



Does size still matter? How micro firms and SMEs vary in network learning

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ABSTRACT

How can geographically constrained Micro firms and SMEs in emerging markets upgrade their products? How might firm size affect the benefits from accessing diverse knowledge and from participating in different learning relationships? Although access to diverse knowledge can be vital to innovation, smaller firms have a limited understanding about which new knowledge is most relevant to their context and how they may convert their capabilities into a more innovative organization. These latter aspects, we argue, come largely from relationships embedded in interfirm networks and certain types of non-market institutions that act as knowledge bridges and provide tutelage. Such institutions appear to benefit Micro firms in processing diverse knowledge. In contrast, product upgrading for SMEs improves more from their interfirm networks, but these networks do not aid with managing diverse knowledge. We argue that differences in complementary capacities explain these variations. We use unique survey data from the Argentine wine industry.

KEYWORDS

Public private institutions; economic development; innovation; small firms; networks

Over the past twenty years, scholars of innovation and development have increasingly debated how emerging market firms might benefit from cluster formation and from increased participation in global value chains (GVCs) as direct exporters or suppliers to global buyers (Crespi, Fernandez-Arias & Stein, 2014; Mesquita and Lazzarini 2008; Alcacer and Oxley 2014). The basic notion has been that the combination of local inter-organizational networks and GVC participation can provide local firms with the relationships that facilitate knowledge sharing and access to diverse, advanced knowledge about standards and products. (Schmitz 2004; Giuliani, Pietrobelli, and Rabellotti 2005) Firms in turn would be more likely to compete in international markets by upgrading their products – creating new, higher value added products. This debate is all the more salient for emerging market Micro firms and small and medium size firms (SMEs), which represent the vast majority of firms, output, and employment. For instance, in Latin America, these firms accounts for about 65% of manufacturing output and over 80% of employment. (IDB 2014) Yet, despite policies to liberalize trade and investment and promote cluster formation, these firms have seen little gains in productivity, income growth, and innovation. In turn, scholars and policy- makers have

begun to rethink the learning mechanisms and policies that can improve the upgrading capabilities of Micro firms and SMEs and help them overcome legacies of weak social capital and institutions. (ECLAC 2014, OECD-ECLAC 2013)

This article takes up this call by examining how geographically constrained Micro firms and SMEs¹ might in general need not only access to diverse knowledge but also the tutelage to use it and how their capacity differences can lead to variance of the types of intermediary organizations and institutions that facilitate learning and upgrading. A key assumption in the work on innovation and development is that access to diverse knowledge, for resolving technical and market uncertainties, is critical for firms to participate in GVCs and adapt their products and processes quickly. (Fleming 2001, Levinthal & March 1993) However, this view may underestimate how access to diverse knowledge can overload the capacities of smaller firms, which also may lack the learning relationships that can help them to apply it. That is, smaller firms have limited understanding about which new knowledge on processes and products is most relevant to their context and how they may process it in order to convert their capabilities toward a more innovative organization. (McDermott & Pietrobelli 2017, Perez-Aleman 2011) These latter aspects, we argue, come largely from particular relationships embedded in interfirm networks and certain types of non-market institutions that act as knowledge bridges and provide tutelage for firms to absorb more effectively new knowledge. In particular, our evidence suggests that such institutions can benefit Micro firms in processing diverse knowledge. In contrast, SMEs appear to benefit more from their interfirm networks, but not in helping process knowledge diversity.

We seek to make two contributions to the debates on micro-geography and innovation that focus on decomposing the relationships and the actors in a region. The first is clarifying the composition of embeddedness, particularly the different roles that certain types of inter-organizational networks and institutions play in helping smaller, capacity constrained firms to learn from and to access diverse knowledge resources. (Lin 2001, Powell et al. 2012) The very ties and organizations that can facilitate inter-firm trust and sharing in a particular district (Saxenian 1994, Lorenzen and Mudambi 2012) can also insulate member firms from outside, new relationships, and knowledge. (Uzzi 1996, Camuffo and Grandinetti 2011, Locke 1995) Moreover, the advanced firms and R&D organizations that can provide access to diverse, pioneering knowledge may be unable or unwilling to nurture and transform a broad base of firms with backward capabilities and technologies (Baum & Oliver 1991, Kogut and Zander 1993; Corredoira and McDermott 2014).

In turn, we build on growing literatures that increasingly emphasize the different types of organizations (e.g., firms, banks, schools, associations) as well as different government support institutions (GSIs), such as training and extension centers, subsidized R&D institutes) can help smaller firms overcome these limitations. (Laursen, Masciarelli, and Prencipe 2012, Powell et al. 2012) In doing so, we combine recent work in economic sociology and comparative capitalism, which views configurations of

¹The precise cut off points between Micro firms and SMEs vary often in emerging market countries. Micro firms range from 10 to 20 employees, where SMEs are below 200–250 employees. Following the standards from development agencies and as we discuss later, we use a revenue cut off, which is more reliable due to some seasonal and informal employment common in our industry and the region. Micro firms have annual revenues under \$350,000. (Ferraro and Stumpo 2010; Henriquez 2009; ECLAC 2014).

networks and institutions as resources for strategic coordination, a view that allows one to identify a broader ranges of organizational forms (often non-market) that can shape firm capabilities (Deeg & Jackson 2008, Dutt et al. 2012, Mair et al, 2012, Perez-Aleman 2011).

The second contribution is trying to clarify how the differences in resources and organizational capacities between Micro firms and SMEs affect their abilities to benefit from the different social and institutional resources available to firm in a region. Although research reveals that Micro firms can account for as much as 60% of private sector employment in places like Latin American and that they face stepwise barriers to productivity improvements and growing into SMEs, there is little systematic research on why Micro firms and SMEs may vary in their upgrading capabilities. (Audretsch 1995; Heshmati 2001; Liedholm & Mead 1999; Henriquez 2009; Ferraro and Stumpo 2010; Sohns and Revilla Diez 2018). Building on the above arguments and recent anecdotal evidence, we suggest that the capacity constraints on Micro firms lead them to learn more effectively via certain GSIs than from their own inter-firm networks. SMEs, in contrast, may have the capacities to implement the knowledge gained from a larger set of strong interfirm network ties, but they may be barriers to taking advantage of direct access to diverse knowledge.

We advance our arguments by analyzing the transformation of the Argentine wine sector in the Cuyo region, namely the two neighboring, dominant winemaking provinces of Mendoza and San Juan. Despite its long history of weak institutions, technology and product quality, the Argentine wine sector witnessed a dramatic turnaround in the 1990s and accounts for almost 5 percent of the over \$20 billion global wine market. (Artopoulos et al 2011) Mendoza led this change, pioneering a new constellation of institutions and inter-firm networks that appears to have facilitated wide spread product upgrading, and later extended to San Juan. At the same time, the industry is dominated by Micro firms and SMEs. In turn, this setting allows us to investigate how the different types of institutional and network mechanisms can help these firms differently to access a variety of knowledge resources and learn.

Section I discusses how different configurations of networks and institutions can facilitate or impede the ability of geographically constrained Micro firms and SMEs in emerging markets to access diverse knowledge resources and learn how to absorb it to improve their product upgrading capabilities. Section II offers a brief overview of the barriers and institutional innovations in the Cuyo wine industry. Section III describes our methods and unique cross-sectional data set based on our 2004–05 field survey of wineries in the two provinces that allows us to differentiate firm size, proxy a focal firm's direct and indirect access to diverse knowledge, and decompose a focal firm's network into different types of organizations. Most research on emerging markets focuses on single cases, fails to capture firm-level upgrading, and relies on inter-personal relationships (Giuliani, Pietrobelli, and Rabellotti 2005; Giuliani and Bell 2005). Sections IV and V present a discussion of the results.

1. Product upgrading, networks, institutions and firm size

Following Schumpeter (1934), the development and management literatures view product upgrading as a particular form of innovation, in which firms focus on creating new products to improve quality and value-added by developing capabilities to

experiment incrementally with new combinations of material, human, and knowledge inputs (Giuliani, Pietrobelli, and Rabelotti 2005; Kumaraswamy et al. 2012). Such capabilities are indicative of the firm's ability to adapt and compete in subsequent periods (Moran and Ghoshal 1999; Zollo & Winter, 2002).

Research on networks and open innovation has argued that a firm's access to larger amount of and more varied information will lead to increased levels of innovation (Chesbrough, 2012, Fleming 2001; Rosenkopf and Nerkar 2001). This can occur when the firm has greater network centrality (more ties to other organizations) or ties to a greater variety of organizations located in different networks or geographical locations (Ahuja 2000; Burt 2005). These views are echoed in the work on emerging markets. By exporting or supplying GVCs and MNC subsidiaries, local firms are exposed to a greater variety of new, international product and process standards and techniques that should translate into product upgrading (Alcacer and Oxley 2014, Gereffi et al. 2005, Giuliani & Bell 2005).

However, the underlying assumption is that firms already possess procedural knowledge (know how) that will facilitate the learning from the discrete knowledge that the firms access. Innovation scholars have noted the limits to diverse knowledge, focusing on difficulties to absorb different levels of complex knowledge through inter-firm networks (Fleming, Mingo, and Chen 2007; Lane and Lubatkin 1998; Sorenson, Rivkin, and Fleming 2006). These concerns are amplified in emerging markets, which are dominated by Micro firms and SMEs that are far from the technological frontier and lack key organizational capabilities to be able to take advantage of new types of knowledge even if they have access to it. Adaptation of new product or process standards demands combining them with complementary inputs, like skills and know-how, which are not readily available (Perez-Aleman 2011). Instead, local firms need access to applied, experiential knowledge that offers practical examples and tutelage of how new knowledge can be adapted to the local context and how existing capabilities can be transformed to integrate effectively certain types of new knowledge (Pietrobelli and Rabelotti 2011; Corredoira and McDermott 2014; White 2002).

