Open innovation search strategies in family and non-family SMEs

Evidence from a natural resource-based cluster in Chile

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Estrategias de búsqueda de innovación abierta en empresas familiares y no familiares

Evidencia en un clúster basado en recursos naturales en Chile

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Abstract

Purpose – The purpose of this paper is to investigate what types of open innovation search strategies are associated with internal innovation activities in family and non-family SMEs within natural resource-based clusters.

Design/methodology/approach – This study is based on an empirical analysis of a sample of 245 Chilean firms.

Findings – Results suggest that while family and non-family SMEs do not significantly differ in terms of internal innovation activities, important differences exist in terms of open innovation search strategies. In particular, family SMEs search for new ideas and knowledge within their closest network of relationships (e.g. customers, suppliers and competitors), whereas non-family SMEs mainly focus on broader network relationships (e.g. universities, public institutions and fair trade organizations).

Practical implications – This study shows that within a natural resource cluster, the types of firm do matter. In fact, family and non-family SMEs use different open innovation search strategies to

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innovate; hence, this research may help and assist policy makers in tailoring innovation policies aimed at expanding the potential benefits of clusters for regional growth and development.

Originality/value – This research addresses the call to further investigate the link between family SMEs and innovation in developing countries, given that SMEs may also act as a lively player for regional development.

Keywords Family business, Open innovation search strategies, Natural resource-based cluster, Chile

Paper type Research paper

Resumen

Propósito – El objetivo de este artículo es investigar las estrategias de búsqueda de innovación abierta de las pequeñas y medianas empresas familiares y no familiares en un clúster basado en los recursos naturales.

Diseño/metodología/enfoque – Este estudio está basado en un análisis empírico con una muestra de 245 empresas Chilenas.

Recomendaciones – Los resultados muestran que no hay diferencias significativas en las actividades internas de innovación entre las pequeñas y medianas empresas familiares y no-familiares de la muestra. Sin embargo, se han encontrado diferencias en las estrategias de búsqueda de innovación abierta que utilizan de las empresas. Las empresas familiares buscan nuevas ideas y conocimiento para innovar entre sus contactos más cercanos (por ejemplo: clientes, proveedores y competidores). Las empresas no-familiares se enfocan en contactos más amplios (por ejemplo: tales como universidades, instituciones públicas y ferias internacionales).

Implicaciones prácticas – Este estudio muestra que distinguir entre empresas familiares y no familiares dentro de los clúster basados en los recursos naturales es importante. Las pequeñas y medianas empresas familiares y no familiares usan diferentes estrategias de búsqueda de innovación abierta. Por lo tanto, nuestros resultados pueden ayudar al diseño de políticas públicas de innovación diferenciando empresas familiares y no familiares con el objetivo de potenciar los beneficios de los clúster para el crecimiento y desarrollo regional.

Originalidad/valor – Este artículo intenta avanzar en la investigación relacionando innovación y pequeñas y medianas empresas familiares en países en desarrollo.

Palabras clave empresas familiares, estrategias de búsqueda de innovación abierta, clúster basado en los recursos naturales, Chile

Tipo de documento Trabajo de investigación

1. Introduction

Firm clusters, a concentration of interdependent firms intrinsically linked through common or complementary inputs, innovations, processes or products (Rosenfeld, 1997), have long been considered a viable strategy for regional and local development (Rocha, 2004). The proximity of firms (Marshall, 1920; Porter, 1998) and their interconnections (Becattini, 2004) are expected to improve the flow of information through networks (Audretsch, 1998), fostering innovation (Block and Spiegel, 2013) and enhancing firms' performance (Wennberg and Lindqvist, 2010), which subsequently affects regional development and competitiveness. Because of these expected positive effects, national governments in developing countries, supported by international organizations (e.g. the Organization for Economic Co-operation and Development (OECD) and the World Bank), encourage regions to adopt cluster strategies as an economic development policy. In spite of the acknowledged importance and benefits of clusters for regional and local development, there is still a lively debate about their limitations, especially with reference to natural resource-based clusters (Bas and Kunc, 2009; Buitelaar, 2001; Singh and Evans, 2010). Indeed, in some Latin American regions, natural resource-based clusters seem not to have fulfilled initial government expectations in terms of knowledge-innovation and further economic development (Arias *et al.*, 2014; Bas and Kunc, 2009).

The level of innovation within clusters varies, largely because of heterogeneity in terms of economic and social structure (Markusen, 1996) and types of firms. It is well documented that innovation is a problem in natural resource-based clusters because the model of extraction of a few large players is based on resource exploitation and scale. Large corporations outsource all the services necessary to maintain and support their core business to small- and medium-sized firms (hereafter SMEs). Such large corporations strategically focus on low-cost strategies, and SMEs in the supply chain seek to develop products and services that enable them to offer lower prices than their main competitors. Even though the natural resource-based cluster is not a knowledge-based cluster, SMEs may have considerable incentives to engage in innovation as a way of achieving a competitive and sustainable position within the natural resource-based cluster. This leads us to investigate innovative behaviors of SMEs to better understand the specific dynamics within natural resource-based clusters.

Focussing our research at the firm level, two main SME characteristics seem to be of particular importance for this study. First, as SMEs are constrained by scarce internal resources for innovation, to do so they need to search for ideas and knowledge beyond their own organizational boundaries by developing an open innovation search strategy (Katila and Ahuja, 2002; Laursen and Salter, 2006). Second, SMEs are not a homogenous group, and family and non-family SMEs coexist in the same environment (Basco, 2015; Johannisson *et al.*, 2007). The family or non-family dominant coalition controlling SMEs alters firms' interests, incentives and motivations, which consequently affects their behaviors. Considering that being a family firm (i.e. family involvement in the firm) affects the way the firm is governed and managed (Basco and Pérez Rodriguez, 2009), we contend that in order to better understand open innovation search strategies within natural resource-based clusters, it is important to tackle differentiation between family and non-family SMEs. Therefore, we investigate what types of open innovation search strategies are associated with internal innovation activities in family and non-family SMEs within natural resource-based clusters.

To address this research question, we build a theoretical framework by integrating arguments from open innovation and family business literature. SMEs are not a homogenous group of firms thus we theoretically deduce by using arguments from family and entrepreneurial logics (Miller *et al.*, 2011; von Schlippe and Jansen, 2014) that different types of firms (such as family and non-family SMEs) might have distinct open innovation search strategies. Specifically, we hypothesize that, in order to innovate, family SMEs prefer a less diversified set of external relationships than non-family SMEs. Indeed, family SMEs search for new ideas and knowledge within their close network (Classen *et al.*, 2012). This strategy is aligned with family logic (Basco and Pérez Rodríguez, 2011), helping family firms avoid situations that might put their socioemotional wealth at risk, but, at the same time, help them increase their reputation and differentiation strategy (Basco, 2014). On the other hand, non-family firms search for ideas and knowledge that are outside their own current knowledge, which entails high-risk behaviors aligned with entrepreneurial logic.

Our main hypotheses are tested on a sample of 264 Chilean SMEs. We focus on the Chilean region of Antofagasta, which is a prominent example of a natural resource-intensive economy in Latin America. The main findings suggest that while family and non-family SMEs do not significantly differ in terms of internal innovation activities, important differences exist in terms of open innovation search strategies. In particular, while family SMEs search for new ideas and knowledge within their closest network of relationships (e.g. customers, suppliers and competitors), non-family SMEs mainly

focus on a broader network of relationships (e.g. universities, public institutions and fair trade organizations).

This study contributes to open innovation in SMEs, family business and cluster literature. First, we address the call made by Pérez Rodríguez and Basco (2011) that the theorizing process of family businesses needs to be extended to new fields, and also, specifically, the call made by De Massis *et al.* (2013) about the need to extend family business research at the intersection of family business and innovation literature. This research also responds to the call made by West *et al.* (2006) for more research on open innovation in the context of SMEs. In particular, our research considers that SMEs are not a homogenous group and that firms differ according to the dominant coalition (family or non-family members) determining a firm's innovative behavior. Our findings – that family and non-family firms do not use the same open innovation search strategies to compete – are in line with Classen *et al.* (2012) in supporting the view that family involvement in the firm is likely to affect the firm's innovative behavior (De Massis *et al.*, 2013; Chrisman and Patel, 2012).

