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A Matter of Location: The Role of Regional Social Capital in Overcoming the Liability of Newness in R&D Acquisition Activities

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Abstract: External knowledge acquisition is a precondition for firms' competitive advantage. However, young firms exhibit a lower propensity to acquire external R&D than their older counterparts. The paper explores the role of regional social capital in moderating this aspect of the liability of newness. The results show that young firms operating in regions with low levels of social capital are less likely to acquire R&D externally. However, this is not the case in regions with high levels of social capital, suggesting that the liability of newness in terms of acquisition of external R&D does not play a role in these regions.

Keywords: Research and development, social capital, liability of newness, geography.

JEL Codes: R11, O32, C24

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1. Introduction

Firms have a higher probability of failing when they are young. STINCHCOMBE (1965) coined the term 'liability of newness' to refer to younger firms' disadvantage compared to their older counterparts. Young firms have to devote resources to acquiring the abilities to operate a business and developing new organizational capabilities (HENDERSON, 1999; ZHANG and WHITE, 2013). The challenge for young firms is to find ways to nullify their disadvantages. CEFIS and MARSILI (2005) suggest innovation as an important solution to the liability of newness. Scholars agree that firms that invest in research and development (R&D) are more likely to introduce new products, and obtain more patents and licenses (COHEN and LEVINTHAL, 1990; GREVE and TAYLOR, 2000). While traditionally investment in internal R&D has been a crucial source of innovation, it is not the only one: firms can leverage resources and knowledge from competitors, suppliers, and other agents, through contractual arrangements such as R&D agreements (LEONE and REICHSTEIN, 2012; LOVE and ROPER, 2001; PISANO, 1990). Exploiting external R&D represents an efficient way to achieve high innovation performance (CASSIMAN and VEUGELERS, 2006; GRIMPE and KAISER, 2010; LAURSEN et al., 2012a), and since young firms are under pressure to seek ways to innovate, one possibility is to invest in external R&D.

However, young firms can find it difficult to acquire knowledge from outside. Trust is a prerequisite for knowledge transfer agreements and stable professional relationships (NGUYEN and ROSE, 2009), and is a resource that takes effort, time, and experience to build. By definition, young firms are disadvantaged in relation to time and experience, and therefore face substantial barriers to the potentially valuable acquisition of knowledge from

external sources. Young firms' difficulties in forging knowledge transfer agreements stem from organizational issues such as lack of reputation, absence of internal routines, and low levels of general management skills (STINCHCOMBE, 1965). While numerous studies (e.g., KOR and MISANGYI, 2008; ZHANG and WHITE, 2013) discuss the strategies that allow firms to escape the liability of newness, the authors of the present article are not aware of work that investigates the role of economic geography in this context.

The economic geography literature highlights how geographical proximity promotes social interactions among local actors. In turn, these social interactions allow knowledge transfer (HAUSER et al., 2007; MALECKI, 2011). This is confirmed in studies of networked firms in industrial districts in the 'Third Italy' (SAMMARRA and BELUSSI, 2006), and work on regional clusters (IAMMARINO and MCCANN, 2006), innovative milieux (CAMAGNI, 1995), innovation systems (COOKE et al., 1997), and learning regions (HAUSER et al., 2007). Consistent with these traditions, this article takes a regional social capital perspective and argues that the population of a region's collective social interactions can foster knowledge transfer, and in turn, increase the probability of young firms' acquiring external knowledge. A social capital perspective includes aspects that inform those interactions such as trust, social norms, obligations, and shared communication codes (NAHAPIET and GHOSHAL, 1998). This paper follows GUISO et al. (2011) and defines regional social capital as persistent shared values and beliefs within a geographically constrained area, that ultimately induce cooperative social behavior and a willingness to act collaboratively. Managers and employees of firms operating in regions with high levels of social capital are more likely to connect with socially distant and diverse individuals (KWON et al., 2013; PUTNAM, 2001). Regional social capital acts as a 'channel' that facilitates the exchange of information and promotes the formation of knowledge exchange agreements within a geographical location (LAURSEN et al., 2012b). High levels of regional social

capital may allow even young firms easier access to different pools of knowledge and new technologies, which in turn, favors innovation activities. Thus, regional social capital can moderate the liability of newness.

The central argument is that geographically bounded social capital eases access to external knowledge since the effort required to set up these embedded ties is significantly lower in contexts with high levels of regional social capital. Firm age plays a secondary role in the likelihood of acquiring new knowledge from external partners in high as opposed to low social capital regions. Empirically, the data come from Italian datasets that provide information on geographically bounded social capital and acquisition of external R&D which cover 4,529 Italian manufacturing firms. Firms' R&D activities are modeled using a nested logit approach since it is assumed that firms' engagement in external R&D activities is the result of a two-nested structure: first, the firm's choice of whether or not to engage in R&D; second, whether this R&D should be performed exclusively in house, or bought partly from outside the firm's boundaries. One finding is that social capital moderates the relationship between firm age and acquisition of external R&D, so young firms are more likely to acquire external R&D in high social capital geographic environments. Indeed, it is only in regions with low levels of social capital that the liability of newness is observed, in the sense of young firms being less likely than mature firms to acquire external R&D. Accordingly, this paper contributes to ongoing debate in economic geography on the importance of firm-specific and region-specific factors for understanding firm behavior (see e.g., BEUGELSDIJK, 2007; STERNBERG, 2001).

2. Previous Literature

Young firms are particularly likely to fail because age is a determinant of the development of high levels of reliability and accountability in firm performance, internal routines, and structures (NELSON and WINTER, 1982). Prospective partners often rely on track records

when evaluating a potential firm collaborator. However, by definition, young firms have no track record and need to overcome information asymmetry problems (CERTO et al., 2001), signal the presence of effective monitoring (DEUTSCH and ROSS, 2003), and compensate for lack of experience and reputation (HONIG et al., 2006).

