ARTICLES

Redefining the Brain Drain: China's 'Diaspora Option'[*]

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For many years, China's government worried about the 'brain drain'. But beginning in 1992, China began to encourage students settled abroad to return for short visits and engage in various programmes on the Chinese mainland. Then, in 2001, the government adopted a new policy, encouraging overseas mainlanders to contribute to China's modernisation, even if they stayed abroad, and outlining various ways they could help China. This policy mirrors the strategies of other countries who encourage 'brain circulation' and develop a 'diaspora option' in order to overcome the loss of talented people. But what forms does this assistance take? Why do people contribute to China's modernisation while remaining abroad? What are the characteristics of those who 'serve China', as compared to those who do not? We employ data from a survey in Silicon Valley, as well as two Web-based surveys carried out in Canada and the US with mainland Chinese academics to answer these questions.

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Redefining the Brain Drain: China's 'Diaspora Option'

A GREAT DILEMMA confronting human resource development in non-industrialised states is the loss of human talent through the 'brain drain'. For a variety of reasons, including political instability, salary differentials, inferior research facilities, family complications including children's education, and the relative rewards of individual labour in the West relative to their home country, educated people from many Third World countries are pushed out of their homelands and pulled into the industrialised world (Glaser 1978).

Despite its authoritarian regime and relatively strict control over immigration policy, China has been no less vulnerable to this outflow of human talent compared to many developing states. Between 1978 and 2006, almost 1 million scholars went overseas, and approximately 300,000 had returned. Initially, most returnees were government sponsored, Visiting Scholars, who had little opportunity to find permanent employment abroad (Zweig and Chen 1995). Recently, and quite fortunately for China, a significant 'reverse brain drain' has emerged. While the annual increase in the number of returnees in the late 1990s was 13 per cent, between 2001 and 2002 it rose by 45 per cent. In 2007 approximately 40,000 students returned to China. For a developing country, that is no mean feat. Overall, however, the return rate has hovered around 25 per cent.

While much attention has focused on either the brain drain or the 'reverse brain drain, many who do not return can contribute to the economic development of their country of origin. Through what Meyer et al. (1997) call the 'diaspora option', many developing countries try to turn human capital, lost through the brain drain, into a positive force for development by encouraging overseas citizens or educational migrants to help their home country.

For many years, China's leaders, its academics and journalists were alarmed at the massive outflow of educated talent. Chen and Liu (2003: 22–23) employed the 'core–periphery model' to understand why developing countries such as China were losing brain power to the developed West, though they criticised the stagnant nature of the model for its inability to explain China's reverse brain drain. China's 'fever to go abroad' was also seen to result from the poor quality of university training, including equipment and the low quality of educators, relative to the West.[1] In 1999, one of every three postgraduate student was leaving China, and

among graduates from top universities, often 50 per cent were applying to study abroad. This grim situation left the country facing a severe talent shortage.[2] Using data on publications by Chinese scientists in 1995–2000, and their year of birth, Jin, Li and Rousseau showed that the brain drain created a research gap within China's scientific community; people between ages 28 and 36 were not publishing in China—in fact, many of them were not in China at all, but instead were abroad. Yet in most countries, this group forms the most productive age cohort in the natural sciences. China's lost scientific productivity, they conclude, is indeed great (Jin et al. 2004: 547).

By the mid- to late-1990s, elite views of the brain drain had come into alignment with this diaspora option. This paper shows how this policy of 'serving the country'—what the Chinese call '*wei guo fuwu*'—evolved. Using data from surveys of mainland professionals in Silicon Valley and mainland academics in the US and Canada, we outline the ways this new mainland diaspora is helping China. We then define the characteristics of those in the mainland diaspora who are bringing business opportunities, exchanging academic information and encouraging technology transfer from the outside world to China.

Reconceptualising the Brain Drain

For years, the developing world could do little but watch as its most talented citizens either went abroad to study or, having been trained at home, migrated to the West where they could find larger remuneration, better working conditions, more stable political systems and a more comfortable lifestyle. While China has suffered from the former situation, where Chinese students receive their graduate training abroad (that is, 'migrate then educate'), India has suffered from the more costly latter case, an 'educate then migrate' phenomenon (Kapur 2007).

