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Between rock and a hard place: The impact of home country demand on exclusive international strategic alliances forged by new technology ventures

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ABSTRACT

This study seeks to progress the relatively thin body of scholarly research on the exclusive characteristics of strategic international alliances forged globally, particularly by new technology ventures. Due to the liability of smallness and newness, these new ventures need to strategically adopt exclusivity in licensing to secure partners across the globe to help them overcome the lack of resources and market access capability. Adopting resource dependence theory, the present study suggests that market size is a key consideration for the determinants of exclusive licensing for new technology ventures. The study investigates if the home demand of a country will influence the propensity to form exclusive international partnerships for new technology ventures. Based on the dataset of 545 international partnerships across the globe, findings of the study provide strong support to the idea that new ventures based in developed countries with limited market size (i.e., small-developed countries) are disproportionately more inclined to offer exclusive partnerships. Significant and positive moderation to the above findings were found due to the effect of sub-sectors, but not due to the size of the partner firms in the international market. The post-hoc analysis considering international and domestic alliances combined sample indicated consistent findings. The findings have theoretical, practical, and policy related implications for international strategic partnerships.

1. Introduction

The scholarly research has paid enormous attention to the management and governance mechanisms for alliances (e.g., Chen and Chen, 2003; Hseih et al., 2010; Kumar et al., 2023; Kale and Singh, 2009). Extant literature on alliances has made a rich contribution to our understanding of international alliances with varied perspectives (e.g., Bouncken et al., 2023; Contractor and Ra, 2002; Globerman and Nielsen, 2007; Hosanoo et al., 2024), but scarce attention has been paid to exclusivity in partnerships, despite its wide adoption in practice. Particularly for new technology ventures, they tend to utilize licensing exclusivity to secure international partners to help them overcome the lack of resources and manufacturing capability. However, given the fact that the exclusivity of international licensing agreements is granted on a country-by-country basis (Anand and Khanna, 2000), it is little known whether new technology

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ventures should always compromise on the exclusivity when seeking partners overseas, or they may have bargaining power to waive exclusivity in certain countries in the global marketplace. If the latter, what factors will help explain the cross-country variation of licensing exclusivity for new technology ventures?

To answer this question, we apply resource dependency theory (RDT) by Pfeffer and Salancik (1978) to argue that the exclusive nature of international alliance governance design reflects the imbalance of power proxied by the different market sizes of domicile for international alliance partners. RDT, which in turn is based on Emerson's (1962) power dependence theory, ably captures the concerns and motivations of new ventures to partner to secure resources, as well as gives due consideration to the 'power' of those controlling resources (Casciaro and Piskorski, 2005; Davis and Cobb, 2010; Hillman et al., 2009; Jiang et al., 2023; Pfeffer and Salancik, 1978). It helps to understand the dynamics of global partnerships formed by new technology ventures. On the one hand, these new technology ventures need to constantly network and forge global partnerships to secure enough resources and access to markets to survive, grow and eventually be competitive (Zhao and Aram, 1995). On the other hand, they tend to face comparatively higher technological and relational uncertainty in a given dyadic partnership with a relatively larger firm (Steensma et al., 2000). So, to secure critical resources it is important for technology new ventures to skillfully manage their dependency for it and the power differential between them and the providers of those resources, often putting them in a difficult between a rock and a hard place, with little maneuverability. At a global level, the comparative source of power for smaller and/or newer firms among themselves could be due to easy access to vital resources. Furthermore, easy access to resources and large markets could be dependent on the country context, which in turn affects the choice of exclusivity in seeking partnership in a focal country.

This paper seeks to extend the line of enquiry on exclusive partnerships within an industry that is highly knowledge intensive, i.e., biotechnology. The present study investigates if the home demand of a country will influence the propensity to form exclusive partnerships. We examine this idea further by analyzing the moderation impact of the sub-industry type (i.e., therapeutics vs. R&D services), and size of the partner (i.e., large vs. small partner). Our main proposition is that the international partners yield power through the access of larger markets and/or the volume of resources they possess, and this aspect would generally put them in an advantageous position irrespective of often-cited partnership concerns (e.g., information asymmetry, opportunistic behavior (c.f. Cuervo-Cazurra et al., 2018). This advantage is particularly more evident at the time of forging partnership as governance issues, but opportunistic behavior concerns show once the partnership is in place. On the other side, new technology ventures are competing to secure scarce resources for their survival, growth and performance. This competition is likely to be more intense in countries with a small market size and less prospective commercialization partners of desired scale. Therefore, new ventures in those contexts will comparatively have more pressure to secure resources, and thus more likely to yield to exclusive partnership terms that are desired by the other partner organization. The new venture and country demand level thus permits us to draw abundantly on RDT to provide a distinctive exposition. Yet, at the same time, it complements other theoretical perspectives (such as, transaction costs, resource-based view, network theory, knowledge accessing theory, and organizational learning) that thus far have conveyed the story of larger companies. Similar argument can be applied for different industry settings wherein firms in a particular industry would yield more power by virtue of having access to more resources and/or having less dependence on firms from the other industry (Casciaro and Piskorski, 2005). Although, prior research examined partner selection in international alliances based on risk, technology and agreement provision factors, however, the role of exclusivity was pointed as an important domain yet controlled for in the study (Contractor et al., 2011). Accordingly, overall, this paper seeks to overcome the scholarly neglect on the topic of "exclusivity in licensing" in context of international strategic alliance (Somaya et al., 2010).

Next, we discuss theoretical underpinning to the proposed hypothesis. Thereafter, we discuss the unique industrial context of pharmaceutical and biotechnology as part of hypothesis development. This is followed by a detailed research methodology. Analysis is then succeeded by a discussion and conclusion section. The latter includes theoretical, managerial and policy related implications.

2. Literature review and hypotheses development

2.1. Exclusive partnerships in high-tech industries

Strategic alliances are prevalent in technology-based industries (Murmann et al., 2015). The alliance formation manifests as inter-organizational cooperative strategies (Varadarajan and Cunningham, 1995) that could range across varying levels of formality in international partnerships, such as an informal alliance that is lose in structure and disposition versus a joint venture that is a tightly coupled formal partnership. However, from theoretical perspective, forging strategic alliances is primarily seen as an alternative to the bipolar options of either pursuing internalization or using market exchanges. It is then not a surprise that both motivations and governance mechanisms/structures have sought to be a favored topic for investigation.

International partnerships involving equity investments have often been researched as a mechanism to overcome some of the concerns (e.g., opportunism, information asymmetry) associated with strategic alliances. Albeit, studies on exclusive partnerships are sparse even though exclusivity is often sought after and negotiated globally to allay similar concerns (Somaya et al., 2010). Somaya et al. (2010) suggests that exclusivity is used as a "contractual hostage" to safeguard licensee investments and/or as an incentivizing mechanism for the risks that come with investing in an early-stage technology. According to them, exclusivity is a "strategic choice" that is "designed to ensure the most commercial success for the licensor while accounting for the licensee's incentives to participate productively in the license". Scholars (e.g., Rothaermel and Boeker, 2008; Somaya et al., 2010) further mention that managers seek to create a win-win situation by using exclusive licensing to access valuable complementary resources and capabilities of partners. So, it could be seen as a mechanism to stimulate trust and sincerity in the relationship for both the partners, especially the one that is committing valuable resources and also facing information asymmetry with respect to the technology that is being partnered for. This

also creates joint dependencies between the two (Gulati and Sytch, 2007), which can generate higher value to the contributors and bestow them with competitive advantage (Teece, 1986).

At the same time, exclusive partnerships forged across the globe is often seen in industries that has a high rate of technological change (Aulakh et al., 2013). Aulakh et al. (2013), therefore, make a strong case to study exclusive partnerships as a mechanism to create higher joint value, but they also rebut the often-made assumption that all potential licensees are homogeneous in their value generation potential. The same argument can be made about the non-homogeneity of licensors or for that matter any type of partnership (of which licensing is just one). The cause of non-homogeneity in the type of partnership and also propensity relating to it is due to the economic and industry context, which often seems to be neglected in the discourse (Murmann et al., 2015).

The above argument is again more relevant in the case of alliances between two firms of similar/different sizes and/or sharing similar market context. In the case of global strategic alliance between large and new venture partners, the exclusivity could be due to unevenness in relationship and would possibly rest on power of the larger partner. However, exclusivity can also be granted by a firm belonging to a country offering limited market potential to the one that demonstrates superior commercialization potential for it is located in a country that is a substantive market. Or, it could be because of both the reasons. Such instances show the context-dependent pressing needs of companies to offer exclusive partnerships. At the same time, it is prudent to suggest and acknowledge that there are usual contractual hazards for both partners entering exclusive partnerships. For instance, the new technology innovator granting exclusive rights is at a significant risk if the partner devotes inadequate attention and/or resources due to changed priorities, or learns about the innovation and then seeks to develop and commercialize technology opportunistically by itself (Somaya et al., 2010). Similarly, failure of an exclusive partnership will likely have more adverse impact on the strategic progression of the licensor partner due to unwarranted delays and missed opportunities in the ensuing exclusive period. These risks get accentuated if the partnership is international and between a large partner and a smaller and/or newer partner, often the case in biotechnology industry. Hence, generally speaking, in such circumstances, a non-exclusive partnership must be beneficial to smaller/newer partners because it allows them to forge other partnerships if a contingency situation arises within a partnership (Aghion and Tirole, 1994).