Social capital may represent an external contingency that moderates the liability of newness. This expectation is grounded in two theoretical perspectives: the relational view of the firm, and social capital theory. The relational view of the firm posits that a firm's critical resources which are embedded in inter-firm resources and practices, often span firm boundaries (DYER and SINGH, 1998). New firms compensate for human and financial capital deficits by relying on social capital; friends and acquaintances can use their ties to spread information about the new firm (BRUDERL and PREISENDORFER, 1998). Also, entrepreneurs tend to rely on pre-existing networks to obtain advice and feedback on ideas (ELFRING and HULSINK, 2003) in order to increase the likelihood that their ventures will survive (BRUDERL and PREISENDORFER, 1998). However, this rich literature says little about the role of geographically bounded social capital. This type of social capital is crucially important; it is widely acknowledged that face-to-face contact required for the transfer of knowledge (LAWSON and LORENZ, 1999), is facilitated by geographical proximity (MORGAN, 2004).

Geographically bounded social capital captures aspects of the firm's context that create the opportunities for knowledge exchange. The 'geographic view' of social capital was introduced by PUTNAM et al. (1993) who looked at social capital as a geographically bounded mechanism that promotes knowledge diffusion through informal interactions. Their work was succeeded by contributions focusing on the relationship between social capital and economic performance (GUISO et al., 2004; KNACK and KEEFER, 1997), and numerous works which claim that social interactions in a geographically bounded area facilitate

learning, knowledge diffusion, and relationship formation (PARK, 1926; SAXENIAN, 1994; SORENSON and STUART, 2001).

3. Hypotheses Development

3.1. New firm liability in the search for knowledge

To innovate, firms need to relate to different sources, and to search for opportunities (SCHUMPETER, 1942/87; TUSHMAN and ROSENKOPF, 1992). One of the firm mechanisms used in this search for new opportunities is investment in R&D (COHEN and LEVINTHAL, 1990; GREVE and TAYLOR, 2000). Firms cannot rely exclusively on internal sources and need to combine them with external sources of technical expertise to become successful (see e.g., LAURSEN et al., 2012a).

There are many reasons why new firms may find it difficult to acquire external R&D. First, it is difficult for new firms to signal to other resource holders, their worth in terms of resources and knowledge, which in turn, limits startups' access to additional resources. Second, firm reputation is built over time, and in collaborating with new organizations, resource holders assume some risk which may make external partners hesitant about providing resources to new firms. Third, as COHEN and LEVINTHAL (1990: 131) point out, firms searching for external partners need to be able to recognize and evaluate external knowledge. Lack of diversified activities is a characteristic of most new firms which makes it more difficult for them to track down complementary partners. Thus, in sum, the liability of newness generally hampers young firms in their quest to acquire R&D externally:

H1: Acquisition of external R&D is positively related to firm age.

3.2. The effects of social capital on the liability of newness

The strategy implemented by the firm can be heavily influenced by the social structure of the context in which the firm is embedded (BURT, 1992; COLEMAN, 1988; GRANOVETTER, 1973; UZZI, 1997). Geographically bounded social capital is one such context and operates

through three related yet different effects. First, there is the *collaboration inducing effect* of regional social capital. At the outset, both acquirer and supplier of external R&D will likely have private knowledge and information about the on-going R&D project, and it may be difficult *ex ante*, to specify precisely in the contract the outcome of the R&D in question (PISANO, 1990).

On the one side, the R&D supplier firm can exploit this situation to obtain economic advantage through a hold-up behavior (LOVE and ROPER, 2002). In this case it might be advantageous for the R&D acquiring firm to accept new — and significantly worse — terms of delivery, given that, in many cases, the alternative (canceling the R&D project which may be connected to internal R&D efforts) could be catastrophic. On the other side, outsourcing of R&D often requires exchange of knowledge between the contractual partners (OSBORN et al., 1998) and the acquiring firm may not be able to specify its specific needs and its knowledge of the complementary technologies under its control. The acquiring firm's lack of competence can make it difficult for the supplier to deliver the appropriate technology. In addition, if the acquiring firm cannot meet its financial obligations in relation to payment for the externally performed R&D, this can expose the R&D supplier to hold-ups or refusal by the acquiring firm to pay the full costs of the R&D activity. In those cases, it may be advantageous for the R&D supplying firm to accept new, less favorable transaction terms given that the alternative might be owning a technology that has few or no alternative uses.

These uncertainties result in a dysfunctional market characterized by low transaction frequency. High levels of regional social capital can provide supplier and acquirer firms with potential resources and information, and an environment that facilitates risk taking while also reducing the need for formal control (OUCHI, 1980). In the presence of localized social capital, the threat of hold-ups for the two firms involved in a transaction is likely to be reduced because of the higher levels of shared information due higher regional social capital.

In defining its knowledge creation strategy, a firm decides whether to engage in R&D activities in the context of the threats and opportunities in its environment (COHEN and LEVINTHAL, 1989). The behavioral theory of the firm (CYERT and MARCH, 1963) emphasizes that organizations choose among available solutions in a search and evaluation process. Alternative solutions compete (OCASIO, 1997), and the solutions external to the firm are identified through relationships with earlier adopters, consultants, or suppliers. A cooperative context increases the stock of solutions available to the firm, increasing the possibilities to access more fine-grained information about the competencies, needs, and reliability of possible partners (KRACKHARDT, 1990; POWELL et al., 1996). Social capital may help the firm to locate and evaluate opportunities (ELFRING and HULSINK, 2003). Moreover, in a region with high levels of social capital, the entrepreneur is more likely to have some established relationships and some reputation which will secure tangible commitments from otherwise skeptical resource holders (STUART and SORENSON, 2003) such as suppliers of R&D. When a regional context presents a variety of social connections, it is easier to obtain information about external partners that can deliver R&D.

