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Document Version
Accepted author manuscript

Published in:
Journal of International Business Studies

DOI:
10.1057/s41267-020-00324-y

Publication date:
2021

License
Unspecified

Citation for published version (APA):
Gregorič, A., Rabbiosi, L., & Santangelo, G. D. (2021). Diaspora Ownership and International Technology Licensing by Emerging Market Firms. *Journal of International Business Studies*, *52*(4), 671-691. https://doi.org/10.1057/s41267-020-00324-y

DIASPORA OWNERSHIP AND INTERNATIONAL TECHNOLOGY LICENSING BY EMERGING MARKET FIRMS

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Acknowledgments
We are very grateful to the editor, Jaideep Anand, and three anonymous referees for their guidance in developing the paper. We also thank participants at the conferences DRUID 2019, AIB 2019 and the 7th Reading-UNCTAD International Business Conference for discussion and comments on earlier drafts of the paper. This work was supported by the Independent Research Fund Denmark | Social Sciences.
Grant: "The role of diaspora investors in developing countries: A study of firm internationalization and inter-firm collaborations" (DFF – 4182-00053).

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ABSTRACT

The liability of origin makes participation in international technology licensing challenging for emerging market firms. We draw on signaling theory to propose that diaspora ownership—diaspora members' equity investments in their homeland firms—constitutes a reliable third party signal of emerging market firms' trustworthiness, which facilitates the access of these firms to international technology licensing. We further hypothesize that the efficacy of diaspora ownership as a third party signal varies with the firm's subnational context. Specifically, the relevance of diaspora ownership signal increases with the degree of homogeneity of the within-industry R&D effort in the firm's sub-national location. This is because under these conditions additional signals are required to differentiate among local firms operating in the same industry. To the contrary, the diaspora ownership signal has a smaller effect in dysfunctional institutional contexts due to their prohibitive transaction costs. We test our arguments on a matched sample of 597 Indian firms operating between 2006 and 2015 and find general support for the predicted relationships. Our study advances research on the liability of origin of emerging market firms, the work on subnational dimension of international business, and the literature on the benefits diasporans bring to their homelands and resident countries.

Key words: Emerging market firms, International technology licensing, Diaspora ownership, Liability of origin, Subnational environments, Signaling theory, Matched sample, Instrumental variables estimation.

Running head: Diaspora ownership and foreign technology licensing

INTRODUCTION

To access international technology and know-how emerging market firms can adopt a range of strategies from acquiring foreign firms for strategic asset-seeking motives or creating R&D subsidiaries abroad and participating in global value chains, to stipulating technical collaborations and license agreements (Awate, Larsen, & Mudambi, 2015; Elia & Santangelo, 2017; Kumaraswamy, Mudambi, Saranga, & Tripathy, 2012; McDermott & Corredoira, 2010). Accessing and integrating technological knowledge from abroad is extremely relevant for emerging market firms' catching-up and upgrading processes (Luo & Tung, 2007). In particular, emerging market firms' reliance on license agreements to access valuable foreign technology and know-how works as a critical input to their innovation performance (Kumaraswamy et al., 2012; Wang & Li-Ying, 2015).

Although participation in the international market for technology is important for emerging market firms' innovation activities, liability of origin can make this problematic (Ramachandran & Pant, 2010). Liability of origin refers to negative perception of emerging market firms' trustworthiness due to home market institutional weakness which results in high information asymmetries and opportunities for opportunistic behavior from local actors. In conditions of underdeveloped institutions foreign stakeholders find it more difficult to access the information needed to evaluate emerging market firms (Cuervo-Cazurra & Ramamurti, 2014). Poor legal enforcement and poor functioning of other governance mechanisms including absence of specialized intermediaries, increase moral hazard, and thus the costs of transacting with firms operating in such an environment (Khanna & Palepu, 1997, 2010). When comparing licensees from emerging markets to those from more developed countries, licensors are likely to anticipate higher risk of rent arrears and misappropriation of knowledge and technology in relation to the former. Potential foreign licensors perceive emerging market firms as less trustworthy. Thus, they may be more reluctant to share their knowledge with emerging market firms (Mottner & Johnson, 2000) which is problematic for these firms efforts to source international technology.

Several studies highlight firm-level initiatives such as corporate social responsibility (CSR) reporting and other policies that emerging market firms adopt to convey positive information on unobserved

organizational attributes and overcome their liability of origin (Fiaschi, Giuliani, & Nieri, 2017; Marano, Tashman, & Kostova, 2017; Marquis & Qian, 2013). These firm initiatives are intentional *signals* to potential business partners and customers to demonstrate quality, trustworthiness, and good intent (Connelly, Certo, Ireland, & Reutzel, 2011). Positive information about the firm can be channeled also through prominent third-party endorsements or *third party signals* (Dineen & Allen, 2016; Podolny, 2005; Rindova, Williamson, Petkova, & Sever, 2005; Stuart, 2000). However, the type of third party signals that are relevant, and the context in which they can help emerging market firms to reduce their liability of origin have received little attention in the literature. We try to redress this by investigating diaspora members' equity investments in their homeland emerging market firms (diaspora ownership) as a type of third party signal that can ease these firms' participation in international technology licensing. We study how the efficacy of diaspora ownership (as a third party signal) varies with the firm's subnational context.

Diaspora members (or diasporans) are migrants from a given country of origin (the homeland) who reside outside this homeland country. They are considered important drivers of growth for both developed and less developed countries (Kerr, 2008; Saxenian, 2006; Saxenian & Hsu, 2001) as reflected in the flourishing origin-state institutions dedicated to emigrants and their descendants around the world (Gamlen, Cummings, & Vaaler, 2019; Riddle, Brinkerhoff, & Nielsen, 2008). Diasporans are often major investors in their homelands (Gillespie, Riddle, Sayre, & Sturges, 1999). Their dual identity and cultural understanding can give diasporans superior access to information on emerging market firms in their homelands (Choudhury, 2016; Saxenian, 2005, 2006). We argue that as equity investors and residual risk bearers, diaspora owners will be motivated to rely on this information when selecting among investment opportunities in their homeland. Thus, the ownership shares of diaspora members in their homeland emerging market firms can be considered a third party endorsement of these firms' trustworthiness. Drawing on signaling theory (Spence, 1974) and related work on third party signals (e.g. Dineen & Allen, 2016; Rindova et al., 2005), we propose that these endorsements allow emerging market firms to distance themselves from the weaknesses of the institutional environments in which they operate, thereby improving perception of their trustworthiness by potential new stakeholders such as foreign licensors. Thus, diaspora

ownership reduces the transaction costs associated to licensing international knowledge and technology (Fosfuri, 2006; Gallini & Wright, 1990; Hill, 1992; Katz & Shapiro, 1986; Schmitz, 2007, 2002).

On the same theoretical grounds, we suggest that the efficacy of diaspora ownership as a third party signal will depend on the emerging market firm's subnational context (Beugelsdijk & Mudambi, 2014; Narula, 2015). Location characteristics affect information asymmetries in intangibles transactions (Santangelo, Meyer, & Jindra, 2016), and the anticipated costs and benefits of transacting with high-quality or low-quality contracting parties. We focus on the economic and non-economic aspects of the local context (Lamin & Ramos, 2016; Laursen & Santangelo, 2017), and consider the homogeneity of local within-industry research and development (R&D) efforts and local institutional distrust. We argue that the efficacy of diaspora ownership as a third party signal increases with the degree of homogeneity of the within-industry R&D effort in the firm's sub-national location. In contexts with high R&D homogeneity some additional signals are required to differentiate among local firms operating in the same industry. Further, although the signal constituted by diaspora ownership can mitigate concern over institutional weaknesses, its effect weakens as the level of local institutional distrust increases. In subnational contexts with very high levels of institutional distrust, transaction costs become excessive which prevents economic exchanges even with perceived high-quality local actors.

We test and find support for our arguments using a matched sample and a total of 4,391 observations of 597 domestic owned firms operating in India between 2006 and 2015. Our results are robust to controlling for unobserved differences between firms with and without diaspora ownership (i.e. endogeneity), and to alternative theoretical explanations.

Our study contributes to the literature on emerging market firms' liability of origin which suggests that these firms can overcome this disadvantage by undertaking deliberate initiatives (e.g. CSR activities) to convey information on unobserved superior organizational attributes. We add to this research by proposing diaspora ownership as a third party signal which helps foreign firms to positively discriminate higher quality emerging market firms from less trustworthy local actors. We underscore a mechanism which helps to reduce the liability of origin that is not related to emerging market firms' planned initiatives. Our

identification of another mechanism which enables emerging market firms' access to international knowledge and technology, adds also to the literature on technological upgrading of such firms. Moreover, we contribute by investigating the subnational dimension of international business through joint consideration of economic and institutional aspects of subnational spatial heterogeneity as boundary conditions for the efficacy of diaspora ownership signals. Finally, we extend the literature on the benefits brought by diasporans to both their respective homelands and resident countries. Existing work focuses on the effects on knowledge production in homeland firms of remittances from migrants and migrants' mobility. We theorize about the beneficial effects of diasporans homeland firm ownership in relation to those firms' access to the international knowledge and technology markets.