Despite the above concerns, exclusive partnerships are widespread in high-technology industries. Biotechnology industry is one such industry that has benefitted from strong networking and international strategic partnership building; and major pharmaceutical and biotechnology firms have sought to play a pivotal role in crafting such an interdependent industry framework (Rothaermel and Boeker, 2008). For instance, >80 % of licensing agreements had some component of exclusivity in the sample curated by Somaya et al. (2010). Accordingly, a possible explanation for this extensive phenomenon of exclusivity rests in its high demand by the partnering organizations providing valuable resources to the other firms that need such resources for its progression. Surely, heeding such demands is dependent on factors such as the size and capability of the firm with which partnership is sought, and the market and market size that the partner firm will help realize. Within these technology-based industries that have been the focus of scholarly attention, there is also an implicit realization of alliance formation between large incumbent companies and new ventures (Eisenhardt and Schoonhoven, 1996; Rothaermel and Boeker, 2008). It is then not a surprise that scholars have often sought to review this web of partnerships, but because of the centrality of the large firms in the web of global network, the concerns of new ventures in exclusive international partnerships have got least attention in global strategy literature. This is reflected in the scholarly reliance on transaction cost theory for explanations, as pointed by Eisenhardt and Schoonhoven (1996).

2.2. *Resource dependence theory and strategic alliances*

Access to markets and/or resources of other firms is an important reason for firms in a given country to enter into strategic agreements (Hosanoo et al., 2024). Nonetheless, an important viewpoint that foretells the sustainability concerns of smaller and/or newer ventures to do international strategic partnerships is often neglected. This complementary perspective is about the necessity to enter strategic partnerships across the globe to survive. Furthermore, the survival of the venture is often based on securing enough resources to be able to continue developing and progressing innovative technologies and also making sure it gets commercialized successfully. Hence, survival logic is as much important as the ability to add value, and remain competitive (Wry et al., 2013; Xia, 2011).

RDT gives due consideration to the 'power' of those controlling resources and having market access. It elaborates on exchange mechanisms (like, M&A, JV, strategic alliance, etc.) often used by the organizations to balance the autonomy concerns, and uncertainty and dependence on other organizations (Davis and Cobb, 2010). There is little disagreement that the power rests with larger organizations that control more resources and/or those organizations that have ability to provide access to larger markets. At a global level, the comparative source of power for technological new ventures could be their unique innovation in a given niche field. So, to secure critical resources it is important for the smaller/newer firms to skillfully manage their innovative technology. This is especially important for new ventures in technology intensive sectors such as the biotechnology industry. It is so because biotechnology industry is characterized by the R&D intensive nature that is not only long drawn and consuming significant resources but also have long gestation to fruition (i.e., generation of revenue and profits). It is for this reason that these new ventures often experience resource scarcity that translates into resource dependency on other organizations (Luo and Deng, 2009). This adverse situation is further accentuated in the context of small-developed economies with high science and technology base to engender several new ventures, but do not have enough local demand to create an ecosystem with optimal number of commercialization partners that could shoulder the burden of resource dependency of smaller/newer firms (Murmann et al., 2015). This context driven imbalance for resources and market access can also result in an imbalance within the global biotechnology industry sector. It is for this very reason that smaller/newer firms in small-demand country contexts will be especially vulnerable to uncertainty relating to their technological progression, thus driving them to seek and forge partnerships. Especially, these companies from small-demand countries will more often seek to

forge international partnerships with a view to have a foothold in those lucrative overseas markets (Murmann et al., 2015).

Resource dependence theory suggests that few organizations are self-sufficient in their resources (Pfeffer and Salancik, 1978). It is because of this lack of self-sufficiency that creates their dependency on other firms. Yet, the degree of the need for partnerships is not equal for the partnering organizations. One may need the other more and that is what creates power imbalance. The need is more profound in the case of small and/or new ventures that often face resource scarcity, and thus often relenting to exclusivity in partnership as a reciprocate gesture and possibly stabilizing the formed partnership. Eisenhardt and Schoonhoven (1996) acknowledge and highlight these vulnerabilities among new technology ventures that were competing in emergent and/or highly competitive industries and also trying to pioneer new technologies. When there is survival risk due to external dependence on critical resources, an organization is forced to take measures to reduce those uncertainties relating to critical resources. Based on principles of exchange theory (Blau, 1964; Emerson, 1962; Jacobs, 1974), RDT suggests that whoever controls critical resources is likely to wield more power (Pfeffer and Salancik, 1978); hence it is likely that new ventures have to accommodate implicit/explicit demands of partner firms, especially those that bring in critical resources and/or market access impacting their survival and competitiveness. This behavior is likely to be more pronounced in international strategic partnerships.

The contextual vulnerabilities faced by the new ventures of a resource-intensive sector based in small demand economies can create dependency for access to market and resources. The dependency is inversely proportion to the availability of exchange partners that will result in goal fulfillment of the dependent actor, as argued in the power-dependence theory (Emerson, 1962). The small market in home country thus exacerbates the dependence of any resource-intensive new venture, often resulting in power advantage to the other organization that can provide valuable resources and/or access to larger international markets. For the scarcity of valuable resources and market access, the new venture based in small demand economy is more likely to compromise on the virtues of non-exclusivity. Yielding to the exclusivity demands by the partner organization is a considerate move to balance the international exchange relationship and reduce the associated costs of being in an imbalance state. This is in keeping with the arguments of RDT that rest on Emerson's (1962) power-dependence theory. However, since we focus on the exclusivity dimension in international strategic alliance across the globe, which is a valuable resource from the perspective of both the actors, so RDT is more suited to provide explanation vis-à-vis power dependence theory that focuses on the 'form' of exchange rather than the 'content' of the exchange (Molm, 2007).

2.3. Home demand market and exclusivity

Wry et al. (2013) argue that the external context of the organization is a primary concern for the RDT, yet there has been a "general disregard" by scholars citing this theory. The context is an important factor that shapes the strategy of the firm. Market condition that includes the market size is a well-established contextual dimension that influences a firm's global strategic direction. Significant decisions such as internationalization are often shaped by the home country conditions (Cuervo-Cazzura et al., 2018), yet the explicit consideration of small home country local demand is sparse (Murmann et al., 2015).

Some scholars (e.g., Moon et al., 1998) have sought to demonstrate that firms seek to compensate for small local demand by venturing overseas. Despite the gradual scholarly progression on the impact of home demand on the internationalization of the firms, there has hardly been a study that systematically investigates how home demand impacts new ventures in their proclivity to grant exclusivity in strategic international alliance. The premise of the idea is an extension of the argument by Casciaro and Piskorski (2005) that firms in different industries will manifest dependence and power imbalance at the industry level. In this case the dependence and power imbalance in the highly globalized and networked biotechnology industry is manifested by means of the strength of market demand for that industry in a given country. Firms that are present in a country that has a larger market demand for a particular industry will likely enjoy advantageous position vis-à-vis a firm in a country with a smaller market demand of that industry.

It is almost an acknowledged fact that new ventures are hard pressed for resources, and it is this uncertainty to secure resources that often sends them into an overdrive to seek and develop partnerships internationally. The partnerships sought could be to secure resources that will progress their technological development or they could be to advance business development (Murmann et al., 2015; Chen et al., 2024). However, the perceived pressure of forming partnerships will comparatively be greater for firms in the countries that have less endowed demand conditions for they may need to venture beyond the boundaries and thus face international competition to secure resources. Since home demand of the country, an important external environment construct that influences power asymmetry by virtue of resources and market access, is the central concern here, so RDT is the principal theory that motivates the logic of the research. In fact, Wry et al. (2013: 441) argue that external context is the "nuanced" aspect of RDT that scholars have disregarded in general.

In short, the new ventures in small demand countries are comparatively more susceptible to compromises and need to further international strategic alliances by demonstrating their sincerity through exclusivity provisions to the partner. This is similar to cooptation strategies (such as offering a board seat) wherein organizations are willing to trade "sovereignty for support" (Davis and Cobb, 2010). Therefore, other things being equal (e.g., technological competence), exclusivity provisions are then likely to generate a higher level of interest and sincerity from the partners pledging much needed resources.

H1: *The home country demand of new technology ventures has a negative association with the exclusivity of the international strategic partnerships.*

2.4. Sub-industry influence on exclusivity

The type of industry and/or vulnerability with regards to strategic positioning in a given market context impacts the need to form international strategic alliances (Eisenhardt and Schoonhoven, 1996; García-Canal, E., Duarte, C. L., Criado, J. R., Llaneza, A. V., 2002;

Nohria and Garcia-Pont, 1991). Traditional scholarly literature has focused on horizontal partnerships between established firms, as noted by Rothaermel and Boeker (2008); hence, the emphasis on ideas such as complementarities due to geographic locations and status similarity. Some of those ideas and concepts (e.g., complementarities) are equally valid for new age high-technology industries. However, the concept of status similarity as a pre-condition to alliance formation has evolved.

The idea of incumbent large partners entering partnerships with smaller and/or newer ventures has taken ground (Eisenhardt and Schoonhoven, 1996; Rothaermel and Boeker, 2008; Bouncken et al., 2023). The dynamicity in the industry context makes strategic position of incumbent large firms vulnerable. So, complementary partnerships with new ventures across the globe demonstrating innovativeness in technology front is a viable strategic choice.

Traditional pharmaceutical and new age biotechnology industry demonstrate substantive complementarities and thus it provides a fertile ground for alliance formation between incumbent large firms and innovative new ventures (Powell et al., 1996; Rothaermel and Boeker, 2008). This is because new biotechnology ventures can help incumbent large firms in strengthening and revitalizing their portfolio in a difficult landscape where innovation is the key (Pategou, 2019). R&D spending in the biotechnology industry has doubled over the past five years and net income fell by 44 % (US 7.4 billion to 4.4. billion) (PharmaVoice, 2022). 6.7 % of industry sales are projected to be at risk by 2028 (EY, 2023). Furthermore, it takes about eight to twelve years to get a new drug to the market, and of 10,000 compounds being investigated, only one reaches the market (Pategou, 2019). For this low return on investments, it is common to see incumbent firms hedging their bets by investing in a portfolio of new ventures (Pategou, 2019). At the same time, it is this very reason of substantial investments and long gestation to earnings that the new ventures in therapeutics often experience resource scarcity that translates into resource dependency on other organizations (Luo and Deng, 2009; Gilding et al., 2020).