The second effect is the *appropriability effect*. In general, external actors are more willing to share knowledge in a context characterized by a high level of social capital which facilitates the transmission of more sensitive and richer information (KRACKHARDT, 1990). In fact, the effectiveness of external knowledge acquisition depends on the willingness of other actors to share useful information and resources (DYER and SINGH, 1998; YLI-RENKO et al., 2001). The social capital literature argues that social capital has a positive effect on knowledge transfer, influencing the willingness of individuals to dedicate time and effort to cooperation with others (COLEMAN, 1988; GRANOVETTER, 1985). Trust provides confidence that the knowledge shared will not be appropriated or misused (KRACKHARDT, 1990; MCEVILY et al., 2003).

All companies, including young firms, acquire knowledge from other firms through 'ingoing spillovers'. However, it is necessary to guard against the damaging effects of 'outgoing spillovers' (CASSIMAN and VEUGELERS, 2002). When the focal firm acquires R&D from another firm, it may have to disclose some of its own knowledge in order to be able to specify the type of technology it wants to develop (GRIMPE and KAISER, 2010). The firm providing the R&D could exploit this knowledge and use it for its own ends (and might also appropriate part of the technology it is being paid to develop). Young high-tech firms are especially vulnerable to outgoing spillover problems because they rely on just one or very few technologies (GANS and STERN, 2003). However, in local environments characterized by high levels of social capital, concern over outgoing spillovers may be smaller since accounts of knowledge theft are likely to spread rapidly as a result of the high degree of social connectedness. Thus, breaching an explicit or implicit agreement is likely to be heavily penalized by the external regional environment (GULATI, 1995, terms this phenomenon 'deterrence-based trust').

The third mechanism is the *communication effect*. Sharing the same localized communication codes makes it easier for firms to cooperate over complex projects such as R&D. Regional social capital enables shared language and meaning which facilitate access to information and resources. GULATI (1995) argues that a degree of familiarity with partners promotes reciprocal understanding. Following NAHAPIET and GHOSHAL (1998), it is argued here that geographical areas that are rich in social capital are the locus of a shared language and norms that facilitate knowledge diffusion. Social capital promotes relationships that are stable and productive over time and increases relation-specific common knowledge. In turn, this improves knowledge flows by accelerating the sharing of ideas and feedback. Thus, the liability of newness in general hampers young firms in their quests to acquire R&D externally but this effect is reduced in geographical contexts with high levels of social capital.

In sum, collaboration inducing, appropriability, and communication effects all support the following hypotheses:

H2a: Firms operating in settings associated with high levels of regional social capital are more likely to acquire R&D externally than similar firms operating in settings associated with low levels of regional social capital.

H2b: The liability of newness in the acquisition of external R&D plays a role in low but not high social capital regions.

4. Data and Method

4.1. Data

The article builds on a dataset created by merging data collected by the Italian Bank Group, Unicredit-Capitalia for a sample of Italian manufacturing firms, with regional data collected by the Italian Institute of Statistics (ISTAT). The data refer to the three-year period 2001-2003. The Unicredit-Capitalia survey response rate was 28.5% and the sample obtained is representative of Italian manufacturing firms across four macro regions (i.e. northwest, northeast, center, and south), Pavitt (1984) sectors (i.e. supplier dominated, scale intensive, science based, specialized supplier), and firm sizes (11-20, 21-50, 51-250, 251-500, more than 500 employees) (CAPITALIA, 2005).The analysis relies on 3,270 observations after deleting a small number with missing values for one or more variables.

The regional ISTAT data collected in 1999 provides information on the features of the social relationships among citizens in the firm's home region that define social capital. The aim is to capture the social features of the sub-national regions that comprise Italy. In 1999, the response rate was 82.5. Data were aggregated into 21 regions corresponding to the Nomenclature of Territorial Units for Statistics level 2 (NUTS 2).

Two separate data sources are used for the dependent variable and one of the two main independent variables (regional social capital). The other independent variable is firm age,

which is objectively observable. Therefore, most problems related to common method bias are avoided although it might affect the control variables and the dependent variable. However, a Harman's one-factor test on the firm-level variables to examine whether common method bias might be augmenting some of the relationships detected, did not indicate the presence of such bias.

Dependent Variable: The Unicredit-Capitalia survey provides information on firms' R&D investments by asking respondents whether they invest in R&D activities, and what percentage of R&D is acquired externally. Based on these questions, a three level dependent variable with the following outcomes was constructed (i) '*Does Not Invest in R&D*', (ii) '*Internal R&D Only*', or (iii) '*External R&D*'. Empirically, 114 firms that invest exclusively in external R&D, and 616 firms that invest both internally and externally are observed. For simplicity, these are grouped into one category, labeled external R&D. Among firms that invest in both internal and external R&D, an average of 42% of this investment was external. Although firms' internal and external R&D investments are continuous variables, both exhibit skewed distributions, with many firms showing zero R&D investments. 54% of firms engage in neither internal nor external R&D activities. It was decided to use discrete dependent variables given the non-normality of these distributions.