In this view, the challenge for upgrading in smaller firms in emerging markets is combining their access to diverse knowledge with relationships that offer the tutelage to integrate and take advantage of such knowledge. We now consider how the heterogeneity of a firm's network and then firm size might impact its ability to meet this challenge.

2. Networks and institutions helping firms to learn from diverse experiential knowledge

The literature on networks and knowledge access is usually restricted to ties among firms or individuals. (Chesbrough, 2012, Dyer and Singh 1998) That logic would point to the key knowledge sources coming from ties to global buyers or MNCs and local firms. These different types of 'alters', however, present problems to learning that are mirror images of one another. On the one hand, researchers of GVCs and MNC suppliers note that even with the most codified products and processes, practice transfer and implementation into a new context is highly complex and demands rather specific

learning relationships and capabilities (Laursen, Masciarelli, and Prencipe 2012; Camuffo and Grandinetti 2011). These relationships are not necessarily available to a broad base of firms trying to learn from and supply MNCs. Collaboration with advanced firms in sophisticated supply chains – from advanced manufacturing to fresh produce – demands that suppliers maintain a minimum level of capabilities or absorptive capacities. (MacDuffie and Helper 2006; Perez-Aleman 2011) In the context of an emerging market, MNC subsidiaries have a limited interest in guiding such detailed, continuous training of weak firms, preferring to work with a select few that made significant *ex ante* investments in their own systems (Giuliani, Pietrobelli, and Rabellotti 2005; Gereffi et al., 2005; Kumaraswamy et al. 2012; Corredoira and McDermott 2014).

On the other hand, although other local firms and their attendant local non-market organizations (like local trade associations) may have the experiential knowledge and historical relationships for sharing it, they may be over embedded in ties that limit access to diverse knowledge (Locke, 1995; McEvily and Zaheer 1999; Safford, 2009; Uzzi, 1996). The collaborative ties and production traditions promoted by the firms and institutions of a particular district or region can just as easily restrict access or blind firms to new knowledge and contacts. By drawing from too small and potentially homogenous pool of knowledge, even resource rich local associations might not be able to sustain firm level upgrading. Firms may be embedded in dense collaborative networks; however lacking more encompassing institutions, they may live in broader balkanized regions, in which each smaller clusters remain relatively isolated from one another, restricting the development of new conduits of knowledge.

An alternative solution that can combine the strengths of these different channels while reducing their limitations comes from work on learning communities (Breznitz 2005). This work integrates research on networks and comparative capitalism as it considers how different types of inter-organizational relationships and institutional configurations can enhance the flow and implementation of certain knowledge to a broad base of firms (Jackson & Deeg, 2008; Granovetter, 2002; Padgett & Powell 2012). Researchers emphasize the relationships and collective resources that provide low cost access to technology application and extension services, such as in metrology, standards, testing and quality (Pietrobelli and Rabellotti 2011). These types of services draw on knowledge of production systems through practical examples within the resource and organizational legacies at hand. It seeks to recombine old habits and practices into new process capabilities that can meet needed performance standards (Perez-Aleman 2011). Practical experiential knowledge will likely be embedded in network firms that are engaged constantly in improving their organizational capabilities. A focal firm would likely gain more from strong relationships with peer or lead firms instead of other market actors (banks, consultants) as the former would possess this tacit, somewhat complex knowledge. (Breznitz 2005; Laursen, Masciarelli, and Prencipe 2012) The emergence of markets also depends on the co-development of firm capabilities and the public or non-market institutions facilitating such services. This view stresses that the relevant support institutions in emerging markets may not have the same characteristics as western models but arise with the old institutional fragments of the past system (Dutt et al., 2012; Mair et al., 2012).

What might then be the main traits of such government support institutions or GSIs? This literature suggests two traits that both are grounded in stake-holder groups participating in non-market institutions, hence public-private on paper and in practice (PPIs).² Following Breznitz (2005), the first trait is that the PPIs provide reliable channels for collective learning and knowledge diffusion as well as create forums and programs that infuse the system with trust and cooperation. Recent research in manufacturing and agriculture shows how non-market institutions, though lacking in substantial material resources, facilitate upgrading of firm capabilities (especially in Micro firms and SMEs) because their services can act as repositories of diverse applied knowledge drawn from the local contexts, provide mentoring relationships, and foster collaborative inter-firm relationships (Lengyel & Bottino, 2011; Corredoira and McDermott 2014; Perez-Aleman 2011; Schrank 2011). In a highly resource constrained and volatile environment, like Latin America, however, these functional traits would likely not be found in existing schools, associations, and typical GSIs because of their historical lack of funding and lack of direct professional and governance links with the relevant industries (Baruj et al, 2009, Sutz 2000).

Instead, one would want to identify new GSIs (i.e., PPIs) that are more embedded with relevant stake- holder groups and recombine the knowledge and materials resources of the participating public and private actors (Mair et al. 2012)).

A second trait would be the PPI's bridging or boundary spanning structure that can integrate or combine the knowledge and social ties of the previously balkanized communities. The idea here is that structures and programs can be designed in a variety of ways to help Micro firms and SMEs access a variety of knowledge resources – directly and indirectly. The indirect channel comes from training, R&D, and benchmarking programs that continually draw on and are embedded in a diverse set of localities or inter-firm networks. The direct channel comes from programs and forums that help the firms themselves begin to learn from one another, particularly those from previously isolated producer communities. (McDermott & Pietrobelli 2017, McEvily and Zaheer 1999, Safford 2009, Zuckerman and Sgourev 2006)

3. How micro firms and smes may have different learning needs

Thus far we have argued that emerging market Micro firms and SMEs would lack the capacities to take advantage of direct access to diverse knowledge and in turn need access to organizations and relationships that offer experiential, applied knowledge. We now theorize how Micro firms and SMEs may differ from one another in accessing and learning from these types of knowledge resources. The economics and development literatures are consistent in demonstrating that, when considering smaller firms, size may not be a continuous variable, but rather that Micro firms and SMEs are strategic groups unto themselves, pursuing different innovation approaches and niches as well exhibiting stepwise differences in productivity, revenues, survival rates and growth. (Audretsch 1995; Henriquez 2009; Liedhom and

²Following Breznitz (2005), Thelen (2003) and Mair et al. (2012), GSIs would be any institutions with the government contributing directly to the budget and having a representative in its governance. PPIs are a subset that in their bi-laws require formal board membership from and resource contributions from certain government and non- government actors.

Mead 1999) However, other than some case work, there is little systematic quantitative research examining the innovation and network differences between these two categories. In turn, our theorizing draws on this case work, the research focusing on smaller firms in general, and our above arguments.

Together, this work suggests that Micro firms would be less likely than SMEs to expand and utilize their direct interfirm networks because of the relative lack of organizational capacities and more forceful presence of the owner. Micro firms would lack key complementary assets in capital and human resources for a multi-disciplinary knowledge base that would be vital to nurturing and integrating new knowledge relationships. (Chesbrough 2012; Hutter et al. 2013; van Oostrom & Fernandez-Esquinas 2017) The owner provides rapid, but more narrow strategic direction, preferring to focus on the immediate demands of a few paying customers. (Giuliani, Balland, and Matta 2018; Hutter et al. 2013) In turn, Micro firms would tend to be less likely to pursue inter-firm ties in depth without clear payoff. These tendencies would lead Micro firms to break off weaker ties and not generate new ones for the learning process.

In contrast, SMEs would appear to foster a greater number of and stronger inter-firm relationships. Not only they have a greater number of qualified employees building ties to other firms, but they also have relatively stronger organizational capacities to take the time and learn from the practices and experiments in other firms. (Baumann and Kritikos 2016; van Oostrom and Fernández-Esquinas 2017) However, it is less clear whether the internal capabilities would lead the SMEs to select on and build relationships that help processing diverse knowledge or knowledge that promote execution of a given set of strategies. Relative to Micro firms, SMEs may have size and structure that prefers product upgrading for expanding a set of products but may still be insufficient to process a greater variety of knowledge from its relatively larger and stronger set of ties to other firms. (Breznitz 2005; Giuliani, Balland, and Matta 2018)

The literature argues generally that PPIs or similar institutions offer less endowed firms the variety of knowledge and tutelage that they would otherwise not find in the market or on their own. Its logic would suggest that the effects may be greater for Micro firms than SMEs. First, recent policy research finds that the productivity and innovation gaps between Micro firms and SME in the EU is much narrower than those in Latin America. Researchers attribute this comparative difference to policy initiatives across the EU (especially toward the former communist country members) that are customized to supporting Micro firms – providing similar extension services to those described above and fostering stronger learning communities. (Baumann and Kritikos 2016; Henriquez 2009; Grazzi and Pietrobelli 2016) Second, if the bureaucratic barriers are not high, Micro firms may be more likely to participate in several PPIs because of PPIs' greater efficiency at knowledge transfer when compared to unstructured learning via firm ties. That is, the institutions offer a one-stop shop, with trained personnel to evaluate the needs of the Micro firm and offer ready solutions. (Giuliani, Balland, and Matta 2018; Grazzi and Pietrobelli 2016) Hence, in this logic, the very resources and organizational constraints that might impede Micro firms from utilizing

inter-firm ties can lead them to benefiting from participation in PPIs. For SMEs the literature is less clear. It would appear that SMEs still lack key capacities and thus would benefit from the programs of PPIs.

