Brain circulation? British and Indian scientists in Boston

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Abstract

This article argues that despite the growing emphasis on brain circulation, most British and Indian scientists are still contributing to a brain drain in their home countries. I show that although the majority of respondents have regular, albeit different kinds of business contacts with their home countries, this has yet to translate into significant personal investments. Although most British and Indian scientists do not forge social contacts with professionals in their home countries, I suggest that such links could help induce investment in the UK and India in the future.

KEYWORDS: highly skilled migrants; social networks; brain circulation; British scientists; Indian scientists

Introduction

Highly skilled migrants are increasingly becoming the focus of academic research (Beaverstock 2002, 2005; Borjas 2005; Florida 2005; Iredale 2001; Kennedy 2004; Khoo *et al.* 2007a, 2007b; Koser and Salt 1997; Martin 2003; Meyer 2001; Millar and Salt 2008; Montgomery 2008; Robinson and Carey 2000; Salt 1997; Saxenian 2006; Scott 2007; Vertovec 2002; Yeoh and Willis 2005a, 2005b; Zaletel 2006; Zhang 2003). Many of these accounts have analysed the impact that different highly skilled migrant groups have made upon national and regional economies.¹ What has remained relatively unexplored, with a few notable exceptions (Newbold 2001; Newbold and Bell 2001; Iredale *et al.* 2003; Saxenian 2006; Chacko 2007; Larner 2007; Williams 2007), is whether highly skilled migrants are investing in their countries of birth. This is important because highly skilled migrants have the potential to make a significant impact upon the economies of their home countries.

This article analyses the investment patterns of British-born and Indian-born scientists working in Boston's pharmaceutical and biotechnology sectors. There is segmentation within the British and Indian population with a significant proportion of respondents travelling, collaborating and conducting business in their home countries, while a significant proportion have no business contacts with their home countries. Although British respondents conduct more business in the UK than Indian respondents do in India, and travel more frequently for business purposes to their home country, they exchange significantly less job, business and technological information with professionals

in their home country. This suggests that the process of brain circulation might be different between British and Indian scientists. However, Indian scientists show a greater desire to invest in their home country than British scientists, owing to recent high levels of economic growth in India. This is important because it suggests that Indian scientists will contribute more to the economic development of India than British scientists will to the economic development of the UK in the future.

Review of the literature

Brain Circulation

Scholars have tended to use the terms 'return migration' and 'brain circulation' interchangeably when in fact they describe different processes. Even Saxenian (2006) who employs the phrase 'brain circulation' frequently seems to use it interchangeably with 'return migration.' In the section *From Brain Drain to Brain Circulation* for example, she does not mention the phrase brain circulation once, but refers to returning entrepreneurs on several occasions (Saxenian 2006, pp. 18-21). I argue that brain drain is the continual loss of highly skilled individuals to particular countries, while other countries experience marked gains of such highly skilled individuals. This is distinct from return migration which describes people who emigrate to another country and at a later date return to their country of birth. Brain circulation describes highly skilled migrants who move in and out of their host and home countries for business, work and investment purposes.

Traditionally, the literature on highly skilled migrants has focused on the brain

drain of talent away from developing countries. Saxenian (2006, pp. 18-19) argues that theories should move beyond the brain drain because developing countries are now starting to benefit in significant ways from the investments of their emigrants:

The picture today is different. The countries that suffered most from postwar brain drain – especially Taiwan, Israel, India, and China – are those that now benefit most directly from the rise of the new Argonauts. [...] Returning entrepreneurs typically attempt (with varying success) to transfer venture capital finance, merit-based advancement, and corporate transparency to economies with traditions of elite privilege, government control, and widespread corruption. They seek to create team-based corporate cultures with minimal hierarchy in environments that are dominated by family-run or state-owned enterprises.