Independent Variables: The analysis uses two independent variables. First, firm age is considered as the measure of the liability of newness. *Age* is measured in logarithmic terms as number of years since the firm was founded. Second, *Regional Social Capital* is considered. Membership in informal and formal associations and networks is commonly used to measure social capital (WOOLCOCK and NARAYAN, 2000). In line with previous empirical studies on social capital (BEUGELSDIJK and SCHAIK, 2005; HAUSER et al., 2007; LAURSEN et al., 2012a), the measure of social capital proposed aims at capturing elements of the firm's context that indicate strong social ties and local participation in social

associations (PUTNAM et al., 1993). Eight regional items were selected. Three (i.e. *Meeting friends regularly; Social meetings; Satisfaction with relationships with friends*) provide a measure of the networking activities of citizens related to socializing with friends (PUTNAM, 2000), and five (i.e. *Participation in cultural associations; Participation in voluntary associations, Money donations to associations; Participation in non-voluntary organizations, Number of voluntary associations per region*) capture local involvement in social associations.

The literature shows that the 21 Italian regions represent an appropriate unit of analysis compared to the alternative of provinces. In a variance component analysis with random effects, LAURSEN et al. (2012a) show that there is much larger variance among Italian regions than among provinces within regions (103 provinces in 21 regions) in relation to variables for social capital. Moreover, the data at the level of the 21 Italian regions arguably are better than the available provincial level data for measuring social capital, hence the choice of the regional rather than the provincial level. However, in the results section, a robustness check is conducted using the available province-level data.

The chosen items used to measure social capital were selected based on multiple considerations. First, they measure the level of social relationships among citizens as reflected by participation in networks, participation in the community, and involvement of citizens in associations, rather than outcomes such as perceived levels of trust. Those outcomes are more difficult to measure empirically. Second, the measures are representative of a very large underlying population and allow measurement of the social features of entire regions. Third, they reflect the breadth of social ties, an essential element of social capital theory, and fourth, they are in line with Putnam's (PUTNAM, 2000; PUTNAM et al., 1993) proposed measurement of social capital and with other empirical studies of social capital (BEUGELSDIJK and SCHAIK, 2005; HAUSER et al., 2007; LAURSEN et al., 2012a).

Principal Component Analysis (PCA) is used to estimate the degree to which a common underlying structure can be identified. The widely used KAISER (1960) criterion is adopted in this context. Among the eight items, only one component with an eigenvalue greater than 1 (eigenvalue=5.99) was extracted. This component (i.e. Regional social capital) explains 75% of the total variance and appears to capture both strong ties and social associations. The analysis suggests that the variables are interrelated which allows them to be captured in one latent construct. Table 1 presents the PCA factor loadings.

[Insert Table 1 about here]

An item-test correlation shows that each item is correlated with the overall scale. Individual correlations range from 0.74 to 0.94. An item-rest correlation highlights that each item is correlated with a scale computed from the other seven items, ranging from 0.67 to 0.91. Thus, convergent validity is confirmed. In addition, the Cronbach's Alpha, computed to check the correlation between the observed and true values, is equal to 0.94, above the widely accepted threshold of 0.70, and therefore demonstrating good internal consistency of the measure. Figure 1 shows how the measure of social capital varies across Italy. Social capital is higher in the north of Italy (especially in the northeast), weaker in the center, and very weak in the south.

[Insert Figure 1 about here]

Control Variables: In order to avoid the possibility of the results being due to firm-, industry-, or geography-specific differences, controls are included at each level of aggregation.

Firm-specific controls: Large firms are more likely to pursue formalized R&D activities (COHEN and KLEPPER, 1996; SCHERER, 1965). Accordingly *Firm Size* is controlled for, measured as number of employees. The ability to draw on other entities within the same corporate structure may have a positive effect on firm's external R&D acquisition. Therefore,

belonging to a *Corporate Group* is controlled for. *Export Intensity* is controlled for, measured as the ratio of foreign to total sales, since firms exhibiting export capabilities may be more attractive to external partners. Also, since attention to user needs is important for a successful R&D strategy (VON HIPPEL, 1988), a dummy variable is included for a firm policy of exploiting *Customer Satisfaction*. To proxy for *Firm Human Capital*, the percentage of employees with degrees is controlled for. Finally, firm openness is proxied by the dummy variable *Patent Acquisition* to control for whether the firm has participated in the international market for technology by acquiring a patent or a license in a foreign country.

Industry-specific controls: To account for industry differences in R&D activities, *Industry R&D intensity* is included in addition to four dummies for PAVITT's (1984) sectors: *Supplier -dominated, Scale intensive, Science-based,* and *Specialized supplier*.

Regional-specific controls: To capture regional technological characteristics private firms' R&D expenditure as a percentage of regional GDP (*Regional Private R&D/GDP*) is included. To proxy for the regions' economic activities the *Herfindahl Index of Industry Concentration* by region is included, measured using industry sales data for 38 industries in each region. To control for region size, *Regional Population*, measured using the logarithm of the number of residents in the given region, is added. Finally, *Labor Productivity* is included to account for regional development, measured as value added per employee.

4.2. Econometric method

The dependent variable is a three-level categorical variable. Following HAUSMAN and MCFADDEN (1984), the theoretical mechanisms underlying the research question being investigated are considered. Logically, the three outcomes of the dependent variable can be categorized into two main groups — the firms choosing a proactive innovation based strategy (to generate competitive advantage through R&D investment in innovative outputs), and those choosing strategically not to invest in purposeful innovation efforts. The former group

includes the outcomes for the two dependent variables '*Internal R&D Only*' and '*External R&D*'. This suggests that these two outcomes have some common features, and are fairly well correlated compared to the third possible outcome, '*Does not invest in R&D*'. External R&D investments are often perceived as an extension of in-house R&D activities, and a response to shorter product life-cycles. Rather than being considered outsourcing, external R&D is often considered to be a joint, interactive effort to achieve more effective innovation (MOLS, 2005). These arguments suggest that the three levels are nested, and that two out of the three are likely to be nested in a common strategy in which R&D is considered central.