However, one might also surmise that the very capacities that would enable SMEs to take advantage of inter-firm ties directly might also lead them to forgo the benefits of PPIs. As suggested by the work on organizational rigidities diminishing adaptation (Nelson & Winter 1982), SMEs may have a size that already locks in one type of learning but not another.

4. The challenge of wine upgrading in the Cuyo region of argentina

Argentina is historically one of the largest volume producers of wine in the world, and for decades through the 1980s production focused on low-quality wine and grapes for the domestic market. By the end of the 1990s, the industry had undergone a profound transformation, with wine exports growing from a few million dollars in 1990 to over \$480 million in 2004 (Azziazu & Basualdo, 2003). These gains came especially from consistent advancements in product quality and innovation, including new types of varieties and blends. The vineyards in the Cuyo region significantly increased the varieties of high enological value grapes from 20% of vine surface area in 1990 to about 43% by 2001 (Cetrangolo et al., 2002). Wine quality improved, with 85% of wine exports coming from fine wines sold in sophisticated, competitive markets like the United States and the European Union. For instance, by 2011, Argentina was the fourth largest exporter in value terms to the United States, surpassing Chile. (INV 2015)

Mendoza became the leader of this transformation, charting a path of innovation in the 1990s that was remarkably different from both its own past and its neighbor, San Juan, despite their common soil, climate and unproductive histories (Cetrangolo et al., 2002; Ruiz & Vila, 2003). Mendoza and San Juan (together the Cuyo region) account for roughly 60% and 30%, respectively of the country's wine production. But the former's share of wine exports is over 90% and the latter's only 6%. Improvements in product quality and vineyard conversion were both more widespread and advanced among firms in Mendoza than those in San Juan by the late 1990s. (McDermott 2007)

Given our arguments above about the difficulties Micro firms and SMEs may have in accessing diverse experiential knowledge and the leadership of Mendoza in the transformation, the context of the Cuyo region is apt for two reasons. First, the region and industry is historically suffered from a fragmented or balkanized structure of mainly Micro firms and SMEs with limited resources and weak institutions. McDermott (2007) revealed in detail how the two provinces had the same political parties and regulatory laws, similar natural endowments as well as a similar socio-economic structure, such as their indicators of associationalism and business-government relationships through the 1980s. Second, a critical turning point came with Mendoza's gradual but steady creation of PPIs alongside of old GSIs that appeared to offer firms a variety of new training and export services embedded across the different producer communities or Zones. Because of the ways these institutions and services were structured they also had subsequent spillover effects of fostering new ties between firms from different Zones as well as institutional reforms in San Juan.

Upgrading in wine takes several years, beginning with transforming the middle segments of the value chain: state-of-the-art quality control and product development running from careful vineyard maintenance to flawless harvests to fermentation and blending. Enologists work closely with agronomists and growers to introduce, evaluate,

and document experiments with new methods of growing and fermentation for different types of varieties and clones. Because of the variation in climates and soils, experimentation is contextualized and knowledge is often tacit, posing barriers to dissemination and application elsewhere. In turn, to accelerate product upgrading, wineries gain a variety of market and applied technical knowledge from other firms as well as collective resources housed in industry associations, schools, and GSIs. (Giuliani and Bell 2005; Roberts & Ingram, 2002)

Such coordination and relational-based upgrading is not necessarily forthcoming, however, especially for firms embedded in volatile environments with limited resources and fragmented industry structures. First, the Cuyo wine industry was composed mainly of a great variety Micro firms and SMEs. For instance, in 2004, Mendoza and San Juan had about 600 wineries of which 350 wineries were exporters, and 35 wineries account for about 70% of the exports. (INV 2005) More than 50% of the wineries have annual sales less than \$330,000 and only 16% of the wineries have annual sales larger than \$1,500,000. Wineries range from many micro, small and medium family firms to some cooperatives and a few large diversified corporations. At the same time, the average winery contracts about 50% of its grape needs from a sector of over 16,000 independent, small and mid-sized vineyards across both provinces (Cetrangolo et al., 2002; Ruiz & Vila 2003).

Second, the industry in the Cuyo was geographically fragmented, even within provinces, with relatively isolated communities or Zones of producers between which there was a history of poor communication and interaction (McDermott 2007). Mendoza and San Juan have over 100 micro-climates supporting a wide variety of high value grapes and thousands small vineyards, which typically supply 30–50% of a winery's needs. Frequent communication between zones was hindered by geographic barriers and a sparse network of roads, in part driven by the Cuyo topography. (Figures 1 and 2 show the location of Zones and firms in our sample.) Figure 1 shows the natural barriers and visual differences between regions. Figure 2 reveals the limited road infrastructure and few roads connecting the regions. These factors create a barrier to knowledge transfer across geographic regions (Szulanski 2000) and exacerbate negative perceptions about economic endowments especially when there are geographic differences between Zones (see pictures in Figure 1).

In turn, the micro-geography of Cuyo has been a blessing and a curse for the wine industry. It created abundance of potential wine and grape production experiments, but it also led to serious coordination problems for collective learning across different regions. That is, although diversity and a decentralized industry structure can be sources of innovation, they can also exacerbate the problems of concerted action and block the wide-spread diffusion of new practices (Ostrom 1999). In the Cuyo region these economic and geographical impediments were magnified by the historical balkanization of socio- economic life between Zones within the two provinces. (Rofman 1999, Walters 1999) Although dense ties and secondary associations can facilitate social learning among firms within a community, they can also insulate members of the community from outside groups and new knowledge. At the same time, public policy can reinforce these tendencies. (Locke 1996, Uzzi 1996) This balkanization undermined both inter-firm learning and collective institutions.

For instance, at the end of the 1980s, those zones where the elite, foreign educated firms were located (Valle de Uco and North) began moving into high quality wines, but

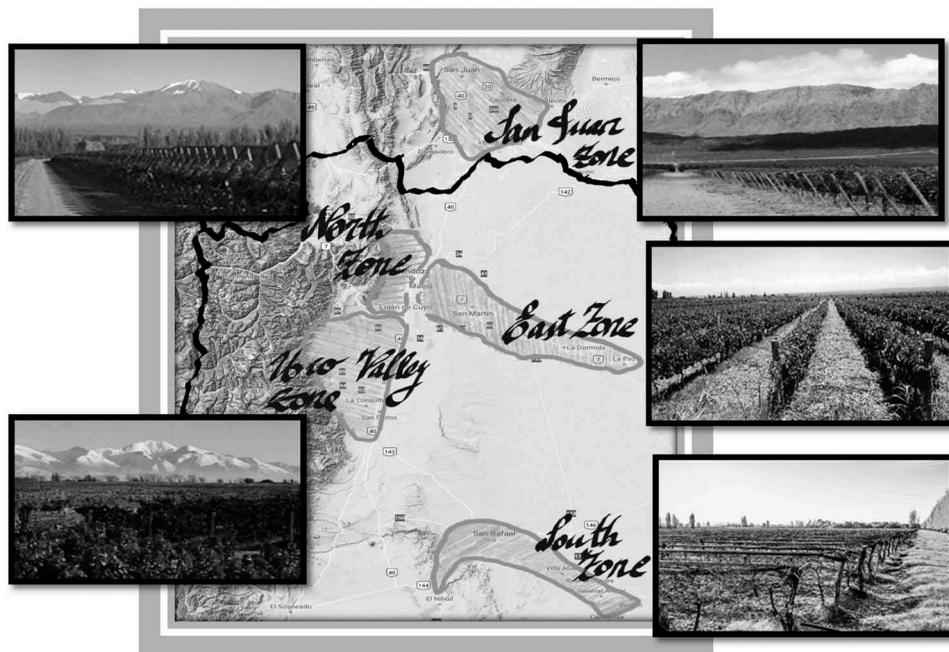


Figure 1. Location of Sample Wineries in Satellite Map of Mendoza and San Juan, Argentina. Imagery ©2018 Landsat, Map Data ©2018 Google. Zones limits are approximate. Pictures courtesy of: Bodegas y Viñedos Casarena (North Zone), Bodegas y Viñedos Tornaghi (South Zone), Enrique Guardia (San Juan Zone), Finca El Origen (Uco Valley Zone), and Finca El Pehuén (East Zone).

excluded other zones (East and South Zones) and San Juan. Even when the elites created a voluntary learning forum and later invited firms from the weaker Zones to participate, negative perceptions about benefits of learning from firms of different capacities and Zones persisted (Walters 1999). As one enologist from the East Zone remarked to us ³ :

The winemakers of the Valle de Uco had no interest in what I was doing, except to tell me I was wrong. We were a very small firm (about 18 employees), in a Zone with limited resources and different conditions. So, I could not learn anything from them about how to improve the wine I was making or how to adapt the grapes, pruning, and watering conditions I had to deal with.

Collective action through the 1980s focused on extracting public rents, gaining preferential regulations, and blocking others from doing the same. While firms within particular Zones often conversed with one another and had their own trade associations (usually dominated by SMEs and some large firms) to lobby the old GSIs for subsidies, they viewed their counterparts in other Zones as rivals, to whom they had little in common. The traditional policymaking in the provinces of zero-sum games on price supports also reinforced weak horizontal ties between sectoral and zonal associations

³The quotes in this article are from interviews that were conducted by the authors between 2004 and 2009. The larger project included interviews with over 50 actors in the industry, such as managers, engineers, policy makers, and civic leaders. For more details, see McDermott et al. 2009, McDermott 2007.