Second, we address the call to further investigate SMEs and innovation in developing countries (Kim *et al.*, 1993), especially in Latin America (Bas *et al.*, 2008), by considering one specific type of environment: the natural resource-based cluster. We thus extend previous research on firm innovation in natural resource-based clusters (e.g. Bas and Kunc, 2009; Bas *et al.*, 2008) by introducing a new dimension – family involvement in the firm – to distinguish types of firms, which, to the best of our knowledge, has not been considered so far by previous studies. Our study also brings a more fine-grained understanding of cluster structure and its main actors (such as types of firms operating in it) to better appreciate how a cluster works.

This research also has practical implications. Our findings bring new insights to the controversy around the advantages and disadvantages of natural resource-based clusters (Arias *et al.*, 2014) as instruments for regional and national economic development (OECD, 2013). The debate cannot be polarized around extreme positions (clusters are either good or bad), but rather around a constructive debate to find solutions to improve the functioning of natural resource-based clusters. The OECD suggests "[to] develop a sophisticated and local innovation infrastructure serving the need of different types of SMEs" (OECD, 2013) and to promote a large network among actors. In this direction, our study shows that the type of firm (family or non-family) within the natural resource clusters matters. Firms with and without family involvement use different open innovation search strategies to innovate; hence, this research may help and assist policy makers in tailoring innovation policies aimed at expanding the potential benefits of clusters for regional growth and development.

The paper is structured as follows. First, we open the debate by presenting a brief review of the literature about clusters, open innovation, and family firms, which helps to position our main theoretical arguments. Next, hypotheses are developed. Thereafter, we introduce the methods section, where the database, data collection, measures, and results are presented. The results are then discussed, and the theoretical and practical implications and limitations and future research directions are outlined.

2. Theoretical background

2.1 Clusters

Cluster research has its roots in the work of Marshall (1920), who posited that a concentration of firms provides benefits through the existence of a solid labor market, the division of labor and knowledge spillovers. Clusters facilitate interconnections

between firms (Becattini, 2004), flexible specialization, local embedded networks (Piore and Sabel, 1984), entrepreneurship (Delgado *et al.*, 2010), institutional and cultural factors and resource sharing (Li and Geng, 2011). Such mechanisms create agglomeration economies external to the firm (location economies) (Parr, 2002) and positive externalities (i.e. innovation). Therefore, it has been argued that clusters may affect a firm's innovation through agglomeration economies and network-based effects.

Because of the above-mentioned positive effects, international organizations, such as the OECD and the World Bank, have encouraged countries to adopt cluster strategies as viable policy toward socio-economic development. However, the evidence from developing countries seems to be contradictory and characterized by a certain level of pessimism regarding clusters as a strategy for regional development (Molina-Morales and Giuliani, 2012). This is largely due to the heterogeneity of clusters. Productive structure, number of players and players' power (Markusen, 1996) affect cluster mechanisms (agglomeration economies and network-based effects) and their positive externalities at firm level (firm performance and innovation) and regional level (development).

The most common type of cluster promoted in developing countries is related to natural resources. Natural resource-based clusters can be described as "hub and spoke" clusters (Markusen, 1996), which are characterized by the presence of a few big export-oriented firms (commonly multinational corporations) which operate in a region with a large number of SMEs related to the main activity (organized as spokes) and other firms to support the general economic system of the region based on population's consumption. In such an environment, the positive externalities that are expected to emerge because of firms' proximity (e.g. innovation, knowledge spillovers and entrepreneurship) are more blurred (van der Ploeg, 2011; Sachs and Warner, 2001) because firm clusters alone do not guarantee innovative activity (Beaudry and Breschi, 2003). Furthermore, there is contradictory information about the benefit of natural resource-based clusters and their effects on firms' innovative behavior (Arias *et al.*, 2014; Bas and Kunc, 2009). For instance, Bas and Kunc (2009) showed that while Chile contributes 36 percent of the worldwide copper production, there is almost no patent originating from Chile registered at the United States Patent and Trade Office.

In particular, natural resource-based clusters are not like high-tech clusters, which usually foster innovation. Hence, the current challenge, especially in developing regions, is to convert the extractive regional model into a knowledge value-added regional model. To this end, innovative behavior (i.e. the acquisition of knowledge for developing new products and production processes, the adoption of new product/process technology and the introduction of new innovative products/process as a competitive strategy; Link and Bozeman, 1991), rather than innovation outputs (such as number of patents) of SMEs operating within a natural resource-based cluster, is considered to be an important condition for future development. Consequently, within a natural resource-based cluster it is important to understand to what extent SMEs embrace open innovation search strategies to develop internal innovation activities.

2.2 SMEs open innovation search strategies

Innovation is broadly related to the set of activities through which a firm conceives, designs, manufactures, and introduces a new product, technology, system or technique. Product, service and process innovations do not necessarily have to be new to the world to have an economic impact; they could just be new to a specific context, sector or situation (Koellinger, 2008). Within this general definition, innovation can be

understood through two different perspectives: innovation as consequence (innovation output) and innovation as cause. The former is the materialization of innovation in a product, service, process and/or organizational method, such as a patent. The latter is innovative behavior as the tendency "to engage in and support new ideas, novelty, experimentation and creative processes" with the intention to improve or create new products, services or processes (Lumpkin and Dess, 1996).

Innovative behaviors acquire importance since innovation is not only the result of a firm's internal economic efforts, but is also dependent on external effects. This is also known as open innovation, the integration of external and internal knowledge to create value for customers (van der Ploeg, 2011). More specifically, firms have increasingly pursued collaborative innovation strategies, whereby they systematically access and use knowledge available outside their boundaries and exploit their technologies through external paths to market (Chesbrough, 2003). The ways to access new knowledge through external sources, called open innovation search strategies (Laursen and Salter, 2006), play an important role in a firm's capacity for innovation.

Open innovation search strategies are especially useful to SMEs, as they do not have enough resources to rely on internal innovation activities to come up with the ideas/knowledge necessary to create a marketable innovation. Hence, innovators rely on their interactions with other players within their environment (Brown and Eisenhardt, 1995). SME interactions (e.g. with suppliers, customers, competitors, research institutions and organizations in the same or different industries) bring either solutions to their problems, alternatives for innovations, or help to exploit solutions for those products or services that the firm has developed (Huizingh, 2011). More specifically, SMEs may pursue collaborative innovation strategies, systematically accessing and using knowledge available outside their boundaries, and exploit their technologies through external paths to market (Chesbrough, 2003).

Open innovation search strategies are characterized by two different dimensions: open innovation search breadth (the number of external channels through which a firm has access to new knowledge) and open innovation search depth (the intensity of use of external sources) (Laursen and Salter, 2006). The important distinction between breadth and depth for open innovation search strategies must also take into account the closeness of external sources: related and unrelated open innovation search strategies. A related open innovation search strategy means that firms look for ideas within their close commercial and competitive network such as customers, competitors and suppliers, thus capturing knowledge similar to that which the firm already has; this is mainly related to incremental innovation. On the other hand, an unrelated open innovation search strategy – mainly related to radical innovation – means that firms look for ideas beyond their close commercial and competitive network, such as universities, research institutions and international fairs, thus capturing new knowledge (Katila and Ahuja, 2002).

Innovative firm behaviors (i.e. related- and un-related open innovation search strategies) are not only influenced by the context within which economic activities take place (such as the industry), but are also influenced by the firm's internal characteristics. The nature of the internal dominant coalition of the firm may impose its objective on the firm, affecting its behavior (Cyert and March, 1963) and, specifically, its approach to innovation. This may be particularly evident in SMEs because they do not represent a homogenous group of firms. One important attribute of the dominant coalition that has been discovered to distinguish firms is family participation in the firm (Johannisson *et al.*, 2007). For instance, the family, as main stakeholder in the firm,

may affect the firm's innovative behavior. However, only limited efforts have been made to consider whether and to what extent family involvement in the firm can affect a firm's tendency to be engaged in open innovation search strategies. Below, we extend the debate by analyzing the innovation behavior of family and non-family SMEs.

2.3 Family involvement and open innovation

Several studies which have focussed on clusters and innovation recognize that, within the same region, firms do not show homogenous behaviors (Johannisson *et al.*, 2007). For instance, firm size has been considered an important dimension for capturing differences in firm behavior; indeed, studies from industrial economics have shown that SMEs behave differently to larger firms (Tan *et al.*, 2009; Tether, 1998). Further reasons to argue for heterogeneity among firms within a cluster have their roots in the behavioral theory of the firm (Cyert and March, 1963). This theoretical perspective conceives a firm as a coalition of stakeholders where organizational goals depend on how the individuals in the coalition bargain to determine the goals of the wider organization (Cyert and March, 1963).

