investments) made related to any innovation activities is only significantly and positively correlated with the use of exploitative external information sources, thus providing partial support for our hypothesis 1a. This results seems counterintuitive as R&D investments are traditionally considered a determinant of absorptive capacity (Leahy & Neary, 2007). Additionally, several empirical studies have confirmed a complementarity between internal R&D and external R&D (Cassiman & Veugelers, 2006; Lokshin, Belderbos, & Carree, 2008), indicating that firms which undertake R&D investments usually complement these investments with formal or informal R&D cooperation. However, Audretsch, Menkveld and Thurik (1996) found that this complementarity is only present in high technology contexts whereas low technology contexts - such as that of a developing country like Colombia – are rather characterized by a substitution between internal and external R&D. One of the potential explanations of a lacking correlation between current R&D investments[17] and the use of explorative external sources may lie in this substitution effect between R&D-specific investments and the use of explorative external information sources. This substitution, however,

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[17] The potential problem of endogeneity is discussed in the discussion section.

is not present when considering exploitative external information sources due to the difference in knowledge that can potentially be acquired.

Hypothesis 1b is not confirmed by the empirical results with the exception of training; the percentage of employees trained by the firm either internally or externally is significantly and positively correlated with the use of both exploitative and explorative information sources. This result is similar to those found by Schmidt (2010) and Vega-Jurado and colleagues (2008): the share of employees with higher education was only significantly correlated with the use of external agents providing scientific knowledge but not for the reliance on customers or suppliers. However, our results do not provide empirical evidence for the first link either. One of the reasons maybe that while employees with a university degree embody a higher level of knowledge and as such are more likely to be able to detect and assimilate external knowledge, this is likely to be case when the degree is related to the available knowledge. For example, Rothwell and Dodgson (1991) found that in small firms well-educated engineers and technicians are necessary to access external knowledge. However, the measure we employed takes into consideration any university degree, including human science. The same argument applies for the case of knowledge diversity – we included in the calculation of this measure all disciplines such as social science. It rather seems that relevant knowledge or the applicability in terms of knowledge targeted to the firm's particular needs matters more than formalized (generalized) knowledge. This argument is somewhat reinforced by the significant and positive correlation that exists between the percentage of employees trained and the simultaneous use of both explorative and exploitative external information sources.

Table 2
Descriptive statistics and correlation coefficients for the employed variables.

Variables	Mean	St. Dev.	1	2	3	4	5	6	7	8	9	10
1 spillover_scale	0.10	0.20	1									
2 approb_scale	2.37	0.76	-0.1522*	1								
3 investrdpct	0.03	0.14	0.1440*	-0.0934*	1							
4 investmachinepct	0.25	0.39	-0.2897*	0.0984*	-0.5153*	1						
5 finownpct	0.30	0.44	0.0486*	0.0363	0.0816*	-0.1477*	1					
6 persdegreepct	0.13	0.13	0.0621*	0.0245	0.0590*	-0.1378*	0.0555*	1				
7 persinovpct	0.02	0.04	0.0656*	-0.0597*	0.0481*	-0.1432*	-0.032	0.3801*	1			
8 perstrainpct	0.02	0.13	0.1015*	-0.0353	0.0494*	-0.1291*	0.0375	0.0977*	0.0731*	1		
9 Indexconc	0.62	0.33	-0.1098*	-0.0349	-0.0763*	0.0834*	-0.0269	-0.0909*	0.0738*	-0.0445	1	
10 intsourceprod	0.33	0.47	0.3430*	-0.0988*	0.0508*	-0.1254*	-0.0011	0.0125	0.0771*	0.0421	-0.0319	1
11 intsourcesales	0.26	0.44	0.4364*	-0.1284*	0.1278*	-0.2861*	-0.0041	0.1029*	0.0906*	0.0156	-0.0199	0.4580*
12 intsourcerd	0.15	0.35	0.4311*	-0.0582*	0.2230*	-0.2689*	0.0538*	0.1362*	0.0426	0.0934*	-0.1232*	0.3028*
13 perstotallog	3.67	1.35	0.2861*	0.0858*	0.0773*	-0.1589*	0.0003	0.0567*	-0.2279*	0.0806*	-0.2546*	0.2107*
14 capi	0.07	0.26	0.0682*	0.0568*	0.0429	-0.1136*	0.0999*	0.2553*	-0.0195	0.0812*	-0.1503*	0.0643*
15 pavitt	2.13	0.99	0.0426	0.0065	0.0206	-0.0213	0.0219	0.0066	0.03	-0.0014	-0.0762*	0.0266
16 gdppercap	12,200,000	3,513,496	0.0234	-0.0719*	0.0512*	-0.0522*	0.0391	0.0401	-0.0269	0.0532*	-0.0112	0.0516*
17 trust	0.16	0.05	0.0765*	-0.0481*	0.0733*	-0.0744*	0.0312	0.0157	-0.0061	0.0540*	0.0101	0.0295
18 researcher	58	29	0.0804*	-0.0788*	0.0868*	-0.1115*	0.0535*	0.0322	-0.0203	0.0704*	-0.014	0.0857*
19 higheredu	58	43	0.0572*	-0.0735*	0.0776*	-0.1105*	0.0494*	0.0542*	-0.0101	0.0735*	-0.0346	0.0834*

Variables	Mean	St. Dev.	11	12	13	14	15	16	17	18	19
11 intsourcesales	0.26	0.44	1								
12 intsourcerd	0.15	0.35	0.3736*	1							
13 perstotallog	3.67	1.35	0.2334*	0.3313*	1						
14 capi	0.07	0.26	0.0784*	0.1706*	0.3404*	1					
15 pavitt	2.13	0.99	0.022	0.0921*	0.0569*	0.0269	1				
16 gdppercap	12,200,000	3,513,496	0.0363	0.0365	-0.0044	0.0835*	-0.0577*	1			
17 trust	0.16	0.05	0.0333	0.0754*	0.0016	0.0665*	0.021	0.5619*	1		
18 researcher	58	29	0.0871*	0.0886*	0.0348	0.1088*	-0.0743*	0.8514*	0.5444*	1	
19 higheredu	58	43	0.0833*	0.0889*	0.0418	0.1188*	-0.0638*	0.8702*	0.4861*	0.9628*	1

Exploiting knowledge requires interaction and exchange among members of an organization as mutual understanding and comprehension are a prerequisite (Spender, 1996). Additionally, the organizational practices fostering social integration promote the free flow of knowledge (Sheremata, 2000). Therefore, a firm with an organizational culture which fosters this knowledge exchange is likely to be in a better position to recognize value of external information and be able to assimilate it. Our results provide ample empirical evidence for hypothesis 1c. While the use of knowledge stemming from the production and commercial department is significantly and positively correlated with the use of all three kinds of external information sources, the exchange with an internal R&D department is significantly and positively related with the combined use of exploitative and explorative information sources. The use of the internal R&D department may also be interpreted in a different way; the existence of such a department points towards a mid- to long-term R&D strategy. While R&D investments may be carried out ad hoc, the creation of an R&D department is likely to reflect continuous R&D engagement. Schmidt (2010) provided empirical evidence for German manufacturing enterprises that continuous R&D engagement is an important driver of building a firm's absorptive capacity measured in terms of inputs received from external agents for the implementation of a product innovation.

Our study provides ample empirical evidence for hypothesis 2a and to some extent for hypothesis 2b as well. There exists a positive and significant correlation between incoming generic spill-overs and the use of all three categories of external information sources. These results differ from those of Bönte and Keilbach (Bönte & Keilbach, 2005), but partially confirm those of López (2008). It seems that in the context of a developing country with a general lower knowledge base in firms, general spillovers tend to increase the scope of learning and therefore are positively related with the use of external information sources.

Table 3
Estimation results for product innovation. Multi-level random intercept multinomial model.

	Model 1			Model 2			Model 3		
	Exploitive Inf. Sources Coefficients	Explorative Inf. Sources Coefficients	Exploitive & Explorative Inf. Sources Coefficients	Exploitive Inf. Sources Coefficients	Explorative Inf. Sources Coefficients	Exploitive & Explorative Inf. Sources Coefficients	Exploitive Inf. Sources Coefficients	Explorative Inf. Sources Coefficients	Exploitive & Explorative Inf. Sources Coefficients
Fixed: Firm-Level									
spillover_scale				7.272***	7.942***	12.222***	7.278***	7.976***	12.267***
				(0.4911)	(0.6230)	(0.5320)	(0.4899)	(0.6233)	(0.5312)
approb_scale				-0.206***	-0.026	-0.305***	-0.203**	-0.02	-0.301***
				(0.0684)	(0.1212)	(0.0928)	(0.0685)	(0.1216)	(0.0928)
investrdpct				0.800**	0.707	0.556	0.821*	0.735	0.604
				(0.3438)	(0.4952)	(0.4213)	(0.3437)	(0.4970)	(0.4209)
persinovpct				2.760**	4.659***	4.408***	2.821*	4.895***	4.519***
				(1.1743)	(1.6836)	(1.4268)	(1.1744)	(1.6828)	(1.427)
persdegreepct				-0.381	0.236	-0.322	-0.365	0.159	-0.429
				(0.4644)	(0.7496)	(0.6212)	(0.4645)	(0.7525)	(0.6205)
perstrainpct				0.158	-0.072	0.914**	0.144	-0.171	0.827*
				(0.4320)	(0.6627)	(0.4469)	(0.4267)	(0.6643)	(0.4411)
Indexconc				-0.031	-0.128	-0.294	-0.033	-0.129	-0.306
				(0.1631)	(0.3026)	(0.2364)	(0.1632)	(0.3030)	(0.2365)
intsourceprod				1.506***	0.959***	1.591***	1.498***	0.945***	1.590***
				(0.1270)	(0.2154)	(0.1815)	(0.1270)	(0.2161)	(0.1817)
intsourcesales				1.483***	0.571***	1.534***	1.472***	0.551**	1.497***
				(0.1295)	(0.2169)	(0.1711)	(0.1294)	(0.2171)	(0.1707)
intsourcerd				-0.114	0.242	0.395**	-0.093	0.268	0.399**
				(0.1697)	(0.2451)	(0.1911)	(0.1695)	(0.2454)	(0.1907)
investmachinepct				0.671***	0.430*	0.725***	0.661***	0.450*	0.724***
				(0.1478)	(0.2479)	(0.1907)	(0.1468)	(0.24789)	(0.1903)
finownpct				0.615***	1.038***	0.504***	0.612***	1.047***	0.496***
				(0.1371)	(0.2309)	(0.1748)	(0.1369)	(0.2314)	(0.1745)
perstotallog				-0.123**	0.199**	0.119*	-0.118**	0.204**	0.120**
				(0.0484)	(0.0795)	(0.0644)	(0.0482)	(0.0796)	(0.0643)
capi				0.067	0.249	0.370	0.068	0.244	0.358
				(0.2297)	(0.3082)	(0.2682)	(0.2287)	(0.3077)	(0.2667)
pavitt_science				0.057	0.580**	0.332*	0.047	0.554**	0.303
				(0.1497)	(0.2757)	(0.2001)	(0.1497)	(0.2758)	(0.2002)
pavitt_scale				-0.138	0.831***	0.220	-0.177	0.767***	0.169
				(0.1223)	(0.2250)	(0.1686)	(0.1221)	(0.2251)	(0.1685)
pavitt_special				-0.061	0.536	0.225	-0.064	0.491	0.205
				(0.2102)	(0.3718)	(0.2828)	(0.2104)	(0.3723)	(0.2832)
_cons	-1.437***	-3.096***	-1.591***	-2.350***	-5.909***	-5.018***	-2.688***	-6.517***	-4.938***
	(0.0410)	(0.08391)	(.0580)	(0.2713)	(0.5330)	(0.4136)	(0.3474)	(0.6551)	(0.5022)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Fixed: Regional Level									
gdppercap							-1.38E-08	-3.45E-08	-0.0000000816***
							(0.0000000183)	(0.0000000303)	(0.0000000248)
trust							3.771***	7.120***	6.231***
							(1.4060)	(2.3084)	(1.8341)
Random: Regional Level									
Variance	0.0564	1.1451	0.5047	0.0331	0.1081	0.2316	0.000	0.845	0.806
	(0.0618)	(0.8343)	(0.3143)	(0.0241)	(0.0973)	(0.1123)	(4.132e-06)	-0.5499504	-0.44639859
Covariance (2,1)		0.173			0.054			-2.95E-11	
Covariance (3,1)		0.127			0.062			-1.08E-11	
Covariance (3,2)		0.738			0.232			0.825	
Log-Likelihood		-4971.7567			-2733.05			-2724.797	
Regions		14			14			14	
Observations		5268			5268			5268	

Note: Authors' own elaboration based on data from EDIT IV (2007-08). Coefficients and odds ratio are reported for the multinomial multi-level random intercept model. Base category: no us of external information sources. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The negative and significant correlations between appropriability conditions and the use of exploitive and exploitive/explorative external information sources provide partial empirical evidence for our hypothesis 2b as the negative sign is caused by the measure employed. In case that firms do not perceive the risk of being imitated or see an insufficient system protecting intellectual property as a barrier for innovation increases the odds of firms using these kind of external information sources increases. At the same time, this correlation is not significant for the case of explorative information sources. These results provide evidence for the argument that firms which fear opportunistic behavior in form of involuntary spillovers to external partners are more likely to not rely on external information sources, especially for the case that competitors are among the external actors where the applicability of the knowledge that spills over is high.

All these results combined point towards a higher probability of using external exploitive information sources when an explicit innovation strategy aiming at the generation of imitations based on technology transfers is formulated; an innovation strategy often present in developing countries (Anlló & Suárez, 2009). At the same time, the sole use of explorative information sources is a rather rare case and seems to be related to a more complex innovation strategy employed by larger firms in scale-intensive sectors or science-based sectors based and which involves a larger amount of people in the innovation process.

Finally, we find empirical support for hypothesis 3; the higher the general trust level in the region where the firm operates the higher the odds of relying on external information sources. Based on the theory of relational capital, it can be argued that general trust at the regional level may be driven by the interactions that exist among the different economic agents in the same region, thus causing a problem of endogeneity. In order to at least partially control for it, we reran our analysis separating our sample into two groups: those firms which did not rely on any external information sources during the period 2005-2006, the time period previous to the one we studied and those firms which already relied on external information sources in these previous two years. Based on a much smaller sample for the different regions, we employed a multi-level logistic regression for the two groups of firms evaluating the effect of trust on the use of any type of external information sources while controlling for all the mentioned firm-level drivers. We found that for those firms which had not used external information sources in the two previous years, trust remained positively and significantly correlated with the use of external information sources. However, for the latter group, the trust variable ceased to be significant.

General trust as measured in the World Value Survey refers to trust in unfamiliar others; it is required for the functioning of complex societies based on interactions between unfamiliar people (Nannestad, 2008). We argued that as such, general trust functions as a safeguard mechanism against opportunistic behavior. Our results point towards a phenomenon where trust at the regional level may substitute for non-existent inter-organizational trust; those firms which have not used in previous years external information sources cannot rely on past experiences and as a result on inter-organizational trust generated through these interactions; in other words, they cannot rely on process-based trust (Zucker, 1986) at the inter-organizational level. They therefore rely for the evaluation of potential risks in terms of opportunistic behavior on the general trust in the region. On the other side, those firms which already have experience with using external information sources do not need to rely on general trust at the regional level.

Discussion and Conclusions

In this chapter, we investigate what drives the use of two different types of external information sources, taking into consideration both the firm- and the regional level. Our analysis has shown that traditional drivers such as characteristics increasing the organization's absorptive capacities as well as in- and outward information spillovers play a substantial role in increasing the firm's propensity to adopt an open innovation strategy. Moreover, we show that general trust at the regional level is equally important, especially for the case of firms which do not have recent experiences in using external information sources. Additionally, we show that slight differences exist when differentiating between two types of external information sources: exploitative and explorative.

Our research is characterized by some limitations which at the same time offer potential paths for future research. In particular, the dataset employed can be subject to criticism. First, we can we not rely on panel data; therefore, our analysis is characterized by all the shortcomings related to cross-sectional data. For example, we are not able to determine a causal effect between the potential drivers and the firm's strategy to make use of external information sources and incur in a potential simultaneity bias. While we partially address this problem by estimating a model which is limited to those firms which did not have recent experience with using external information sources, our results need to be interpreted with care. Not only trust can be simultaneously developed with the corporate decision to access external information sources.

The same is also true for incoming spillovers, R&D intensity and training of employees. Our dataset did not allow us to control for this simultaneity bias. Future research should take this into consideration by relying on a longitudinal dataset. Additionally, based on this cross sectional design we cannot detect in which way the different drivers influence in a change in potentially existent patterns of an open innovation strategy. It may very well be that a firm decides to first gain experience by using clients as external information sources and depending on the generated results in subsequent periods decides to amplify towards explorative external information sources. It would therefore be informative in future research to evaluate the existence and the potential drivers of different patterns of an open innovation strategy.

Furthermore, our differentiation between exploitative and explorative external information sources is overly broad; it does not allow, for example, differentiating whether the exploitative external information source is directly related to the industry within which the firm operates (e.g. within the value chain) or lies outside that industry. As such, it is unclear whether directly applicable knowledge can be accessed or not. This direct applicability, however, is important as for example the absorptive capacity required is lower than for knowledge that is not directly applicable (Vega-Jurado, Gutiérrez-Gracia, & Fernández de Lucio, 2008). Lastly, we evaluated the influence of general trust at the regional level. However, trust at the regional level can also be more specific, such as trust in institutions. While general trust refers to interpersonal dimension of trust and as such is assumed to reduce uncertainty, facilitate interaction and communication (Beugelsdijk & van Schaik, 2005; Sako, 1998), institutional trust maybe especially important in the case of relying on external explorative information sources, such as public universities. While institutional trust serves as a foundation for general trust among people (Rose-Ackerman, 2001), it may also independently or jointly influence a firm's open innovation strategy.

Furthermore, our analysis is restricted to Colombia. Not only is Colombia characterized – as most Latin American countries – by a lack of collaboration among the actors in the National Innovation System (M. Bosch et al., 2005). Additionally, Colombia is also among the countries with very low levels of general trust (Delhey, Newton, & Welzel, 2011). An extension of our analysis to other contexts would therefore be very informative regarding the influence of general trust on the firm's open innovation strategy.

"Keep things informal. Talking is the natural way to do business. Writing is great for keeping records and putting down details, but talk generates ideas. Great things come from out luncheon meetings which consist of a sandwich, a cup of soup, and a good idea or two."
T. Boone Pickens

CHAPTER 2

BRIDGING OR BONDING? A MULTILEVEL STUDY ON THE EFFECT OF REGIONAL CIVIC ENGAGEMENT IN FIRMS' INNOVATION PROCESS

Abstract

Firms increasingly are relying on external information from economic agents outside the organizations. We argue in this chapter that localized civic engagement through active memberships in civil associations affect a firm's ability to generate product innovations. Combining data from a large-scale data set on innovation activities and performance of more than 5,000 Colombian manufacturing firms with data on active memberships in civil associations at the regional level, we find no empirical evidence of a direct effect of civic engagement on the firms' innovation performance. Relying on the differentiation between Olson- and Putnam-type civil associations, however, we observe that the effectiveness for relying on external information sources is contingent upon the region's civic engagement. We find empirical evidence that firms which do not rely on external information sources benefit to a greater extent being located in regions with a high degree of memberships in Putnam-type organizations, hinting at a potential substitution effect between bridging networks at the regional and the firm-level. At the same time, the negative effect of bonding civil associations is larger for firms which rely on external information sources, hinting at a potential lock-in effect. Our research provides important insights for future research: external information can be obtained at different level (e.g. firm and region) and these effects should simultaneously be considered.

Introduction

Due to the complex, interactive nature of the innovation process (Lundvall, 2007, 2010) the open innovation strategy (Chesbrough, 2003) has gained importance during the past years. At

the same time, empirical research provides evidence that in presence of social capital, knowledge exchanges among firms is facilitated (Saxenian, 1991, 1994). Against this background, the present study focuses on the effect of external knowledge sources on firm's innovation performance taking into account the moderating effect of one aspect of regional social capital. This topic is important due to the complex, interactive nature of the innovation process (Lundvall, 2007, 2010) and the deriving importance of an open innovation strategy (Chesbrough, 2003). Changing environments with increased market competition and rising technological complexity resulting in augmented R&D costs and shorter product life cycles force managers to rethink their innovation strategy. No longer can firms innovate in isolation; rather they need to look beyond their boundaries drawing on a wide array of new and existing knowledge bases (Chesbrough, 2003; von Hippel, 1988). As a result, the sourcing and acquisition of external knowledge in form of acquisition of external R&D (Bönte, 2003; Cassiman & Veugelers, 2006; Laursen et al., 2012), formal research cooperation (Barge-Gil, 2010; Belderbos, Carree, & Lokshin, 2004; Miotti & Sachwald, 2003; Vega-Jurado et al., 2009a), and informal knowledge sourcing (Amara & Landry, 2005; Bönte & Keilbach, 2005; Caloghirou, Kastelli, & Tsakanikas, 2004; Laursen & Salter, 2006) have emerged as rising phenomena and important topics in academic research during the last years.

Most empirical research focuses on the impact external knowledge sourcing has on the innovation performance of a firm (K.-H. Tsai, 2009) and tends to identify a positive influence of relationships with suppliers, customers, competitors, universities or research centers (Becheikh, Landry, & Amara, 2006). However, the results are far from consistent and point towards potential moderation variables (K.-H. Tsai, 2009). At the same time, a varied effectiveness of collaboration patterns across countries (e.g. Bodas Freitas, Clausen, Fontana, & Verspagen, 2011) suggests the influence of contextual variables. The notion that the innovation process is embedded in an institutional context has been stressed by the literature regarding the national (Lundvall, 1992; Nelson, 1993), regional (Asheim & Isaksen, 1997; Isaksen et al., 2002) and the sectorial (Malerba, 2002) system of innovation.

Despite this recognition, few studies analyze the influence of the institutional context as a potential contingency factor (Bodas Freitas et al., 2011; van Waarden, 2001). The recent investigation by Laursen and colleagues (2012) observed that regionally bound social capital

positively moderates the effectiveness of externally acquired R&D for a firm's propensity to innovate. We position this research in the growing research strands on external knowledge sharing and the influence of social capital for innovation and intend to make three key contributions. We extent the findings of Laursen and colleagues (2012) by focusing on the effect of bridging and bonding social capital[18] at the regional level and by taking into account informal collaboration strategies.

Second, to the best of our knowledge, this is the first research investigating the influence of regional social capital on the firm's innovation performance in a developing country usually characterized by weak institutions which are argued to increase transaction costs (Meyer et al., 2009). As such, this investigation may shed some light on the discussion of whether social capital substitutes weak institutions leading to inefficient markets (Knack & Keefer, 1997). Additionally, contextualizing research collaboration in developing countries, McCormick and Atieno (2002) argument that research collaboration are especially important to overcome the various barriers that firms encounter in these contexts. At the same time, the propensity to interrelate with actors external to the firm has shown to be relatively low among Latin American companies (Melo, 2001). This research may contribute to an understanding why that is the case.

Lastly, our research applies a multi-level design, thus taking into account the hierarchical structure of the above mentioned relations. Although the systemic perspective on innovation calls for the adoption of a multi-level design (Edquist & Johnson, 1997; Lundvall, 1992; Nelson, 1993), quantitative research adopting such a methodology remains scarce (Srholec, 2011). Applying a multi-level analysis, we avoid the ecological fallacy present when assuming that attributes at the regional (or national) level are directly reflected in the behavior of firms (Robinson, 2009). Additionally, we also forego the individualistic fallacy which consists in incorrectly imputing firm-level innovative behavior to the regional or national level (Seligson, 2002).

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[18] The importance of differentiating between bridging (inclusive) and bonding (exclusive) social capital has been stressed by scientific political research, such as Narayan-Parker (1999), Putnam (2000), Woolcock and Narayan (2000). This notion has recently been emphasized for the study of innovation at the regional level as well (Hauser et al., 2007; Kallio et al., 2010).

We have structured the remainder of the paper as follows. First, we introduce the theoretical framework and discuss the theoretical underpinnings of the proposed hypothesis. We then discuss the data used as well as the multi-level design applied, followed by the empirical results. Finally, we outline theoretical and practical implications of our analysis and discussion, as well as directions for future research.

Theory Development

Civic participation, social capital and the institutional context

Innovation is a multi-level phenomenon; simultaneously firm's resources, competences, and capabilities as well as the context in which the firm operates influence the innovation behavior and performance of enterprises (Srholec, 2010). For example, a firm's institutional context, defined as the rules of game by which economic actors play, solves problems of cooperation and coordination by shaping perceptions and dictating the payoffs of engaging in different activities (North, 1990). As such, context is also argued to influence the networking behavior of innovating firms (Saxenian, 1991). Geographically bound social capital can generally be defined as localized norms and networks which enable collective action within a region (Woolcock & Narayan, 2000). It therefore captures certain aspects of the firm's institutional context.

Since Pierre Bourdieu's first systematic, contemporary analysis (Bourdieu, 1986), the term social capital has been characterized by heterogeneity (Cainelli, Mancinelli, & Mazzanti, 2007) with a lack of clear definition. Instead, a wide array of definitions exists.[19] These vary on the one hand depending on whether the authors focus on the substance, sources or effects of social capital (Robison, Schmid, & Siles, 2002). On the other hand, they diverge because social capital is a multidimensional concept with each dimension contributing to its meaning (Hean, 2002). Though it has been described and operationalized in multiple ways, a commonly used framework in the management literature is that of Nahapiet and Ghoshal (1998), proposing the

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[19] For overviews on definitions refer to Adler and Kwon (2002) or Woolcock and Narayan (2000).

structural, relational and cognitive dimension of social capital.[20] While the relational dimension refers to norms, expectations and levels of trust developed through repeated interactions within a social network, the cognitive dimension concerns a set of interpretive schemes, codes and languages which the actors of a social network share, enabling them to make sense of their behaviors (Nahapiet & Ghoshal, 1998). Lastly, the structural dimension of social capital according to these authors comprises the overall configuration of the social network, including the resources actors may access through this network.

We focus on the structural dimension and evaluate the impact of social interaction through civic engagement at the regional level on the innovation performance of manufacturing enterprises. Associational activity, i.e. the tendency of citizens to become members in civil associations and other types of voluntary organizations, can be interpreted as interpersonal networks (Annen, 2001, 2003; Knack & Keefer, 1997) and it is their ability to initiate and preserve social relationships (Maennig & Ölschläger, 2011) which drives their relevance for economic growth and innovation. However, there is a controversy regarding the exact role of these associations. Knack (2003) pointed out that the impact of civil associations will likely vary with "the group's goals and activities, and with the diversity and inclusiveness of their memberships" (p.343). One of the most prominent distinctions between voluntary organizations is the one between Olson-groups and Putnam-groups (e.g. Knack & Keefer, 1997). On the one hand side, Olson (1982) puts an emphasis on group's propensity to lobby for special interests. Such "distributional coalitions" impose disproportional costs on the rest of the society, thus generating a negative impact on economic growth (Olson, 1982). Putnam (1993), on the other hand, states that a "strong tradition of civic engagement – voter turnout, newspaper readership, membership of choral societies and literacy circles, Lions Clubs, and soccer clubs – are the hallmark of a successful region" (p.6). For him, a membership in horizontal associations is a source of economic and social prosperity.

We adopt the distinction between the membership in horizontal and vertical, distributional associations, especially since their functioning can be linked to the prominent

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[20] Measures comprising structural dimensions of networks and trust are predominantly the ones being used in the increasing number of research evaluating the impact of social capital on economic outcomes (Dakhli & De Clercq, 2004).

discussion regarding the bonding and bridging function of social networks. Whereas the first refers to closed networks and organizations that encompass people with the same or similar background and specific interests, the latter describes networks and organizations that bring people into contact with others from a very different, cross-sectional part of society (Putnam, 2000). As a result, the ability of a network to contribute to the generation of innovation depends on the type of network and the derived functioning.