This adverse situation is further accentuated in the context of small-developed economies with high science and technology base to engender several new ventures, but do not have enough local demand to create an ecosystem with optimal number of commercialization partners that could shoulder the burden of resource and market access of newer firms (Murmann et al., 2015), thereby making them more vulnerable to power imbalance in negotiations.

The above-mentioned business model focused on therapeutics/ drug development is distinct to the alternative model wherein innovative biotechnology firms create technology platforms that contribute to the development of drugs. They use these platforms internationally to provide services directly or indirectly (such as licensing their platform) to those firms engaged in drug development (Kiernan and Naylor, 2018). The business model associated risk and income generation of these R&D service providers are distinct to therapeutics focused new ventures that are involved in development of new drugs.

The above two business models- therapeutics vs R&D services - observed within biotechnology industry can be seen as the primary two sub-groups within the broad human biotechnology industry.[1] Since, different business models will entail distinct strategy, resources and capabilities (Tallman et al., 2018), so the resource demands placed on each sub-industry type will be very different. For the varied pressures on resource and income generation, not only the burden to enter partnerships will be different, but also the compulsion (and/or desirability) to enter exclusive partnerships will be dissimilar, as discussed above. Therapeutics firms, more hard-pressed for resources in earlier stages, are more willing to have exclusive deals when compared to R&D services firms, irrespective of the domestic business context (i.e., large demand or small demand). This means that there is more possibility of seeing an increased rate in exclusivity in large to small demand countries with regards to R&D services. It will be less pronounced for therapeutics as it will likely show high rates of exclusivity in both small and large demand countries. Despite this dissimilarity in exclusivity rate in the two contexts, we would still like to contend that in either sub-industry the propensity for exclusivity will be observed more in small demand countries vis-à-vis large demand countries for the similar arguments presented earlier. This leads us to the next hypothesis stated below.

H2: H1 is moderated by the type of sub-industry such that it is more significant for R&D services sub-industry than for therapeutics sub-industries.

2.5. *Partner size effect on exclusivity*

In the biotechnology industry, the contribution of new ventures through their innovation has already been alluded to above and is also discussed in industry reports (e.g., Pategou, 2019; PharmaVoice, 2022). However, large incumbent firms are also able to contribute extensively to the partnerships for they help new ventures in overcoming market failures (Williamson, 1985), bestowing market power (Porter and Fuller, 1986), entering new markets (Kogut, 1991), sharing their substantive learning (Hamel et al., 1989) and even providing legitimacy to the new venture (Baum and Oliver, 1991). For the above reasons, large incumbent partners in alliance can have significant influence and impact on the governance mechanism in a partnership (Bosse and Alvarez, 2010). The larger partner when contributing significantly to revenues of a new venture or providing critical market access will enjoy substantive bargaining power (Bosse and Alvarez, 2010). This asymmetric power balance is often witnessed in high-tech industries such as biotechnology. As discussed earlier, large incumbent firms have deep access to markets and significant resources to contribute to technological development (Rothaermel and Boeker, 2008). Because of higher bargaining power, the larger incumbent partner can often influence structure of partnerships and sharing of alliance benefits.

Across the globe, partnership exclusivity provisions, just as equity arrangements, are an important structural consideration as far as

[1] It is also common to observe some biotechnology firms having hybrid business model, i.e. pursuing drug development in a particular area, but also providing some R&D services. The latter is usually done to generate revenue stream for self-sustenance of drug development. Those firms, for the purpose of this study, are characterized under therapeutics for this is their primary goal and focus.

any partnership is concerned (Teng and Das, 2008). In each context, it seeks to limit the competition and bestow full rights (whether market and/or technological) to the receiving partner. In any industry, exclusivity rights to a valuable asset can confer competitive advantage, so incumbent large firms irrespective of where they are headquartered (i.e., small or large demand countries) are just as likely to press for it as they seek equity in new ventures (Bosse and Alvarez, 2010). Conversely, the small partner size will in general have limited influence on exclusivity, but that influence will likely manifest in situations where the small partner belongs to a large demand country and is thereby able to provide assurance to capabilities and resources that promise entry and subsequent advantage into that large market. In such a scenario, a new venture belonging to a small-demand country will be willing to surrender exclusivity to a competent venture overseas that may not be large enough.[2]

Given the above compelling reasons valid for a new venture in a small demand country, we conclude that new ventures in small demand countries (vis-à-vis large demand countries) are also more likely to concede exclusive international partnerships even with smaller partners. This will have an impact on the overall likelihood of new ventures in small demand countries to form exclusive international partnerships with even smaller ventures. Chen and Chen (2003) confirm to similar thoughts based on their findings that Taiwanese biotechnology firms' high interdependency on foreign firms precipitates them to form equity alliances more often. Exclusivity arrangements like equity alliances are also likely to be founded on more integrative structural arrangements; hence, it will not be unseemly to suggest the following hypothesis.

H3: H1 is moderated by the size of the partner firm such that it is more significant for larger partner than smaller partner.

Based on the hypothesis, Fig. 1 represents our conceptual framework.

3. Research methodology

3.1. Sample and setting

Biotech companies are high-tech companies. Such companies aggressively get into alliances. These companies can be broadly classified into two sub-sectors namely R&D services and Therapeutics industries. In order to test our hypotheses, we have chosen the biotechnology sector health companies of different countries having international strategic alliances. The exclusive nature of international alliance is used as a dependent (i.e. exclusive versus non-exclusive alliances). In this study we investigate the nature of alliances across the globe and its relationships with the health expenditure of the biotech company's geography. To statistically measure the small and large home demand we consider the health expenditure (HE) of the focal country as a continuous variable. We also investigate the moderating effect of type of sub-industry of biotech company, and the size of international alliance partner.

To argue our expected findings, we need a large sample from developed countries where the health expenditure (HE) varies significantly, as well as the industry mix is also sufficient. We selected the high health expenditure countries of Europe (France, Germany, and United Kingdom) and Asia (Japan). At the same time, we considered the low health expenditure countries of Europe (Netherlands, Switzerland and Sweden), and Asia (Israel, Taiwan). We also included Australia which is the base country in our analysis for point of reference for comparison. The health expenditure of Australia is smaller than the high health expenditure countries, but larger than the low health expenditure countries considered in this research. We excluded the USA because the health expenditure of the USA is exceptionally high, and it was an outlier in the group considered in this study. The health expenditure of the countries was measured in absolute billion USD from World Health Organization (WHO) year 2005. The year 2005 was chosen for the health expenditure because the biotech firms considered in this analysis were established between January 1998 up to Dec 2004. The health expenditure of the countries considered in USD billions were as follows: France (233.08), Germany (312.08), United Kingdom (161.35), Japan (349.20), Australia (81.40), Netherlands (64.65), Sweden (35.14), Taiwan (23.30), Israel (16.05).

The younger firms need for alliance formation are cost savings, market access and high technology requirements, among others. Therefore, the partnerships comprised of both R&D and/or business development types and were formal arrangements. They were also across the broad range, that is from being arm's length (contract research, milestone payment research, or licensing of technology) to more involved partnerships (that is joint product development, co-development of market, or even joint ventures).

We considered biotech firms with <11 years of the age (Beckman, 2006; and Certo et al., 2001). Such firms are more prone to alliances and/or resource vulnerabilities. We considered the biotech firms which were established after January 1998. Young firms typically take a few years to form alliances, so we considered firms which were established up to December 2004 and were thus expected to demonstrate partnerships in ensuing years. We thus leverage our analysis on the partnerships formed by these young firms across the globe up to their 10th year (five years being minimum), which is year 2009 for this research.

3.2. Data sources

The study needed the two types of data sets namely the biotech firms, and their partners in and outside the countries considered for investigation. In order to achieve this, we had to diligently collate data from multiple sources and create a data set for the purpose of this research. We briefly describe the process followed for the said purpose.

[2] Note that exclusivity provisions can also be negotiated by another smaller venture, if it is able to contribute complimentary technology know-how that significantly enhances the joint value proposition (Rothaermel and Boeker, 2008). In such situations, given the high level of mutual dependence, constraint absorption aspect of RDT instead of cooptation will be more apt (Casciaro and Piskorski, 2005).

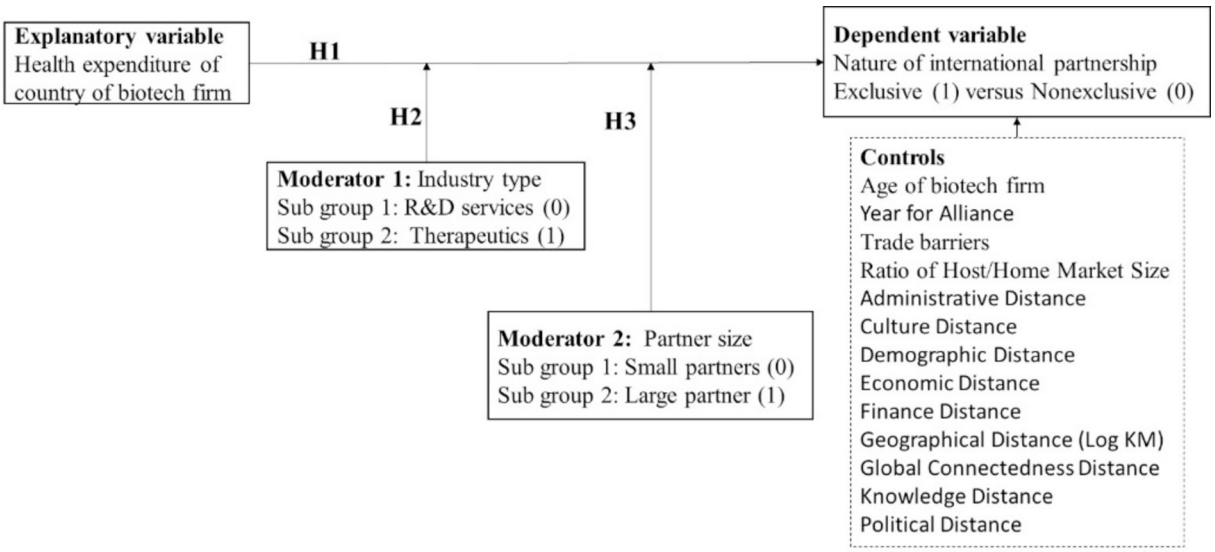


Fig. 1. Conceptual framework of the study.