Saxenian (2006) argues that these new Argonauts are foreign-born, technically skilled serial entrepreneurs who travel in and out of Silicon Valley and their home countries, starting-up ventures and companies. Similarly, Waters (2007, p. 480; original emphasis) finds that her sample of Western-educated professionals in Hong Kong and Vancouver “[...] have the advantage of embodying various cosmopolitan traits, of being tied into particular transnational social networks, *and* of having an intimate (and unaided) understanding of the local market.” Vertovec (2002, p. 7) also shows that the approach towards the brain drain is beginning to change as policymakers understand the importance of the global marketplace as well as national economies:

With the recognition of networks of skilled worker circulation, many social scientists and national policymakers have tended to shift from a discourse of 'brain drain' to notions of the globalization of human capital, brain exchange, brain circulation and the creation of a global mobile workforce.

The OECD (2002) has also recognised the importance of encouraging the circulation of skilled workers, as well as policies promoting skilled workers abroad to remain in contact with their home countries. The Indian government, for example, has attempted to promote brain circulation through “two concrete, proactive steps: (1) ruled to allow dual citizenship for NRIs [Nonresident Indians] and (2) established a new ministry for the singular purpose of serving the needs and eliciting the support of NRIs” (Patterson 2006, p. 1900).

Although there has been some academic analysis on the importance of brain circulation (Vertovec 2002; Iredale *et al.* 2003; Saxenian 2006; Larner 2007), there is relatively little understanding of how extensively highly skilled migrants are travelling between sending and receiving countries for business and work purposes and whether this level of travel impacts upon investments they make in their home countries. Iredale *et al.* (2003) argue that highly skilled migrants cannot drive economic change, but will start to invest in their home countries when change has already started to take place. Jones (2007, p. 235) explains that acquiring new businesses in overseas locations is a difficult but important strategy for law firms in London because such business networks rely on face-to-face contact for trusting relationships between lawyers and clients, as well as for maintaining an ongoing copresence in legal services. This suggests that social networks are critical in influencing overseas investments in firms and highly skilled migrants.

Brain circulation may occur because of both spatial and temporal factors. On a spatial level, migrants may invest in a region owing to its geographic characteristics such as a good supply of skilled labour, low rental costs, and a lack of government restrictions

involving expanding businesses. However, brain circulation is also a process about time because people migrate at particular periods of their lives (Roberts 1995). Although Saxenian (2006, p. 347) demonstrates how 40 per cent of her respondents travel to their home countries at least once a year for business purposes and 5 per cent travel at least five times a year for business purposes, many of her respondents are not participating in brain circulation:

Taiwanese respondents stood out in this regard, with only 36 percent reporting that they *never* traveled home for business, compared to 56 percent of Chinese and 48 percent of Indian respondents who never traveled home (Saxenian, 2006, p. 348; original emphasis).

Thus, it seems reasonable to assume that there is only a limited level of brain circulation that people can participate in if they are only returning to their home country for business once a year (40 per cent of Saxenian's sample). In short, the vast majority of Saxenian's (2006) respondents are not travelling to their home countries more than once a year for business purposes. Iredale *et al.* (2003) also argue that countries such as China, Bangladesh and Vietnam are experiencing significant brain drain abroad, although Taiwan is currently experiencing brain circulation. Therefore, to what extent can we theorise more generally that brain drain is shifting to brain circulation?

Although brain circulation among migrants from developing countries has received a fair amount of attention (Meyer 2001; Hardwick 2003; Dzvimbo 2003; Saxenian 2006), the investments of highly skilled migrants from developed countries has received very little recent academic attention. Larner (2007) is one of the few exceptions. She argues that the

New Zealand government has made strong attempts to forge links with its highly skilled expatriates or '[...] "A-listers" who might add profile to New Zealand and New Zealand companies (p. 341), and shows that the New Zealand government encourages all 'World Class individuals' to participate in this transnational social network known as the 'Kiwi Diaspora'. She further argues that these types of transnational social networks are important for helping induce competitiveness and entrepreneurship. However, as Faist (2008, p. 30) points out, we know little about how expatriates actually facilitate brain circulation:

We need to know more about how business persons act as brokers, as communities in between, sometimes called 'transnational workers' or 'temporary returnees' who work in emigration and immigration regions and play a role as middlemen linking businesses in the two regions with their personal networks and technological and market know-how.

Although these social networks are potentially important, it is questionable how prevalent and significant transnational social networks have been to date for all highly skilled migrant groups.