At the same time, social capital can also be located at different levels such as the individual, the organization, the region or the nation (Portes, 1998). We focus on the regional level. Learning, the basis for any innovation, is an interactive, socially embedded and localized process (Asheim & Gertler, 2005; Lundvall, Johnson, Andersen, & Dalum, 2002): "[…] while not all types of social relations are subject to distance cost, the interdependencies of different types of social relations make dense combinations of them dependent upon geographic proximity" (Lorenzen, 2007, p. 805). Marshall (1890) already pointed to the positive influence of geographical proximity for innovation caused by knowledge spillovers. Furthermore, based on a case study in Wales, Morgan (2007) comes to the conclusion that "trust, and other forms of social capital may be best developed at the regional level" (p. 501). As a consequence, the regional locality is an appropriate level to study the influence of civic engagement on innovation performance. Additionally, substantial differences in social capital between regions (Akçomak & ter Weel, 2009; Beugelsdijk & Van Schaik, 2005; Florida, 2002; Iyer, Kitson, & Toh, 2005; Miguélez, Moreno, & Artís, 2011) and the fact that formal and most importantly informal institutions such as social capital become place-specific (Gertler, 1997) call for an analysis evaluating the impact of civic engagement at the regional level.

External information sources and innovation performance

The relational view (Dyer & Singh, 1998) posits that "firms' critical resources span firm boundaries and are embedded in interfirm resources and routines" (p.660). This is also true for information which forms the basis of innovative activity: based on the assumption that innovation opportunities exist because of information asymmetries, having access to a wider range of information sources provides firms opportunities to tap into new technological

knowledge (K.-H. Tsai, 2009). As such, drawing onto information sources beyond the firm's boundaries puts these in a better position to innovate (Chesbrough, 2003; von Hippel, 1988).

Informal collaborations, that are "relationships developed between individuals independently of any formal structure (…) built over time and used as complementary knowledge sharing alternatives to an organization's formal strategy" (Jewels, Underwood, & de Pablos Heredero, 2003, pp. 5–6) are one form of interaction with external agents and form part of the interorganizational network. According to Adler and Kwon (2002), benefits of such interactions are the direct access to additional information sources and an improved information quality with regard to relevance and timeliness. Additionally, new skills and competencies maybe acquired (Powell, Koput, & Smith-Doerr, 1996), the learning ability can be leveraged (Shu, Wong, & Lee, 2005) and the costs for doing so maybe lowered (Westlund & Nilsson, 2005). Empirical research in different settings has found that the use of external information sources positively influences the firm's innovation performance (e.g. Bönte & Keilbach, 2005), where the variety of external information sources used is positively related to the innovation performance of firms (J. Chen et al., 2011; Laursen & Salter, 2006). Due to the technological complexity and rising market competition, individual firms benefit from specific competencies and knowledge of these external information sources as they complement existing or substitute missing internal ones. We therefore posit a positive relationship between the use of external information sources and the likelihood of product innovation.

Hypothesis 1: The use of external information sources increases the likelihood for the introduction of a product innovation.

Social interaction and innovation performance

Social capital has been proposed as an important driver of economic growth (Beugelsdijk & Smulders, 2003; Beugelsdijk & van Schaik, 2005). One mechanism through which social capital contributes to the process of economic growth is indirect; it derives from its presence in interactive learning as the basis of innovative processes (Falk & Kilpatrick, 2000; Lundvall et al., 2002). Innovation is a "process where the outcome is highly dependent upon interaction and communication between people" (Lundvall & Christensen, 2004, p. 5). Social relations, often maintained for other purposes, can provide the mechanism for such interaction (P. S. Adler &

Kwon, 2002; Coleman, 1988) and as such contribute to the generation of innovation (Dahl & Pedersen, 2004); a notion brought forward by the concept of innovative milieu (Camagni, 1991, 1995)[21].

Based on regions such as the Silicon Valley, researchers argue that social interactions among individuals in a specific geographical area form a critical mechanism of information exchange (Ibarra, 1993). They also enable cooperation (Coleman, 1988), facilitate knowledge diffusion and generate collective learning processes (Bresnahan, 2001; Camagni, 1991; Sorenson & Stuart, 2001). Putnam (1993) argues that an active civil society, that is one with many civic associations, chamber of commerce and the likes, fosters shared norms within a region. Not only do these shared norms expedite the information exchange as they provide the basis for mutual understanding. Additionally, routines and conventions of interactions are established, lowering the costs of future interactions (Fromhold-Eisebith, 2004; Maskell, 2001). As a result of faster, preferential and less costly access to information and a higher quality of transferred knowledge the innovation potential of firms in regions with higher associational activity increases (Fromhold-Eisebith, 2004; Maskell, 2001) generating a competitive advantage for these firms (Koka & Prescott, 2002).

However, we posit that the effect of associational activity within a region on the innovation process of firms located in that region are far from being homogeneous across all types of civil associations; rather dependent upon the functioning of these civil organizations, positive or negative externalities could be generated (P. S. Adler & Kwon, 2002; Portes & Landolt, 1996; Portes, 1998; Woolcock & Narayan, 2000). We therefore distinguish – based on Putnam's (1993, 2000) and Olson's (1982) work – between two types of civil associations: horizontally organized like sports clubs or cultural associations and vertically organized special interest groups such as trade unions or political parties. Not only do these latter endeavor to achieve certain political aims (Knack, 2003) and as such are associated with characteristics of closed networks (Kallio, Harmaakorpi, & Pihkala, 2010). Additionally, it is also believed that they usually agglomerate homogenous members (e.g. Paxton, 2002; Stolle & Rochon, 1998)

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[21] The approach of innovative or creative milieu has been developed mainly by researchers associated with the Groupe de Recherche Européen sur les Milieux Innovateurs (GREMI) (Fromhold-Eisebith, 2004).

whereas horizontal associations such as sports clubs are characterized by more heterogeneous groups. Based on this differentiation, we can link the type of association with two types of socializing: bridging and bonding (Yamamura, 2011; Zmerli, 2003). Bridging associations are those which generate links between diverse social categories, whereas bonding associations fail to do so in most cases and rather tend to cement homogeneous groups (Putnam, 1993, 2000).

Based on the concept of structural holes which refers to unique ties between otherwise unconnected individuals, organizations or regions (Burt, 2009), horizontal organizations may exercise a bridging function between diverse social actors. This provides a broader source of information as it exposes social actors to novel communities, more diverse experiences and varying ideas (Burt, 2009)[22]. As a result, more varied and non-redundant information is generated and accessible at a faster rate (Brass, 1995; Ruef, 2002) and as such greater innovation opportunities can be obtained (Amara & Landry, 2005). Additionally, the resulting greater knowledge about who knows what (Lundvall, 2006) within a certain region will help to reduce search costs. As a result, firms who are located in regions with a high amount of bridging civil associations will have access to a richer set of communication and knowledge transfer channels (Sørensen, 2007). Since the basis of innovation is a large pool of diverse information and knowledge, innovation generation is likely to be increased. We therefore argue that bridging Putnam-type civil associations function as a communication channel for useful new information and knowledge and propose the following hypothesis

Hypothesis 2a: Firms in regions with a high level of memberships in Putnam-type civil associations will have a higher probability to introduce product innovations.

Bonding associations are networks of homogeneous individuals which tend to look inward and clearly identify the inside and outside of the association's boundary (Putnam, 2000). These networks commonly generate strong bonds leading to high levels of trust, reciprocity and commitment among their members (Coffe & Geys, 2007; Coleman, 1988; Krackhardt, 1992) The provision of this is likely to reduce transaction costs by limiting the uncertainty regarding the behavior of social actors and the generation of a control mechanism for opportunistic

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[22] This argument can be linked to Granovetter's (1973) theory of weak ties as structural holes and weak ties are strongly correlated (Reagans & McEvily, 2003), or as Granovetter (1973) put it: "all bridges are weak ties" (p.1364).

behavior (P. S. Adler & Kwon, 2002). It therefore allows for the exchange of more complex and proprietary information (Hansen, 1999; W. Tsai & Ghoshal, 1998). Additionally, the generation of trust facilitates the recognition of the value of new knowledge (Reagans & Zuckerman, 2001).

However, this positive effect may be counterbalanced by the network's potential closure. The network's members do not receive inputs outside their circle thus limiting the production of new ideas, often referred to as lock-in relationships caused by overembeddedness (Grabher, 1993; Uzzi, 1997). In other words, diffusion of varied information and knowledge may be hindered by bonding associations (Rodríguez-Pose & Storper, 2006). Additionally, these bonds potentially foment conformity and collective blindness and hinder acceptance of alternative ways of getting things done (Nahapiet & Ghoshal, 1998; Paxton, 2002; Tura & Harmaakorpi, 2005). One such example is the "not-invented-here" syndrome (Katz & Allen, 1982). These cohesive ties may also hinder co-operation beyond the boundaries of these bonding networks (Burt, 2009). As a result, we propose that the positive effects of bonding Olson-type civil associations are likely to be set off by the negative ones and therefore suggest:

Hypothesis 2b: Firms in regions with a high level of memberships in Olson-type civil associations will have a lower probability to introduce product innovations.

Even though it is now widely acknowledged that social capital "is fundamentally a multilevel theoretical perspective" (Payne & Moore, 2011), empirical studies have largely been limited to one single level of analysis (P. S. Adler & Kwon, 2002; Lazega, Jourda, Mounier, & Stofer, 2008; Payne & Moore, 2011), ignoring potential cross-level effects. However, Fromhold-Eisebith (2004) suggests that the advantage of socially embedded learning processes inherent in an innovative milieu are based among other factors on the "effective combination of personal professional and private relationships" (p. 750). Ceci and Iubatti (2012) showed through a content analysis of interviews undertaken in the Italian CISI consortium, comprised of subsidiaries of various automobile manufacturers that personal and professional relationships coexist in SMEs networks shaping the diffusion of innovation. Saxenian (1991, 1994) argues that it is this fusion which provides regions like Silicon Valley with its basis for success. Against this backdrop, we propose that the influence of regional social capital on a firm's innovation performance should be not be evaluated in an isolated matter. Rather, the influence of regional

social capital based on the individual's participation in civil associations is contingent upon the firm's use of external information sources for the innovation process.

Apart from the potential complementarities between social capital at these two different levels, potential complementarities have theoretically been proposed between bridging and strong ties as well, especially with respect to their effect on the innovation process of firms (Tiwana, 2008). While bridging ties provide the firm with a wide array of non-redundant, heterogeneous information, resources and abilities (Burt, 2009), strong ties enable firms the transfer of more complex and tacit information as well as a greater efficiency at cooperation and coordination within the network (Coleman, 1988). From this argumentation follows that "strong ties provide mechanisms to integrate a diverse repertoire of skills and expertise that are made accessible by bridging ties, which span structural holes" (Tiwana, 2008). We argue that the presence of social capital at the regional level through associational activity should therefore be evaluated in combination with social capital derived from informal collaborations at the firm-level.

The generation of innovation requires first and foremost opportunities to access new and diverse information and knowledge (Moran & Ghoshal, 1996). This information may be obtained from the outside of the firm with external information sources being one and the network of regional associations being another information channel. The combination of external information sources with regional bridging Putnam-type associations can provide the firm with a wider knowledge base. However, social capital is no longer perceived as generating only positive outcomes; instead, risks and costs have to be taken into consideration (P. S. Adler & Kwon, 2002). As a result, empirical research supports for various measurements of the structural dimension of networks (network size, centrality and contact frequency) a u-shaped relationship with respect to knowledge creation (Leenders, Van Engelen, & Kratzer, 2007; McFadyen & Cannella, 2004; Uzzi & Spiro, 2005). The same is true for the usage of external information sources – scope and depth of external information sources is related to innovation performance in a curvilinear way (Laursen & Salter, 2006). It can therefore be expected that the positive effect derived from operating in a region with a high level or Putnam-type bridging civil associations is less for those firms which rely on external information sources. We therefore suggest that:

Hypothesis 3a: Firms which do not rely on external information sources will benefit to a greater extent from the positive impact on innovation performance of operating in regions with high levels of memberships in bridging Putnam-type civil associations.

Information and knowledge exchange relies on trust among the social actors (W. Tsai & Ghoshal, 1998). Partners who trust each other will be in a better position to understand each other, will be more open to each other and exchange more tacit information involving the exposure to higher risks (Nahapiet & Ghoshal, 1998). Furthermore, Coleman (1988) suggested that the closure of professional networks, which are among the Olson-type civil associations, make actors more willing to share tacit knowledge. This argumentation suggests a complementary relationship between bridging and bonding ties: whereas bridging ties provide the firm with a sufficient variety of new information and knowledge, bonding ties provide the necessary trust for the transfer of more complex and tacit information and a closer coordination among network actors. In light of existing external information sources, bonding Olson-type association may establish the necessary sense of trust as well as civic responsibility which leads to collective action and learning (Tura & Harmaakorpi, 2005). At the same time, the potential lock-in and overembeddedness effect which can be generated by bonding Olson-type civil associations may be limited for those firms which rely on external information sources as these firms rely on a firm-level network. We therefore suggest that:

Hypothesis 3b: The negative impact of operating in regions with high levels of memberships in bonding Olson-type civil associations on innovation performance will be higher for firms not relying on external information sources.

Data Description and Methodology

The Colombian context

Colombia is a developing country with historical problems related to internal conflict and violence. It belongs to the group of Latin American country falling into the OECD category of upper-middle income. It has some 44 million inhabitants and a spatial expansion of about 1.2 million km^2. It is spatially very concentrated with the three main cities accounting for about 40% of the population and more than two thirds of economic activity (Galvis, 2001). Until late of last century, Colombia was marked by a relative moderate but stable economic growth, with annual

growth rate being around 3.4% between 1990 and 2008. The importance of regions in Colombia is strong as each of them have idiosyncratic characteristics with respect to geography, economic and socio-cultural development (Royuela & García, 2015). Despite the traditionally important departments, such as Antioquia, Valle del Cauca, Cundinamarca and Bogotá, some departments (e.g. Santander, Meta, Arauca and Casanare) have started to participate much stronger in the production of the national product (Galvis, 2013; Royuela & García, 2015). In the case of Santander, economic growth through the mining sector was accompanied by growth in the secondary and service sector as well (Aguilera, 2013).

Despite significant economic growth especially during the recent decade, Latin America in general and Colombia in particular have been characterized by an "innovation failure" (Marotta et al., 2008). Not only does the country lack behind in innovation inputs, especially regarding innovation-related investments, innovation outputs such as commercial patents or scientific publications are also very low (Lederman & Maloney, 2003). Additionally, the insufficient innovation output seem to be caused both by the low inputs as well as an inefficient National Innovation System which is unable to translate effectively innovation inputs into innovation results (Marotta et al., 2008).

Innovation policy in Colombia was part of the science and technology policy until 1995 when the National Innovation System was created (Arbeláez & Torrado, 2011). Since 2000, the consolidation of Colombia's national science, technology and innovation policy (STI) is underway with a considerable increase of public resources destined to STI investments accompanied by an increase in STI-supporting institutions (Arbeláez & Torrado, 2011). Despite these recent efforts, STI-investments remain well below the average investments of Latin American countries (Arbeláez & Torrado, 2011).

Data description

This research is based on firm- and region-level variables, using data derived from different sources. The firm-level data on innovation behavior and performance stems from the Colombian National Statistics Department (DANE), which collects data on Colombian manufacturing firms every two years. The "Survey on Development and Technological Innovation" (Encuesta de Desarrollo e Innovación Tecnológica - EDIT) follows the Bogota

Manual (RICYT et al., 2001), a guideline which was adapted from the Oslo Manual (OECD, 2005) by the Iberoamerican and Interamerican Network for Science and Technology Indicators (Red de Indicadores de Ciencia y Tecnología Iberoamericana e Interamericana - RICYT). This research uses the data of the fourth wave carried out in 2009 covering the two-year period 2007 and 2008. It is a census of Colombian manufacturing firms which either have 10 or more employees or an annual production of $130.5 million Colombian Pesos in 2008. The survey is based on a questionnaire administered online with personal support by trained staff from the DANE. Empirical research employing this database is recent and remains relatively scarce (Alvarado, 2000; Anlló & Suárez, 2009; Arbeláez & Torrado, 2011; Bogliacino & Naranjo Ramos, 2008; Crespi & Zuñiga, 2012; Juliao Rossi et al., 2013; Lambardi & Mora, 2014; Langebaek & Vásquez Escobar, 2007; Sánchez et al., 2013). However, the innovation surveys following the Oslo Manual have been extensively employed in empirical research (e.g. Becheikh et al., 2006; Hervás-Oliver, Albors-Garrigos, & Gil-Pechuan, 2011; Lhuillery & Pfister, 2009; Tödtling, Lehner, & Kaufmann, 2009).

This dataset is combined with regional-level data containing information about social capital derived from the Social Capital Barometer (Barometro de Capital Social - BARCAS), a survey developed by John Sudarsky (2004, 2007) and carried out by the Fundación Restrepo Barco. The questionnaire, which has been adapted and extended from the World Value Survey to the Colombian context (Sudarsky, 2004, 2007), was applied to a representative sample of Colombian individuals for the second time in 2005. This dataset has not been used for empirical research. However, it follows the guidelines of the World Value Survey (2004-2010) which has been extensively used for empirical research (Beugelsdijk & Van Schaik, 2005; Beugelsdijk & van Schaik, 2005; Dakhli & De Clercq, 2004; Doh & Acs, 2010b; Estrin, Mickiewicz, et al., 2013; Ghazinoory, Bitaab, & Lohrasbi, 2014; Johnson & Mislin, 2012). These two databases were merged, aggregating the firm-level data on the regional level for which the BARCAS is representative[23] and complemented by regional economic, human capital and infrastructure information derived from different official data sources. Appendix A lists the departments of Colombia and its respective classification into the different regions. We excluded the case of the

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[23] Being a census, no limitations regarding the representativeness of the EDIT questionnaire exist.

only firm whose headquarter is located in Casanare. Casanare in 2007 had a GDP per capita 2.5 times higher than that of the capital Bogotá; a result deriving from the very low population density which is coupled with one of the most active mining activities. As such, this case is an extreme outlier for the Orinoquía region and would distort our results.

Variable description

Dependent Variable

The dependent variable is a dummy variable that takes the value of 1 if the firm introduced a product innovation and 0 if it didn't. It is based on the responses to the following question: "Please indicate whether your firm obtained during the period 2007-2008 any of the following innovations: Goods or services new or significantly improved for the firm, new or significantly improved for the national market or new or significantly improved to the international market." This variable is therefore the result of a very broad interpretation of product innovation following the Schumpeterian tradition (1934), focusing on the purpose of innovative activity: converting an invention or imitation into a market success with the aim of achieving financial benefits. As such, innovation can be defined as an increase in the variety of goods, services and processes, rather than a purely technological advance (Unger & Zagler, 2000). In this context, innovations not necessarily need to be based on inventions, a point of great relevance for developing countries where innovation based on imitation is a common phenomenon (Meine Pieter van Dijk & Sandee, 2002). As a result, the independent variable includes products that are new or improved for the firm, the national or the international market, thus representing both the diffusion as well as the generation of product innovation.

Firm-specific independent variable

We employ a dummy variable for the use of external information sources (*fuenextnatpersd*), if any of potentially 18 information sources were used by the firm (see Appendix B for information regarding these information sources). We additionally tested our hypothesis relying on a measure reflecting the scope of openness which has been used in empirical research before (J. Chen et al., 2011; Laursen & Salter, 2006), reflecting the variety of information sources the firm relies upon for its innovative activity (*fuenextnatpersscope*). For this, we added up the number of types of external partners with whom the firm had an informal

relationship. The 18 items have a high degree of internal consistency (Cronbach's alpha coefficient equals to 0.8668). We relied exclusively on those information sources which involve personal interaction and which are restricted to the national borders. We argue that regional engagement in civil association will function as a communication channel facilitating the transfer of information and knowledge at the regional level. We therefore exclude information exchange with international actors. Additionally, our argumentation relies on interrelations between human actors. Clearly, information resources such as databases do not involve these kinds of interrelations and were therefore excluded as well.

Firm-specific control variable

Independent controlling covariates correspond to the theoretical perspective employed in this paper and we therefore include variables controlling for the firm's human capital and R&D activities as determinants of absorptive capacity (Schmidt, 2010). We control for investment in technological, scientific and innovation activities by including a categorical variable indicating the level of investments for innovative activities per employee (*investtotalcat*) and a continuous variable which indicates the percentage of these investments targeted on R&D (*investrdpct*)[24]. We followed earlier research by including these variables (J. Chen et al., 2011) as proxies for absorptive capacity. Absorptive capacity is defined as the firm's ability to effectively find, access, assimilate and commercially exploit new information (Cohen & Levinthal, 1990). It is generally assumed that the ability to make use of externally acquired knowledge, the firm must have engaged in R&D activities itself (Spithoven et al., 2011). However, in the context of Colombia with a very low percentage of firms investing in R&D, this does not seem sufficient. We therefore include people involved in innovation projects in percent of total employees (*persinvopct*) and the percentage of total employees working in R&D (*persrdpct*). However, investment and activities related to innovation are just one of various determinants of absorptive capacity (Schmidt, 2010). Human capital (Becker, 1964), that is the skills and knowledge of the firm's employees, is another one. It is argued that a positive relationship between human capital and innovation exists as those who are better educated and are equipped with more work

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[24] Different than most empirical research (e.g. Laursen et al., 2012) we are not able to include the firm-level R&D intensity, as the EDIT does not contain variables regarding sales figures.

experience will spur the firm's knowledge base (Schmidt, 2010). We therefore control for human capital by including the percentage of employees which count with a university degree (*persdegreepct*) and a concentration index (*indexconc*) reflecting the knowledge diversity in terms of academic formation of the firm's employees. This index takes values ranging from 0 to 1 with the upper limit representing the maximum level of concentration (or minimum level of diversity)[25]. The conditions of appropriability are related to the firm's capacity to capture the benefits derived from innovation activities without information leaking or spilling-over to other actors in the market (Cassiman & Veugelers, 2002; Teece, 1986). We therefore include a variable which represents an index for the lack of appropriability conditions as a barrier for innovation. Firms surveyed had to indicate on a 3-point Likert scale whether the following were two barriers for their innovation process: "ease of imitating third parties" and "insufficient capacity of the intellectual property system for the protection of innovations".

Provided that a debt-intensive financial structure of a firm may constrain investments in R&D (Baldwin, Gellatly, & Gaudreault, 2002), we additionally included a variable which controls for this potential effect: the percentage of investments in innovation activities financed by own resources over the total (*finownpct*). Though size seems to be an ambiguous control variable, we included it in form of number of employees (*perstotal*). On the one hand, it is argued that large firms have an advantage due to the ability to spread the inherent risk of innovation over an array of different innovation projects, an easier access to finance, economies of scale in innovation (Veugelers, 1997) as well as in the commercialization of innovations (Teece, 1986). On the other hand, small firms are more creative, flexible and faster (C. M. Christensen & Bower, 1996). Provided that for Colombia it has been found that the presence of foreign capital is a determinant of innovation activity (Langebaek & Vásquez Escobar, 2007), we control for this effect by including a dummy variable which takes the value of 1 on the case that 25% or more of the firm's capital is foreign-owned (*capi*). Furthermore, we included the common industry classification variables of Pavitt (1984) to control for fixed effects (*pavitt*).

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[25] In the EDIT survey the potential academic formations are grouped into the following categories: a) Chemistry, Physics, Mathematics and Statistics; b) Health science; c) Engineering, Arquitecture and Urban Studies; d) Agronomy, Veterinary Studies and alike; e) Social Science; f) Human Science and Arts.

Regional independent variables

Not only is the definition of social capital an uncontested issue (Woolcock & Narayan, 2000). The question of how to measure social capital is equally discussed (Portes & Landolt, 1996). As mentioned above, we rely on the structural dimension of social capital. To measure the structural dimension we utilize a question which has been used in other empirical research before: "Are you an active or passive member of [civil organization]?" (Beugelsdijk & Van Schaik, 2005; Dakhli & De Clercq, 2004; Doh & Acs, 2010a; Knack & Keefer, 1997). These authors used data from the World Value Survey (WVS). The BARCAS database follows the guidelines established by the WVS but is adapted for the Colombian context and thus includes a wider array of civil organizations, which we all used. We created two variables measuring active membership in various civil associations, differentiating between the Putnam-type and Olson-type relying on previous empirical work for this distinction (e.g. Knack, 2003). For this purpose, we created a dummy variable at the individual level if the person stated to be an active member of any of the civil association falling into either one of the two categories. We then aggregated the dummy variable at the individual level for the regional level by taking the weighted average for each region. Table 4 provides descriptive statistics for these two groups. We additionally add the alpha Cronbach which provides evidence for high internal consistency for both types of civil associations.

Table 4
Descriptive statistics and Cronbach alpha for the two types of civil associations.

Name	Mean	Std. Dev.	Min	Max	Cronbach
Putnam-type Associations	**0.341**	**0.080**	**0.218**	**0.521**	**0.776**
Church or other religous group	0.234	0.061	0.145	0.390	
Sport, social, or recreational club	0.084	0.015	0.038	0.138	
Arts, music or cultural association	0.047	0.021	0.021	0.144	
Educational organization (e.g. Alumni association)	0.082	0.030	0.029	0.180	
Olson-type Assocations	**0.187**	**0.058**	**0.105**	**0.539**	**0.823**
Professional assocation	0.030	0.018	0.007	0.055	
Unions	0.011	0.007	0.000	0.054	
Agrarian organization (e.g. Colombian coffee grower's federation)	0.024	0.038	0.000	0.257	
Political party or organizaton	0.026	0.013	0.005	0.096	
Ecological or environmental association	0.023	0.010	0.006	0.072	
Humanitarian organization	0.038	0.017	0.006	0.114	
Cooperative	0.052	0.035	0.005	0.108	
Community Board, Civil community association	0.040	0.030	0.017	0.216	
Association for surveillance or security	0.019	0.013	0.000	0.066	
Health organization	0.028	0.011	0.005	0.102	
Gender groups (e.g. feminist groups, group of sexual rights)	0.017	0.013	0.005	0.102	
Ethnical assocation	0.003	0.014	0.000	0.150	

Source: Authors' own elaboration based on data from EDIT IV.

Regional control variables

The controlling covariates at the regional level again are incorporated based on the mainstream economics of innovation literature and thus include variables controlling for the regional level of human capital and absorptive capacities which we derived from official data published by the DANE. Regional control variables include the PIB per capita in million Colombian Pesos (*pibpercap*). Additionally, we controlled for the university graduates per 1000 habitants (*graduaprof*), the number of higher education institutes in the region (*institute*) as well as the number of researchers registered at Colciencias to control for human capital in that geographical area. These numbers were all taken for the year 2007.

Methodology

Our dependent variable – the introduction of product innovation in its widest sense – is a dummy variable, requesting the use of logistic regression. The structure of the variables in the proposed relationship is hierarchical: the firm-level data (level-1 units denoted with i=1 … m) is embedded in the regional-level variables (level-2 units denoted with j=1 … n). *Y_{ij}* is the value of our dichotomous outcome variable reflecting whether the firm produced or not a product innovation. When applying a traditional regression model based on partial least square method the assumption of independent observations would be violated (Hox, 2010; Snijders & Bsoker, 2012), leading to biased standard errors and inefficient coefficients (Raudenbusch & Bryk, 2002).

We apply multi-level logistic regression, also known as a hierarchical, random effects, or variance component model, thus taking into account the clustered data. In our case, we use a logistic regression predicting the probability that a firm will generate a product innovation as a function of variables at both the firm-level (i) and the regional-level (j). As such, we include a random intercepts which vary across regions j. We hereby avoid the ecological fallacy often present in innovation studies. This fallacy is present when the attributes at the regional level are assumed to be directly reflected in the firm's behavior (Robinson, 2009). At the same time, we also bypass the individual fallacy which is caused by incorrectly imputing firm-level innovative behavior to the regional or national level (Seligson, 2002). Furthermore, multilevel modeling,

unlike other modeling techniques, allows us to properly evaluate the extent to which differences at the regional level are accountable for differences at the firm level (Srholec, 2011).

The structure of our basic random intercept model estimated in the paper is provided in equation (1):

$$Logit\{P(y_{ij} = 1| \quad)\} = \log\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = \beta_{0j} + \sum_{k=1}^{K} \beta_{kj} X_{ijk} + \varepsilon_{ij} \qquad (1)$$

X_{ijk} are individual characteristics, β_{0j} and β_{kj} are the coefficients to be estimated and ε_{ij} is a random error term. Applying a multilevel regression allows β_{0j} and β_{kj} to be modeled as outcomes that depend on a number of contextual factors which pick-up information regarding the second level, i.e. regions; therefore, β_{0j} and β_{kj} are treated as random variables. Here we consider the simplest case, where the slopes β_{kj} are assumed to be fixed but the intercept β_{0j} is assumed to be determined by:

$$\beta_{0j} = \beta_0 + \sum_{q=1}^{Q} \gamma_{0q} Z_{jq} + u_{0j} \qquad (2)$$

where γ_{00} is a fixed intercept, Z_{qj} a set of contextual factors that only vary at country level, γ_{0q} and γ_{k0} are a set of fixed parameters and u_{0j} are specific country random intercepts.