Firm behavior differs depending on the type of coalition dominating the firm, for instance, family involvement in the organization (i.e. the presence of kinship relationships among the actors working in the firm). When the family is the dominant group, owners and managers have to take into account a variety of goals based on business and family demands (Basco, 2010; Pérez Rodriguez *et al.*, 2007). Consequently, the balance of family and business objectives affects the way an organization is governed and managed (Basco and Pérez Rodríguez, 2011). On the other hand, non-family firms are mainly driven by managerial and/or entrepreneurial incentives related to economic goals. Therefore, while in family firms management and governance are dominated by particularism (specific non-economic objectives introduced by family influence and following a family logic) (Carney, 2005), non-family SMEs are mainly subject to entrepreneurial logics (Miller *et al.*, 2011). Hence, differences in goals between family and non-family firms lead to different strategic behaviors.

Stemming from this differentiation, the main academic debate about family firm innovation has focussed on whether family firms are more, less, or equally as likely to innovate than non-family firms. However, empirical evidence has not yet shown conclusive findings, especially when comparing family and non-family firms (for a comprehensive review of the literature on family firm innovation see De Massis *et al.*, 2013), often leading to contradictory results. Such contradictory evidence can be justified within the arguments of a configurative approach (Meyer *et al.*, 1993), specifically by considering the concept of "equifinality" (Basco and Pérez Rodríguez, 2011; Fiss, 2007). Equifinality suggests that multiple unique firm configurations can achieve similar results by rejecting the premise that there is a simple optimum way to be effective (Duberley and Burns, 1993). That is, there is no unique form of organization to accomplish innovation. Thus, with this assumption in mind, we can argue that even though family and non-family firms are different forms of organization, a priori it is not possible to define which form of organization (family or non-family) is more innovative in products, services or processes. However, family and non-family firms might differ in their paths to achieving innovation, because each organization is guided by different goals (Basco, 2010; Brundin *et al.*, 2014).

Therefore, it is not in innovation output (product and process innovations) that differences between family and non-family firms emerge; rather, they might be found in their innovative behavior (attitude). In other words, differences may emerge in the open

innovation strategies that each type of firms uses to mobilize its resources for achieving innovation. We address this issue by answering the following research question:

RQ1. What types of open innovation search strategies are associated with internal innovation activities in family and non-family SMEs within natural resource-based clusters?

2.4 Hypotheses development

Network relationships emerging from clusters allow firms to access information and knowledge and to directly observe other firms, which contribute to creating or developing new products, services and/or processes. Therefore, firm innovation is enhanced by extending knowledge, costs and risks with external linkage (Freel, 2003). However, the type of cluster and the type of firms within the cluster may constrain innovative firm behaviors.

First, the geographical spatial consideration becomes important for firm innovation because it promotes information exchange by interpersonal links and by a common socio-cultural environment. However, clusters are not homogenous and their structure matters when it comes to firm innovation. Unlike the traditional and well-established industrial districts (Becattini, 2002) where SMEs are integrated to produce a final product or service, in natural resource-based clusters, such as hub and spoke clusters (Markusen, 1996), SMEs are subordinate to hierarchical relationships. To develop their main activity – extracting and exporting natural resources by exploiting national comparative advantages (natural resources and cost advantages) where natural resources are located – large firms need to be supplied by a set of services, traditionally offered by a large number of SMEs. This creates a vertical structure (chain relationship) formed by suppliers with different degrees of responsibility (Silvestre and Dalcol, 2010) and power. In such an environment, due to the fact that large mining firms compete based on a low-cost strategy in international markets, it is expected that suppliers follow this strategy by providing products or services that help reduce costs for large firms (Culverwell, 2001) or for the firms along the supply chain. Low-cost competition implies that suppliers need to find product, service and process innovations to be able to offer lower price than competitors, or to develop innovations to help large firms reduce their own costs. In this context, SME suppliers have incentives to be engaged in innovation as a way to find their own position in the marketplace.

The incentive to be engaged in innovation will vary from firm to firm. Specifically, it is expected that the way family and non-family SMEs acquire knowledge and search for new ideas to innovate or commercialize innovations is likely to be different because of different objectives and motivations. Firm innovative behavior is bounded by firm economic and non-economic goals. But in family firms, innovation decisions must be evaluated in the spectrum of economic, social and emotional endowments. Family firms will assume those innovative positions or actions that minimize the threat to socioemotional wealth (Gomez-Mejia *et al.*, 2010). Under this assumption, family firms will prefer a less diversified set of external relationships for their innovation behaviors (Classen *et al.*, 2012). That is, when SMEs search for new ideas in their close environment (among customers, suppliers and competitors) they are attempting to develop new, or improve the existing, products, services and/or processes based on close, recognizable and familiar knowledge (Laursen and Salter, 2006). This implies preferences for innovative behaviors from a less risky position in order to preserve their socioemotional wealth and, at the same time, safeguard a reputation showing the firm to be closer to customers and suppliers, typical of family firms (Basco, 2014).

The related open innovation search strategy is even more important within a natural resource-based cluster. The survival of family SMEs, in the supply chain, will depend on the ability of owner-managers to respond to customer needs. Therefore, a related open innovation search strategy may be crucial because it can help firms to develop a source of competitive advantage by increasing their ability to create, use and recombine new and existing knowledge, while at the same time reducing the risk of embarking on projects that could jeopardize their socioemotional wealth. Therefore, we postulate the following hypothesis:

H1. Family SMEs engaged in related open innovation search strategies will exhibit a higher likelihood of investment in product, services and/or process innovation activities.

Unlike family firms, owner-managers in non-family SMEs are influenced by different goals and motivations, positioning firm behaviors in the entrepreneurial domain mainly dominated by economic goals. For Miller *et al.* (2011) entrepreneurial logic is mainly characterized by growth, wealth accumulation and superior shareholder returns. The entrepreneurial behavior is the intention and willingness of individuals – either on their own or within organizations – to pursue opportunities without regard to the resources they currently control (Stevenson *et al.*, 1989). Consequently, non-family firms that embrace an entrepreneurial identity will pursue more aggressive positions in their open innovation search strategies. It is expected that non-family SMEs will search for ideas and knowledge to apply to innovation beyond their close network (i.e. universities, research institutions and international fairs). This is an unrelated open innovation search strategy, which implies looking for ideas that goes beyond the current knowledge of the firm and is mainly related to a more radical innovative approach (Katila and Ahuja, 2002). Therefore, we propose the following hypothesis:

H2. Non-family SMEs engaged in unrelated open innovation search strategies will exhibit a higher likelihood of investment in products, services and/or process innovation activities.

3. Methods

3.1 Context: the Antofagasta mining cluster

The Chilean economy is dependent on natural resources (OECD, 2013) and more than 18 percent of Chilean gross domestic product (GDP) derives from natural resource-based economic activities such as mining, agriculture or fishing (Central Bank of Chile). For instance, Chile is one of the world's largest copper producers and exporters, accounting for 36 percent of total production and 40 percent of exports (COCHILCO, 2009). Mining extraction is mainly located in the north of Chile, specifically in the region of Antofagasta. The region of Antofagasta is a natural resource-intensive economy[1], with mining representing 66 percent of the region's GDP[2]. Almost all copper extracted in the region is exported, and the region generated 9.1 percent of Chile's GDP in 2011 (see Figure 1). Indeed, the regional development strategy plan has been focussed on creating and developing a supply industry of products and services to large mining corporations. The Region of Antofagasta has been considered an example of economic growth (CEPAL, 2009), with the growth rate averaging 6 percent over the last decade.

