

## THE GEOGRAPHIC SCOPE OF THE MNC AND ITS ALLIANCE PORTFOLIO: RESOLVING THE PARADOX OF DISTANCE

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*Some research suggests that knowledge transfer and performance suffer when entities are distant from each other, while other work emphasizes that distance is beneficial by allowing firms to access novel and diverse knowledge. We resolve this paradox by focusing on the differing roles of MNC subsidiaries and headquarters vis-à-vis its alliances: distance between technology alliance partners and subsidiaries hurts MNC performance, but MNCs benefit when such partners are located afar from headquarters. We find support for these ideas in a longitudinal sample (2002 to 2006) of 126 Fortune 500 firms. Our work broadens the concept of the geographic scope of the firm, and suggests that MNCs gain by searching globally but collaborating locally. Copyright © 2011 Strategic Management Society.*

### INTRODUCTION

Considerable research on the geographic scope of multinational corporations (MNCs) has examined the effect of the global dispersion of their internal units on firm performance (e.g., Goerzen and Beamish, 2003; Hitt, Hoskisson, and Kim, 1997). More recent work on alliance portfolios has studied the effect of the international distribution of the MNC's alliance partners on MNC performance (Lavie and Miller, 2008). However, it is important to recognize that, in the context of an MNC, its alliance portfolio exists alongside a 'portfolio' of internal units, and both are globally dispersed. Alliances play

a fundamental role in the value creation activities of MNCs by allowing them to reach beyond their boundaries for access to knowledge and other resources. At the same time, MNCs must configure their subsidiaries in ways that allow them to efficiently appropriate the value created through the alliances. Thus, research on the scope of the MNC must consider its internally owned units and alliances jointly to properly understand the effects of geographic scope on firm performance. To this end, and in light of research that has highlighted the role of distance as central to MNC functioning (Ghemawat, 2001; Johanson and Vahlne, 1977; Zaheer, 1995), we study how the geographical distance of the MNC's global alliance portfolio with respect to the MNC's wholly owned units influences its performance.

The joint geographical configuration of wholly owned units and alliances is especially relevant for MNCs engaged in knowledge creation and technology activities, which include elements such as R&D,

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technology transfer, and the seeking out of novel sources of value creation (Kogut and Zander, 1993; March, 1991; Penner-Hahn and Shaver, 2005). In fact, international business scholarship has recognized the growing importance of knowledge-seeking foreign direct investment (FDI) as a driver of the MNC's configuration (Dunning, 2001; Nachum and Zaheer, 2005). For such technology-oriented MNCs, extant work presents a paradox by suggesting that physical distance exerts both positive and negative effects on performance. On the one hand, distance is valuable because it allows firms to reach out to sources of unique, diverse, and non-redundant knowledge (Kogut, 1983; Rosenkopf and Almeida, 2003). On the other hand, doing business across distance imposes well-known costs of control, coordination, and travel, as well as being associated with the difficulties of adapting to different cultural and institutional environments (Zaheer, 1995). More recently, scholars have shown how distance increases the difficulty of transferring tacit knowledge (Bell and Zaheer, 2007; Jensen and Szulanski, 2004)—which is especially important to MNCs engaged in technology-related activities. Given this paradox of distance, it becomes important to explain the conditions under which distance within the technologically oriented firm's geographic scope exerts positive or negative effects on firm performance.

We provide a potential solution to this puzzle by arguing that in the case of MNCs engaged in technological development, fundamental differences in the roles played by headquarters (HQ) and subsidiaries with respect to technology alliance partners explain *when* distance is beneficial or harmful. Specifically, we propose that MNC performance suffers when its subsidiaries are located afar from technology alliance partners, but that it improves when the HQ is distant from such alliance partners. This dichotomy occurs because subsidiaries are primarily involved in knowledge creation and transfer processes with local alliance partners and, thus, require propinquity with them to avoid the well-established difficulties in the transfer of technological knowledge (Jensen and Szulanski, 2004). In contrast, the HQ unit is not primarily involved in ongoing operational activities with alliance partners and, thus, does not experience the costs and difficulties of knowledge transfer (Hewett, Roth, and Roth, 2003). Moreover, the HQ represents the original knowledge base or 'technological core' of the MNC, and the further away the firm reaches to the periphery to source new

ideas through alliances, the greater the likelihood that such ideas will be novel and non-redundant (Brown and Duguid, 1991; Christensen, 1997; Granovetter, 1973). To validate these theoretical mechanisms, we propose two contingencies: (1) the positive effect of alliance distance from headquarters attenuates the negative effect of alliance distance to subsidiaries; and (2) both the positive and negative effects of distance are amplified as the research intensity of the MNC increases, as difficulties and opportunities surrounding the transfer of technological knowledge are magnified with greater research intensity.

We test these ideas on a longitudinal sample of 126 Fortune 500 MNCs from 2002 to 2006, comprising more than 400 firm-years of data. We collected data on all the alliances and subsidiaries of these firms from multiple data sources and calculated the distances based on the cities in which headquarters, subsidiaries, and alliance partners were located. We estimated the effects of these distances on MNC return on assets (ROA) using a dynamic panel generalized method of moments (GMM) estimator (Arellano and Bond, 1991). Our hypotheses are strongly supported.

We contribute to several streams of literature. Broadly, our study makes the key point that the geographic scope of the MNC cannot be properly understood by focusing only on MNCs' internally owned units. Instead, the configuration of internal units and alliances must be studied jointly. To the alliance literature, we show that the effects of alliance portfolios on firm performance need to be explained in terms of the geographic congruence of the portfolio with the firm's internal units, rather than in a stand-alone fashion. To the international business literature, we demonstrate that distance to alliance partners is an important component of MNC performance. In addition, we demonstrate that geographic distance is a central component of global strategy, with effects independent of the cultural, institutional, and other distances that more recent literature has emphasized. To the innovation and geography literature, we contribute by resolving the paradox of distance and disentangling the benefits and costs of distance by distinguishing between the different roles that HQ and subsidiaries play with respect to technology alliance partners. Overall, our study suggests that firms should reach out globally in search of technological knowledge, but collaborate locally to obtain the best results for the MNC as a whole.

## THEORY AND HYPOTHESES

The international business (IB) literature has had a long tradition of pointing to the costs of doing business abroad (Buckley and Casson, 1976; Hymer, 1976). In fact, the liability of foreignness is arguably the key assumption upon which IB theory is built (Zaheer, 1995). By implication, the problem of dealing with the ‘distances’ that give rise to the costs of doing business abroad provides the motivation for the study of global strategy. Distance has been conceptualized in multidimensional terms, such as cultural, institutional, political, and economic, in addition to geographic distance (Delios and Henisz, 2003; Ghemawat, 2001; Kogut and Singh, 1988). We focus on geographic distance (although we control for other dimensions) for two reasons.

First, while many of the nongeographical distances may be legitimately related to geography (and perhaps assumed to eliminate its effects), we argue that an element of geography remains unique and separate from these other distances. For example, two locations may be equal in every other way, but if a firm is close to one but distant from the other, the amount and type of learning and value creation from each location is likely to differ. Here it becomes important to distinguish between the ‘place’ and the ‘space’ implications of geographic distance. ‘Place’ refers to the inherent characteristics of the physical locations—e.g., institutions, natural endowments—that affect MNC strategy and performance. Often the differences between the many places spanned by MNCs are important, as much research shows (e.g., Porter, 1986; Wheeler and Mody, 1992), although there is increasing recognition that firms differ in their capability to extract value from ‘place’ (Zaheer and Nachum, 2011). Yet there remains a distinct element of ‘space’—which refers to the physical distribution of entities—that should also affect MNCs and their performance because these are inherently multispace organizations.