Econometric Analysis and Results

Descriptive analysis

Table 6 presents descriptive statistics and the correlation coefficients for the variables used in this study. The analysis of the correlation coefficients indicates a potential problem with multicollinearity due to very high correlation coefficients for the variables at the regional level. The Variance Inflation Factor shows a values well above 170, a problem that other authors have encountered as well (Laursen et al., 2012). Among other things, such multicollinearity may cause greatly inflated parameters. To circumvent this problem, we dropped the regional variables *graduaprof* and *institute* having extremely high individual VIF, reducing the VIF just below the typically recommended threshold of 10 (Belsley, 1991). When taking out *researcher* as well, the VIF drops to levels around 4 for all variables.

The descriptive statistics show that the average Colombian firm has little over 100 employees. However, 25% employ less than 15 people and half of the firm less than 35, making Colombia a country of mainly SME. 35% use at least one national external information source which involves interaction with another social actor and about 40% invest in innovation-related activities. However, a very low amount of these investments (3% on average) are spent for R&D. Figures 4 and 5 provide us with information on the regional level. One can observe that there are region with a vast geographical extension for which we do not have any information regarding the firm-level. These regions – mainly Chocó in the Northwestern Pacific coast and the Amazonian region with departments like Guaviare – are classified as the poorest regions in Colombia with little to no economic activity[26]. The exception is – as mentioned above – the mining sector. However, companies which operate in these areas are usually not registered in these regions but rather in the capital of the country, Bogotá. The EDIT IV, on which we rely for our databases, registers only the region of the firm's main affiliate or headquarter in Colombia. Furthermore, only those establishments are registered which have at least 10 employees or a relatively high sales volume. It is for these reasons why these regions do not have any manufacturing firm surveyed in the EDIT IV.

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[26] At the same time, these regions are also the regions with a high level of violence due to the internal armed conflict by which Colombia has been struck for the past 40 years.

Figure 4. Regional average of active memberships in Putnam-type civil associations with and without churches.

(0.39,0.52]
(0.34,0.39]
(0.30,0.34]
[0.22,0.30]
No data

(.1897436,.3173653]
(.159375,.1897436]
(.127451,.159375]
[.1071429,.127451]
No data
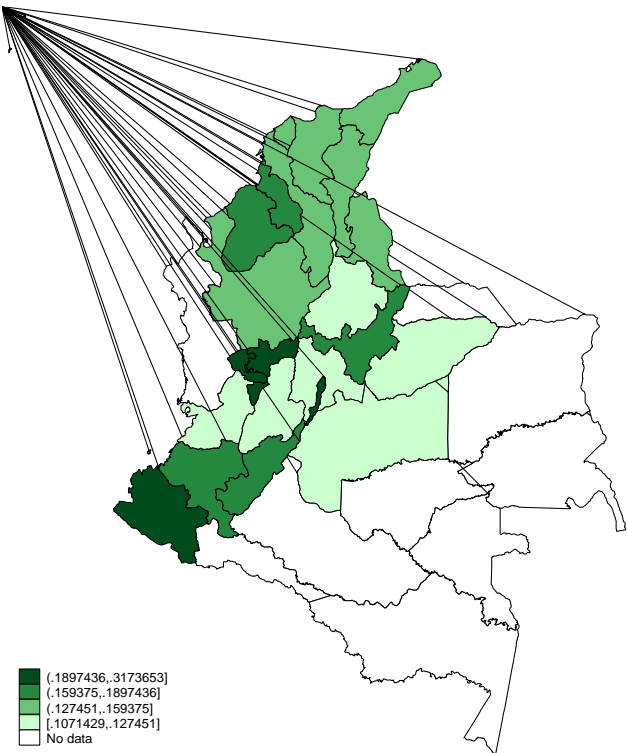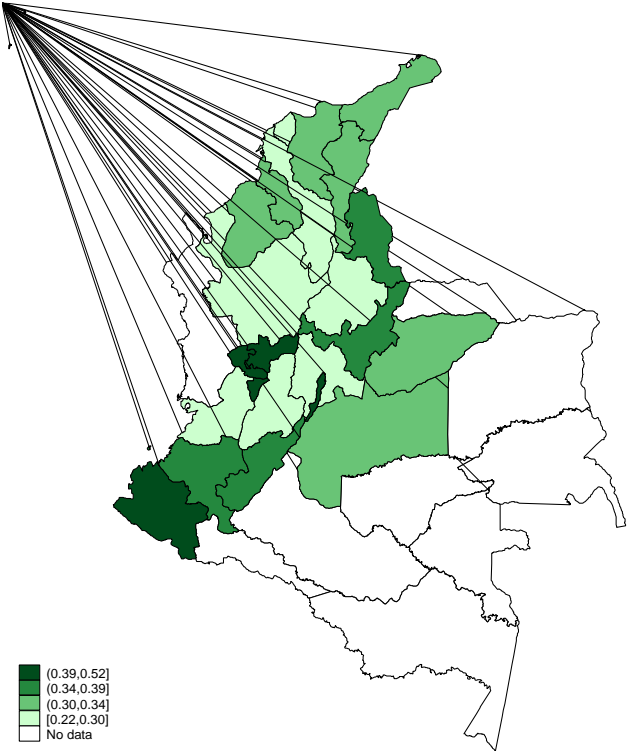
Figure 5. Regional average of active memberships in Olson-type civil associations.
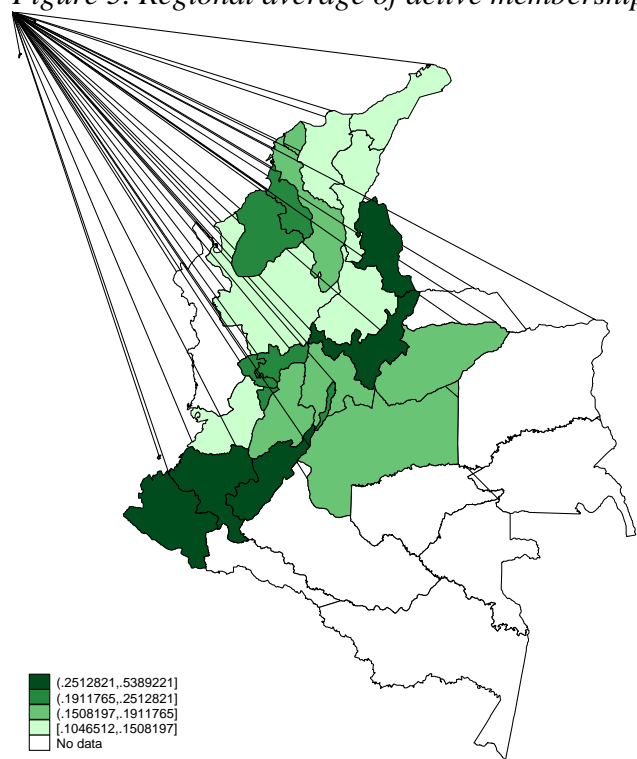
Note: The data for the generation of the maps was retrieved from https://www.arcgis.com, the official Geoportal of the Geographical Institute Augustín Codazzi (IGAC) and were combined with data retrieved from BARCAS 2005.

Figure 4 and 5 exhibit the propensity of each region for active participation in bridging and bonding civil associations. The three regions Viejo Caldas, Nariño and Bogotá show the highest propensity for its inhabitants to be active members of Putnam-type civil organizations. One might argue that this – due to the vast geographic extension of the departments and regions in Colombia – may be caused by the high population density in these regions. And while Bogotá and the three departments of Viejo Caldas region are among the most densely populated regions, Nariño is not[27]. At the same time, Atlántico, Valle del Cauca and Antioquia, three departments which rank among the highest densely populated regions due to its capitals Barranquilla, Cali and Medellín, are among the regions ranking lowest with respect to active memberships in Putnam-type associations. As one can observe in Table 4, active membership in churches or religious groups is an outlier among the different civil association with a regional average of

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[27] This information was retrieved from
http://www.enciclopediacolombiana.com/enciclopediacolombiana/departamentos/departamentos.php

23% of the population. The civil association which follows in terms of regional average is sports, social and recreational clubs with 8.4% of the population. For this reason, we included a map which shows the propensity of forming Putnam-type civil associations without including churches for each region. As one can observe comparing the two maps in Figure 4, the percentage drops considerably and additionally, some differences with regard to rankings arise, e.g. Norte de Santander where a very high active civil engagement seems to be driven mainly through memberships in churches and religious organizations. Comparing the participation in Putnam-type and Olson-type civil associations in Figure 5, we can observe that despite a high correlation, the same regions are not the top ranking for Olson- versus Putnam-type civil associations.

Regression analysis

In order to investigate the contingent effect of regional bridging and bonding social capital on the effectiveness of using external information for a firm's probability to generate a product innovation, we conduct two separate estimations for the two measures of the usage of external information sources. Our empirical results are presented in Table 6 and 7. The dependent variable for all models is product innovation in its widest definition. Table 6 and 7 vary due to the inclusion of a different measure for the usage of external information sources: whereas Table 6 includes a dummy variable, Table 7 includes a measure for the scope of external information sources. We report both regression coefficients and odds ratio in the multi-level logit regression for each explanatory variable. The 3 model specifications in each table are included in order to assess the robustness of the results. We first estimate a model that focuses only on the firm-level determinants. We then add the regional-level variables and in the third model we add the interaction terms. As we can observe, results for the individual-level control variables do not change across the three model specification, indicating the robustness of our results. Additionally, Figure 6 illustrates the differences between regions in the production of product innovation for model 3, with 95% confidence intervals. We can observe considerable heterogeneity across the different regions, with Norte de Santander being the region with the lowest average probability of achieving a product innovation and Antioquia being the region with the highest average probability.

For Model 1 and 2, we can evidence a statistically significant and positive correlation for the usage of at least one external information source, thus providing evidence for *hypothesis 1*. The odds of producing a product innovation for a firm is approximately 1.7 times higher for those firms using at least one external information source than for those who do not. Model 3 is consistent with this result in that there is a positive correlation between the reliance on external information sources and the generation of product innovation. Model 2 does not provide empirical evidence for *hypothesis 2a* and *2b*. The positive correlation of Putnam-type civil associations and the negative correlation of Olson-type civil association are statistically not significant. This result is partially confirmed in Model 3; the negative correlation of bonding civil associations becomes significant, though only at the 10% level. At the same time, Model 3 provides us with partial empirical evidence for *hypothesis 3a* and *3b*. The coefficients for the interactions between bridging versus bonding civil associations and the use of external information sources are statistically significant at the 10% level. The positive effect of the regional propensity to actively participate in Putnam-type associations is 0.04 times lower for those firms which rely on external information sources. At the same time, the negative effect of the regional propensity to actively participate in Olson-type civil associations is 78 times greater for those firms which use external information sources.

In order to better assess these interactions, the two graphics in Figure 7 plot the predictive margins for product innovation separately for those firms which rely on external information sources and those which don't. We can observe for the latter group of firms that for higher values of Putnam-type of associations, the predictive margin for product innovation is higher. The slope for those firms which use external information sources is almost flat, thus providing evidence for our hypothesis. In the case of Olson-type of civil associations, we can observe that while again the slope for those firms using external information sources is almost flat, with very low levels of Olson-type civil associations this group of firms seems to benefit more than those firms which do not rely on external information sources. For both groups, however, a higher propensity to engage at Olson-type organizations at the regional level lowers their propensity to generate product innovation. This hints at a potential substitution effect between bridging networks at the regional and the firm-level; if the firm already maintains informal collaborations with external economic actors, the new knowledge which can obtained through personal networks in civil associations of its employees may be limited. Different from what we suggest, the negative effect

of bonding civil associations is not smaller for firms which rely on external information sources. This may be due to extremely regionally focused, bonding firm-level network of external actors which then overlap with the personal networks through civil associations of the firm's employees, intensifying the problem of lock-in and over-embeddedness. These results call for further investigation, especially in light of recent findings of Kallio and colleagues (2010). These authors brought forward in their analysis of the Lahti region that regional bridging, organizational bonding and personal creative social capital are present in a regional innovation system.

These results do not vary when taking into consideration the scope of external information sources a firm is using. *Hypothesis 1* is empirically verified: the coefficient for scope of external information sources is significant and positive. Again, *hypothesis 2a* and *2b* are not confirmed in Model 2 with both coefficients being statistically insignificant. And just as was the case for the dummy variable of external information sources, we find empirical evidence for *hypothesis 3a* but not for *hypothesis 3b*. Our results confirm earlier evidence that using at least one external information source increases the probability of firms to generate product innovations just as does the scope of external information sources (J. Chen et al., 2011; Laursen & Salter, 2006) for the case of a developing country. At the same time, the lack of evidence for a statistically significant correlation between the existence of civil association within a region and the innovation generation of firms of that region differs from earlier empirical research (Crescenzi, Gagliardi, & Percoco, 2013; Hauser, Tappeiner, & Walde, 2007; Kaasa, 2009; Laursen et al., 2012). These differences in empirical results may be attributed to the fact that most of these studies do not take into consideration that innovations are generated by firms located in different regions; instead, they evaluate the impact of regional social capital on regional innovativeness. Furthermore, the only study where the firm-embeddedness is taken into consideration does not apply a multi-level regression design (Laursen et al., 2012). Additionally, the lacking relationship may be caused by the very broad categorization inherent in the data and a much more fine grained function of these civil associations (Knack & Keefer, 1997).

Above, we have observed that the propensity of active memberships in Putnam-type organizations is mainly driven by memberships in churches or religious organizations. We therefore reevaluated our results taking into consideration Putnam-type organizations excluding

churches. Additionally, we also ran a regression analysis including only churches and Olson-type organizations. In both cases, our results were generally confirmed thus providing an indication of the robustness of our results.

Figure 6. Country effects in rank order with 95% confidence intervals for product innovation.
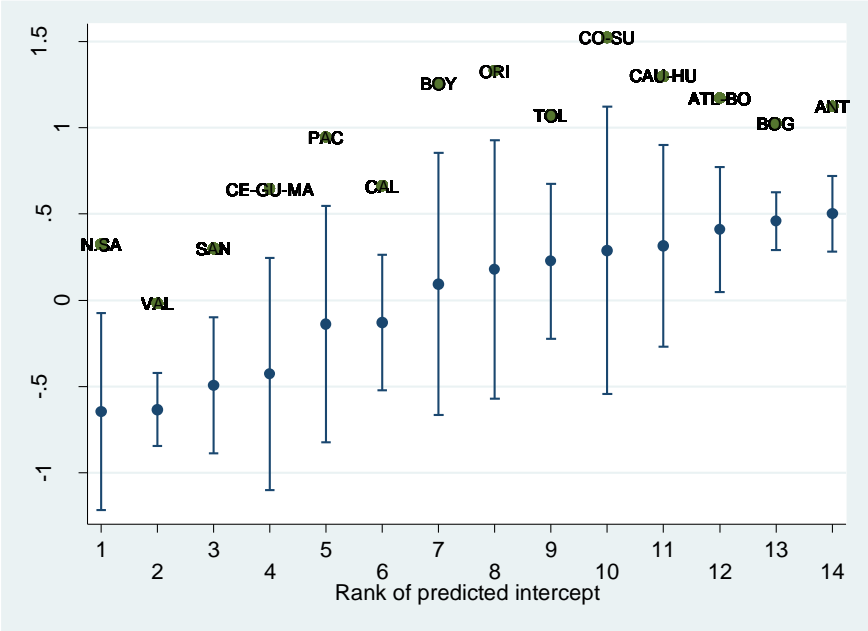
Note: Authors' own elaboration based on data from EDIT IV (2007-08).

Table 5

Correlation matrix, descriptive statistics and Variation Inflation Factor (VIF) for firm-level and regional-level variables.

Variables	Mean	St. Dev.	VIF1	VIF2	1	2	3	4	5	6	7	8	9	10	11	12
1 productinov	0.30	0.46			1											
2 fuenextnatpersd [+]	0.35	0.48	1.62		0.5214*	1										
3 fuenextnatpersscope [+]	1.37	2.57		1.43	0.4643*	0.7257*	1									
4 investrdpct	0.03	0.14	1.12	1.12	0.2812*	0.2039*	0.1889*	1								
5 investtotald	0.40	0.49	4.09	3.80	0.7622*	0.5979*	0.4887*	0.2893*	1							
6 finownpct	0.30	0.44	3.34	3.34	0.6202*	0.4939*	0.4155*	0.2887*	0.8345*	1						
7 persdegreepct	0.13	0.13	1.22	1.22	0.0883*	0.0914*	0.0942*	0.0714*	0.0941*	0.1031*	1					
8 persrdpct	0.00	0.02	1.16	1.16	0.1517*	0.1568*	0.1690*	0.1289*	0.1544*	0.1367*	0.2415*	1				
9 persinvopct	0.02	0.04	1.34	1.34	0.2969*	0.2778*	0.2423*	0.1579*	0.3496*	0.2833*	0.2907*	0.3030*	1			
10 Indexconc	0.62	0.33	1.05	1.05	-0.0637*	-0.0451*	-0.0703*	-0.0388*	-0.0509*	-0.0440*	0.1357*	-0.0444*	0.0229	1		
11 perstotal	113.90	292.67	1.16	1.18	0.2112*	0.1875*	0.2583*	0.0798*	0.2206*	0.1811*	0.0593*	0.0708*	-0.0107	0.0939*	1	
12 approb_index	2.37	0.76	1.06	1.06	-0.1661*	-0.1978*	-0.2055*	-0.084*	-0.1566*	-0.1211*	-0.0161	-0.0623*	-0.1033*	-0.0118	0.0015	1
13 capi	0.07	0.26	1.15	1.15	0.0989*	0.0835*	0.0786*	0.0553*	0.1146*	0.1278*	0.2005*	0.0805*	-0.0192	-0.0781*	0.2639*	0.0483*
14 pavitt	2.13	0.99	1.01	1.01	0.0404*	0.0317*	0.0339*	0.0133	0.0526*	0.0507*	0.0210	0.0223	-0.0211	-0.0223	0.0135	0.0040
15 putnam_a	0.34	0.08	4.16	4.17	-0.014	-0.0188	0.0123	0.0126	-0.0730*	-0.0461*	0.0502*	-0.0018	-0.0010	0.0168	0.0267	0.0071
16 olsen_a	0.19	0.06	2.02	2.02	-0.0092	-0.0384*	-0.0275*	-0.0089	-0.0385*	-0.0122	0.0791*	-0.0004	0.0177	0.0047	-0.0190	0.0253
17 pibpercap	9,781,118	3,140,362	5.43	5.43	-0.0366*	0.0006	-0.0086	0.0035	-0.0600*	-0.0362*	0.0559*	-0.0215	-0.0050	0.0024	-0.0130	0.0204
18 educacionsup	783,357	489,951	134.20	134.31	-0.0079	-0.0045	-0.0078	0.0148	-0.0629*	-0.0406*	0.0756*	0.0288*	0.0027	0.0074	-0.0160	0.0195
19 researcher	2,770	2,174	166.70	166.82	-0.0112	-0.0037	-0.0031	0.0164	-0.0679*	-0.0425*	0.0695*	0.0284*	-0.0011	0.0067	-0.0101	0.0192

	13	14	15	16	17	18	19
13 capi	1						
14 pavitt	0.0201	1					
15 putnam_a	0.0340*	-0.0081	1				
16 olsen_a	0.0278*	0.0422*	0.6748*	1			
17 pibpercap	0.0455*	-0.0653*	0.4173*	0.1495*	1		
18 educacionsup	0.0838*	-0.0665*	0.4946*	0.2936*	0.8760*	1	
19 researcher	0.0807*	-0.0658*	0.5704*	0.3410*	0.8832*	0.9922*	1

*Note: [+] indicates that these two variables are alternative measures for the use of external information sources. * p < .10; ** p < .05; *** p < .01. Source: Authors' own elaboration based on data from EDIT IV.*

Table 6
Estimation results for product innovation. Multi-level random intercept logistic model.

productinov	Modell (1)		Modell (2)		Modell (3)	
	Coefficients	Odds Ratio	Coefficients	Odds Ratio	Coefficients	Odds Ratio
Firm-Level Variables						
fuenextnatpersd	0.528***	1.695***	0.524***	1.689***	0.810*	2.248***
	(0.109)	(0.184)	(0.109)	(0.1836)	(0.429)	(0.965)
investrdpct	0.925***	2.522***	0.925***	2.522***	0.929***	2.532***
	(0.301)	(0.758)	(0.301)	(0.758)	(0.301)	(0.761)
investpercapcat_ < 1,000 per employee	4.442***	84.967***	4.441***	84.871***	4.458***	86.297***
	(0.224)	(19.033)	(0.224)	(19.010)	(0.225)	(19.434)
investpercapcat_ < 3,000 per employee	5.062***	157.974***	5.063***	157.986***	5.082***	161.174***
	(0.225)	(35.508)	(0.225)	(35.513)	(0.226)	(36.465)
investpercapcat_ < 8,000 per employee	5.194***	180.104***	5.195***	180.384***	5.222***	185.280***
	(0.221)	(39.7811)	(0.221)	(39.851)	(0.223)	(41.237)
investpercapcat_ < 20,000 per employee	5.324***	205.165***	5.325***	205.397***	5.335***	207.446***
	(0.242)	(49.708)	(0.242)	(49.760)	(0.243)	(50.478)
investpercapcat_ < 35,000 per employee	5.404***	222.313***	5.410***	223.672***	5.427***	227.522***
	(0.337)	(74.931)	(0.337)	(75.414)	(0.338)	(76.839)
investpercapcat_ < 150,000 per employee	5.225***	185.909***	5.221***	185.207***	5.230***	186.863***
	(0.334)	(62.151)	(0.334)	(61.915)	(0.335)	(62.682)
investpercapcat_ >= 150,000 per employee	5.890***	361.469***	5.886***	360.058***	5.911***	368.909***
	(1.089)	(393.769)	(1.089)	(392.265)	(1.089)	(401.588)
finownpct	-0.0470	0.9541	-0.0453	0.9557	-0.0359	0.9648
	(0.146)	(0.139)	(0.146)	(0.139)	(0.146)	(0.141)
persdegreepct	-0.600	0.5488	-0.605	0.5460	-0.614	0.5413
	(0.479)	(0.2631)	(0.480)	(0.262)	(0.481)	(0.260)
persrdpct	1.170	3.2204	1.177	3.2432	1.229	3.4191
	(3.030)	(9.758)	(3.028)	(9.820)	(3.050)	(10.429)
persinvopct	1.317	3.7338	1.331	3.7849	1.321	3.7481
	(1.093)	(4.081)	(1.093)	(4.138)	(1.096)	(4.107)
Indexconc	-0.244	0.7838	-0.243	0.7844	-0.241	0.7860
	(0.171)	(0.134)	(0.171)	(0.134)	(0.171)	(0.134)
perstotal	0.000532***	1.000532***	0.000533***	1.000533***	0.000531***	1.000531***
	(0.000201)	(0.000201)	(0.000201)	(0.0002009)	(0.000201)	(0.0002015)
approb_index	-0.278***	0.757***	-0.278***	0.757***	-0.283***	0.754***
	(0.0681)	(0.052)	(0.0681)	(0.0516)	(0.0683)	(0.052)
capi	-0.271	0.7627	-0.270	0.7634	-0.270	0.7631
	(0.187)	(0.142)	(0.187)	(0.143)	(0.187)	(0.143)
pavitt_*science*	0.527***	1.694***	0.530***	1.699***	0.531***	1.701***
	(0.151)	(0.256)	(0.151)	(0.257)	(0.152)	(0.258)
pavitt_*scale*	-0.0444	0.9566	-0.0430	0.9579	-0.0381	0.9626
	(0.119)	(0.114)	(0.119)	(0.114)	(0.119)	(0.114)
pavitt_*special*	-0.0289	0.9715	-0.0283	0.9721	-0.0172	0.9830
	(0.204)	(0.199)	(0.204)	(0.199)	(0.205)	(0.201)
Constant	-3.713***	0.024***	-3.604***	0.027***	-3.760***	0.023***
	(0.308)	(0.008)	(1.003)	(0.027)	(1.034)	(0.024)

Regional-level variables						
putnam_a			1.723	5.599	3.769	43.355
			(2.375)	(13.298)	(2.604)	(112.876)
olsen_a			-1.909	0.148	-4.542*	0.011*
			(2.339)	(0.347)	(2.718)	(0.029)
pibpercap			-3.01e-08	1	-3.43e-08	1
			(5.55e-08)	(5.55e-08)	(5.54e-08)	(5.54e-08)
Interactions Firm-Regional-Level						
fuenextnatpersd#putnam_a					-3.292*	0.037*
					(1.761)	(0.066)
fuenextnatpersd#olson_a					4.362*	78.401*
					(2.280)	(178.756)
Random Intercept						
Constant	-0.641**	0.527**	-0.693***	0.500***	-0.697***	0.498***
	(0.256)	(0.135)	(0.265)	(0.132)	(0.266)	(0.132)
Observations	5,198	5,198	5,198	5,198	5,198	5,198
Number of groups	14	14	14	14	14	14
LR test vs logistic reg	77.51		56.16		55.3	
p-value LR test	0		0		0	
ll(model)	-1321.383		-1320.9893		-1318.854	

Note: Authors' own elaboration based on data from EDIT IV (2007-08). Coefficients and odds ratio are reported for the logistic multi-level random intercept model. Standard errors in parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Figure 7. Predictive margins using an external information sources by the level of active memberships in Putnam (a) versus Olson (b)-type civil associations at the regional level.
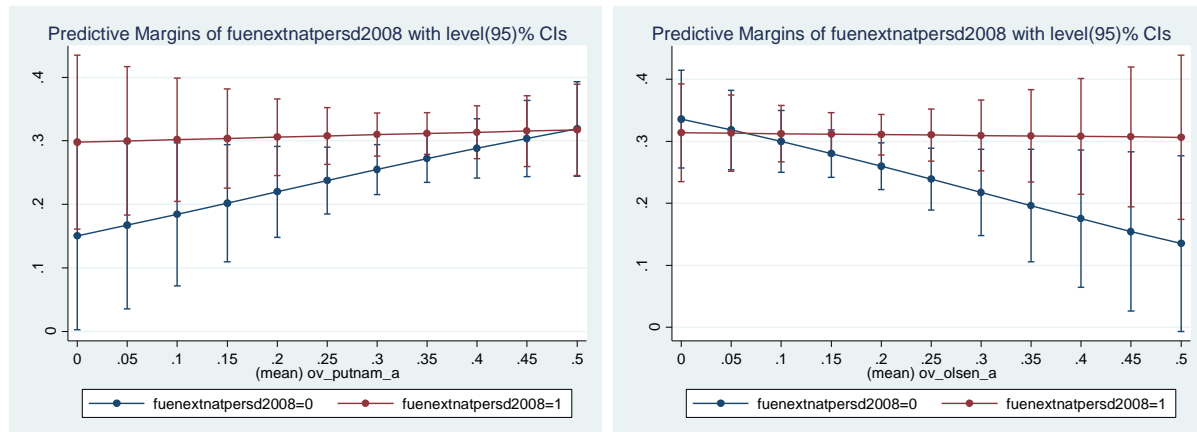
Note: Authors' own elaboration based on data from EDIT IV (2007-08).