THEORY AND HYPOTHESES

Technology licensing agreements give the licensee the right to use the licensor's knowledge and technology to replicate the licensor's entire commercialization process in a contractually defined geographical market (Teece, 1976). These agreements specify payment of a royalty[1] for the duration of the agreement, plus an agreed up-front lump-sum payment and possibly some minimum performance payments. Our hypotheses assume that given the higher uncertainty related to emerging markets, most of these license agreements will be non-exclusive since compared to exclusive agreements these types of agreements involve lower opportunity costs for the licensor (Contractor, 1984). The lower level of industrialization in emerging countries makes non-exclusive licensing more likely; this is supported by evidence showing that the percentage of exclusive licensing drops from 21% in the industrialized countries to about 4% in less industrialized (including emerging) countries (Jiang, Aulakh, & Pan, 2007).

Local firms' license agreements with international partners are particularly important in emerging countries since they provide access to technological resources that are mostly unavailable in the home market. The access to these resources are critical to boost recognition and exploitation of technological opportunities that can enhance the innovation performance of emerging market firms (Wang & Li-Ying, 2015). These firms are technological latecomers and international licensing grants them access to state-of-the-art technology and the latest technological developments associated to the transferred know-how (Li-

Ying & Wang, 2015). A license agreement usually includes technology assistance, training, and support which all provide additional learning opportunities (Chen & Sun, 2000; Jiang et al., 2007). Thus, licensing technology from international partners can enhance emerging market firms' R&D activities and technological innovation performance, and strengthen their technological capabilities (Chatterji & Manuel, 1993; Kumaraswamy et al., 2012).

License agreements entail the sharing of the licensors' proprietary know-how with external entities (i.e. the licensees) which might behave opportunistically with regard to using this know-how, adhering to quality standards, and making appropriate production and marketing investments (Jiang et al., 2007). Thus, license agreements are accompanied by the risks related to opportunistic self-interested agents, and incomplete and asymmetrically distributed information (Milgrom & Roberts, 1992; Williamson, 1985). The resulting adverse selection and moral hazard problems increase transaction costs and can be a barrier to contracting (Holmstrom, 1979; Williamson, 1985). Specifically, pre-contractual information asymmetries and adverse selection risks increase the licensor's *search costs* related to gathering information on the licensee before signing the contract (Bergen, Dutta, & Walker, 1992; Milgrom & Roberts, 1992). In addition, post-contractual asymmetric information and related moral hazard risks increase the costs of negotiating and drafting the contract (*bargaining costs*) and the need for specific clauses to protect against the licensee's opportunistic behavior. For example, licensors might be concerned about suboptimal investments and missed royalty payments (Shapiro & Varian, 2003). Finally, these moral hazards increase the costs related to monitoring (mis)use of the technology, and enforcing the contractual agreement (i.e. *enforcement costs)* (Milgrom & Roberts, 1992; Williamson, 1985).

The liability of origin related to licensees located in an emerging country is likely to increase transaction costs (Ramachandran & Pant, 2010). Institutional inefficiencies, corruption, political instability, lack of specialized intermediaries, and other weaknesses typical of emerging market institutional environments increase the anticipated information asymmetries and the risks associated to adverse selection and emerging market firms' post-contractual opportunism (e.g. Khanna & Palepu, 1997, 2010). Expectations of opportunistic behavior are heightened by the presence of informal institutions which can

play a prominent role in these contexts (Peng & Heath, 1996) and affect firms' willingness to conduct legitimate business (Marano et al., 2017). Regardless of actual behavior, the weaknesses inherent in emerging countries' institutional environments lead to negative stereotyping of these countries' firms (Peterson & Jolibert, 1995). Thus, emerging market firms' access to international technology licensing might be hampered by discriminatory hazard and anticipation of weak ability and commitment to providing high-quality products and complying with the licensing conditions.

Based on signaling theory (Bergh, Connelly, Ketchen Jr, & Shannon, 2014; Connelly et al., 2011; Spence, 1974), we expect that for firms in such contexts their search for international licensing partners will be helped by signals that convey information about superior unobserved attributes and help to distance them from the average less trustworthy firms. Such signals can reduce information asymmetry and reassure potential stakeholders about the firm's quality and reliability.

Firms can signal quality and enhance their credibility vis-à-vis potential partners through various intentional efforts and initiatives; for instance, emerging market firms increasingly are adopting CSR reporting and related policies to demonstrate superior quality (Fiaschi et al., 2017; Marano et al., 2017; Zheng, Luo, & Maksimov, 2015). However, there are other signaling mechanisms which do not require a deliberate effort by the firm. Specifically, a potential partner's perception of a firm will be more positive if there is evidence of previous links to prominent third parties such as high-status actors and intermediaries (Rao, 1994; Rindova et al., 2005). For instance, affiliations to high-performing collaborators, employees, and investors have been shown to increase the social standing of new ventures, and reduce uncertainty about these firms' quality and intent (Gulati & Higging, 2003; Stuart, 2000). Concerns over reputation and finance will lead prominent third parties to evaluate potential partners carefully before initiating a relationship. Therefore, the existence of a relationship can be seen as confirmation of the firm's quality and reliability (Stuart, 2000; Stuart, Hoang, & Hybels, 1999). Moreover, third party actors' selection processes generally involve systematic evaluation methods which allow standardized comparison across companies (Dineen & Allen, 2016). These evaluations tend to be stringent because—in the case of financial investments in particular—third parties are exposed to financial and/or reputational losses if they are linked to poor quality

or less trustworthy firms (Stuart, 2000). Establishing affiliations to and obtaining endorsements from third parties will be more difficult for these latter firms. Finally, by virtue of their relationships to the firm and their interactions with the firm's constituencies, third parties are privy to firm information which they will use as the basis for confirming the firm's quality vis-à-vis potential new partners (Dineen & Allen, 2016; Podolny, 2005; Rao, 1994; Rindova et al., 2005; Sleptsov, Anand, & Vasudeva, 2013).

On the above premises, we propose that previous affiliations between emerging market firms and prominent third party actors act as a signal to potential foreign technological licensors allowing them to distinguish between more and less trustworthy emerging market licensees.

Diaspora Ownership and International Technology Licensing

We propose that diaspora owners of homeland emerging market firms are relevant third party actors whose investment choices signal to potential foreign licensors that the homeland firm is reliable. Compared to corporate or institutional investors, diasporans have limited financial resources, and as a result are less likely to hold diversified portfolios. Therefore, when investing in an emerging market firm they are more exposed to idiosyncratic (firm-specific) risk, and therefore will have a stronger incentive to scrutinize investment opportunities and exploit all the available information. Diasporans' exposure to foreign environments and institutions allow them to benchmark the emerging markets business behavior, rules, and practices. Consequently, diasporans' equity investments are a stronger signal of firm trustworthiness than investments made by emerging market owners such as local families and financial institutions. In addition the co-ethnicity of diasporans provides privileged access (not enjoyed by foreign investors) to information about the investment opportunities in their homeland emerging market. Specifically, familiarity with the home country language, culture, system of meaning, and business practices allows a more accurate interpretation of publicly available information, and the firm's business conduct (Hernandez, 2014; McPherson, Smith-Lovin, & Cook, 2001; Zaheer, Lamin, & Subramani, 2009). This cognitive affinity facilitates interactions between diasporans and the homeland firm, and provides preferential access to relevant non-publicly available information and tacit knowledge (e.g. firm reputation in the domestic business context) which otherwise is difficult to collect (Nahapiet & Ghoshal, 1998). Also,

diasporans' ethnic ties allow the development of network relationships and greater insights into available information than foreign investors would enjoy (Adler & Kwon, 2002; Coleman, 1988; Prashantham, Dhanaraj, & Kumar, 2015). Ethnic and cognitive ties foster relational trust between the diaspora investor and other of the firm's constituencies, thereby facilitating mutual exchange of soft information. This information increases the investor's ability to evaluate the firm, and especially its productivity and knowledge-based assets such as R&D capabilities (e.g. Uysal, Kedia, & Panchapagesan, 2008).