3.2.1. Biotech firms

The Bioscan, Thomson Reuter Cortellis, Internet CM's NewsAnalyzer and IndustryAnalyzer (discontinued databases), Biotechgate, and EBI (Elsevier Business Intelligence, earlier known as Windhover), and the national trade directories were the leading sources to collate biotech startup firms in various countries. We reviewed the union and intersections of the availability of the number of biotech startup firms in these databases. Thereafter, we decided to consider at least two sources in each country which gave us the widest coverage of the firms. The sampling method ensured that a comprehensive list of biotech firms founded between January 01, 1998, to December 31, 2004, was used for testing the hypotheses. This is due to data availability. The EBI was considered as the first data source for each country. The Biotechgate database was then considered as the second-best source for Japan and European Union countries, and national industry directory (e.g., AusBiotech in Australia) was considered for Australia, Taiwan and Israel. The firms that originated out of mergers and acquisitions were disregarded from the sample. The number of biotech firms clearly identified to have established in the desired time period (i.e., 1998–2004) in each country were as follows France- 21, Germany- 26, UK- 56, Japan- 8, Australia- 16, Israel- 16, Netherlands- 6, Sweden- 10, Switzerland- 10, and Taiwan- 7. The sample in each country was near about the population representative for the firm's profile considered under the research.

Once the name of the companies was found, it was easy to establish whether they were therapeutic firms or R&D services providers. In some instances, where the firms followed dual strategy, we identified those firms as therapeutics. It is not uncommon within the industry for firms to provide services as ancillary part of their business model for sustenance and/or growth purposes, even though the primary purpose is to develop therapeutics.

3.2.2. Partner firms

The comprehensive list of partnerships was developed by collecting and reading the news items from NewsAnalyzer, Cortellis, EBI, and Factiva databases. We also visited the biotech firm's websites and sought to further verify/enrich the partnership list further. The news items that were painstakingly collected were then coded to define the nature of partnership being exclusive or nonexclusive, and also identify the partner and its location. The partners could be a pharmaceutical company, another biotech firm or a research institute/university. In some instances, it was not possible to discern clearly whether the partnership was exclusive or non-exclusive. Those partnerships were then not used for analysis purposes. The partnerships that had partial component of exclusivity (e.g., partial exclusivity with regards to geography or use of technology) were also considered as exclusive alliances. The total number of partnerships in the database that we created for the firms in countries mentioned was 1222; however, the total partnerships that were found to be usable for the purpose of this paper were 545 international alliances.

Once the partner organizations were known, it was easy to do a search to locate their head office. This helped in determining whether the partner organization was domestic or international. Through this information on the city head offices of the biotech firm and that of the partner organization, it was also possible to identify their latitude and longitude dimensions. This information was then used to establish the distance in kilometers.

Finally, the size of the partner had to be established for the purpose of this paper. In case the partner was an established pharmaceutical company or a university/research institute, it was easy to do so. However, this is not easy information to collect if the partner is a biotechnology firm. It poses several challenges in the case of industry like biotechnology. There are no standard criteria to define the size of the firm. It can be defined by number of people in the organization, valuation of the company, or revenue (profits may not be the ideal common criteria in a R&D intensive industry such as biotechnology). Given the nature of the industry, other dimensions can fluctuate tremendously in a short period of time. For instance, within a short span of five to six years between 1997 and

2003 the valuation of PPL Therapeutics (the creator of Dolly the Sheep, the very first cloned mammal) declined 99 % to be less than $10 million (Timmons, 2003). Likewise, the opposite is also true. A company having a modest valuation in a year may potentially be valued very highly on a successful technological finding. So, we tried to painstakingly estimate the size of the partner company for the year the partnership was being formed using multiple approaches. If it was not possible to do so for the exact year, it was sought to look for criteria in the years nearer to partnership year and make some logical judgements so as to be able to categorize them as large or small sized. Given the nature of the pharma/biotech industry, we relied on one or more than one criterion mentioned here to determine the size of the partner: a) firms having +100 employees are considered as mid-sized as per international norms (example in USA). So, any firm having near about 100 employees, or more were considered to be large; b) firms having revenue of $50million or more were categorized as large; c) firms having valuation of $100million or more were categorized as large.

3.3. Multi-level, mixed-effect, linear regression model

We developed multi-level, mixed effect logistics regression model (Hair et al., 2014). Whether the groupings in a data arise in a nested fashion or in a non-nested fashion, one can fit a multilevel model to account for the lack of independence within these groups. It estimates variance of random intercepts and random coefficients. The outcome variables in such models are binary. The log odds of the dependent variable are measured as a linear regression equation of the explanatory variables. It computes intra-class correlations and predicts random effects. It estimates the relationship that are population averaged over the random effects and much more (Hair et al., 2014).

3.3.1. Dependent variable

The predicted variable in all models is binary i.e., if the alliance is non-exclusive (coded as ‘0’), or exclusive (coded as ‘1’). We write exclusive versus nonexclusive; henceforth, as *Exclusivity*.

3.3.2. Independent variables

The health expenditure is used as a continuous variable as a measure of home country demand (Murmann et al., 2015). The health expenditure of countries was skewed, ranging from 349.20 billion (Japan) to 16 billion (Israel), therefore the variable was scaled using logarithm base. The log health expenditure (LHE) in the home country is our key independent variable tested for negative association with the exclusivity of alliances. The type of industry was defined as a binary variable in our models, where the two industry sub-classifications were 1) R&D Services coded as ‘0’, and 2) Therapeutics coded as ‘1’. The size of the partner company was defined as a binary variable in our models, where the sizes were 1) Small size partner coded as ‘0’, and 2) Large size partners coded as ‘1’.

3.3.3. Controls

We used a series of relevant individual and dyadic control variables in the models such as focal firm's life cycle as the age of the biotech firm, and the macroeconomic climate as the year of the alliance. The study also controlled for the dyadic barriers such as the trade barriers between the countries and dyadic distances between the biotech firm focal country and the alliance partner country such as the administrative distance, cultural distance, demographic distance, economic distance, financial distance, geographical distance, global connectedness distance, knowledge distance, and political distance (Berry et al., 2010). Though the biotech firms used in this study were all young and founded in the year 1998 onwards, but we control for the firm's lifecycle as the age of the firm. A firm with more age may have more knowledge about the market and more control over the resources. Or an aged firm may have a less likelihood of making exclusive alliance than a relatively less aged firm.

Cross boundary macro-economic conditions may influence the likelihood of the nature of alliance. The macro-economic climate varies over the years. The year in which the alliance was executed may have an influence on the likelihood of alliance. The first two years from 1998 was a good representative of dot-com boom; the next three years from 2000 was a period for dot-com burst; later five years starting from 2003 were the dot-com recovery phase; and the remaining two years from 2008 were the global financial crisis. Therefore, we controlled for the year of alliance.

The trade barrier is an important variable from the viewpoint of this study such that if there are no trade barriers among countries, the biotech firms may have an influence on the likelihood of exclusive alliance vis-à-vis if there are trade barriers. We measured the trade barriers as a dyadic relationship between the firm country and the partner country such that if the firm country has rights to sell and promote its pharmaceutical products in the partner country. For instance, European biotech firm obtain drug approval through European Medicine Agency (EMA), so for them there is no trade barrier to sell their products in any other European country if they already have an approval from EMA (Murmann et al., 2015). However, an Australian biotech firm having approvals in Australia will still need EMA approval to sell its product. Therefore, international alliances following under a trade regime allowing automatic approvals (such as EMA), the trade barrier was classified as ‘0’. In all other cases, the trade barrier was deemed to be existing and classified as ‘1’.

The cross-national distances between the focal country of biotech firms, and the partner country may have influence on the potential exclusivity of alliance based on the dyadic distances between countries. We used multi-dimensional dyadic controls to measure various distances between countries, namely administrative, culture, demographic, economic, finance, geographical, global connectedness, knowledge, and political distances (Berry et al., 2010).

Finally, we also controlled for the market size of the partner where it is domiciled. One of the arguments is that the new ventures from small demand countries are likely to offer exclusive partnerships if the partner is able to provide market access. The partners who are able to provide access to larger markets will likely have more negotiating power. We therefore calculated the market size of the

partners' country (i.e., host country) just as we had calculated for the home country. And, after that we took the ratio of host country to home country as the control. We collected the health expenditure data for all the partner countries from the WHO website. The ratio of the host versus home country market size for each alliance was used as a dyadic control. Power asymmetry captured using these dyadic controls also justify the arguments based on resource dependence theory that we have used to establish hypothesized relations.

4. Empirical data analysis

The descriptive statistics of the variables, and their bi-variate correlations are presented in Tables 1 and 2 respectively. We first argue the hypotheses with the frequencies of exclusive and nonexclusive alliances in each of the large and small demand countries. We also argue our subgroups and moderation hypotheses on industry type, and partner size based on the frequencies of exclusive and nonexclusive international alliances in each of the groups by comparing between large and small demand countries (Appendix A).

Due to the large-scale absolute numbers of health expenditure, and geographical distances between the biotech firm country and alliance country, the two variables were scaled down using base as Log.

The total sample of 545 international alliances was considered in these models. The nonexclusive international alliances were coded as '0' while exclusive international alliances were coded as '1'. Models were solved using *melogit* command of STATA.

4.1. Robustness checks

4.1.1. Endogeneity

Endogeneity leads to misleading interpretation of the estimates and the correlations among variables. The end result of the endogeneity is that the model remains mis-specified. The bias in inferences in any research should be conservative; however, endogeneity leads to just the opposite outcome. Endogeneity inflates the results and renders this over-permissive inference, hence a check for that element is desired. The use of appropriate control variables helps address the endogeneity issue in the model. This research uses country level, alliance level, and dyadic country pair distances as control variables. To that end, instrumental variable in the model is used to empirically test for the omitted variables and potential endogeneity.

