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Human Mobility and International Knowledge Spillovers: Evidence from High-tech Small and Medium Enterprises in an Emerging Market

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Human mobility and International Knowledge Spillovers: Evidence from High-tech Small and Medium Enterprises in an Emerging Market

Abstract

Using novel survey data, we examine the relationship between returnee entrepreneurs, multinational enterprise (MNE) working experience and firms' innovation performance in high-tech SMEs in China. We adopt an integrated framework which combines the knowledge based view and social capital theory to investigate whether human mobility across national borders and MNE working experience facilitate international knowledge spillovers. We find that firms founded by returnees are more innovative than their local counterparts. We also find that returnee firms have an indirect impact/spillover effect on non-returnee firms' innovation performance and act as a new channel for technological knowledge spillovers. The findings show that the presence of a technology gap positively moderates the effect of returnee spillovers on non-returnee firms' innovation performance but the impact of MNE working experience on local innovation is constrained by the technology gap. Our results extend the existing literatures on knowledge spillovers and strategic entrepreneurship and have important managerial and policy implications.

Human mobility and International Knowledge Spillovers: Evidence from High-tech

Small and Medium Enterprises in an Emerging Market

Introduction

Intensive research has been conducted on the effect of knowledge spillovers on host countries. Foreign direct investment (FDI) and trade have been regarded as the main vehicle for knowledge spillovers (Blalock and Simon, 2009; Blomstrom and Kokko, 1998; Buckley et al., 2002; Grossman and Helpman, 1991; Keller and Yeaple, 2003; Liu and Wang 2003; Liu, Wang and Wei, 2009; Marin and Bell, 2006). However, in a globalized economy, knowledge spillovers also take place through human mobility since highly skilled labor has become more mobile and more easily able to cross national borders.

A new phenomenon of returnee entrepreneurs has appeared recently. Returnee entrepreneurs are defined as scientists and engineers returning to start up new ventures in China, after several years of business experience and/or education in OECD countries (Saxenian, 2002a). This phenomenon has raised an important research question as to whether knowledge spillovers occur through entrepreneurs' mobility across national borders.

However, very few studies have been carried out on the impact of cross-border human mobility on knowledge spillovers (Song et al., 2003). There is relatively little evidence on the extent to which cross-border human mobility affects the international diffusion of knowledge. In particular, the impact of reverse flows of highly skilled labor from OECD countries to emerging economies, such as China, India and Russia, which provides a potentially important channel for international knowledge spillovers, has been largely overlooked. In addition, most of the prior studies on knowledge spillovers were based on secondary data analysis and

used FDI presence or exports/imports as proxies of spillovers from foreign firms/trade partners to local firms at industry level in emerging economies. Hence, knowledge spillovers were treated as a 'black box' (Blomstrom and Kokko, 1998; Buckley et al., 2002; Grossman and Helpman, 1991; Keller and Yeaple, 2003; Liu and Wang 2003; Liu, Wang and Wei, 2009). Using novel survey data, we go beyond the existing literature by measuring knowledge spillovers from human mobility at firm level through interaction between different types of entrepreneurs.

Returnee entrepreneurs, who studied or worked in OECD countries in the past, possess a number of important characteristics that differentiate them from local non-returnee entrepreneurs. First, returnee entrepreneurs may have specific human capital that relates to a spectrum of skills and knowledge with varying degrees of transferability (Castanias and Helfat, 1992). They are simultaneously embedded in two distinctive knowledge contexts in the country they studied/worked and their home country. Embeddedness in the country in which they studied/worked provides them an opportunity to draw upon sources of advanced knowledge and new ideas. Non-returnee entrepreneurs have limited access to non-local knowledge and networks. Moreover, returnees' cultural background and language skills enable them to exploit non-local experiences and knowledge through formation of a new firm in China.

Second, returnee entrepreneurs may develop specific social capital that involves the relational and structural resources attained through a network of social relationships in the host country (Adler and Kwon, 2002; Cooper and Yin, 2005). They may be able to maintain personal and professional ties in the host country which enable them to continue updating technology when they return to their home country. The social capital established through working/studying abroad helps returnees to access diverse sources of knowledge when they

become a returnee entrepreneur in their home country. In contrast, non-returnee entrepreneurs have limited opportunities to develop such social capital and access sources of advanced technology and new ideas directly, and may lack technological and entrepreneurial expertise.

This study aims to examine the relationship between returnee entrepreneurs and their firms' innovative performance as well as their role in knowledge spillovers in high-tech firms. Innovation is determined by internal knowledge creation and external knowledge acquisitions as few firms possess all the necessary elements need for innovation. External knowledge spillovers are an important factor affecting innovation. Returnee entrepreneurs not only affect the innovation performance of their own firms due to their unique skills and advantages obtained abroad, but also local non-returnee firms through external knowledge spillovers. Strategic entrepreneurship, grounded in the resource-based view (RBV) of the firm, recognizes the importance of accessing the resources and capabilities required to support opportunity seeking behavior aimed at achieving competitive advantage (Ireland, Hitt and Sirmon, 2003). However, given the emergent nature of the concept of strategic entrepreneurship (Kuratko and Audretsch, 2009), the sources of these resources and capabilities remain under-explored in the context of knowledge spillovers. Our focus on returnee entrepreneurs emphasizes the role of the resources and capabilities embodied in their knowledge and social capital in gaining competitive advantage through innovation. Accordingly, we adopt an integrated framework which combines the knowledge-based view (KBV) with social capital theory. Specifically, we investigate whether returnee entrepreneurs act as a channel for knowledge diffusion in high-tech industries. In addition, we also consider how entrepreneurs' previous working experience in multinational enterprises (MNEs) affects their firms' innovation. Non-returnee entrepreneurs may have worked for an MNE within the home country. In this sense, we consider two modes of knowledge spillovers through human