From this perspective, San Juan and Mendoza diverged significantly in their different approaches to industrial policy and building new learning communities beginning in the early 1990s. (McDermott 2007) San Juan adopted a top down approach of using economic and tax incentives to induce investment. This appeared to simply reinforce value chain fragmentation. In contrast, Mendoza initiated a series of policy experiments over a 12 year period focused on creating new public-private institutions (PPIs) alongside the old GSIs that would support agriculture in general and the wine-grape sectors in particular (e.g., R&D and extension centers, export promotion, technical training, specialized insurance, etc.). These PPIs had two important governance traits: rules of inclusion and rules of participatory governance (McDermott 2007). These rules demanded that government actors and a variety of relevant industry associations (mainly representing grape and wine producers of different Zones and sizes) jointly govern and invest into these institutions. These rules helped improve the responsiveness of programs to different types and communities of firms, ensuring that their needs be met, if not immediately, at least over time.

For instance, the participatory governance with diverse stakeholders often forced the PPIs to stop favoring one set of firms and to attend to the different needs to firms with different capacities and geographic conditions. Consider for example the following remark from a board member of Promendoza, the PPI for export promotion:

ProMendoza was hit from all sides. The team responded, but it took time. First, it realized that it could not just take any firm to an international trade fair. So, it created a diagnostic, and those that failed were excluded. Then, after we heard more complaints, the team created some training programs on international markets to help the weak small firms or sent them to INTA and IDR (PPIs for extension services and R&D) for one of their programs on new standards. Later, the associations from different zones pushed the team to make sure the foreign journalists visited their firms and not just the big boys. That wasn't so difficult, so we did that too.

Regardless of whether PPIs were focused on technological and agro extension, export standards and marketing, financing, small firm training, or special hazard insurance, their increased attention to different Zones and firms allowed them draw on a variety of new and applied knowledge resources from these participating actors and their communities. In turn, the relevant institutions created programs that were synthesizing and disseminating applied knowledge from different producer communities and from the international markets. They also created programs that helped firms learn from one another, and build professional relationships across previously isolated wine making and grape growing Zones. This created different learning mechanisms for firms of different capacities under one roof. As one winemaker of small firm from the South Zone told us:

My buddy down the road participated in one of these programs set up in a new extension center nearby. He thought their people and the new techniques were pretty interesting, especially what they were doing in the other zones. I did not think much of it, but I went to one, and my son went to another. The best parts of INTA's and IDR's programs were the group discussions and visiting one another's vineyards. We hardly new any of these other guys from the different zones. That was about six years ago, and we still talk regularly about all the issues – new clones, new blends, pruning, technology. I learned more from these guys and the programs than any book or consultant.

The upshot is that the PPIs Mendoza created could have significant impacts on the upgrading capabilities of Micro firms and SMEs (wineries). Similar to the work on Knowledge-Intensive Business Systems (KIBS) in advanced industrial districts, they could allow the institutional configurations to facilitate knowledge recombination and flows (Camuffo and Grandinetti 2011) and potentially restructure existing network linkages. At the same time, PPI programs can facilitate greater access to a diversity of knowledge while offering complementary mechanisms of tutelage and relationship building to help firms access the experiential knowledge that can accelerate transforming old capabilities. By the early 2000s the PPIs were flourishing, including increased participation from San Juan firms. The demonstration effects and political pressure from their own industry associations led San Juan to initiate restructuring of their own support institutions. In 2004, the Argentine government passed legislation that supported transferring the Mendoza model to other winemaking provinces (McDermott 2007).

5. Methods and data

Winery data was collected by means of a survey administered during 2004–05. This survey captured winery's level product upgrading, demographics, and location as well as winery's ego network of ties to firms, publicly supported institutions, and other organizations. The design of the sample and survey was based largely on field interviews of experts and government officials in Mendoza and San Juan conducted between 2000 and 2003. In addition, between 2000 and 2004 and in order to gain a better understanding of the industry, and its history and evolution, we conducted a survey of industry magazines and government reports, and several interviews with industry experts. This information was utilized to illuminate our theory and develop the survey.

A simple random sample of 115 firms was selected from a roster of the wineries in Mendoza and San Juan. In order to increase participation and response rates we adopted several strategies including gaining the enthusiastic approval of the project by the relevant sectoral associations, and inviting firm owners/directors by mail and telephone to participate in the survey (Buse 1973; Hansen and Robinson 1980). Fifteen firms that declined to participate were replaced with 15 similar firms randomly selected. The final response rate was 84% due to non-response and missing data. We compared with data of wineries from relevant government source and found no significant differences in geographic distribution, age, size, and FDI.

The survey was divided in two questionnaires, one filled by the owner or general manager (covering firm's demographics and general strategies) and one by the chief enologist or production manager (covering production, product development and ego networks). The questionnaires asked for responses for the year 2003, except for questions utilized to measure capability upgrading (which were asked for the years 2002–2003). It should be noted, that we used that period because at the end of 2001 Argentina went through a financial crisis that create a very salient discontinuity in the business environment that help to anchor the respondents' answers. The survey was implemented in collaboration with a leading agro-extension center in the region, whose field consultants interviewed each informant in person for about one hour using the questionnaire.

6. Dependent variable

Product Upgrading, a type of innovation that involves the creation of new products for higher value by incrementally experimenting with new combinations of existing material and natural resources (Giuliani and Bell 2005; Moran and Ghoshal 1999), is a perceptual measure derived from the answer to questions that assess the extent to which the firm implemented product upgrading practices in the context of wine production (e.g., regular introduction of new and higher value wines, emphasis of quality over cost, experimentation with new blends, varietals and clones, and monitoring domestic and overseas markets – see Appendix 1). To create it we added the responses, on a 5-point Likert scale, to the eight questions shown in the Appendix 1 (Cronbach's alpha of 0.78). We assessed the validity of our instrument with an exploratory factor analysis with oblimin rotation (PROC FACTOR, SAS v.9) on 22 questions that extracted five factors. Two of the five factors contain the questions in our *Product Upgrading* index. These items address directly the extent to which the firm overcomes technological and market uncertainties. *Upgrading Motivation*, is the factor extracted in the same procedure and captures the firm investment in upgrading in general (see questions in appendix). As such, this variable captures the overall upgrading motivation of the firm as it reacts to market and technological demands, and it was utilized to help control for endogeneity problems.

7. Independent variables

The survey asked wineries to identify the firms (i.e., other wineries, independent grape growers, technology suppliers, consultants, etc.), institutions, and other organizations (i.e., banks, cooperatives, associations, and schools) that provided important information on a number of functional areas of the firms (e.g., technology, product development, finance, sales, labor relations, etc.). From these responses, we developed a measure for the knowledge diversity accessed by the firm through ties to other firms. Following prior research, we proxy knowledge diversity via geographic diversity – ties to firms in different locations, and limited the estimation of geographically diverse knowledge to ties directly generated through firms and excluded those generated through PPI or other GSIs. (Burt 2001, Fleming 2001, McEvily & Zaheer 1999, Dyer & Singh, 1998) Our main reason for adopting this approach is the intrinsically different characteristics of a focal firm's relationship with firms than with non-market actors, particularly GSI or PPIs. As discussed before, the main goal of non-market actors is to support the industry. However, firm-firm relationships involve market interactions under competitive forces or conflicting economic interests (between competitors, supplier or customers). For this reason, non-market actors are assumed to process information and provide less biased advice than firms. By constructing the variable this way, we are able to isolate the access to information through ties from the learning capabilities contributed by PPIs or other GSIs.

The diversity of knowledge accessed by the winery is based on the location of the firms to which the winery is tied to. First, we identify the location of the 830 out of 957 unique firms mentioned by the wineries. Second, for each winery we create a vector of

ties to each region (East, North, South, Valle de Uco, and San Juan zones plus a region including firms in the rest of Argentina and foreign countries).

Third, by an iterative process and multiple imputation of the unknown location of firms, we estimate a Herfindahl-like index capturing the concentration of ties to those regions (see [Appendix 2](#) for method description). Assuming that information obtained from the same geographic regions is less diverse than the one obtained from different ones, we calculate *Geographically Diverse Knowledge* as 1 minus the Herfindahl-like index of ties' geographic concentration.

Following McDermott, Corredoira, and Kruse (2009), we measured the embeddedness of the firm as the count of mentions to each type of *alter* (firms, public private institutions newly created by the government of Mendoza during the 90s (PPIs), other organizations – which includes associations, banks, cooperatives and schools). We then decomposed those ties into *ties to all but government supported institutions (GSIs) and firms, ties to firms, ties to PPIs*, and ties to *Old GSIs*. The distinction between *ties to PPIs* and *ties to Old GSIs* is due to the PPI's particular governance and programs. Past work has shown Ties to PPI's having distinct effect on product upgrading (McDermott, Corredoira, and Kruse 2009). We capture the strength and multiplex characteristics of the ties by counting every instance when a winery mentioned an *alter* (Cross, Borgatti, and Parker 2001; Padgett and Ansell 1993). As the questionnaire asked for ties serving different functional areas, a firm could have multiple ties to the same *alter* and ties to multiple *alters* in each category.

8. Control variables

We include several variables to control for alternative explanations and possible measuring biases in our dependent variable. Fixed effects for the geographic location of the winery (a dummy variable for each region) absorb systematic errors in the measurement of our dependent variable (due to its perceptual nature). Following extant literature on wine production (Giuliani and Bell 2005; McDermott, Corredoira, and Kruse 2009), we control for absorptive capacity differences by including *Education*, an index that is the sum of the level of education of top management and enologists, *Enologist*, a dummy variable that takes the value of 1 if the firm has at least one full time enologist and 0 otherwise (both variables associated to wineries abilities to incorporate new practices (Giuliani and Bell 2005), and *Sales*, a categorical variable with 6 levels measuring the sales per year capturing the firm resources and marketing capabilities.