Our second reason for focusing on geographic distance is that the ‘space’ dimension is relatively under-researched in the global strategy literature. Rather, the focus has been on: (1) locations (the ‘place’ dimension), including factors such as industry agglomeration (Chung and Alcacer, 2002; Marshall, 1920), culture (Hofstede, 1980) or institutions (Henisz, 2000); and (2) the ways in which firms generate and capture value as they capitalize on ‘place’ (Zaheer and Nachum, 2011). We view these as highly important but also distinct from the physi-

cal separation of the firm from resources (Nachum, Zaheer, and Gross, 2008), including its separation from and access to knowledge resources, particularly through its geographically dispersed alliances. Our specific contribution comes from introducing the concept of geographical distance of the firm’s alliance partners vis-à-vis different kinds of internal MNC units (in our case, headquarters and subsidiaries) and showing its effect on firm performance over and above the effects of ‘place,’ thereby exploring the outcomes of a broadened conception of the MNC’s geographic scope.

Within the realm of research on space in the IB context, scholars have typically conceived of distance in terms of the physical separation between the home country where headquarters are located and the host countries where subsidiaries are located (Ghemawat, 2001). While such prior research has been valuable, it understates the importance of a conception of the MNC as a networked entity (Ghoshal and Bartlett, 1990). The lack of attention to this conceptualization has an important implication: the subsidiary network is only one means of accessing knowledge and resources for the focal MNC; its alliance network also plays a crucial role in this process. Thus, a characterization of an MNC as solely represented by the distances of the HQ to subsidiaries misses a significant proportion of the knowledge and resources flowing to the firm that explain its performance.

Plentiful research has examined MNCs’ alliance portfolios as knowledge networks (Goerzen and Beamish, 2003; Lavie and Miller, 2008). Prior work has demonstrated the value of the firm’s alliance network as a means of resource access (see Gulati, 2007, for a review). In this vein, scholars show that MNC subsidiaries become locally embedded and depend on geographically proximate sources of knowledge (Andersson, Forsgren, and Holm, 2002; Frost, 2001). One such fount of local resources is to be found in the alliances established with local partners. This suggests that the proximity or distance between an MNC’s internally owned units and the partners with which the firm has formed alliances should also be a key consideration in the configuration of the MNC’s global activities. However, in light of evidence regarding the localization of knowledge spillovers (e.g., Rosenkopf and Almeida, 2003) and research documenting the difficulties of knowledge transfer across geographical space (e.g., Bell and Zaheer, 2007), a question may be raised as to the effectiveness of MNCs’ use of alliance and

subsidiary networks together to access local knowledge as well as to transfer knowledge from the alliance to the subsidiary network. Thus, the geographical juxtaposition of MNC subsidiary and alliance networks should affect knowledge transfer effectiveness, particularly for more tacit knowledge (Kogut and Zander, 1993).

### The paradox of distance

A review of the literature touching upon the effects of distance on firm performance reveals an important paradox. While a body of work—usually focused on knowledge transfer—emphasizes the costs of distance for performance, other research—emphasizing the need for innovation—discusses the benefits of reaching far for novel and diverse ideas. We review this work and then offer a possible solution to this paradox. We draw from theoretical foundations that discuss the costs of distance among the MNC's subsidiaries and alliances: the knowledge-based view of the firm (Kogut and Zander, 1992, 1993) and the control and coordination perspective from the literature on strategic alliances (e.g., Das and Teng, 1998) and IB (Porter, 1986). To establish the benefits of distance, we draw from the innovation and IB literatures that argue for the value of reaching out to distant sources of knowledge (Andersson et al., 2002; Rosenkopf and Almeida, 2003).

We begin by using the first set of theoretical perspectives to identify a series of costs to having an alliance portfolio composed of partners located far from the MNC. The knowledge-based view of the firm suggests that geographic proximity is desirable to aid in the process of knowledge creation and dissemination. We build on the by now well-established notion that technologically advanced knowledge incorporates plentiful tacit elements that make such knowledge hard to transfer across geographical distance (Brown and Duguid, 1991; Polanyi and Sen, 2009). Related is the idea that knowledge tends to be circumscribed within tightly bounded geographical domains and that the embeddedness of alliance partners within the same geographical domain facilitates mutual learning and the transfer of knowledge across organizational boundaries. In fact, empirical evidence suggests that distance is an important barrier to knowledge transfer for the MNC (Jensen and Szulanski, 2004). Moreover, the control and coordination view of strategic alliances argues that overseeing operations and coordinating activities becomes more difficult to achieve across geographical distance.

These difficulties arise from communication and travel costs (Ghemawat, 2001; Porter, 1986) and time zone diseconomies (Zaheer, 2000), which are inherently geography based.

At the same time, a broad stream of research in IB has pointed to the benefits of going abroad which, while not necessarily the same as distance, imply that distance may create value through access to markets, resources, and knowledge (Nachum, Zaheer, and Gross, 2008). When it comes to technological resources in particular, research has theorized about the access that firms obtain to novelty, diversity, and non-redundancy when they reach out beyond their home bases (Kogut, 1983; Rosenkopf and Almeida, 2003). A related idea underscores the notion that proximity to the organizational core also implies proximity to the traditional and original knowledge base of the MNC; the further the MNC goes from that knowledge base, the more it is likely to encounter novelty in ideas (Christensen, 1997; Cyert and March, 1963). In the same vein, the conceptualization of the MNC as a learning network suggests that MNCs create and access new knowledge from the periphery of their networks by connecting with local entities (Andersson et al., 2002; Ghoshal and Bartlett, 1990). In addition, distance may be beneficial because it allows alliance partners to have greater autonomy, which has been shown to be of value in, for example, the well-known Fuji-Xerox alliance (McQuade and Gomes-Casseres, 1992).

In short, a review of prior work leads to the conclusion that distance can be both beneficial and harmful for performance at the same time. We resolve this paradox next by arguing that, when it comes to geographic distance between technology alliances and the MNC, a key contingency giving rise to the benefits or costs of distance lies in the role played by different internal units of the MNC relative to the technology alliance partner. Specifically, we propose that distance between local subsidiaries and technology alliance partners will be subject to the costs of distance, while distance between HQ and technology alliance partners will be associated with the benefits of distance. We provide the arguments for subsidiaries first and then for HQ.

### Alliance distance from subsidiaries

As we summarized, a great deal of research has argued that the transfer of knowledge over increasing distance is fraught with challenges (e.g., Jensen and

Szulanski, 2004). Studies have also shown how the difficulty of transferring knowledge over distance is exacerbated when the nature of knowledge is tacit (Bell and Zaheer, 2007; Szulanski, 1996). These difficulties arise from the problems associated with the mismatch of the richness of the medium with the requirements of the information or knowledge being transferred. The more tacit the knowledge being transferred, the richer the medium (i.e., face-to-face interaction) needed to transfer it effectively (Daft and Lengel, 1986). At the same time, research has also pointed to the difficulties of transferring knowledge across boundaries, such as across units or subunits, even within the same organization. The rationale is that language, coding schemes, communication patterns, and styles are more likely to be similar within organizational boundaries than across them (Allen, 1977; Dougherty, 1992). When knowledge crosses boundaries, both the receiver and the sender of knowledge may experience difficulty in decoding and encoding the knowledge emanating from a different domain.