mobility across firms and across national boarders in a large emerging economy, China, where returnees have gained significance under the government policy which encourages overseas Chinese students and scientists to return to China. We also investigate how a technology gap moderates the magnitude of knowledge spillovers from returnee-firms and MNEs. By doing that, we are able to shed light on the tension in this literature regarding the effect of a large versus a moderate technology gap. We argue theoretically and show empirically that the conduit matters, that is the spillover effects of returnees and MNE experience moderate the magnitude of knowledge spillovers differently in the presence of a technology gap. We propose that cognitive barriers differ with different sources or channels of knowledge spillovers. This aspect has been underexplored in the literature where FDI or MNEs are considered the major channel of external knowledge spillovers, whereas our study considers both returnees and MNEs with different cultural distance from non-returnee firms as the conduit of knowledge spillovers.

Our findings help broaden understanding of the role of human mobility in emerging economies and provide new insights into the new phenomenon of returnee entrepreneurs. The evidence from the study helps extend the existing literature on knowledge spillovers by considering the role of human mobility across national boarders in knowledge spillovers which has been neglected in the existing literature. With respect to strategic entrepreneurship research, our findings provide new insights into the source of the resources and capabilities required for innovative opportunity seeking behavior, with particular emphasis upon the knowledge embodied in individual returnee entrepreneurs.

This paper is organized as follows. The next section discusses theories and hypotheses. Section three introduces our empirical model and data used in the study. While the subsequent section presents and analyses empirical results, the last section concludes with the

suggestions for future studies.

Theory and Hypotheses

We adopt a comprehensive framework which embraces the KBV and social capital theory to examine knowledge spillovers. While the KBV focuses on the importance of knowledge creation and acquisition in innovation, social capital theory highlights the role of relational capital in acquiring knowledge externally through firm networks. Thus, these two approaches complement each other by emphasizing that critical resources/knowledge for innovation may be beyond firm boundaries and so firms may benefit from external knowledge spillovers through human mobility and their networks (Dyer and Singh, 1998). This combined framework allows us to examine how human mobility and social interaction affect international knowledge spillovers. Entrepreneur mobility across national borders may act as a potential channel for international knowledge spillovers which has not been commonly noted in the existing literature. In this section, we discuss our integrated framework first then establish hypotheses based on the framework.

Knowledge based view and knowledge spillovers

Knowledge is considered as a specific strategic resource and the principal basis for creating competitive advantage according to KBV (Grant and Fuller, 1995; Grant, 1996a, 1996b, 1997). The knowledge needed for innovation may be obtained from a variety of internal and external sources. From the knowledge-based perspectives, firms may develop internal innovative capabilities associated with R&D activities (Peteraf, 1993). Few firms, however, possess all the elements required for successful and continuous technological development even though they are the source of much of the knowledge needed in innovation. Some

studies (Mansfield, 1988) have found that the original sources of invention came from outside the firm. Firms often find that it is less costly and faster to source external knowledge rather than develop it internally.

External knowledge spillovers exist due to the non-rival nature of knowledge. Knowledge spillovers imply that knowledge created by one party produces externality which can facilitate innovation by other parties (Jaffe et al., 2000). This is consistent with the insight of Arrow (1962) into knowledge spillovers from the traditional factors of production which are non-rivalrous; if one firm uses an idea, it does not prevent others from using it. On the other hand, knowledge is not universally accessible (Arrow, 1962) and is also partially excludable which gives private firms an incentive to invest in R&D in order to obtain higher profits based on market demand (Romer, 1994).

The process of knowledge creation involves a combination of tacit and codified knowledge (Nonaka and Takeuchi, 1995). Explicit or codified knowledge may be published in books, papers or documents, which can be reproduced at low cost. The transfer of this kind of knowledge does not prevent its use by the original holder. On the other hand, much knowledge in organizations is tacit (Nonaka and Takeuchi, 1995) and socially complex. The tacit and complex nature of valuable knowledge makes knowledge acquisitions very difficult (Kogut and Zander, 1992) as it embodies in organizational members, tools, tasks and networks (Argote and Ingram, 2000). This kind of knowledge can be transferred more effectively through human mobility (Kaj et al. 2003; Song et al., 2003) and hands-on experience (Almeida and Kogut, 1999; Teece, 1982; Zucker et al., 1998). Hence, human mobility enables firms to overcome barriers in knowledge transfer and facilitate knowledge diffusion.

Social capital theory and knowledge spillovers

As discussed above, firms need to obtain new knowledge and business information externally within the firm's networks and through human relations. Social capital theory places a greater emphasis on human relations and on the elicitation of tacit knowledge in the context of the global economy. Social capital in the form of networks is viewed as the relational and structural resources attained by entrepreneurs/firms through a network of social relationships (Adler and Kwon, 2002; Cooper and Yin, 2005). We argue that social capital-related factors may enable firms to access external knowledge and new ideas created anywhere else, thus stimulating their firms' innovation performance (Coviello and Munro, 1997; Zahra et al., 2000). Prior research has identified that informal knowledge transfers take place through networks of inter-firm relationships, and networks serve as an informational conduit and facilitate knowledge spillovers between firms. Moreover, firms' access to external knowledge spillovers through their networks contributes to their effective R&D and hence to their innovation performance (Ahuja, et al., 2008).