The mining sector has a positive impact on economic growth and regional development such as direct and indirect employment effects, creation of infrastructure, new business opportunities based on the forward and backward mining linkages and international

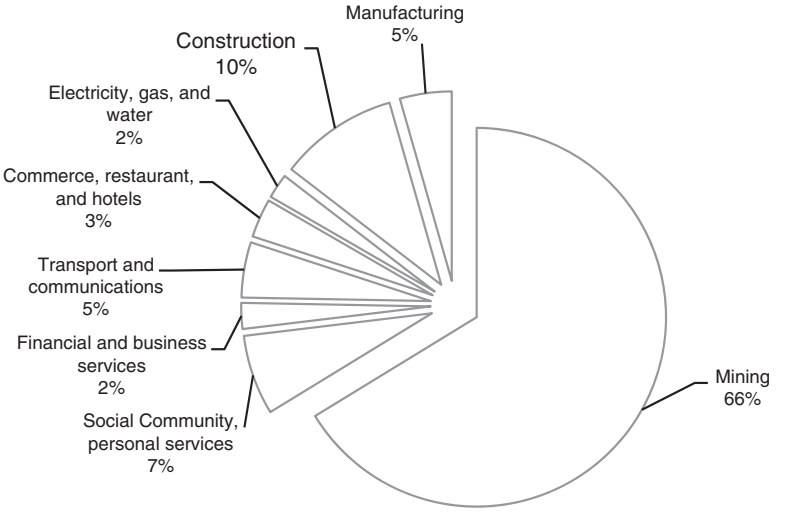

Figure 1.
GDP share by economic activity

Note: The Region of Antofagasta (Chile)
Source: Central Bank of Chile

investment in the region (Aroca, 2001; Lagos and Blanco, 2010), all of them creating a multiplier effect on the society. However, several factors work against the multiplier effects by diluting their positive consequences. First, production is almost completely exported (more than 96 percent of exports are of minerals) showing a low level of downstream integration industry (Bas and Kunc, 2009); that is, no local value is added. Second, only half of the products and services bought by big mining firms is provided nationally (Bas and Kunc, 2009), and in particular only a low percentage is supplied locally (the mining sector imports 76 percent of its purchases; OECD, 2013). Third, there is a reduced percentage of local firms outside of mining (mainly in construction, financial or personal services; Lufin *et al.*, 2012), meaning that the region loses the multiplier effect because consumption is captured by firms that are external to the region.

Regarding the structure of the mining sector, minerals are extracted and exported by few big corporations, which are supplied by a large number of SMEs. Indeed, in the region more than 90 percent of the firms are SMEs, generating more than 75 percent of the existing jobs (Atienza and Romaní, 2009). However, their contribution to the regional GDP is low. Indeed, the region's overall SME activity is low, representing only 3 percent of Chile's SMEs and 2.9 percent of their sales (OECD, 2013). Relationships among firms (among SMEs, and among SMEs and big mining firms) are asymmetrical, depending on the place that a firm occupies in the supply chain (where large mining firms are the hubs) (see Figure 1). Local SMEs attempt to prioritize relationships with large mining firms (Lufin *et al.*, 2012). The local backward linkages of the mining sector are related to financial and business services, electricity, construction and commerce, with reduced technological competencies and medium or low specialization (Lufin *et al.*, 2012; OECD, 2013), which creates dependent contractors alongside the supply chain.

3.2 Sample and data collection

The data presented in this paper is derived from a large study of SMEs, which took place in the region of Antofagasta, Chile. According to the Servicio de Impuestos

Internos, the public organization responsible for collecting taxes in Chile, there were 4,744 SMEs in the region of Antofagasta in 2008. The survey was administrated by a random selection of 3,111 SMEs operating in Antofagasta during 2009. SMEs were defined following the MIDEPLAN (Ministry of Social Development) criteria based on the number of employees; i.e., firms with between 5 and 199 employees. The fieldwork took place during 2009, and the questionnaires were administrated via personal interviews with owners or owner-managers. The sample estimation error was 6 percent and the confidence level was 95 percent. In total, 597 firms were surveyed, which represents a response rate of 19 percent. After removing firms that did not belong to the mining industry and those with missing information, the final number of firms used in this study was 245, with an average age of 14 years, and average of 26 employees. In total, 29 percent of the firms belonged to the manufacturing sector, and most of the firms in the sub-sample of family firms, were in their first generation.

3.3 Measures

3.3.1 Dependent variable. Innovation was the dependent variable in this study. Following the European Community Innovation Survey and Freel (2003), we recognized that innovation efforts could be related to adapting existing products, processes and/or organizational methods or inventing new ones. Four questions asked whether or not the firm had made any effort during the past years regarding internal innovation activities to develop or create new products/ services and processes. All four items were initially codified as 1 = yes, and 0 = no. Then, one binary variable was created to be used in the empirical model: the variable takes the value of 1 when the firm has made at least one effort in any of the above four items, and the value of 0 when firm has not made any effort in all four items.

3.3.2 Independent variables. Three main independent variables were used in this research. Search breadth scale was created based on Laursen and Salter's (2006) research. The questionnaire asked respondents to identify to what extent the firm had used the following seven potential types of search channels for innovation: customers, suppliers, competitors, universities, fairs and exhibitions, public agencies, other international agencies. Each item was measured on a seven-point Likert-type scale anchored between "not used" and "widely used." To determine the underlying factor structure, we carried out an exploratory factorial analysis using a varimax rotation and eigenvalue-one criterion to determine the number of factors. The analysis creates two factors, and all factor loadings fall above a 0.50 cut-off value (see Table I). Factor one was called "related open innovation search strategy." It had three items (customers, suppliers and competitors) and explained 33.20 percent of the total variance. Factor two was called "unrelated open innovation search strategy." It had four items (universities, fairs and exhibitions, public agencies, other international agencies) and explained 35.05 percent of the total variance. The reliability of these scales was high, with a Cronbach's α of 0.80 for related open innovation search strategies and 0.81 for unrelated open innovation search strategies.

Finally, to distinguished family from non-family firms, we considered the parameter "presence of two or more family members working together in the firm." Other research, such as Cruz *et al.* (2012), have used a similar proxy variable to capture the potential differences between family and non-family firms. The family firm variable was coded with a value of 1 if there were two or more family members working together, and a value of 0 otherwise.

Items[a] To what extent has the firm used the following potential types of open innovation search channels for internal innovation activities?	Rotated factor loading	
	Unrelated open innovation search strategy	Related open innovation search strategy
Customers		0.835
Competitors		0.695
Suppliers		0.803
Universities and research institutes	0.567	
Fairs and expositions	0.790	
Public organizations	0.790	
International organizations	0.855	
Reliability	0.81	0.75
Eigenvalue	2.49	2.14
Explained variance (%)	35.56	30.57

Table I. Factorial analysis

Notes: Factor loadings less than 0.45 are omitted. [a]Each item utilized a seven-point Likert-type scale anchored between "not used" and "widely used"

3.3.3 Control variables. Several control variables were used in the analysis. First, because the sector may affect the relationships under study (de Jong and Vermeulen, 2006) we considered a dummy variable indicating whether a firm belonged to the manufacturing (value 1) or to other sectors (value 0) such as service. Second, because firm size may also have an effect on firm innovative behavior (Acs and Audretsch, 1987; Galende and de la Fuente, 2003), we considered the number of full-time employees as a proxy variable of firm size. Third, firm age can be another determinant of innovative behavior (Galende and de la Fuente, 2003); for example, De Massis *et al.* (2014) showed that a firm's efforts to seize new opportunities and innovate, change as the family firm ages. Fourth, to account for human capital in SMEs, which could affect innovation and innovative behavior, we selected two proxy variables: percentage of employees with a university degree and percentage of employees with a technical degree. Finally, the generation of family involvement may alter firm behavior, specifically innovative decision making in family firms (Kellermanns *et al.*, 2012). Moreover, existing research has pointed out the importance of distinguishing first generation family firms from late-generation family firms (Miller *et al.*, 2011). Thus, generation was incorporated as a control variable and was measured as a binary variable taking a value of 1 for the founder generation and a value of 0 for second and subsequent generations.

3.3.4 Analysis. Logistic regression was used to test hypotheses developed in this research because the dependent variable is binary. Logistic regression determines the probability of an internal innovation activity occurring for a given value of predictors or independent variables. Generally speaking, the statistical model estimates the effects caused by an increase in each independent variable on the likelihood that the dependent variable takes the value of 1 (i.e. internal innovation activities) as opposed to a value of 0 (i.e. no innovation activities).