In East Asia, Taiwan was the first to suffer this devastating loss of talent (Chang 1992), as tens of thousands of Taiwanese poured into the United States in the 1960s. During the 1970s and 1980s, an estimated 20 per cent of Taiwanese college graduates went abroad to attend graduate school, and, at the peak of the brain drain in 1979, only 8 per cent of students who studied abroad returned after completing their studies (O'Neil 2006). South Korea has faced a similar dilemma (Bang 1992).

Originally, the goal of these developing societies was to trigger a 'reverse brain drain', whereby the talented would bring back their knowledge and enhanced human capital, putting it to work for their home country. As a result of a series of policies aimed at attracting hi-tech entrepreneurs home, Taiwan and South Korea underwent a reverse flow in the 1980s and 1990s. China, too, has been relatively successful, as the booming domestic market has attracted entrepreneurs who have access to technology that is absent in China (Zweig et al. 2006).

This third alternative has emerged recently. The 'diaspora option' reconceptualises the brain drain and the migration of scientific personnel, seeing it less as a permanent exodus or loss to the home country, but more as a form of 'brain circulation', where talent goes abroad but information circulates back to the individual's country of origin (Gaillard and Gaillard 1997). Through scholarly, business and educational exchanges, educational migrants who prefer to stay in the host country, are finding ways to participate in the economic and scientific development at home. This way, scientific collaboration ensues without people in the diaspora uprooting their lives and moving back home (ibid.: 218).

Since many of these countries, particularly poorer ones in Africa or Latin America, lack the financial wherewithal or market strength to trigger a significant return flow, the diaspora option is critical to narrowing the North–South scientific gap. Gaillard and Gaillard (2003) hope this model can solve Africa's scientific crisis. According to Meyer et al. (1997), Colombia's diaspora option—the Caldas Network, or the Colombian Network of Scientists and Engineers Abroad—shows developing states how a broad-based strategy of linking with scientists who remain overseas can play an important role in S&T development. For Dickson (2003) the high cost of the brain drain and the difficulty triggering a reverse brain drain in much of the Third World makes the diaspora option a moral necessity.

The Taiwanese and Hong Kong Chinese were the first in Greater China to follow this strategy. Many transnationals, known as 'astronauts' (*taikong ren*), left their families in Los Angeles, San Francisco or Vancouver and re-established firms back home, strengthening business networks across the Pacific (Chan 2002). Saxenian et al. (2002) show that many Taiwanese and Indian firms in Silicon Valley actively promote global networks that link California and the home country of the immigrant professionals.

As early as 1992, Chen Shujin, a researcher at China's Academy of Social Sciences (CASS), writing in *Keji Daobao* (Science and Technology Review), called on the Chinese government to translate and publish in China important articles written by mainlanders who were not immediately returning to China. He called on their original home units in China to re-establish ties with them and invite them back to speak. He also called on state-owned firms to learn from Taiwan and hire overseas mainlanders as sales representatives for their companies, alleviating these overseas Chinese who often had low-paying jobs (Chen 1992: 54–55). In 1996, Lin Qitan, a researcher at the State Council's Development Research Centre, in Shanghai, called on Shanghai to evaluate the conditions and tap into the deep pool of mainland talent—what he called the 'Think Tank of Overseas Chinese'—to help the city promote its economic development. He also called for establishing a Chinese language journal to make their articles available to researchers in China (Lin 1996: 17).

Some Chinese observers discussed this strategy in 1999. For example, Wang Xi, then teaching at Indiana University of Pennsylvania, argued that many mainlanders staying abroad were working on 'bellwether projects'; yet they were willing to exchange information with friends and colleagues in China. He called on the government to set up a data bank of students abroad, establish long-term stable exchanges with them, and collate their research achievements that are in the public realm (Wang 2000). Thus, China has begun to benefit from this diaspora option as more and more scientists and professors with established positions overseas, including people employed in businesses or running their own companies, are developing businesses in China. Chen Xuefei et al. (2003: 83) estimate that 25 per cent of mainlanders currently working abroad are 'serving the country' in some form.

Promoting this diaspora option is a key innovation of the Chinese government in its recent S&T and human resource policies. It began in the mid-1990s, with the 'spring light project' (*chunhui jihua*), which brought overseas mainlanders back for short-term visits, while the government formulated a policy breakthrough in 2001 with its '*wei guo fuwu*' ('serving the nation') strategy. This Chinese version of the diaspora option, outlined in greater detail later, can lessen the brain drain by turning a potential loss into a significant gain.