While these ideas have been well documented in prior research, the overwhelming emphasis in the empirical literature has been on the transfer of knowledge *within* the organization (Tushman and Katz, 1980). We argue that these difficulties are significantly heightened when the locus of the knowledge transfer is between an internal MNC unit and an external alliance partner because the lack of a common corporate umbrella further amplifies the difficulties. Moreover, the problems of knowledge transfer may be exacerbated by the lack of convergent incentives for the sharing and free flow of knowledge across organizations. As the distance from the alliance partner to the subsidiary increases, the likelihood of face-to-face meetings diminishes due to the greater cost and effort involved in setting up and realizing such meetings among the staff of the MNC subsidiary and that of the alliance partner firm. Greater distance also increases the likelihood that such knowledge transfer takes place across boundaries of various types, such as culture (Kogut and Singh, 1988), institutions (Delios and Henisz, 2003), time zones (Zaheer and Zaheer, 2001), and language, each of which is known to hamper the process.

Our key point is that such costs of knowledge transfer arising from distance will particularly affect the relationship between technology alliance partners and the MNC's local subsidiaries. More specifically, research has demonstrated that subsidiaries play a key role in developing innovation and capa-

bilities and accessing knowledge and ideas locally—thus, relative to HQ, they are much more directly involved with the firm's alliance partners in technology activities (Hewett, Roth, and Roth, 2003). This view of subsidiaries as deeply and primarily involved in the knowledge development process is consistent with a more contemporary understanding of the MNC as a globally dispersed, knowledge-creating network (Ghoshal and Bartlett, 1990), in contrast to the early conceptualization of HQ as the exclusive center of innovation that disseminated knowledge and intangible assets to its subsidiaries (Vernon, 1966).

We argue that MNCs following technology alliance strategies are strongly subject to the costs of distance. Given that the focus of such alliance strategies is on knowledge creation and sharing, they will tend to be particularly influenced, in a negative way, by the costs of transferring tacit knowledge over distance. Regarding the benefits of distance, these may accrue from the possibility of developing a unique set of technologies, but greater distance from the firm's internal units will diminish these potential benefits because the odds of collaboration, transfer, appropriation, and absorption of that knowledge are lower as distance goes up (Zahra and George, 2002). When considered at the level of the alliance portfolio, the dyadic costs of distance to individual alliances add up in a significant way and have a meaningful impact on the bottom line of the MNC, negatively affecting its performance. Thus,

*Hypothesis 1 (H1): The greater the distance between an MNC's global subsidiaries and its technology alliances, the lower the firm's profitability.*

### **Alliance distance from headquarters**

When alliance partners are located at a distance from headquarters, we argue that the MNC benefits for a number of reasons. Firms access diverse, novel, and non-redundant ideas by reaching out afar, as proximate alliance partners are more likely to be exposed to similar ideas as the focal firm. This concept echoes the structural holes idea in the network literature (Burt, 1992), which has been applied to geographic disconnections, or geographic 'holes' (Bell and Zaheer, 2007). Related is the idea that weak ties provide access to different kinds of knowledge than would be available from strong and tightly connected entities that are more likely to be geographically proximate (Granovetter, 1973).

Another parallel notion comes from the behavioral theory of the firm, which contrasts limited local search with more diverse and high-potential global search (Cyert and March, 1963).

Research from a number of other fields supports the notion that innovation is greater at the periphery, the further one moves away from the ‘ossifying’ effects of the core (Brown and Duguid, 1991). Work on innovation is consistent with the notion that ideas emerging from areas far from the headquarters tend to be more radically innovative, such as the case of IBM that deliberately developed its PC far from its Armonk, New York, head office to avoid being constrained by extant ideas (Christensen, 1997). Studies in IB also echo this idea, specifically the research conceptualizing the MNC as a network, which sees the outer reaches of the MNC network as potential sources of new knowledge (Ghoshal and Bartlett, 1990). It is important to note that the motivation of this research was to not only highlight the role of subsidiaries in the knowledge development process, but also to include the local connections of the firm to external partners. Put another way, the HQ represents the original knowledge base of the firm and the further away the MNC goes to source new ideas from alliance partners, the greater the likelihood that such ideas will be novel and non-redundant. Even though the HQ is not the unit that is directly absorbing the diverse and novel ideas from the external alliance partners, alliance partner proximity to HQ signifies that the firm has not moved beyond its original base toward a more global search and knowledge access process.

Here it becomes important to re-emphasize the differences between the role that HQ performs versus that of the subsidiary. We explained how subsidiaries are more intimately involved with alliance partners in the process of technological knowledge development and transfer. Consistent with a current view of the MNC, we argued earlier that knowledge development and transfer with alliance partners does not take place mainly with the HQ. In contrast, research suggests that the HQ is concerned with control, coordination, resource allocation, and support of the enterprise, but it is the subsidiaries that perform the bulk of the operational value creation functions (Birkinshaw and Hood, 1998), including knowledge cocreation through alliances and knowledge transfer within the focal firm. Therefore, the costs of distance discussed earlier do not apply when the HQ is distant from alliance partners.

Instead of being involved in the encoding and decoding of technological knowledge with alliance partners, the HQ unit may be instrumental in identifying potential partners, choosing among alternative locations, negotiating contractual terms, and approving high-level decisions related to or resulting from the alliance. For technology alliances in particular, HQ sets corporate R&D and technology policy and allocates resources to accomplish strategic goals. These kinds of activities are significantly less likely to be affected by distance because they are one-time events and, thus, do not require a consistent and sustained rich medium of communication, unlike technology cocreation and diffusion. At the same time, the benefits of distance we just detailed do operate because in an MNC, HQ is the ‘core’ and far-flung alliance partners interacting with local subsidiaries represent the ‘periphery.’ Thus,

*Hypothesis 2 (H2): The greater the distance between an MNC’s headquarters and its technology alliances, the higher the firm’s profitability.*

We have argued that increasing distance between HQ and technology alliances enhances the benefits of reaching out for novelty from sources removed from the firm’s core. In contrast, increasing distance between MNC’s subsidiaries and technology alliances is hurtful because of the well-known difficulties of transferring tacit knowledge across distance and organizational boundaries, which arise because knowledge transfer occurs at the local level. We now propose a combined effect to validate these theoretical mechanisms, arguing that these opposing forces act in a countervailing fashion with respect to each other. Specifically, the difficulties of knowledge transfer across large distances between subsidiaries and technology alliances can be partially compensated for by the novelty and non-redundancy of knowledge accessed far away from headquarters. In sum, the greater potential for value creation from searching for technological novelty in distant territories partially makes up for the inefficiencies and challenges of transferring knowledge between local subsidiaries and external alliance partners. Thus,

*Hypothesis 3 (H3): The distance between an MNC’s headquarters and its technology alliances positively moderates (makes less negative) the negative effect on the firm’s profitability of the distance between an MNC’s global subsidiaries and its technology alliances.*

### Contingent effect of R&D intensity

Our logic in this section draws on the notion that, if the mechanisms we proposed are in operation, the research intensity of the MNC should amplify the benefits and costs of physical distance. Specifically, when firms are more research intensive, issues related to knowledge transfer become that much more salient. Tacit knowledge is likely to be a larger component of the knowledge being transferred when research intensity is greater and the difficulties and costs imposed by having to move knowledge across distance are exacerbated. Moreover, technology activities are more likely to involve reciprocal interdependence, which benefits from proximity and rich interaction media (Daft and Lengel, 1986). Since firms engaged in high levels of R&D intensity are likely to organize activities to capitalize on the benefits of reciprocal interdependence, these are also the types of firms more likely to suffer the downside of having technology alliance partners far away from local subsidiaries.