In sum, in the context of emerging market firms, diaspora owners can be seen as high-status third party actors whose choice to invest in the homeland firms provides an unsolicited signal to potential foreign partners of the firm's trustworthiness and business prospects. Since foreign licensors are able to obtain ownership information for potential licensees (i.e. diaspora ownership is observable), they can use this to select more trustworthy potential emerging market partners. Their endorsement of the emerging market firm implied by their share purchase means that diaspora owners become information intermediaries, and confirm the reliability of the firm (Rindova et al., 2005; Sleptsov et al., 2013). In turn, this reduces the transaction costs inherent in international technology licensing. Based on this reasoning, we posit that by reducing transaction costs diaspora ownership facilitates emerging market firms' access to international technology licensing, and propose:

> Hypothesis 1: Diaspora ownership in the homeland domestic firm is correlated positively to the extent of the firm's international technology licensing.

The Role of the Subnational Context

We expect that the effect of diaspora ownership as a third party signal will vary depending on the firm's location characteristics. First, the signal provided by diaspora ownership will be stronger if co-located firms operating in the same industry have comparable R&D investments (i.e. there is local within-industry R&D effort homogeneity). In the context of technology licensing, firms' R&D investments are an important direct signal of commitment to high product quality, and thus, of the attractiveness of the firm as a licensing partner (Aulakh, Jiang, & Li, 2013; Jiang et al., 2007; Kim & Vonortas, 2006). If potential licensees' R&D efforts are markedly different, licensors might use a minimum R&D investment threshold to discriminate

among them and allow their better evaluation (Basdeo, Smith, Grimm, Rindova, & Derfus, 2006). As the number of potential licensees decreases, more signals become observable (Basdeo et al., 2006) and the relevance of individual signals is reduced. Since there is more information available for receivers to process, the marginal contribution of individual signals such as diaspora ownership, is likely to decrease (e.g. Basuroy, Desai, & Talukdar, 2006; Branzei, Ursacki-Bryant, Vertinsky, & Zhang, 2004; Zerbini, 2017). This applies particularly if we consider that unlike R&D investment, diaspora ownership is not aimed explicitly at signaling to potential foreign licensors (i.e. we assume diaspora equity investments are not driven by the intent to facilitate the firm's access to foreign licenses). However, we argue that firm specific signals such as firm-level R&D investments are not always available or informative. For example, if all the firms in an industry have similar R&D efforts i.e. highly homogenous local within-industry R&D efforts, R&D investment cannot be considered a firm differentiator. In this case, other signals such as diaspora ownership will become more relevant for reducing transaction costs. Consequently, we propose that:

> Hypothesis 2: The greater the within-industry R&D effort homogeneity in the homeland firm's subnational environment, the stronger will be the positive relationship between diaspora ownership in the homeland domestic firm and extent of the firm's international technology licensing.

Second, we propose that the efficacy of diaspora ownership as a third party signal is conditioned by the quality of the institutions in the firm's subnational environment. As described above, institutional quality affects transaction costs in contractual relationships, particularly in the case of complex agreements such as technology licensing. In this context, local institutions are especially important because national intellectual property rights law and contractual law are enforced by sub-national courts (Santangelo et al., 2016). Also, studies show that foreign firms are aware of the critical role of subnational institutions, and in contracting involving intangibles they devote major effort and resources to scrutinizing the subnational context. This applies especially to institutionally weak countries such as emerging markets (e.g. Estrin & Prevezer, 2011; Maggioni, Santangelo, & Koymen-Ozer, 2019; Meyer & Nguyen, 2005; Nielsen, Asmussen, & Weatherall, 2017).

The uncertainty stemming from institutional weaknesses affects the choices and strategic opportunities of the firms operating in emerging markets (Hoskisson, Eden, Lau, & Wright, 2000; Khanna & Palepu, 2010). Low legal enforcement, and lack of intermediaries and other actors able to ensure transparency and compliance with contracts (Khanna & Palepu, 2010) prevent local firms from providing ex-ante guarantees of quality or ex-post remediation against transactional risks (Gao, Zuzul, Jones, & Khanna, 2017). Therefore, in the presence of weak institutions local firms must rely on alternative ways to signal their quality and distinguish themselves from other firms to achieve credibility in the eyes of potential stakeholders (Gao et al., 2017; Guiso, Sapienza, & Zingales, 2004; Marano et al., 2017; Marquis & Qian, 2013). Thus, the relevance of these signals increases with greater institutional weaknesses. In the case of licensee and licensor behaviors, we expect the mechanism of diaspora ownership as a third party signal to be particularly important in environments characterized by institutional weaknesses. This is because foreign partners dealing with firms operating in such environments will pay more attention to firm-specific characteristics which might alleviate concern over adverse selection and moral hazard.

However, along a continuum of institutional distrust (and relative perceived uncertainty), emerging markets tend to lie at the upper end and high levels of subnational institutional distrust will resemble dysfunctional institutional contexts (Khanna & Palepu, 2010). Accordingly, we posit that diaspora ownership helps emerging market firms to overcome local institutional weakness but we expect also that this effect weakens as local institutional distrust increases. In turn, as the level of local institutional distrust increases reliance on firm-level mechanisms aimed at aligning parties' behavior in contracting activities will be reduced. That is, although the local firm might intend to conform to the license terms (i.e. the firm is trustworthy), its compliance might be compromised by very weak local institutions, poor enforcement of contractual obligations and legal titles, and opportunistic behavior from other local constituencies (Santangelo et al., 2016). Very weak local institutions are often associated to cultural norms that increase opportunistic behavior among local constituencies (e.g. local accountants, auditors, and legal advisors, and local suppliers, customers, and intermediaries) involved in the implementation of a specific contract (Zhu, Wittmann, & Peng, 2012). Thus, in conditions of extreme institutional weakness foreign partners will

perceive transactions with local actors as too risky, regardless of perceived trustworthiness of the focal firm. We expect that these high hazard levels will increase all license-related transaction costs and limit transactions between foreign licensors and emerging market licensees. Accordingly, the efficacy of third party signals such as diaspora ownership will weaken even for high quality firms. We hypothesize that:

> Hypothesis 3: The higher the institutional distrust in the homeland firm's subnational environment, the weaker will be the positive relationship between diaspora ownership in the homeland domestic firm and extent of the firm's international technology licensing.

METHOD

Data and Sample

Our data come from Prowess (2016 release) which provides financial information on Indian firms and is maintained by the Center for Monitoring of the Indian Economy (CMIE). Prowess data include ownership information from 2006; thus, we observe firms between 2006 and 2015. Prowess data allow us to identify aggregate ownership shares in a specific year for various owner types such as Indian families, foreign corporates, and domestic and foreign financial institutions. Prowess also records the aggregate percentage of equity held by non-resident Indians (NRI) who are either Indian citizens or persons of Indian origin residing outside India. NRI is a legally constituted category used by the Indian government and other institutions such as the Ministry for Overseas Indians to regulate relationships between the Indian nation-state and the population of Indians living abroad. We use NRI to identify Indian diasporans.

We complement Prowess data with information on perception of subnational institutional quality based on the 2005 India Human Development Survey (IHDS) which is a nationally representative, multi-topic survey of 41,554 households in 1,503 villages and 971 urban neighborhoods across India (Sonalde & Vanneman, 2006).

We constructed the sample as follows. We are interested in domestically-owned private firms; thus, we excluded foreign owned firms and firms controlled by national or subnational governments or government institutions. To avoid studying industries with a predominance of firms unlikely to be involved

in licensing, we classified the economy into six main sectors: extractive (mining and quarrying), agriculture, manufacturing, construction, utilities, and services. We then considered those sectors where at least 5% of the firms are involved in international technology licensing i.e. manufacturing and construction. To test the effect of diaspora ownership on firms' international technology licensing we need to account for potential sources of endogeneity because diaspora ownership and emerging market firms' investments in international technology licensing might be determined endogenously. To address this concern and restrict the observable differences between firms with and without diaspora ownership, we created a matched sample of treated (i.e. firms with diaspora equity investment) and control (i.e. firms which did not receive diaspora equity investments) firms. We applied coarsened exact matching (CEM) (Iacus, King, & Porro, 2012, 2011) to create a sample with balanced characteristics in terms of location (i.e. in the same state), industry (i.e. same industry class), size (i.e. comparable average sales in the observed period), and age (i.e. comparable average years of operation in the observed period). The sample size before applying CEM was 1,586 firms without diaspora ownership and 206 firms with diaspora ownership. Excluding firms with missing financial data yielded a sample of 1,716 firms among which 165 have diaspora ownership. CEM reduced the imbalance in the data (Blackwell, Iacus, King, & Porro, 2009). The multivariate imbalance L1 statistic moved from 0.88 to 0.62 and the univariate imbalance L1 for each of the matching variables moved as follows: from 0.7 to 0 for the state variable; from 0.8 to 0 for the industry variable; from 0.17 to 0.09 for the size variable; and from 0.12 to 0.09 for the age variable. The CEM matched 453 control firms to 144 treated firms for a total of 597 firms and 4,391 observations. Among the 597 matched firms, 81 (13.6%) had been involved in international technology licensing in the observation period, with the numbers of treated and control firms respectively 26 (18.1%) and 55 (12.1%).