4. Results

The descriptive and correlation analysis are shown in Table II. Multicollinearity is not a problem because none of the correlations appear to be large (Hair *et al.*, 2010). The results of the logistic regressions are presented in Table III. Three models are tested, all

	Mean	SD	1	2	3	4	5	6	7	8	9
1. Internal innovation activities	0.613	0.487	1								
2. Firm age	14.30	10.02	−0.186**	1							
3. Firm size	26.01	35.06	0.059	0.047	1						
4. % of employees with university degree	0.192	0.197	0.093	−0.075	−0.105	1					
5. % of employees with technical degree	0.289	0.252	0.09	0.094	−0.097	−0.066	1				
6. Sector (1 = manufacturing; 0 = other sectors)	0.292	0.455	0.107	−0.077	−0.077	−0.243**	0.028	1			
7. Family firm (1 = family firm; 0 = non-family firm)	0.418	0.494	−0.071	0.066	−0.069	−0.061	0.026	0.088	1		
8. Unrelated open innovation search strategy	0.000	1.000	0.166**	0.002	−0.029	0.263**	0.052	−0.086	−0.124	1	
9. Related open innovation search strategy	0.000	1.000	0.186**	−0.107	0.014	−0.007	−0.029	−0.085	0.008	0.000	1

Notes: $n = 246$. **Correlation is significant at the 0.05 level (two-tailed)

Table II.
Descriptive statistics and correlations

with good goodness-of-fit and significant χ^2 tests (< 0.01 for Models 1 and 3 and < 0.05 for Model 2). For each predictor variable, Table III shows the following: the maximum likelihood estimate (β), the estimates of the robust standard errors of the estimated coefficient, and the marginal effects (discrete change for dummy variables).

Model 1 shows that the family firm coefficient is negative, but not significant, which supports our argument that family firms and non-family SMEs do not differ in their internal innovation activities. This result could be explained by using the configurative approach, which considers that there is no superior unique form of organization. Extending this logic to our results, we can argue that innovation, as an outcome dimension, can be achieved by using different forms of organization – family and non-family firms. Model 2 shows that a related open innovation search strategy is positively and significantly associated with internal innovation activities within the family SME sample. However, Model 3 shows that an unrelated open innovation search strategy is significantly and positively associated with internal innovation activities within the non-family SME sample.

We can explain these results by using the arguments that different behaviors in open innovation search strategies are related to different managerial logic and the level of risk: family-oriented logic (Basco and Pérez Rodríguez, 2011) vs entrepreneurial-oriented logic (Miller *et al.*, 2011). The family logic has to deal with two different systems (family and business systems) each of them imposing some specific characteristics which materialize in the fact that the decision making and the governance and management mechanisms (Carney, 2005) are dominated not only by economic aspects but also by non-economic aspects (Basco, 2010; Brundin *et al.*, 2014). In this specific context, open innovation search strategies (implying an intrinsic economic risk for any firm) for family SMEs may also threaten family goals imposed by family logic. Therefore, to minimize this risk, family SMEs will be more willing to look for new ideas and knowledge close to their core knowledge, which typically leads to incremental changes rather than radical innovations. As our results show, family SMEs focus on related open innovation search actions, which theoretically imply less risk

Table III.
Logistic regression

Predictor variables	Model 1 All firms DV: internal innovation activities Coefficient (robust SE)	Model 1 All firms DV: internal innovation activities Marginal effect (SE)	Model 2 Family firms DV: internal innovation activities Coefficient (robust SE)	Model 2 Family firms DV: internal innovation activities Marginal effect (SE)	Model 3 Non-family firms DV: internal innovation activities Coefficient (robust SE)	Model 3 Non-family firms DV: internal innovation activities Marginal effect (SE)
Firm age	−0.036 (0.014)**	−0.008 (0.003)**	−0.014 (0.023)	−0.003 (0.005)	−0.047 (0.020)**	−0.010 (0.004)**
Firm size	0.006 (0.004)*	0.001 (0.001)	0.012 (0.006)*	0.003 (0.001)*	0.003 (0.005)	0.000 (0.001)
Sector (1 = manufacturing; 0 = other sectors)	0.786 (0.329)**	0.172 (0.067)**	0.857 (3.586)	0.199 (0.115)*	0.805 (0.464)*	0.164 (0.086)*
% of employees with university degree	1.147 (0.819)	0.267 (0.189)	3.586 (1.564)**	0.870 (0.368)**	0.233 (1.010)	0.051 (0.222)
% of employees with technical degree	1.113 (0.531)**	0.259 (0.124)**	−0.076 (0.833)	−0.018 (0.202)	2.081 (0.783)***	0.459 (0.173)***
Generation (1 = founder generation; 0 = other)			1.028 (0.651)*	0.251 (0.152)*		
Unrelated open innovation search strategy	0.366 (0.163)**	0.085 (0.037)**	0.092 (0.278)	0.022 (0.067)	0.407 (0.209)**	0.089 (0.045)**
Related open innovation search strategy	0.431 (0.138)***	0.100 (0.032)***	0.580 (0.235)**	0.140 (0.055)**	0.272 (0.192)	0.060 (0.042)
Family firm (1 = family firm; 0 = non-family firm)	−0.234 (0.284)	−0.054 (0.066)				
Statistical information						
−2 log likelihood	146.623		59.580		80.798	
Likelihood test	28.36***		15.58**		22.29***	
Pseudo-R^2	0.106		0.145		0.132	
No. observations	246		102		143	

Notes: The table reports coefficient and marginal effect at the means (discrete change for dummy variables); robust standard errors or standard error are reported in parentheses; dependent variable 1 = internal innovation activities and 0 = no innovation activities; for all independent dummy variables the reference category is 0 (zero). *,**,***Significance at 0.10, 0.05, 0.01 levels, respectively

than unrelated open innovation. Therefore, our results provide evidence to suggest that family SMEs look for ideas and knowledge similar to the knowledge that already exists in the firm and in its close commercial network (customers, suppliers and competitors), reducing the risks of innovation. Moreover, open innovation search strategies may help the firm to develop differentiation and reputation positions in its close environment, which is traditionally a behavior that family SMEs better exploit (Basco, 2014). In contrast, non-family SMEs, which typically embrace an entrepreneurial logic, are characterized by growth vision, wealth accumulation and superior shareholder returns (Miller *et al.*, 2011). Under this logic, open innovation search strategies are dominated by economic goals and risk-seeking, leading firms to look for ideas beyond their current knowledge, which implies more risk.

Additionally, regarding the control variable, for Model 1 (Table III), we found that firm age, percentage of employees with a technical degree, and sector, are significant predictors for internal innovation activities. That is, while older firms are less likely to be involved in internal innovation activities ($\beta = -0.036$, $p < 0.05$) firms with a higher percentage of employees with technical degrees are more likely to be involved in internal innovation activities ($\beta = 1.113$, $p < 0.05$). Finally, SMEs that are in the manufacturing sector are 17.02 percent more likely than SMEs in other sector to be involved in internal innovation activities. For the family SME sample (Model 2, Table III), firm size, generation, and percentage of employees with university degrees have positive and significant coefficients ($\beta = 0.012$, $p < 0.1$, $\beta = 1.028$, $p < 0.1$, and $\beta = 3.586$, $p < 0.05$, respectively). First generation family SMEs (founder generation) are 25.10 percent more likely than family SMEs in subsequent generations to be involved in internal innovation activities. On the other hand, for the non-family SME sample (Model 3, Table III), the firm age coefficient is negative and significant ($\beta = -0.047$, $p < 0.05$) while coefficients are positive and significant for sector and percentage of employees with technical degree ($\beta = 0.805$, $p < 0.1$ and $\beta = 2.081$, $p < 0.01$, respectively). Non-family manufacturing SMEs are 16.40 percent more likely than non-family SMEs in other sectors to be involved in internal innovation activities.

4.1 Robustness analysis

We performed a set of robustness tests. First, instead of aggregating product and process innovation activities items in one dependent variable, we executed two different logistic regressions by using two dependent variables (i.e. product innovation items, new product, product adaptation; and process innovation items, new process and process adaptation). By using these dependent variables, we repeated our analyses on a full sample. The results are in line with those presented in Model 1 (Table III). That is, family and non-family firms are not significantly different in their product or process innovation activities. Additionally, we repeated our analysis for separate samples (family and non-family SMEs) and the relationship between related and unrelated open innovation search strategies, and internal innovation activities remained similar to our primary findings (Models 2 and 3 in Table III).

We also performed a set of robustness tests to address the potential problem of endogeneity (see Table AI). Specifically, because our research relies on cross-sectional data, it is possible to argue that reverse causality (innovation activities may affect open innovation search strategies) is likely to create bias parameter estimates. To address this problem we used a two-stage procedure with instrumental variables (Wooldridge, 2012) (ivprobit command for STATA). A good instrumental variable is correlated with the possible endogenous variables (in our model related and unrelated open innovation

search strategies) but uncorrelated with the error term. Following Bascle's (2008) recommendation, we selected three instrumental variables that may meet the above condition related to firm strategic actions: communication with customers; effort to increase contact with current and future customers; and monitoring strengths and weaknesses of competitors. We used an over-representation test to statistically analyze whether our instrumental variables were exogenous.