A nested logit estimation technique is applied.[1] This model configures the decision process as a nested structure by grouping alternatives into sub-groups (nests) such that the Independence of Irrelevant Alternatives (IIA) assumption is valid for each subgroup (TRAIN, 2003). Figure 2 provides an overview of the model specification depicting the asymmetric nature of the data. In Figure 2, $\mathbf{X_1}$ is a vector of the explanatory variables in the upper nest and $\mathbf{X_2}$ is a vector of the explanatory variables in the lower nest. Interaction effects are used to implement this asymmetric specification (see for instance, DRUCKER and PURI, 2005). Note that the nested logic technique does not assume a specific sequential outcome of the firm strategy.

[Insert Figure 2 about here]

To investigate whether the '*liability of newness*' is moderated by social capital, the model was run three times: on the full sample of firms, and on two split samples based on the regions where the firms are located. The two sub-samples are defined by the quartiles investigating firms operating in regions that are among the upper 75% in terms of social capital (high social capital), and firms operating in regions that are among the lower 25% in terms of social capital (low social capital).

5. Results

5.1. Main Results

Table 2 reports the descriptive statistics of the variables included in the model, and the associated Pearson correlation coefficients of the reshaped data. None of the correlations are very high, ruling out the possibility of multicollinearity. Table 2 shows that 54% of the observations made no investment in R&D, 24% invested in internal R&D only, and 22% invested externally.

[Insert Table 2 about here]

Table 3 presents the results of the nested logit regressions. Model I contains the results for the total sample across both low and high social capital regions. Models II and III respectively present the results for the sample of firms located in regions with high social interaction and low social interaction.

[Insert Table 3 about here]

Support is found for Hypothesis 1. Model I provides positive and significant estimates for firm age explaining firms' external knowledge acquisitions (significant at the 1% level). This result implies that older firms are overrepresented among those investing in external R&D. It was found also that younger firms are less likely to invest only in internal R&D. Note that a Wald test suggests that the liability of newness appears equally strong for external R&D compared to internal R&D investment only.

The significance of the interaction term Regional Social Capital × External R&D in Model I shows that regional social capital facilitates external R&D acquisition, lending support to hypothesis H2a that firms operating in settings associated with high levels of regional social capital are more likely to acquire R&D externally than similar firms operating in settings associated with low levels of regional social capital. It is observed also that the coefficient of Regional Social Capital × Internal R&D Only is positive and significant. A Wald test indicates that the two parameters cannot be considered to be different. There may be two

reasons for this. First, firms' investments in in-house R&D can enhance the value of a location characterized by high levels of social capital: To gain from external knowledge facilitated by geographically bounded social capital, firms are better off having higher levels of in-house knowledge because it enhances the firm's ability to understand and absorb external knowledge (COHEN and LEVINTHAL, 1990). Second, the value of internal R&D investments can be enhanced by external knowledge facilitated by localized social capital. Often, internal R&D-based search is not on its own sufficient to resolve all the problems that arise in the course of an innovation project. A combination of in-house and beyond-firm knowledge is required (ROSENKOPF and ALMEIDA, 2003).

Taken together, Models II and III in Table 3 suggest that young firms suffer from the liability of newness only if they are located in regions with low social capital. Age does not seem to play a role for firms operating in regions characterized by high levels of social capital. Thus, social capital acts as a moderator, and the results support Hypothesis 2b.[2] Again, a Wald test shows that the magnitude of the liability of newness for internal R&D investment only is not different from external R&D investment in a low social capital setting.

Average Marginal Effects (AMEs) associated with firm age in Model III can be found in Table A1 in the Online Appendix. These are calculated for all three potential choices, and illustrate the change in probabilities given a one unit increment in firm age at mean values. Increasing Firm Age × Internal R&D Only by one unit is associated with a 5.4 percentage point increment in the likelihood of investing externally, given that initially firms only invest internally. Similarly, the same unit change is associated with a 3.3 percentage point reduction in the likelihood of not investing in R&D given that the respondent is investing externally. Older firms tend to be more active in R&D in low social capital regions. While the AMEs tend to be consistent in the external and internal nodes, the magnitudes in the external node seem greater in absolute values.

5.2. Robustness Checks

A number of robustness checks were performed to evaluate the consistency of the results. The outcomes of these checks are reported in the Online Appendix, Table A2. First, the estimates might be affected by the choice of region as the level of aggregation for the social capital variable. To address this issue, the analysis is performed at the provincial level using five items. Three (*Number of non-profit firms*, *Number of unpaid workers in non-profit organizations*, *Number of employees in non-profit firms*) provide a measure of local involvement in social associations. Following PUTNAM (2002) a measure of *Social inclusion* based on number of foreign residents is included. Finally, PORTES and SENSENBRENNER (1993) argue that social capital is generated by individual disciplined compliance with group expectations and respect for contractual terms. Hence a measure of *Enforceable trust* is used based on the number of legal cases per capita over non-recognition of payment obligations in year 2001. The results are reported in the top section of Table A2 in the Online Appendix, and are consistent with the results obtained at the regional level.

Second, consideration was given to whether the reported results are a consequence of the choice to use the 25th and 75th percentiles of the social capital values to define low and high social capital regions respectively. They were varied both upwards and downwards but remained unchanged even when the 50th percentile was used to create a dichotomy of low and high social capital regions and when the 10^{th} and 90^{th} percentiles were used as border values. The results in general were robust to these specification changes.

Third, to be parsimonious when estimating the nested logit models reported in Table 3, the group of firms that invest in both internal and external R&D and the group of firms that invest only in external R&D were separated. Results were consistent but less significant for the category of firms investing only in external R&D (see the Online Appendix, Table A2). The sample was then split by social capital values using first the 25/75 percentile split and

then the 10/90 percentile split. The age relation holds only for low social capital regions, and only for the 10/90 percentile split. However, the relatively small number of observations of investment in both internal and external R&D, and in only external R&D reduces the power of these tests, and the strength of their foundation for any conclusions. Nevertheless, the findings are in line with the main story in this paper.