Table 7
Estimation results for product innovation. Multi-level random intercept logistic model.

productinov	Modell (4)		Modell (5)		Modell (5)	
	Coefficients	Odds Ratio	Coefficients	Odds Ratio	Coefficients	Odds Ratio
Firm-Level Variables						
fuenextnatperssum	0.107***	1.112***	0.106***	1.112***	0.130*	1.139***
	(0.0199)	()1662	(0.0199)	(0.022)	(0.0769)	(0.088)
investrdpct	0.927***	2.528***	0.927***	2.528***	0.928***	2.531***
	(0.299)	(0.757)	(0.299)	(0.756)	(0.299)	(0.757)
investpercapcat_ < 1,000 per employee	4.512***	91.101***	4.510***	90.957***	4.511***	90.986***
	(0.222)	(20.238)	(0.222)	(20.203)	(0.222)	(20.241)
investpercapcat_ < 3,000 per employee	5.141***	170.900***	5.141***	170.810***	5.142***	171.134***
	(0.222)	(37.962)	(0.222)	(37.942)	(0.223)	(38.105)
investpercapcat_ < 8,000 per employee	5.263***	193.024***	5.263***	193.129***	5.267***	193.926***
	(0.218)	(42.075)	(0.218)	(42.105)	(0.218)	(42.356)
investpercapcat_ < 20,000 per employee	5.401***	221.584***	5.401***	221.649***	5.391***	219.435***
	(0.239)	(53.056)	(0.239)	(53.064)	(0.240)	(52.617)
investpercapcat_ < 35,000 per employee	5.455***	234.022***	5.461***	235.299***	5.455***	233.931***
	(0.335)	(78.312)	(0.335)	(78.770)	(0.335)	(78.412)
investpercapcat_ < 150,000 per employee	5.250***	190.493***	5.246***	189.768***	5.236***	187.840***
	(0.334)	(63.682)	(0.334)	(63.442)	(0.335)	(62.940)
investpercapcat_	5.915***	370.631***	5.913***	369.661***	5.937***	378.652***
	(1.090)	(403.869)	(1.090)	(402.875)	(1.089)	(412.172)
finownpct	-0.0648	0.9373	-0.0627	0.9392	-0.0569	0.9447
	(0.146)	(0.137)	(0.146)	(0.137)	(0.146)	(0.138)
persdegreepct	-0.619	0.5387	-0.623	0.5365	-0.620	0.5380
	(0.478)	(0.258)	(0.478)	(0.257)	(0.479)	(0.258)
persrdpct	0.788	2.1990	0.800	2.2256	0.930	2.5344
	(2.994)	(6.584)	(2.993)	(6.661)	(3.034)	(7.689)
persinvopct	1.304	3.6833	1.318	3.7356	1.280	3.597
	(1.097)	(4.040)	(1.097)	(4.099)	(1.101)	(3.959)
Indexconc	-0.219	0.8036	-0.218	0.8040	-0.218	0.8039
	(0.171)	(0.137)	(0.171)	(0.137)	(0.171)	(0.137)
perstotal	0.000431**	1.000431***	0.000432**	1.000432***	0.000428**	1.000428***
	(0.000204)	(0.0002041)	(0.000204)	(0.0002041)	(0.000206)	(0.000206)
approb_index	-0.254***	0.776***	-0.254***	0.776***	-0.253***	0.776***
	(0.0686)	(0.053)	(0.0687)	(0.053)	(0.0688)	(0.053)
capi	-0.250	0.7789	-0.249	0.7793	-0.250	0.7788
	(0.188)	(0.147)	(0.188)	(0.147)	(0.188)	(0.147)
pavitt_science	0.523***	1.686***	0.525***	1.690***	0.522***	1.6858
	(0.151)	(0.255)	(0.152)	(0.256)	(0.152)	(0.256)
pavitt_scale	-0.0471	0.9540	-0.0459	0.9551	-0.0424	0.9585
	(0.119)	(0.113)	(0.119)	(0.113)	(0.119)	(0.114)
pavitt_special	-0.0216	0.9787	-0.0207	0.9795	-0.00178	0.9982
	(0.204)	(0.200)	(0.204)	(0.200)	(0.204)	(0.203)
Constant	-3.741***	0.024***	-3.578***	0.028***	-3.629***	0.027***
	(0.308)	(0.007)	(0.999)	(0.028)	(0.997)	(0.027)

Regional-level variables

putnam_a		1.444	4.2371	2.856	17.3947
		(2.369)	(10.038)	(2.436)	(42.380)
olsen_a		-1.757	0.1725	-3.741	0.0237
		(2.334)	(0.403)	(2.493)	(0.059)
pibpercap		-2.91e-08	1	-3.47e-08	1
		(5.53e-08)	(5.53e-08)	(5.44e-08)	(5.44e-08)

Interactions Firm-Regional-Level

fuenextnatpersd#putnam_a				-0.574**	0.563**
				(0.285)	(0.161)
fuenextnatpersd#olson_a				0.947**	2.577**
				(0.474)	(1.222)

Random Effects

Random Intercept	-0.658**	0.518***	-0.699***	0.497***	-0.721***	0.487***
	(0.257)	(0.133)	(0.263)	(0.131)	(0.266)	(0.130)

Observations	5,198	5,198	5,198	5,198	5,198	5,198
Number of groups	14	14	14	14	14	14
LR test vs logistic reg	75.03		55.99		52.82	
p-value LR test	0		0		0	
ll(model)	-1317.587		-1317.263		-1314.788	

Note: Coefficients and odds ratio are reported for the logistic multi-level random intercept model. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Reviewing the control variables, we can observe that there is strong empirical support that any investment in any kind of innovation-related activities, no matter the amount, has a positive effect on the probability of the firm to generate product innovation. However, there seems to be a tipping point as the odds ratio for those firms falling into the category of investing more than 150 billion Colombian Pesos per employee is less than for the case of firms investing between 35 billion and 350 billion Colombian Pesos, an interesting result which calls for further study. At the same time, the higher the share of R&D investment of the total innovation-related investments, the higher the probability of the firm to generate a product innovation.

Even though for a long time, the premise that R&D investments are the main source for firm-level innovation (Freeman, 1994), research focusing on small and medium-sized enterprise (SME) have recently advocated for looking into other innovation-related investments, such as the formation of human capital (Ortega-Argilés, Vivarelli, & Voigt, 2009). In the case of the Colombian firms, we provide empirical evidence that as a whole innovation-related investments matter, even though they might not be spent on R&D but instead on technology acquisition, training or alike. At the same time, we provide empirical evidence that formal R&D investments

increase the firm's propensity to innovation, confirming general knowledge regarding innovation performance of firms.

While innovation-investments matter, the different variables which control for the effect of human capital as one driver of the firm's absorptive capacity are not significant. This result is somewhat surprising as other empirical research has found a strong positive correlation between human capital and innovation (e.g. Dakhli & De Clercq, 2004). Appropriability conditions matter for Colombian firms. Appropriability conditions represent the firm's capacity to retain the benefits of the innovation activities (Cohen & Levinthal, 1990). Our results show that the higher firm's consider the possibility of imitation by third actors and the inability of the intellectual property system to protect the innovation, the lower the propensity to generate product innovation. Our results goes in line with the argumentation and empirical results of Vega-Jurado and colleagues (2008).

Furthermore, size, measured in number of employees has a very low but positive and statistically significant effect on the generation of product innovation. Lastly, we were able to provide empirical evidence that firms operating in industries classified as science-based according to Pavitt (1984), are more likely to produce a product innovation than those operating in the supplier-based. This result is not surprising as – according to the research of this author – chemical and electronics/ electrical sectors are mainly based on R&D activities.

Conclusions

We base our research on the notion that innovation is a process, "a bridge-building process linking individuals" (Anderson & Jack, 2002, p. 207). As such, we argue that regional social capital in form of active memberships in civil associations play a crucial role in boosting innovation output at the firm level. We place this contention on the fact that memberships in civil associations are often local activities which put individuals into contact with others in their community, city, and region (Dakhli & De Clercq, 2004). Some authors argue that the scope and intensity of personal relationships within a regional innovation system function as local buzz (Storper & Venables, 2004), that is a process of information and knowledge exchange which based on face-to-face interactions between members of firms geographically concentrated taking place in local community organizations, bars or restaurants (Bathelt, Malmberg, & Maskell,

2004). We contest that the effect of actively participating in bonding and bridging civil associations constitutes a potential channel for the acquisition of new information and knowledge. However, this effect needs to be evaluated in light of the firm's network with external economic actors.

Our empirical research provides no statistical evidence for a direct effect of bridging or bonding regional social capital. However, we do find empirical evidence that the effectiveness of relying on external information sources for Colombian manufacturing firms depends on the regional civil activity. To the best of our knowledge, we provide first empirical evidence that associates civil engagement through memberships in voluntary organizations at the regional level with firm-level innovation output applying a multi-level model and therefore bypass the ecological and individual fallacy when not taking into account the hierarchical structure of firms being embedded in regions. Our results go in line with earlier research that positively associates civic participation at the regional level with the aggregated regional patenting activity in Italy (Crescenzi et al., 2013) and Europe (Hauser et al., 2007; Kaasa, 2009). Our research, however, goes further by differentiating between the two mentioned types of civil associations, making clear that not all civil associations serve the same cause. Laursen and colleagues (2012), on the other hand, provide empirical evidence at the firm-level that social interaction at the regional level positively moderates the effect of external R&D acquisition. We extend this finding providing evidence that not only externally acquired R&D activities but also the use of external information sources is moderated by social interaction at the regional level. Our results, however, differ from those from Hauser and colleagues (2007). For a sample of the 60 largest German cities, they found a statistically significant negative direct effect between voluntary associations and patent intensity, while at the same time a statistically significant positive direct correlation was found for expenditures of Chambers of Commerce. One possible explanation of these findings is that the authors relied on patent application, a measure for innovations which is much more restricted than the ones used in this empirical study, though it only represents inventions rather than innovations. As mentioned above, future research should evaluate the influence of bridging and bonding ties differentiating between the degrees of innovation. Furthermore, the authors relied on a very broad measure for voluntary associations: the registration of the association. This, however, does not say anything regarding the active participation. Additionally, it may distort the results as the same amount of people can be member in either

many small organizations or one very large organization. Lastly, they evaluated these correlations at the aggregated regional level which might generate difference in results.

We acknowledge that our research is not free of caveats. However, most of these shortcomings offer interesting venues for future research. In particular, the datasets on which we relied can be subject to criticism. We have mentioned that the data on social capital is representative at the regional level, not at the department level. However, though it is likely that civil associations are of local rather than national character (Dakhli & De Clercq, 2004), we cannot derive from the data whether these associations generate personal interactions at the community, city, department or regional level. It would be very interesting for future research to evaluate the cross-effects between these regional levels of social capital generated through civil associations. Furthermore, the categories of groups in the BARCAS are overly broad, a shortcoming brought forward already by Knack (2003). It is therefore difficult to differentiate between Putnam- and Olson-type civil associations. Also, the empirical operationalization between those two types on which we relied (Knack, 2003), is far from clear cut and needs further empirical work (Coffe & Geys, 2007). Lastly, we are not able to infer about the depth of commitment regarding the active membership in civil organizations; relying on active memberships and excluding passive memberships is only a very broad distinction.

The problem of not being able to differentiate between the different geographical levels also applies for the case of external information sources: while we explicitly excluded international external resources, the classification of national external information sources is rather broad. The famous comparison of Silicon Valley and Route 128 shows that this is a shortcoming which in future research should be overcome. Saxenian (1994) provides evidence that the lacking success of Route 128 in comparison with Sillicon Valley were due to missing bridging links with outer-regional network actors. The possible negative effects of strong regional bonding ties such as overopportunism and lack of flexibility (P. S. Adler & Kwon, 2002; Tura & Harmaakorpi, 2005) were overly pronounced in that case. In summary, future research should take into consideration the joint influence of firm-level, regional-level and outer-regional level bridging and bonding social capital.

We have, taking into consideration the developing country context in which this study takes place, adopted a very broad definition to measure product innovation. That means that while from our empirical results we can infer that regional civic participation is a moderating contextual variable impacting the adoption and diffusion of product innovation, we are not able to differentiate between various degrees of novelty. Provided that the empirical studies mentioned earlier found evidence of regional civic participation on patenting activity, brings forward the necessity for further studies evaluating this differential impact arises. Furthermore, the generation of innovation is a process that takes place in different stages with stage-specific tasks; for example while during the innovation initiation the central tasks are concentrated on problem perception and idea formation, during the innovation implementation the implementation of plans and actions are at the center of attention (Damanpour, 1991). Based on the differentiated tasks involved, the moderating effects of regional civil participation may differ as well. While during the idea generation stage, bridging ties maybe of greater help and accelerate development speed by providing access to a wide information and knowledge pool bonding ties are required at later innovation stages with increasing complexity (Harrison and colleagues (2008). Future research may focus on the impact depending on the innovation stages.

An additional limitation lies in the lack of being able to control for possible problems of endogeneity. While we have bypassed – applying the multilevel design – the ecological and individual fallacy present in the cited empirical studies, our data inhibits the use of an adequate instrument variable as did Laursen et al. (2012) at the firm-level and Crescenzi (2013) at the regional level. Endogeneity problems arise when there is a third, unobservable or unobserved variable that would affect both the use of external knowledge sources and product innovation respectively social capital and product innovation. Unfortunately, EDIT IV does not contain any financial information which could be used as an instrument variable nor did we identify any regional-variable which could serve as an instrumental variable.

"It is hardly possible to overrate the value...of placing human beings in contact with persons dissimilar to themselves, and with modes of thought and action unlike those with which they are familiar... Such communication has always been, and is peculiarly in the present age, one of the primary sources of progress"
John Stuart Mill, 1848

CHAPTER 4

TOLERANCE, AGGLOMERATION AND ENTERPRISE INNOVATION PERFORMANCE: A MULTILEVEL ANALYSIS OF LATIN AMERICAN REGIONS

Abstract

In this chapter, we examine the effect regional tolerance levels have on the innovation performance of firms in the regions of 7 Latin American countries. Based on Richard Florida's theory of creative class, we put forward the hypothesis that tolerance positively influences the innovation performance of firms by attracting human talent and lowering barriers for face-to-face interaction leading to knowledge exchange within a region. This effect is magnified in regions with high agglomeration economies. The empirical analysis which relies on a multi-level design and therefore explicitly differentiates between the regional and firm-level shows that regional differences in tolerance matter for product innovation. Additionally, firms in highly tolerant regions are able to better capitalize on agglomeration economies of large urban conglomerations. Taking into account the context of Latin America, the current study further provides evidence that tolerance and agglomeration economies are especially beneficial for firms which operate in a local or national market and generate new-to-the-market innovations.

Introduction

The emergence of the evolutionary literature and more research on innovation systems at the national and regional level have contributed to an understanding of innovation that stresses its interactive nature and thus emphasizes its social embeddedness (Lundvall, 2010). At the same time, Richard Florida's (2002) theory of creative class has drawn the attention to the influence tolerance, openness and cultural or social diversity play not only for economic development

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(Boschma & Fritsch, 2009; Florida, Mellander, & Stolarick, 2008; Kemeny, 2014), but more specifically for entrepreneurship (Audretsch, Dohse, & Niebuhr, 2010; Cheng & Li, 2012; Smallbone, Kitching, & Athayde, 2010) and innovation (N. Lee & Nathan, 2010; Niebuhr, 2010; Ozgen, Nijkamp, & Poot, 2011a, 2011b; Qian, 2013; Qinglan & Yingbiao, 2011).

Despite this growing body of literature, a need for further research exists especially linking the different levels where tolerance impacts innovation. The tolerance – innovation link may be explored at the micro-level (individual firm) as well as at the macro-level (city, region, or nation). In this study, we go beyond the aim of most studies by combining the firm and regional levels. Our main objective is to investigate how tolerance at the regional level impacts on firms' innovation performance for 28 regions in 7 Latin American nations: Chile, Colombia, Peru, Mexico, Uruguay, Ecuador, and Argentina (see Table 8 for a list of the regions).

Though Bamberger (2008) noted that contextual research has contributed to closing the micro-macro gap in management, quantitative studies concerning the relationship between contextual variables at the national or regional level and the innovation behavior or performance of firms adopting multi-level methods remain an exception (Beugelsdijk & Van Schaik, 2005; Lederman, 2009; Lorenz 2011, 2015; Srholec, 2010, 2011). However, the systemic perspective on innovation (Lundvall, 1992; Nelson, 1993) explicitly calls for a multi-level study design. Our research contributes to closing this research gap by using multi-level regression. It therefore avoids the ecological fallacy observed in some macro studies (Robinson, 2009) of assuming that group-level attributes and relations accurately capture individual-level relations.

At the same time, we not only focus on regional tolerance as an important regional contextual variable influencing the innovation performance of firms. Closely linked to any discussion of regional innovation systems is the impact of spatial concentration on innovative activities and performance. From a regional point of view, innovation is localized and locally embedded (Asheim & Gertler, 2005). Due to the tacit nature of much knowledge needed for new product development, face-to-face interactions facilitating the exchange of tacit knowledge are one way to augment innovation performance (Chesbrough, 2003; Lawson & Lorenz, 1999; Lundvall & Johnson, 1994; Pavitt, 2002; West & Bogers, 2014). We evaluate the impact of

regional tolerance in combination with regional agglomeration effects and analyze their individual and combined impact on the innovation performance of firms.

Our paper also contributes to the growing understanding of innovation activities of manufacturing firms in developing countries by placing it in the context of Latin America. Innovation surveys, the basis for much of empirical research in industrialized countries, are a relatively recent phenomena in Latin America (Castellacci & Natera, 2012)[28]. Despite following a common methodological guideline (Bogliacino, Perani, Pianta, & Supino, 2012) – the Bogota Manual (RICYT et al., 2001) – harmonization is low (Castellacci & Natera, 2012), limiting cross-country studies. The current study relies on the World Bank's Enterprise Survey for Latin America, thus allowing for a comparative study in this region. It extends knowledge derived from the few and very recent comparative studies in the region (e.g. Crespi & Zuñiga, 2012; Zuñiga & Crespi, 2013). We contribute to the understanding of the innovation process in developing countries by differentiating between firms in terms of the level of novelty of their product innovation activities. Latin American countries are developing countries where imitation or technology transfer are common practice (Anlló & Suárez, 2009) and lead to innovations that are characterized by imitation or incremental changes. Innovations involving the development of genuinely new products based on heavy R&D investments, on the contrary, are rare. By differentiating innovators according to levels of novelty, our study extends current understanding which is still limited regarding drivers of creative imitation (R. P. Lee & Zhou, 2012).

Theory Development

Tolerance versus diversity

Despite the rising recognition that tolerance, social and cultural diversity and openness influence regional economic development, the terms tolerance and diversity are often used interchangeably (Qian, 2013). Florida (2003) defines tolerance as "openness, inclusiveness, and diversity to all ethnicities, races, and walks of life" (p10). He has translated this definition into three different measures: the Gay Index, the Bohemian Index and the Melting Pot Index which

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[28] For a comparison and a methodological discussion of the different innovation surveys, please refer to Crespi & Peirano (2007) and Anlló et al. (2014).

have been used in empirical studies (Mellander & Florida, 2011; Qian, 2013) and reflect the regional density of gays and lesbians, Bohemians, and immigrants respectively.

However, recent literature has stressed the important difference between tolerance and diversity (Reese & Sands, 2008). The expression of "tolerance of societal or cultural diversity" as used for example in business ethics (Valentine & Fleischman, 2002) clarifies such differentiation. Whereas diversity is reflected by the distribution of people across different societal or cultural groups, tolerance involves the comparison with one's standard for certain beliefs or practices and implies co-existence, acceptance and integration (Corneo & Jeanne, 2009). This interpretation goes in line with the definition of tolerance according to the Merriam-Webster dictionary: tolerance is "sympathy or indulgence for beliefs or practices differing from or conflicting with one's own" or "the allowable deviation from a standard". As a result of this differentiation, Qian (2013) argues that Florida's measures proxy tolerance. Our analysis focuses on tolerance and the influence it exercises on the innovation performance of firms at the regional level and we therefore adopt similar measures as those developed by Florida.

Tolerance and innovation

Since the publication of Florida's The Rise of the Creative Class (2002), tolerance is increasingly considered as one influential contextual factor driving innovation[29]. As such, some studies have linked tolerance with innovation (Florida et al., 2008; Qian, 2013) emphasizing different mechanisms through which this may occur. Firstly, tolerance contributes to the exchange of different and complementary knowledge by facilitating knowledge spill-overs (Florida et al., 2008). The importance of knowledge spill-overs for innovation is widely recognized in the literature on economic geography and evolutionary economics (see Knott, Posen, & Wu, 2009 for an overview). Due to the partially tacit nature of knowledge used in innovation activity, knowledge transfer often relies on face-to-face interactions (Storper & Venables, 2004). Highly tolerant regions are likely to harbor highly tolerant employees who value openness and self-expression (Berggren & Elinder, 2012a, 2012b; Welzel, Inglehart, & Kligeman, 2003) and accept the participation of all kinds of people in a society (Corneo &

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[29] Mokyr (1990) mentioned the link between tolerance and innovation much earlier, but Florida (2002) was more influential in driving research and public policy in this direction.

Jeanne, 2009). As such, regional tolerance is likely to contribute to lowering the potential barriers to face-to-face communication and thus drive innovation through facilitating passive or active knowledge spillovers (Qian, 2013; Storper & Venables, 2004).

Second, highly tolerant regions are characterized by an ambience where unconventional ideas in thought and practice may flourish (Kotkin, 2000). Creativity forms one of the building blocks of innovation (von Stamm, 2003) and implies the breaking away from traditional routines and practice (Gustavsson & Laestadius, 2006). Tolerance stimulates creativity (Å. Andersson, 1985) because it signals acceptance that old ways of doing things may be replaced by new ones. As a result, highly tolerant regions are more likely to accept new ideas which lie at the basis of any innovation.

And lastly, a higher regional tolerance provides a signaling effect which indirectly affects innovation; a highly tolerant region is likely to be attractive to human talent, especially a diverse (Olfert & Partridge, 2011) and creative (Trip & Romein, 2009) pool of talent. In fact, empirical studies have provided evidence for such a positive relationship between tolerance and talent (Boschma & Fritsch, 2009; Florida, 2002; Mellander & Florida, 2011; Niebuhr, 2010; Qian, Acs, & Stough, 2013). Tolerance enhances diversity as it lowers barriers, encouraging people who value creativity and diversity to move to the specific region (Florida, 2002). For these reasons we argue that in regions with higher level of tolerance firms are more likely to introduce new products onto the market.

Hypothesis 1: A higher level of regional tolerance will increase the probability of firms to introduce a new product onto the market.

Tolerance and the city-region context

One of the central issues addressed in the literature on geographical determinants of innovation is the importance of agglomeration economies. In particular, the way size and economic diversity of urban agglomerations can positively impact firms' innovative performance is put forward (Carlino, Chatterjee, & Hunt, 2007; Ciccone, 2002; Crescenzi, Rodríguez-Pose, & Storper, 2007; Sedgley & Elmslie, 2004). Large and densely populated urban agglomerations benefit from Marshallian externalities associated to labor pooling and sharing, linking and

matching processes between intermediate and final goods producers, and knowledge spillovers resulting in the diffusion of knowledge (Duranton & Puga, 2004). In addition to these locational advantages associated with industrial specialization and the clustering of firms in the same sector, large urban agglomerations may benefit from Jacobian externalities associated with economic diversity. Jacobs (1970) argued that knowledge may spillover between different and complementary industries facilitating search and exploration among diverse firms and agents. As a result, agglomeration economies generally influence the generation of innovation positively (for an overview, see for example Feldman & Kogler, 2010).

Both types of externalities are based on knowledge exchange and interactive learning, recognized to be regionally bounded (Jaffe, 1986; Lawson & Lorenz, 1999; Maskell, Eskelinen, Hannibalsson, Malmberg, & Vatne, 1998). The capacities required for the transfer of tacit knowledge, an important basis for the creation of innovation (Lundvall and Johnson, 1994; Pavitt, 2002), are specific to time and space (Lam, 2000), as they often rely on face-to-face interactions (Storper & Venables, 2004). Additionally, knowledge is spatially sticky as the social and institutional context in which it is produced permeates it and influences its meaning (Gertler, 2003). As a consequence, tacit knowledge transfer is somewhat regionally bounded (Jaffe, 1986; Maskell et al., 1998; Storper & Scott, 1995).

We argue that these potential benefits of agglomeration are likely to be realized to a greater extent in regional settings where tolerance is high, though some authors argument that tolerance goes hand in hand with large agglomerations: "the urban milieu provides a natural refuge for original spirits ill at ease in rural areas, where the pressure to conform is as a rule stronger" (Bairoch & Braider, 1991, p. 336). However, observed differences in tolerance levels among large urban agglomerations – for example between Boston and Pittsburgh (Florida, Mellander, & Adler, 2011) – challenge this argument. Instead, we suggest that the positive effects of agglomeration economies and tolerance for innovation are complementary. The probability of accessing new knowledge is higher in urban agglomeration due to its sheer size; each individual can meet, on average, a much larger amount of people (Bairoch & Braider, 1991). However, these interactions are not sufficient when a culture of low tolerance inhibits the acceptance of new and diverse knowledge. As argued above, tolerant regions value openness and self-expression (Berggren & Elinder, 2012b; Welzel et al., 2003), thus letting diversity in

thoughts and ideas thrive. As a result, new ideas are more likely to be accepted, to flourish and be materialized (Silver, Clark, & Graziul, 2011), skills more likely to be freely exchanged (Shalley, Zhou, & Oldham, 2004). Additionally, tolerant regions are also characterized by a high amount of interaction (Florida, Mellander, & Stolarick, 2010), thus enabling and enhancing knowledge spillovers. We therefore suggest:

Hypothesis 2: The positive benefits of agglomeration economies for innovation will be greater in regions with higher tolerance levels.

Data Description and Methodology

The Latin American context

The Latin American region has been characterized by a relatively prolonged period of economic growth during the last decade. Yet, with the exception of Brazil and to some extent Mexico, the region still lags significantly behind industrialized countries. This situation will likely worsen with lower commodity prices, on which the region heavily depends. With low productivity lying at the heart of a region's poor economic performance (Crespi, Navarro, & Zuñiga, 2010; Pagés, 2010), innovation is essential for catching-up (e.g. Fagerberg & Srholec, 2008). A recent study for Latin American countries confirms the impact of knowledge investments on the level of productivity, reporting productivity gaps between innovative and non-innovative manufacturing firms in these countries that are more than twice as high as in industrialized countries (Crespi & Zuñiga, 2012). Thus, understanding how innovation can be fostered and nurtured in the context of Latin America is important. Additionally, highly divergent empirical results regarding innovation activities of firms in this region (Zuñiga & Crespi, 2013) call for further innovation studies in Latin America.

It has been long argued that studies in developing countries need to evaluate firms' capabilities to innovate in light of national factors (Dahlman, Ross-Larson, & Westphal, 1987; Lall, 1992). Thus, it is important to understand the specificities of innovation in this context. Relatively low investments in R&D for which incentives are relatively small or even absent (Acemoglu, Aghion, & Zilibotti, 2006) and which do not always seem to translate into a higher propensity to introduce technological innovation (e.g. Benavente, 2006) are characteristic for Latin America. In many of these countries, firms' innovations consist in incremental changes

based on imitation or technology transfer (Anlló & Suárez, 2009). Despite this common phenomenon, theoretical development and empirical evidence regarding drivers of product imitation remain scarce (R. P. Lee & Zhou, 2012).

At the same time, the literature has stressed extensively the roles of imitation and technology acquisition as preconditions for learning and catching up (Bell & Pavitt, 1997). This is especially true if the innovation process moves on from 'duplicative imitation', to 'creative imitation' and finally towards innovation in the sense of developing genuinely new products and technologies as is true for a number of successful Korean enterprises (Kim, 1997; K. Lee & Lim, 2001) and the Indian pharmaceutical industry (Kale & Little, 2007). Against this backdrop, our study contrasts two different degrees of novelty: new-to-the-firm and new-to-the-market-product innovations.

Data sources

Our data derives from various sources. The measure for regional tolerance levels is derived from the results of the 5th and 6th World Values Surveys (WVS) carried out in 2005-2009 and 2010-2014 respectively. The WVSs are carried out by a global network of social scientists studying changing values and their impact on social and political life and covers a large number of nations ranging from very poor to very rich countries. Samples for these surveys are drawn from the entire population of 18 years and older with the minimum sample being 1000. In most countries, some form of stratified random sampling is used to obtain representative national samples.[30]

We link this data to micro-level data on enterprise innovation derived from the World Bank Enterprise Surveys (WBES) carried out in Latin America during 2010. The World Bank Enterprise surveys are firm-level surveys of representative samples of key manufacturing and service sectors in each country. The survey has been carried out in 135 nations since 2000 and covers all regions of the world. Since 2005-06 data collection has been centralized within the World Bank and a standard methodology has been applied. The sample frame covers firms with

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[30] For details on the World Values Survey sampling methodology, see:
http://www.worldvaluessurvey.org/WVSContents.jsp

5 employees or more in manufacturing and selected service sectors and excludes 100% government or state owned enterprises. The sampling methodology is stratified random sampling with strata according to firm size, business sector, and geographic region within a country.[31] In the case of the surveys carried out in Latin America in 2010, questions on innovation were only addressed to firms in the manufacturing sector and for this reason our analysis is restricted to manufacturing sector enterprises.