Two IV probit models were used for each sub-sample (family and non-family SME samples). For family SME samples, the related open innovation search strategy variable was instrumented using communication with customer, effort to increase contact with current and future customers, and monitoring strengths and weaknesses of competitors. For the non-family SME sample, the unrelated open innovation search strategy variable was instrumented with the same instrumental variables mentioned above. In the first-stage of a two-stage procedure, we introduced the instrumental variables to obtain the estimated values for our endogenous regressors. The first-stage results are consistent with our intuition, showing that instrumental variables are strong. This is confirmed as the Amemiya-Lee-Newey test of overidentifying restriction is not significant (p-value of 0.806 in the model for the sample of family SMEs and 0.349 in the model for the sample of non-family SMEs). Therefore, we could not reject the null hypothesis that our instrumental variables were endogenous, a necessary condition to continue with our analysis. The Wald exogeneity test (p-value of 0.619 and 0.814 in the model for the sample of family firms and non-family firms, respectively) provided enough evidence that endogeneity is not a real concern and, therefore, we can trust the results of our logistic regression models.

5. Discussion and conclusion

The motivation for this research was framed within the current debate about SME innovation within clusters. It is well known that clusters are not homogenous, and cluster structure and types of SMEs affect firm innovation. Instead of comparing SME innovation in different clusters, we focussed on firm innovative behavior within one specific cluster (i.e. a natural resource cluster). Therefore, considering the heterogeneity of SMEs, the aim of this research was to better understand the differences in innovative behavior between family and non-family SMEs within a natural resource-based cluster. Using a unique sample of SME firms from the Region of Antofagasta (Chile) and applying a logistic regression analysis, we found that family and non-family SMEs do not significantly differ in their internal innovation activities to develop or create new products, services and/or processes. However, what is it that differentiates family SMEs from non-family ones is their open innovation search strategies. That is, their innovation behaviors to find new ideas to develop or create new products, services and processes. Our findings suggest that family SMEs search for ideas in a related environment, focussing on customers, suppliers and competitors, while non-family SMEs look for ideas in an unrelated environment such as universities, international agencies and public institutions, among others. This is because being engaged in internal innovation activities has different roots in family and non-family SMEs; specifically because of the incentives, motivations and goals that guide each type of SME are different.

5.1 Contribution to theory

This research contributes to family business, innovation and cluster literature. First, we address the call to integrate family business and innovation literature (De Massis *et al.*, 2013) and the call for more research considering open innovation in the context of SMEs

(West *et al.*, 2006). In this sense, we extended prior work (Classen *et al.*, 2012) by identifying the differences in open innovation search strategies between family and non-family SMEs. Our results show that internal innovation activities are not an exclusive behavior of entrepreneurs, and family firms are also able to be engaged in innovative behaviors. However, we found family firms to be more conservative in their ways of searching for new knowledge and ideas to be applied to their internal innovative actives than non-family firms. This result challenges those arguments that polarized the debate about the dark or bright side of family firms by showing that family firms have different innovative behaviors than non-family firms. This is supported by the theoretical position of the behavioral theory of the firm (Cyert and March, 1963) which predicts that incentives and objectives of the main stakeholders determine firm behavior.

Second, we address the call to further investigate family SMEs and innovation in developing countries (Bas *et al.*, 2008). Specifically, our result shows, in line with Stough *et al.* (2015), that family SMEs in developing countries may also act as a lively player for regional development. While entrepreneurship has been a long-debated topic in the economic growth literature and in regional development studies, family firms and their role in the economy have received less attention (Basco, 2015). In line with Block and Spiegel (2013), we highlight that family firms are also able to keep entrepreneurial attitudes within the geographical space. In this sense, this research also offers new evidence about SMEs in one specific type of cluster: the hub and spoke cluster (Markusen, 1996). This type of cluster has been criticized for its limitations on development and the creation of knowledge spillovers (Bas and Kunc, 2009) because of its hierarchical and rigid productive structure. Even though natural resource-based clusters are not characterized by intensive technological development, we have demonstrated that firms within this environment are able to develop innovative behavior (i.e. open innovation search strategies for new knowledge and ideas), and this could be the basis for policy makers to tailor-specific intervention policies.

5.2 Practical implications

This research contributes to the current debate about whether natural resource-based clusters foster or hinder firm innovation. Natural resource-based clusters are socially and economically important in Latin American countries such as Chile (OECD, 2013) and their effects must be reflected in the competitive structure of local firms through their innovative and entrepreneurial behavior. However, empirical evidence has shown that natural resource-based clusters have a limited effect on local firm innovation (Arias *et al.*, 2014; Bas and Kunc, 2009). Being stuck in a natural resource-based economy may carry a risk of relying on artificial development, which is based on a favorable scenario highly dependent on international demand and the prices of natural resources, such as the price of copper in Chile. Indeed, this can guide the economy to a "Dutch" disease, undermining the development of non-tradable resources (OECD, 2013). Therefore, the challenge for Latin American countries is to catch up with the knowledge/entrepreneurial economy through local actors. The fact that there are different SMEs (with and without family involvement), the effect of clusters on firm innovation is not always the same. Our results provide evidence that the main strategy used by family SMEs, unlike non-family SMEs belonging to the same cluster, is to search for ideas in their close network. This action carries lower risks because firms are looking for new ideas and knowledge close to their core knowledge, which typically leads to incremental change rather than radical innovation. This attitude fits the incentive system behind family firms – that decisions should not jeopardize

socioemotional wealth and should support the family firm's identity, which is built around the sense of belonging to the local territory where it is socio-culturally embedded. Indeed, the commitment of family firms with their future (long-term orientation) makes it possible for them to boost their own behavior with an innovative posture.

The OECD suggests that developing "a sophisticated and local innovation infrastructure serving the need of different types of SMEs" (OECD, 2013) promotes a large network among actors. Understanding the innovative posture of firms within natural resource-based clusters may help develop better policies to enhance firm innovation and indirectly have a positive effect on local and regional development. In this sense, our findings have practical implications as they can serve as background for policy makers to tailor innovation policies that foster regional growth and development by considering family involvement as an important antecedent of firm innovation, and distinguishing different types of firms that dominate the regional productive structure. This research shows that the likelihood of investment in innovation activities increases when family firms search for ideas and knowledge in a related network; such relationships may foster incremental innovation. We found that family firms are less likely to search for ideas beyond their closest relationships (trust network circle). In this sense, public policies have to promote action to improve the relationship between family firms and their unrelated networks (universities, research institutes and public institutions) in order to help family firms reduce uncertainty. One important aim for public policies may be to encourage family firms to go beyond their closest relationships in searching for ideas, and attempt to stimulate relationships, which can add new and different knowledge to SMEs.

5.3 Limitations and future research directions

Aside from its contributions, our study has several limitations, which not only represent the boundaries of its insights, but also provide opportunities for future research aimed at extending our knowledge about family firms, innovation and clusters. First, our independent variable is binary, showing whether or not the firm has been engaged in internal actions to develop new, or to improve existing, products, services and/or processes. Future studies should improve the way in which we measured what type of efforts SME firms make to innovate. Unlike research into large firms, where it is possible to account for innovation by using investments in R&D or patents (objectives measures), to identify innovative behavior in SMEs is more complicated because the effort can come from different sources, which are not explicitly recorded or reported; for example, the time used by employees/owner-managers in developing new ideas. In relation to the above comment, another important dependent variable that should be incorporated into this line of research is innovation performance in order to better understand the impact of open innovation search strategies on a firm's performance.

Second, we found that family and non-family firms rely on different open innovation search strategies, and we advanced theoretical arguments showing that this distinctive behavior is due to differences in the logics/goals of both types of firm. We assumed that family involvement imposes specific logic on firms because of economic and non-economic goals, but we would welcome future research efforts to measure the real effect of economic and non-economic goals on open innovation search strategies. Third, this study was carried out in one specific context – a hub and spoke cluster – where the main activity is the extraction of natural resources. It would be interesting to extend this research to other natural resources-based clusters that already exist in Chile

and in Latin America, such as oil extraction and agriculture, among others. Indeed, business and economic agglomerations around different types of natural resources may have different effects on the innovation and innovative behavior of family and non-family firms.