6. Discussion

This study demonstrated that geographically bounded social capital shapes young firms' tendencies to acquire external R&D. It was argued that it is difficult for young firms (compared to older firms) to establish relationships with key resource holders, and to access external sources of knowledge, and that geographically bounded social capital moderates the liability of newness. Empirically, social capital was shown to represent a contextual variable which increases the likelihood that young firms will exploit external R&D, thereby compensating for the liability of newness. Theoretically, these empirical findings can be accounted for by the collaboration inducing effect, the appropriability effect, and the communication effect.

Following STINCHCOMBE's (1965) analysis of the liability of newness, researchers have tried to identify factors that influence the survival of young organizations. This article contributes to this work by showing that new firms are less likely to participate in external R&D networks. The paper also contribute to debate in economic geography (BEUGELSDIJK, 2007; STERNBERG, 2001), and provides evidence suggesting that regional social capital is an important contingency for small firms' engagement in external R&D. Following the directions in BEUGELSDIJK (2007), the present paper shows that regional settings have an impact on small firms' innovation-related behavior. The results are consistent with work in economic geography highlighting the importance of location for firm competitiveness, in relation to industrial districts and territorial innovation systems

(BRUSCO, 1982; ROMANELLI and KHESSINA, 2005). The article contributes also to understanding the difference between the general knowledge base and specific sources of knowledge and their impact on spatial distributions (see e.g., KENNEY and PATTON, 2005).

The study adds to the social capital literature in two ways. First, the research shows that geographically constrained social capital can yield private benefits to firms (in the present study, reducing the liability of newness in the context of R&D outsourcing) but that it is the collective aspect (localized norms and networks that induce cooperative behavior and a willingness to act together) which facilitates these private benefits. Second, by linking firm strategies to geographically constrained social capital, the study demonstrates the value of integrating concepts from the social capital, geography, and entrepreneurship literatures.

This study has some limitations. The focus was on the positive net effects of social capital whereas social capital can also have negative effects. Relying on GRANOVETTER (1973), social capital scholars recognize that strong ties can have negative consequences such as excessive claims on group members and exclusion of outsiders (see, PORTES, 1998: 15). PUTNAM (2000) suggests that there are two forms of (within-group) social capital: bonding social capital, and bridging social capital. When bonding social capital prevails, there may be negative effects on knowledge sharing. In line with PUTNAM (2001), it should be acknowledged that it is very difficult empirically to separate these types of ties. The measure of social capital proposed in this paper is based on a combination of measures related to bonding and bridging ties. Although valuable, research that separates bonding and bridging social ties would be extremely difficult to carry out at the relatively high level of aggregation of the Italian regions.

Furthermore, although prior research suggests that formal links occur in close geographical proximity (see e.g., FELDMAN, 1994; JAFFE, 1989), this study does not

provide information on whether or not the R&D selling partner is located in the firm's home region. It might be that a high level of regional social capital allows the acquiring firm to be better connected socially to a selling firm located in the home region, or alternatively, that a high level of regional social capital makes acquirers better able to learn to deal with the process of outsourcing R&D generally (beyond the home region). Future research should collect data on the geographic origins of acquired R&D to further disentangle the effects investigated in this paper. Related to this is the more general point that this paper hypothesized relationships between regional social capital and the firm-level variables that are observed empirically but based on theoretical mechanisms which are not observable. Three theoretical mechanisms were proposed — the collaboration-inducing effect, the appropriability effect, and the communication effect — to explain why regional social capital should be linked to external R&D; however, it is a limitation that these effects were not modeled empirically. Future research could provide more fine-grained empirical analyses which account explicitly for the relevant theoretical mechanisms.

Greater emphasis on how geographically bounded social capital enables and constrains behavior in young organizations would seem a fruitful area for future research. Here, the focus was on R&D activity but regional social capital might influence the effectiveness of other external relations of entrepreneurial firms. The insights from research along these lines would inform the decisions made by entrepreneurial firms about how to work with external partners. Finally, the paper investigates the probability of linkages being established with an external R&D partner but does not examine the formal outcomes of such linkages. Follow up research could investigate the extent to which social capital not only lowers the liability of newness barrier but also enhances firm performance once this hurdle has been cleared.

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Endnotes

[1] A multinomial logit model violated the IIA assumption, supporting the choice of a nested logit.

[2] To confirm that differences between young and old firms are less pronounced in regions with higher levels of social capital, the means of the External R&D dummy for the two independent groups of firms were compared (i.e. younger and older than 15 years) across high and low social capital settings. In low social capital settings, the *t*-test indicates that there is a statistically significant difference between the mean of the External R&D dummy for the two group of firms (t=-2.5869, p=0.0098). In high social capital settings, this difference is not significant (t=-1.6275, p=0.1042).