Superior resources were controlled by *Foreign Ownership*, a dummy variable taking the value of a 1 for firms with foreign investment greater than 10% of equity and a 0 otherwise, and firm's demand structure and positioning choice were controlled by introducing *Upgrading motivation*, which reveals the firm's allocation of limited resources consistent with acting on a perceived demand for upgrading (McDermott, Corredoira, and Kruse 2009). We finally included *Age*, the number of years since inception, to capture possible inertia effects.

9. Model specification and statistical inference

As we discussed above, micro firms are qualitatively different from SME in terms of antecedents of product upgrading. The literature increasingly finds that the resource and performance differences between small and medium firms are not very large especially in emerging markets, while they are of significant orders of magnitudes between Micro firms and SMEs (Henriquez 2009, Berry, Rodriguez, and Sandee 2002, Liedholm & Mead 1999). The differences across micro and SMEs have been found of practical relevance across developed countries and the classification in these categories is commonly utilized by government agencies to implement economic development projects, though the thresholds in developed countries are much higher than the thresholds in developing ones (Henriquez 2009). The sales threshold adopted here is utilized by the Argentine government and international economic development agencies to address the inherent heterogeneity associated to annual sales of Argentine firms (Henriquez 2009).⁴ As noted above, we follow the common approach and reasoning to split the sample into the two categories, because size in these contexts is not viewed as a continuous variable when considering the transition from Micro firm to SME. This assumption is confirmed by the descriptive statistics for each population (see Table 1) and by comparing parameter estimates and significance levels between estimations of product upgrading on a set of independent variables for populations of Micro firms and SME. For this reason, we present the results for independent estimations for Micro firms (annual sales below \$350,000) and for SMEs (annual sales above \$350,000⁵) that, while being estimated on a limited degrees of freedom, should provide unbiased estimates of the parameter (Results for the pooled sample and the issues due to model misspecification affecting the estimation are presented and discussed in Appendix 3).

We estimated models regressing product upgrading on a series of main effects and interaction terms with the firm as the unit of analysis. Model 1 is our baseline and follows prior studies. Model 2 adds *Geographically Diverse Knowledge*. Model 3 and 4 add the interactions of *Geographically Diverse Knowledge* and *Ties to PPIs* and *Ties to Firms*, respectively. Following McDermott, Corredoira, and Kruse (2009), we corrected the skewness of the embeddedness variables by applying the Box-Cox transformation (Box and Cox 1964) to each one of our ties measures.⁶ We report the results from robust regression (proc robustreg, SAS v.9) with Least Trimmed Squares (LTS) estimation (Rousseeuw 1984), which generates OLS estimates robust to the presence of outliers. In the following section, we present the results of these models estimated over the two sub-samples: Micro firms and SMEs samples.

⁴Our Sales data is categorical, with boundaries at \$170,000, \$350,000, \$500,000, \$700,000 and \$1,600,000. Sample size make impossible to calculate the models with cuts below \$170,000 (30 observations) or above \$500,000 (34 observations). To test the sensitivity to different thresholds we calculated the models for samples above \$170,000 and below \$500,000. In both cases, parameter estimates for the lower and higher thresholds were in between the ones estimated with the above and below \$350,000 threshold; the p -values tend to be smaller, and closer to the ones for the full sample estimation. This is consistent with the mixing of two heterogeneous populations, which confirm the appropriateness of the \$350,000 threshold utilized by the Argentinean government and international agencies.

⁵All the wineries in our sample qualify as PYMES (Spanish acronym for Small and Medium firms). From secondary data we confirmed that these wineries are below the upper threshold for Medium firms (\$16,000,000 annual sales).

⁶Box-Cox transformation yields the transformed variable most proximate to a normal distribution. Log transformation is a particular case of BoxCox ($\lambda = 0$) Greene, W. H. 2000. *Econometric analysis* (4th ed.). Upper Saddle River, N.J.: Prentice Hall.

Table 1. Correlation matrices and Descriptive Statistics for Sub-Samples.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16	v17	v18	v19
SME Sample																			
v1	1																		
v2	-0.15	1																	
v3	-0.36	-0.39	1																
v4	0.37	-0.35	-0.33	1															
v5	0.26	-0.19	-0.18	-0.16	1														
v6	0	-0.24	-0.23	0.07	0.11	1													
v7	0.15	-0.05	0.06	0.07	0.11	-0.19	1												
v8	0.38	-0.26	-0.1	0.06	0.66	-0.13	0.06	1											
v9	0.04	0.19	-0.07	-0.09	0.11	-0.14	0.15	-0.08	1										
v10	0.55	-0.25	-0.09	0.11	0.55	-0.13	0	0.54	0.01	1									
v11	0.12	-0.18	-0.09	0.2	0.04	0.06	0.22	0.08	-0.15	0.07	1								
v12	0.34	-0.27	-0.12	0.2	0.52	-0.16	0.25	0.41	-0.1	0.42	-0.02	1							
v13	0.21	-0.25	0.01	0.09	0.38	-0.1	0.36	0.33	0.06	0.34	0.38	0.07	1						
v14	0.3	0.29	-0.31	0.13	0.16	-0.29	0.32	0.01	0.33	0.06	0.1	-0.07	0.25	1					
v15	0.03	-0.19	0.16	-0.24	0.39	0.04	0.17	0.3	0.24	0.2	-0.03	-0.04	0.62	0.09	1				
v16	0.33	-0.18	0.06	0.23	0.39	-0.45	0.13	0.42	0.09	0.34	0.11	0.11	0.43	0.33	0.36	1			
v17	0.03	0.17	-0.31	-0.06	0.17	0.11	0.34	0.07	0.28	-0.06	0.09	0	0.15	0.53	0.28	-0.06	1		
v18	0.34	-0.11	-0.04	0.18	0.46	-0.4	0.31	0.42	0.24	0.35	0.16	0.15	0.47	0.52	0.45	0.9	0.35	1	
v19	0.2	0.25	-0.26	0.05	0.2	-0.22	0.37	0.06	0.3	0.06	0.11	0	0.2	0.91	0.16	0.28	0.73	0.56	1
Mean	20.38	0.29	0.27	0.23	0.08	0.13	4.58	4.5	0.81	5.4	34.42	0.15	1.83	12.58	0.09	0.61	0.5	0.3	6.9
Std Dev	7.49	0.46	0.45	0.42	0.28	0.33	1.18	2.99	0.39	3.26	33.95	0.36	1.84	6.14	0.34	0.63	0.19	0.37	4.09
Micro Firm Sample																			
v1	1																		
v2	0.13	1																	
v3	-0.09	-0.2	1																
v4	-0.06	-0.28	-0.12	1															
v5	-0.07	-0.37	-0.16	-0.23	1														
v6	0.04	-0.37	-0.16	-0.23	-0.3	1													
v7	-0.12	0.13	-0.23	-0.2	-0.01	0.19	1												
v8	-0.09	-0.04	-0.08	-0.03	0.09	0.03	0.13	1											
v9	0.22	0.19	-0.11	0.04	-0.46	0.28	0.09	0.26	1										
v10	0.13	-0.24	-0.23	-0.16	0.54	0	0.02	0.1	0	1									
v11	-0.15	0.02	-0.27	-0.03	0.31	-0.14	0.13	0.32	-0.03	0.01	1								
v12	-0.03	-0.14	-0.06	0.5	-0.11	-0.16	-0.16	0.04	0.15	-0.09	0.12	1							
v13	-0.13	-0.23	0.18	-0.31	0.51	-0.11	-0.04	0.26	-0.18	0.28	0.26	-0.2	1						
v14	0.06	0.45	0.04	-0.21	0.05	-0.4	0.28	-0.18	-0.18	-0.17	0.08	-0.27	0.11	1					
v15	0.09	-0.21	-0.08	-0.16	0.38	0.1	-0.14	0.1	-0.15	0.39	0.28	-0.12	0.35	-0.22	1				
v16	-0.01	-0.2	0.03	0.04	0.73	-0.56	-0.28	-0.05	-0.41	0.34	0.21	0.06	0.44	0.17	0.47	1			
v17	0.13	0.12	-0.19	-0.22	0.23	-0.06	0.39	-0.2	-0.16	0.03	0.22	-0.26	0.17	0.62	0.05	0.16	1		
v18	0.06	-0.16	-0.06	-0.04	0.77	-0.52	-0.26	-0.04	-0.4	0.41	0.24	-0.05	0.5	0.16	0.53	0.96	0.22	1	
v19	0.14	0.39	-0.11	-0.27	0.08	-0.22	0.35	-0.18	-0.13	-0.09	0.09	-0.25	0.15	0.91	-0.19	0.12	0.76	0.17	1
Mean	18.37	0.31	0.08	0.15	0.23	0.23	1.38	3.71	0.67	4.38	27.42	0.04	1.58	11.22	0.19	0.42	0.49	0.23	6.24
Std Dev	6.19	0.47	0.28	0.36	0.42	0.42	0.49	1.75	0.48	3.2	27.33	0.2	1.6	5.67	0.32	0.71	0.2	0.4	3.88



Table 2. Robust regression results for Product upgrading as dependent variable (split samples).