Notes

1. A natural resource-intensive economy is defined as an economy in which natural resources account for more than 10 percent of gross domestic product (GDP) and 40 percent of export (OECD, 2013).
2. Arias *et al.* (2014) conclude that degree of sectorial concentration in the region of Antofagasta (Hirschman-Herfindahl coefficient) is the highest in Chile.

References

Acs, Z.J. and Audretsch, D.B. (1987), "Innovation, market structure, and firm size", *The Review of Economics and Statistics*, Vol. 69 No. 4, pp. 567-574.

Arias, M., Atienza, M. and Cademartori, J. (2014), "Large mining enterprises and regional development in Chile: between the enclave and cluster", *Journal of Economic Geography*, Vol. 14 No. 1, pp. 73-95.

Aroca, P. (2001), "Impacts and development in local economies based on mining: the case of the Chilean II region", *Resources Policy*, Vol. 27 No. 2, pp. 119-134.

Atienza, M. and Romaní, G. (2009), "La Pyme en Chile", in Atienza, M. (Ed.), *La Evolución de la Pyme de la Región de Antofagasta. Hacia una demografía del tejido productivo local*, Ediciones Universitarias Universidad Católica del Norte, Antofagasta, pp. 29-42.

Audretsch, D.B. (1998), "Agglomeration and the location of innovative activity", *Oxford Review of Economic Policy*, Vol. 14 No. 2, pp. 18-29.

Bas, T.G., Amorós, J.E. and Kunc, M.H. (2008), "Innovation, entrepreneurship and cluster in latin America natural resource – implication and future challenges", *Journal of Technology Management & Innovation*, Vol. 3 No. 4, pp. 52-65.

Bas, T.G. and Kunc, M.H. (2009), "National systems of innovations and natural resources clusters: evidence from copper mining industry patents", *European Planning Studies*, Vol. 17 No. 12, pp. 1861-1879.

Bascle, G. (2008), "Controlling for endogeneity with instrumental variables in strategic management research", *Strategic Organization*, Vol. 6 No. 3, pp. 285-327.

Basco, R. (2010), "Tipo de orientación y prácticas de dirección y gobierno. Un estudio aplicado a las empresas familiares españolas", *Revista Europea de Dirección y Economía de la Empresa*, Vol. 19 No. 2, pp. 129-144.

Basco, R. (2014), "Exploring the influence of the family upon firm performance: does strategic behaviour matter?", *International Small Business Journal*, Vol. 32 No. 8, pp. 967-995.

Basco, R. (2015), "Family business and regional development. A theoretical model of regional familiness", *Journal of Family Business Strategy*, Vol. 6 No. 4, pp. 259-271.

Basco, R. and Pérez Rodriguez, M.J. (2009), "Studying the family enterprise holistically evidence for integrated family and business systems", *Family Business Review*, Vol. 22 No. 1, pp. 82-95.

Basco, R. and Pérez Rodríguez, M.J. (2011), "Ideal types of family business management: horizontal fit between family and business decisions and the relationship with family business performance", *Journal of Family Business Strategy*, Vol. 2 No. 3, pp. 151-165.

Beaudry, C. and Breschi, S. (2003), "Are firms in clusters really more innovative?", *Economics of Innovation and New Technology*, Vol. 12 No. 4, pp. 325-342.

Becattini, G. (2002), "From Marshall's to the Italian 'industrial districts'. A brief critical reconstruction", in Curzio, A. and Fortis, M. (Eds), *Complexity and Industrial Clusters*, Physica-Verlag HD, pp. 83-106.

Becattini, G. (2004), *Industrial Districts: A New Approach to Industrial Change*, Edward Elgar, Cheltenham.

Block, J.H. and Spiegel, F. (2013), "Family firm density and regional innovation output: an exploratory analysis", *Journal of Family Business Strategy*, Vol. 4 No. 4, pp. 270-280.

Brown, S.L. and Eisenhardt, K.M. (1995), "Product development: past research, present findings, and future directions", *The Academy of Management Review*, Vol. 20 No. 2, pp. 343-378.

Brundin, E., Samuelsson, E.F. and Melin, L. (2014), "Family ownership logic: framing the core characteristics of family businesses", *Journal of Management & Organization*, Vol. 20 No. 1, pp. 6-37.

Buitelaar, R. (2001), *Aglomeraciones Mineras y Desarrollo Local en América Latina*, CEPAL/IDRC/ Alfaomega, Bogotá.

Carney, M. (2005), "Corporate governance and competitive advantage in family-controlled firms", *Entrepreneurship Theory and Practice*, Vol. 29 No. 3, pp. 249-265.

CEPAL (2009), *Economía y territorio en América Latina y el Caribe: Desigualdades y políticas*, Naciones Unidas, Santiago de Chile.

Chesbrough, H. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston, MA.

Chrisman, J.J. and Patel, P.C. (2012), "Variation in R&D investment of family and nonfamily firms: behavioral agency and myopic loss avesion perspective", *Academy of Management Journal*, Vol. 55 No. 4, pp. 976-997.

Classen, N., Van Gils, A., Bammens, Y. and Carree, M. (2012), "Accessing resources from innovation partners: the search breadth of family SMEs", *Journal of Small Business Management*, Vol. 50 No. 2, pp. 191-215.

COCHILCO (2009), *Yearbook: Copper and Other Mineral Statistics*, Comisión Chilena del Cobre, Gobierno de Chile, Santiago de Chile.

Cruz, C., Justo, R. and De Castro, J.O. (2012), "Does family employment enhance MSEs performance?: integrating socioemotional wealth and family embeddedness perspectives", *Journal of Business Venturing*, Vol. 27 No. 1, pp. 62-76.

Culverwell, M. (2001), "Desarrollo de proveedores en la Región de Antofagasta", in Buitelaar, R. (Ed.), *Mineras y desarrollo local en América Latina*, CEPAL – Alfaomega, Bogotá, pp. 75-105.

Cyert, R.M. and March, J.G. (1963), *A Behavioural Theory of the Firm*, Prentice-Hall, NJ.

de Jong, J.P.J. and Vermeulen, P.A.M. (2006), "Determinants of product innovation in small firms: a comparison across industries", *International Small Business Journal*, Vol. 24 No. 6, pp. 587-609.

De Massis, A., Frattini, F. and Lichtenthaler, U. (2013), "Research on technological innovation in family firms: present debates and future directions", *Family Business Review*, Vol. 26 No. 1, pp. 10-31.

De Massis, A., Chirico, F., Kotlar, J. and Naldi, L. (2014), "The temporal evolution of proactiveness in family firms: the horizontal s-curve hypothesis", *Family Business Review*, Vol. 27 No. 1, pp. 35-50.

Delgado, M., Porter, M.E. and Stern, S. (2010), "Clusters and entrepreneurship", *Journal of Economic Geography*, Vol. 10 No. 4, pp. 495-518.

Duberley, J.P. and Burns, N.D. (1993), "Organizational configurations: implications for the human resource/personnel management debate", *Personnel Review*, Vol. 22 No. 4, pp. 26-34.

Fiss, P.C. (2007), "A set-theoretic approach to organizational configurations", *Academy of Management Review*, Vol. 32 No. 4, pp. 1180-1198.

Freel, M.S. (2003), "Sectoral patterns of small firm innovation, networking and proximity", *Research Policy*, Vol. 32 No. 5, pp. 751-770.

Galende, J. and de la Fuente, J.M. (2003), "Internal factors determining a firm's innovative behaviour", *Research Policy*, Vol. 32 No. 5, pp. 715-736.

Gomez-Mejia, L.R., Makri, M. and Kintana, M.L. (2010), "Diversification decisions in family-controlled firms", *Journal of Management Studies*, Vol. 47 No. 2, pp. 223-252.

Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E. (2010), *Multivariate Data Analysis*, 7th ed., Pearson, Upper Saddle River, NJ.

Huizingh, E.K.R.E. (2011), "Open innovation: state of the art and future perspectives", *Technovation*, Vol. 31 No. 1, pp. 2-9.

Johannisson, B., Caffarena, L.C., Cruz, A.F.D., Epure, M., Pérez, E.H., Kapelko, M., Murdock, K., Nanka-Bruce, D., Olejárová, M., Sanchez Lopez, A., Sekki, A., Stoian, M., Tötterman, H. and Bisignano, A. (2007), "Interstanding the industrial district: contrasting conceptual images as a road to insight", *Entrepreneurship & Regional Development*, Vol. 19 No. 6, pp. 527-554.