Regional matching

Both the WVS and the WBES code individuals respectively firms according to region. In the case of the WVS, the regional break-down is according to the largest administrative jurisdiction: provinces (Argentina and Ecuador), states (Mexico), departments (Uruguay and Colombia), and regions (Peru). An exception is Chile where the data is broken down according to the divisions of north, central, south and the Santiago Metropolitan Region rather than by region, the largest administrative jurisdiction. The major urban agglomerations are treated differently. In Mexico sampling includes the Federal District which is a separate federal entity encompassing Mexico City, not forming part of any of the 31 states. Figures for Buenos Aires are for Gran Buenos Aires which is not a jurisdiction and include the Autonomous City of Buenos Aires as well as 26 adjacent municipalities. Figures for Bogotá are for Bogota Capital District and in the case of Peru figures are for Lima Province which is the only province not belonging to any of the 25 regions.

In the WBESs, the within nation regional break in most cases is not by administrative jurisdiction, as in the case of the WVS, but rather by major city and the surrounding business area. For example, in the case of Colombia the regional stratification of the sample was defined in four cities: Bogota, Cali, Medellin, and Barranquilla. In order to match the two surveys, we have matched the cities and their surrounding areas used to stratify the WBESs to the appropriate administrative region identified in the stratification of the WVS. Appendix C gives the

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[31] For details on the sampling methodology of the World Bank Enterprise survey, see
http://www.enterprisesurveys.org//Methodology

correspondence between the two surveys and the number of observations by region for each survey. Regions with less and 35 observations have been excluded.

Variable description

Dependent variable

Our dependent variables are two binary measures of firm innovation and are based on two questions from the WBES which follow the Oslo Manual (OECD, 2005). The respondent is asked whether or not the firm has introduced onto the market a new or significantly improved product and whether or not the product is new not only to the firm but also new to the firm's market. The variable new-to-firm takes the value of 1 if the firm has introduced any product innovation whereas the variable new-to-market takes the value of 1 only in the case that the product innovation was new to the market. Table 8 shows the regional averages for the two innovation measures for the 28 Latin American regions taken into account. While an average of 56% firms undertake some kind of product innovation, the differences among the various regions is notorious, ranging from 21% in Puebla, Mexico to 77% in Canelones, Uruguay. The same applies for the more restrictive measure of product innovations which are new to the market.

Firm-level variables

Following theoretical and empirical research on the determinants of product innovation, we include as enterprise-level controls several variables derived from the WBES, indicating whether the firm undertakes R&D expenditures (*R&D*), whether it provides formal vocational training for its full-time employees (*train*), whether it has direct or indirect exports (*export*), whether any of the principal owners are female (*female-owner*), and size in terms of employees (*size*). R&D investments are considered to be one of the main driver of firm-level innovations (Freeman, 1994), as it not only increases the firm's knowledge base but also contributes to build up absorptive capacity, that is the firm's ability to use external knowledge (Cohen & Levinthal, 1990). Formal vocational training increases the employee's level of education and training, thus also contributing to build up the knowledge stock of the firm and to increase its absorptive capacity (Schmidt, 2010).

Table 8
Descriptive statistics at the regional level for dependent and main independent variables

Region, Country	New to firm product innovators %[1] New_Firm	New to market product innovators %[1] New_Mkt	Tolerance measure[2] TOL	Population (millions) POP	GDP % of national GDP_REG
Santiago RM, CL	59.5	28.5	0.004	6.683	45.9
Antofagasta, CL	59.0	24.5	0.446	0.531	12.6
Los Lagos, CL	56.9	25.3	0.444	0.768	2.63
Valparaiso, CL	45.8	23.3	0.467	1.698	8.6
Bogota DF, CO	67.6	49.3	1.040	7.879	25.4
Valle de Cauca, CO	64.7	28.7	1.136	4.560	9.9
Antioquia, CO	71.9	46.4	0.949	6.300	13.2
Atlantico, CO	34.9	18.9	0.891	2.403	3.8
Coahuila, MX	26.0	12.3	0.647	2.930	5.2
Distrito Federal, MX	40.2	16.3	0.977	8.872	17.2
Jalisco, MX	29.7	10.4	0.339	7.554	6.3
Estado de Mexico, MX	51.8	29.2	0.365	16.619	9.4
Nuevo Leon, MX	45.8	16.4	-4.390	4.826	7.6
Puebla, MX	21.2	11.5	-0.925	5.914	3.4
Guanajuato, MX	51.8	22.7	-0.820	5.486	3.9
Lima Dept, PE	62.9	35.9	0.715	9.752	44.3
Arequipa, PE	66.3	44.5	0.142	1.140	5.3
Lambayeque, PE	56.1	36.3	0.788	1.091	2.4
La Libertad, PE	71.6	32.8	0.668	1.618	4.7
Montevideo Dept, UY	60.2	29.7	0.835	1.319	46.2
Canelones Dept, UY	77.0	10.5	0.893	0.520	10.8
Pichincha, EC	54.2	37.1	-4.048	2.576	24.4
Guayas, EC	45.4	29.3	-3.077	3.645	26.8
Azulay, EC	47.0	12.1	-4.001	0.712	4.9
Gran Buenos Aires, AR	72.0	33.1	1.396	12.801	25.7
Santa Fe Province, AR	68.9	15.7	1.197	3.195	7.2
Mendoza Province, AR	62.6	29.1	0.696	1.739	4.2
Cordoba Province, AR	44.6	35.1	1.139	3.309	7.3

Sources: Authors' calculations based on data from the 5th and 6th World Values Survey; World Bank Enterprise

Despite the fact that female ownership is not a common determinant of firm-level innovation performance, we included this variable in the current research. Despite the widespread hypothesis of underperforming female entrepreneurs (for an overview see Marlow & McAdam, 2013), recent research shows that female-owned businesses outperform male-owned ones (Kalnins & Williams, 2014). Additionally, Gry and colleagues (2013) argue that women are not less innovative as often claimed but rather organizational practices inhibit women's innovative behavior. We argue that in those organizations which are partially owned by women, these organizations practices are likely to not exist. As such, female ownership may lead to the participation of women in innovation-related processes which leads to firm-level diversity and as such may enhance the innovation performance of the firm. This connotation is supported by a recent empirical study in the Mexican context (Serviere-Munoz & Saran, 2012).

Exports have constantly been linked with innovation. However, the causal relationship between these two variables is far from straightforward. While many empirical studies emphasize that R&D investments or innovation activities increase the probability of exporting, literature on organizational learning suggests that exposure to foreign markets through exports increases the firm's technological knowledge through a process of double-loop learning (Yeoh, 2004). Recent work drawing on World Bank Enterprise survey data has identified a positive impact of trade openness on innovation performance. Almeida and Fernandes (2008) and Seker (2011) find that firms which export are more likely to innovate and this supports the thesis that exporters will be more innovative through their contacts with more knowledgeable foreign customers or due to the increased pressure of international competition. In the same vain, the importance of clusters being connected to global pipelines through knowledge gatekeepers has been stressed (Bathelt et al., 2004; Giuliani & Bell, 2005).

Size is a very ambiguous variable with respect to its influence on the innovation performance of firms. Large firms are said to have an advantage due to their ability to spread the inherent risk of innovation over an array of different innovation projects, their easier access to finance, and the generation of economies of scale in the production (Veugelers, 1997) and commercialization of innovations (Teece, 1986). On the other hand, small firms are argued to be more creative, flexible and faster (C. M. Christensen & Bower, 1996). Table 9 includes a definition of each of the firm-level variables as well as descriptive statistics.

Table 9

Definition of enterprise-level variables and their respective descriptive statistics

Variable name	Definition	Mean[*]	Std. dev	min	max
New-to-firm	Binary variable equal 1 if the firm has introduced any new or significantly improved products over the last 3 years, 0 otherwise	0.56	0.5	0	1
New-to-mkt	Binary variable equal to 1 if the firm has introduced a product which is not only new to the firm but also new to the firm's market, 0 otherwise.	0.29	0.45	1	2
female_owner	Binary variable equals 1 if any of the firm's principal owners are female, 0 otherwise	0.31	0.46	0	1
export	Binary variable equals 1 if the firm has direct or indirect exports, 0 otherwise	0.34	0.47	0	1
train	Binary variable equals 1 if the firm offers formal (beyond "on the job") training to its permanent employees, 0 otherwise	0.5	0.5	0	1
r&d	Binary variable equals 1 if the firm spent R&D over the last year, 0 otherwise	0.43	0.5	0	1
size cat. 1	Binary variable equals 1 if the firm employs between 1 and 49 employees, 0 otherwise	0.47	0.5	0	1
size cat. 2	Binary variable equals 1 if the firm employs between 50 and 249 employees, 0 otherwise	0.36	0.48	0	1
size cat. 3	Binary variable equals 1 if the firm employs between 250 and 499employee, 0 otherwise	0.17	0.38	0	1
mkt cat. 1	Binary variable equals 1 if the firm's main market is local or municipal 0 otherwise	0.44	0.5	0	1
mkt cat.2	Binary variable equals 1if the firm's main market is national, 0 otherwise	0.49	0.5	0	1
mkt cat.3	Binary variable equals 1 if the firm's main market is international, 0 otherwise	0.07	0.25	0	1

Note: * Means are equal to the percentage frequency for binary variable. Source: World Bank Enterprise surveys.

Regional-level context variables

We build our tolerance measure from a series of questions derived from the WVS asking respondents to mention whether they would not like to have specific groups of people as neighbors. We include questions referring to people of a different race, to people of a different religion and to immigrants or foreigners. The percentage of respondents in each region not mentioning these categories or groups were calculated and a principal components analysis was undertaken on the three variables for the 28 regions. The factor scores for each region on the first component, which accounts for over 93 percent of the total variance in the data set, is our measure of regional tolerance. The values of the tolerance measure for each region are presented in column 4 in Table 8 and the results of the principal components analysis are presented in Appendix E.

Furthermore, we develop two measures of agglomeration economies for the administrative regions identified in the WVS. One, an absolute measure, is the size of the population. The other, a relative measure, is the share of regional GDP in national GDP. Population figures are based on the most recent census figures with projections for 2010 to 2014 in the case of where census figures are prior to 2009. We use size of the regional population rather than population density due to lack of harmonization in the definition of regions across nations. This lack of harmonization has an especially large impact on the density figures for the major urban conurbations which are often administratively separate entities from the regional jurisdictions. For example, the density figure for Gran Buenos Aires is 3,342 per km^2 while the density figure for the Autonomous City of Buenos Ares is 14,000 per km^2. Columns 5 and 6 of Table 8 present the values of these agglomeration measures for each of the 28 regions and Table 10 below presents descriptive statistics and correlations for the three regional context variables. The tolerance measure is only weakly positively correlated with the two agglomeration measures which are themselves moderately positively correlated.

Table 10
Descriptive statistics and correlation coefficients for tolerance-related variables

	mean	Std dev.	TOL	POP	GDP_REG
TOL	-0,039	1,69	1		
POP	4,52	3,97	0,16	1	
GDP-REG	0,14	0,13	0,01	0,3	1

Sources: Authors' calculations based on data from the 5th and 6th World Values Survey and National Statistical Sources.

At the regional level, we control for the economic development of each region. For this purpose, we use the regional GDP share rather than the absolute value of GDP given that the large differences in the level of economic development across the nations would bias downward the figures for the poorer nations.

Methodology

We make use of multi-level regression analysis in order to estimate the fixed effects of regional indicators on micro-level measures of enterprise innovation performance for 28 regions in 7 Latin American nations. Multi-level modelling uses hierarchically structured data, with firms at level-1 being clustered within regions at level-2.[32] Applying an OLS regression in this case would violate the assumption of independent observations (Snijders & Bsoker, 2012), leading to biased standard errors and unreliable regression coefficients (Rabe-Hesketh & Skrondal, 2014; Raudenbusch & Bryk, 2002). We hereby also avoid the ecological fallacy (Robinson, 2009) by not assuming that group-level attributes and relations accurately capture individual-level relations.

Given the binary nature of our dependent variables, we apply a multi-level probit regression predicting the probability that an enterprise will innovate as a function of both enterprise-level variables and regional-level contextual variables:

New-to-firm ~ Binomial (n_i, π_i) (1)

where π_i denotes the probaility that *new-to-firm* equals 1 and

---

[32] See Goldstein (2005) and Rabe-Hesketh and Skrondal (Rabe-Hesketh & Skrondal, 2014) for a presentation of multi-level regression analysis.

New-to-market $\sim$ Binomial (n_i, π_i) (1)

where π_i denotes the probaility that *new-to-market* equals 1.

The structure of the basic random intercept model estimated in the paper is given in equation (2). The subscripts *j* vary across the sample of regions and the subscripts *i* vary from enterprise to enterprise within regions.

probit $(\pi_i) = \beta_{0j} + \beta_{1j}\text{train}_{ij} + \beta_2\text{r\&d}_{ij} + \beta_3\text{export}_{ij} + \beta_4\text{female-owner3}_{ij} + \beta_5\text{size2}_{ij} + \beta_6\text{size3}_{ij}$ (2)

with

$\beta_{0j} = \beta_0 + u_{0j}$

Regional-level context variables capturing tolerance levels and agglomeration economies are estimated by adding to the basic equation the aggregate variables TOL and POP or GDP_REG:[33]

$B_7\text{TOL}_j + \beta_8\text{POP}_j$ (3)

Interaction effects between tolerance and agglomeration are estimated by including variables constructed by multiplying TOL by POP or by GDP_REG:

$+ \beta_9(\text{TOL}_j * \text{POP}_j)_j$ (4)

Since the aggregate contextual variables are continuous, the interpretation of the coefficients on the interaction terms is straight forward. Treating POP as the moderator, a positive and significant coefficient on the interaction terms means that the size of the positive impact of increasing the level of tolerance on the predicted probability of a firm introducing a new product increases for larger regional populations.

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[33] The absence of the subscripts *i* on the coefficients for the level-2 context variables indicates that their value varies across nations but not across individuals within nations.

<center>**Econometric Analysis and Results**</center>

Econometric Analysis

Table 12 presents the results of the probit regressions in form of coefficients investigating the predictors of new-to-the-firm innovations. This is a very broad measure of product innovation capturing the adoption and diffusion of product innovation as well as the creation of innovation with higher novelty requirements. The first column (model 1) presents the baseline level-1 regression. Model 2 introduces the regional-level contextual variable tolerance. Model 3 and 4 add our absolute and relative measures of agglomeration economies versus the share of regional in national GDP. Models 5 and 6 introduce the interaction terms between tolerance and the two agglomeration economies measures. Results for the firm-level control variables do not change across the different models, providing an indicator for their robustness.

For Model 2, we find evidence for a statistically significant positive correlation between the regional level of tolerance and the probability of introducing new-to-the-firm product innovation, as advanced by Hypothesis 1. This effect remains statistically significant when adding either one of the two agglomeration economies measures. The results of Model 3 and 4 show that the absolute measure of regional population is not significantly correlated with the innovation measure, while the share of regional on national GDP is positively and significantly correlated with the probability of introducing a new-to-the-firm product. At the same time, the interaction with tolerance is significant in the case of the absolute agglomeration measure whereas it is not for the relative agglomeration measures. Hypothesis 2 therefore receives partial empirical support, indicating that the positive effect of regional tolerance on the probability of introducing a new-to-firm product is significantly greater in larger agglomerations. This result should be evaluated in light of the theoretical discussion laid out above. We argued that the increased probability of face-to-face interactions in large agglomerations contribute to a higher probability of information exchange (Bairoch & Braider, 1991). However, this increased probability only contributes to a higher probability of introducing new-to-the-firm product innovation in case that it is met with a sufficient level of tolerance, giving way to the acceptance of new ideas. This interaction is likely to be captured by a population measure, as the one employed by us as the absolute measure for agglomeration effects.

Regarding the firm-level control variables, the results show a significant positive correlation between offering training respectively investing in R&D and the probability of introducing a new-to-firm product innovation. These results not only confirm theoretical discussions regarding the development of absorptive capacity (Cohen & Levinthal, 1990; Schmidt, 2010) but also confirm earlier results on firm-level drivers of product innovation (e.g. Thornhill, 2006). Additionally, firms with female ownership are more likely to introduce a product innovation. Both size and direct/ indirect exports are not significantly related to the probability of introducing new-to-firm products. The latter goes against the idea that trade openness has a positive impact on innovation performance through exposure to broader knowledge and more intensive competition (Almeida & Fernandes, 2008; Seker, 2011). This result should be interpreted in light of the innovation measure adopted which includes 'duplicative imitation'. For the adoption and diffusion of products or technologies already present on local or national markets, access to foreign markets is unlikely to have a positive impact.

Table 13 presents a similar exercise for the introduction of product innovations characterized by a higher degree of novelty: being new to the firm's market. Unlike the case of new-to-firm product innovations, the results for new-to-the market innovators do not provide empirical support for our two hypotheses. However, there is statistically significant evidence that these firms benefit in their innovation performance from agglomerations economies (Models 9 and 11). A possible explanation for this difference between new-to-firm product innovators and new-to-the market innovators is that the latter are more dependent on external, global knowledge in order to obtain a high degree of novelty. The positive and significant coefficient on the export variable in these models is consistent with this argumentation. Further, as the literature on technological catch-up has argued, firms in developing nations may pursue global strategies to access knowledge, including partnership with more advanced multinational firms or even establishing research outposts in more developed nations (Lee and Lim, 2001). For such globally oriented firms high levels of local tolerance are unlikely to contribute much to the success of their innovation activities.

Table 11
Descriptive statistics aggregated at the regional level for 28 Latin American regions

Region, Country	New to firm product innovators %[1]	New to market product innovators %[1]	Tolerance measure[2]	Population (millions)	GDP % of national
	New_Firm	*New_Mkt*	*TOL*	*POP*	*GDP_REG*
Santiago RM, CL	59.5	28.5	0.004	6.683	45.9
Antofagasta, CL	59.0	24.5	0.446	0.531	12.6
Los Lagos, CL	56.9	25.3	0.444	0.768	2.63
Valparaiso, CL	45.8	23.3	0.467	1.698	8.6
Bogota DF, CO	67.6	49.3	1.040	7.879	25.4
Valle de Cauca, CO	64.7	28.7	1.136	4.560	9.9
Antioquia, CO	71.9	46.4	0.949	6.300	13.2
Atlantico, CO	34.9	18.9	0.891	2.403	3.8
Coahuila, MX	26.0	12.3	0.647	2.930	5.2
Distrito Federal, MX	40.2	16.3	0.977	8.872	17.2
Jalisco, MX	29.7	10.4	0.339	7.554	6.3
Estado de Mexico, MX	51.8	29.2	0.365	16.619	9.4
Nuevo Leon, MX	45.8	16.4	-4.390	4.826	7.6
Puebla, MX	21.2	11.5	-0.925	5.914	3.4
Guanajuato, MX	51.8	22.7	-0.820	5.486	3.9
Lima Dept, PE	62.9	35.9	0.715	9.752	44.3
Arequipa, PE	66.3	44.5	0.142	1.140	5.3
Lambayeque, PE	56.1	36.3	0.788	1.091	2.4
La Libertad, PE	71.6	32.8	0.668	1.618	4.7
Montevideo Dept, UY	60.2	29.7	0.835	1.319	46.2
Canelones Dept, UY	77.0	10.5	0.893	0.520	10.8
Pichincha, EC	54.2	37.1	-4.048	2.576	24.4
Guayas, EC	45.4	29.3	-3.077	3.645	26.8
Azulay, EC	47.0	12.1	-4.001	0.712	4.9
Gran Buenos Aires, AR	72.0	33.1	1.396	12.801	25.7
Santa Fe Province, AR	68.9	15.7	1.197	3.195	7.2
Mendoza Province, AR	62.6	29.1	0.696	1.739	4.2
Cordoba Province, AR	44.6	35.1	1.139	3.309	7.3

Sources: Authors' calculations based on data from the 5th and 6th World Values Survey; World Bank Enterprise Survey; National Statistical Sources.

Table 12

Multilevel probit model of new-to-the-firm product innovation with random intercept

Dependent variable	New-to-the firm Innovation					
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed: Level 1						
Constant	-.44***	-.44***	-.48***	-.42***	-.52***	-.52***
training	.35***	.37***	.37***	.37***	.37***	.37***
r&d	.87***	.86**	.86**	.86**	.86**	.86**
export	0.05	0.03	0.03	0.03	0.03	0.03
Female_owner	.13*	.13*	.13*	.13*	.13*	.13*
Size (empl.)						
5-24			Reference			
25-100	0.07	0.05	0.05	0.05	0.05	0.05
> 100	-0.05	-0.03	-0.04	-0.04	-0.04	-0.04
Fixed: Level 2						
TOL		.05**	.04*	-0.04	.04*	0.05
POP			0.01	-0.01		
GDP_REG					.44**	.47**
TOL * POP				.02**		
TOl * GDP_REG						-0.09
Random Effect						
Intercept	0.02	0.02	0.02	0.01	0.01	0.01
No. Groups	*28*	*28*	*28*	*28*	*28*	*28*
N	*4454*	*4454*	*4454*	*4454*	*4454*	*4454*

Note: * p < .10; ** p < .05; *** p < .01. Sources: Authors' calculations based on data from the 5th and 6th World Values Survey; World Bank Enterprise Survey; World Bank Indicators.

This interpretation assumes that new-to-the market innovators are introducing genuinely novel products for world markets based on R&D and high-level technical and scientific human resources. However, we observe in Figure 8 that in our context – developing countries – the main markets of most firms introducing new-to-market innovations are either local or national. From a global perspective, their innovative activity can be interpreted as a form of imitation or diffusion that uses knowledge and technologies already available externally. As we argued above, while such locally or nationally oriented firms may benefit from having access to external, global knowledge, their ability to adapt this to meet the demands of local users will often depend on locally embedded interactive learning processes involving a dense network of connections with local firms and institutions. For this reason, we argue that new-to-market innovators oriented primarily to the local or national market may well benefit from higher levels of regional tolerance.

Table 13
Multilevel probit model of new-to-the-market product innovation with random intercept

Dependent variable	New-to-market Innovation					
	Model 7	**Model 8**	**Model 9**	**Model 10**	**Model 11**	**Model 12**
Fixed: Level 1						
Constant	-1.85***	-1.20***	-1.27***	-1.25***	-1.30***	-1.35
training	.32***	.33***	.33***	.33***	.33***	.33***
r&d	78***	.76***	.76***	.76***	.76***	.76***
export	.19***	.18***	.18***	.18***	.17**	.17**
Female_owner	0.04	0.05	0.05	0.05	0.05	0.04
Size_5-24			Reference			
Size_25-100	-0.07	-0.07	-0.07	-0.07	-0.07	-0.08
Size_> 100	-0.08	-0.03	-0.07	-0.07	-0.07	-0.07
Fixed: Level 2						
TOL		0.03	0.02	-0.02	0.02	0.03
POP			.01*	0.01		
GDP_REG					.53**	.61***
TOL * POP				0.01		
TOl * GDP_REG						-0.13
Random						
Intercept	0.04	0.04	..03	0.03	0.01	0.01
No. Groups	28	28	28	28	28	28
N	*4454*	*4454*	*4454*	*4454*	*4454*	*4454*

Note: * $p < .10$; ** $p < .05$; *** $p < .01$. Sources: Authors' calculations based on data from the 5th and 6th World Values Survey; World Bank Enterprise Survey; National Statistical Sources.

The effect of the market's geographical scope

In order to provide evidence relevant to these arguments, in Table 14 we present the results of regressions that include a measure of whether the firm's main market is local, national or international. We investigate how these differences in the firm's main market interact with the level of regional tolerance. Our expectation is that relative to firms whose main market is international, firms whose main market is local or national will benefit in their new-to-the market innovation activity from being located in a higher tolerance region.

Figure 8. Distribution of firms according to degree of novelty
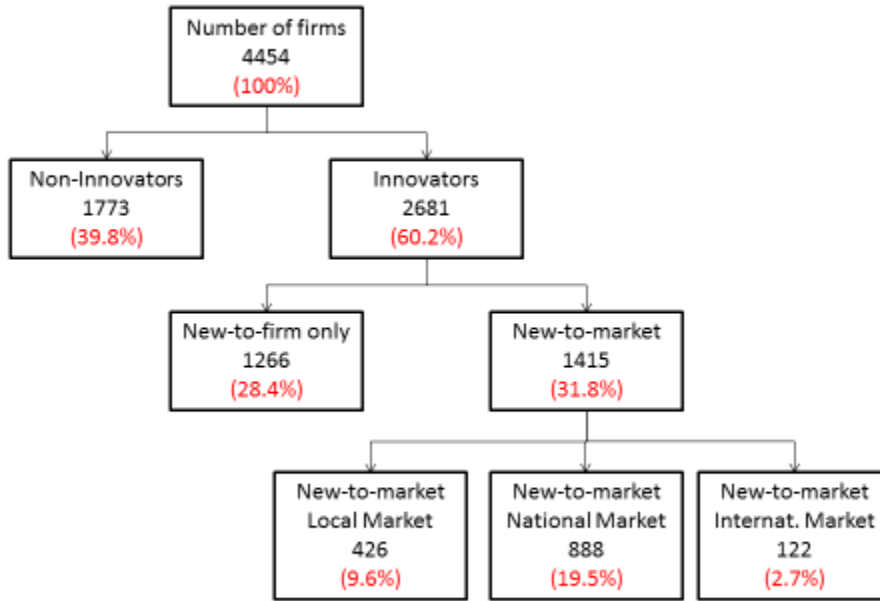
Sources: Authors' calculations based on data from the World Bank Enterprise Survey

The results in Model 14 show positive and statistically significant coefficients on the terms measuring interaction effects between the levels of regional tolerance and having one's main market local or national. These results support our argumentation that regional tolerance will have a positive impact on enterprise innovation performance in cases where the firm's main market is local or national. Combined with the positive and significant coefficient for exporting activities for Model 14, we may observe the result of a combined process involving the absorption of new codified knowledge from outside the main market, often referred to as 'global pipeline', with the interactive learning processes at the local or national level, labelled as 'local buzz' (Bathelt et al., 2004; Isaksen, 2003; Storper & Venables, 2004) in order to transform this knowledge into commercially viable products for local or national markets. A related idea has been developed in the literature on clusters or regional systems of innovation in developing nations, where 'gatekeepers' link the local networks or clusters of firms to external sources of knowledge and contribute to its local diffusion through their dense connections with local firms and agents (Bell & Albu, 1999; Giuliani & Bell, 2005; Giuliani, 2005; Humphrey & Schmitz, 2002).

Table 14
Multilevel probit model of new-to-the-market product innovation with random intercept and random coefficient

Dependent variable	New-to-the market innovation		
	Model 13	Model 14	Model 15
Fixed: Level 1			
Constant	-1.74***	-1.40***	-1.34***
training	.32***	.32***	.32***
r&d	.76***	.75***	.75***
export	0.23	.20***	.20***
Female_owner	0.03	0.094	0.038
Size_5-24		reference	
Size_25-100	-0.07	-0.08	-0.08
Size_> 100	-0.07	-0.08	-0.07
Main market			
Main Market_Local	.19*	0.09	0.08
Main Market_National	.30***	.21***	.21**
Main Market_International	reference		
Fixed: Level 2			
TOL		-.12**	-0.03
POP		.01*	0
TOL * Local		.18***	
TOL * National		.15***	
TOL*POP			-0.01
TOL * POP * Local			.02*
TOL * POP * Nat			.02*
Random Effects			
Intercept	0.03	0.01	0.03
Coefficient: Local		0.01	0.02
Coefficient: Nat.		0	0
No. Groups	28	28	28
N	*4434*	*4434*	*4434*

Note: * p < .10; ** p < .05; *** p < .01. Sources: Authors' calculations based on data from the 5th and 6th World Values Survey; World Bank Enterprise Survey; National Statistical Sources.

The results in Model 15 extend the analysis by including three-way interaction terms between levels of tolerance, the absolute measure of agglomeration economies, and having one's main market local or national. In both cases of having the local or national market as the firm's main market, the coefficients are positive and statistically significant at the .1 level, a result that goes in line with the results for new-to-firm innovators. We therefore provide first empirical evidence that firms with a local or national market orientation benefit in their new-to-the market

innovation activities by being located in large and tolerant agglomerations just as do firms that undertake new-to-firm innovation activities.