The Chinese Government's Policy Towards Those Who Study Abroad

The Chinese government's attitude towards mainlanders who studied abroad, but did not return (*liu xue renyuan*), has undergone a sea change.[3] Table 1 lists different policies put forward by various ministries and commissions to attract scholars to help the nation, even if they do not return.

In 1988, when central leaders first realised the scale of the brain drain, officials in the State Education Commission advocated severely constraining the outflow.[4] The State Science and Technology Commission, however, believed that people who stayed abroad would more easily gain access to American technological skills. And while the Ministry of Personnel worried that a massive inflow of talented people would create a crisis in the labour market, then Party Secretary Zhao Ziyang reportedly portrayed the brain drain in a positive light, calling it 'storing brain power overseas'.

The flow of returnees stalled after the Tiananmen crackdown of June 1989, as a leftist lurch in government policy portrayed overseas students who protested in the West as 'class enemies'. But in January 1992, after Deng Xiaoping called on overseas students to return, promising them that all would be forgotten if they avoided future anti-government activity, policy liberalised considerably (Jiao 1999: 72–74). In November 1993, a twelve-point slogan on returnee policy emphasised getting people back and offered them the 'freedom to come and go' (*lai qu ziyou*) after they had returned,[5] the first hint that the state would allow mainlanders to flow in and out of the country (see Table 1).

In 1992, the government also began to encourage overseas students to visit China, to benefit from their knowledge and to show them how China had changed. Between 1992 and 1995, the Ministry of Education (MOE) helped over 1,200 people return and 'serve the country' in some form (China Scholars Abroad Electronic Board, undated). In 1996, in response to a successful visit by a group of mainland students studying in Germany, the 'spring light project' (*chun hui jihua*) went into an experimental stage, and in 1997 was officially established, offering financial support for short-term visits (Zi 2003). The programme reportedly paid for one-way tickets only, assuming that overseas scholars could use their research grants to go abroad again.[6]

While 600 scholars came in 1997, the programme was expanded in 1998, funds were added, and the government actively encouraged people

Table 1
Major Policy Documents on Returnees, 1988–2007

March 1989	Ministry of Personnel and State Education Commission	Established many postdoctoral centres to attract overseas Ph.Ds to return for postdoctoral positions on the mainland.
November 1989	Ministry of Personnel	Younger returnees and younger academics to be given preferential opportunities in jobs located at scientific and technological research institutions and at large- and medium-sized state enterprises.
1990	State Education Commission	Established research funds for funding around 1,000 overseas returnees every year.
March 1992	Ministry of Personnel	Job introduction centres for returned students established in Shenzhen, Shanghai and Fujian; preferential policies given to returnees, especially better living and working conditions; help in founding a national association of returned students; and providing greater support for scientific research.
August 1992	Ministry of Personnel and State Education Commission (Doc. 16)	Resurrect the effort to attract excellent overseas Ph.D.s to return for postdoctoral positions.
August 1992	State Council (Doc. 44)	Document based on Deng's January 1992 speech, outlined the Communist Party's willingness to forgive returnees who, while overseas, had criticised China over 4th June events if they refrained from future political action.
June 1993	Ministries of Personnel, Public Security and Commence	'Joint Circular on the Placement of Returned Student' makes the key point that 'if some students want to move to other units, personnel departments should try to meet their requests'. Returnees allowed to apply for work in all areas of the economy or set up their own companies.
November 1993	Central Committee of CPC	Twelve-point slogan: 'Support overseas studies, encourage returnees to China, grant the freedom to come and go'.
1994	Chinese Academy of Sciences	Established the 'One Hundred Talents Programme' to attract 100 top young mainlanders overseas in the natural sciences to return before 1999.

(*Table 1 contd*)

(*Table 1 contd*)

September 1995	Ministry of Personnel	Ministry of Personnel will fund scientific research for excellent overseas returnees.
1996	Ministry of Education	'Spring Light Project' gives financial support for people to return for short-term visits.
1998	Chinese Academy of Sciences	Enlarges the 'One Hundred Talent Programme', recruits 100 top scientists every year for three years.
1998	Ministry of Education	Enlarges the 'Spring Light Project'.
May 1998	President Jiang Zemin and Ministry of Education	Under the '985 Plan' to build world-class universities in China, the central government invests billions of RMB in nine universities, and 20 per cent of the funds earmarked to hire overseas scholars.
August 1998	Ministry of Education	The Changjiang Scholars Programme offers funds to leading Chinese scientists living abroad to return for one year in strategic research areas.
January 2001	Ministry of Personnel	New regulations on 'incubators' in hi-tech zones for overseas returnees.
May 2001	Ministries of Education, Science & Technology, Personnel, Finance and Public Security (Doc. 49)	'Serve the nation' without 'returning to the nation'; a policy to encourage Chinese who remain abroad to engage in seven types of activities that can help China.
March 2002	Public Security Bureau, Foreign Ministry, Ministry of Ed., Personnel, Labour, Foreign Trade, Office of Overseas Chinese Affairs, etc.	Regulations that simplify entry and exit for highly talented mainlanders and investors holding overseas citizenship.