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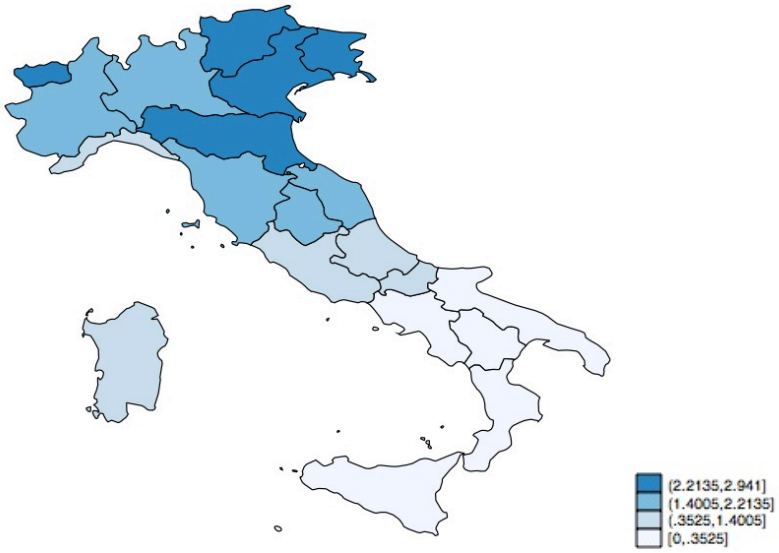

Figure 1: The level of social capital across Italian regions

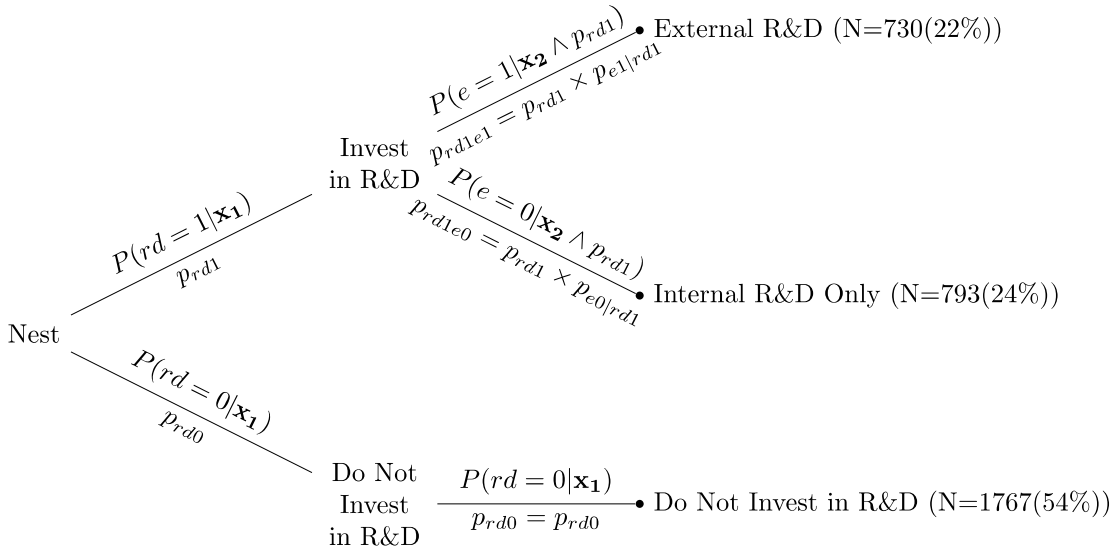

Figure 2: Nesting structure of the implemented strategy

Table 1. Results of Principal Component Analysis at the regional level

	Component1: Regional social capital	
	Factor loading	Communalities
Participation in cultural associations	0.938	0.910
Participation in voluntary associations	0.908	0.680
Participation in non-voluntary organizations	0.912	0.950
Number of voluntary associations per region	0.849	0.900
Money donated to associations	0.936	0.770
Meeting friends regularly	0.727	0.600
Social meetings	0.880	0.650
Satisfaction with relationships with friends	0.745	0.700

Table 2: Descriptive statistics and correlation matrix.

	Mean	S.D.	Min	Max	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
[1] Does Not Invest in R&D	0.540	0.498	0.000	1.000									
[2] Internal R&D Only	0.243	0.429	0.000	1.000	-0.625								
[3] External R&D	0.217	0.412	0.000	1.000	-0.558	-0.300							
[4] Regional Social Capital	1.749	0.759	0.000	2.941	-0.163	0.090	0.104						
[5] Firm Age	4.067	0.729	1.000	6.247	-0.054	0.027	0.037	0.129					
[6] Firm Size	103.306	255.374	0.000	7085.000	-0.151	0.057	0.124	0.018	0.052				
[7] Member of a Corporate Group	0.301	0.459	0.000	1.000	-0.158	0.053	0.136	0.030	-0.095	0.268			
[8] Export Intensity	29.944	30.234	0.000	100.000	-0.278	0.162	0.167	0.117	-0.008	0.151	0.128		
[9] Customer Satisfaction	0.715	0.451	0.000	1.000	-0.090	0.025	0.083	-0.030	0.036	0.077	0.039	-0.002	
[10] Firm Human Capital	5.249	7.431	0.000	85.71	-0.188	0.086	0.138	-0.047	-0.028	0.082	0.203	0.107	0.085
[11] Patent Acquisition	0.021	0.144	0.000	1.000	-0.084	0.042	0.058	0.030	0.045	0.117	0.065	0.074	0.051
[12] Industry R&D Intensity	0.809	0.853	0.000	5.707	-0.219	0.114	0.146	0.057	-0.042	0.049	0.112	0.139	0.049
[13] Supplier-dominated	0.524	0.500	0.000	1.000	0.155	-0.091	-0.093	-0.059	0.002	-0.049	-0.123	-0.055	-0.049
[14] Scale-intensive	0.169	0.375	0.000	1.000	0.074	-0.038	-0.050	-0.069	0.007	0.033	0.045	-0.166	-0.005
[15] Science-based	0.039	0.195	0.000	1.000	-0.105	0.018	0.110	-0.026	-0.005	0.037	0.085	-0.005	0.049
[16] Specialized-supplier	0.268	0.443	0.000	1.000	-0.193	0.128	0.099	0.137	-0.006	0.010	0.064	0.205	0.038
[17] Regional Expenditure on Innovation (% of regional GDP)	0.539	0.361	0.010	1.320	-0.113	0.083	0.049	0.403	0.090	0.036	0.042	0.043	0.026
[18] Herfindahl Index of Industry Concentration	0.152	0.033	0.122	0.398	0.111	-0.066	-0.066	-0.447	-0.053	-0.029	-0.024	-0.111	0.022
[19] Regional Population	15.209	0.706	12.689	16.007	-0.028	0.043	-0.012	0.017	0.097	-0.016	-0.049	0.027	0.018
[20] Labour Productivity	30.004	4.356	19.100	36.000	-0.133	0.104	0.051	0.550	0.178	0.024	0.021	0.085	0.009