Extending the existing literature on knowledge spillovers, our study examines the role of human mobility and networks in innovation, and seeks evidence as to whether returnee entrepreneurs are a new force of international knowledge diffusion. Our theoretical framework helps explain how external knowledge spillovers and internal efforts jointly determine the innovation performance of high-tech firms. Specifically we focus on returnee entrepreneurs and MNE working experience as channels for external knowledge spillovers. We consider returnee entrepreneurs and MNE working experience as spillover channels as that they involve human mobility and direct interaction rather than through tangible means of spillovers, such as trade and FDI. Based on our framework, we derive a number of testable hypotheses below.

Returnee entrepreneurs and innovation

Intensive research has been conducted on knowledge spillovers via different channels such as FDI and trade (Blalock and Simon, 2009; Blomstrom and Kokko, 1998; Buckley et al., 2002; Grossman and Helpman, 1991; Keller and Yeaple, 2003; Liu and Wang 2003; Liu et al., 2009; Marin and Bell, 2006). However, few studies have considered entrepreneurs as a channel for knowledge transfer, with the exception of Acs et al. (2006) who propose the knowledge spillover theory of entrepreneurship. They adopt the view that a firm is created endogenously through innovative activities by economic agents. Their approach considers new knowledge and ideas as a source of entrepreneurial opportunities. Hence, a knowledge gap across different countries may create entrepreneurial opportunities. When returnee entrepreneurs start new businesses in their home countries, they may serve as a conduit through which knowledge transfer occur via new firm formation (Acs and Audretsch, 1989; Audretsch and Lehmann, 2005; Shane, 2001a; 2001b). This kind of direct knowledge transfer or application may boost the innovation performance of their own firms.

Returnee entrepreneurs, as a new phenomenon of human mobility, may help facilitate the flow of capital, knowledge and new ideas. Such mobility has at least two important implications. One is that knowledge possessed by these entrepreneurs can be transferred and applied to a new context. The other is that there is potential for learning which can be instrumental both for generating innovative ideas as well as for finding solutions to existing problems. Human mobility is crucial to transferring tacit knowledge or knowledge-building capabilities (Ettlie, 1980; Chesbrough, 1999, Leonard-Barton, 1995) as tacit knowledge, rather than explicit knowledge, becomes a necessary condition enabling firms to improve their flexibility, performance and innovative capabilities (Angel 1991; Feldman, 2000;

Saxenian 1994). We argue that these returnee entrepreneurs act as an important channel for transferring tacit knowledge (Fornahl et al., 2005). For example, some returnee entrepreneurs bring not only the latest technology and patents with them when they return to their home country, but also their tacit knowledge, experience and business networks. In this sense, returnee entrepreneurs are able to contribute to the knowledge creation and innovation of their own firms. Advanced technology and new ideas which returnee entrepreneurs have obtained from OECD countries provide a basis for the competitive advantages of their firms and may directly affect their firms' innovation performance compared to non-returnee entrepreneurs' firms. Hence we propose:

H1: Innovation performance of returnee-owned firms will be higher than non-returnee-owned firms.

Knowledge spillovers and non-returnee firm innovation

In addition to the direct effects of returnee entrepreneurs' experience on the innovation performance of their own firms, returnee entrepreneurs may be an important source of dynamic externalities. In a globalized economy, international human mobility has increased significantly and the emergence of trans-national scientists and engineers has played an important role in knowledge diffusion across national borders (Saxenian, 2006). Hence, human mobility is an important mode of knowledge spillovers across national borders. As documented by Saxenian (2002a), returnee entrepreneurs have contributed to scientific and technological development in Taiwan, South Korea and India. Malmberg and Maskell (2002) found that the rivalry between firms encourages variation, observability and comparability. As a consequence, different types of knowledge are exchanged, and the possibilities for

innovation are enhanced. Innovation diffusion is not only through the commercialization of a new product, but also the imitation and introduction of the product into different contexts. Learning through observation (i.e. imitative behavior/imitation) may also allow for the diffusion of tacit knowledge.

Knowledge spillovers from the presence of returnee firms may affect non-returnee firms in two ways. First, non-returnee firms can learn new knowledge and new ideas from returnee-firms through direct contact and networks which may lead to an increase in the innovation performance of their firms. Returnee firms and non-returnee firms share the same cultural background and may easily establish formal and informal contacts through socialization. This kind of social contact and informal networks helps to build trust and facilitate communications, hence serving a mechanism of knowledge spillovers through which non-returnee firms are able to observe and absorb advanced technology and new ideas from returnee-firms. In other words, returnee firms may transfer knowledge effectively due to their embeddedness in both environments of home and host countries which enable them to avoid cultural incompetence and lacking local networks (Lin, 2010). Second, returnee entrepreneurs who possess new technology and ideas may not only enhance the innovation performance of their own firms, but also are able to accelerate the technological development of their industry, thus increasing the overall technical standard of the industry. In turn, non-returnee firms are able to benefit from the increased technology standard of the industry indirectly. Therefore, we propose:

H2a: Non-returnee firm's innovation performance is positively associated with knowledge spillovers from returnee entrepreneurs.