Measures

The dependent variable *international technology licensing* is the firm's total foreign expenditure (in USD million) on royalties and technical know-how during year *t*. Considering the full sample, average expenditure on international technology licensing is USD 395, and for the subsample of firms with non-zero international technology licensing is USD 4,918. Our main explanatory variable is *diaspora ownership*

measured as the total ownership shares held by Indian diasporans. In our overall sample, diaspora investors hold about 1% of the firms' equity. In the subsample of firms with non-zero diaspora ownership this percentage is significantly higher at 6%.

To capture the characteristics of the firm's subnational location we defined the following variables. *Local within-industry R&D homogeneity* is calculated as 1 minus the Herfindahl index for R&D investment intensity of the firms operating in the same 2-digit industry and located in the same geographic district. A higher *local within-industry R&D homogeneity* value implies a less technologically concentrated local environment, and consequently greater homogeneity of R&D effort among co-localized firms in the industry. The average value of this variable is 0.63 in the range 0 to 1. To measure the institutional weakness in the local environment, we defined *local institutional distrust* which captures institutional lack of confidence among households in the state where the focal firm is located. We measure this variable based on IHDS data. Specifically, households were asked to rate the level of their confidence in the country's (i) politicians, (ii) media, and (iii) courts on a scale from 1 (a great deal of confidence) to 3 (very little confidence). To construct the institutional distrust index, we calculated the within-state average of the sum of the scores assigned to each of the three institutions (sums ranging from 3 to 9) by each household in the relevant state. Higher values indicate greater local lack of confidence in the state institutions. The variable is time-invariant and was measured at 2005; its average value is 5.5 ranging from a minimum of 4.2 to a maximum of 6.1. We opted for a state rather than a district level measure of subnational institutions since Indian legislation includes central level and state-level but not lower level laws. Moreover, as a federal structure, India mandates legal enforcement to the state-level. Given the Common Law origin of Indian legislation, the state courts have certain discretion in their interpretation of the legal rules. Researchers have highlighted significant differences in judicial quality among Indian states (Ahsan, 2013; Chakraborty, 2016; Chemin, 2004) but we did not find similar evidence related to district-level differences.

We control for several factors which might affect homeland firms' expenditure on international technology licensing. For example, there might be other owners relevant to the firm's ability to source knowledge in international markets. We include the following variables: o*ther foreign ownership* for equity

shareholding in the firm by other foreign owners than diasporans; *family ownership* measured as the ownership share held by local individuals identified as Hindu Undivided Families (a legal entity defined by Indian law); and *domestic institutional ownership* measured as the share of equity held by Indian institutions. The firm's ability to source knowledge internationally depends also on the firm's overall quality. We identified various firm characteristics which might signal firm quality to the market. *Technological intensity* is the firm's annual R&D expenses divided by total sales normalized by the industry's average technological intensity. *Advertising intensity* measures the firm's annual expenditure on advertising, sales, and distribution divided by total sales normalized by the industry's average advertising intensity. We control also for *domestic technology licensing* measured as expenditure on domestic knowledge and technological resources by the focal firm. On the one hand, the ability to source knowledge locally might indicate general experience of sourcing knowledge; on the other hand, a focus on domestic knowledge search might suggest reduced motivation to search abroad. The variable *export intensity* is the percentage of exports in the firm's total sales. The existence of more sources or means of obtaining international knowledge might make direct access less important (or easier). Thus, we include the dummy variables *group affiliation* (which takes the value 1 if the focal firm is part of an Indian business group and 0 otherwise) and *joint venture with foreign firms* (which takes the value 1 if one foreign firm has at least 10% but less than 50% of ownership in the focal firm). We control for *firm age* measured as the logarithm of the number of years since the firm's establishment, *firm size* measured as the logarithm of firm sales, and *firm profitability* measured as return on investment (ROI). All firm-level financial data are in USD million. We differentiate among industries based on their R&D investment intensity following the OECD classification (Hatzichronoglou, 1997), and define industry dummies for *high-tech*, *medium-high tech*, *medium-low tech*, and *low-tech*. However, since in the medium-low tech industry group the chemicals (NIC code 20) and rubber and plastics (NIC code 22) sectors are overrepresented (i.e. more than 10% of the sample firms in each sector), we also identify firms operating in these two sectors by specifying the control dummies *sector20* and *sector22*.[2] In terms of location characteristics, we control for per-capita GDP in the state where the focal firm is located (*per-capita state GDP*). Finally, we include year dummies. All the

time-variant independent and control variables are lagged one year with respect to our dependent variable. Table 1 reports the descriptive statistics and correlation matrix.

Insert Table 1 about here

Results

Given the nature of our dependent variable which resembles a corner solution outcome (i.e. it takes the value zero with positive probability but is a continuous random variable over strictly positive values), our regressions use a Tobit estimator (Wooldridge, 2002). We employ *CEM weights* to compensate for differential strata sizes (Blackwell et al., 2009).

Table 2 presents the results which generally support our hypotheses. In line with hypothesis 1, we observe that the share of diaspora ownership in a homeland firm is associated positively to the homeland firm's expenditure on foreign royalties and technical know-how. In model 1, the coefficient of *diaspora ownership* is positive and significant (p-value = 0.011). To illustrate the economic magnitude of this effect, we compare the predicted values of international technology licensing expenditure (conditional on the covariates and the subpopulations where international licensing expenditure is not at the boundary) for different values of diaspora ownership. Our reference is a firm operating in a high-tech sector which is not part of a business group and is not part of a joint venture with a foreign firm, with all the other continuous variables set at the mean value (a reference scenario is necessary given the non-linear nature of the Tobit model). An increase in *diaspora ownership* from zero to the sample mean value (about 1%) yields an increase in the expected value of international technology licensing expenditure from USD 4,136 to USD 4,197 (1.5% change). If we consider a change in *diaspora ownership* from the sample mean value to its mean value plus one standard deviation (i.e. from around 1% to 5%), we observe a change in the expected value of international technology licensing expenditure from USD 4,197 to USD 4,482, which corresponds to an increase of about 7%. When comparing firms operating in different sectors the size effects remain similar.

In model 2, the coefficient of the interaction term *local within-industry R&D homogeneity* × *diaspora ownership* is positive and significant (p-value = 0.012). This supports hypothesis 2 that the impact

of diaspora ownership on international technology licensing will be stronger in subnational environments where it is difficult to differentiate firm quality based on firm-level R&D investments. Considering the same reference scenario as before, we evaluate the effect of changes in *diaspora ownership* in different conditions of *local within-industry R&D homogeneity*. An increase in *diaspora ownership* from 1% to 5% in an environment where *local within-industry R&D homogeneity* is at its sample mean value, is associated to a USD 303 change in the expected value of international technology licensing expenditure. An increase in *diaspora ownership* from 1% to 5% in contexts where the *local within-industry R&D homogeneity* is at its mean value plus one standard deviation (i.e. a value of around 1, or the maximum level of homogeneity) implies a change in the expected value of international technology licensing expenditure of about USD 428. Accordingly, the effect of a change in diaspora ownership from 1% to 5% on firms' international licensing is about 41% greater in contexts with high local within-industry homogeneity of firm R&D investments compared to contexts with average local within-industry R&D homogeneity. The effects of *diaspora ownership* for different values of *local within-industry R&D homogeneity* are depicted in figure 1.