The instrumental variable, '*financial distance*' between alliance countries, was identified keeping in mind that it should have a high correlation with the regressor, but not correlated to the original endogenous variable (Bascle, 2008). The partner's countries financial distance was regressed with the health expenditure (LHE) and was found to be significant. The two-stage least square (2SLS) regression analysis was then run using the STATA command *ivregress 2sls*. The command *estat endog* endogeneity was tested in the model. The tests of endogeneity assume a null hypothesis as variables are exogenous. The Durbin (p value = 0.5028) and Wu Hausmann (p value = 0.5041) values were both observed as not significant, which indicates that the null hypothesis was not rejected. Furthermore, the endogeneity was tested with two additional instrumental variables, namely demographic distance, and trade barriers. Both the Durbin (p values = 0.1805, 0.1873) and Wu Hausmann (p values = 0.1816, 0.1884) tests were noted as not significant, and indicates that the null hypothesis was not rejected. Subsequently, the over-identification of the instrumental variables was also investigated using the command *estat overid*. No over-identification restrictions were found, which confirms the absence of instrumental variable selection bias. These tests confirm the absence of endogeneity in the model variables. Hence, it can be concluded that there is no need of 2SLS, and the mixed effect multi-level hierarchical method used is correct (Bascle, 2008).

4.1.2. Multi-collinearity

The presence of multi-collinearity among the independent variables may bias the estimates. We report the bi-variate correlations

Table 1
The variables descriptive.

#	Variable	Obs	Mean	Std. Dev.	Min	Max
[1]	*Exclusivity*	545	0.468	0.4994263	0	1
[2]	Age	545	8.871	1.729	5	11
[3]	Year for Alliance	545	8.160	2.534	1	12
[4]	Administrative Distance	545	69.141	54.974	0	271.584
[5]	Culture Distance	545	13.731	9.662	0	29.655
[6]	Demographic Distance	545	2.213	3.303	0	20.744
[7]	Economic Distance	545	2.552	4.941	0	50.586
[8]	Finance Distance	545	3.995	3.681	0	20.541
[9]	Geographical Distance (Logged)	545	3.527	0.558	1.913	4.272
[10]	Global Connectedness Distance	545	1.690	1.556	0	9.676
[11]	Knowledge Distance	545	23.863	24.584	0	70.694
[12]	Political Distance	545	5.587	3.853	0	32.061
[13]	Trade Barrier	545	0.660	0.473	0	1
[14]	Ratio of host/home country market size	545	12.900	30.937	0	176.993
[15]	Health Expenditure (Logged)	545	11.101	0.371	10.20535	11.543
[16]	Industry Type	545	0.599	0.490	0	1
[17]	Partner Size	545	0.666	0.472	0	1

Note: The terms base firm, focal firm, or biotech firm has been used interchangeably in the paper.

Table 2
Bi-variate correlation matrix among the variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	-0.107															
3	0.121	-0.320														
4	0.157	-0.168	0.156													
5	-0.041	-0.020	-0.036	0.093												
6	0.086	-0.014	0.107	0.239	-0.077											
7	0.067	-0.139	0.135	0.048	0.066	0.652										
8	0.075	-0.052	0.057	0.180	-0.059	0.209	0.260									
9	0.078	0.030	0.004	0.090	-0.246	0.358	0.134	0.414								
10	0.054	-0.034	0.151	0.417	-0.096	0.460	0.259	0.307	0.153							
11	-0.062	0.012	-0.068	-0.162	-0.273	-0.184	-0.159	0.218	0.546	-0.188						
12	-0.017	0.013	-0.030	-0.065	0.073	0.266	0.179	0.062	0.453	0.031	0.386					
13	0.081	-0.028	0.050	0.198	-0.292	0.399	0.129	0.373	0.896	0.195	0.590	0.523				
14	0.071	-0.147	0.087	0.424	-0.181	-0.016	0.037	0.587	0.299	0.129	0.229	-0.117	0.262			
15	-0.166	0.227	-0.192	-0.631	0.080	-0.176	-0.154	-0.306	-0.175	-0.350	-0.008	0.124	-0.162	-0.534		
16	0.141	-0.145	-0.053	0.092	0.090	0.056	0.016	-0.016	-0.060	0.091	-0.127	0.024	-0.025	-0.065	0.006	
17	-0.176	0.021	0.003	-0.021	-0.006	-0.086	-0.095	-0.024	0.000	0.040	0.154	-0.052	0.028	0.046	0.005	-0.076

among the variables (Table 2). We determined the variance inflation factor (VIF) using the *vif* command of STATA and report the VIF values in Table 3. The highest VIF value was 9.09 (Threshold <10.0) for variable. The VIF ranged between 1.09 and 9.09. The tolerance was also determined for each variable. The lowest tolerance was 0.11 (Threshold >0.1). The tolerance of all variables ranged between 0.11 and 0.92. The VIF and tolerance values were within the required threshold, and this confirmed the absence of multi-collinearity among the independent variables. The estimates of the model are free of multi-collinearity bias.

4.2. Testing hypotheses

To test our first hypothesis H1, we developed three models (Table 4). The three incremental models H1A, H1B, and H1C were with essential controls variables, and their combinations to test hypothesis H1. It is evident from Table 4 that the beta coefficient of HE (i.e., health expenditure) of the countries is consistently negative and significant across all three models (−0.772, −0.843, and − 0.663) respectively, therefore hypothesis H1 is supported. This implies that small compared with large home demand countries, firms are more likely to form exclusive partnerships than non-exclusive partnerships (Fig. 2). Alternatively, the health expenditure of the home country is negatively associated with the likelihood of exclusive alliance.

$$Likelihood\ of\ exclusive\ alliance = \frac{E^Y}{1 + E^Y}$$

Where the outcome variable Y can be estimated as (Hair et al., 2014) follows:

$$Y = X + + \beta_{14}{}^{*}[Log\ Health\ Expenditure]$$

And, $X = \beta_0 + \beta_1{}^{*}[Age] + \beta_2{}^{*}[Year\ of\ Alliance] + \beta_3{}^{*}[Administrative\ Distance] + \beta_4{}^{*}[Cultural\ Distance] + \beta_5{}^{*}[Demographic\ Distance] + \beta_6{}^{*}[Economic\ Distance] + \beta_7{}^{*}[Financial\ Distance] + \beta_8{}^{*}[Log\ Distance\ KM] + \beta_9{}^{*}[Global\ Connectedness\ Distance] + \beta_{10}{}^{*}[Knowledge\ Distance] + \beta_{11}{}^{*}[Political\ Distance] + \beta_{12}{}^{*}\ [Trade\ Barriers] + \beta_{13}{}^{*}[Host/Home\ Country\ HE\ Ratio]$.

The negative and significant beta of HE in all the three incremental models confirms that the hypothesis H1 is true, and the results are stable.

The model H2 (Table 4) shows the interaction effect of the HE with the industry type, the beta of the moderating variable ($\beta = 1.757$, $p < 0.05$) was positive and significant, therefore H2 was supported. The positive beta signifies that the negative effect of HE on *exclusivity* is more in the case of R&D services than Therapeutics. Alternatively, we can say in small versus large demand countries, the rate of increase of likelihood of exclusive nature of partnerships from large to small demand countries is observed more in R&D services than therapeutics (i.e., H1 is moderated by the type of sub-industry in the direction as stated) (Fig. 3). The below expression is used for likelihood calculation in logistics regression (Hair et al., 2014).

$$Y = X + \beta_{15}{}^{*}[Industry\ Type] + \beta_{16}{}^{*}[\text{LHE X IND}]$$

The model H3 (Table 4) showed that the interaction effect of the HE and size of partner ($\beta = -0.004$, $p > 0.05$) was not significant, therefore H3 was not supported. This implies that in small versus large demand countries, the propensity of exclusive versus nonexclusive international partnership is more in case of alliance with both large and small partners (Fig. 4). The exclusivity of alliance remained indifferent to the size of partner. The below expressions used for likelihood calculation in logistics regression.

$$Y = X + \beta_{15}{}^{*}[Partner\ Size] + \beta_{16}{}^{*}[\text{LHE X Psize}]$$

Table 3
VIF and Tolerance values.

#	Variable	VIF	Tolerance
[2]	Age	1.25	0.799
[3]	Year for Alliance	1.18	0.847
[4]	Administrative Distance	2.86	0.349
[5]	Culture Distance	1.48	0.677
[6]	Demographic Distance	3.31	0.302
[7]	Economic Distance	2.19	0.456
[8]	Finance Distance	2.14	0.466
[9]	Geographical Distance (Logged)	6.27	0.159
[10]	Global Connectedness Distance	1.74	0.573
[11]	Knowledge Distance	2.92	0.342
[12]	Political Distance	1.83	0.547
[13]	Trade Barrier	9.09	0.110
[14]	Ratio of host/home country market size	2.60	0.384
[15]	Health Expenditure (Logged)	2.27	0.441
[16]	Industry Type	1.09	0.921
[17]	Partner Size	1.09	0.920

Table 4
Coefficients confirming existence of partnership exclusivity [DV = Is partnership exclusive (PEX)] – International alliances sample.