Founders/entrepreneurs who previously worked for MNEs may also act as a channel for knowledge transfer (Zhou & Xin, 2003). We differentiate the impact of MNE working experience from that of returnee entrepreneurs on non-returnee firms' innovation[1] as local non-returnee entrepreneurs may have worked for an MNE within the home country. Knowledge spillovers can arise when former MNE employees move to domestic firms or set up their own enterprises as they embody the firm-specific knowledge assets of MNEs and may be able to transfer technological know-how, marketing and management skills to local firms (Inkpen and Tsang, 2005), thus positively affecting non-returnee firms' innovation. From the KBV perspective, the past experience of decision-makers represents an important organizational resource that may underpin the firm's innovation (Reid, 1981; Axinn, 1988). Moreover, the former employees of MNEs who become founders of local firms may also maintain collaborative links with MNEs that facilitate knowledge spillovers and hence innovation (Tan, 2006). The benefits of MNE experience in accessing non-local knowledge may be especially important for non-returnees to overcome the disadvantages of being local only and is another channel for knowledge spillovers. Therefore, we propose:

H2b: Non-returnee firm's innovation performance is positively associated with knowledge spillovers from MNE working experience.

Knowledge spillovers, technology gaps and innovation

The existing literature contends that knowledge spillovers may be affected by a technology gap between knowledge recipients and knowledge creators (Verspagen, 1993). This is especially the case where a technology gap exists between those who are able to

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[1] Non-returnee firms do not include MNEs as the latter are not SME entrepreneurial firms. Our study mainly focuses on how returnee entrepreneurs affect Chinese non-returnee firms.

innovate to produce new technology, and those who cannot. The technology gap may enhance knowledge spillovers for a firm whose knowledge is based on other firms through intangible outputs, such as patents and the process of reverse engineering.

The notion of a technology gap can be applied to the case of returnees and entrepreneurs with MNE working experience who are more likely to access advanced technological knowledge due to their background and international networks. In contrast, non-returnee entrepreneurs with solely domestic experience in emerging economies have few such opportunities. A possible technology gap between returnee firms, MNEs and non-returnee firms may impact the effectiveness of knowledge spillovers and innovation performance of non-returnees firms. It is recognized that external knowledge spillovers depend on the size of technology gap. The larger the technology gap, the more the laggard firms learn from leaders (Driffield, 2001; Castellani and Zanfei, 2003) although the presence of cultural and cognitive barriers mean that domestic firms may gain limited benefits from FDI spillovers (Flores et al. 2001). The extent of technological differences represents potential for local firms to learn from returnee-firms and MNEs. When the technology gap between returnee firms, MNEs and non-returnee firms is relatively small, the marginal impact of knowledge spillovers on the focal firm's innovation may be limited. A relatively large technology gap implies greater potential for knowledge spillovers but the effects of as returnees and former MNE employees in enabling non-returnee firms to stretch their existing knowledge base to bridge the technology gap (Nooteboom et al., 2007) may differ.

A key unresolved tension in the technology gap literature is how these barriers can be overcome. We argue that in the context of knowledge spillovers, non-local knowledge can help local non-returnee firms to be less exposed to these barriers but that it matters where this knowledge comes from. If knowledge receivers and generators have a similar cultural

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background, then it is easier to overcome cognitive barriers. In contrast, when local firms and MNEs operate in different organizational and cultural boundaries, local firms may have difficulty absorbing or transferring non-local knowledge and may fail to realize learning potential (Lin, 2010).

In addition, returnees have typically gained broader explorative knowledge in a foreign context often involving new technology and patents (Wright et al., 2008). Together with their knowledge of the local culture, this is expected to reduce the barriers to knowledge transfer. In contrast, MNE experience alone by employees in non-returnee firms likely involves firm-specific knowledge that is more difficult to transfer. Hence, a technology gap may be a mechanism which positively moderates the impact of returnee spillovers, but negatively moderates MNE working experience on non-returnee firms' innovation, and we suggest:

H3a: The effect of returnee spillovers on innovation performance in non-returnee firms is positively moderated by a technology gap.

H3b: The effect of MNE working experience on innovation performance in non-returnee firms is negatively moderated by a technology gap.

The sample and method

The sample

To test our hypotheses, a sample of firms was selected from the largest science park in China, Zhongguancun Science Park (ZSP), one which has attracted a large number of returnee and local entrepreneurs (Tan, 2006). All firms in our sample are from high-tech industries, following the definition of the Ministry of Finance and China National Bureau, comprising

electronics and information technology, bio-engineering and new medical technology, new materials and applied techniques, advanced manufacturing technology, aviation and space technology, modern agricultural technology, new energy and high power conservation technology, environmental protection technology, marine engineering technology and nuclear-applied technology. Since returnee-owned firms are a recent phenomenon in China, we limited the sample to SMEs, according to the official Chinese definition, where an SME has fewer than 300 employees, and a total value of sales below 5 million RMB.

By applying the criterion of high-tech SMEs founded for around 3-5 years, populations of 1,003 returnee-owned and 1,138 local firms were identified from a list obtained from the management committee of ZSP. A willingness to participate in our survey was indicated by 857 returnee-owned firms and 976 local entrepreneurial firms, representing 85.4% and 85.6% of the population respectively.