Insert Figure 1 about here

Hypothesis 3 predicts that the effect of diaspora ownership on firms' international technology licensing will be weaker in local environments with higher institutional distrust than in environments with lower institutional distrust. In model 3, the coefficient of the interaction term *local institutional distrust* × *diaspora ownership* is negative and significant (p-value = 0.036) suggesting that the positive association between diaspora ownership and firms' international knowledge sourcing is stronger if institutional quality is perceived to be relatively higher.[3] To understand further how weaknesses of local institutions affect the signal of diaspora ownership, we also split the sample into two subsamples. The first subsample includes all firms located in Indian states whose level of *local institutional distrust* is equal to or below its sample mean (for a total of 2,110 observations). The second subsample includes all firms located in Indian states with *local institutional distrust* above the sample mean (for a total of 2,281 observations). We ran model 1 for the two defined subsamples (models 4 and 5) and tested the statistical significance of the difference between the two estimated coefficients of *diaspora ownership*. In line with our hypothesis, the coefficient

of *diaspora ownership* is positive and significant (p-value = 0.000) for the subsample of firms operating in local contexts with low-moderate levels of institutional distrust. However, we found no significant effect of *diaspora ownership* for firms operating in local environments with high institutional distrust. Our statistical evidence shows that the two estimated coefficients are different (chi2(1) = 12.38, p-value = 0.004). The results are confirmed by splitting the sample at different levels of *local institutional distrust*. Specifically, we defined low-moderate *local institutional distrust* as below the value of the 60th percentile in one case, and below the value of the 75th percentile in the other case. In both cases, we find support for hypothesis 3. The results of the split sample together with those reported in model 3 indicate that for high levels of local institutional distrust the credibility-enhancing mechanism of diaspora ownership is not important. Considering the same reference scenario as before, we evaluated the effect of changes in *diaspora ownership* for the low-moderate *local institutional distrust* subsample; the context in which the diaspora ownership signal is significant. An increase in *diaspora ownership* from zero to its sample mean value (about 1%) is linked to an increase in the expected value of international technology licensing expenditure from USD 3,877 to USD 3,951 (1.9% change). If we consider a change in diaspora ownership from the sample mean value to the mean value plus one standard deviation (i.e. from about 1% to 5%), international technology licensing expenditure rises from USD 3,951 to USD 4,298, corresponding to a roughly 8.8% increase. Therefore, when firms operate in local environments with low-moderate institutional distrust compared to high institutional distrust a 1% to 5% increase in diaspora ownership has a 8.8% stronger effect on international licensing. The effects of *diaspora ownership* for the two subsamples low-moderate and high levels of *local institutional distrust* are depicted in figure 2.

Insert Figure 2 about here

The coefficients of the control variables are in line with our ex-ante expectations and the findings in the literature. On average, better performing and larger firms spend more on international knowledge and technological know-how; indeed, these firms likely have greater financial resources and consequently are more visible (i.e. have a better reputation) in the international market for technology. Not surprisingly, firms that collaborate with foreign firms spend more on international technology licensing since joint ventures

are a means of achieving cross-border knowledge transfer. However, firms that are part of an Indian business group have lower levels of expenses for international knowledge and technology on average. We also found negative and statistically significant coefficients of *family ownership* and *domestic institution ownership*. One explanation for the observed negative correlations might be that Indian domestic owners prefer more inward-looking strategies, and therefore, are more inclined to support local knowledge sourcing. Finally, we find a positive and significant effect of *other foreign ownership*. This result suggests that other foreign ownership can signal trustworthiness for emerging market firms. However, model 1 shows that the coefficient of *diaspora ownership* is statistically greater than the coefficient of *other foreign ownership* (F test = 3.46, p-value = 0.063). This is in line with hypothesis 1 that diaspora investors have superior ability to access and assess the trustworthiness of emerging market firms.

Insert table 2 about here

Robustness Tests

We conducted a number of robustness checks and additional analyses to confirm our findings (estimates available upon request). First, to reduce concerns that our results are driven by the choice of estimator we estimated two different specifications, a probit and an ordinary least square (OLS) model. To run the probit model, we transformed our dependent variable into a dummy variable which takes the value 1 if international technology licensing expenditure is greater than zero and is 0 otherwise. To run the OLS model, we considered the logarithm transformation of our dependent variable. The results are stable across different estimators, and confirm the hypotheses.

Second, since we assume that the majority of the licensing activity engaged in by the firms in our sample is non-exclusive licensing, we investigate whether the results change if we relax this assumption. Marketing capabilities of prospective licensees are important and are correlated positively to exclusive licensing (Jiang et al., 2007). Therefore, we split the sample into two subsamples based on whether *Advertising intensity* which is the firm's annual expenditure on advertising, sales, and distribution divided by total sales normalized by the industry's average advertising intensity takes values below or above the sample mean. We ran model 1 (table 2) for the two subsamples, and tested the statistical significance of the

difference in the coefficients of *diaspora ownership*. Based on our theoretical arguments, we expect the third party signal of diaspora ownership to be as or more important in the case of exclusive licensees. That is, under the assumption of non-exclusive licensing, our estimations of the diaspora ownership coefficient are conservative. In line with our expectations, we found that the coefficient of *diaspora ownership* is greater for the subsample of firms with *Advertising intensity* above the mean value; the difference in the size of the coefficient between the two subsamples is statistically significant (chi2(1) = 7.81 and prob > chi2 = 0.005). Prior work suggests also that higher R&D intensity in the licensee firm will increase the probability of an exclusive license agreement (Aulakh et al., 2013). Based on *Technological intensity* which is the firm's annual R&D expenses divided by total sales normalized by the industry's average technological intensity, we created two subsamples of firms lower than the sample mean of *Technological intensity* and higher than the sample mean of *Technological intensity*. Again, in this case, we expect the effect of diaspora ownership to be as or more important for the subsample of firms with higher R&D intensity. We ran model 1 (table 2) for these two subsamples and tested the statistical difference from zero of the coefficients of *diaspora ownership*. The results show that the coefficients are the same at the usual levels of significance, suggesting no variation in the efficacy of diaspora ownership for different values of the firm's technological intensity (chi2(1) =1.56, prob > chi2 = 0.211). Overall, these two findings indicate (indirectly) that diaspora ownership works as a third party signal for various types of licensing agreements. If anything, our coefficients of diaspora ownership are conservative estimates of its relevance for emerging market firms' access to international knowledge and technology.

Third, we are interested in whether our results depend on licensor location in a developed or less developed country. Specifically, we expect liability of origin to be most pronounced for potential licensors located in advanced industrial economies (Ramachandran & Pant, 2010). The literature suggests that firms from institutionally weak countries are better able to cope with institutional weaknesses typical of less developed markets (Cuervo-Cazurra & Genc, 2008). Therefore, the coefficients of diaspora ownership (see table 2) which do not distinguish between licensor location in an emerging or a developed economy will provide conservative estimates of the effect of diaspora investment on firms' international licensing.

However, regardless of experience in dealing with weak institutions, licensors located in developing countries are likely to be concerned about selecting the best firms, and diaspora ownership can be assumed to be relevant also in the case of emerging market firms transacting with licensors from less advanced industrial economies. While emerging market firms are becoming important technology developers, most high and medium-high technologies are developed in more advanced countries (D'Agostino, Laursen, & Santangelo, 2012). We selected the subsample of firms operating in high- and medium-high tech sectors (98 out of 597 firms) to try to capture licensing agreements with licensors located in more advanced country contexts. We also considered the subsample of firms operating in low technology sectors to capture licensing agreements where both parties are located in an emerging market. If diaspora ownership works as a third party signal of firm trustworthiness regardless of the licensor's location, the coefficients of the two subsamples should show no differences. Thus, we tested hypothesis 1 on the two subsamples, and checked for differences in the diaspora coefficients between the two subsamples; we found no statistical evidence of any difference (chi2(1) = 1.22, prob > chi2 = 0.270).

Lastly, it is likely that diaspora owners make their investment decisions based on various firm and manager characteristics, meaning that the distribution of diaspora ownership across firms is endogenous. To address this, we tested our hypotheses on a matched sample of firms which minimizes the observable differences between firms with and without diaspora ownership. However, this does not completely exclude biases deriving from unobserved differences between treated and control firms, or from selection effects. To account for these biases we employ an instrumental variables (IV) estimation procedure which requires an appropriate instrument for diaspora ownership. Our IV is *non-business-related immigrants net of local GDP*. That is, we observe the total number of individuals who as a result of marrying into or otherwise joining the household, migrated from abroad to the Indian state location of the focal homeland firm (source: India Census 2001). To alleviate concerns that state characteristics (e.g. higher GDP and strongly correlated variables such as political stability, legal system strength, education level, etc.) which positively affect the firm's likelihood to undertake international technology licensing (our dependent variable) might be correlated systematically also to the percentage of immigrants entering the state, we normalize the number

of non-business-related immigrants by the focal Indian state's GDP. For this variable to be a valid instrument, it must be uncorrelated to the error term but correlated to the endogenous variable (i.e. diaspora ownership). A priori we have no strong expectations about the sign of the correlation to diaspora ownership. Due to the Indian tradition of arranged marriage, the number of immigrants entering India to marry an individual residing in state A should be a good proxy for the intensity of personal relations between state A and the diaspora. Stronger links would likely imply a higher probability of diaspora members investing in the state. In this case, the total number of non-business-related immigrants to state A will be correlated positively to diaspora investment in firms located in state A. On the other hand, the correlation will be negative if individuals who migrated to India for non-business reasons are mostly those with fewer opportunities and less success abroad. Diasporans tend to network with members of their ethnic group who have similar education, occupation, and skills. Since the likelihood of a diasporan investing in a homeland firm is not uniform across occupations and skill levels, it might be expected that diaspora investments in firms located in state A will be lower if the non-business-related migrants to state A are mostly individuals with lower opportunities abroad and lower investment capacity. The results of the first-stage estimation are reported in table 3 and confirm that our instrument is correlated (negatively) to the potentially endogenous explanatory variable (p-value = 0.004) which is the first requirement for an IV regression. The second assumption related to our IV cannot be tested statistically. However, we see no reason why a higher (smaller) share of non-business-related immigrants to the homeland firm's state should have a direct influence on the firm's expenditure on international technology licensing. Using the IV estimator to re-estimate our main regression model, we obtain a positive relation (p-value = 0.043) between diaspora ownership and firm expenditure on international technology licensing (see table 3).[4]

Insert Table 3 about here

DISCUSSION AND CONCLUSION

We investigated the role of diaspora ownership as a third party signal facilitating international technology licensing for emerging market firms. We found that the efficacy of this signal depends on the characteristics of the domestic subnational environment in which the emerging market firm operates.