Models ➔	H1A	H1B	H1C	H2	H3
Ind. Variables	β / p	β / p	β / p	β / p	β / p
Age of Biotech Firm	−0.064	−0.067	−0.069	−0.026	−0.064
	(0.054)	(0.054)	(0.056)	(0.059)	(0.057)
	[0.239]	[0.218]	[0.224]	[0.654]	[0.261]
Year for Alliance	0.065	0.063	0.060	0.080	0.063
	(0.037)	(0.037)	(0.038)	(0.039)	(0.038)
	[0.077]	[0.087]	[0.114]	[0.042]	[0.101]
Administrative Distance			0.005	0.004	0.004
			(0.003)	(0.003)	(0.003)
			[0.104]	[0.156]	[0.163]
Culture Distance			−0.017	−0.024	−0.013
			(0.011)	(0.012)	(0.011)
			[0.128]	[0.038]	[0.257]
Demographic Distance			−0.039	−0.050	−0.037
			(0.050)	(0.051)	(0.050)
			[0.442]	[0.331]	[0.469]
Economic Distance			0.015	0.025	0.013
			(0.029)	(0.030)	(0.029)
			[0.592]	[0.400]	[0.657]
Finance Distance			0.047	0.037	0.032
			(0.036)	(0.037)	(0.036)
			[0.192]	[0.314]	[0.377]
Geographical Distance (Log)			0.377	0.453	0.275
			(0.396)	(0.401)	(0.399)
			[0.341]	[0.259]	[0.491]
Global Connects Distance			−0.141	−0.146	−0.101
			(0.077)	(0.078)	(0.079)
			[0.069]	[0.061]	[0.199]
Knowledge Distance			−0.014	−0.014	−0.011
			(0.006)	(0.006)	(0.006)
			[0.022]	[0.023]	[0.088]
Political Distance			−0.007	0.001	−0.020
			(0.031)	(0.032)	(0.032)
			[0.831]	[0.979]	[0.527]
Trade Barrier		0.277	0.302	0.156	0.421
		(0.193)	(0.566)	(0.575)	(0.572)
		[0.151]	[0.594]	[0.786]	[0.462]
Ratio of host/home country		−0.003	−0.008	−0.007	−0.007
market size		(0.003)	(0.005)	(0.005)	(0.005)
		[0.429]	[0.089]	[0.134]	[0.162]
Health Expenditure (Logged):	−0.772	−0.843	−0.663	−1.796	−0.651
LHE	(0.247)	(0.293)	(0.363)	(0.505)	(0.497)
	[0.002]	[0.004]	[0.068]	[0.000]	[0.190]
Industry Type: IND				−18.892	
				(6.013)	
				[0.002]	
LHE_X_Ind				1.757	
				(0.542)	
				[0.001]	
Partner Size: Psize					−0.650
					(6.080)
					[0.915]
LHE_X_Psize					−0.004
					(0.546)
					[0.994]
_cons	8.477	9.157	6.317	17.937	6.819
	(2.774)	(3.314)	(4.514)	(5.932)	(5.880)
	[0.002]	[0.006]	[0.162]	[0.002]	[0.246]
Observations (N)	545	545	545	545	545
Number of companies	176	176	176	176	176
Number of variables	3	5	14	16	16
Log-likelihood	−365.86	−364.71	−357.63	−346.65	−351.61
Wald Chi2	20.50	22.45	33.02	49.40	43.67
P > chi	0.000	0.000	0.000	0.000	0.000

Note: Exact p values are reported in square bracket, and the standard error of the estimates is reported in parenthesis.

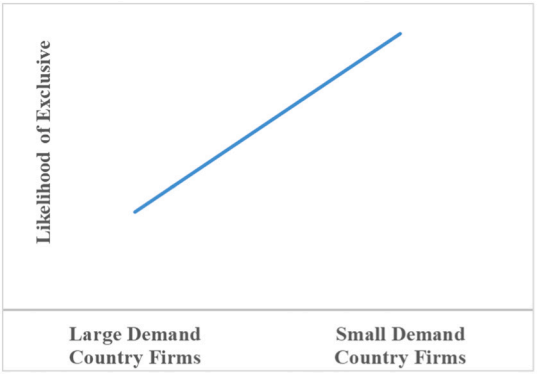


Fig. 2. H1 Test Results (Full Sample).

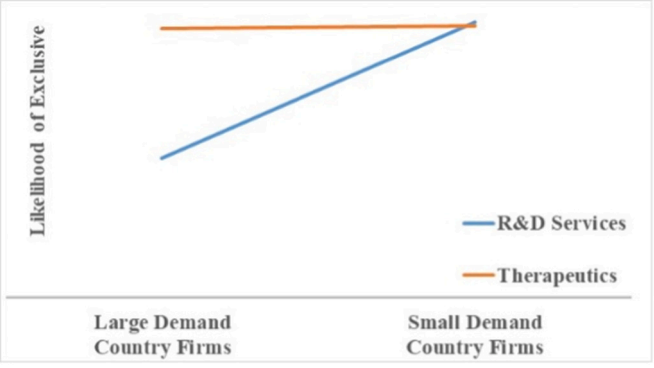


Fig. 3. H2 Moderating Effects.

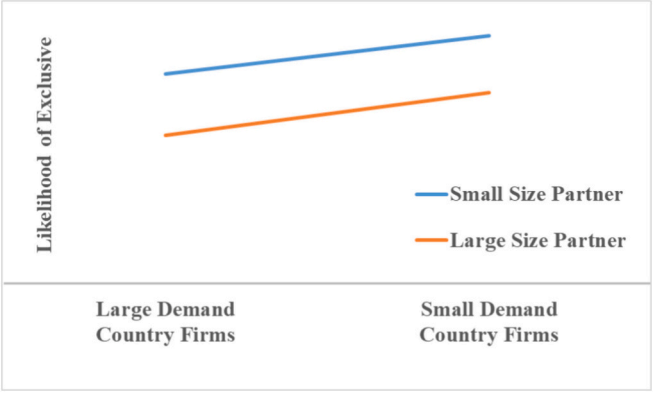


Fig. 4. H3 Test Results (Full sample).

4.3. Post-hoc analysis

We extend the alliances' exclusivity analysis further by taking the full sample including both international (545 alliances) and domestic alliances (348 alliances). Appendix B depicts the detailed frequency analysis of the exclusive versus nonexclusive alliances on various dimensions including domestic and international. The entire analysis was conducted again (Table 5 and Figs. 5A - 5D), and below we list the observations from the analysis:

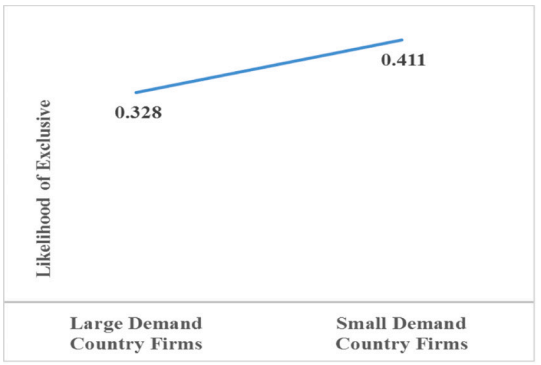
1. The LHE is negative and significant across all models with all alliances. The results are stable and consistent with all alliances sample, that is domestic and international alliances combined (similar to H1 tested earlier).

Table 5
Coefficients confirming existence of partnership exclusivity [DV = Is partnership exclusive (PEX)] – International and domestic alliances full sample.

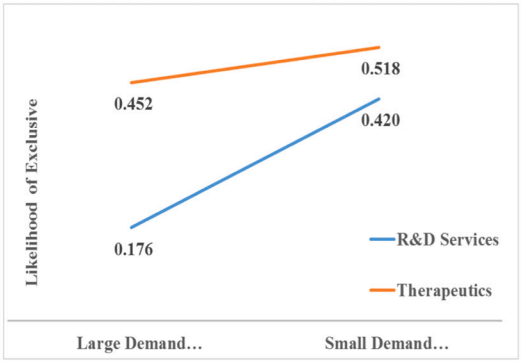
Models →	M1	M2	M3	M4	M5	M6	M7
Ind. Variables	β / p	β / p	β / p	β / p	β / p	β / p	β / p
Age of Biotech Firm	−0.008	−0.004	−0.009	−0.001	−0.003	−0.025	−0.037
	0.852	0.921	0.846	0.974	0.938	0.563	0.393
Year for Alliance	0.084	0.087	0.083	0.084	0.088	0.060	0.062
	0.006	0.005	0.006	0.007	0.004	0.044	0.036
Administrative Distance		0.002		0.002	0.003	0.002	0.003
		0.253		0.459	0.309	0.341	0.236
Culture Distance		−0.014		−0.010	−0.013	−0.009	−0.011
		0.094		0.314	0.164	0.323	0.237
Demographic Distance		0.034		−0.040	−0.049	−0.042	−0.043
		0.455		0.441	0.335	0.407	0.394
Economic Distance		−0.001		0.018	0.025	0.014	0.017
		0.981		0.542	0.409	0.619	0.556
Finance Distance		0.038		0.034	0.052	0.036	0.059
		0.190		0.346	0.146	0.299	0.091
Geographical Dist (Log)		−0.119		−0.205	−0.102	−0.165	−0.201
		0.259		0.067	0.269	0.074	0.065
Global Connects Dist.		−0.151		−0.141	−0.170	−0.122	−0.171
		0.038		0.057	0.019	0.094	0.019
Knowledge Distance		−0.002		−0.010	−0.014	−0.012	−0.016
		0.749		0.099	0.021	0.042	0.008
Political Distance		0.002		−0.028	−0.002	−0.025	−0.010
		0.933		0.383	0.949	0.426	0.747
Trade Barrier			0.335	1.025	0.950	1.141	1.029
			0.093	0.008	0.013	0.003	0.006
Ratio of host/home country market size			−0.001	−0.004	−0.007	−0.006	−0.008
			0.831	0.364	0.135	0.188	0.105
Health Expenditure (Logged): LHE	−0.903	−0.774	−0.891	−0.859	−1.757	−0.922	−0.903
	0.000	0.001	0.000	0.000	0.000	0.019	0.005
Industry Type: IND	0.883	0.896	0.890	0.871	−13.887		
	0.000	0.000	0.000	0.000	0.004		
LHE_X_Ind					1.327		
					0.002		
Partner Size: Psize	−0.823	−0.813	−0.831	−0.818		−1.475	
	0.000	0.000	0.000	0.000		0.765	
LHE_X_Psize						0.060	
						0.892	
Internationalization: INT	0.189	0.332	−0.022	0.296			−0.444
	0.201	0.159	0.910	0.214			0.933
LHE_X_INT							0.063
							0.893
_cons	9.101	7.961	8.975	9.107	18.418	10.758	10.078
	0.000	0.003	0.000	0.001	0.000	0.015	0.005
Observations (N)	893	893	893	893	893	893	893
Number of companies	222	222	222	222	222	222	222
Number of variables	6	15	7	16	15	15	15
Log-likelihood	−563.1	−559.0	−561.7	−555.0	−564.8	−572.3	−585.8
Wald Chi2	88.51	93.29	90.25	98.66	84.02	73.31	51.47
P > chi	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Note: Exact p values are reported in parenthesis.