Methodology

This article is part of a wider project on highly skilled migrants and social networks. It is not clear from the theoretical literature whether highly skilled migrants from developed and developing countries differ in the investments they make in their home countries.² British and Indian scientists were chosen not only to make this comparison, but

also because there is a similar representation of both groups residing in Boston, according to the US Census Bureau (2000). Boston was selected as the case study location because like Silicon Valley, it is one of the leading high technology clusters in the US and hosts a significant proportion of foreign-born inhabitants (25.8 per cent). Yet, surprisingly, little research has been conducted on the role of highly skilled migrants within this regional economy.

Interviews were chosen as the principal method of data collection. A large proportion of respondents held senior management positions and were unwilling to spend much time answering questions. Therefore, it was decided before the fieldwork that structured interviews would be the most effective method for obtaining the highest quality data in a short time span. This method also meant that the interviewer could encourage respondents to expand and provide more detailed responses to open-ended questions.

A total of one hundred and one British-born and one hundred and one Indian-born migrants working at large, medium and small firms³ were interviewed. The interviews were conducted between January and June of 2006, with the majority taking place over the telephone (60 per cent) and the remainder in person (40 per cent). Face-to-face interviews were preferred over telephone interviews since responses tended to be more detailed and candid. Having said this, there was no significant difference in the quality of the data obtained from face-to-face and telephone interviews.

The average age of British respondents was 42 and the average age of Indian

respondents was 39. The age distribution of British and Indian scientists was similar, but more Indian scientists were in the 26-35 age range and more British scientists were in the 46-55 age range. 18 per cent of the British sample and 28 per cent of the Indian sample were women. All British and Indian scientists held high educational qualifications. Most British and Indian scientists held a Ph.D or an M.D. with the remaining respondents holding at least master's or bachelor's degrees. British respondents held significantly more senior management positions, particularly in the Vice-President category, compared to Indian scientists who held significantly more junior positions.

A number of avenues were pursued for gaining access to respondents. First, since no formal register of foreign-born scientists working around Boston exists, some key gatekeepers in the life sciences sector were contacted. Second, through participating in a number of conferences, workshops, and networking events, as well as attending a range of social and sporting events, a large number of other respondents were contacted. Third, snowballing contacts at the end of an interview was a further important method of gaining access to British and Indian scientists. This proved an effective means of contacting foreign scientists because the referrer was confident in the ethics of the research and less concerned that the interviews would take up excessive amounts of time. This article uses pseudonyms to protect the identity of respondents. In addition, the names of companies are not provided for confidentiality reasons, but the type and size of the company (e.g. small, medium, large pharmaceutical or biotechnology company) is stated.

Investing in home country

Sharing Professional Information with People in Home Countries

This section argues that transnational social networks have a critical influence on the level of brain circulation. Saxenian (2006) argues that the social networks that individuals hold with different actors in their home country can influence them to invest in that country. Larner (2007, p. 340) also shows that transnational social networks can help “[...] to generate a “pool of altruism” made up of advice, contacts and experience that can assist future efforts’ to invest in countries.”

Before analysing the extent to which highly skilled migrants invest in their home countries, it is important to see how frequently they exchange different types of business information with professionals in their home countries, as well as how often they travel to their home countries for business purposes. This is significant for two reasons. First, it is part of the brain circulation process because highly skilled migrants are contributing to investments in their home countries on behalf of their employers. Second, it could suggest that there is a positive linear correlation between the frequency of business information that highly skilled migrants exchange with people in their home country and the amount of business they personally conduct in that country. Saxenian (2006) shows that a number of Chinese and Indian engineers in Silicon Valley exchange business information with people in their home countries and regularly travel to those countries. She argues that many of these people have subsequently collaborated, made investments, and started

companies in their countries of birth.

Table 1

Most British respondents exchanged professional information with people in their home country highly infrequently. Table 1 shows that the mean British respondent, for example, exchanged job information once a year, business information three times a year and technology information three times a year. Furthermore, the standard deviation was high for all three sets of results, showing a high dispersion of results from the mean. Many British respondents said that they exchanged zero information about jobs (58 per cent), business (40 per cent) and technology (33 per cent), while a small proportion (1 per cent for jobs, 6 per cent for business and 7 per cent for technology) exchanged such information at least twelve times a year (see Table 2). In short, most British respondents exchanged little professional information with people in the UK. It is argued here therefore that they would be less likely to contribute to brain circulation.