The questionnaire was translated from English into Mandarin Chinese then back-translated by two Chinese Professors in Beijing to ensure its validity. A pilot study was carried out in ZSP where two workshops were organized involving groups of 6 to 8 returning and local entrepreneurs who completed the questionnaire and were asked to identify any unclear questions. We modified the questionnaire according to feedback received from the workshops, and copies were mailed to 857 returnee-owned and 976 local firms. Given the nature of the questions we were addressing, we adopted a key informant approach (Kumar et al., 1993). The key informant at firm level is the founder/owner/entrepreneur. We employed two full-time research assistants from the Great Wall Enterprise Institute in Beijing who were responsible for following up the respondents with phone calls and visits to 156 sample firms.

A total of 353 usable questionnaires were returned from returning entrepreneurs (a 41.2% response rate), and 358 questionnaires from local firms (36.7%). The possibility of

non-response bias was checked by comparing the characteristics of the respondents with those of the original population sample. The calculated t-statistics for the number of employees and R&D expenditures of the firms were all statistically insignificant, indicating that there were no significant differences between the respondent and non-respondent firms. The variables used in the estimation were defined as follows:

Dependent variable

We used the number of patents owned by firms as a measure of *innovation performance (IP)*. Patents are mainly the outcome of formal research processes. This measure is convenient because patent data are easily accessible. Also, it is argued that innovation facilitated by international knowledge spillovers can be more directly assessed in firms' efforts to generate patents (Jaffe, Trajtenberg and Henderson, 1993; Salmon and Shaver, 2005). Hence, patents classified across various technological categories allowed us to characterize firms' positions in the technological space.

Independent variables

We constructed a dummy variable for *returnee-owned firms (RE)* which equals 1 (zero otherwise), where a returnee entrepreneur is defined as a Chinese native with at least two years of commercial and/or educational experience in an OECD country and returning to China to set up a new venture. A dummy variable was created for entrepreneurs' working experience in an *MNE*, taking the value 1 if non-returnee entrepreneurs previously worked for an MNE, and zero otherwise.

We constructed two measures for returnee spillovers. The first measure (Returnee spillovers 1) was a dummy variable, taking 1 if non-returnee entrepreneurs stated that they

have had regular interaction with returnee entrepreneurs, and zero otherwise. The interaction between returnee and non-returnee entrepreneurs includes formal and informal contact. The former refers to business links, cooperation and meetings organized by the ZSP management committee, whereas the latter includes joining the same professional associations, social interaction with friends and former classmates or alumni. The measure for returnee spillovers differs from that of most existing studies which used secondary data analysis to calculate spillovers at industry level. This variable enables us to directly capture the spillover effect through the interaction between returnee entrepreneurs and non-returnee entrepreneurs as these two types of firms locate in an industrial cluster, ZSP. Hence, formal and informal contact between returnee and non-returnee entrepreneurs serves as a mechanism of knowledge spillovers. The second measure (Returnee spillovers 2) was calculated as returnee density in an industry which was measured as the ratio of number of returnees to total employees in an industry. These two measures are able to capture knowledge flows through social contact and the impact of returnees on the overall technical standard of an industry.

Measuring the technology gap between the two types of firms poses significant challenges, so we used two different proxies. The *technology gap (Gap1)* variable was constructed based on the question of how long it would take for non-returnee entrepreneurs to catch up with returnee firms and MNEs. If the answer was over three years, then there is a substantial technology gap between them. Following existing literature (Kokko, 1994; Sjoholm, 1999; Tian, 2007), technology gap (*Gap2*) was also measured by the ratio of the average labor productivity of returnee firms and MNEs in the same industry to the labor productivity of non-returnee firms in that sector. Labor productivity was measured by the ratio of sales value to the total number of employees. This measure captures the difference in productivity which may

cause by a difference in technology employed by returnee firms, MNEs and non-returnee firms.

Control variables

We controlled for firm *age* in years since founding, and firm *size* measured by number of employees (see Bonaccorsi, 1992 for a discussion). As the sample firms mainly fall into four sub-sectors that are broadly qualified as high-tech *industries*, including electronics and information technology with 49.5% of the sample firms, bio-engineering and new medical technology (17.5%), new materials (17.2%) and environmental protection technology (8.9%), we controlled for industry-specific effects by introducing dummy variables for firms from these sub-sectors.

A firm's own R&D activity may enable the focal firm to develop innovative capabilities that generate a high number of innovative outputs, such as patents (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). R&D not only contributes directly to enterprises' knowledge stock and increases innovation intensity (Damijan et al., 2006), but also improves firms' absorptive capabilities of adapting and applying the external technology stock (Cohen and Levinthal, 1990). In this sense, R&D activities play a dual role, developing innovations on the one hand, and enhancing the learning capacity of an organization on the other. Therefore, we control for investment in R&D as an important driver of innovation. *R&D intensity (RD)* was measured as R&D expenditure per employee.

Being embedded in social networks also gives entrepreneurs the opportunity to acquire information and ideas needed for innovation (McDougall et al., 1994). The importance of networks for learning and knowledge spillovers has been recognized (Kostova and Roth, 2002; Ahuja et al., 2008). Moreover, international linkages are important for obtaining leading-edge knowledge for firms in emerging economies to catch up with advanced

technology developed anywhere else (Simmie, 2003). Havnes and Senneseth (2001) find that entrepreneurs who are heavily involved in global networking are able to access information and knowledge. We control for the impact of global networks established by both returnee and non-returnee entrepreneurs on their firms' innovation. A *global networks (GN)* variable was constructed using three questions in our questionnaire. These seven point Likert-type questions focused on the degree of importance of three types of networks: (1) networks established in foreign markets; (2) contacts maintained with people in foreign markets; (3) membership of different associations abroad. Factor analysis confirmed that these three questions all loaded on one factor with eigen value exceeding 1.0. The cumulative variance explained was 84.64%.