Our results advance current understanding of the mechanisms through which emerging market firms can overcome the liability of origin. Extant research suggests that these firms can align themselves proactively to the practices and characteristics of other legitimate global actors to overcome their liability of origin (Fiaschi et al., 2017; Marano et al., 2017; Zheng et al., 2015). For instance, adoption of CSR reporting can signal emerging market firms' credibility in the eyes of global stakeholders (Marano et al., 2017). However, the role of third party actors in signaling these firms' trustworthiness has been rather overlooked. We propose that diaspora owners are such actors, and that their choice to invest in their homeland emerging market firms (diaspora ownership) acts as a third party signal which helps these firms to overcome the liability of origin. Our results provide empirical evidence supporting the theoretical argument that stakeholders (other than diasporans) can rely on diaspora ownership to signal that the firm is trustworthy in a context of weak local institutions. This relies on diaspora owners' simultaneous superior ability and motivation to evaluate their homeland market firms and their detachment from the homeland institutional environment. Thus, emerging market firms' abilities to overcome the liability of origin depends on (unsolicited) support and endorsement by diaspora owners.

By proposing diaspora ownership as a third party signal, we add to the literature on technological upgrading (Awate et al., 2015; Elia & Santangelo, 2017; Kumaraswamy et al., 2012; McDermott & Corredoira, 2010). The absence of mechanisms that increase emerging market firms' credibility vis-à-vis foreign stakeholders (Khanna & Palepu, 2010) will constrain these firms' access to international technologies and technology upgrading (McDermott & Corredoira, 2010; McDermott & Pietrobelli, 2017). Such access allows the emerging market firms build the competencies they need in order to innovate. This is particularly the case for license agreements, which involve provision of training and technical and managerial assistance, and social interactions between licensor and licensee to transfer knowledge, skills, and routines critical to successful exploitation of the licensed-in technology (Chen & Sun, 2000; Jiang et al., 2007). Our findings indicate that diaspora ownership improves emerging market firms' ability to enter in license agreements with foreign licensors and gain access to foreign knowledge and technology not

available locally, and thus, constitutes a mechanism allowing upgrading of these firms' innovation capability.

Our study responds to a recent call for more research that takes account of the subnational spatial heterogeneity of international business (Beugelsdijk & Mudambi, 2014). We argue that the economic and non-economic characteristics of the subnational context matter for the efficacy of diaspora ownership as a third party signal in relation to emerging market firms' participation in the international market for technology. Specifically, we find that diaspora ownership is a more effective third party signal in local contexts where potential co-located licensees in the same industry have similar levels of R&D investments. We observed also that in dysfunctional subnational institutional contexts diaspora ownership becomes irrelevant for firms' access to international technology. Thus, we show that the characteristics of subnational spatial heterogeneity constitute boundary conditions for the efficacy of diaspora ownership as a third party signal to overcome the liability of origin. Also, our results suggest that focusing merely on average characteristics (e.g. industry structure of firms' R&D investments, institutional distrust) provides an incomplete understanding of such conditions.

Finally, our findings add to the literature on diasporans and their contribution to the home country. Diaspora members have been regarded as important facilitators of global connectivity and cross-border knowledge flows (Saxenian, 2005, 2002; Saxenian & Hsu, 2001). The growing economic importance of African, Latin American, and Asian countries highlights the contribution of diasporans to economic development, as does the increase around the world of origin-state institutions dedicated to emigrants and their descendants (Gamlen et al., 2019; Riddle et al., 2008). Diasporans contribute to their homeland with remittances (Vaaler, 2011), as returnee entrepreneurs (Kenney, Breznitz, & Murphree, 2013), or returnee scientists and managers (Choudhury, 2016; Foley & Kerr, 2013), and by acting as contractors for activities outsourced to their country of origin (Ghani, Kerr, & Stanton, 2014). A strand of scholarship suggests that foreign owners including diaspora investors promote internationalization (Bhaumik, Driffield, & Pal, 2010; Ferreira, Massa, & Matos, 2010; Rabbiosi, Gregorič, & Stucchi, 2019). Our study complements this work by showing that investment choices of diaspora members can become unsolicited third party signals of the

trustworthiness of emerging market firms for foreign stakeholders, and thereby can facilitate these firms' participation in the international market for technology. This evidence has significant policy implications. It suggests that in addition to direct contributions to the financing and growth of homeland firms, diaspora investments can have additional positive spillover effects on their homeland firms. In particular, by easing the participation of these firms in the market for technology diaspora investments can stimulate their technological upgrading. We provide evidence of another reason why national investment promotion agencies should identify ways to cultivate and facilitate diaspora homeland investment (Riddle et al., 2008). Governments should adopt policies aimed at facilitating diaspora investments in their homeland firms' equity to maximize the economic opportunities provided by these beneficial spillover effects.

Limitations and Directions for Future Research

This paper has some limitations which represent important directions for future research. First, we observe only the firm total share of diaspora ownership; we do not have more detailed information on individual diaspora owners. While our propositions hold for diaspora investors as a group, it would be interesting to identify well-known individuals among these diaspora owners, and to test whether their presence in the emerging market firm has a stronger impact on its international technology licensing contingent on the reputation of the individual. Second, we are not able empirically to differentiate among the various components of licensing expenditure. It might be that greater trustworthiness ceteris paribus would reduce the relative costs of licensing. This would imply a negative relationship between diaspora ownership and firms' licensing expenditure. We addressed this problem in the present paper by examining the relationship between diaspora ownership and the probability of (rather than the size) of the firm's licensing expenditure, and found that companies with higher levels of diaspora ownership are also more likely to engage in international licensing. The relationship between the various control variables in our regressions, and the amount of the licensing costs provides further support for the non-observability of the specifics of the licensing contract not being a major issue. Nevertheless, it would be useful to investigate how the presence of diaspora investors affects the various components of a licensing deal. Future research could examine these additional effects which would extend the boundary conditions investigated in the present study.

The last two limitations are related to our measure of licensing costs. While these limitations do not significantly alter our conclusions, they do suggest that the estimated coefficients of the impact of diaspora ownership might be conservative compared to the real contribution of diaspora ownership to the emerging market firms' international knowledge sourcing. First, we are unable to distinguish among licensors' countries of origin. Future research could investigate whether the signal constituted by diaspora presence carries more weight if the emerging market firm is interacting with a licensor in an advanced industrial economy—and particularly, if that licensor firm has not previously worked with an emerging market licensee. Second, we were unable to observe whether the license contract involved first-time or recurrent licensing activity. We expect the proposed mechanism to hold for both cases since partners that have proved trustworthy in the past might behave opportunistically in the future due for example, to a change in their management and firm strategy. However, the signals might be less relevant in the case of repeat relationships. Investigating these issues would be interesting avenues for future research.

Conclusion

Emerging market firms' innovation activity depends strongly on their ability to access and integrate technologies and knowledge from abroad. However, the liability of origin can restrict these firms' access to foreign knowledge and technology, particularly if they involve market transactions such as licensing. Work on diaspora shows how by bridging between communities across borders, diaspora members participate in the transfer and diffusion of knowledge between distant locations. We extend this literature by exploring the effect of diasporans (as investors) on emerging market firms' international technology licensing, and the boundary conditions of that effect. Our main finding of a positive effect of diaspora ownership on emerging market firms' international technology licensing suggests that diaspora investment leads to positive effects beyond the securing of financial resources, and provides further support for the relevance of on-going reforms and actions in emerging markets aimed at enhancing diasporans' engagement with their homelands.