Table 2

Indian respondents exchanged professional information with people from their home country more frequently than British respondents. Table 1 shows that the mean Indian respondent exchanged job information four times a year, business information nine times a year and technology information twelve times a year. Again, the standard deviation of results was high. Many Indian respondents exchanged zero information about jobs (48 per cent), business (54 per cent) and technology (35 per cent), while a

moderate proportion (10 per cent for jobs, 12 per cent for business and 17 per cent for technology) exchanged such information at least twelve times a year (see Table 2). Although most Indian respondents exchanged little professional information with people from India, a significant proportion of respondents exchanged information highly frequently.

The results above show that Indian scientists exchange more professional information with people in their home country than British scientists. This suggests that transnational social networks are more important for professional purposes for Indian scientists than British scientists. Insufficient research has been conducted on whether highly skilled migrants from developed and developing countries differ in the extent to which they participate in transnational social networks for job, business, and technological purposes. The evidence from this research indicates that highly skilled migrants from developing countries exchange more professional information with people in their home countries because of growing economic opportunities and because they want to maintain the option of returning there in the future. My sample of British and Indian scientists showed similar although less frequent trends to Saxenian's (2006) sample in that a small, but significant number of highly skilled migrants are talking about professional opportunities with people in their home country. She shows that 80 per cent of her sample of foreign-born engineers and professionals in Silicon Valley exchanged job, business, and technological information with professionals in their home country, with more than 20 per cent of her Chinese and Indian sample exchanging such information on a regular basis (Saxenian 2006, p. 347). This is important because it suggests that highly skilled migrants

that maintain transnational social networks with different professionals in their home country are more likely to contribute to brain circulation.

Travelling to Home Countries

British and Indian scientists varied significantly in the frequency that they travelled to their home countries for business purposes. The average British respondent and the average Indian respondent had travelled to the UK and India six times and once, respectively in the last three years. However, the dispersion of results was high. Table 3 shows that 31 per cent of British respondents and 81 per cent of Indian respondents travelled to their home countries zero times in the past three years for business purposes. In comparison, 13 per cent of British respondents and 1 per cent of Indian respondents had travelled to their home countries at least fifteen times in the last three years. These differences are important because 50 per cent more British than Indian scientists are travelling to their home country for business purposes. This suggests that British scientists are given more opportunity to travel to their home country for business than Indian scientists.

It is questionable how important geographic proximity to the home country is in influencing all business travel. Boston, for example, is relatively close to London (a distance of 3,275 miles) and there are important economic, social and historical ties between both cities. As a result, there are a number of airlines that operate between both cities which reduce the cost of air travel and therefore facilitate trans-Atlantic business collaborations. Having said this, five per cent of Saxenian's (2006) Indian sample in Silicon

Valley (a distance of 8,712 miles from Bangalore) compared to one per cent of my Indian sample in Boston (a distance of 8,135 miles from Bangalore) have travelled more than fifteen times in the last three years to India for business purposes. Therefore, geographic proximity is not always important in influencing business travel because the types of highly skilled migrants who travel for business purposes (e.g. Argonauts) are able to afford the higher costs of travel.

The frequency of business travel is also likely to be affected by the sector. In the pharmaceutical and biotechnology sector, for example, it is costly, time-intensive and complicated to collaborate because scientists are often restricted to obtaining results in the laboratory. In contrast, in the ICT sector, engineers can write software and programmes remotely using laptops. As a result, scientists are more geographically restricted in where they collaborate compared to IT workers. Although differences in sector might explain why Saxenian's (2006) Indian sample travelled more to their home country than my Indian sample, it does not explain why British and Indian scientists in Boston differed in how frequently they travelled to their home countries for business purposes.