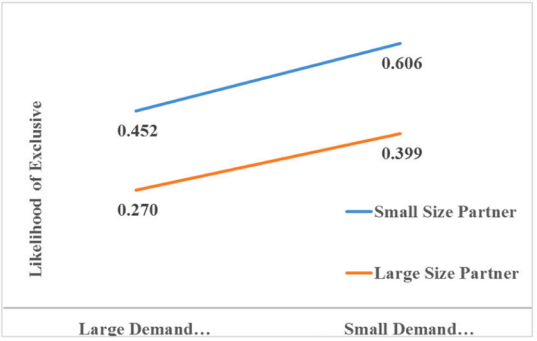
2. Industry has a positive moderation on the negative effect of LHE on exclusivity. The positive moderation beta ($\beta = 1.327$, $p < 0.05$) signifies that the negative effect of HE on *Exclusivity* is more in case of R&D services than Therapeutics. Alternatively, one can state that in small versus large demand countries, the rate of increase of likelihood of exclusive nature of partnerships from large to small demand countries is observed more in R&D services than therapeutics. The industry moderation results remained consistent with all the alliances, similar to international alliances (similar to H2 tested earlier).
3. The partner size does not have a moderation on the negative effect of LHE on exclusivity. The interaction effect of the HE and size of partner ($\beta = -0.060$, $p > 0.05$) was not significant. This implies that in small versus large demand countries, the propensity of exclusive versus nonexclusive partnership is similar in case of alliance with either large or small partners. That is, the exclusivity of alliance remained indifferent to the size of the partner. The partner size moderation results thus remained consistent with all alliances like the international alliances sample (similar to H3 tested earlier).
4. As domestic alliances data was a new advent in the post hoc analysis, we could conduct the moderation of internationalization (that is, domestic vs. international alliances as binary variable). Similar exclusivity intensity is observed in domestic and international alliances. This is evident from the non-significant direct effects of internationalization (INT) on exclusivity across all incremental models. The interaction effect ($\beta = 0.063$, $p > 0.05$) of LHE and INT is observed non-significant, which confirms that the negative



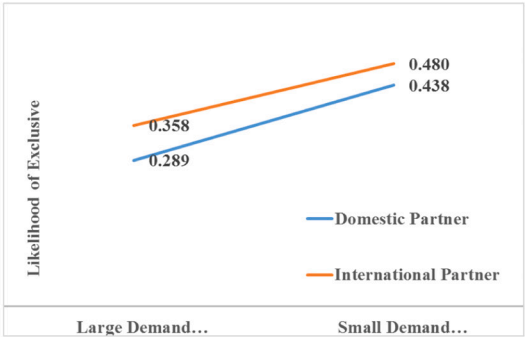
A: H1 Results (All firms)



B: H2 Test Results (All firms)



C:H3 Test Results (All firms)



D: H4 Test Results (All Firms)

Fig. 5. A. H1 Results (All firms)
Fig. 5B. H2 Test Results (All firms)
Fig. 5C. H3 Test Results (All firms)
Fig. 5D. H4 Test Results (All Firms).

effect of health expenditure on exclusivity is stable and consistent in international as well as domestic alliances. This implies that in small versus large demand countries, the propensity of exclusive versus nonexclusive partnership is alike in the case of both international and domestic partnerships. The below expression is used for likelihood calculation in logistics regression.

$$Y = X + \beta_{15}{}^{*}[International/Domestic] + \beta_{16}{}^{*}[\text{LHE X INT}]$$

5. Discussion

Since early 1990s, 'international new ventures' have caught the attention of policy makers, practitioners and scholars alike (Oviatt and McDougall, 1994). Much of this phenomenon is attributed to new-age technology start-ups that are pushing the frontiers of technology and causing emergence of new industries (Evers, 2011). It is then not surprising that scholars in international business (e.g., Cavusgil and Knight, 2015) and network theory (e.g., Coviello, 2006) are as much fascinated with this spectacle as much as entrepreneurship scholars (e.g., McDougall et al., 1994; Sleuwaegen and Onkelinx, 2014). Despite the scholarly attention that the phenomenon received, an area of neglect was the influence of home demand on the internationalization of new ventures. The present study is an attempt to bridge the gap by contributing empirically to the relatively thin body of scholarly research on exclusive characteristics of international strategic alliances (Somaya et al., 2010). In doing so the paper draws arguments from the resource dependence theory to showcase an alternative viewpoint that is the perspective of international new ventures.

5.1. Theoretical implications and contributions

The exclusivity clause in partnership deals forged across the globe is surely to protect and progress the interests of international partners who are taking significant risks by committing to put resources and time to commercialize products (Das and Teng, 2001), but at the same time the junior partners seeking international alliances are likely to part away with exclusivity in order to secure a partnership for strategic reasons. The pressure to do exclusive deals more often will be seen in the countries that have small demand

market suggesting restricted commercialization resources and even opportunities to partner with. For the same reasons, to overcome the deficient environment, Murmann et al. (2015) argued that new ventures from small-developed countries will seek foreign partners three times more than new ventures in large-developed countries.

In the paper we advanced the above-mentioned ideas as we combine the two thoughts together to investigate if exclusivity partnerships are likely seen more in small-developed country new ventures vis-à-vis large-developed country new ventures. We found positive and significant evidence to that effect. Further investigations of the idea were carried out to allow for sectoral differences, and size of the partner firms. Hence, we further categorized the sample each time on the said dimensions and tested again. In each of the cases, we found that the propensity for exclusive partnership is more in small demand countries versus large demand countries. This is to say that whether it was R&D services or therapeutics sub-sector of biotechnology, more exclusive alliances are witnessed in small demand countries vis-à-vis large demand countries. Similar observations are noted when the international partner firms were divided into small and large sizes. For either type of partner, i.e., irrespective of the size of the partner, there is more exclusive alliance observed in small demand countries versus large demand countries. These outcomes suggest strong support to the idea that new and/or small ventures based in small-developed countries with limited market size are disproportionately more inclined to offer exclusive partnerships due to the limited opportunities they have to secure resources for potential growth and/or survival. This explanation is based on the need to secure resources and power imbalance between partners relates to the primary arguments of resource dependence theory proposed by Pfeffer and Salancik (1978).

While the above results strongly confirm our base hypothesis about more exclusive partnerships being offered by the new ventures in small demand countries, we also tested the moderation of two key dimensions - sub-sectoral differences and size of the partner firms– on the base hypothesis. Significant and positive moderation outcomes were found in the case of sub-sectors only. New biotechnology ventures having R&D services business model when present in small-developed countries are willing to forge exclusive partnerships significantly greater number of times than when present in large, developed countries having large biotechnology/pharmaceutical market. The latter ensures more possibilities and resources for both technological progression and commercialization. New ventures in significantly more resource intensive and risky business model of therapeutics sub-sector demonstrates an overall high proclivity to exclusive deals. This proclivity is higher among ventures in small-developed countries, albeit not statistically significant. So, overall, the total moderation effect of sub-sector is significant in the case of biotechnology industry.

The moderation effect of partner firm size is insignificant. This implies to the international strategy that while the new biotechnology ventures from small demand countries show more proclivity to forge exclusive international partnerships with both small and large sized partners, but the rate of increase of likelihood of exclusive partnerships does not increase sufficiently in the case of large partners vis-à-vis small partners. A likely argument to that effect could be that the new ventures from small, developed countries seeking international partnerships are more susceptible to grant exclusivity rights, irrespective of the size of the international partner.

Overall, the present study is motivated by the tenets of RDT in international management and seeks to make a theoretical contribution to it by explicitly articulating the external context (i.e., the extent of home demand in that industry) and the associated imbalance in power between new ventures in different countries because of the size of the market. The external environment of organizations is regarded by scholars (such as, Wry et al., 2013) as the nuanced yet empirically disregarded concern of RDT. The research considers granting exclusivity to partner organizations as a strategic mechanism for the new ventures to pursue their interests. This adds another dimension to exclusivity by strongly arguing that it can be perceived as a cooptation mechanism, similar to offering a board seat or an equity holding within the company (Casciaro and Piskorski, 2005; Davis and Cobb, 2010). Therefore, the study has the three key components deemed core to RDT, that is the context, relative power imbalance due to the context, and exclusivity as the international strategy by new ventures to further their interests (Davis and Cobb, 2010).

Another theoretical contribution to RDT is that, in this research, the power imbalance is articulated by taking the market demand of the industry in a given country and the associated benefits that firms in that country accrue due to larger domestic demand. This is an extension of the idea by Casciaro and Piskorski (2005) wherein they had articulated dependency and power imbalance at the industry level. Or Beckman et al.'s (2004) articulation that dependence-management strategies by firms could be similar because those firms face resource constraints that are due to industry structure rather than firm specific. Further theoretical insights are developed by using moderators that show how exclusivity as new venture strategy will be impacted by the size of the partner and sub-industry type (having different business model). This complements Wry et al. (2013) suggestion on using external context of the firm in theoretical progression.