August 2002	Ministry of Personnel	Ministry of Personnel, along with local governments, builds up technology parks for overseas returnees.
March 2005	Ministries of Education, Science & Technology, Personnel, and Finance	Define what is 'top overseas talent', as future policies target this group.
November 2006	Ministry of Personnel	Eleventh 'five year plan' for overseas returnees
February 2007	Ministries of Personnel, Education, Science & Technology, Finance, Foreign Affairs, Commerce, Public Security, National Development and Reform Commission, People's Bank, Chinese Academy of Sciences, State Assets Supervision and Administration Commission, State Taxation Bureau, China Customs, State Administration for Industry and Commerce	Sets up 'green channel' for 'top overseas talent' to work in China; creates good domestic conditions for returnees, makes entry for overseas Chinese easier.

overseas to help national development. In November 2000, the MOE's Document Number 81 agreed to pay overseas scholars as much as five times their overseas salaries if they returned during the summer vacation. According to another report, between 1996 and May 2003, the Chinese government helped over 7,000 individuals and over fifty groups of overseas mainlanders come back to 'serve the country' (China Scholars Electronic Board 2003).[7] In 2002 alone, the MOE awarded fourteen projects under this programme to seven universities for a total of RMB 670,000.[8]

The Changjiang Scholars' Plan, funded by Li Ka-hsing's Cheung Kong Conglomerate in Hong Kong, offered leading Chinese scientists living abroad a chance to return for one year to work on strategic research areas[9] while, at the end of 2000, the Ministry of Foreign Affairs issued long-term, multiple-entry visas to overseas students and scholars so they could go back and forth easily. A survey conducted in 2000 by the MOE found that of 551 overseas educated mainlanders who had set up enterprises in thirteen industrial parks, only 44 per cent resided in China on a regular basis (MOE research report [2000], cited in Biao 2003: 31).[10] Also, in 1999, China's Natural Science Foundation began giving twenty to thirty awards a year—some as high as RMB 500,000—to overseas mainlanders as 'exemplary young researchers'; the stipulation was that they had to spend the money in China.

By the turn of the century, China was ready for a more deliberate policy focusing on the benefits of 'brain circulation', rather than the costs of the 'brain drain' (Richtel 2002; Saxenian et al. 2002). Leaders of that time, such as President Jiang Zemin and Prime Minister Zhu Rongji, were more comfortable with the increasing globalisation of talented Chinese (Moore 2000), and recognised that if they were 'to strengthen the country through human capital' (*rencai qiang guo*), they must let their citizens go abroad and then compete for them in the global marketplace.

Thus, in 2001 a major policy document, combining the efforts of many ministries, called on mainlanders overseas to 'serve the nation' (*wei guo fuwu*), even if they did not 'return to the nation' (*hui guo fuwu*). Under this policy, Chinese citizens who remained overseas and their organisations were encouraged to engage in seven types of activities:

1. utilise the advantages of their professional bodies;

2. hold concurrent positions in China and overseas;[11]
3. engage in cooperative research in China and abroad;
4. return to China to teach and conduct academic and technical exchanges;
5. set up enterprises in China;
6. conduct inspections and consultations; and
7. engage in intermediary services, such as run conferences, import technology or foreign funds, or help Chinese firms find export markets (*Chinese Education and Society* 2003).[12]

China also called upon communal organisations of overseas students to 'give full play to their collective advantages in developing various activities in the service of China' (ibid.: 9).

The Chinese government recognises that the expertise that they have acquired overseas may have made these people too expensive for the Chinese state or for state-run institutions under current conditions. Also, the state cannot afford all the technical infrastructure and equipment they might need to create new products. But if they were to run their own businesses overseas or work in an overseas company, while maintaining contacts with the motherland, China could reap significant returns with little investment. Given the enormous interest within the mainland diaspora to take advantage of China's booming economy, the government's policy to encourage academics, scientists and businessmen overseas to establish businesses or research institutes in China was well timed.