This research found that highly skilled migrants who hold senior positions within companies are more likely to travel and make personal investments in their home countries than more junior workers. Although 31 per cent more British scientists hold CEO and Vice-President positions than Indian scientists, this is not the only explanation for the strong difference in business travel. As the next section shows, pharmaceutical and biotechnology companies around Boston hold more collaborations in the UK than in India,

meaning that there has been greater demand to send British scientists abroad for business purposes. However, this trend appears to be changing.

Scholars argue that frequent travel between different countries is an important strategy for maintaining productivity in different global locations. Jones (2007, p. 230) argues that face-to-face contact is vital for promoting transnational operations:

[...] a variety of different face-to-face interactions play an essential role in ensuring that firms continue to maintain all the day-to-day activities which are intrinsic to ongoing business operations: for example, the running of factories, hiring of sufficient employees or relating to suppliers and markets.

Millar and Salt (2008, p. 34) also find that business travel is an essential type of corporate mobility which their extractives and aerospace firms relied upon regularly. Despite improvements in virtual mobility tools such as teleconferencing, they find that there has been a limited reduction in business travel. Business travel is important because it helps to maintain key business relationships. Millar and Salt (2008, p.42) further suggest that: “[...] the penalties for inadequate relationship building are high in terms of loss of business and participation in complex supply-chain networks. Maintaining trust and goodwill generates high volumes of business travel”. In addition, according to Faist (2008, p.30), face-to-face contact still helps to build the trust needed to close deals.

My results above complement Saxenian’s (2006) findings in that only a small proportion of highly skilled migrants travel frequently to their home countries for business purposes, while a much larger proportion of migrants do not travel to their home countries for business at all (see Table 3). My data show that a sizeable proportion of

British respondents (13 per cent) travelled to their home country for business purposes compared to only a very small proportion of Indian respondents (1 per cent). This suggests that British scientists may be making important contributions to economic development in the pharmaceutical and biotechnology sector in the UK compared to the limited impact that Indian scientists are making in this sector in India. Similarly to Saxenian's (2006) sample, my results indicate that highly skilled migrant groups differ significantly in the level they travel to their home countries for business purposes. This is telling because migrant groups that have a larger number of people travelling frequently to their home country for business purposes are arguably more likely to contribute to economic development in their home country. The fact that only one Indian respondent regularly travels to India for business purposes suggests that brain circulation for Indians working in the pharmaceutical and biotechnology sector around Boston is much less significant than Indians working in the ICT sector around Silicon Valley. This is important because there are clearly group, sector and regional differences in the extent to which highly skilled migrants participate in brain circulation. However, as will be discussed shortly, Indian scientists argue that business opportunities are rapidly growing in India, which may lead to greater brain circulation in the pharmaceutical and biotechnology sector in this country in the future.

Table 3

Company Collaborations

The collaborations that companies hold with other companies, universities and

organisations in countries abroad will arguably increase the likelihood of highly skilled migrants investing in those countries. Saxenian (2006, p. 350) argues that highly skilled migrants with their own businesses in Silicon Valley had formed “[...] subsidiaries, joint ventures, subcontracting, or other business operations in their home countries to exploit their privileged access to the market, low-cost skill, and other resources.” It is argued here that highly skilled migrants who do not own their own company but who work for a company that has business operations in their home country, are more likely to conduct their own business and invest in that country than if their company did not have any collaborations in that country. Beaverstock (2002; 2005) hints at this process taking place at a firm level. He argues that investment banks, management consultancies and law firms encourage their British expatriate workers in Singapore and New York to conduct business with clients and companies from the UK. Jones (2007) argues that acquiring new business in overseas markets is a difficult but important strategy for British law firms. Thus, regular face-to-face contact is vital:

The substantial growth in business travel reflects the necessity of face-to-face at all stages of legal work. In terms of acquiring business, in legal services, the ‘products’ being offered to clients are often complex pieces of legal work and it takes a considerable amount of detailed face-to-face discussion for both parties to establish whether the required service can be provided adequately (Jones, 2007, p. 235).