	[10]	[11]	[12]	[13]	[14]	[15]	[16]	[17]	[18]	[19]
[12] Industry R&D Intensity	0.073									
[13] Supplier-dominated	0.230	-0.365								
[14] Scale-intensive	-0.187	-0.134	-0.477							
[15] Science-based	-0.002	0.556	-0.219	-0.091						
[16] Specialized-supplier	0.241	0.280	-0.635	-0.264	-0.121					
[17] Regional Expenditure on Innovation (% of regional GDP)	0.106	0.086	-0.132	0.018	0.033	0.121				
[18] Herfindahl Index of Industry Concentration	0.031	-0.080	0.027	0.067	-0.031	-0.074	-0.161			
[19] Regional Population	0.023	0.067	-0.123	0.025	0.017	0.111	0.238	-0.160		
[20] Labour Productivity	-0.040	0.108	-0.137	-0.012	0.021	0.157	0.455	-0.402	0.594	

Table 3: Determinant of R&D activity: Results of the Nested Logit Regression.

	Model I Total Sample	Model II High Regional Social Capital	Model III Low Regional Social Capital
Make or Buy Equation			
Regional Social Capital × External R&D	0.242**		
	[0.120]		
Regional Social Capital × Internal R&D Only	0.330***		
	[0.126]		
Firm Age × External R&D	0.214**	0.130	0.383**
	[0.098]	[0.219]	[0.156]
Firm Age × Internal R&D Only	0.082	0.035	0.342**
	[0.081]	[0.208]	[0.134]
Invest in R&D Equation			
Firm Size	0.002***	0.006***	0.001
	[0.001]	[0.002]	[0.000]
Member of a Corporate Group	0.236**	0.210	0.258
	[0.103]	[0.258]	[0.202]
Export Intensity	0.014***	0.014***	0.014***
	[0.001]	[0.004]	[0.003]
Customer Satisfaction	0.308***	0.209	0.138
	[0.088]	[0.226]	[0.199]
Firm Human Capital	0.039***	0.078**	0.036**
	[0.008]	[0.024]	[0.015]
Patent Acquisition	0.615*	14.221***	0.014
	[0.339]	[0.477]	[0.901]
Industry R&D Intensity	0.318***	0.624***	0.261**
	[0.081]	[0.194]	[0.124]
Supplier-dominated	-0.431***	-0.301	-0.230
	[0.113]	[0.292]	[0.263]
Scale-intensive	-0.434***	-0.777**	-0.027
	[0.143]	[0.375]	[0.304]
Science-based	-0.205	-0.685	-0.219
	[0.284]	[0.770]	[0.570]
Specialized-supplier	Benchmark	Benchmark	Benchmark
Regional Expenditure on Innovation (% of regional GDP)	0.128	0.012	0.421
	[0.133]	[0.297]	[0.483]
Herfindahl Index of Industry Concentration	-1.879	-1.425	-3.646
	[1.525]	[35.183]	[2.379]
Regional Population	-0.058	-0.038	-0.172
	[0.087]	[0.934]	[0.012]
Labour Productivity	0.013	0.081	0.033
	[0.017]	[0.485]	[0.056]
Constant	-2.313	-5.045	-1.018
	[1.711]	[12.285]	[3.435]
Observations	8574	1536	2151
Firms observed	2849	512	717
Log-Likelihood	-2599.16	-468.964	-1272.16
Chi2	398.87***	1167.55***	199.08***

*p<0.10; **p<0.05; ***p<0.01. Two-tailed tests of significance. Standard errors in parentheses.

Online Appendix

Appendix Table A1: Average Marginal Effects of explanatory variables and Model I.

	Firm Age x Internal	Firm Age x External
Prob(Choice=None)		
None	0.073	0.082
Internal	-0.039	-0.044
External	-0.033	-0.037
Prob(Choice=Internal)		
None	-0.039	-0.044
Internal	-0.015	-0.017
External	0.054	0.061
Prob(Choice=External)		
None	-0.033	-0.037
Internal	0.054	0.061
External	-0.021	-0.024

Appendix Table A2: Robustness checks with regard to definition of region and of higher and low social capital.

	Complete Sample			High Social Capital Region		Low Social Capital Region		
	Coeff.		Std. Err.	Coeff.	Std. Err.	Coeff.		Std. Err.
	Social capital variables estimated based on province levels							
Social Capital x External	0.167	**	0.082					
Social Capital x Internal Only	0.330	***	0.718					
Firm Age x External	0.209	***	0.072	0.045	0.142	0.357	***	0.159
Firm Age x Internal Only	0.125	**	0.540	0.020	0.133	0.111		0.094
	Using 90th and 10th percentiles for defining high and low social capital regions							
Firm Age x External				0.436	0.304	0.475		1.383
Firm Age x Internal Only				0.454	0.299	1.671	*	1.011
	Using median for defining high and low social capital regions							
Firm Age x External				0.082	0.157	0.221	*	0.131
Firm Age x Internal Only				0.010	0.147	0.190	**	0.094

*p<0.10; **p<0.05; ***p<0.01. Two-tailed tests of significance.