At the same time, the imperative to search globally for novel, non-redundant, and diverse ideas is also enhanced under conditions of greater research intensity. Thus, firms that deploy their resources to create alliance relationships at greater distances from HQ are more likely to benefit than MNCs that are limited to partners in locations more proximate to headquarters. In addition, it is well established in the literature that knowledge-intensive firms benefit to a greater degree from technology alliances than do other firms (Gomes-Casseres *et al.*, 2006). Thus, when knowledge development is a more important part of the mission of the firm, alliances and R&D collaborations become more critical to the value creation and appropriation process (Gulati, 2007). We draw on this logic to further argue that for knowledge-intensive MNCs to reap the benefits of technology alliances, they must configure their alliance portfolios geographically in a way that allows them to simultaneously reach out globally for novelty, while at the same time collaborating locally through subsidiaries and alliance partners. Formally,

*Hypothesis 4 (H4): MNCs with high R&D intensity exhibit a greater decline in profitability as the distance between global subsidiaries and technology alliances increases than MNCs with low R&D intensity.*

*Hypothesis 5 (H5): MNCs with high R&D intensity exhibit a greater increase in profitability as the distance between global subsidiaries and technology alliances increases than MNCs with low R&D intensity.*

## DATA AND METHODS

Our sampling frame included all firms that were part of the S&P 500 at some point during the years 2002 to 2006. We limited the sample to those firms that were involved in technology-related activities using two criteria. First, given our interest in distance from technology alliance partners, firms had to be engaged in at least one technology alliance during the period of study. We will explain later our criteria to determine whether alliances were technology focused. Second, firms had to report R&D expenditures in their financial statements, which is an indicator that they were involved in the search for new technologies or products. These criteria yielded a final sample of 126 unique firms with 405 firm-years of data for the longitudinal analysis. We also explain below the robustness of our results when using selection models to account for factors affecting selection into our final sample based on these criteria.

### Variables

#### *Firm performance*

We measured performance by calculating the annual *return on assets* of each firm, calculated as income before interest and taxes divided by total assets. ROA has been used extensively as a measure of performance for firms and their alliance portfolios (e.g., Bae and Gargiulo, 2004; Goerzen, 2007). Given that the range of industries from which we have drawn our sample is wide (see Table 1), we opted to use a measure of performance that is comparable across firms from these many different industries. All the independent variables were lagged at least one year with respect to ROA.

#### *Geographical distance*

We calculated the great circle distance between the technology alliances in each MNC's portfolio and (1) the MNC's headquarters and (2) the MNC's subsidiaries. We obtained data on firm's alliances from *SDC Platinum*, which provides comprehensive coverage of alliances announced by large corporations.

Table 1. Frequency of sectors in sample

| Sector | Frequency | %     | Description                             |
|--------|-----------|-------|-----------------------------------------|
| 28     | 29        | 23.02 | Chemicals and allied products           |
| 35     | 18        | 14.29 | Industrial machinery and equipment      |
| 36     | 16        | 12.70 | Electronic and other electric equipment |
| 73     | 16        | 12.70 | Business services                       |
| 37     | 13        | 10.32 | Transportation equipment                |
| 38     | 13        | 10.32 | Instruments and related products        |
| 29     | 2         | 1.59  | Petroleum and coal products             |
| 33     | 2         | 1.59  | Primary metal industries                |
| 39     | 2         | 1.59  | Misc. manufacturing industries          |
| 51     | 2         | 1.59  | Wholesale trade                         |
| 70     | 2         | 1.59  | Hotels and other lodging places         |
| 01     | 1         | 0.79  | Agricultural production-crops           |
| 21     | 1         | 0.79  | Tobacco products                        |
| 25     | 1         | 0.79  | Furniture and fixtures                  |
| 26     | 1         | 0.79  | Paper and allied products               |
| 27     | 1         | 0.79  | Printing and publishing                 |
| 34     | 1         | 0.79  | Fabricated metal products               |
| 48     | 1         | 0.79  | Communication                           |
| 56     | 1         | 0.79  | Apparel and accessory stores            |
| 57     | 1         | 0.79  | Furniture and home furnishing stores    |
| 59     | 1         | 0.79  | Miscellaneous retail                    |
| 63     | 1         | 0.79  | Insurance carriers                      |

Sector: Two-digit primary SIC code of the MNC.

Frequency: Number of MNCs in the sample who list the sector as their primary one (total of 126 MNCs in sample).

Building on prior research (Koza and Lewin, 1998; Rothaermel and Deeds, 2004), we categorized alliances as technology collaborations if they involved R&D jointly conducted between partners or if the alliance agreement involved technology transfer activities between partners. Clearly, firms engage in these types of alliances to learn or generate knowledge in novel technological areas.

In order to create each firm's alliance portfolio, we had to identify the group of alliances in which the firm was active each year. While identifying the alliance formation date is straightforward, firms rarely report alliance termination dates. To skirt this chal-

lenge, we followed the convention from the bulk of alliance portfolio research and assigned all alliances a five-year productive life span, which has typically been assumed based on studies of the duration of interorganizational relationships (Gulati, 1995; Kogut, 1988). Thus, each alliance remained in a firm's portfolio for five years after the initial announcement. To calculate the geographical distance to each alliance, we identified the city of the alliance partner as coded by *SDC Platinum*.

In addition to obtaining data on alliances, our measures required data on each MNC's headquarters and subsidiaries. We obtained this data from the *Directory of Corporate Affiliations*, which provides in-depth information on the legal structure of large firms like those in the S&P 500. We identified the city and country of each unit owned by the focal firm. With this data in hand, we then calculated the great circle distance between each subsidiary and each active technology alliance, as well as between each firm's headquarters and each active technology alliance. Finally, we aggregated the dyadic distances to establish a portfolio-level measure of geographical distance. In the case of HQ-alliance distance, we used the average distance between HQ and each active technology alliance as our variable. In the case of subsidiary-alliance distance, taking the average distance of each active technology alliance with each subsidiary could be misleading because alliance partners are not expected to interact with every internal unit of the MNC. Rather, each alliance is likely to collaborate with a specific subsidiary—consistent with the notion that MNCs establish local partnerships via subsidiaries in host countries (Ghoshal and Bartlett, 1990). Thus, we took the distance between each active technology alliance and the nearest subsidiary and averaged this measure to obtain an indicator of geographic propinquity at the portfolio level. We describe below the robustness of our results to alternative measures of subsidiary-alliance distance.

#### *R&D intensity*

We measured this variable as the ratio of R&D expenditures to total revenues.

#### *Control variables*

By using a fixed effects model specification (described in greater detail below), we controlled for all time-invariant sources of heterogeneity in the data—including many unobserved intangibles (such

as persistent capabilities) that would affect firms' profitability (Barney, 1991). In what follows, we describe several additional variables designed to account for time-varying factors that also affect ROA. We controlled for firm size, measured as annual total revenues. Given that total revenue is the primary criteria for inclusion in the S&P 500, this was a good indicator of firm size. We also included a measure of geographical diversity because MNCs with higher global scope are more likely to have access to alliance partners from diverse locations. In addition, geographical scope has been shown to impact firm performance under certain circumstances (Goerzen and Beamish, 2003; Hitt *et al.*, 1997). We measured geographical diversity through the formula  $1 - \sum (n_i/N)^2$ ; where  $n_i$  represents the number of subsidiaries from country  $i$  and  $N$  is the total number of countries in which the firm operates subsidiaries. Similarly, firms with large numbers of subsidiaries may be more able and likely to establish local alliances. Thus, we included a measure of subsidiary portfolio size, measured as the number of subsidiaries for each firm-year combination. We also accounted for the size of each firms' alliance portfolio by counting the total number of active alliances of any kind (not just technology alliances) in which the firm participated in each year.