Conclusions

In this chapter we have made a first attempt to explore the relation of regional tolerance to the innovation performance of firms in different Latin American regions. Our analysis has shown that differences in the level of tolerance matter for innovation performance. Moreover, by exploring the way tolerance interacts with agglomeration size, our results show that being located in a highly tolerant region increases the chances that firms will benefit in their innovation activities from the agglomeration economies that characterise large urban conglomerations. At the same time, our results provide insight into the specificities of firm innovation activity in the Latin American context. Although slightly under a third of the firms in our sample report having introduced a new-to-market product innovation, the large majority of these firms (over 90 percent) produce mainly for the local or national market. This hints at the dominance of diffusion processes and creative imitation of products and technologies developed first by external firms in the new-to-the market innovation activity of Latin American enterprises. Our results show that these innovators who can play a key role by linking the regional and national economies to external sources of knowledge benefit from being located in large and highly tolerant regional agglomerations.

Our analysis can usefully be extended in a number of respects. Agglomeration economies are captured with measures of the absolute and relative size of agglomerations, and it would be informative to explore how size interacts with different levels of industrial specialisation and diversity and in this way make a distinction between the importance of Marshallian and Jacobian externalities. It would also be useful to extend the analysis to regions in other parts of the world and to explore what may be specific to Latin America. While there is considerable inter-regional variation in levels of tolerance within Latin American nations, the Latin American region as a whole appears to be characterised by relatively high levels of tolerance when compared to

nations in other parts of the globe.[34] A broader international project would allow us to determine how general our findings are and whether broad differences in the social and political context that are common to groups of nations in different parts of the world impact on regional innovation dynamics.

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[34] Based on the results of the 5th WVS, less than 6 percent of respondents in the 7 Latin American nations covered in this study indicated that they would not like to have persons of another race as neighbours, while the percentage for the entire sample of nations in the survey covering the different regions of the world is over 17 percent.

"Don't limit yourself. Many people limit themselves to what they think they can do. You can go as far as your mind lets you. What you believe, remember, you can achieve."
Mary Kay Ash

CHAPTER 5

HOW CONTEXT SHAPES ENTREPRENEURIAL SELF-EFFICACY AS A DRIVER OF ENTREPRENEURIAL INTENTIONS: A MULTILEVEL APPROACH

Abstract

In this chapter, we study how the effect of entrepreneurial self-efficacy on entrepreneurial intentions is shaped by available role models and aspects of national culture. We focus on the institutional individualism-collectivism orientation of national culture, and the incidence of entrepreneurial role models as moderators of the relationship between entrepreneurial self-efficacy and entrepreneurial intentions in order to account for the multi-layered nature of the context. We observe that exposure to entrepreneurial role models offsets entrepreneurial self-efficacy as a driver of entrepreneurial intentions. The effect, however, depends on the individualistic-collectivistic character of the national culture.

Introduction

Evaluating how context interacts with the person in shaping entrepreneurial intentions is pending (Fayolle & Liñán, 2014; Liñán & Fayolle, 2015) despite that "in entrepreneurship research […] economic behavior can be better understood within its historical, temporal, institutional, spatial, and social context" (Welter, 2011, p. 165). Untangling the role of context is even more difficult when the multi-layered and nested nature of socio-cultural environment is recognized (Erez & Gati, 2004; Leung & Bhagat, 2005). In this regard, Mowday and Sutton (1993) introduce the notion of a proximate and distal environment and Johns (2006) hints at the cross-level effects of contexts, where situational variables at one level of analysis impact those at a different level. Welter (2011) calls attention to the importance of a multi-layered approach for the study of entrepreneurship, considering the proximate social interactions and the distal political and cultural systems. This paper recognizes context as multi-layered and draws on the

triadic reciprocity between individual behavior, personal characteristics and environmental influences from Social Cognitive Theory to model individual entrepreneurial intentions. We combine Expectancy Theory and Social Cognitive Theory to account for the impact of proximate social interactions and institutional theory to recognize the influences of the distal environment.

While existing theory has accepted that perceptions and attitudes are major antecedents of entrepreneurial intentions (Krueger, Reilly, & Carsrud, 2000), the influential role of the environment over these has been largely overlooked (Welter, 2011) with only few exceptions.[35] This is rather unexpected because the proponents of the Social Cognitive Theory, the theoretical foundation for considering self-efficacy as one of the main drivers of entrepreneurial intentions, propose a triadic reciprocality between individual behavior, personal characteristics (including cognitions), and environmental influences (Bandura & Wood, 1989; Bandura, 1986; Lent, Brown, & Hackett, 1994). We combine these arguments and propose a multilevel approach to study the influence of the individual's proximate and distal socio-cultural context on entrepreneurial intentions by affecting entrepreneurial self-efficacy.

Understanding the formation of entrepreneurial intentions is important because intentions are the "best single predictor of an individual's behavior" (Fishbein & Ajzen, 1975). Entrepreneurial intentions are partially determined by perceived entrepreneurial self-efficacy (Krueger et al., 2000) which reflects the self-belief, willingness, and persistence to overcome the initial anxiety associated with the creation of a new start-up (Alvarez, DeNoble, & Jung, 2006). While the social and cultural environments as well as personal traits seem particularly influential for shaping entrepreneurial cognitive structures (Busenitz & Lau, 1996; Koellinger, Minniti, & Schade, 2007; Mitchell, Smith, Seawright, & Morse, 2000; Wennberg et al., 2013), little is known as to how the confidence in one's own capabilities to start a business venture is shaped by the context (Mauer, Neergaard, & Linstad, 2009). Drawing on this line of argumentation, we conjecture that entrepreneurial intentions can be properly understood only if the effect of the proximate and distal environment is accounted for.

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[35] Among these exceptions are the following works: (Lim, Morse, Mitchell, & Seawright, 2010; Shinnar et al., 2012; Siu & Lo, 2011) Most of these studies focus on the influence that aspects of national cultures have on cognitions.

Conceptually, the entrepreneur is increasingly seen as embedded in social networks (Aldrich & Zimmer, 1986; Hoang & Antoncic, 2003). Previous research on proximate social environments such as social networks has mainly focused on the exchange of resources and information, frequently overlooking the influence of specific network actors such as role models, on cognitive structures (Autio et al., 2013; Krueger et al., 2000). At the same time, it is acknowledged that entrepreneurial cognitive structures are shaped not only by personal traits but also by aspects of the social environment (Mitchell et al., 2000). More specifically, intention-based theories of entrepreneurship recognize that the individual not only takes into account its perceived ability but also whether the action of founding a new enterprise is considered to be consistent with prevailing social norms (Krueger, 1993). We suggest that entrepreneurial role models shape the proximate social environment and as such exert a great influence on how entrepreneurial self-efficacy shapes entrepreneurial intentions. Few empirical studies delve into how role models shape entrepreneurial intentions and to the best of our knowledge there is none that addresses how the relationship between entrepreneurial self-efficacy and entrepreneurial intentions is moderated by available role models.

Moreover, national culture has long being recognized as pivotal for entrepreneurship. Back in 1930 the influential work of Max Weber (1930) suggested that the varying predisposition among societies towards entrepreneurial behavior was rooted in different cultural values. Since then, the influence of culture on entrepreneurship has been repeatedly studied and it is now virtually undisputed that culture profoundly impacts all facets of entrepreneurship in societies (Autio et al., 2013; De Clercq et al., 2013; Hayton, George, & Zahra, 2002; Li & Zahra, 2012; Shinnar, Giacomin, & Janssen, 2012; Stephan & Uhlaner, 2010). Results, however, are ambiguous and contradictory as research is performed at different levels of analysis and is plagued with methodological imperfections. Certainly, cognitive mechanisms, such as self-efficacy, are found not only to vary across cultures (Earley, Gibson, & Chen, 1999; Hayton et al., 2002; Mitchell et al., 2000) but national cultures are thought to shape individual mental patterns such as self-efficacy (N. J. Adler, Doktor, & Redding, 1986). Wennberg et al. (2013) provide first empirical evidence that some specific dimensions of the national culture alter the effect of self-efficacy on early-stage entrepreneurial behavior. Therefore, our understanding about the role of the context for shaping entrepreneurial intentions remains limited if the moderating role of national culture is not investigated.

The objective of this paper is to extend current knowledge by developing and testing a conceptual framework of entrepreneurial intentions that accounts for the multilayered nature of the context. In particular, we analyze how the well-established relationship between entrepreneurial self-efficacy and entrepreneurial intentions is contingent on socially-proximate role models. Additionally, we assess the moderating effect of relevant characteristics of the national culture and introduce a triple interaction between national culture, role models and entrepreneurial self-efficacy to study entrepreneurial intentions. We draw on Bandura's Social Cognitive Theory and the Theory of Planned Behavior (Ajzen, 1991) to hypothesize the ways in which role models and national culture independently and jointly moderate the strength of the relationship between entrepreneurial self-efficacy and entrepreneurial intentions.

We use the Global Entrepreneurship Monitor (GEM) surveys in 39 countries for a pooled sample of 2002-2010, combining it with data from the Global Leadership and Organizational Behavior Effectiveness (GLOBE) project. We employ multi-level analysis to account for the hierarchical structure of the data. Our empirical results show that role models boost intentions to start a business while at the same time they moderate the effect of entrepreneurial self-efficacy on entrepreneurial intentions. This effect, however, is contingent on the individualistic nature of the socio-cultural context. These results suggest that both the proximate as well as the distal socio-cultural context independently and jointly moderate the relationship between entrepreneurial self-efficacy and entrepreneurial intentions. We make a case in favor of treating context as multilayered and considering both the proximate and the distal socio-cultural environment in research of entrepreneurial intentions. Additionally, we introduce the possibility of studying the joint influence of proximate and distal environments. Future research can extend this approach by using alternative and complementary aspects of the individual's context. Moreover, evaluating the impact of entrepreneurial self-efficacy on behavior in different settings could infuse policy decisions.

Theory Development

Contextualizing entrepreneurial intentions

The entrepreneurial intention approach emerged in the 1980s (Liñán & Fayolle, 2015). Deeply rooted in psychological antecedents (Hindle, Klyver, & Jennings, 2009), intentions are a

cognitive state that precedes action (Krueger, 2005) and "[s]ince much of human behavior appears to be under volitional control, … the best single predictor of an individual's behavior will be a measure of his intention to perform that behavior" (Fishbein & Ajzen, 1975). Early research in this area mainly focused on the distinction of entrepreneurs from non-entrepreneurs in relation to psychological traits, demographic and situational variables (Hindle et al., 2009). Despite some significant results, many of these studies have been criticized because of their low explanatory power (Krueger et al., 2000).

Based on this early work, a strand of research emerged where several entrepreneurial intention models were developed (for example Ajzen, 1991; Bird, 1988; Douglas & Shepherd, 2002; Hindle et al., 2009; Shapero & Sokol, 1982)[36] and there, entrepreneurial self-efficacy seems to play a particularly important role as an antecedent of entrepreneurial intentions (Ajzen, 1991; Barbosa, Gerhardt, & Kickul, 2007; Boyd & Vozikis, 1994; Krueger et al., 2000; Shapero & Sokol, 1982; Zhao, Seibert, & Hills, 2005).

At the same time, scholars have advocated that economic behavior is facilitated or constrained by different social (Granovetter, 1985), cultural (Weber, 1930), institutional (Polanyi, 1957), and geographical (Katz & Steyart, 2004) contexts. The institutional perspective on entrepreneurship advocates that entrepreneurial behavior depends on the individual's relationship with her external environment (Thornton, Ribeiro-Soriano, & Urbano, 2011; Veciana & Urbano, 2008) and allows incorporating both macro and micro influences (Bruton et al., 2010). Welter (2011), for example, calls for taking into consideration the interaction between contexts at a higher level of analysis with the phenomenon at a lower level of analysis and differentiates between societal (society at the macro level) and social contexts. We follow this idea and introduce the concept of social norms in order to evaluate the impact of proximate role models and distal national culture on entrepreneurial intentions.

In Ajzen's (1985) Theory of Planned Behavior the perception of the individual regarding the social inducements to perform a specific behavior are introduced as an antecedent of entrepreneurial intentions. Social norms, understood as rules and logics of what is perceived to

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[36] For an exhaustive review of the entrepreneurial intentions literature, please refer to Liñán and Fayolle (2015).

be "desirable" or "appropriate" behavior or way of thinking (Bruton et al., 2010) within a group (Elster, 1989) shape individual decision-making. This proposition resonates with the Social Learning Theory (Bandura,1986), in which self-efficacy is seen as socially constructed.

Against this backdrop, we perform a comprehensive study of interacting layers of context for the specific case of entrepreneurial intentions and the cognitive mechanisms that shape them, focusing on variables that have received attention in the entrepreneurship literature. We argue that the norms of the close social environment as well as of the more distal, cultural context alter the effect entrepreneurial self-efficacy has on the intentions to start a new business venture.

Entrepreneurial self-efficacy and entrepreneurial intentions

Entrepreneurial intention models are based on the idea that human behavior is planned and preceded by intentions towards that behavior, which in turn are also molded by perceived feasibility (Krueger et al., 2000). Perceived feasibility reflects the individual's belief whether the person is capable of starting a new venture, which turns entrepreneurship into an accessible and realistic career option. In this, like other scholars who study entrepreneurial intentions, we treat feasibility as related to entrepreneurial self-efficacy (for example Devonish, Alleyne, Charles-Soverall, Marshall, & Pounder, 2010; Fitzsimmons & Douglas, 2011; Krueger et al., 2000).[37]

In this framework, entrepreneurial self-efficacy is seen as the individual's belief to be able to successfully launch a business venture (McGee, Peterson, Mueller, & Sequeira, 2009). It is therefore linked to the perception of entrepreneurship as a "credible" career choice (Wennberg et al., 2013) and as such represents an important driver of entrepreneurial intention. Empirical research has provided ample evidence for this relationship (Chen, Greene, & Crick, 1998; Douglas, 2013; Fitzsimmons & Douglas, 2011; Sequeira, Mueller, & McGee, 2007; Zhao et al., 2005) and we therefore expect to confirm the following conjecture, which has been advanced in previous research:

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[37] Generally, self-efficacy represents the individual's judgment of her ability to perform a certain task within a specific domain. It relates to the choice of activities a person pursues, the effort invested, the persistence applied to perform these activities and the reaction when facing obstacles (G. Chen, Gully, & Eden, 2004; Lent et al., 1994).

Hypothesis1: An individual's perception of entrepreneurial self-efficacy will be positively related to the individual's entrepreneurial intentions.

Role models and entrepreneurial intentions

Entrepreneurship is understood as a social phenomenon (Aldrich & Zimmer, 1986; Hoang & Antoncic, 2003) where the process of founding a business venture is rooted in social interactions (Newbert & Tornikoski, 2011, 2012). In this context, role models have a prominent role as they are strongly related to vocation choices (Quimby, Wolfson, & Seyala, 2007). In fact, previous studies have shown that 35-70% of entrepreneurs had entrepreneurial role models (Scherer, Adams, Carley, & Wiebe, 1989).

Entrepreneurial role models have been reported to positively influence both entrepreneurial intentions (van Auken, Fry, & Stephens, 2006) and entrepreneurial behavior (Bosma et al., 2012; Lafuente, Vaillant, & Rialp, 2007). In particular, persistent variance in entrepreneurship activities between countries, clusters and regions is partially attributed to availability of role models (Brixy, Sternberg, & Stüber, 2013; Lafuente et al., 2007). In the words of Fornahl, "the development and the related likelihood of discovering entrepreneurial opportunities and increasing the willingness to start a new firm is strongly influenced by positive examples, so-called role models" (2003, p. 50). From this perspective, entrepreneurial role models facilitate access to information and other resources (Anderson & Miller, 2003; Greve & Salaff, 2003) as well as facilitate the recognition of entrepreneurial opportunities (Fornahl, 2003) and consequently drive the intention to become an entrepreneur. Therefore, we expect a positive correlation between available role models and entrepreneurial intentions.

Hypothesis 2: The presence of an entrepreneurial role model will be positively related to an individual's entrepreneurial intentions.

As part of the social sphere, role models are instrumental for the construction of social norms as they act as benchmarks for self-identification and social comparison (Gibson, 2004). Social norms, the unwritten rules of conduct of a group, determine the opportunity cost for specific behavior and define sanctions for defecting from it within a given community (Kandori, 1992). As a consequence, they can influence the perceived social value of the entrepreneurial

career choice. In fact, from theses lenses entrepreneurship is seen as a self-reinforcing phenomenon (Minniti, 2005). Taking into account available evidence, we posit that entrepreneurial role models shape the social norms of the proximate context and through them alter the perceived social value of entrepreneurship.

Following the Theory of Planned Behavior (Ajzen, 1985) and drawing from Expectancy Theory (Steel & König, 2006), we argue that individuals who consider entrepreneurship will evaluate both the expected probability to be successful and how the expected outcome is socially valued. Only the combination of both expected probability and value will determine whether an action has the largest expected outcome leading the individual to undertake it (Steel and Koenig, 2006). Because entrepreneurship is an inherently risky activity, the primary focus in the process of forming entrepreneurial intention is avoidance of negative outcomes rather than maximization of positive outcomes (Brockner, Higgins, & Low, 2004) as at this stage of the entrepreneurial process, individuals will likely be cautious and try to avoid mistakes (Fitzsimmons & Douglas, 2011). Following Brockner et al. (2004) we contend that the interaction of the perceived social value of the entrepreneurial career option molded by role models and its perceived feasibility, frequently understood as self-efficacy, are essentially driven by the dominant preventive regulatory focus, which gives priority to avoidance of loss. In such context, Shah and Higgins (1997) suggested that goal expectancy and goal value would interact negatively.

In essence, within this prevention-focused orientation, role models serve as living and tangible confirmation that certain achievements are within reach and frame the value of entrepreneurship as an alternative career option. Therefore, following the predictions of Shah and Higgins (1997) and Fitzsimmons et al. (2011) we posit that self-efficacy and role models have a negative interaction effect in the formation of entrepreneurial intentions driven by the focus on avoiding negative outcomes that characterizes the process:

Hypothesis 3: The presence of an entrepreneurial role model and the individual's perceived self-efficacy have a negative interaction effect on his or her entrepreneurial intentions.

Societal institutional individualism and entrepreneurial intentions

Societal culture is commonly understood as "the collective programming of the mind that distinguishes the members of one group or category of people from another" (Hofstede, 2001, p. 9), representing a set of shared beliefs, values and expected behaviors. In this context, culture can be understood as informal institutions, that is, patterns of common behavior, which shape social interactions. As such, institutional theorists refer to culture as practiced code of conduct.

There is bountiful empirical research suggesting that cultural traits can enhance or pose barriers to entrepreneurial intentions and entrepreneurial activity in general (e.g. Davidsson & Wiklund, 1997, 2001; Davidsson, 1995; Kreiser, Marino, Dickson, & Weaver, 2010; Mueller & Thomas, 2000). Empirical research in entrepreneurship has drawn on different approaches to operationalize national culture, mainly the cultural dimensions provided by the work of Hofstede (1980) and the work of the GLOBE project (House & Javidan, 2004)[38]. We follow recent research and rely on data from the GLOBE project (Autio et al., 2013; Thai & Turkina, 2014; Wennberg et al., 2013) as they represent informal institutions rather than the work-related values of Hofstede's (1980) work (Brewer & Venaik, 2011).

Individualism/collectivism is one of the most extensively studied cultural dimensions in the entrepreneurial domain constituting the "profound structure" of culture differences (Triandis & Suh, 2002). Individualism is associated with the notion that individuals seek and pursue personal goals and that the individual's needs take precedence over the needs of the group. According to GLOBE (House, Javidan, Hanges, & Dorfman, 2002), two kinds of individualism exist: institutional and in-group individualism. The first is defined as "the degree to which organizational and institutional practices encourage and reward collective distribution of resources and collective action", whereas the latter refers to the degree to which "individuals express pride, loyalty, and cohesiveness in their organizations and families" (House & Javidan, 2004, p. 12). We rely on societal institutional collectivism because the construct of in-group collectivism reflects mostly family collectivism (Brewer & Venaik, 2011). This kind of

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[38] For a discussion of the merits and shortcomings of both approaches refer to the editor's introduction by Leung (2006).

collectivism is too narrow for our research as role models can easily be placed outside of a family.

Theoretical and empirical research has related societal individualism/collectivism to entrepreneurship. More specifically, in individualistic societies opportunity recognition is likely to be biased towards opportunities that individuals (as opposed to groups) can take advantage of (Mitchell et al., 2000). On the other hand, laws and norms in collectivistic cultures often limit private property and idea protection (Mitchell et al., 2000), potentially discouraging individuals to engage in setting up a business venture. The notion that individualism as one specific and extremely relevant cultural dimension favors entrepreneurship has received empirical support (McGrath, MacMillan, & Scheinberg, 1992; Mueller & Thomas, 2000; Shane, 1992; Wennekers, Uhlaner, & Thurik, 2002) and leads us to posit that:

Hypothesis 4: A high level of institutional individualism will be positively related to an individual's entrepreneurial intentions.

Societal cultural dimensions such as individualism/collectivism may also alter the influence of cognitive mechanisms on entrepreneurial intentions, such as self-efficacy (Earley et al., 1999). We argued above that in a prevention-focused regulatory focus such as that of forming entrepreneurial intentions, expectancy and value interact negatively. While the societal institutional individualism positively shapes the perceived value of entrepreneurship, we content that it will interact positively with self-efficacy.

The quest for freedom and autonomy in individualistic cultures is likely to shape a normative system where entrepreneurship is a culturally legitimized behavior and where the perception that it is proper and appropriate is fully crystallized (Suchman, 1995). In institutionally individualistic countries, there are scarce social norms and complementary systems that reduce variance in individual behavior, including economic behavior (House et al. 2004). Rephrasing Wennberg et al. (2014), in individualistic societies the room for deviation in individual income maximization is larger and there is no well-established sense of loyalty towards the individual. As a result, entrepreneurship confers more positive social value in individualistic societies.

Based on the assertion that in collectivistic cultures people focus on norms, obligations and duties rather than on personal attitudes, needs and rights as guidance for their social behavior, Bontempo and Rivero (1992) hypothesized that in individualistic countries, personal attitudes are more likely to predict intentions towards behavior than social norms; a result confirmed in the empirical research of Singelis (1994). Therefore, institutional individualism may enhance the effect of an individual's self-efficacy for entrepreneurial intentions because the self-centered motivation to engage in entreprepeurship is more influential for institutionally individualistic societies. Taking together these arguments, we conjecture that the effect of self-efficacy on entrepreneurial intentions will be stronger in intitutionally individualistic societies.

Hypothesis 5: In societies characterized by a high level of institutional individualism, entrepreneurial self-efficacy will be a more powerful predictor of individual's entrepreneurial intentions.

Interacting contexts

A small set of empirical studies has investigated the impact of national culture on the social dimension of entrepreneurship, "suggesting a degree of generic universal entrepreneurial behavior, and some heterogeneity, highlighting the importance of cultural differences" (Dodd & Patra, 2002: 119). These studies point to a potential moderation of culture in the relationship between aspects of the proximate social context and entrepreneurial behavior (Klyver, Hindle, & Meyer, 2007).

People in individualistic cultures are expected to rely more on their own abilities than on the thoughts of others (Singelis, 1994). However, at the same time, relationships in individualistic cultures are assumed to operate on an equality basis and to mutually benefit the individuals involved (Triandis, 1995). In collectivistic cultures, on the other hand, the individual is defined as part of a larger whole; a group of people connected through relationships. As such, the relationships are understood as necessary and obligatory rather than pleasant and for mutual benefit (Oyserman, Coon, & Kemmelmeier, 2002). These cultures value relatedness and communal relationships and as such discourage the interaction with knowledgeable others belonging to another referent group (Matsumoto & Fontaine, 2008), reducing the possibility of potential entrepreneurs to leverage their skills and contacts. Thus, while the importance of social

embeddedness in collectivistic cultures may increase the influence of others (Aldrich & Cliff, 2003), for example, role models, we contend that the positive impact of role models on entrepreneurial intentions will be greater in cultures characterized by institutional individualism due to the nature of the relationship with role models.

Hypothesis 6: In societies characterized by a high level of institutional individualism, role models will be a more powerful predictor of individual's entrepreneurial intentions.

We discussed above that when the dominant regulatory focus in forming entrepreneurial intentions is avoidance of negative outcomes then a negative interaction between perceived feasibility and perceived social value arises. In this context, strong entrepreneurial intentions might be formed when perceived feasibility is low (self-efficacy is low but above some minimal level) and perceived social value is high (role models are present) and the other way around (Shih and Higgins, 1997). Fritzsimmons et al. (2011) conjecture that accidental entrepreneurs (high perceived feasibility and low perceived social value) and inevitable entrepreneurs (high perceived social value and low perceived feasibility) result irrespective of cultural and social differences. However, by focusing on the institutional individualism/collectivism dimensions, the differences that might arise across cultures become obvious.

In institutionally individualistic society 'every man is for himself' (Thessen, 1997). Self-efficacy in this context is therefore built relying on one's own performance whereas in collectivistic cultures, self-efficacy is primarily based on environmental sampling from the individual's social context (Erez & Earley, 1993). Moreover, regarding the variation-generating aspect of entrepreneurship (Thessen, 1997) in which entrepreneurs engage in creative destruction and alter the status quo, individuals expose themselves to the dominant social norms about tolerating deviant behavior. In individualistic societies, the established societal norms tolerate to a greater extent deviant from the commonly accepted behavior and thus lend more support to entrepreneurial intentions and behavior. Therefore, institutional individualism magnifies the effect on entrepreneurial intentions produced by the interaction between self-efficacy and role models:

Hypothesis 7: In societies characterized by high level of institutional individualism, the negative interaction between perceived feasibility and perceived desirability will be a more potent predictor of entrepreneurial intentions.

Data Description and Methodology

Data description

We construct a dataset to test the proposed hypotheses relying on several sources. Individual-level data about entrepreneurial activity and its determinants is taken from the Global Entrepreneurship Monitor's (GEM's) Adult Population Survey (Reynolds et al., 2005). This dataset, though characterized by some limitations, is one of the few standardized datasets on entrepreneurial activity that enables cross-national entrepreneurship research. It has been used in recent research (e.g. Aidis et al., 2008; Anokhin & Schulze, 2009; Autio et al., 2013; De Clercq et al., 2013; Estrin, Korosteleva, et al., 2013; Estrin, Mickiewicz, et al., 2013; Klyver et al., 2013; Kwon & Arenius, 2010; Stenholm et al., 2013; Thai & Turkina, 2014; Wennberg et al., 2013). We use the sample of 2002 through 2010 covering 39 countries and almost 390,000 observations.[39] With very few exceptions, the data for each country contains a representative sample of the work-aged population of 2,000 or more individuals. Appendix E contains the list of countries included in the sample and the respective number of respondents.

In order to determine how the cultural context influences entrepreneurial behavior, we adopt the framework developed by the GLOBE study (House et al., 2002; House & Javidan, 2004). The GLOBE study is a multi-phase and multi-method research program. Based on data collected in the mid-1990s from middle managers in 62 countries, the study yielded nine distinct cultural dimensions (House & Javidan, 2004). Despite all its limitations and expressed criticism (for example Leung, 2006), it is an established framework for cross-cultural studies, also in the field of entrepreneurship.

Apart from the cultural aspect, we account for the stage of development of the country because it affects individual entrepreneurial behavior. Variables that characterize the

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[39] We were not able to use 2003 and 2004 as necessary demographic control variables were not included in these years. Previous research (e.g. Wennberg et al., 2013) ran into similar problems.

macroeconomic and institutional environment of a country are taken from the World Bank's World Development Indicators (World Bank). Following earlier research (Autio et al., 2013; Estrin, Korosteleva, et al., 2013; Estrin, Mickiewicz, et al., 2013; Klyver et al., 2013; Stenholm et al., 2013) we introduced these control variables with a time lag.