Arguably once a company has established links with institutions abroad, employees, particularly highly skilled migrants, are then encouraged to use their transnational social networks for investment purposes. Graph 1 shows that 67 per cent of British and 54 per cent of Indian scientists in Boston said their employer had

collaborations with organisations in their home country. A further 71 per cent of British and 52 per cent of Indian scientists said that their companies held sub-contracts in their home countries. In addition, British and Indian respondents said that these collaborations had been formed recently (a median of 2002 and 2004, respectively). The fact that most respondents worked at companies that held recent collaborations with organisations in the UK and India suggest that business and investment in both countries is significant. I would argue that transnational business networks help promote these collaborations. Saxenian (2006; p. 283) supports this position, arguing that the eventual success of Hewlett Packard and Texas Instruments opening software development centres in India, for example, caused Indian expatriate entrepreneurs and managers to become more confident in the potential business opportunities available in the country.

Graph 1

There was a distinct geographic clustering of business collaborations in the UK and India. The vast majority of business collaborations in the UK (80 per cent) were located in the Southeast and East Anglia region. In particular, business collaborations were clustered around the cities of London, Oxford and Cambridge. Most business collaborations in India (80 per cent) were located in the South⁴ and in particular in the cities of Hyderabad, Mumbai and Bangalore. This is important in terms of social networks because my respondents argued that their companies invest in regions where they perceive there to be excellence in pharmaceutical and biotechnology research. Beaverstock (2002) and Saxenian (2006) argue that highly skilled migrants are encouraged to invest on behalf of their

companies in regional economies that demonstrate economic strength in particular sectors. This perception is influenced by transnational social networks with professionals abroad who ease the process of collaborating. Further research is needed to link the transnational social networks of highly skilled migrants with economic development in their home countries.

Table 4

Personal Investments

Having identified how frequently British and Indian scientists travel to their home countries and exchange professional information with people in their home countries as well as how many of their employers hold collaborations with organisations in their home countries (see Table 4), one would expect a similar proportion of people from both groups making their own investments in their home country. In my research, 24 per cent of British and 18 per cent of Indian respondents said that they had made personal investments in their home country (see Table 5). Although on the surface this appears a significant number of people making personal investments in their home countries, responses show that the nature of investments were very minor and mostly only included small investments in stocks and shares in British and Indian pharmaceutical and biotechnology companies. Zero British respondents said that they had started a company in the UK, or invested directly in angel investments or venture capital funds. For example, Nigel Thompson, Director of a large pharmaceutical company, said that he had investments in pharmaceutical and biotechnology companies, but these were made when he was working

in the country and he had made no recent investments since he moved to the US four years ago.

Zero Indian respondents have made significant investments in India's pharmaceutical and biotechnology sector. However, they have made more recent minor investments in their home country compared to British respondents, suggesting that the process of brain circulation is gradually becoming more important in India compared to the UK. This trend is strengthened by 89 per cent of Indian respondents, as compared to 76 per cent of British respondents, expressing a strong interest in making personal investments in their home country in the future (see Table 5). Alpana Suresh, Director of a large biotechnology company, like many Indian respondents talking about their personal investments, said: "I think it's inevitable we will. It's not a matter of if, but when."

Table 5

The above results are highly important because they show that British and Indian scientists are not making significant personal investments in the pharmaceutical and biotechnology sector in their home countries. In contrast, Saxenian (2006, p. 309) argues that a small number of "Successful Indian entrepreneurs from the United States also invested actively in Indian technology start-ups, both directly as angel investors and indirectly through commitments to venture capital funds, and they demonstrated their loyalty to their alma maters – universities like the Indian Institutes of Technology." One of the advantages of my interview-based research is that I could determine the nature of investments that respondents made in their home countries. Although a sizeable

proportion of people were making personal investments in their home countries, these investments were not significant in terms of the amount of money invested. My results, for example, show the presence of British-born and Indian-born serial entrepreneurs around Boston but these individuals have yet to make significant personal investments such as starting-up companies in their home countries. In light of my research findings, it appears that highly skilled migrants are not necessarily making significant investments in their home countries. As I mentioned above, arguably a key reason for this is because it is more difficult to collaborate and start-up companies in the pharmaceutical and biotechnology sector compared to other sectors such as ICT. Further research is needed to establish the extent of the investments that other highly skilled migrant groups are making in different sectors in their home countries.