	SME firms				Micro Firms			
	Model S1	Model S2	Model S3	Model S4	Model M1	Model M2	Model M3	Model M4
Intercept	6.63 (4.25)	10.58** (4.46)	13.31** (5.41)	3.31 (3.87)	13.66*** (3.20)	14.35*** (3.54)	16.66*** (3.28)	13.53*** (4.09)
Sales	0.67 (0.66)	0.96 (0.68)	1.17** (0.49)	0.62 (0.58)	2.29 (1.59)	2.01 (1.78)	-1.86 (1.55)	2.10 (1.83)
Education	0.42 (0.31)	0.56* (0.31)	0.59*** (0.22)	0.19 (0.25)	-0.20 (0.43)	-0.04 (0.49)	0.66 (0.43)	-0.05 (0.50)
Enologist	0.89 (1.81)	0.62 (1.83)	0.26 (1.35)	-1.60 (1.57)	7.83*** (1.72)	7.67*** (1.89)	1.18 (1.80)	7.71*** (1.93)
Upgrading Motivation	0.92*** (0.26)	0.85*** (0.26)	0.53*** (0.21)	0.94*** (0.20)	-0.01 (0.28)	-0.07 (0.27)	-0.40 (0.27)	-0.07 (0.28)
Age	-0.01 (0.02)	-0.01 (0.02)	-0.02 (0.02)	-0.01 (0.02)	-0.05* (0.03)	-0.06** (0.03)	-0.17*** (0.04)	-0.06** (0.03)
Foreign Ownership	3.85 (2.59)	3.58 (2.63)	3.89** (1.88)	8.57*** (2.18)	-7.46** (3.71)	-7.38* (4.09)	6.75* (4.04)	-7.21* (4.17)
Ties to all but GSI and Firms	-0.05 (0.6)	-0.72 (0.58)	0.38 (0.46)	-0.45 (0.51)	1.02* (0.55)	0.95 (0.60)	-0.59 (0.54)	1.04 (0.65)
Ties to Firms	0.32** (0.14)	0.46*** (0.16)	0.36*** (0.11)	1.79*** (0.32)	-0.10 (0.18)	-0.40* (0.23)	1.01*** (0.22)	-0.26 (0.41)
Ties to Old GSI	-2.97 (3.06)	1.54 (3.12)	-2.26 (2.5)	5.62* (2.91)	-2.93 (3.10)	-1.01 (3.30)	1.71 (3.15)	-1.63 (3.66)
ties to PPI	2.69* (1.45)	1.11 (1.55)	-2.46 (4.50)	4.71*** (1.35)	6.96*** (2.24)	6.15** (2.46)	-8.28* (4.25)	6.45** (2.60)
Geographically Diverse Knowledge		-9.30* (5.21)	-14.16** (6.97)	1.24 (5.70)		6.67 (5.36)	-7.43 (4.86)	7.87 (6.15)
Ties to PPI * Geographically Diverse Knowledge			7.42 (8.45)				26.34*** (7.42)	
Ties to Firms * Geographically Diverse Knowledge				-2.27*** (0.54)				-0.29 (0.69)
Observations	48	48	48	48	48	48	48	48
R-sq	0.81	0.82	0.83	0.83	0.53	0.62	0.68	0.68

LTS Regression. Standard errors in parentheses.

*** p -value < 0.01 ** p -value < 0.05 * p -value < 0.10. Region fixed effects included

10. Results

Descriptive statistics and correlation matrix are presented in Table 1 and estimations for models M1-M4 and S1-S4 in Table 2. For every model, variance inflation tests show no multicollinearity problems. First, although some control variables have distinct and (relatively) consistent effects on *Product Upgrading* across models for each type of firms others do not. On the one hand, having an enologist (p-value < 0.001 for models M1, M2 and M4) is positively associated to *Product Upgrading* for Micro firms while shows no significant association for SME firms (p-values between 0.30 and 0.85 for Models S1 to S4). On the other hand, having high levels of *Upgrading Motivation* (p-values < 0.001 for models S1 to S4) is positively associated to *Product Upgrading* for SMEs while shows no significant association for Micro firms (p-values between 0.14 and 0.95 for Models M1 to M4). Interestingly, *Age* has a negative association to *Product Upgrading* but only for Micro firms (p-values between 0.09 and less than 0.0001 for Models M1 to M4).

Second, the main effects of our key independent variables of interest show consistency across models. Overall, *Geographically Diverse Knowledge* fails to reach significance across models for Micro firms and SMEs except for SMEs in model S2, where it is negative (p-value = 0.07). In the case of Micro firms (see Model M1 and M2), results show that *Ties to PPIs* is positively associated to *Product Upgrading* (p-value = 0.002 and 0.01 for M1 and M2). In addition, *Ties to Firms* is negatively associated to *Product Upgrading* (p-value = 0.57 and 0.08 for M1 and M2). In the case of SMEs (see Model S1 and S2), results show that the associations of these variables with *Product Upgrading* are quite different from the ones in the case of Micro firms. For SMEs, *Ties to Firms* is positively associated to *Product Upgrading* (p-values between 0.02 and 0.0001). In particular and as expected, Models S2 and M2 show that the association for SMEs (positive and p-value = 0.043) is larger than for Micro firms (negative and p-value = 0.08), which yields a non-overlapping 95% confidence intervals. For SMEs, *Ties to PPIs* is positively associated to *Product Upgrading* with varying significant level ranging from non-significant (p-value = 0.47, model S2) to significant (p-value = 0.0003, model S4).

Third, we again see a divergence of association for interaction variables between ties and knowledge diversity. For Micro firms, Model M3 shows a significant positive interaction between *Ties to PPIs* and *Geographically Diverse Knowledge* (p-value = 0.0004) and Model M4 shows a non-significant interaction between *Ties to Firms* and *Geographically Diverse Knowledge* (p-value = 0.67). For SMEs, we obtained the opposite pattern. Model S3 shows no significant interaction between *Ties to PPIs* and *Geographically Diversity Knowledge* (p-value = 0.38) and Model S4 a significantly negative interaction between *Ties to Firms* and *Geographically Diverse Knowledge* (p-value < 0.0001).

Finally, we assess the size of the changes associated to the significant interaction among both types of firms. In the case of Micro firms, one standard deviation increase in the *Ties to PPIs* (at the average level of *Geographically Diverse Knowledge*) is associated to a *Product Upgrading* increase of 50% in addition to a 24% increase associated just to the increase in number of ties. In the case of SMEs, one standard deviation increase in *Ties to Firms* (at the average level of *Geographically Diverse*

Knowledge) is associated to a *Product Upgrading* decrease of 34% in addition to a 54% increase associated just to the increase in the number of ties.⁷

11. Discussion

The aim of this paper has been to evaluate the debate about how Micro firms and SMEs in emerging markets can learn and innovate, namely in upgrading their products. The general view has been that firms need greater access to diverse knowledge to innovate via ties to organizations in different networks and locations. However, scholars and development agencies have shown a growing concern that direct access to diverse knowledge may overwhelm the limited resources and experience of these firms and also that Micro firms and SMEs may need different types of organizational networks and institutional supports to learn how to process new knowledge and how to transform their existing organizational capabilities (Ferraro and Stumpo 2010; Henriquez 2009). Our results suggest that these concerns are warranted, particularly that Micro firms can benefit from PPIs while SMEs tend to benefit more from their firm networks. We proceed by highlighting the overall effects of key variables and then turn to a more detailed discussion of how they play out for Micro firms and SMEs separately.

First, we see that all firms consistently have difficulty benefiting directly from knowledge diversity (in our case, Geographically Diverse Knowledge), and sometimes, as shown by the split samples, the diversity can have a negative effect. It also appears that increasing one's ties to other firms (increasing the volume of information) may not help a firm overcome the organizational and resource weaknesses that lead to decision making inertia or an inability to process diverse knowledge.

Second, we see that the benefits for product upgrading do not necessarily come from ties to all types of organizations, but mainly ties to other firms and ties to PPIs. This has implications for the kind of knowledge that is important and the benefits and limits to increasing ones ties to other firms. On the one hand, a common trait between other firms and PPIs, as argued in Section I, is that they offer access to experiential, applied knowledge – very much embedded in firm experiments and purposefully sought in PPIs. (Perez-Aleman 2011; Pietrobelli and Rabellotti 2011) But the weak (insignificant or negative) interaction effect between firm ties and knowledge diversity may also suggest that firm ties (effectively increased amounts of information) may help directional learning – learning to apply practices or advance a product once a decision is taken, but not good at helping the focal firm sort through various, conflicting types of knowledge. While we discuss these implications in greater detail below, the results are also consistent with the notion that ties to other firms may provide access to experiential knowledge but not necessarily needed tutelage.

Third, we began to see how the PPIs are distinct from other institutions and organizations, including simply learning from other firms, especially when it comes to helping access and process diverse knowledge. We argued that the advantage of the PPIs or the new institutions created in Mendoza is that they act as conduits of knowledge diversity *and* they offer programs to help firms process and learn from this diversity. The results from the baseline models (full and split samples) as well as

⁷Estimation available upon request from the authors.

those for the Micro firms are consistent with this argument, but they especially suggest that the PPIs can act as a repository and learning capability for Micro firms, which relatively speaking have the weakest capacities to process diverse knowledge. A winery can gain direct access to diverse knowledge by ties to firms in different locations. But added noise comes with this information because of the different types of firms (by size, function, etc.) and inherent biases from the sources (Szulanski 2000). In contrast, the PPIs gain access to diverse information located in different Zones through ties that connect them directly with wineries and vineyards and develop capabilities to recombine the knowledge for effective transfer to wineries. Note that the argument here about the PPIs is particularly about their combined bridging and tutelage capabilities, which appeared to be a consequence of their governance traits. Hence, in other contexts one may find the functional equivalents in other types of institutions or organizations, such as in more traditional educational institutions or via associations with historical capacities. (Camuffo and Grandinetti 2011; Pietrobelli and Rabellotti 2011)

We now extend these arguments when considering the differences in product upgrading between Micro firms and SMEs. The results combined with our fieldwork suggest significant differences in how resources and organizational capacities impact the different intermediary organizations that the firms use for product upgrading. The average number of employees for micro firms is around 14 and for SMEs is around 35 employees. There are clear differences in their organizational structure, as one expert put it in comparing the limitations faced by SMEs to those of a micro firm when trying to implement innovations:

‘... [micro firms] are faster in adopting change. They have one and only one decision maker, the owner. Owners don’t have to argue with anybody, when convinced about something they act on it... On the other hand, larger wineries have structure. Now you learn about something and you believe it’s the solution, that is just the beginning... you have to convince others and negotiate in order to get support for your idea. That takes time...’