To test our hypotheses, we adopted a count model approach as the dependent variable (patents) is a non-negative number. We estimated the Poisson regression model first and then tested over-dispersion. The result based on the approach suggested by Wooldridge (1990) shows evidence of over-dispersion as the coefficient of the predicted dependent variable is statistically significant at the 0.01% significance level. Therefore, we estimated a negative binomial model (Green, 1997).

To minimize the effect of common method variance, we took the following steps. First, multiple item constructs were used in our survey. Response biases are more likely to occur at the item level than at the construct level. In addition, our main hypotheses involve interaction effects. It is observed that complex relationships between the dependent and independent variables are not part of the respondents' theory-in-use (Chang, Witteloostuijn and Eden, 2009). This may help reduce the risks of common method variance. Finally, common method bias was tested by performing the single factor test proposed by Podsakoff and Organ (1986). We conducted a factor analysis with all the variables used in our study and obtained a

four-factors solution. The largest factor explained only 26.63% of the variance.

Empirical Results

Table 1 reports the descriptive statistics for the variables used in the analysis and the correlation matrix. The correlations between the variables show the predicted signs and most of the coefficients are statistically significant, providing preliminary evidence for the proposed hypotheses.

[TABLE 1 NEAR HERE]

First, we estimated the overall sample to test whether returnee entrepreneurs have had a direct impact on their firms' innovation performance or whether returnee firms perform better than non-returnee firms in terms of innovation. Second, we test whether possible knowledge spillovers from returnees to non-returnee firms affect innovation in non-returnee firms by including two returnee spillover variables for the subsample of non-returnee firms. The results for the whole sample summarized in Table 2 show that most of our hypotheses received support. Only control variables were included in Model 1 which shows that firm age and size are positively associated with innovation performance. This implies that large and well established firms tend to be more innovative than small ones. Hence, firm size positively affects innovative performance. Industry dummy variables are not significant, showing that the innovation performance of the sample firms is not industry-driven. Innovation performance is only weakly positively associated with in-house R&D (10% level), indicating that firms that invest more in R&D exhibit higher innovation than those that are weak in

R&D investment. The innovation performance of both types of firms is strongly related to global networks as the coefficient of this variable is statistically significant at the 1% significance level. This result suggests that firms with global networks are able to produce a high number of patents.

[TABLE 2 NEAR HERE]

The results in Model 2 indicate that returnee firms are more innovative than non-returnee firms and have better innovation performance as the coefficient of the returnee dummy variable is positive and statistically significant at the 0.1% significance level. The result implies that those returnee firms have exhibited a higher level of innovation than non-returnee firms which supports hypothesis H1.

Table 3 summarizes the results for the subsample of non-returnee firms by including the variable of returnee spillovers. The results in Model 4 and Model 5 in Table 3 show that returnee spillovers positively affect the innovation performance of non-returnee firms (significant at the 1% level), thus supporting H2a. The coefficient of the variable for MNE working experience is strongly positively and statistically significant (at 0.1% level), showing that MNE working experience is an important means of gaining external knowledge and new ideas by non-returnee firms as hypothesized in H2b.

Models 6, 7, 8 and 9 include the variables for the interactions between returnee spillovers, MNE working experience and a technology gap. The results show that the technology gap positively moderates the effect of returnee spillovers (measured by social interaction, Returnee spillovers 1) on non-returnee firms' innovation performance (significant at 5% level), providing support for H3a. This implies that the larger the technology gap, the

larger the magnitude of returnee spillovers to non-returnee firms. The coefficient of the interaction between MNE working experience and the technology gap is weakly negatively significant (10% level), which is consistent with H3b. This result suggests that the impact of MNE working experience is decreased with the size of a technology gap. The findings are consistent for both our measures of technology gap. The alternative measure for returnee spillovers produced an insignificant result of the interaction term in Model 9, showing that the impact of returnee density is unrelated to a technology gap. Taken together, the results show non-returnee firms extract more benefits from knowledge spillovers via through formal and informal contact with returnee entrepreneurs when a technology gap increases, whereas the benefits of MNE working experience is decreased with a technology gap.

[TABLE 3 NEAR HERE]

Discussion

This paper has examined the spillover effects of human mobility across national borders and MNE employee mobility on local innovation. Specifically, we considered the role of human mobility as represented by returnee entrepreneurs and of MNE working experience in providing the resources and capabilities to stimulate opportunity seeking behavior in the form of innovation by local firms. Using novel survey data, our results show that returnee firms are more innovative and perform better than non-returnee firms in terms of innovation. Hence, we have obtained evidence of direct knowledge transfer through returnee entrepreneurs. The results also show a positive association between our returnee spillover variables and innovation performance in non-returnee firms. This finding suggests that returnee firms have an indirect impact on non-returnee firms' innovation performance and act as a new channel for technological knowledge spillovers. Our results support the hypotheses

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built on social capital theory which emphasize the importance of networks and social interaction in obtaining external sources of knowledge and ideas needed for innovation. We have found that MNE working experience significantly and positively affects non-returnee firms' innovation performance. The result indicates that MNEs working experience is an important source of non-local knowledge which helps non-returnee firms overcome the disadvantages of being local only.