Given the complexities due to multiple factors, it is safe to assume that firms in general are under less pressure to have structural arrangements (such as equity considerations or exclusivity) to manage partnership risks in domestic alliances when compared to international alliances. The former offers better outcome with regards to integration of resources (Wiklund and Shepherd, 2009). Nonetheless, resource dependency perspective place new ventures in small demand countries at a relative disadvantage to those in large demand countries, and thus, they are comparatively more susceptible to greater accommodation to structural arrangements (i.e., offer exclusivity) even with domestic partners. Hence, as partnerships were divided and categorized as being domestic or international, while we still found that exclusivity is offered to any of these types of partners more by a venture based in small demand countries as against large demand countries, supporting our primary arguments based on resource dependency theory. However, for a new ventured domiciled in a small demand country is almost equally pressed to grant exclusivity rights in domestic partnerships as in international partnerships; hence, moderation effect of domestic vs. international partnerships did not come significant.

5.2. Practical and policy implications

The above outcomes are insightful for the global strategists and policy makers in small demand countries. Based on the results, a

key message that international business managers and strategists can draw from the findings is that founding members and top management team of a new venture based in a small-demand country need to be more pragmatic about their international partnership approach and related expectations for exclusivity provisions. Although, for them, it is a difficult 'between rock and a hard place' situation but having robust information can serve their primary and contingent planning. The alternative options to international alliances could be setting up of greenfield and/or brownfield operations in strategic markets; however, this also requires careful planning to garner sufficient resources. Despite the difficult position, managers in small-demand countries when cognizant of the sub-sectoral differences due to distinctive business and revenue models can either formulate exclusivity strategies (determining when and where prudently) for international partnerships that are more conducive to their specific business context or make adjustments to their business models. The latter may involve judiciously considering portfolio of products/services vis-à-vis resources to assess what can be furthered in-house and what requires strategic alliance formation to bring maximum value.

Policy makers of small demand countries should facilitate the networking avenues for international alliances e.g., supporting firms in attending knowledge exchange forums and international business forums and conferences. Furthermore, policy makers can contribute to the alliance capacity building of international new ventures, particularly in the exclusive partnerships. They can do so by offering subsidized educational and training programs to these firms. The program can be connected with the key international industrial associations to upskill the firms to forge and govern exclusive strategic partnerships in the global marketplaces.

5.3. Limitations and future directions

Across industry, variations in the application of exclusive contracts were reported by Anand and Khanna (2000). Our analysis demonstrates the positive and significant moderation impact of sub-sector in the biotechnology industry. While this is encouraging and useful, the result cannot be generalized across other industries. Different industries will have their unique business models impacting their risk and revenue model. This will in turn impact several other dimensions, including the need to partner and offer exclusivity provisions. In short, the moderators that were used in the empirical analysis may manifest differently in other industries.

The primary hypothesis on higher likelihood of new/small ventures from small demand countries forging more exclusive partnerships consistently stood the results. Nonetheless its generalization is limited by its testing in a single industry setting. Empirical analysis across other industry segments, especially with similar technological risk profile and/or resource needs, will ascertain the generalizability. Nonetheless, it also provides a fruitful avenue for future research.

More nuanced understanding on the phenomenon can be developed by associating it with the firm performance globally. We were limited with the data on this, but future researchers are encouraged to bring this as a dependent variable. Whether exclusivity provisions impact (or contribute to) firm performance more than non-exclusive partnerships is an important avenue to conduct research, since robust empirical evidence for that are lacking. It is also important to ascertain if any significant variation is observed across small and large demand countries.

As the scholars investigate the exclusivity provisions using multiple lenses, it is expected that they will likely use other dimensions and/or moderators that are equally important. Or they will seek to broaden the framework. In either case, the proposed ideas in this paper and others in the area (e.g., Aulakh et al., 2010, 2013; Somaya et al., 2010) will provide a useful platform to progress literature. In addition, the scholars in future research can include instances where firms sought to construct partnerships but failed, providing more insight on the subject.

5.4. Conclusions

The primary contribution of this empirical work is to empirically test the impact of domestic market size on the exclusive partnerships offered by the new ventures. To do this, present study does not take business context to be homogeneous as it segregates countries into small and large market demand countries. Furthermore, it assesses partnerships across the globe from the perspective of new ventures by putting them at the center of partnership formation. In doing so the present study provides an alternative narrative to the exclusivity provision, a narrative of new ventures. This account uses the neglected resource dependence theory by Pfeffer and Salancik (1978) to provide a useful perspective of them on exclusive partnerships. It thus seeks to enrich and complement other scholarly works in the area (e.g., Aulakh et al., 2013; Somaya et al., 2010) that often draw upon more used theories, such as transaction cost analysis or resource-based view and cater to the perspective of partner firms that are often large and resourceful. Furthermore, it empirically showcases the overall difficult business context for biotechnology firms based in a small demand country, where the limited local market size and number of potential local partners test their will to survive, often putting them in tough spot between rock and a hard place, regularly having to make compromises (such as offer exclusivity and/or equity rights in partnerships). Finally, it extends the prior work on international partnerships that have neglected the role of industry type and partner size in exclusive partnerships (Ju et al., 2019). A more holistic perspective can be developed on exclusive partnerships if account of new ventures and their partnering firms are taken. Bringing those two insights also engenders tension that is likely to provide fertile ground for scholarly research.

CRediT authorship contribution statement

Deepak Sardana: Writing – review & editing, Writing – original draft, Methodology, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Narain Gupta:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Huda Khan:** Writing – review & editing, Writing – original draft.

Right retention statement

For the purpose of open access, the author has applied a Creative Commons Attribution (CC BY) [or other appropriate open licence] licence to any Author Accepted Manuscript version arising from this submission".

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Appendix A. Frequency distribution of international alliances (Non-exclusive (NE) versus Exclusive (E))

Health Exp Category	Countries	Details	All Global Alliances		R&D Services Alliances		Therapeutics Alliances		Small partner		Large partner	
			NE	E	NE	E	NE	E	NE	E	NE	E
Large Demand Countries	France	Freq	50	29	34	9	44	30	18	21	60	18
		Pct.	63	37	79	21	59	41	46	54	77	23
	Germany	Freq	54	35	63	23	29	30	20	25	72	28
		Pct.	61	39	73	27	49	51	44	56	72	28
	UK	Freq	102	70	79	19	102	107	58	54	123	72
		Pct.	59	41	81	19	49	51	52	48	63	37
	Japan	Freq	6	13	1	0	19	28	4	11	16	17
		Pct.	32	68	100	0	40	60	27	73	48	52
Small Demand Countries	Australia	Freq	28	34	11	21	30	24	8	20	33	25
		Pct.	45	55	34	66	56	44	29	71	57	43
	Israel	Freq	11	24	3	14	15	27	3	11	15	30
		Pct.	31	69	18	82	36	64	21	79	33	67
	Netherlands	Freq	9	12	9	3	9	12	3	5	15	10
		Pct.	43	57	75	25	43	57	38	63	60	40
	Sweden	Freq	10	17	10	12	7	14	4	17	13	9
		Pct.	37	63	45	55	33	67	19	81	59	41
	Switzerland	Freq	17	12	11	7	8	15	6	6	13	16
		Pct.	59	41	61	39	35	65	50	50	45	55
	Taiwan	Freq	3	9	2	1	2	9	1	7	2	3
		Pct.	25	75	67	33	18	82	13	88	40	60
Overall Total		Freq	290	255	223	109	265	296	125	177	363	228
		Pct.	53	47	25	12	30	33	41	59	61	39

Appendix B. Frequency distribution of international and domestic alliances (Non-exclusive (NE) versus Exclusive (E)) – Full Sample

Health Exp Category	Countries	Details	All Alliances		R&D Services Alliances		Therapeutics Alliances		Small partner		Large partner		Domestic		International	
			NE	E	NE	E	NE	E	NE	E	NE	E	NE	E	NE	E
Large Demand Countries	France	Freq	78	39	34	9	44	30	18	21	60	18	28	10	50	29
		Pct.	67	33	79	21	59	41	46	54	77	23	74	26	63	37
	Germany	Freq	92	53	63	23	29	30	20	25	72	28	38	18	54	35
		Pct.	63	37	73	27	49	51	44	56	72	28	68	32	61	39
	UK	Freq	181	126	79	19	102	107	58	54	123	72	79	56	102	70
		Pct.	59	41	81	19	49	51	52	48	63	37	59	41	59	41
	Japan	Freq	20	28	1	0	19	28	4	11	16	17	14	15	6	13
		Pct.	42	58	100	0	40	60	27	73	48	52	48	52	32	68
Small Demand Countries	Australia	Freq	41	45	11	21	30	24	8	20	33	25	13	11	28	34
		Pct.	48	52	34	66	56	44	29	71	57	43	54	46	45	55
	Israel	Freq	18	41	3	14	15	27	3	11	15	30	7	17	11	24
		Pct.	31	69	18	82	36	64	21	79	33	67	29	71	31	69
	Netherlands	Freq	18	15	9	3	9	12	3	5	15	10	9	3	9	12
		Pct.	55	45	75	25	43	57	38	63	60	40	75	25	43	57
	Sweden	Freq	17	26	10	12	7	14	4	17	13	9	7	9	10	17
		Pct.	40	60	45	55	33	67	19	81	59	41	44	56	37	63
	Switzerland	Freq	19	22	11	7	8	15	6	6	13	16	2	10	17	12
		Pct.	46	54	61	39	35	65	50	50	45	55	17	83	59	41
	Taiwan	Freq	4	10	2	1	2	9	1	7	2	3	1	1	3	9

(continued on next page)

(*continued*)

Health Exp Category	Countries	Details	All Alliances		R&D Services Alliances		Therapeutics Alliances		Small partner		Large partner		Domestic		International	
			NE	E	NE	E	NE	E	NE	E	NE	E	NE	E	NE	E
Overall Total		Pct.	29	71	67	33	18	82	13	88	40	60	50	50	25	75
		Freq	488	405	223	109	265	296	125	177	363	228	198	150	290	255
		Pct.	55	45	25	12	30	33	41	59	61	39	57	43	53	47

Data availability

Data will be made available on request.

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