While our theoretical interest centers on physical distance to technology alliances, other types of distances are likely to affect firm performance. Thus, we controlled for four additional geographic distances. First, we included the average distance between HQ and each subsidiary (Cantwell and Piscitello, 2005). Second, we calculated the average distance among all subsidiaries of the MNC, because technological collaboration and knowledge transfer within the firm have been shown to be crucial to effective MNC functioning (Kogut and Zander, 1993; Martin and Salomon, 2003). Third, we included the distance between HQ and nontechnology alliances (measured as marketing and licensing), as well as, fourth, the distance between non-technology alliances and subsidiaries. In addition to accounting for distances that prior research has considered as important for MNCs—especially internal MNC distances—each of these controls also plays an important role by introducing alternative sources of time-distance variation, which ensures that our independent variables of interest are not simply reflecting unobserved heterogeneity from factors that vary with geography and time.

Mindful of arguments made by scholars regarding the different types of distances that affect global strategy and performance, we were also careful to include nongeographic distances as controls. Based on Ghemawat's (2001) CAGE framework, we controlled for cultural, institutional, and economic distance in our models by creating a variable that captures the distance between each MNC's home country (the U.S. in our case) and each technology alliance partner in the portfolio. We termed this control *CIE distance index*, with 'CIE' standing for cultural, institutional, and economic. We created this variable using the same calculations as Lavie and Miller (2008). To capture cultural distance, we implemented the widely used measure introduced by Kogut and Singh (1988). To measure institutional distance, we used the six dimensions of country governance provided by the World Bank: voice and accountability, political stability and violence, government effectiveness, regulatory quality, rule of law, and control of corruption (Kaufmann, Kraay, and Mastruzzi, 2008). Finally, we used gross domestic product per capita to capture economic distance. We combined these into a composite index for each firm-year-alliance portfolio based on the factor score derived from a principal components analysis with varimax rotation (eigenvalue of 6.45, Cronbach alpha of 0.92). We note that each distance was weighted by the number of alliances from each host country.

In order to account for the possibility that locating in the same city is a qualitatively different case (i.e., distance = 0), we added two additional controls: a dummy for zero distance between technology alliances and the nearest subsidiary and a dummy for zero distance between alliances and HQ. Finally, to account for many other time-varying factors that are difficult to measure, we include the lagged value of ROA as a control in each model. The inclusion of such a lagged dependent variable requires special handling in longitudinal models, which we describe next.

### Estimation approach

Our model has two characteristics that require consideration. First, as just mentioned, the inclusion of a lagged dependent—while helpful to control for sources of time-variant heterogeneity—in longitudinal analyses also creates some problems because, by definition, such a variable is correlated with the error term, creating potential bias in the estimated

coefficients. Second, the panel structure of the data allows us to eliminate all sources of time-invariant heterogeneity by using a fixed effects specification. In order to simultaneously take advantage of the fixed effects specification and the inclusion of a lagged dependent variable, while also eliminating the bias introduced by the latter, we follow the approach proposed initially by Arellano and Bond (1991). Specifically, we eliminate all sources of time-invariant heterogeneity by taking the first difference of the equation. In addition, we eliminate the correlation between the one-period lagged dependent variable ( $t-1$ ) and the error term by using all available older lags of the dependent variable (e.g.,  $t-2$ ,  $t-3$ ,  $t-4$ , etc.) as instruments. With these transformations, the coefficients can be efficiently calculated through a GMM estimator. We utilized the improved methodology proposed by Arellano and Bover (1995) and Blundell and Bond (1998), which uses a system GMM estimator that provides reliable results in the presence of high auto correlation or high within-panel variance.

## RESULTS

Table 2 shows descriptive statistics and correlations and Table 3 contains the results of the estimation. Model 1 shows the effects of the control variables. Models 2-6 test the hypotheses. We found support for H1 in Model 2, as shown by the negative and significant effect of distance between the MNC's subsidiaries and its technology alliances ( $p < 0.05$ ). Based on the coefficient from Model 2, each 1,000 miles increase in the average distance between technology alliances and the nearest subsidiary decreases ROA by 0.85%—a nontrivial amount given that the average ROA of firms in the sample was 11 percent. We also found support for H2, as shown in Model 2 through the positive and significant effect of distance between the MNC's HQ and its technology alliances ( $p < 0.05$ ). Each 1,000 miles increase in the average distance between technology alliances and the firm's HQ increases ROA by 0.4 percent. Consistent with H3, Model 3 shows that the interaction of the two distances of interest (to headquarters and to subsidiaries) is positive and significant ( $p < 0.05$ ). The graph in Figure 1 makes interpretation of the interaction effect more straightforward and clearly shows the trade-off between the costs of distance to subsidiaries and the benefits of being far from headquarters for technology alliances.

We tested H3 and H4 by splitting the sample at the median level of R&D intensity in Models 4 (low R&D intensity) and 5 (high R&D intensity) and comparing coefficient sizes across subsamples. In both subsamples, the main effect of distance to subsidiaries predicted in H1 continues to be negative and significant. However, the downside of distance becomes amplified for firms with high R&D intensity—we observe a drop in profitability of 1.41 percent for firms high in R&D intensity compared to 0.58 percent for firms with low R&D intensity for every thousand miles increase in distance between technology alliances and the nearest subsidiary. In addition, the positive effect of distance between HQ and technology alliances is stronger (more positive) for firms with high R&D intensity (0.85% increase in ROA per 1,000 miles distance) than for firms with low R&D intensity (0.17% increase in ROA). In fact, the effects of distance to HQ are not significant for low R&D intensity firms. We conducted a t-test across subsamples and found that the differences just reported were statistically significant ( $p < 0.01$ ). Thus, we find clear support for H3 and H4.

## Robustness tests

Earlier, we described how, to be included in the sample, firms needed to report R&D expenditures and be involved in at least one technology alliance. This was necessary to be able to measure the relevant geographic distances and observe R&D intensity. Nevertheless, there could be a systematic bias, where firms more likely to be selected into the sample also perform better in terms of ROA. To account for such possible selection bias, we ran alternative models employing Heckman's (1979) selection estimator. In the first stage, we included both the 405 firm-years that made it into our final sample as well as a large additional group of 4,186 firm-years in which Fortune 500 firms did not report R&D or did not engage in technology alliances.

To properly identify the selection effects, we introduced two exclusion restrictions in the first-stage model. The first was *firm age*, based on the rationale that older firms may have a different approach toward technology development in general—including their preference for using technology alliances versus internal development. We speculated that older firms, due to path dependency, may be more prone to the HQ-centered model of MNC innovation (Vernon, 1966) and, thus, less