These observations, coupled with our arguments from Section I, first give us a better understanding of the results for SMEs. Models S1 and S2 suggest that SMEs benefit namely from their own growing inter-firm network. But S4 suggests that the increased firm ties do not positively moderate the effects of direct knowledge diversity. The combination of these results suggest two forces at work revealing the benefits and limitation to the relative capacities of SMEs and their inter-firm networks. We argued above that, relative to Micro firms, SMEs may have the complementary capacities and personnel to be more likely to pursue a greater quantity and quality of firm ties, which gives them a greater amount of information. SMEs, as opposed to Micro firms, may have the resources and experience to learn from their ties and that these ties may be sufficient at their stage of development to offer experiential learning. That is, SMEs may be relatively more likely to have a clearer direction and experience on their strategy and product development, and the inter-firm network gives them the applied knowledge to help execute the project.

On the other hand, the relative capacities of SMEs may be a barrier – sufficient to develop certain firm ties but insufficient to manage a growing diversity of knowledge. And adding more firm ties may only complicate the processing of knowledge diversity, especially because of a more complex governance structure. That is, in

an SME the need to convince more managers with different perspectives can be a barrier to sorting the diverse information. (Fleming 2001) Diverse (contradictory) information may slow down and block the group decision making processes as managers argue in larger firms, and the successful sales performance of SMEs will favor the status quo and impede product upgrading. (Kahneman, Knetsch, & Thaler, 1991) Conversely, the negative results in S4 for the interaction variable may suggest that the SMEs have reached a size threshold where they seeking upgrading of a particular set of products, and thus benefit from more redundant knowledge than from more exploration.

The importance of PPIs for SMEs is less clear. The general development literature of smaller firms would expect PPIs would help them as well. But the impact of *Ties to PPIs* was not consistent, only significantly positive in model S4. One might speculate that that the interaction variable may be absorbing the effects of knowledge diversity, while the PPI variable offers the tutelage mechanism. That is, the PPIs may still be aiding SMEs in filtering certain knowledge and teaching them the applications. This would be consistent with our field work, which revealed the PPIs focus in the transfer of technical knowledge about markets and wine production, but not involved with issues of improving management or decision making processes.

In contrast, Micro firms appear to consistently benefit from PPIs and especially in using PPIs to both gain new knowledge and learn how to apply it, but not from ties to firms. The above quotation is consistent with our arguments in Section I that the relatively limited complementary capacities of Micro firms makes the owner's influence and the pressure on more immediate returns dominant. In turn, the Micro firms need more efficient mechanisms to explore new techniques and products. The PPIs can act as a one stop shop for Micro firms. They act as knowledge bridges and as sources of tutelage to help Micro firms access and process new applied, experiential knowledge. These are conduits and learning mechanisms that the Micro firms lack on their own. And they also may be at such an early stage of development, that, relative to SMEs, they still can find benefits from diverse knowledge but also need help in the exploration process. At the same time, Micro firms may have only marginal benefits from their inter-firm networks. The Micro firms lack the capabilities and resources to develop learning relationships with firms. Instead, PPIs provide the Micro firms with the solution to their problems, their very simple governance structure, as suggested in the quote, may not expose them to as much contradictory information as SMEs, which would reduce ambiguity and not elicit the status bias response.

Among this paper's limitations are the size of our sample and its cross-sectional nature. Although our survey covers a significant portion of wineries in the Cuyo region and has a high response rate, the limited number of observations constrains the number of alternative explanations we can control for simultaneously. Nevertheless, we were able to address potential systematic differences due to perceptual measures, and several endowment differences across firms. The cross-sectional nature limits our ability to deal with endogeneity issues, such as reverse causality. We adopted a two pronged approach in an attempt to overcome this limitation. First, we introduced a variable capturing the overall upgrading motivation of the firms to address, at least partially, the endogeneity concerns. Nevertheless, a clear possibility is that we are not capturing any effect of PPIs on SME upgrading because they have already gone through that learning process and

our methods cannot address this issue. Second, we drew on the historical records about the rise of new types of government support institutions in Mendoza (PPIs) since the 1980s and about the transformation of the Cuyo wine industry. This field work suggests a significant role of PPIs in the development of upgrading capabilities. Nonetheless, further qualitative and quantitative research on how PPIs and their functional equivalents can support Micro firms and SMEs in different ways would be warranted. It is important to address this issue before drawing strong conclusions regarding the role PPIs play for SMEs. While not consistently beneficial for SMEs, their participation on PPIs' programs may be crucial and has clear potential to benefit Micro firms. In addition, SMEs may draw other benefits from their participation on PPIs that may not been captured by our survey. Indeed, recent reports from the multilaterals consistently fault public programs for being too generic and not addressing specific needs of Micro firms and SMEs. (Henriquez 2009; IDB 2014; ECLAC 2014)

A second and related issue is the need to examine in greater depth how the different complementary capacities of Micro firms and SMEs are proxies for differences in stages of development needing more exploration or exploitation. Much of the research on innovation and development argues that larger firms have superior resources to integrate complex, diverse knowledge. (Almeida, Dokko, and Rosenkopf 2003; Owen-Smith and Powell 2004) But our study suggests that the simply distinguishing firms as large and small can miss the important differences within smaller firms, namely Micro firms and SMEs. Following the classic arguments of Schumpeter (1934) about firm size and innovation, Micro firms may still need to explore a variety of options to gain traction in upgrading products, but their resource limitations may demand complementary capacities via public industry support institutions like PPIs. SMEs may find that their own capacities are sufficient to pursue more directional upgrading of products and but not to increase exploration of variety. In turn, research should examine how ties to intermediary organizations can help or hinder Micro firms and SMEs in learning from a greater variety of knowledge or a greater amount to similar knowledge.

12. Concluding remarks

This article has sought to provide a deeper understanding of how Micro firm and SMEs in emerging markets can innovate in a context of geographic, resource, and institutional constraints. Much of the work from innovation and international business has place a premium on the advantages of local firms accessing a variety of new, advanced knowledge. While we do not deny such a claim, we have argued that these firms in these settings equally need access to a variety of experiential, applied knowledge that informs them not only about different standards or market trends but especially how to convert their existing weak capabilities to more advanced ones in order to upgrade their products. In doing so, we have examined how the heterogeneity in network composition and firm size can effect firm learning.

First, our findings suggest that for smaller firms direct access to a variety of knowledge is not a universal source of innovation. In our context, the diverse information acquired directly through other firms in a variety of geographic locations may even hinder the ability of these firms to innovate, perhaps because of capacity constraints, but certain non-market institutions may provide some benefits to this type of learning.

Second, the study contributes to our understanding of how organizations and industries that lack the minimum levels of absorptive capacity can generate innovation, but largely through certain organizations and support institutions. We provide a picture where the firms were attempting to upgrade their products by recombining the information and knowledge that was embedded in the different regions. This is consistent with our results and fieldwork, which suggest that increased ties to other firms and to PPIs were the main intermediaries contributing to improving upgrading capabilities. But these types of ties did so in different ways. The larger amounts of information via ties to firms would seem to help particularly SMEs accessing directional experiential knowledge but not necessarily in learning from a greater variety of knowledge. The PPIs had particular bylaws – requiring them to be inclusive and participatory – that appeared to tap into and recombine the knowledge contained in different sub-regions. In the process, the PPIs appeared to act as a repository and processor of information, but also supported the creation of knowledge and learning capabilities, particularly in Micro firms. Such capabilities are not limited to PPIs per se. Functional equivalents have been found in KIBS and other types of non-market institutions, such as universities, testing centers, and some industry associations in a variety of industries and countries. (Camuffo and Grandinetti 2011; Perez-Aleman 2011; Pietrobelli and Rabellotti 2011)

Third, our study highlights how firm size, namely the variation in firm capacities and resources, can amplify the differences between these intermediaries, or conversely, how the size categories have different innovation needs. There are growing literatures demonstrating the step-wise difference in Micro firms and SMEs in terms of productivity, innovation and growth as well as arguing how smaller firms may be limited in their abilities to process new knowledge and generate effective network relationships. (Henriquez 2009; Ferraro and Stumpo 2010; Giuliani, Balland, and Matta 2018; Grazzi and Pietrobelli 2016) Yet few have systematically examined how Micro firms and SMEs may have different learning and network mechanism. Our study offers evidence about how the difference in complementary capacities for product upgrading can create different approaches to learning for firms at different stages of development. Micro firms would appear to benefit more from PPIs than from firm ties. Because of their very limited absorptive capacities and pressure to find more immediate benefits from external ties, Micro firms would appear to invest less in firm ties but gain from PPIs. PPIs would appear to act as an effective one-stop shop in exposing Micro firms to new experiential knowledge and to guide them in the application.

In contrast, the relatively larger and diverse complementary capacities of SMEs would appear to take more advantage of ties to other firms. SMEs may have sufficient capacities to generate more and deeper learning relationships with other firms, relative to Micro firms. But these findings coupled with the negative interaction effects between firm ties and knowledge diversity point to limitations for SME capacities in exploration. One might view their capacities as still too limited to manage the great amounts and variety of incoming knowledge, particularly because the relatively more complex organizational structure leads more to delays and confusion than synergies and synthesis. SMEs may also already have a clearer strategy and prefer to forgo exploration of diversity with the priority being upgrading a defined set of products via redundant knowledge from peer firms.