Variable description

Dependent variable

Entrepreneurial intention is the dependent variable of interest. Deeply rooted in psychological antecedents (Hindle et al., 2009), intentions are a cognitive state that precedes action (Krueger, 2005) and as such are believed to (imperfectly) predict behavior (Ajzen, 1991). Entrepreneurial intentions are measured as a dummy variable that takes the value of 1 if the respondent answers affirmatively to the following question "Within the next three years, do you expect to start alone or with others a new business, including any type of self-employment?" and 0, otherwise. The approach to measure entrepreneurial intentions by a single-item proxy has been widely accepted (Díaz-García & Jiménez-Moreno, 2010; Graevenitz, Harhoff, & Weber, 2010; Krueger et al., 2000; Veciana, Aponte, & Urbano, 2005) and this dichotomous variable has been used by researchers who explore the GEM database (Guzmán-Alfonso & Guzmán-Cuevas, 2012; Klyver et al., 2013; Wennberg et al., 2013).

Individual-level independent variables

There are three independent variables of interest. These are entrepreneurial role model (*knowent*), self-efficacy (*suskill*) and societal institutional collectivism (*institutional_collectivism_p*). The first two variables vary at the individual level and are considered in the matrix X_{ijk} in equation (5). The latter variable varies at country level and is considered in the set of contextual factors (Z_{jq}).

Self-efficacy (*suskill*) is measured as a dummy variable that takes value of 1 if the respondent answers affirmatively to the following question "Do you think to possess the knowledge, skills and experience to start a new business?" and 0, otherwise. Following Bandura (1977), who advocates that self-efficacy should be focused on the specific context or activity domain, we argue that the employment of an entrepreneurial self-efficacy measure as opposed to

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a general self-efficacy measure will generate better predictive results (Pajares, 1996). However, we acknowledge that the dichotomous variable employed in this study is limited in that it does not reflect different dimensions of entrepreneurial self-efficacy (Barbosa et al., 2007; McGee et al., 2009). Nevertheless, this variable has been widely adopted by researchers (Autio et al., 2013; Bosma & Schutjens, 2011; Estrin, Korosteleva, et al., 2013; Guzmán-Alfonso & Guzmán-Cuevas, 2012; Wennberg et al., 2013).

Entrepreneurial role model (*knowent*) is a dummy variable that takes the value of 1 if the respondent answers affirmatively to the question: "Do you personally know someone who started a business in the past two years?" and 0, otherwise. While in some studies (e.g. Klyver et al., 2007) this variable has been used as a proxy for an individual's social network, we see this interpretation as overreaching and interpret the variable as indicative for the presence or absence of an entrepreneurial role model. We acknowledge the limitation of this variable as it does not indicate whether the role model, if present, is successful or not. However, it has been established that the presence of a role model far outweighs the importance of the role model's specific performance (Scherer et al., 1989). Additionally, this interpretation of the variable has been adopted in previous studies (for example, Lafuente et al., 2007).

Individual-level control variables

The empirical test of the proposed hypotheses compels the use of control variables at both individual as well as country level. At the individual level (X_{ijk}), we include six control variables: Fear of failure (*fearfail*), Opportunity Perception (*opport*), Age (*age*), Age squared *(age_sq)*, Gender (*sex*), Formal Education (*educ*), and Labor Status (*laborstat*).

We include two individual perceptual variables (X_{ijk}) which have been shown to affect entrepreneurial intentions (Arenius and Minniti,2005). Opportunity Perception (*opport*) is the most distinctive and fundamental characteristic of entrepreneurship (Kirzner, 1978). This dummy variable takes the value of 1 if the individual expects good business opportunities in the next six months in his/her area of residence. A low fear of failure (*fearfail*), reflecting part of the risk attached to starting a new business, is expected to increase levels of entrepreneurial activity (Weber and Williman, 1997). We, therefore, include a dummy variable taking the value of 1 if the individual's fear of failure would prevent him/her from starting a new business and 0,

otherwise. Following previous research (Johansson, 2000; Langowitz & Minniti, 2007; Singh & Verma, 2001; Wennberg et al., 2013), we include the following five demographic variables that potentially influence entrepreneurial intentions: *Age, Age Squared, Gender, Formal education* and *Labor Status.*

Country-level independent variables

We rely on the GLOBE study to measure societal institutional collectivism (*institutional_collectivism_p*). The GLOBE study distinguishes between cultural values and cultural practices. As measured in that study, values represent the way individuals perceive the society (or organization) should behave, whereas practices reflect the way it actually behaves (House et al., 2002; House & Javidan, 2004). We state above that we adopt the view that culture is interpreted as informal institutions to which institutional theorists refer as practiced code of conduct. GLOBE's practice variable better aligns with this interpretation and we therefore adopt it in this study. GLOBE's method of measuring cultural dimensions is a bipolar 7-point Likert scale. The cultural dimensions scores are provided as regression-predicted scores allowing the correction for response bias.

Country-level control variables

At the country level (Z_{qj}) we account for the general economic context related to the process of creating business ventures, relying on data from 2001. Several authors have reported a negative impact of economic development on entrepreneurship (Kuznets, 1971). We, therefore, include GDP per capita at purchasing power parity (*gdppercap*) representing the economic development stage of the country. Variables related to the country's human capital also reflect the economic development of a nation because human capital is accumulated in the structural transformation process of economic development (Syrquin, 1988). Enrollment in primary school (*primaryenroll*) is, therefore, included as a control. Furthermore, we included the concentration of a nation's population in urban areas (*urbanpop_per*) as the influence of role models is expected to differ between urban and rural areas (Freire-Gibb & Nielsen, 2014; Lafuente et al., 2007). Additionally, following earlier research (Autio et al., 2013; Wennberg et al., 2013), we included the remaining cultural dimensions as listed in GLOBE as control variables. The list of

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variables, their description, sources and main statistics are presented in Table 15 and explained subsequently.

Methodology

Given the hierarchical nature of the data – individual-level data is embedded in country-level data – we employ a multilevel analytical method. This allows controlling for clustering of the individual data per country. Failure to do so would violate the assumption of independent observations (Snijders & Bsoker, 2012) and lead to biased standard errors and unreliable regression coefficients (Rabe-Hesketh & Skrondal, 2014; Raudenbusch & Bryk, 2002). Additionally, we hereby avoid the individualistic fallacy of ignoring the broader context within which individuals are embedded, often present in studies of entrepreneurial behavior (Stenholm et al., 2013) while at the same time bypass the ecological fallacy which assumes that variables at a collective level, such as that of a nation, are directly reflected in individual behavior (Peterson, Arregle, & Martin, 2012).

Table 15
Definition of dependent and independent variables

Variable	Description	Type	Level	Source
Dependent				
futsup	Within the next three years, do you expect to start alone or with others a new business, including any type of self-employment? *1 = yes 0 = otherwise*	binary	Individual	GEM
Explanatory				
knowent	Do you personally know someone who started a business in the past two years?" *1 = yes 0 = otherwise*	binary	Individual	GEM
suskill	Do you think you possess the knowledge, skills and experience to start a new business? *1 = yes 0 = otherwise*	binary	Individual	GEM
institutional_ collectivism_p	Cultural dimension which indicates the degree to which organizational and societal institutional practices encourage and reward collective distribution of resources and collective action	Likert scale 1 - 7	Country	Globe
Control Variables				
fearfail	Fear of failure would prevent you from starting a new business? *1 = yes 0 = otherwise*	binary	Individual	
opport	In the next 6 months there will be good opportunities for starting a business in the area where you live? *1 = yes 0 = otherwise*	binary	Individual	
age	The exact age of the respondent at the time of the interview	continuous	Individual	
age_sq	Age squared	continuous	Individual	
sex	Gender of the respondent *1 = female 0 = male*	binary	Individual	GEM
educ	Identifies the highest educational degree obtained *primary, some secondary, secondary degree, post secondary, graduate level*	categorical	Individual	
laborstat	Identifies the occupational status at the moment of the survey *full-time employed, part-time employed, retired or disabled, full-time homemaker, student, not working or others, self-employed*	categorical continuous	Individual Individual	
assertiveness_p	Cultural dimension which indicates the degree to which individuals are assertive, confrontational, and agressive in their relationships with others	Likert scale 1 - 7	Country	
uncertainty_ avoidance_p	Cultural dimension which indicates the degree to which a society, organizations, or groups relies on social norms, rules, and procedures to alleviate the unpredictability of future events	Likert scale 1 - 7	Country	
power_distance_ p	Cultural dimension which indicates the extent to which a community accepts and endorses authority, power differences and status privileges	Likert scale 1 - 7	Country	
performance_ orientation_p	Cultural dimension which indicates the extent to which a community encourages innovation, high standards, excellence, and performance improvements	Likert scale 1 - 7	Country	Globe
humane_ orientation_p	Cultural dimension which indicates the degree to which organizations or society encourages and rewards individuals for being fair, altruistic, friendly, generous, caring and kind to others	Likert scale 1 - 7	Country	
gender_ egalitarianism_p	Cultural dimension which indicates the degree to which a collective minimizes gender inequality	Likert scale 1 - 7	Country	
future_ orientation_p	Cultural dimension which indicates the degree to which a collective encourages and rewards future-oriented behavior such as planning and delaying gratification	Likert scale 1 - 7	Country	
ingroup_ collectivism_p	Cultural dimension which indicates the degree to which individuals express pride, loyalty, and cohesiveness in their organizations or families	Likert scale 1 - 7	Country	
GDPpc_PPP	GDP per capita at purchasing power parity (current international $)	continuous	Country	World Bank
urbanpop_per	Percentage of urban population at national level of total population	continuous	Country	Development
primaryenroll	Enrollment in Primary School in % of total Population	continuous	Country	Indicators

Since the dependent variable is dichotomous (*entrepreneurial intentions*), we use a logistic regression with random intercepts that vary across countries. We observe a binary indicator, Y_{ij}, constructed from a survey question that reveals an individual's intentions to open a business in the near future, where

$$Y_{ij} = \begin{cases} 1 & \text{si} \quad Y_{ij}^* > 0 \\ 0 & \quad \text{c.c.} \end{cases} \tag{1}$$

with the outcome variable, Y_{ij}^*, being a non-observable latent variable that represents the propensity of individual *i* residing in country *j* to open a business and which is determined by the following linear relationship:

$$Y_{ij}^* = \beta_{0j} + \sum_{k=1}^{K} \beta_{kj} X_{ijk} + \varepsilon_{ij} \tag{2}$$

X_{ijk} are individual characteristics, β_{0j} and β_{kj} are the coefficients to be estimated and ε_{ij} is a random error term. If we assume the logistic distribution for ε_{ij} then:

$$P(Y_{ij} = 1) = P(Y_{ij}^* > 0) = P\left(\varepsilon_{ij} < \beta_{0j} + \sum_{k=1}^{K} \beta_{kj} X_{ijk} \right) = \frac{\exp\left(\beta_{0j} + \sum_{k=1}^{K} \beta_{kj} X_{ijk} \right)}{1 + \exp\left(\beta_{0j} + \sum_{k=1}^{K} \beta_{kj} X_{ijk} \right)}, \tag{3}$$

The hierarchical structure of the data into two levels implies that in the first level n individuals (*i*=1,..,n) are clustered in J countries (*j*=1,…,J) in the second level. In the first level, the causal relationship is determined by equation (2). Without clustering at the country level, we could estimate the model with a standard logistic regression and in this case β_{0j} and β_{kj} would be β_0 and β_k. However, applying a multilevel regression allows β_{0j} and β_{kj} to be modeled as outcomes that depend on a number of contextual factors which pick-up information regarding the second level, i.e. countries; therefore, β_{0j} and β_{kj} are treated as random variables. Here we consider the simplest case, where the slopes β_{kj} are assumed to be fixed but the intercept β_{0j} is assumed to be determined by:

$$\beta_{0j} = \gamma_{00} + \sum_{q=1}^{Q} \gamma_{0q} Z_{jq} + u_{0j} \qquad\qquad (4)$$

where γ_{00} is a fixed intercept, Z_{qj} a set of contextual factors that only vary at country level, γ_{0q} and γ_{k0} are a set of fixed parameters and u_{0j} are specific country random intercepts. Under these considerations, the linear relationship expressed in (2) now reads as follows:

$$Y_{ij}^{*} = \gamma_{00} + \sum_{q=1}^{Q} \gamma_{0q} Z_{jq} + \sum_{k=1}^{K} \beta_{0k} X_{ijk} + \left(u_{0j} + \varepsilon_{ij} \right). \qquad\qquad (5)$$

Econometric Analysis and Results

Descriptive statistics

In Table 16 we report the descriptive statistics at the individual level. We include comparative statistics differentiating between more individualistic versus more collectivistic countries at the societal level.[40] We can observe that almost 15% of the population across all countries exhibit entrepreneurial intentions, with a statistically significant higher proportion in less individualistic countries. More than one third of the sample population personally knows an entrepreneur. Again, this rate is significantly higher for less individualistic societies. We can observe that slightly more than half of the population believes to possess the necessary knowledge, skills and experience to start a new business venture, with a significantly higher rate for less individualistic countries. In Table 17, we report the correlation matrix for our variables at the country-level. Previous research relying on data from the GLOBE Study has shown very high levels of correlation between these cultural dimensions (Autio et al., 2013; Wennberg et al., 2013). We ran into similar problems and therefore do not consider further in-group collectivism and future orientation as the two variables show correlations of 0.8 or higher and thus might introduce multicollinearity. Moreover, these variables have Variation Inflation Factors greater than 10.

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[40] We base the distinction between "more individualistic" versus "more collectivistic" on the median of the applied Likert scale in the GLOBE study (House & Javidan, 2004).

Regression results

Our empirical results are presented in Table 18. We report marginal effects calculated at the means of the other regressors in the multi-level logistic regression for each of the explanatory variables. We report three model specifications to assess the robustness of the results; the first model includes variables only at the individual level as well as the interaction between self-efficacy and the presence of an entrepreneurial role model. We add the country-level variables in the second model and next add the interactions between individual-level variables and country-level variables in the third model. The dependent variable in all models is entrepreneurial intentions.

Table 16
Descriptive statistics and comparisons at individual-level.

Variable	Full Sample			less individualistic			more individualistic			Diff: (1)-(2)	t-stat
	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.		
futsup	386,992	0.1463	0.3534	227,573	0.1609	0.3675	159,419	0.1255	0.3313	0.0354	31.3
knowent	386,992	0.3616	0.4805	227,573	0.3783	0.485	159,419	0.3377	0.4729	0.0406	26.01
suskill	386,992	0.5008	0.5	227,573	0.5282	0.4992	159,419	0.4618	0.4985	0.0665	40.8
fearfail	386,992	0.3721	0.4834	227,573	0.4042	0.4907	159,419	0.3263	0.4689	0.0778	49.86
opport	386,992	0.3439	0.475	227,573	0.3253	0.4685	159,419	0.3704	0.4829	-0.0452	-28.99
age	386,992	43.1515	14.8299	227,573	42.0792	13.9824	159,419	44.6822	15.8368	-2.603	-52.78
male	386,992	0.4863	0.4998	227,573	0.4966	0.5	159,419	0.4715	0.4992	0.0251	15.38
educ45	386,992	0.4003	0.49	227,573	0.3702	0.4829	159,419	0.4433	0.4968	-0.0731	-45.55

Table 17

Correlation matrix for country-level variables and individual-level variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
futsup	1												
suskill	0.243	1											
knowent	0.219	0.246	1										
fearfail	-0.073	-0.130	-0.029	1									
opport	0.230	0.199	0.217	-0.065	1								
age	-0.188	-0.043	-0.166	-0.045	-0.090	1							
sex2	-0.078	-0.155	-0.113	0.065	-0.074	0.026	1						
educ2-*primary*	0.017	-0.019	-0.035	0.026	-0.003	0.064	0.025	1					
educ2-*some secondary*	-0.051	-0.077	-0.085	0.037	-0.061	0.110	0.020	-0.119	1				
educ3-*secondary degree*	0.017	-0.023	-0.009	-0.025	-0.006	-0.068	0.005	-0.132	-0.389	1			
educ4-*post secondary and graduate*	0.023	0.098	0.098	-0.020	0.061	-0.059	-0.033	-0.164	-0.483	-0.537	1		
laborstat2-*part-time employed*	0.006	-0.019	-0.008	-0.002	0.012	-0.028	0.129	0.001	-0.051	0.044	0.004	1	
laborstat3-*retired or disabled*	-0.112	-0.099	-0.133	-0.065	-0.070	0.487	-0.004	0.025	0.064	0.003	-0.070	-0.112	1
laborstat4-*full-time homemaker*	-0.010	-0.097	-0.074	0.049	-0.039	0.048	0.302	0.115	0.130	-0.029	-0.135	-0.105	-0.120
laborstat5-*student*	0.047	-0.067	0.024	-0.005	0.023	-0.344	-0.009	-0.036	-0.031	0.086	-0.038	-0.077	-0.089
laborstat6-*not working, other*	0.051	-0.015	-0.013	0.019	-0.023	-0.067	-0.004	0.035	0.026	0.001	-0.038	-0.091	-0.105
gdppercap_ppp	-0.241	-0.072	-0.070	-0.001	-0.074	0.159	-0.006	-0.175	-0.084	-0.002	0.146	0.056	0.099
urbanpop_per	-0.164	-0.086	-0.080	-0.001	-0.042	0.118	0.011	-0.128	-0.055	-0.010	0.109	0.039	0.064
Primaryenroll	-0.282	-0.090	-0.079	0.087	-0.169	0.114	0.009	-0.077	0.032	0.000	0.002	-0.018	0.039
institutional_collectivism_p	-0.039	-0.089	0.012	-0.085	0.059	0.068	0.003	-0.101	-0.171	0.079	0.119	0.113	0.042
assertiveness_p	-0.109	0.006	-0.055	0.028	-0.102	0.038	-0.012	-0.028	0.066	-0.050	0.000	-0.053	0.061
uncertainty_avoidance_p	-0.148	-0.07	-0.03	-0.05	0.06	0.14	0.02	-0.13	-0.11	0.07	0.08	0.11	0.11
power_distance_p	-0.032	0.009	-0.034	0.093	-0.146	-0.048	-0.012	0.041	0.148	-0.037	-0.113	-0.104	-0.061
performance_orientation_p	-0.082	-0.048	-0.036	-0.054	0.016	0.121	0.018	-0.075	-0.086	0.024	0.084	0.088	0.094
humane_orientation_p	0.141	0.010	0.063	-0.098	0.148	-0.016	0.003	0.006	-0.151	0.044	0.091	0.097	0.014
gender_egalitarianism_p	0.011	-0.033	-0.013	-0.086	0.093	0.049	0.023	-0.070	-0.118	0.108	0.032	0.068	0.109

	14	15	16	17	18	19	20	21	22	23	24	25	26
laborstat4-*full-time homemaker*	1												
laborstat5-*student*	-0.083	1											
laborstat6-*not working, other*	-0.098	-0.072	1										
gdppercap_ppp	-0.122	-0.048	-0.048	1									
urbanpop_per	-0.070	-0.040	-0.007	0.544	1								
Primaryenroll	-0.031	-0.035	-0.034	0.316	0.282	1							
institutional_collectivism_p	-0.068	-0.026	-0.026	0.338	0.304	0.016	1						
assertiveness_p	-0.007	-0.014	-0.012	0.241	0.267	0.104	-0.524	1					
uncertainty_avoidance_p	-0.12	-0.05	-0.05	0.54	0.43	0.21	0.65	-0.20	1				
power_distance_p	0.072	-0.001	0.033	-0.201	-0.252	0.248	-0.584	0.273	-0.542	1			
performance_orientation_p	-0.029	-0.048	-0.048	0.395	0.332	0.055	0.418	0.185	0.578	-0.378	1		
humane_orientation_p	-0.019	0.006	-0.041	0.012	-0.193	-0.443	0.644	-0.557	0.329	-0.652	0.276	1	
gender_egalitarianism_p	-0.139	-0.001	-0.018	0.115	0.122	-0.299	0.306	-0.170	0.440	-0.442	-0.077	0.320	1

For Model 1 and Model 2, we find evidence of statistically significant and positive correlations between the presence of entrepreneurial self-efficacy (*suskill*) as well as entrepreneurial role models (*knowent*), on the one hand, and entrepreneurial intentions, on the other, as advanced by *Hypothesis 1* and *Hypothesis 2*, respectively. The marginal effect is somewhat greater for entrepreneurial self-efficacy than for the presence of an entrepreneurial role model. In Model 3 the results are consistent with *Hypothesis 1* but are not consistent with *Hypothesis 2*. Additionally, for Model 1 and 2, we observe a significant negative interaction effect between self-efficacy and availability of role models (*knowent x suskill),* which is consistent with *Hypothesis 3*. In essence, when we do not take into account the broader societal

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context the positive effect of self-efficacy on entrepreneurial intentions is 3.8 percentage points lower (Model 2) for those individuals who know an entrepreneurial role model than for those who don't. However, when we take into account the moderating influence of societal individualism in Model 3, we find no empirical support for both *Hypothesis 2 and Hypothesis 3*. The positive effect of self-efficacy (*suskill*) on entrepreneurial intentions when the broader societal context is accounted for is significant at the 10%-level, providing additional empirical support for *Hypothesis 1*. However, its marginal effect on entrepreneurial intentions (3.5 percentage points) is much lower than in Model 1 and Model 2 (13.4 percentage points). Taken together this first evidence supports the general proposition that the multi-layered and nested nature of the societal context should be taken into consideration when studying entrepreneurial intentions.

In fact, we do not find evidence that societal institutional individualistic/collectivistic values (institutional_collectivism) per se correlate with entrepreneurial intentions (*Hypothesis 4*). However, when taking into account the moderating effect this societal cultural dimension has on each self-efficacy's and role models' influence on entrepreneurial intentions, statistically significant relationships are observed. In particular, we confirm that societal institutional collectivism moderates the relationship between self-efficacy and entrepreneurial intentions (*Hypothesis 5*). In order to make the evaluation of the interactions effects easier, we provide plots of the predictive margins and their respective confidence intervals for entrepreneurial intentions.

Table 18

Estimation results for *Entrepreneurial intentions*. Multi-level random intercept logistic model.

	Marg. effect	s.d.	MODEL 2 Marg. effect	s.d.	MODEL 3 Marg. effect	s.d.
Indiviudal variables						
Suskill	0.1335 ***	0.0052	0.1342 ***	0.0054	0.0353 *	0.0185
Knowent	0.1109 ***	0.0046	0.1114 ***	0.0047	0.018	0.021
Fearfail	-0.019 ***	0.0013	-0.0191 ***	0.0014	-0.0192 ***	0.0014
Opport	0.076 ***	0.0028	0.0762 ***	0.0029	0.0764 ***	0.0029
Age	-0.0024 ***	0.0003	-0.0024 ***	0.0003	-0.0025 ***	0.0003
age_sq	0 *	0	0 *	0	0	0
Sex	-0.0267 ***	0.0015	-0.0267 ***	0.0015	-0.0265 ***	0.0015
educ2-some secondary	-0.0051	0.0032	-0.005	0.0032	-0.0045	0.0032
educ3-secondary degree	0.003	0.0031	0.0032	0.0032	0.0039	0.0032
educ4-post secondary	0.0054 *	0.0032	0.0055 *	0.0032	0.0063 *	0.0032
educ5-graduate degree	0.0161 ***	0.0035	0.0162 ***	0.0035	0.0168 ***	0.0035
laborstat2-part-time employed	0.0171 ***	0.0021	0.0171 ***	0.0021	0.0172 ***	0.0021
laborstat3-retired or disabled	-0.0507 ***	0.0036	-0.0508 ***	0.0036	-0.0507 ***	0.0036
laborstat4-full-time homemaker	0.0087 ***	0.0022	0.0087 ***	0.0022	0.0084 ***	0.0022
laborstat5-student	0.0127 ***	0.0024	0.0127 ***	0.0024	0.0125 ***	0.0024
laborstat6-not working, other	0.0508 ***	0.0026	0.051 ***	0.0027	0.0512 ***	0.0027
Interaction – Individual Level						
knowent x suskill	-0.0382 ***	0.0026	-0.0383 ***	0.0026	0.0186	0.0262
Country variables						
institutional_collectivism			-0.0287	0.0219	-0.0508	0.0223
assertiveness			-0.0187	0.0301	-0.0193	0.0301
uncertainty_avoidance			-0.0235	0.017	-0.0257	0.017
power_distance			-0.0126	0.02	-0.0122	0.02
performance_orientation			-0.0211	0.0261	-0.0199	0.0261
humane_orientation			0.0375 *	0.0209	0.0372 *	0.021
gender_egalitarianism			-0.0787 ***	0.0227	-0.0791 ***	0.0227
gdppercap_ppp			0 ***	0	0 ***	0
urbanpop_per			0.0012 **	0.0006	0.0012 **	0.0006
Primaryenroll			-0.0093 ***	0.0017	-0.0092 ***	0.0017
Interactions – Individual & Country Level						
knowent x instit_collect					0.0212 ***	0.005
Instit_collect x suskill					0.0248 ***	0.0046
knowent x instit_collect x suskill					-0.014 ***	0.006
Random Effects						
s.d.(random intercepts)	0.7745	0.0469	0.6979	0.0424	0.696	0.0423
N	*386,992*		*386,992*		*386,992*	
LR test vs. Logistic regression	*13,063* ***		*10,780* ***		*10,712* ***	
p-value LR test	*0*		*0*		*0*	

Note: Coefficients and marginal effects are reported for the logistic multi-level random intercept model. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The interaction of self-efficacy and societal institutional collectivism is shown in Figure 9. It plots the predictive margin of entrepreneurial intentions separately for those individuals who report self-efficacy and those who don't for a range of values for institutional collectivism. We

can observe for both groups of individuals that for higher values of institutional collectivism, the predictive margin of entrepreneurial intentions is lower. It thus provides support for the conjecture (*Hypothesis 5*) that for more individualistic societies with low levels of societal institutional collectivism (and high institutional individualism); self-efficacy has a larger effect on entrepreneurial intentions. Furthermore, the slope for those individuals knowing an entrepreneurial role model is steeper, thus indicating that these individuals are affected more strongly by the cultural dimension of institutional individualism/collectivism than those individuals who are not acquainted with an entrepreneur.

Figure 9. Predictive margins of self-efficacy (suskill) by institutional collectivism with 95% Confidence Interval.
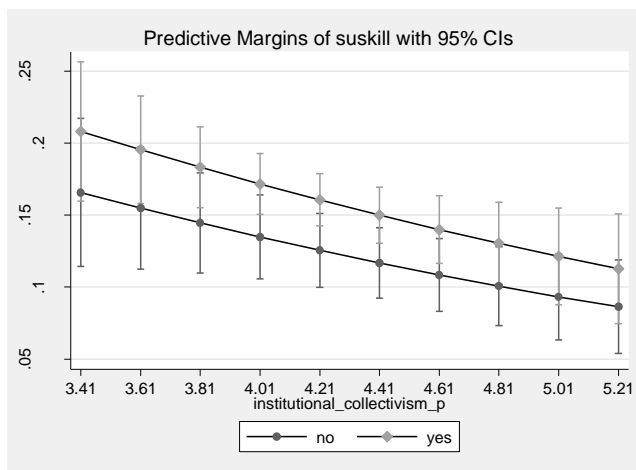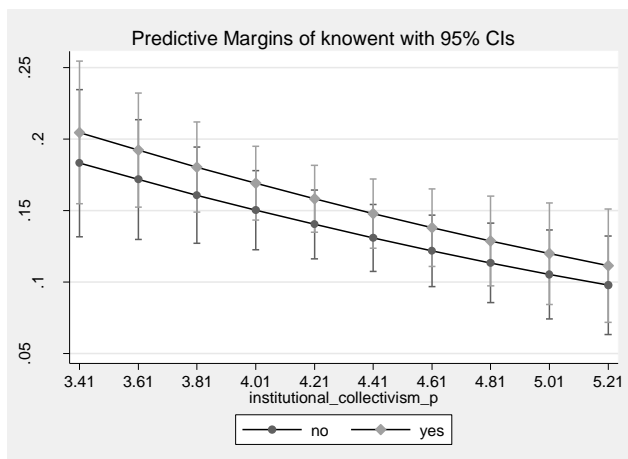

Figure 10. Predictive margins of availability of an entrepreneurial role model (knowent) by institutional collectivism with 95% Confidence Intervall.

Additionally, institutional individualism positively moderates the relationship between role models and entrepreneurial intentions. Role models seem to enhance to a greater extent entrepreneurial intentions in more individualistic socio-cultural contexts (*instit_collect x suskill*) as advanced by *Hypothesis 6*. Figure 10 plots this interaction and provides evidence similar to Figure 9. In sum, the effect on entrepreneurial intentions of both self-efficacy and role models is stronger in countries with high institutional individualism (low level of institutional collectivism).