Consular officials, particularly in the education and science sections, cultivate talented overseas mainlanders to connect them with people in China so that they might participate in research projects at home (Chen et al. 2003: 84). For example, in December 2001, the science consul in China's Los Angeles Consulate led a delegation of thirty-four overseas professors from the Chinese American Professors/Scholars Network to the Fourth International Science-Tech Convention for Overseas Scholars and Professionals in Guangzhou.[13] According to Chen and Liu (2003: 191), since consulates are critical in utilising former students in the diaspora, their education sector should be expanded. Mainlanders who stay abroad may lose touch with developments in China, be unfamiliar with research there, or not know whom to contact. Thus, consular officials could organise meetings where delegations from China describe the changing

circumstances on the mainland, be introduced to Chinese student organisations, or have meetings with successful overseas scholars.[14]

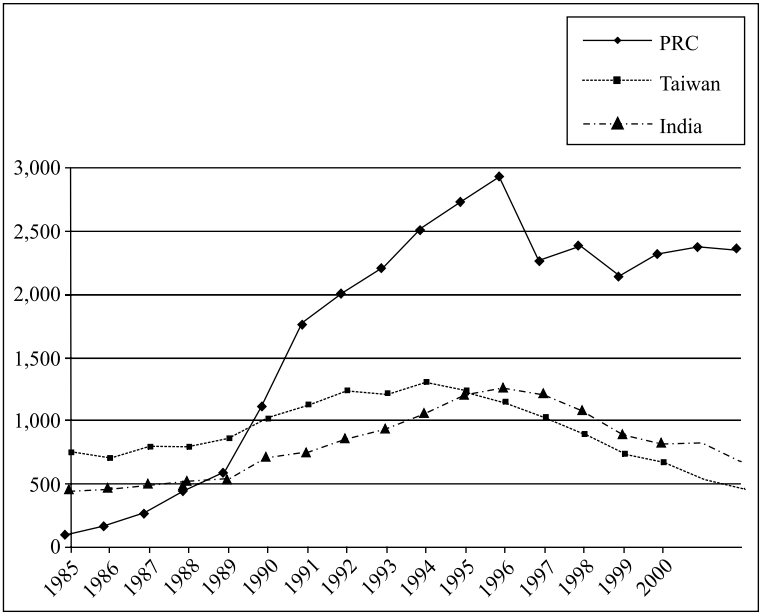
According to a study of Eastern Europe, China's government employs United Front tactics to encourage overseas students and scholars to contribute to the motherland, mobilising people to join pro-mainland organisations, meet regularly with these associations, inform them about changes in the mainland, and ask them to help China. They even call people who stay overseas 'patriotic' (Nyiri 2001). But an education official in a Chinese consulate in the United States denied such a strategy exists; he interacted with people overseas much more haphazardly. He argued that the sole incentive that encourages cooperation is economic or academic self-interest, not ideology or patriotism.[15]

Professional associations in disciplines such as economics, political science, history and agriculture build bridges between East and West. Some associations have been supported by international donors, such as the Ford or Rockefeller foundations, while others were supported by the Chinese government.[16] For example, in 2004, the Economic and Technology Division of the Shanghai government's Overseas Chinese Office (*Qiao ban*) offered to strengthen its universities' alumni associations in the US in order to disseminate information about business and scientific opportunities in Shanghai to mainlanders in the US.

The Emergence of a Highly Skilled Mainland Diaspora

Even before 1989, the number of highly trained mainlanders staying overseas had begun to grow. The purge of Hu Yaobang from his post as general secretary of the Communist Party in January 1987, and the subsequent Anti-Bourgeois Liberalization Campaign, warned people overseas that conservative or hard-line Marxists were still influential and that political campaigns were not a thing of the past. But as Figure 1 shows, the Tiananmen crackdown of 4 June 1989 created an instant diaspora of Chinese who did not want to return to the PRC.[17] This diaspora includes an enormous pool of Chinese talent that the government wants to tap. According to the US National Science Foundation data (Table 2), between 1988 and 1996, China produced twice as many science and engineering Ph.D.s in the US as its closest rival, Taiwan, comprising

FIGURE 1
Non-US Citizens Awarded Doctorates in Science and Engineering: PRC, Taiwan and India, 1985–2000



Source: Science and Engineering Doctorate Awards, 2002, SRS website, http://www.nsf.gov/statistics/doctorates/, October 2003.