Table 2. Descriptive statistics and correlations

| Variable                                | Mean  | Med.  | SD    | Min   | Max    |
|-----------------------------------------|-------|-------|-------|-------|--------|
| 1 ROA                                   | 0.11  | 0.10  | 0.07  | -0.12 | 0.32   |
| 2 Total revenue                         | 21.58 | 8.44  | 38.86 | 0.68  | 335.09 |
| 3 Geographic diversity                  | 0.68  | 0.75  | 0.22  | 0     | 0.96   |
| 4 Subsidiary portfolio size             | 65.01 | 39    | 79.59 | 2     | 576    |
| 5 Alliance portfolio size               | 19.51 | 10    | 31.69 | 1     | 265    |
| 6 R&D intensity                         | 0.10  | 0.06  | 0.11  | 0     | 1.56   |
| 7 CIE distance index                    | 0.07  | -0.05 | 0.62  | -0.73 | 2.16   |
| 8 Distance HQ to subs                   | 4.03  | 3.99  | 2.04  | 0.22  | 9.61   |
| 9 Distance subs to subs                 | 4.11  | 4.67  | 1.54  | 0     | 7.39   |
| 10 Distance HQ to nontech alliances     | 3.47  | 3.26  | 2.15  | 0     | 10.97  |
| 11 Distance subs to nontech alliances   | 1.73  | 1.22  | 1.62  | 0     | 8.60   |
| 12 Zero distance HQ to tech alliances   | 0.01  | 0     | 0.09  | 0     | 1      |
| 13 Zero distance subs to tech alliances | 0.03  | 0     | 0.18  | 0     | 1      |
| 14 Distance HQ to tech alliances        | 3.87  | 3.50  | 2.76  | 0     | 11.35  |
| 15 Distance subs to tech alliances      | 0.85  | 0.19  | 1.77  | 0     | 8.76   |

| Variable                                | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | 11    | 12    | 13    | 14   |
|-----------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| 1 ROA                                   |       |       |       |       |       |       |       |       |       |       |       |       |       |      |
| 2 Total revenue                         | 0.13  |       |       |       |       |       |       |       |       |       |       |       |       |      |
| 3 Geographic diversity                  | 0.13  | 0.08  |       |       |       |       |       |       |       |       |       |       |       |      |
| 4 Subsidiary portfolio size             | 0.05  | 0.51  | 0.11  |       |       |       |       |       |       |       |       |       |       |      |
| 5 Alliance portfolio size               | 0.01  | 0.25  | 0.13  | 0.41  |       |       |       |       |       |       |       |       |       |      |
| 6 R&D intensity                         | -0.06 | -0.19 | 0.17  | -0.17 | 0.03  |       |       |       |       |       |       |       |       |      |
| 7 CIE distance index                    | -0.05 | 0.25  | 0.36  | 0.18  | 0.21  | -0.09 |       |       |       |       |       |       |       |      |
| 8 Distance HQ to subs                   | 0.10  | -0.10 | 0.79  | -0.10 | 0.07  | 0.26  | 0.16  |       |       |       |       |       |       |      |
| 9 Distance subs to subs                 | 0.12  | 0.03  | 0.76  | 0.11  | 0.13  | 0.09  | 0.25  | 0.58  |       |       |       |       |       |      |
| 10 Distance HQ to nontech alliances     | 0.03  | 0.00  | 0.20  | 0.06  | 0.13  | -0.03 | 0.42  | 0.12  | -0.02 |       |       |       |       |      |
| 11 Distance subs to nontech alliances   | 0.05  | -0.20 | 0.25  | -0.21 | -0.23 | -0.06 | 0.03  | 0.27  | 0.24  | 0.08  |       |       |       |      |
| 12 Zero distance HQ to tech alliances   | 0.02  | -0.04 | 0.07  | 0.00  | -0.04 | -0.05 | -0.04 | 0.03  | 0.07  | -0.05 | -0.03 |       |       |      |
| 13 Zero distance subs to tech alliances | -0.02 | -0.08 | 0.02  | 0.00  | -0.08 | -0.09 | -0.05 | -0.01 | 0.03  | -0.18 | 0.06  | 0.47  |       |      |
| 14 Distance HQ to tech alliances        | 0.03  | 0.05  | 0.15  | 0.09  | 0.17  | -0.05 | 0.46  | 0.05  | 0.02  | 0.42  | 0.03  | -0.12 | -0.09 |      |
| 15 Distance subs to tech alliances      | -0.15 | -0.14 | -0.11 | -0.24 | -0.11 | 0.06  | 0.10  | 0.03  | -0.41 | 0.22  | 0.16  | -0.04 | -0.09 | 0.33 |

## NOTES:

All distances are in thousands of kilometers and account for the curvature of the earth (i.e., great circle distances).

'CIE Distance Index' refers to cultural, institutional, and economic distance index. See Lavie and Miller (2008) for details on how this index was constructed.

Table 3. Dynamic panel GMM estimates of firm profitability (ROA)  
(Robust standard errors in parentheses)

|                                                                    | Model 1               | Model 2               | Model 3               | Model 4               | Model 5               |
|--------------------------------------------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|                                                                    | Controls              | Full model            | Interaction           | Low R&D               | High R&D              |
| Lagged ROA                                                         | 0.3135**<br>(0.1300)  | 0.3234**<br>(0.1312)  | 0.3247**<br>(0.1322)  | 0.4343**<br>(0.2189)  | 0.3150**<br>(0.1575)  |
| Total revenue                                                      | 0.0004<br>(0.0003)    | 0.0005<br>(0.0003)    | 0.0005<br>(0.0003)    | 0.0003<br>(0.0003)    | −0.0012<br>(0.0022)   |
| Geographic diversity                                               | −0.0619<br>(0.0679)   | −0.0453<br>(0.0638)   | −0.0358<br>(0.0613)   | 0.0502<br>(0.0788)    | −0.0192<br>(0.0967)   |
| Subsidiary portfolio size                                          | 0.0000<br>(0.0001)    | 0.0000<br>(0.0001)    | 0.0000<br>(0.0001)    | 0.0001<br>(0.0001)    | 0.0000<br>(0.0001)    |
| Alliance portfolio size                                            | −0.0001<br>(0.0002)   | −0.0002<br>(0.0002)   | −0.0001<br>(0.0002)   | −0.0005<br>(0.0003)   | −0.0003<br>(0.0003)   |
| R&D intensity                                                      | −0.0345<br>(0.0248)   | −0.0297<br>(0.0250)   | −0.0274<br>(0.0257)   | 0.4245<br>(0.3972)    | −0.0091<br>(0.0252)   |
| CIE distance index                                                 | 0.0027<br>(0.0085)    | 0.0016<br>(0.0084)    | 0.0010<br>(0.0084)    | −0.0051<br>(0.0062)   | −0.0097<br>(0.0211)   |
| Distance HQ to subs                                                | −0.0027<br>(0.0090)   | −0.0056<br>(0.0083)   | −0.0062<br>(0.0082)   | −0.0110<br>(0.0105)   | −0.0032<br>(0.0120)   |
| Distance subs to subs                                              | 0.0149*<br>(0.0083)   | 0.0114<br>(0.0084)    | 0.0104<br>(0.0083)    | 0.0065<br>(0.0083)    | −0.0006<br>(0.0152)   |
| Distance HQ to nontech alliances                                   | 0.0045**<br>(0.0018)  | 0.0032*<br>(0.0017)   | 0.0030*<br>(0.0017)   | −0.0001<br>(0.0017)   | 0.0110**<br>(0.0043)  |
| Distance subs to nontech alliances                                 | −0.0074**<br>(0.0036) | −0.0069**<br>(0.0035) | −0.0067*<br>(0.0035)  | −0.0001<br>(0.0022)   | −0.0111**<br>(0.0051) |
| Zero distance HQ to tech alliances                                 | −0.2439<br>(1.1811)   | 0.0323<br>(1.1345)    | 0.1378<br>(1.1977)    | −0.0025<br>(0.4253)   |                       |
| Zero distance subs to tech alliances                               | −0.0100<br>(0.0065)   | −0.0095<br>(0.0061)   | −0.0089<br>(0.0059)   | −0.0521<br>(0.1492)   | −0.0062<br>(0.0061)   |
| Distance subs to tech alliances                                    |                       | −0.0085**<br>(0.0041) | −0.0180**<br>(0.0079) | −0.0058**<br>(0.0027) | −0.0141**<br>(0.0085) |
| Distance HQ to tech alliances                                      |                       | 0.0041**<br>(0.0019)  | 0.0032**<br>(0.0019)  | 0.0017<br>(0.0013)    | 0.0085**<br>(0.0038)  |
| Distance subs to tech alliances X<br>distance HQ to tech alliances |                       |                       | 0.0012**<br>(0.0007)  |                       |                       |
| Constant                                                           | 0.0651<br>(0.0424)    | 0.0713*<br>(0.0423)   | 0.0751*<br>(0.0429)   | 0.0226<br>(0.0313)    | 0.0929<br>(0.0659)    |
| Firm-years                                                         | 405                   | 405                   | 405                   | 202                   | 203                   |
| Firms                                                              | 126                   | 126                   | 126                   | 77                    | 59                    |
| Chi-squared                                                        | 58.21***              | 63.70***              | 66.14***              | 110.41***             | 62.37***              |
| AR1 test                                                           | −2.4539**             | −2.36722**            | −2.29385**            | −1.02963              | −2.24054**            |
| AR2 test                                                           | 0.66056               | 0.73996               | 0.55296               | −0.53344              | 0.7518                |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .

First-order autocorrelation (AR1) is expected to be significant given the use of a one-period lag of the dependent variable. Second-order autocorrelation (AR2) should not be significant (as in this case) for the model to provide consistent estimates.

likely to engage in technology alliances. The second instrument was the *crime rate* of the state in which the focal firm was headquartered. This could affect the ability to engage in global technology alliances as well as R&D more generally. Our reasoning was

that high-quality human capital central to the technology innovation process (i.e., scientists, engineers) would prefer to avoid such locations to either live in—if they are internal resources—or visit—if they are alliance collaborators. This serves as a good

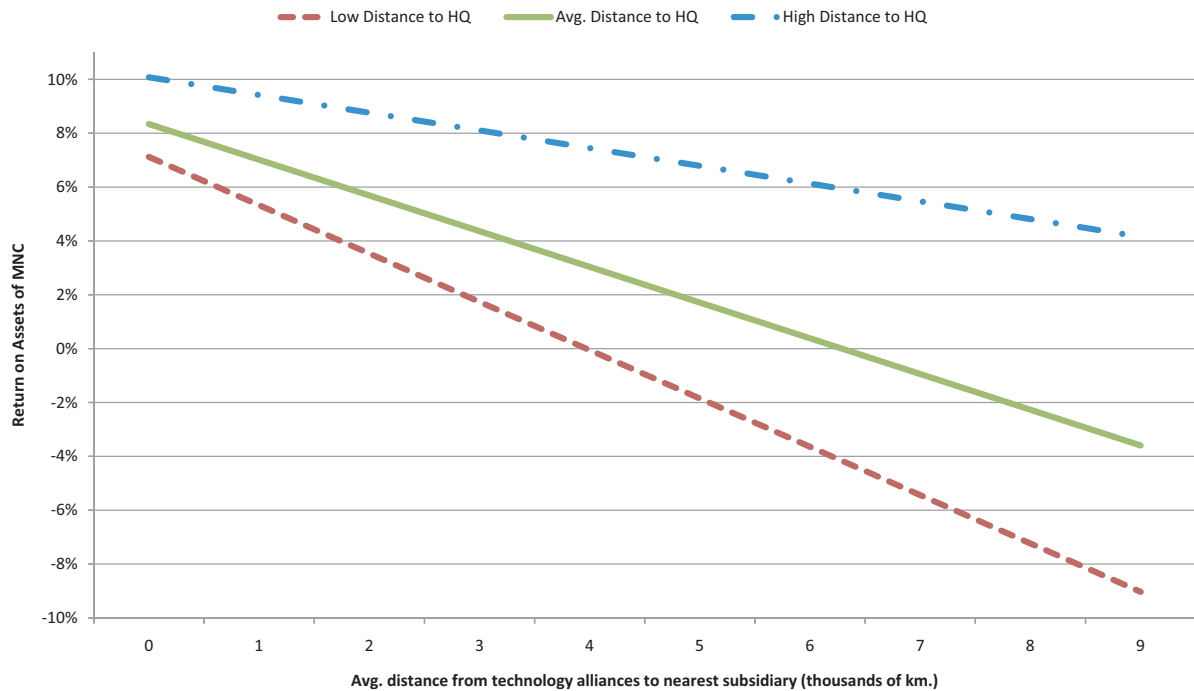


Figure 1. Interaction of distance from HQ to alliances and distance from subsidiaries to alliances  
Each line corresponds to a different distance between HQ and technology alliances. Low and high distances are measured at the 5th and 95th percentiles, respectively.

instrument precisely because one can make the case that it has some type of effect (albeit marginal) on the preferences of individuals to live in or visit a certain location, but not on ROA directly. Our results remain stable after including the inverse Mills ratio as a selection control, with the exception that we do not find support for H3, as shown in Table 4.

The results are robust to alternative measures of our independent and control variables. We used the average distance between HQ and technology alliances, as well as the average distance between the nearest subsidiary and each technology alliance as our primary measures. The results hold if we use the median to capture these two distances. While we followed precedent by using Lavie and Miller's (2008) composite measure of cultural, institutional, and economic distance in the alliance portfolio, the results are robust if we include separate controls for each kind of distance rather than a composite variable. In addition, while we used a control for MNC geographical diversification based on a Herfindahl index, the results also hold if we use Palepu's (1985) often-used entropy measure of diversification.

## DISCUSSION

Although considerable research has separately examined internal networks of the MNC, as well as firms' external alliance networks, three issues arise. First, studies have yet to examine the two networks together and have, thus, considered only a limited notion of the geographic scope of the firm. While each network has independently been shown to affect MNC performance, their joint effects may present fresh insights because of potential tradeoffs and spillovers across the networks. Second, research looking at alliance networks has largely ignored their geographical implications. Given the paradox that knowledge transfer takes place more easily when organizations are collocated, but also that distance allows firms to access ideas of greater novelty, our research considers the extent to which geographical proximity and distance in internal and external networks jointly affect MNC performance. Third, we resolve this paradox by making a critical distinction between the HQ and the subsidiaries in terms of their roles with respect to technology alliance partners and show how each is