Figure 11. Predictive margins of availability of an entrepreneurial role model (knowent) and self-efficacy (suskill) by institutional collectivism with 95% Confidence Intervall.
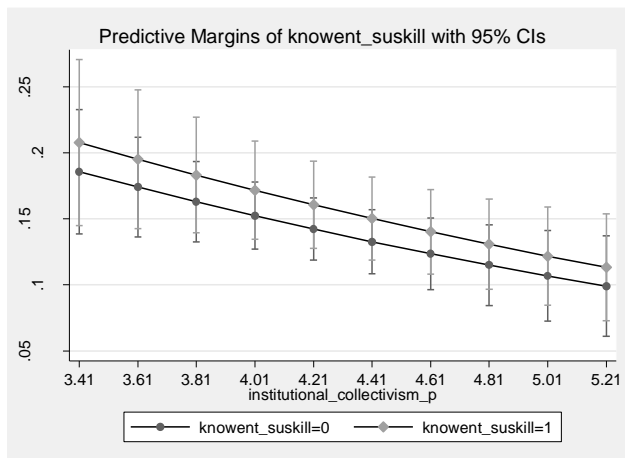
Moreover, the individualistic nature of the socio-cultural context affects the interplay between self-efficacy and role models (*knowent x instit_collect x suskill*) as drivers of entrepreneurial intentions (*Hypothesis 7*). This triple interaction effect cuts across the individual, proximate and distal contexts: the offsetting effect between role models and self-efficacy (*knowent x suskill*) we observe when ignoring the cultural dimension of institutional individualism/collectivism (Model 1 and Model 2) ceases to be statistically significant while at the same time, the triple interaction shows a significant coefficient at the 1 per cent level, indicating that the offsetting effect between self-efficacy and knowing an entrepreneurial model is more important in countries with low values of institutional collectivism (high institutional individualism). Figure 11 provides a graphical representation of this result.

Turning to the control variables, we find that the two perceptual variables *Fear of Failure* and *Opportunity Recognition* show a statistically significant effect on entrepreneurial intentions,

confirming the results of previous studies (e.g. Arenius & Minniti, 2005). Additionally, we can confirm that many demographic variables are important in determining entrepreneurial intentions. Younger individuals, males, and individuals with at least post-secondary education have a higher propensity to form entrepreneurial intentions. Moreover, individuals who are not full-time employees are more likely to show entrepreneurial intentions compared to full-time employees, with the exception of pensioners or disabled.

All country-level control variables show a statistically significant effect on entrepreneurial intentions: the coefficient for GDP is close to zero; a higher share of urban population affects positively the formation of entrepreneurial intentions. This result is in line with earlier research which reports that entrepreneurship (especially opportunity-driven entrepreneurship) tends to be greater in urban areas (Bosma & Sternberg, 2014). On the other hand, there is a significant negative impact of the percentage of individuals enrolled in primary education as a measure for a country's human capital on entrepreneurial intentions. This result may reflect the limitation of the proxy, as enrollment in primary school does not reveal anything regarding the quality of education. It might also be indicative of social policies focused on primary instead of tertiary education.

Furthermore, the analysis of the results reported in Table 18 indicates that the potential bias that might arise from the omission of variables, if there is any, should be modest. Altonji et al. (2005) and Oster (2013) show under the assumption of proportional selection that shifts in the coefficient of interest, with controls that rise concerns about omitted components, are revealing about the remaining bias. In particular, Oster (2013) proves that if the coefficient of interest does not change much after considering such controls, it is indicative of a limited bias. Finally, the remaining high level of correlation between some of the country-level variables calls attention to the challenges of simultaneously analyzing multiple country-level variables as this can generate inflated standard errors of the regression coefficients. Such problems appear to be modest in our case given the robust and statistically significant coefficients across the different model specifications. In fact, we reran the different models excluding the highly correlated variables at the country-level and were able to largely replicate the results.

Discussion and Conclusions

We contribute to the literature on entrepreneurial intentions by showing that the proximate and distal environment influence the way an individual's self-efficacy drives entrepreneurial intentions. We draw on the idea of a triadic reciprocality between individual behavior, personal characteristics, and environmental influences (Bandura & Wood, 1989; Bandura, 1986; Lent et al., 1994) and the separation between the proximate and distal social contexts (Johns, 2006; Mowday & Sutton, 1993; Williamson, 1998, 2000). We subscribe to the idea that national culture and the presence of role models separately influence the way self-efficacy affects an individual's intention to start a new business venture (Wennberg et al., 2013). We theoretically advance this argument and provide evidence for cross-level effects.

Our results complement earlier research which shows that role models exercise a positive influence on entrepreneurial intentions (Lafuente et al., 2007) and that societal cultural dimensions alter the effect of cognitive variables such as self-efficacy on entrepreneurial behavior (Wennberg et al., 2013).While we cannot uphold the idea that higher levels of individualism translates into higher rates of entrepreneurship (Pinillos & Reyes, 2009), the significant interaction between the presence of a role model and individualistic/collectivistic social values provides first empirical evidence for Johns' (2006) approach of cross-level effects between the different layers of socio-cultural context. While collectivistic countries may provide a more appropriate institutional setup for role models (Siu & Lo, 2011), we conjecture that individualistic countries provide a more favorable context for relationships with entrepreneurial role models that is beneficial for forming entrepreneurial intentions.

Our results extend earlier research which establishes that personal attitudes are stronger predictors of intentions in individualistic contexts (Markus & Kitayama, 1991) as we show that individualistic values strengthen the positive impact of self-efficacy on entrepreneurial intentions. Arguably this is so because in individualistic countries, self-evaluations of individuals are based for the most part on personal achievements (Trafimow, Triandis, & Goto, 1991). These self-centered reference points are rather limited at this stage of the entrepreneurial process and consequently stimulate a positive self-assessment.

Our work is the first to address the amplifying effect that individualistic values exert on an individual's self-efficacy in the presence of a role model. Taken figuratively, the distal socio-cultural environment behaves as a magnifying glass for the interaction between personal characteristics and proximate cultural context in molding entrepreneurial intentions. The crowding out effect the presence of an entrepreneurial role model has on self-efficacy as a driver for entrepreneurial intentions is prevalent in more institutionally individualistic countries. As both policymakers and scholars share interest in identifying drivers of entrepreneurial intentions, uncovering the interactive nature of the proximate and distal contexts is bound to attract more attention in the future.

We acknowledge that our investigation is not free of caveats and that many of the limitations of this study offer venues for future research. In particular, the use of rather simple measures of entrepreneurial role models and entrepreneurial self-efficacy can be subject to criticism. We are not able to infer from these measures whether the role model is successful or anything regarding the nature of the relationship between the role model and the respondent (Gibson, 2004; Scherer et al., 1989). Additionally, we cannot control for similarities between the role model and the individual, a fact that has been argued to strongly influence the adoption of a specific behavior (Bandura, 1977). We also acknowledge that the complex and multi-dimensional nature of self-efficacy (Drnovšek, Wincent, & Cardon, 2010) is not fully respected. Likewise, we adopt measures of national culture from the GLOBE study (House & Javidan, 2004), a framework that has been criticized for being overly simplistic.

Second, the data we are using does not allow uncovering the cognitive processes through which the traits of national culture alter the effect of self-efficacy and role models on entrepreneurial intentions. Qualitative research may shed light on such individual cognitive mechanisms. Third, adopting an entrepreneurial process view and differentiating between different stages of entrepreneurial action, may allow further insights on how national culture influences individual cognitive structures when deciding to engage in entrepreneurial activity. The recent research of Wennberg and colleagues (2013) evaluates, among others, the moderation between societal institutional collectivism and self-efficacy on early-stage entrepreneurship. Their study yields results that are consistent with ours; however, the effect of role models on this relationship is not taken into consideration.

Fourth, some omitted variables bias can be remaining. For instance, recent research highlights the importance of individual's financial capital (Danis, De Clercq, & Petricevic, 2011), the individual's access to venture capital (Colombo & Grilli, 2010) as well as cultural capital (Elam & Terjesen, 2010) which are not included in this study. Eventually, the team nature of the entrepreneurial process is not accounted for.

While improvements in all these directions are welcome, there are venues for future research that appear to be particularly desirable. Studying local concentration of entrepreneurship (Minniti, 2005) and determinants of regionally and locally relevant entrepreneurial practices (Stenholm et al., 2013) connects entrepreneurship scholarship with the research and practice of economic development and competitiveness. The inclusion of interacting layers of contextual variables in this research line not only better informs the work of development agencies and policymakers but in the light of the present research it will be necessary in the future. In addition, a stronger focus on the contextual forces and cognitive processes of specific classes of entrepreneurs such as women (Koellinger, Minniti, & Schade, 2013; Langowitz & Minniti, 2007) or technological entrepreneurs (Marvel & Lumpkin, 2007) holds the potential to provide the levers for fine tuning that would enable targeted entrepreneurial initiatives. The study of all these questions at later stages of the entrepreneurial process calls for further investigation.

It is our understanding that entrepreneurship cannot be comprehended and much less purposefully influenced without a proper understanding of the interactive layers of proximate and distal contexts that enable and constrain this process. A theoretically-driven empirical estimation that can show that the interactions of proximate and distal factors generate nontrivial effects on entrepreneurial intentions would have significant scholarly and practical merit. To that end, we have studied the interplay between the individualism/collectivism orientation of national culture, the incidence of entrepreneurial role models and self-efficacy understood as the perception of possessing relevant skills and knowledge to become a successful entrepreneur. We establish that exposure to entrepreneurial role models offsets self-efficacy as a driver of entrepreneurial intentions and that the effect is magnified by the individualistic character of the national culture. These insights extend and deepen our understating about drivers of entrepreneurial intentions, pose some new questions and give rise to puzzling trade-offs among drivers of entrepreneurial intentions. We believe that both the novelty as well as the practical

implications of this research will provoke scholars to ask new questions and equip policy makers with actionable knowledge.

CHAPTER 6

CONCLUSIONS

This concluding section attempts to establish an overall summary based on the single conclusions of each study contained in this dissertation, trying to highlight the importance of the social context for innovation and entrepreneurship and providing implications for policy makers and future research. Additionally, we present a discussion on the limitations of this present study. First and foremost it must be said that the importance of contextual variables for both innovation and entrepreneurship has risen during the recent years, despite being far from playing a prominent role. This doctoral dissertation provides empirical evidence for the relevance of these variables upon which future studies can build. My approach to the study of contextual variables on innovation and entrepreneurship relies on multilevel models and ranges from geographic regions to countries.

Summary

The overarching aim of this dissertation was to *advance knowledge about the role individual/firm-related characteristics (i.e. enabler and barriers) and institutional variables simultaneously play in influencing innovation and entrepreneurship.* Throughout this multilevel doctoral thesis I have shown ways - through the exploration of various dimensions of social capital - how empirical research may respond to this important research topic. In general, this dissertation has demonstrated that social context matters in shaping the innovation process, influencing the innovation success and driving entrepreneurial intention, an important predictor of entrepreneurial behavior.

In the second chapter of this thesis, I look at the common in-bound open strategy to rely on external information sources and evaluate to which extent general trust at the regional level drives the use of this strategy. While earlier research has looked at determinants of using external information sources, i.e. informal and formal innovation collaboration, these studies mainly focused on drivers at the firm- and industry-level. I show that besides these factors, the social context in which the firm is embedded is a decisive factor for adapting this strategy. Firms located in regions characterized by an attitude of generally trusting other people are much more

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likely to use external information sources for their innovation process than those firms which are located in rather leery region. This result applies especially for those firms which do not count with recent experience in accessing external information sources. This finding is important, as it adds to earlier research on determinants of innovation or R&D collaboration. Additionally, we provide first empirical evidence that the lacking interactions among the actors of Colombia's National Innovation System (M. Bosch et al., 2005) can at least partially be explained by a lack of general trust.

This result directly connects with chapter 3, where I evaluate whether the percentage of inhabitants actively participating in civil associations influences the success of such an inbound open strategy for the generation of product innovation. Much of the empirical research investigating formal or informal R&D and innovation collaboration has focused on its impact on the innovation performance (K.-H. Tsai, 2009). And while a positive influence of relationships with suppliers, customers, competitors, universities or research centers is generally identified in these studies (Becheikh et al., 2006), a lacking consistency among empirical results has drawn the attention towards potential moderation factors. These moderation variables are generally identified at the firm level (e.g. Laursen & Salter, 2014; K.-H. Tsai, 2009). This dissertation relies on the observation that the effectiveness of collaboration patterns varies across nations (e.g. Bodas Freitas, Clausen, Fontana, & Verspagen, 2011), suggesting the influence of contextual moderation variables. We build upon the recent research by Laursen and colleagues (2012) who empirically validated that the propensity of a region to actively participate in different civil associations and social interactions outside of associations complements firms' investment in externally acquired R&D and extend these findings.

This chapter relies on a more fine-grained measure for civil participation, differentiating between Olson- and Putnam-type civil associations. This distinction is based upon the differing objectives (Olson, 1982; Putnam, 1993) and the resulting bonding versus bridging functioning. The empirical results again confirm that the social context matters, as it supports a substituting relationship between Putnam-type civil associations at the regional level and the use of external information sources. At the same time, the negative effect of Olson-type civil associations is stronger for firms relying on external information sources. However, our empirical results put into question the strong direct influence found in earlier studies such as that of Laursen and

colleagues (2012). The reason for these differences may lie in our adoption of a multi-level design which so far has not been used in these studies.

Chapter 4 evaluates yet another contextual factor impacting the innovation process of firms – the extent to which inhabitants within a region are tolerant, focusing on racial, religious and tolerance towards foreigners. The empirics confirm that differences in the regional level of tolerance matter for the innovation performance. Moreover, I provide evidence that firms located in regions with high tolerance levels increase their chances to benefit in their innovation activities from agglomeration economies that characterise large urban conglomerations. All three chapters make a point in highlighting the effect of various dimensions of social capital at the regional level for the innovation process and innovation success in the context of a developing country.

Chapter 5 focuses on entrepreneurial intentions, the single most important predictor of entrepreneurial behaviour. I evaluate how the effect of entrepreneurial self-efficacy on entrepreneurial intentions is shaped by two different contextual variables: the presence of an entrepreneurial role model and the cultural dimension of individualism. By doing so, I differentiate between two distinct layers of the social context, the near one and the distal one. While chapter 4 focuses on one important social norm, i.e. tolerance, chapter 5 focuses on factors which might affect social norms related to entrepreneurial intentions. Our empirical results suggest a substitution effect: the presence of an empirical role model offsets entrepreneurial role models. However, this effect depends on the individualistic – collectivistic character of the nation.

Contributions and Implications

The presented empirical results provide empirical grounding for the importance of social context, and more specifically of social capital, for innovation and entrepreneurship. Additionally, evaluating the impact of social capital taking into consideration various contextual layers (personal or firm-level, regional and national), I provide empirical support for the importance of different layers of social context. While some empirical research has highlighted the importance of social capital (Crescenzi et al., 2013; Dakhli & De Clercq, 2004; Doh & Acs, 2010b; Estrin, Mickiewicz, et al., 2013; Hauser et al., 2007; Kaasa, 2009; Pérez-Luño, Cabello-

Medina, Carmona-Lavado, & Cuevas Rodríguez, 2011), I extend these findings not only by looking at various dimensions of social capital. More importantly, I provide empirical evidence for the impact social capital located at different layers of the social context has on innovation and entrepreneurship. By adopting a multilevel design for all of the empirical studies, the thesis avoids the various shortcomings of other research which relied on traditional OLS regressions. The findings of the dissertation are consistent with previous literature on the role of the social context in influencing innovation, such as that of the Regional or National Innovation System (Asheim et al., 2011; Lundvall, 2007), industrial districts (Storper & Scott, 1995), and the innovative milieu (Camagni, 1995) as well as entrepreneurship (Welter & Smallbone, 2011; Welter, 2011).

I also contribute towards a better understanding of the role firms' and individuals' social context plays. Often, the term 'context' is used for what cannot be explained by other variables with regard to individuals' or firms' behavior; i.e. as a residual variable. Likewise, context, when taken into consideration, is often included in form of dummy variables to control for fixed effects, thus inhibiting a closer look at what exactly is influencing and how is it influencing firms' and individuals' behavior. While empirical research explicitly evaluating the social context is on the rise (as mentioned above), it still is somewhat limited. I therefore contribute to this research line, extending previous findings which all highlight the importance of social context for innovation and entrepreneurship.

Finally, by placing most of this research in the context of one or more developing countries, I contribute to the recent interest in these countries. So far, knowledge regarding innovation behavior and performance in developing countries is still rather limited, despite its importance based on the contribution innovation can make towards economic growth. Additionally, developing countries are usually characterized by a relatively weak formal institutional setting. In such a context, social capital may exercise an even more important function in substituting formal institutions.

The findings of this dissertation hold managerial implications. Chapter 2 suggests that firms located in regions with a higher level of general trust are more likely to adopt an inbound open innovation strategy. This implies that firms operating in rather leery regions not only will

have to make a much more deliberate decision to rely on external information sources; they will also likely need to invest more time and resources to build up trust with their potential external partners. Empirical findings of chapter 3 suggest that social capital in form of interaction with other economic actors plays a different role depending on whether it is located at the firm or the regional level. That means that firms which are located in regions with a low level of active memberships in Putnam-type civil associations, will have to build a social network at the firm-level in order to tap into regional knowledge. At the same time, firms located in regions with a high level of memberships in Olson-type associations will have to undertake efforts in order to escape the potential lock-in effects that bonding social capital at the regional level has on the innovation performance. Chapter 4 calls attention to the fact that when firms want to benefit from agglomeration economies, they should not only take into consideration size when locating in such a large urban agglomeration. Additionally, they should take into consideration that social norms such as that of tolerance towards diversity will influence to which extent they are able to benefit more from agglomeration economies. Finally, chapter 5 suggests that knowing an entrepreneurial role model can compensate for lacking self-efficacy, especially in more individualistic societies. This translates into the urge for potential entrepreneurs in these contexts to search for entrepreneurial role models.

The results of this dissertation also offer interesting implications for policy makers interested in fostering innovation (at the regional level) and entrepreneurship (at the national level). I illustrated through the empirical research that specific dimensions of social capital at the regional level may constitute an asset for firms wanting to engage in an innovation process or aiming to improve their innovation performance. I follow earlier research (Knack & Keefer, 1997; Woolcock & Narayan, 2000) in arguing that it is a challenge for policy makers to identify and subsequently advocate mechanisms that can create and sustain social capital. Fukuyama (1995) suggested that education is key for this. Institutions providing education not only contribute to the construction of human capital, but are also able to contribute to the generation of social capital. Based on the research of this dissertation, I submit that another powerful mechanism is to encourage and facilitate interaction among economic actors within a region. Not only can this potentially contribute towards the generation of higher trust level (Knack, 2003), but it can also compensate for lacking civil associativeness at the regional level among inhabitants. Finally, policy makers can make an important contribution towards entrepreneurship

especially in the context of more individualist countries promoting the presence and highlighting the successes of entrepreneurial role models.

Limitations and Directions for Future Research

I acknowledge that the present dissertation is not free of caveats, which principally lie in the limitations by the data bases employed. While I have controlled in all the empirical studies for a large number of variables and have relied on data sets with a large number of observations, empirical results are based on cross-sectional data. As a result, not only can I not derive conclusions regarding the causality of the different relationships presented. Additionally, the time that different mechanisms researched may take is not taken adequately into consideration. Further research should be conducted relying on panel data, thus allowing to overcome these limitations. Another potential way forward regarding the problem of causality would be to employ instrumental variable estimations. I was unable to do this due to the lack of an adequate instrumental variable.

A further limitation concerns the measures employed for the various dependent variables. Chapter 2 relies on a categorical measure, differentiating between exploitive and explorative external information sources. A more fine-grained differentiation based on a detailed research into the functions of each of the different external information sources may extent findings regarding the role trust plays for adopting an inbound open innovation strategy. Chapter 3 does not differentiate between degrees of novelty for product innovation. As results in chapter 4 shows, this is an important distinction as determinants for each type of innovation may vary. For example, each type of innovation is characterized by a different resort to external information sources (Laursen & Salter, 2006). Therefore, future innovation should differentiate between the different types of innovation evaluating the differential impact of bridging and bonding social capital on the varying degrees of novelty. It would hereby contribute to the debate on information benefits on brokerage and cohesive social structures (Uzzi & Spiro, 2005; Uzzi, 1997). This dissertation focuses on product innovation in Chapter 2 and 3. Future research might extent the empirical findings by evaluating the impact civil associations and tolerance has on process innovation.

Similar limitations concern several of the important dependent variables. Chapter 2 and 3 rely – in different ways – on measures for external information sources. Future research should try to differentiate the geographical extent of these information sources; an important point in light of the empirical findings of chapter 4. As I have discussed in chapter 3, the measures for Olson- and Putnam-type civil associations are far from perfect. Further empirical research should be undertaken in order to establish the functions and working of each of these organizations so that empirical measures reflect these to a greater extent. Due to data limitations, the measure for tolerance employed does not include all the potential dimensions (e.g. sexual tolerance). Therefore, future research should therefore try to include all potential dimension of tolerance. Additionally, future research may evaluate the differential impact tolerance has on the innovation performance of firms. Finally, both entrepreneurial self-efficacy and the presence of entrepreneurial role models are far from being fine grained measures. Future research evaluating the impact especially of the influence of entrepreneurial role models should strive to evaluate in greater detail this figure. Success rate, the quality of the relationship with the entrepreneurial role model, gender and other characteristics might be influential in driving the impact it has on the relationship between entrepreneurial self-efficacy and entrepreneurial intentions.

Finally, for Chapter 2 through 4 I focus on the regional level. However, the definition of region and its adequate measurement is far from being clear. The regional limitations applied were data-driven, yet at least in the case for Colombia they represent identifiable regions in the sense that besides departments, these regions are identified by official institutions as regions based on historic and geographical reasoning. However, future research may extent the findings by applying different geographic limitations and evaluating the differential and even cross-level impact on innovation.

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APPENDIX A. CLASSIFICATION OF DEPARTMENTS INTO REGIONS

Region	Department
ANTIOQUIA	Antioquia
ATLANTICO-BOLIVAR	Atlántico
	Bolívar
BOGOTA	Bogotá
BOYACA	Boyacá
CAUCA-HUILA	Cauca
	Huila
CESAR-GUAJIRA-MAGDALENA	Cesar
	Magdalena
CORDOBA-SUCRE	Córdoba
NORTE SANTANDER	Norte de Santander
ORINOQUIA	Meta
PACIFICO	Nariño
SANTANDER	Santander
TOLIMA	Cundinamarca
	Tolima
VALLE DEL CAUCA	Valle del Cauca
VIEJO CALDAS	Caldas
	Quindío
	Risaralda

APPENDIX B. EXTERNAL INFORMATION SOURCES

Spanish Name	English Translation
Departamento I + D de otra empresa	R&D department of other firm
Competidores u otras empresas del sector	Competitors and other firms from the same sector
Clientes	Clients
Proveedores	Providers
Empresas de otro sector	Firms of other sectors
Agremiaciones y/o asociaciones sectoriales	Sectorial gremiums and associations
Cámaras de Comercio	Chamber of Commerce
Centros de Desarrollo Tecnológico (CDT)	Technological Centers
Centros de investigación	Research Centers
Incubadoras de Empresas de Base Tecnológica (IEBT)	Incubators (Technology-based)
Parques Tecnológicos	Technology Parks
Centros Regionales de Productividad	Regional Centers of Competitiveness
Universidades	Universities
Centros de formación o Tecnoparques SENA	Training Centers (SENA)
Consultores o expertos	Consultants or experts
Ferias y exposiciones	Fairs and expositions
Seminarios y conferencias	Seminars and conferences
Instituciones Públicas (Ministerios, entidades descentralizadas, secretarías)	Public Institutions (Ministries, decentralized entities and secretaries)

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APPENDIX C. CORRESPONDENCE BETWEEN REGIONS IN THE WORLD VALUE

SURVEY AND THE WORLD BANK SURVEY

World Values Survey regions	No. Obs.	World Bank Survey regions	No Obs.
Zona Metropolitana, CL	501	Santiago RM, CL	524
North, CL	148	Antofagasta, CL	48
Central, CL	123	Valparaiso, CL	72
South, CL	228	Los Lagos, CL	103
Bogota DF, CO	264	Bogota, CO	402
Valle de Cauca, CO	144	Cali, CO	75
Antioquia, CO	168	Medellin, CO	133
Atlantico, CO	96	Barranquilla, CO	263
Coahuila, MX	36	Monclova, MX	53
Distrito Federal, MX	156	Distrito Federal, MX	247
Jalisco, MX	108	Guadalajara, MX	218
Estado de Mexico, MX	156	AMCM	206
Nuevo Leon, MX	60	Monterrey, MX	173
Puebla, MX	72	Puebla, MX	84
Guanajuato, MX	72	Leon, MX	132
Lima Dept, PE	440	Lima, PE	592
Arequipa, PE	90	Arequipa, PE	75
Lambayeque, PE	95	Chiclayo, PE	35
La Libertad, PE	110	Trujillo, PE	46
Montevideo Dept, UY	452	Montevideo, UY	311
Canelones Dept, UY	151	Canelones, UY	39
Pichincha, EC	228	Pichincha, EC	41
Guayas, EC	370	Guayas, EC	44
Azulay, EC	59	Azuay, EC	35
Gran Buenos Aires, AR	415	Buenos Aires, AR	503
Santa Fe Province, AR	120	Rosario, AR	103
Mendoza Province, AR	60	Mendoza, AR	78
Cordoba Province, AR	60	Cordoba, AR	82

APPENDIX D. RESULTS OF PRINCIPAL COMPONENTS ANALYSIS

Principal components analysis of tolerance variables

Table D.1 below shows the descriptive statistics for the three original variables. It shows that they are highly correlated. Table D.2 show the values of the eigenvalues of the components resulting from the principal components analysis and the proportion of the total variance accounted for by each of the components. The first component accounts for 93% of the total variance. Table D.3 shows the correlations between the three principal components and the original variables. Each of the three original variables is highly positively correlated with the first component. The factors scores on first component are our measure of regional tolerance (See Table 1).

Table D.1

Descriptive statistics for tolerance related variables

	mean	S.E.	Racial	Religious	Foreigners
Racial tolerance	.92	9.8	1.00		
Religious tolerance	.91	10.3	.86	1.00	
Tolerance for foreigners	.90	8.8	.95	.89	1.00

Source: Authors' calculation based on the data from the World Value Survey.

Table D.2

Eigenvalues and proportion of total variance

Component	Eigenvalue	Proportion
Component 1	2.80	.93
Component 2	0.15	.05
Component 3	0.05	.02

Table D.3

Correlations between the components and the original variables

Variable	Component 1	Component 2	Component 3
Racial tolerance	0.97	-0.108	0.143
Religious tolerance	0.95	0.316	.026
Tolerance for foreigners	0.98	-0.115	-0.169

APPENDIX E. OBSERVATIONS PER COUNTRY

Country	Freq.	Percent	Country	Freq.	Percent
Australia	6,452	1.67	Morocco	944	0.24
Bolivia	4,256	1.1	Netherlands	11,150	2.88
Colombia	14,714	3.8	New Zealand	493	0.13
Denmark	15,877	4.1	Philippines	1,598	0.41
Ecuador	4,458	1.15	Poland	1,433	0.37
Egypt	3,410	0.88	Portugal	1,235	0.32
Finland	6,719	1.74	Russia	898	0.23
France	8,917	2.3	Slovenia	8,672	2.24
Greece	4,475	1.16	South Korea	4,842	1.25
Guatemala	3,364	0.87	Spain	112,865	29.16
Hong Kong	2,986	0.77	Sweden	7,927	2.05
Hungary	9,005	2.33	Switzerland	7,534	1.95
India	1,530	0.4	Thailand	3,569	0.92
Indonesia	1,028	0.27	Turkey	5,040	1.3
Ireland	7,652	1.98	United Arab Emirates	3,669	0.95
Israel	5,234	1.35	United Kingdom	71,337	18.43
Italy	7,964	2.06	United States	17,007	4.39
Japan	7,313	1.89	Venezuela	1,313	0.34
Kazakstan	1,002	0.26	Zambia	1,385	0.36
Mexico	7,725	2			
			Total	**386,992**	**100**