Importantly, however, we have found that the presence of a technology gap interacts differently with two channels of knowledge spillovers, namely returnee spillovers and MNE working experience. The result suggests that the presence of a technology gap positively moderates the effect of returnee spillovers on non-returnee firms' innovation performance. This finding implies that non-returnee firms that lag behind returnee firms are able to learn more from returnees, thus enhancing innovation in those firms. This positive moderating effect suggests that non-returnee entrepreneurs are able to absorb new knowledge and ideas from returnee entrepreneurs even though the technology gap is increased. Our results also show that the impact of MNE spillovers on non-returnee firms' innovation performance will be decreased when the technology gap between MNEs and non-returnee firms increases. It suggests that non-returnee firms may gain limited benefits from MNE working experience in the presence of a large technology gap. The reason for this different, we suggest, is that MNE working experience may be firm-specific and less transferrable, whereas returnee-firms and non-returnee firms share the same culture which may reduce barriers to knowledge transfer.

Taken together, these results suggest that returnee entrepreneurs are an important channel for international knowledge spillovers. Returnees not only contribute to their own firms' innovative performance, but also make an indirect contribution to those non-returnee firms. MNE working experience has a positive impact on non-returnee firms' innovation

performance and its impact is negatively moderated by a technology gap.

Our study makes a number of contributions to existing research. First, this study is among the few which compare the innovation performance of two groups of firms with different characteristics. Besides returnee entrepreneurs as a new channel for international knowledge and technology spillovers, this study also estimates the impact of MNE working experience on the innovation performance of local firms in high-tech industries. Second, our research extends the literature on international knowledge spillovers by adding a new channel for knowledge spillovers. We not only consider human mobility, such as returnee entrepreneurs and MNE working experience, but also incorporate social capital theory into the existing literature. This helps broaden the mechanisms which facilitate international knowledge spillovers. Importantly, we have found that the spillover effect from returnee entrepreneurs is positively moderated by a technology gap, whereas the spillover effect from MNE working experience is constrained by the technology gap. This finding suggests that the spillover effect from returnee entrepreneurs and previous MNE working experience varies with a technology gap and helps shed light on a tension in the technology gap literature about cognitive barriers to knowledge transfer. Our findings suggest that it is the nature of the conduit of knowledge spillovers that is important. Local non-returnee firms are able to extract more spillovers when they lag behind returnee firms due to negligible cultural barriers. However, they may gain from MNE working experience only when their firms are compatible with MNEs; this may be because MNE working experience is more firm-specific and thus less easily transferable. Hence, differences in organizational and cultural boundaries between non-returnee firms and MNEs may represent cognitive barriers to knowledge spillovers and hinter non-returnee firms to realize learning potential represented by a technology gap. Third, the findings from the study will provide new insights into the role of

human mobility in technological development in emerging economies and will help to advance the theoretical development of the new channel for knowledge spillovers and broaden our understanding of the factors affecting international knowledge flows.

The findings from our research have implications for policy makers and practitioners. For policy makers, attracting returnees from OECD countries may be an effective way of catching up with technological leaders in developed countries. Hence, providing incentives to induce returnees back to their home country will be able to benefit local firms and may provide a complementary approach to providing incentives for foreign firms to invest in emerging economies. For non-returnee firms, building partnership or networks with returnee firms and MNEs may represent a viable strategy to access external knowledge and ideas which are unavailable internally.

We acknowledge some limitations of the study which suggest further research possibilities. With respect to innovation performance, future studies should also consider organizational innovation which cannot be measured by patents and R&D only. As noted in the existing studies, patent counts have several shortcomings as a measure of innovation (Pavitt, 1985; Griliches, 1989; 1992). Also, our measures for knowledge spillovers from returnees and MNEs are limited. Due to data limitations, we used simplified dichotomous variables to capture the impact of returnee spillovers and MNE working experience, although we also used an alternative measure for returnee spillovers and obtained broadly consistent results. Future studies should investigate detailed mechanisms through which non-returnee firms gain knowledge spillovers from returnee-firms and MNEs, and examine how and which types of networks facilitate knowledge flows between different types of firms in an industrial cluster in detail. Moreover, further research is needed to examine the process and dynamic nature of indirect knowledge spillovers from returnee firms and MNEs to non-returnee firms

based on longitudinal datasets. We have identified the moderating roles of a technological gap, but measuring the gap poses major challenges. We built upon the existing literature that has used differences in labor productivity as a proxy for the technology gap by using a dichotomous variable concerning respondents' perceptions of how long it would take for non-returnee firms to catch up with returnee firms. Although our findings from both these measures were consistent, we acknowledge that they represent rather crude proxies. Future research may use more refined measures based on inter-firm differences in using modern production technologies and IT, or specific R&D processes. However, the possible trade-offs between obtaining data on these more refined measures and gaining access to respondents willing to provide this information should be recognized in this context (Hoskisson et al., 2000).

The study was restricted to a single science park in the Chinese context, notwithstanding that this is the largest science park in China and one that has attracted a large number of returning overseas Chinese. We also obtained a high response rate for this kind of survey and, quite unusually for studies in an emerging market context (Hoskisson et al., 2000), were able to establish the representativeness of the sample. However, further research in China might extend to returnee entrepreneurs in science parks elsewhere such as Shanghai and close to Hong Kong where the nature of the technological context and returnee entrepreneurs' links abroad might be different. Additional research could also be extended to other emerging economies such as India, Central and Eastern Europe, and Latin America where returnee entrepreneurs have a notable presence.