47 per cent of all foreign science and engineering students with firm plans to stay in America. However, with many on postdoctoral fellowships, they were more likely to return than if they had a secure job. Still, while the total number of mainlanders surpasses any other Asian country, the percentage of Indians with firm plans to stay and in possession of jobs is greater than their mainland counterparts.[18]

A Chinese research team in 2002 found 130,000 current or former students from the mainland in the US and 40,000 in Japan, with 50,000 and 15,000 respectively possessing permanent residence status. Two-thirds had completed their studies. Based on an evaluation scheme, which defined associate professors or department heads in large companies as 'exceptional' people, equivalent to middle- or higher-ranking cadres on

TABLE 2
Asian S&E Doctoral Recipients with Firm Plans to Stay in the US, 1988–96

Location	*Total S&E doctorates*	*Total with firm plans*	*Percentage with firm plans*	*Postdoctoral study*	*Percentage*	*Total employment*	*Percentage*
Asia (total)	43,171	16,956	39.3	9,766	22.6	7,189	16.7
PRC	16,550	7,930	47.9	5,085	30.7	2,845	17.2
India	7,843	4,291	54.7	1,828	23.3	2,463	31.4
Korea	8,851	2,002	22.6	1,505	17.0	497	5.6
Taiwan	9,927	2,733	27.5	1,348	13.6	1,384	13.9

Source: 'Statistical Profiles of Foreign Doctoral Recipients in Science and Engineering: Plans to Stay in the United States', an SRS Special Report, November 1998.

the mainland, 3 to 5 per cent of the 50,000 permanent residents in the US would fall into this group, while another 10 per cent would be categorised as 'rather talented'. Moreover, the economic returns of their contribution to China 'greatly surpasses the state's level of investment over the past twenty years in sending them overseas to study' (Chen and Liu 2003: 172). The Chinese government recognises that this pool of human capital is quite large. According to Vice-minister of Personnel Shu Huiguo, by 2002, 100,000 students and scholars had helped the motherland develop in ways other than by returning (Xinhua New Service 2003).

Different Ways to Serve the Country

How do mainlanders in the diaspora serve China? Certain strategies are employed by academics or scientists; others by people in business. Some combine the two cohorts. For example, scientists in universities or laboratories who devise a new product may manufacture it on the mainland, either for export or for sale in the domestic market.

Serving through Teaching, Lecturing or Collaborative Research

People overseas help the mainland by teaching, lecturing, organising seminars or engaging in collaborative research. Since 2000, the Chinese Academy of Sciences has been bringing in fifteen mainlanders working overseas (plus ten others who had previously worked overseas) to run courses at the Shanghai Institute for Biological Sciences. One organiser, a faculty member at the institute, received his Ph.D. in Zurich and then worked in the US; a second organiser teaches at Washington University in St Louis (Cyranoski 2002: 683).

The new policy outlined in 2001 encouraged overseas mainlanders to use their professional associations to help China. One such organisation is the Chinese American Professors/Scholars Network, whose programmes link mainlanders in the US with Chinese institutions. It channels information about programmes on the mainland, encouraging academics and scientists in the US to join projects in China. In 2001, they recruited participants for the 'Fourth Annual Summer Teaching Programme at Qinghua University by Excellent Young Chinese Scholars in the US'.

Under the 'double base model' (*liangge jidi moshi*) or 'dumb-bell model', individuals hold joint positions in China and the diaspora, or jointly train graduate students. For example, one former Beijing University undergraduate received a Canadian Ph.D. in psychology. After setting up a lab at a major Canadian university, he established a second lab at Beijing University (interview in Mississauga, Ontario, 2003). His goal is to create collaborative projects between the two centres. In his view, working in China has advantages: funding is easier, and interdisciplinary projects and programmes can be readily established because Chinese institute directors wield more administrative authority than their Canadian counterparts. Also, the demand for his products—hearing aid implants—is enormous in China. Still, he found it difficult to manage professional relationships at Beida because some locally educated colleagues, who resented this academic 'astronaut', constantly made life difficult for him.