ENDNOTES

[1] Typically, royalties are a percentage of the licensee's sales based on the licensed technology, thus the licensor's pay-off is tied to the licensee's market performance.

[2] We did not use 2-digit industry dummies because some sectors have very limited numbers of firms which required sector aggregation.

[3] We also run a model in which we included both interaction terms. The results of this extended specification further support our hypotheses.

[4] We also adapted the IV approach to confirm hypotheses 2 and 3 (results available upon request). For hypothesis 2, we used the interaction of the variable *non-business related immigrants net of local GDP* with the moderator *local within-industry R&D homogeneity* as an instrument for the interaction term *diaspora ownership* × *local within-industry R&D homogeneity* (Bun & Harrison, 2019). The results based on this IV confirm hypothesis 2. Moreover, applying the variable *non-business related immigrants net of local GDP* as an instrument for *diaspora ownership* to the split sample analysis provides support for hypothesis 3.

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TABLES AND FIGURES

Table 1 Descriptive statistics and correlation matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1)	International technology licensing																	
2)	Diaspora ownership	0.310																
3)	Local within-industry R&D homogeneity	0.007	0.020															
4)	Local institutional distrust	0.020	0.022	0.024														
5)	Other foreign ownership	0.147	0.015	0.017	0.007													
6)	Family ownership	-0.058	-0.041	-0.011	0.028	-0.216												
7)	Domestic institution ownership	0.056	0.008	-0.038	-0.013	0.157	-0.192											
8)	Technological intensity	0.035	0.008	-0.086	-0.094	0.030	-0.063	0.134										
9)	Advertising intensity	0.035	-0.004	0.003	0.083	0.098	-0.020	0.001	0.081									
10)	Domestic technology licensing	0.043	-0.012	-0.009	-0.001	0.011	-0.044	-0.007	-0.012	0.029								
11)	Export intensity	-0.050	-0.016	-0.123	0.043	0.000	0.129	-0.018	0.128	0.110	-0.002							
12)	Joint venture with foreign firms	0.211	-0.022	0.023	0.079	0.297	-0.103	0.015	-0.016	0.020	0.087	-0.036						
13)	Group affiliation	0.027	0.004	-0.050	-0.041	0.178	-0.351	0.257	0.240	0.072	0.031	-0.067	0.083					
14)	Firm age (log)	0.009	-0.046	0.024	-0.122	0.002	-0.095	0.143	0.160	0.022	-0.034	-0.023	-0.056	0.241				
15)	Firm sales (log)	0.101	-0.008	-0.152	0.054	0.340	-0.099	0.275	0.190	0.043	0.046	0.126	0.087	0.372	0.181			
16)	Firm profitability	0.120	0.065	-0.009	-0.035	0.065	0.099	0.048	0.081	0.019	-0.011	0.050	0.013	0.025	0.064	0.267		
17)	Per capita state GDP	-0.065	-0.034	0.025	-0.444	-0.057	0.014	-0.025	0.015	-0.088	-0.016	-0.056	-0.098	0.013	0.156	-0.013	0.065	
	Mean	0.000	0.010	0.631	5.486	0.040	0.281	0.025	0.750	0.754	0.002	20.49	0.016	0.324	3.175	3.061	6.463	12.84
	Standard deviation	0.003	0.042	0.369	0.344	0.104	0.223	0.050	2.035	0.975	0.041	28.22	0.125	0.468	0.413	1.616	17.10	0.718
	Minimum	0.000	0.000	0.000	4.224	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.742	0.002	-358.2	8.880
	Maximum	0.049	0.632	1.000	6.100	0.828	0.964	0.341	10.644	6.646	1.952	103.6	1.000	1.000	4.534	7.436	132.9	13.71

N. of observations = 4,391. Correlations greater than 0.025 are significant at $p<0.1$.

Table 2 Relationship between diaspora ownership and emerging market firms' international technology licensing

Variables	Model 1			Model 2			Model 3			Model 4			Model 5		
										Low-moderate local institutional distrust			High local institutional distrust		
	Coeff.	*S.E.*	*P-value*	*Coeff.*	*S.E.*	*P-value*	*Coeff.*	*S.E.*	*P-value*	*Coeff.*	*S.E.*	*P-value*	*Coeff.*	*S.E.*	*P-value*
Diaspora ownership	0.051	(0.020)	0.011	0.045	(0.021)	0.030	0.038	(0.015)	0.011	0.069	(0.015)	0.000	0.005	(0.010)	0.543
Local within-industry R&D homogeneity	-0.002	(0.002)	0.412	-0.002	(0.002)	0.326	-0.001	(0.002)	0.450	0.002	(0.003)	0.345	-0.003	(0.002)	0.001
Local institutional distrust	-0.001	(0.002)	0.662	-0.001	(0.002)	0.669	0.000	(0.002)	0.832	0.008	(0.008)	0.084	-0.005	(0.005)	0.042
Local within-industry R&D homogeneity×Diaspora ownership[a]				0.054	(0.021)	0.012									
Local institutional distrust ×Diaspora ownership[a]							-0.084	(0.040)	0.036						
Other foreign ownership	0.015	(0.005)	0.004	0.015	(0.005)	0.004	0.015	(0.005)	0.004	0.022	(0.008)	0.000	0.012	(0.005)	0.000
Family ownership	-0.005	(0.003)	0.094	-0.005	(0.003)	0.085	-0.005	(0.003)	0.084	-0.005	(0.005)	0.069	-0.001	(0.003)	0.551
Domestic institution ownership	-0.025	(0.014)	0.074	-0.025	(0.014)	0.068	-0.026	(0.013)	0.048	-0.023	(0.016)	0.021	-0.054	(0.020)	0.000
Technological intensity	0.000	(0.000)	0.387	0.000	(0.000)	0.391	0.000	(0.000)	0.424	0.000	(0.000)	0.224	0.001	(0.000)	0.000
Advertising intensity	0.000	(0.001)	0.582	-0.001	(0.001)	0.548	-0.001	(0.001)	0.548	-0.001	(0.001)	0.119	0.000	(0.001)	0.408
Domestic technology licensing	0.007	(0.006)	0.234	0.007	(0.006)	0.244	0.007	(0.006)	0.226	0.010	(0.007)	0.018	0.007	(0.016)	0.631
Export intensity	0.000	(0.000)	0.217	0.000	(0.000)	0.200	0.000	(0.000)	0.231	0.000	(0.000)	0.036	0.000	(0.000)	0.942
Joint venture with foreign firms	0.010	(0.004)	0.004	0.010	(0.004)	0.004	0.010	(0.003)	0.004	-0.003	(0.006)	0.480	0.012	(0.004)	0.000
Group affiliation	-0.003	(0.002)	0.106	-0.003	(0.002)	0.099	-0.003	(0.002)	0.106	-0.006	(0.002)	0.000	-0.001	(0.002)	0.592
Firm age (log)	0.003	(0.002)	0.123	0.003	(0.002)	0.106	0.003	(0.002)	0.098	0.005	(0.002)	0.000	-0.001	(0.002)	0.401
Firm sales (log)	0.003	(0.001)	0.000	0.003	(0.001)	0.000	0.003	(0.001)	0.000	0.003	(0.001)	0.000	0.003	(0.001)	0.000
Firm profitability	0.000	(0.000)	0.008	0.000	(0.000)	0.006	0.000	(0.000)	0.008	0.000	(0.000)	0.000	0.000	(0.000)	0.594
Per capita state GDP	-0.001	(0.001)	0.471	-0.001	(0.001)	0.532	-0.001	(0.001)	0.484	-0.004	(0.002)	0.001	0.000	(0.001)	0.759
Industry dummies	Yes			Yes			Yes			Yes			Yes		
Year dummies	Yes			Yes			Yes			Yes			Yes		
Constant	-0.018	(0.021)	0.401	-0.019	(0.021)	0.378	-0.021	(0.021)	0.320	-0.034	(0.027)	0.072	0.016	(0.035)	0.409
F Test	2.12		0.000	3.08		0.000	2.13		0.000	4.29		0.000	1.66		0.000
Akaike's information criterion (AIC)	-1345.61			-1353.22			-1359.77			-649.73			-839.71		
Mean variance inflation factor (VIF)	1.20			1.19			1.21			1.37			1.19		
Observations	4,391			4,391			4,391			2,110			2,281		

Robust standard errors in parentheses corrected for cluster-correlated observations.