Katila, R. and Ahuja, G. (2002), "Something old, something new: a longitudinal study of search behavior and new product introduction", *The Academy of Management Journal*, Vol. 45 No. 6, pp. 1183-1194.

Kellermanns, F., Eddleston, K., Sarathy, R. and Murphy, F. (2012), "Innovativeness in family firms: a family influence perspective", *Small Business Economics*, Vol. 38 No. 1, pp. 85-101.

Kim, Y., Song, K. and Lee, J. (1993), "Determinants of technological innovation in the small firms of Korea", *R&D Management*, Vol. 23 No. 3, pp. 215-226.

Koellinger, P. (2008), "Why are some entrepreneurs more innovative than others?", *Small Business Economics*, Vol. 31 No. 1, pp. 21-37.

Lagos, G. and Blanco, E. (2010), "Mining and development in the region of Antofagasta", *Resources Policy*, Vol. 35 No. 4, pp. 265-275.

Laursen, K. and Salter, A. (2006), "Open for innovation: the role of openness in explaining innovation performance among UK manufacturing firms", *Strategic Management Journal*, Vol. 27 No. 2, pp. 131-150.

Li, J. and Geng, S. (2011), "Industrial clusters, shared resources and firm performance", *Entrepreneurship & Regional Development*, Vol. 24 Nos 5-6, pp. 357-381.

Link, A. and Bozeman, B. (1991), "Innovative behavior in small-sized firms", *Small Business Economics*, Vol. 3 No. 3, pp. 179-184.

Lufin, M., Garrido, N., Atienza, M. and Romaní, G. (2012), "Organización del tejido industrial de la Region de Antofafasta: Una perspectiva de redes aplicadas a las relaciones de cliente-proveedor", in Atienza, M. (Ed.), *La Pyme de la Region de Antofagasta 2005-2009*, Ediciones Universitarias, Antofagasta.

Lumpkin, G.T. and Dess, G.G. (1996), "Enriching the entrepreneurial orientation construct – reply to entrepreneurial orientation or pioneer advantage", *Academy of Management Review*, Vol. 21 No. 3, pp. 605-607.

Markusen, A. (1996), "Sticky places in slippery space: a typology of industrial districts", *Economic Geography*, Vol. 72 No. 3, pp. 293-313.

Marshall, A. (1920), *Principles of Economics*, 8th ed., Mcmillan, London.

Meyer, A.D., Tsui, A.S. and Hinings, C.R. (1993), "Configurational approaches to organizational analysis", *The Academy of Management Journal*, Vol. 36 No. 6, pp. 1175-1195.

Miller, D., Le Breton-Miller, I. and Lester, R.H. (2011), "Family and lone founder ownership and strategic behaviour: social context, identity, and institutional logics", *Journal of Management Studies*, Vol. 48 No. 1, pp. 1-25.

Molina-Morales, F.X. and Giuliani, E. (2012), "The cluster model: whether and what developing countries should learn from advanced countries", *International Journal of Transitions and Innovation Systems*, Vol. 3 No. 4, pp. 219-232.

OECD (2013), *OECD Territorial Reviews*, OECD publishing, Antofagasta.

Parr, J.B. (2002), "Missing elements in the analysis of agglomeration economies", *International Regional Science Review*, Vol. 25 No. 2, pp. 151-168.

Pérez Rodríguez, M.J. and Basco, R. (2011), "The cognitive legitimacy of the family business field", *Family Business Review*, Vol. 24 No. 4, pp. 322-342.

Pérez Rodriguez, M.J., Basco, R., García-Tenorio Ronda, J., Giménez Sánchez, J. and Sánchez Quirós, I. (2007), *Fundamentos En La Dirección De La Empresa Familiar. Emprendedor, Empresa Y Familia*, Thomson, Madrid.

Piore, M.J. and Sabel, C.F. (1984), *The Second Industrial Divide. Possibilities for Prosperity*, Basic Books.

Porter, M.E. (1998), *On Competition*, Harvard Business School, Boston, MA.

Rocha, H.O. (2004), "Entrepreneurship and development: the role of clusters", *Small Business Economics*, Vol. 23 No. 5, pp. 363-400.

Rosenfeld, S.A. (1997), "Bringing business clusters into the mainstream of economic development", *European Planning Studies*, Vol. 5 No. 1, pp. 3-23.

Sachs, J.D. and Warner, A.M. (2001), "The curse of natural resources", *European Economic Review*, Vol. 45 Nos 4-6, pp. 827-838.

Silvestre, B. dos S. and Dalcol, P.R.T. (2010), "Innovation in natural resource-based industrial clusters: a study of the Brazilian oil and gas sector", *International Journal of Management*, Vol. 27 No. 3, pp. 713-727.

Singh, I. and Evans, J. (2010), "Natural resource-based sustainable development using a cluster approach", in Richards, J. (Ed.), *Mining, Society, and a Sustainable World*, Springer, Berlin and Heidelberg, pp. 183-201.

Stevenson, H.H., Roberts, M.J. and Grousbeck, H.I. (1989), *Business Ventures and the Entrepreneur*, Richard D Irwin Publishing, Homewood, IL.

Stough, R., Welter, F., Block, J., Wennberg, K. and Basco, R. (2015), "Family business and regional science: 'bridging the gap'", *Journal of Family Business Strategy*, Vol. 6 No. 4, pp. 208-218.

Tan, J., Fischer, E., Mitchell, R. and Phan, P. (2009), "At the center of the action: innovation and technology strategy research in the small business setting", *Journal of Small Business Management*, Vol. 47 No. 3, pp. 233-262.

Tether, B.S. (1998), "Small and large firms: sources of unequal innovations?", *Research Policy*, Vol. 27 No. 7, pp. 725-745.

van der Ploeg, F. (2011), "Natural resources: curse or blessing?", *Journal of Economic Literature*, Vol. 49 No. 2, pp. 366-420.

von Schlippe, A. and Jansen, T. (2014), *In Between Family, Ownership, and Organization. How to Govern Paradox(es) in a Business Family*, Witten/Herdecke University, Witten.

Wennberg, K. and Lindqvist, G. (2010), "The effect of clusters on the survival and performance of new firms", *Small Business Economics*, Vol. 34 No. 3, pp. 221-241.

West, J., Vanhaverbeke, W. and Chesbrough, H. (2006), "Open innovation: a research agenda", in Chesbrough, H., Vanhaverbeke, W. and West, J. (Eds), *Open Innovation: Researching a New Paradigm*, Oxford University Press, Oxford, pp. 285-307.

Wooldridge, J.M. (2012), *Introductory Econometrics. A Modern Approach*, 5th ed., Cengage Learning, Mason, IA.

Appendix

Predictor variables	Model 1 Family firms DV: internal innovation activities Coefficient (SE)	Model 2 Non-family firms DV: internal innovation activities Coefficient (SE)
Firm age	−0.010 (0.015)	−0.027 (0.119)**
Firm size	0.007 (0.005)	0.001 (0.003)
Sector (1 = manufacturing; 0 = other sectors)	0.515 (0.300)	0.496 (0.294)*
% of employees with university degree	2.119 (0.893)**	−0.204 (0.692)
% of employees with technical degree	−0.022 (0.593)	1.310 (0.561)**
Generation (1 = founder generation; 0 = other)	0.576 (0.437)	
Unrelated open innovation search strategy	0.068 (0.692)	0.315 (0.290)
Related open innovation search strategy	0.485 (0.335)	0.263 (0.335)
Statistical information		
Wald test of exogeneity	0.25	0.05
p-value of the Wald test of exogeneity	0.619	0.814
Test of overidentifying		
Amemiya-Lee-Newey minimum χ^2 statistic	0.429	2.104
p-value of the Amemyia-Lee-Newey minimum distance χ^2 statistic	0.806	0.349
No. observations	102	143

Notes: IV probit model is used; in Model 1 related open innovation search strategy variable is instrumented using communication with customer, effort to increase contact with current and future customers and monitoring strengths and weaknesses of competitors; In Model 2 unrelated open innovation search strategy variable is instrumented using communication with customer, effort to increase contact with current and future customers, and monitoring strengths and weaknesses of competitors; standard errors are reported in parentheses; dependent variable 1 = internal innovation activities and 0 = no innovation activities. *,**,***Significant at 0.10, 0.05, 0.01 levels, respectively

Table AI.
IV probit regression

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