These results do not definitively say whether one set of intermediary organizations and institutions is better for Micro firms or SMEs. Rather they force us to consider that Micro firms and SMEs, usually conflated with one another, have significant differences in key capacities, which in turn affect their learning processes, paths of innovation, and the types of network relationships that prove helpful.

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Appendix 1. Measurement of Product Upgrading and Upgrading Motivation

Product Upgrading and *Upgrading Motivation* are indices created with the factors extracted from 22 questions included in the extensive survey answered by managers and enologist of the wineries interviewed. The questions and wording (presented below) asked in a 5-point Likert format about whether firms have engaged in actions and behaviors associated to product upgrading and upgrading in general.

The sum of the responses for the questions in the indices were subtracted from a constant to obtain a variable with increasing values as upgrading increases.

Product upgrading questions:

Could you please indicate the level of agreement or disagreement with each one of the following descriptions of your firm? (1 = totally agree, 2 = agree, 3 = do not agree or disagree, 4 = disagree, 5 = totally disagree)

- (1) Our firm incorporated new types of wines to offer more variety to our customers
- (2) Our firm incorporated many types of wines with larger margins than the average margin of our vines
- (3) Our winery introduced many new varietals and cuts
- (4) Our enologist regularly visit wineries abroad
- (5) Our enologist regularly meet with our sales and export directors
- (6) When we develop a type of wine, we already know the market segment and/or retail price for the target market.
- (7) We clearly know who the competition is in the foreign market
- (8) Our enologist and managers have absolute decision-making power over the wine development policy.

Upgrading commitment

Could you please indicate the level of agreement or disagreement with each one of the following descriptions of your firm? (1 = totally agree, 2 = agree, 3 = do not agree or disagree, 4 = disagree, 5 = totally disagree)

- (1) Our winery made important investments in micro-vinification
- (2) Our winery has regularly participated in wine R&D cooperation with other organizations
- (3) Our winery has regularly participated in technological R&D agreements with other organizations

Appendix 2. Method to Calculate Geographically Diverse Knowledge Variable

In order to calculate a Herfindahl index to measure the winery geographic concentration of ties to firms, we standardized the names of all the firms mentioned by wineries and followed this procedure:

- (1) We collected the address.
 - (a) To do so, we search on Argentinean wine industry publications for the firms mentioned by the firms.
 - (b) For those that we were not able to find, experts in the wine industry located in Mendoza, Mendoza, identified the address of the firms.
 - (c) For those firms for which the experts could not identify an address, we conduct an extensive online search utilizing white and yellow pages, and wine industry related

websites. This resulted in 830 firms for which we found their addresses and 127 with unknown location.

- (2) We imputed the locations for the unknown locations
 - (a) To do so, we utilize this iterative process by Multiple Imputation (SAS, PROC MI, v.9) with option Discriminant Function Method, and utilizing the number of ties, firm Herfindahl, weighted ties to zones (based on mentions by winery and weighted winery Herfindahl). Follow this procedure:
 - (b) Calculate the Herfindahl for each winery based only on the firm zones that are known and exclude the unknowns.
 - (c) Use these Herfindahl to weight the citations of the firms in the reverse citation vectors for the firms. I.e., if a firm was cited by two wineries from the Este zone, one with Herfindahl based on known zones = 0.5 and the other = 0.75, a focal firm from the Norte zone with Herfindahl = 1, and one from Valle Uco with Herfindahl = 0.1, then the reverse vector for the firm would be: Este 1.25, Norte = 1, Valle Uco = 0.1, and the rest = 0.
 - (d) These reverse vectors were used to impute zones for the firms using the monotone discriminant function with a categorical variable for zone, using 50 imputations, and allocating a zone based on the most frequently cited zone.
- (3) Calculate the Herfindahl for the winery with the imputed values.
- (4) Repeat the imputation of the unknown locations (step 2b-2c) utilizing the Herfindahl calculated in step 3 for ten times.

Appendix 3. Model estimation over Micro firm and SME samples and pooled sample

As stated in the methods section, we presented the results for estimations utilizing 2 samples (a sample of micro firms and a sample of SMEs). This reduced the sample size which diminished the power of our estimates. However, for theoretical reasons, organizational structure and decision making process difference between micro firms and SME, empirical reasons, governments and development agencies treat these two types of firms as qualitatively different when designing programs to promote the economic development of countries, regions or firms have driven our decision. Model estimations for both samples and descriptive statistics support our statistical approach.

We also run our estimations over a pooled sample of both types of firms with a dummy variable identify to what population the observation belongs. *Micro firm* is a variable introduced in the models that takes a value of 1 when the firm is a micro firm and 0 otherwise. The problem of estimating models pooling together two populations of firms is that the estimation impose the condition of the marginal effect of every single variable to be identical for each population. This condition does not hold when the populations are qualitatively different. In order to eliminate this constraint, an interaction term between the variable identifying the population and each one of the independent variables should be added. As a result, models not including those interaction terms would result on biased model estimations.

In our case, to estimate whether the interaction between, for example, *Ties to PPIs* with *Knowledge Geographic Diversity* is different for Micro firms when compared with SMEs firms or not on a pooled sample demands the introduction of: a) the three main effects (i.e., *Ties to PPIs*, *Knowledge Geographic Diversity*, and *Micro Firms*), b) the triple interaction term between the 3 variables and c) the lower level interactions between those variables. We run a series of

simulations with two synthetic populations, which were created with different functions of the same independent variables driving the same dependent variable in a manner similar to our empirical data. The simulation shows that, despite the relatively small number of observations in each population, estimations tend to be able to test the highest level interaction term in an unbiased manner, but failed to achieve the same performance on lower interactions and main effects. When both populations are pooled together, estimations tend to produce parameters estimates that are close to be a weighted average of the true parameters of each population. An interaction of higher level interactions with an indicator for the population of the observation parameter estimation depends on the true parameters of lower interactions and main effects of both populations. (Results available upon request from the authors)

As said before and despite the caveats pointed at in prior paragraphs, we estimated models equivalent to Models P1-P3 on the pooled sample (see Table A1). This served as a robustness

Table A1. Robust regression results for Product upgrading as dependent variable (pooled sample).

	Pooled Sample			
	Model P1	Model P2	Model P3	Model P4
Intercept	11.18 *** (3.87)	11.24 *** (4.22)	6.53 (4.60)	7.73 * (4.01)
Sales	0.02 (0.69)	0.23 (0.77)	0.64 (0.71)	0.61 (0.64)
Education	0.38 (0.26)	0.40 (0.29)	0.32 (0.26)	0.78 *** (0.26)
Enologist	1.10 (1.40)	0.09 (1.51)	1.60 (1.43)	1.34 (1.36)
Upgrading Motivation	0.66 *** (0.21)	0.65 *** (0.24)	0.79 (0.21)	*** 0.46 ** (0.20)
Age	-0.02 (0.02)	0.00 (0.02)	-0.01 (0.02)	-0.03 (0.02)
Foreign Ownership	3.60 (2.25)	3.72 (2.48)	3.34 (2.29)	4.30 ** (2.07)
Ties to all but GSI and Firms	-0.01 (0.45)	-0.51 (0.49)	-0.17 (0.47)	0.09 (0.42)
Ties to Old GSI	-2.43 (2.33)	0.74 (2.54)	-0.85 (2.53)	-1.53 (2.19)
Micro Firms	0.03 (2.47)	0.29 (2.71)	2.71 (3.48)	1.95 (2.29)
Ties to Firms	0.27 ** (0.13)	0.33 ** (0.16)	0.68 * (0.36)	0.44 *** (0.14)
Ties to PPI	2.61 * (1.41)	2.95 * (1.57)	2.82 * (1.45)	5.82 * (3.43)
Geographically Diverse Knowledge		-1.96 (4.33)	0.03 (5.42)	-1.69 (4.08)
Ties to Firms * Geographically Diverse Knowledge			-0.62 (0.59)	
Ties to Firms * Micro Firms			-0.84 * (0.5)	
Ties to Firms * Geographically Diverse Knowledge * Micro Firms			1.42 ** (0.71)	
Ties to PPI * Geographically Diverse Knowledge				-8.07 (4.72)
Ties to PPI * Micro Firms				-8.93 (6.43)
Ties to PPI * Geographically Diverse Knowledge * Micro Firms				21.17 ** (8.55)
Observations	96	96	96	96
R-sq	0.64	0.65	0.67	0.7

LTS Regression. Standard errors in parentheses.

*** p -value < 0.01 ** p -value < 0.05 * p -value < 0.10. Region fixed effects included

test, in which we increased the degrees of freedom available to estimate the parameters. We run a Model P1, which added *Micro firm* to Model S1. Consistent with our argument, parameter estimates in this pooled sample are usually between the parameter estimates for the same independent variables for the subsamples. Model P2 estimation included *Ties to PPIs* and the interactions with *Micro Firm* and *Knowledge Geographic Diversity*. The triple interaction term was positive (p-value = 0.01) and suggest that *Ties to PPI* help Micro firms more to utilize *Knowledge Geographic Diversity* in order to upgrade products. Model P3 parallels model P2, but in this case, instead of ties to PPI we utilized Ties to Firms. Again, parameter estimations show a triple interaction term positive ((p-value = 0.04) suggesting that Micro firms benefit significantly more from *Knowledge Geographic Diverse* the more *Ties to Firms* they have when compared to SMEs. Nevertheless, while these models confirm that Micro firms and SMEs are affected differently, we cannot tell the absolute levels from these estimations. We resort to the split sample estimations to analyze the interactions ties to knowledge geographic diversity for each population. The results reported on the main text are aligned with the results in this appendix.