Conclusions

Using novel survey data, this study is one of the first to examine the relationship between

returnee entrepreneurs, MNE working experience and firms' innovative performance and their role in knowledge spillovers in high-tech SMEs in a large emerging market. Our findings show that international knowledge transfer more often occurs in returnee firms and is strongly associated with innovation performance of their firms. The results show that international knowledge flows with human mobility. In the context of China as an emerging economy, the results show returnee entrepreneurs not only absorbed international knowledge, but also indirectly transferred their knowledge to non-returnee firms. MNE experience is positively associated with the innovative capacity of non-returnee firms. By highlighting the role of human mobility and returnee entrepreneurs in particular in facilitating both direct technology transfer and indirect technology spillovers to other non-returnee firms, our study has introduced new dimensions to both spillover and strategic entrepreneurship research.

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Table 1 Correlation Matrix and Descriptive Statistics

	Mean	Std. Deviation	Patents	GN	R&D	Returnee Spillover1	Returnee Spillover2	GAP1	GAP2	MNEs	Age
Patents	1.709	2.382	1.000								
GN	0.041	0.478	0.031	1.000							
R&D	137.485	68.188	0.004	0.053	1.000						
Returnee Spillovers1	0.608	0.491	0.157	0.160	0.103	1.000					
Returnee Spillovers2	0.001	0.001	0.069	0.007	-0.029	0.257	1.000				
GAP1	0.165	0.373	0.198	0.154	0.001	0.243	0.090	1.000			
GAP2	1.187	3.617	-0.017	0.112	-0.045	0.050	0.047	0.016	1.000		
MNEs	0.344	0.475	0.133	0.229	0.014	0.283	0.057	0.224	-0.093	1.000	
Age	4.613	0.641	0.091	0.086	0.078	-0.024	0.011	0.044	0.003	0.039	1.000
Size	2.515	3.953	0.091	0.246	0.142	0.021	0.158	-0.021	0.318	0.198	0.144

All correlation coefficients more than 0.13 or less than –0.13 are significant at 5% level or higher.

Table 2: Direct Knowledge Transfer for the whole sample
Dependent Variable: Patents

Variables	Model 1	Model 2
Control Variables		
Age	0.026	0.023
	(0.022)	(0.021)
Size	0.699***	0.698***
	(0.057)	(0.058)
R&D	0.001†	0.001†
	(7.74E-05)	(7.95E-05)
GN	0.532***	0.336**
	(0.117)	(0.122)
Independent Variables		
Returnee firms		0.464***
		(0.111)
Industry dummies	included	included
Adjusted R^2	0.13	0.20
Observations	711	711

Notes: ***, **, * and † represent the 0.01%, 1%, 5% and 10% significance levels.

Table 3 Knowledge Spillovers from Returnee firms to Non-returnee Firms
Dependent variable: Patents of non-returnee firms

Variables	Model 3 Coefficients (Std. errors)	Model 4 Coefficients (Std. errors)	Model 5 Coefficients (Std. errors)	Model 6 Coefficients (Std. errors)	Model 7 Coefficients (Std. errors)	Model 8 Coefficients (Std. errors)	Model 9 Coefficients (Std. errors)
Control Variables							
Age	0.034*** (0.014)	0.019 (0.039)	0.009** (0.015)	0.009 (0.042)	0.031 (0.062)	0.002 (0.041)	0.184 (0.070)
Size	0.799*** (0.034)	0.682*** (0.107)	0.517** (0.044)	0.676*** (0.113)	0.665*** (0.115)	0.651** 0.106	0.736** (0.114)
R&D	4.58E-05 (0.001)	4.32E-05 (0.001)	2.16E-05 8.20E-05	2.39E-05 (0.001)	7.07E-0.5 (0.001)	2.68E-05 (0.001)	1.92E-05 (0.001)
GN	0.152 (0.119)	0.096 (0.248)	0.085 (0.121)	0.017 (0.263)	0.076 (0.269)	0.072 (0.246)	0.124 (0.253)
Independent Variables							
Returnee Spillovers1		0.478** (0.202)		0.021 (0.386)	0.815*** (0.235)		
Returnee Spillovers2			0.836** (0.344)			1.672** (0.905)	0.891** (0.967)
MNEs		1.729*** (0.211)	1.993*** (0.161)	2.082*** (0.307)	1.611*** (0.226)	1.578*** (0.312)	1.929*** (0.297)
RS1*GAP1				0.717* (0.424)			
MNEs*GAP1				-0.582† (0.343)			
RS1*GAP2					0.361* (0.234)		
MNEs*GAP2					-0.068† (0.053)		

RS2*GAP1						0.487† (1.435)	
MNE*GAP1						-0.341 (0.335)†	
RS2*GAP2							0.108 (0.218)
MNE*GAP2							-0.075 (0.055)
Industry dummies	included	included	included	Included	Included	Included	Included
Adjusted R^2	0.13	0.17	0.19	0.23	0.14	0.17	0.10
Observations	369	369	369	369	369	369	369

Notes: 1. RS1 and RS2 represent the variables of Returnee spillovers1 and Returnee spillovers2.

2. ***, **, * and † represent the 0.01%, 1%, 5% and 10% significance levels.