My research shows there was a positive correlation between the age of respondents and their likelihood of making investments in their home country. In addition, respondents who conducted more company business with their home country, including travel, showed a greater propensity to make personal investments in that country. Respondents who hold senior management positions with greater levels of professional experience are more likely to invest in their home countries than workers at more junior positions. This supports microeconomic theory which argues that workers at more senior positions have greater access to accumulated wealth and are therefore more likely to make personal investments than workers with less accumulated wealth. Jones (2007, p. 237) also finds that senior lawyers tend to travel overseas more for business purposes than junior lawyers.

This research finds that Indian respondents have a significantly greater desire to contribute to the economic development of their home country than British respondents. In addition, Indian scientists perceive the economic opportunities in India as significantly more promising compared to the British scientists' general perception of economic opportunities in the UK. Table 5 shows that the mean Indian respondent, for example, ranked their desire to contribute to the economic development of their home country as eight in importance out of ten, compared to the mean British respondent who ranked this factor as five in importance. This suggests that there may be distinct differences between developed and developing countries in terms of brain circulation and expectations of how much expatriates should contribute towards economic development in their home countries.

I argue that highly skilled migrants from developing countries which are experiencing economic growth are more likely to invest in their home countries than highly skilled migrants from developed countries. Saxenian (2006) shows that many highly skilled migrants from developed and particularly developing countries (China, Taiwan, India, and Israel), working in Silicon Valley's ICT sector, have contributed to brain circulation. Her Indian and Chinese respondents also said that the opportunity to contribute to the economic development of their home country would be an important reason why they would invest (see Table 5). Iredale *et al.* (2003), on the other hand, argue that most Asian countries are still experiencing a brain drain. It is not clear from the literature, therefore, if there are differences between highly skilled migrants from developed and developing countries in terms of whether they are more likely to invest in

their home countries. My results suggest that highly skilled migrants from India were more likely to invest in their home country in the future than highly skilled migrants from the UK. The reason for this difference was firstly, the more optimistic perception of scientific research in India and secondly, the greater desire of Indian respondents to help contribute to the economic development of their home country compared to British respondents. Arguably highly skilled migrants from developing countries consider their investments as an important element of economic development in their home countries, particularly when these countries are experiencing significant economic transformation, whereas highly skilled migrants from developed countries see their investments less in development-oriented terms and more as an opportunity for personal gain. Further research is needed to understand these differences in personal investment patterns between highly skilled migrants from developed and developing countries.

Scholars argue that we should begin to analyse the process of brain circulation in addition to brain drain (Vertovec 2002; Iredale *et al.*, 2003; Saxenian 2006; de Haas, 2007; Larner, 2007). However, although a significant proportion of highly skilled migrants are investing in their home countries, it is argued here that the vast majority are still contributing to a brain drain. Specifically, most personal investments are on a small scale and distinctly different from the more significant investments that highly skilled migrants, in particular serial entrepreneurs in Silicon Valley, have made in start-up companies and venture capital funds (Saxenian, 2006). Having said this, Alarcón (1999) finds that Mexican and Indian scientists and engineers in Silicon Valley are contributing to a brain drain because few are returning or making significant investments in their home countries. The

rates of brain circulation are likely to be even lower in less established high technology regional economies where transnational social networks are weaker. Similarly to Saxenian's (2006) sample, the majority of my British and Indian respondents said that they would strongly consider investing in their home countries. However, I would argue that this is not necessarily a strong indicator of *major* future investments in these countries.

Conclusions

The type and frequency of business information that is exchanged between highly skilled migrants and people in their home countries is arguably a significant indicator of their desire to invest in those countries. In addition, the social relationships that are formed when highly skilled migrants travel to and collaborate with organisations in their home countries are also an important indicator of brain circulation. The fact that British and Indian scientists are investing in their home countries in a limited way, however, questions the full extent of brain circulation. Although the literature has emphasised the importance of brain circulation, I suggest that scholars focus on the brain drain as well because it is also germane in the context of highly skilled migration.