Table 4. Results accounting for selection<sup>1</sup>

| SECOND STAGE MODELS                                                | Model 6                | Model 7                | Model 8               | Model 9                |
|--------------------------------------------------------------------|------------------------|------------------------|-----------------------|------------------------|
|                                                                    | Full model             | Interaction            | Low R&D               | High R&D               |
| Total revenue                                                      | 0.0007***<br>(0.0002)  | 0.0007***<br>(0.0002)  | 0.0006***<br>(0.0002) | 0.0018***<br>(0.0006)  |
| Geographic diversity                                               | 0.1415***<br>(0.0507)  | 0.1424***<br>(0.0509)  | 0.0951<br>(0.0601)    | 0.2160**<br>(0.0932)   |
| Subsidiary portfolio size                                          | 0.0001<br>(0.0001)     | 0.0001<br>(0.0001)     | 0.0002*<br>(0.0001)   | 0.0000<br>(0.0001)     |
| Alliance portfolio size                                            | 0.0000<br>(0.0001)     | 0.0000<br>(0.0001)     | -0.0004*<br>(0.0002)  | 0.0000<br>(0.0002)     |
| R&D intensity                                                      | -0.0198<br>(0.0328)    | -0.0193<br>(0.0329)    | -0.2664<br>(0.2587)   | -0.0386<br>(0.0488)    |
| CIE distance index                                                 | -0.0213***<br>(0.0072) | -0.0214***<br>(0.0072) | -0.0126*<br>(0.0073)  | -0.0248*<br>(0.0144)   |
| Distance HQ to subs                                                | 0.0048<br>(0.0031)     | 0.0051<br>(0.0032)     | 0.0045<br>(0.0043)    | 0.0050<br>(0.0048)     |
| Distance subs to subs                                              | -0.0006<br>(0.0041)    | -0.0008<br>(0.0042)    | 0.0024<br>(0.0054)    | -0.0001<br>(0.0064)    |
| Distance HQ to nontech alliances                                   | 0.0020<br>(0.0019)     | 0.0020<br>(0.0019)     | -0.0009<br>(0.0018)   | 0.0059<br>(0.0040)     |
| Distance subs to nontech alliances                                 | 0.0024<br>(0.0024)     | 0.0024<br>(0.0024)     | 0.0004<br>(0.0026)    | 0.0059<br>(0.0044)     |
| Zero distance HQ to tech alliances                                 | 0.0359<br>(0.0459)     | 0.0353<br>(0.0460)     | 0.0212<br>(0.0359)    |                        |
| Zero distance subs to tech alliances                               | -0.0105<br>(0.0221)    | -0.0104<br>(0.0221)    | -0.0092<br>(0.0203)   | -0.0262<br>(0.0378)    |
| Distance subs to tech alliances                                    | -0.0071***<br>(0.0025) | -0.0082**<br>(0.0047)  | -0.0028<br>(0.0030)   | -0.0085**<br>(0.0037)  |
| Distance HQ to tech alliances                                      | 0.0035**<br>(0.0015)   | 0.0033**<br>(0.0017)   | 0.0002<br>(0.0016)    | 0.0069***<br>(0.0026)  |
| Distance subs to tech alliances X<br>distance HQ to tech alliances |                        | 0.0002<br>(0.0006)     |                       |                        |
| Inverse Mills ratio                                                | 0.0808***<br>(0.0274)  | 0.0813***<br>(0.0275)  | 0.0823*<br>(0.0429)   | 0.1255***<br>(0.0421)  |
| Constant                                                           | -0.1488**<br>(0.0746)  | -0.1495**<br>(0.0747)  | -0.1139<br>(0.1028)   | -0.2908**<br>(0.1245)  |
| FIRST STAGE INSTRUMENTS                                            |                        |                        |                       |                        |
| Firm age                                                           | -0.0043***<br>(0.0007) | -0.0043***<br>(0.0007) | -0.0023**<br>(0.0011) | -0.0067***<br>(0.0011) |
| Crime in HQ state                                                  | -0.1376***<br>(0.0383) | -0.1376***<br>(0.0383) | -0.1138**<br>(0.0527) | -0.1600***<br>(0.0585) |
| Firm-years                                                         | 405                    | 405                    | 202                   | 203                    |
| Firms                                                              | 126                    | 126                    | 77                    | 59                     |
| # of censored observations                                         | 4,186                  | 4,186                  | 1,551                 | 2,635                  |
| Chi-squared                                                        | 40.73***               | 40.76***               | 28.49***              | 43.95***               |

\* $p < 0.10$ , \*\* $p < 0.05$ , \*\*\* $p < 0.01$ .<sup>1</sup> Only effects of exclusion restrictions shown for the first-stage models; full set of results available from the authors.

subject to the costs and benefits of distance differently.

Our basic thesis is that the alliance and subsidiary networks need to be examined in conjunction with each other—rather than separately—to more fully understand the concept of geographic scope and explain its effects on MNC performance. We find that the geographic dispersion of the alliance and subsidiary portfolios has negative effects on MNC performance, particularly when the MNC is research intensive. At the same time, an opposite positive effect exists for the HQ in terms of its location relative to the alliance portfolio, which highlights the need for MNCs to reach out broadly in order to access new ideas and knowledge. This positive effect is also heightened in the context of research-intensive firms. We also find an interaction demonstrating that the costs of distance between alliances and subsidiaries are partially offset by the benefits of distance between HQ and alliance partners. These findings are noteworthy because they provide one resolution to the paradox of distance: the recognition that different wholly owned units play distinct roles vis-à-vis alliance partners.

A critical nuance that emerges from our findings is that the negative impact of distance reverses itself when the HQ—rather than the subsidiary—is involved. This finding highlights the opposing and contingent effects of distance, in terms of the advantages of reaching out to access diverse, novel, and non-redundant ideas, while at the same time imposing the costs that are inherent in the transfer of tacit knowledge across distance. We are able to tease out the opposing effects of distance by making a distinction between the HQ and subsidiary roles with respect to technology alliance partners, a distinction which, with its performance implications, may be obscured when only one of those distances are considered. Moreover, by demonstrating the interaction effects of the two opposing distance effects, we are able to also show that they compensate for each other. Thus, reaching out with alliances for far-flung ideas distant from HQ compensates partially for alliances being distant from subsidiaries, although it may be interesting to investigate the boundary conditions of this substitutability.

Our research also contributes by extending the general proposition that firm strategy and structure should be congruent with each other (Chandler, 1962) into the geographic and alliance portfolio realms. More specifically, we show that the congruence of a firm's alliance strategy with the structure

(configuration) of its subsidiaries matters to its performance. Thus, structure may be conceived not just in terms of organizational structure (e.g., the M-form), but also in terms of a geographic structure encompassing the global distribution of HQ, subsidiaries, and alliance partners relative to one another. We also highlight the importance of taking a portfolio approach to geographic configuration rather than the dyadic HQ-subsidiary approach that much prior research has employed. The adoption of a dyadic perspective would not reveal the impact of the benefits and costs of distance aggregated at the level of the firm as a whole because of trade-offs and spillovers that may be involved both within and across portfolios. To re-emphasize, we conceive of the portfolio here not in terms of alliances alone, but also in terms of the portfolio of subsidiaries.

### Future research

While we have used a well-accepted measure of firm performance in ROA, an important outcome to ascertain the knowledge-based mechanisms we propose would be some type of innovation-based measure (such as patents or new product introductions). As we explained, ROA was appropriate for this study because we included a number of industries and patents that vary widely in their importance, meaning, and rate of usage across industries. In addition, our purpose at this nascent stage of work jointly considering internal subsidiary and external alliance networks was to provide an initial set of results that can be refined by subsequent studies. Future work could assess the effects of distance to technology alliance partners using patent-based measures of knowledge creation by restricting the sampling universe to a narrower set of industries for which patents have comparable significance. Through this approach, scholars could assess the relationships between geographical dispersion and technological dispersion, as well as how distance affects the creation of new technological fields and other inventions.

Another extension of this work would be to consider how geographic distance relates to and interacts with cultural, institutional, and other types of distances. At the outset of the article, we explained our objective to isolate the purely geographical dimensions of distance from other types often studied in IB. Thus, we have only controlled for additional kinds of distance. One of the benefits of considering geographic and other distances jointly

would be to understand the boundary conditions of various types of separation. For example, is there a physical range at which institutional and cultural effects on MNCs become more pronounced? Do nongeographic distances decay geographically? We believe these are promising directions for additional work.

## CONCLUSION

We broaden the notion of the MNC's geographical scope to include both its internal and external networks. We contribute to the global strategy and alliance portfolio literatures by showing that it is not just the distance between the MNC's home country and its foreign markets that matters, but also the geographical distance between its alliance partners dispersed across multiple countries relative to its internal units, considered jointly as a portfolio. By taking this approach, we are able to isolate the uniquely geographical aspects of MNC alliance strategy and resolve the paradox of distance by explaining when physical separation is beneficial or harmful for MNC performance.

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