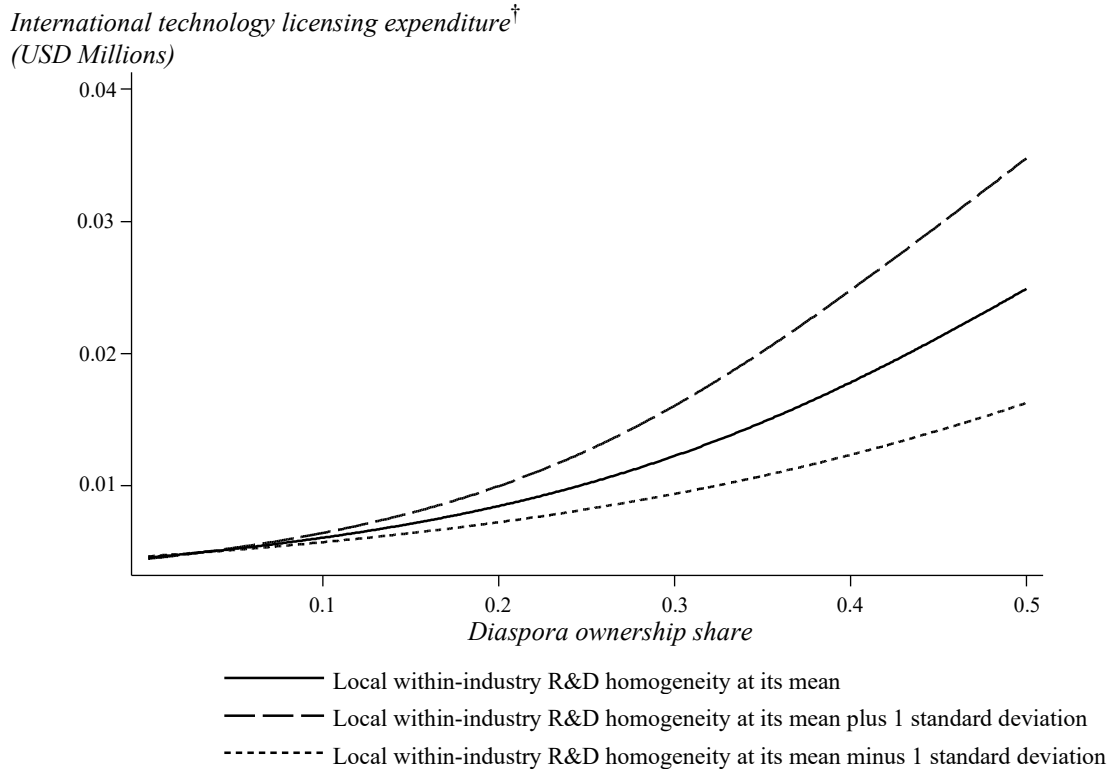
[a] Interacting variables normalized around their mean value before being interacted.

Table 3 Diaspora ownership and emerging market firms' international technology licensing: Instrumental variable estimation

	First stage [a]			Second stage [b]		
	Coeff.	*S.E.*	*P-value*	*Coeff.*	*S.E.*	*P-value*
Non-business-related immigrants net of local GDP	-0.007	(0.003)	0.004			
Instrument for diaspora ownership				0.081	(0.040)	0.043
Local within-industry R&D homogeneity	0.025	(0.007)	0.000	-0.003	(0.002)	0.126
Local institutional distrust	-0.022	(0.008)	0.008	0.005	(0.002)	0.004
Other foreign ownership	0.139	(0.025)	0.000	0.000	(0.006)	0.998
Family ownership	-0.037	(0.013)	0.005	-0.003	(0.002)	0.178
Domestic institution ownership	-0.034	(0.048)	0.478	0.003	(0.007)	0.649
Technological intensity	0.003	(0.001)	0.010	0.001	(0.000)	0.007
Advertising intensity	0.002	(0.003)	0.387	0.001	(0.000)	0.008
Domestic technology licensing	-2.948	(1.651)	0.074	0.247	(0.119)	0.038
Export intensity	0.000	(0.000)	0.000	0.000	(0.000)	0.003
Joint venture with foreign firms	-0.120	(0.026)	0.000	0.016	(0.006)	0.005
Group affiliation	0.011	(0.006)	0.097	0.000	(0.001)	0.712
Firm age (log)	0.003	(0.005)	0.526	-0.001	(0.001)	0.374
Firm sales (log)	0.000	(0.002)	0.903	0.004	(0.001)	0.000
Firm profitability	0.000	(0.000)	0.027	0.000	(0.000)	0.781
Per capita state GDP	0.000	(0.004)	0.919	-0.001	(0.001)	0.029
Industry dummies	Yes			Yes		
Year dummies	Yes			Yes		
Constant	-0.131	(0.080)	0.104	-0.040	(0.015)	0.009
Observations	12,669			12,289		

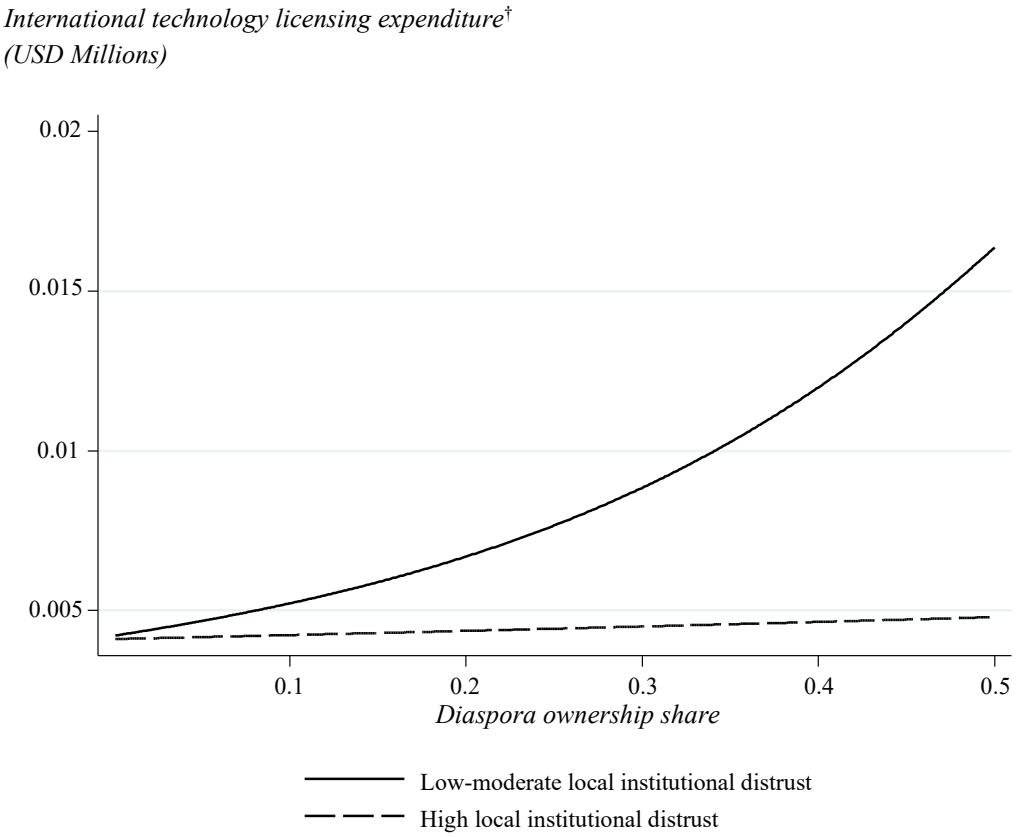
[a] Tobit regression explaining diaspora ownership for the full sample before applying CEM.
[b] Tobit regression explaining international technology licensing expenses for the full sample before applying CEM.
Robust standard errors reported in parentheses.

Figure 1 Effect of diaspora ownership share for different values of local within-industry R&D homogeneity



† Predicted truncated expected value of *international technology licensing* conditional on continuous covariates set to their sample mean values, and the dummy variables set at their median (except for industry and year dummies which are set to high-tech industry and 2008, respectively). The predictions are based on model 2 (table 2). Based on Zelner (2009), we verified that the difference between the predicted expected values for a change of *local within-industry R&D homogeneity* from its mean plus one standard deviation to its mean minus one standard deviation at different levels of diaspora ownership, is always statistical significant at the 95 percent.

Figure 2 Effect of diaspora ownership share for different values of local institutional distrust



† Predicted truncated expected value of *international technology licensing* conditional on continuous covariates set to their sample mean values, and the dummy variables set to their median (except for industry and year dummies which are set to high-tech industry and 2008 respectively). The predictions are based on models 4 and 5 (table 2). Based on Zelner (2009), we verified that the difference between the predicted expected values for a change of *local institutional distrust* from its mean plus one standard deviation to its mean minus one standard deviation at different levels of diaspora ownership, is always statistical significant at the 95 percent.