At least three quarters of British and Indian scientists have not made any personal investments in their home country. Although less Indian respondents have made investments in their home country, those that have invested have taken more advanced procedures to contribute to the economy of India, compared to the contribution that British scientists have made to the UK economy. In addition, 13 per cent more Indian than

British scientists considered making future investments in their home country and they also showed a much greater desire to contribute to the economic development of their home country. In short, Indian scientists were much more positive about the professional opportunities developing in India compared to British scientists who were predominantly negative about the professional opportunities available in the UK.

Although geographic proximity is important in influencing highly skilled migrants to invest in their home countries, I argue that it is not always critical. The type of sector is arguably more significant. Saxenian (2006), for example, cited more collaborations and personal investments in the ICT sector compared to my research in the pharmaceutical and biotechnology sector. Another important determinant of personal investment is the level of professional experience a migrant holds. Similarly to microeconomic theory, my results showed that respondents with higher levels of professional experience were more likely to invest in their home countries.

Theoretically the above findings are important because there have been few comparisons of brain circulation within the highly skilled migration literature. This research suggests that there may be key differences between migrants from developed and developing countries as well as between migrants working in different industrial sectors in terms of their transnational social networks, travelling patterns and intentions to invest in their home countries. I argue that greater transnational social networks between highly skilled migrants and different actors in their home countries, including family members, friends, professionals, government officials, and academics, can help induce higher levels

of brain circulation.

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NOTES

1 National and regional economies are difficult to conceptually define and separate (Storper, 1997). For the purposes of this paper, I do not separate national and regional economies because it is clear that highly skilled migrants have a positive effect on both the national and regional scale. Saxenian (2006), for example, argues that Indian engineers have made a positive impact upon national and regional economies in the U.S. Here, she is referring to the ICT sector in general in the US, as well as Silicon Valley's ICT sector. Any discussion of the 'impact' of highly skilled migrants on national and regional economies refers to their economic influence in terms of starting-up companies, creating jobs, making personal investments in companies, and contributing to the economic development of the high technology sector.

2 I recognise that the term highly skilled migrant is broad and I use it to include scientists, science business consultants, entrepreneurs, managers, and senior managers because I want to include people who hold a wide selection of job positions within the pharmaceutical and biotechnology sector.

3 I use the following categories to distinguish between different sized firms. Small firm: 0-49 employees; medium firm: 50-249 employees; large firm: 250 or more employees.

4 'South' India is understood here as anywhere that lies on or south of the latitude of Mumbai.

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TABLE 1

Mean frequency of British and Indian scientists by type of information they exchanged in a year

	British scientists	Indian scientists
Job information	1	4
Business information	3	9
Technological information	3	12

TABLE 2

Percentage of British and Indian scientists by type and frequency of professional information exchanged

Type of information	British scientists	Indian scientists
Job information		
(0/year)	58	48
(≥ 12 /year)	1	10
Business information		
(0/year)	40	54
(≥ 12 /year)	6	12
Technology information		
(0/year)	33	35
(≥ 12 /year)	7	17

TABLE 3

Percentage of British and Indian scientists who travelled to their home countries for business purposes in the last three years by frequency, in comparison to Saxenian's (2006) sample

	British scientists	Indian scientists	Saxenian's (2006) sample
≥ 15 times	13	1	5
0 times	31	81	Taiwanese respondents (36) Chinese respondents (56) Indian respondents (48)

TABLE 4

Percentage of professional connections between British and Indian scientists and their home countries

	British scientists	Indian scientists
Exchanged professional information ^a with experts at least 12/year	5	13
Company held collaborations	67	54
Travelled for business purposes at least fifteen times in the last three years	13	1

^aProfessional information was calculated as the mean of job, business and technology information.

TABLE 5

The importance of current investments, future investments and economic development in home countries

	British scientists	Indian scientists	Saxenian's (2002) sample
Percentage of respondents who have made personal investments in their home country	24%	18%	Indians (22%) Chinese (10%)
Percentage of respondents who would consider making personal investments in their home country in the future	76%	89%	n/a
How importantly on a scale of zero to ten respondents ranked their desire to contribute to the economic development of their home country	5	8	Indians (8) Chinese (7)

Graph 1: Percentage of British and Indian scientists who said their companies hold collaborations and sub-contracts in their home countries