In a famous case, a geography professor at Berkeley set up a joint research centre at Nanjing University (Chen and Liu 2003: 175–76). The Chinese government encourages such projects by offering grants to local researchers if they partner with an overseas mainlander. Such international scientific networks have grown rapidly, and according to Suttmeier (2005), the number of papers by co-ethnics, that is, Chinese in the US and China, has increased enormously over the past ten years. Chinese institutes are keen to establish these linkages. Universities compete for ranking based on publications in international journals; part-time overseas faculty can increase those numbers.[19]

Establishing Businesses in China

China's government encourages mainlanders overseas to establish businesses in China (*chuan ye*) and includes such activity under the rubric of 'serving the country'. No doubt, what motivates these investors is profit; therefore, some observers do not see such activities as service. For example, Jon Unger of Australian National University asks: 'How are these Chinese any different from a Korean businessman or an American who invests in China?'[20]

But these projects are a new phenomenon. Only recently has the generation of students who went overseas after 1978 amassed the financial

or technical wherewithal to invest in China. Therefore, the government wants to encourage them. Second, the government recognises this group's familiarity with hi-tech industries—a key target of the programme to 'strengthen the country through science and education' (*ke jiao xing guo*). Their firms often have new, high value-added products, or new management techniques that help China compete globally (Chen and Liu 2003: 174). Third, China's government wants foreign investment and foreign markets—partly to create more jobs—and firms established in China by mainlanders living overseas can attract venture capital and multinational corporations. Fourth, overseas mainlanders are much more likely than non-Chinese to transfer technology to China. Some mainlanders working overseas design new technology, but resent the fact that their host country employers maintain ownership over technology that they helped create. Thus, they bring the new technology to a partner in China to reap the benefits of their own creativity. Finally, while overseas mainlanders could invest elsewhere, they come to China because they are familiar with the country and want to engage with their homeland.

There is no systematic data on companies established in China by mainlanders in the diaspora. According to Chen and Liu (2003: 172), this is because so many different ministries, cities, provinces and companies are involved in this process. Also, these firms register as foreign invested firms to gain special privileges China gives to overseas investors, so there is no category for collating data on them. Nevertheless, the hi-tech firms is their comparative advantage (Sheff 2002). Dalian, in northern China, is home to many firms run by Chinese who have stayed in Japan, which outsource software from Japan. For example, in 2006, one of the authors of this article met a Chinese businessman living in Tokyo who owns fourteen factories in China; his main product was high-quality chemical fertiliser that he sold in Japan. Still, many firms could also be simply involved in import/export.

Overseas mainlanders organise economic associations or companies to invest in China. In San Francisco, mainlanders who have been overseas for over ten years created a '*huiguo chuan ye zhuanjia tuan*' (specialists who return to establish companies in China) (Chen and Liu 2003: 172). All either own their own companies or work in American companies, but together have established companies or joint ventures in China using capital and/or new technology.

These business associations often establish ties with one locality, even a small city, where collaborations with local officials yield privileges. These localities recognise that without preferential policies, overseas mainlanders will not bring technology and business contacts that the local government needs. For instance, mainlanders in Osaka established a close link with Changshu City in Jiangsu Province. Between 1999 and 2002, they established three companies to manufacture a material that upgraded the quality of air conditioners but had previously been imported. If the company gets 30 per cent of the domestic market, manufacturing this product domestically could save China RMB 150 million a year. The Communist Party secretary of Changshu applauded this process, saying that 'importing capital is not as useful as importing brain power' (*yinjin zijin bu ru yinjin zhili*), while a local party secretary in that city commented that,

> If we had brought these people back, it is not certain we could have used them, because currently we cannot pay them the same salaries and benefits they get in Japan. If we could use them [that is, pay their salaries], we still could not develop [*yang]* them, because the equipment they need is too expensive for us to buy now. But if we let them stay overseas, and invite them back to serve the country, we can use them. This is a terrific choice and model. (Chen et al. 2003: 75)

Finally, the government called on mainlanders overseas to help China find export markets. Many mainlanders in the US had tried to use personal networks in China to import goods to the US. In Osaka, a former visiting scholar, who has worked in Japan for fifteen years, got his Japanese employer to buy four ships from Shanghai, worth RMB 400 million,[21] while in Tokyo, one of the authors of this paper interviewed a former Chinese Olympic athlete who now imports sports equipment from China.

Some individuals believe that serving from abroad may be more advantageous than returning. One mainlander, with an excellent position in a business school in the US, says that when he returns to China representing his American university, he is treated very well. He becomes a channel through which people, information or capital can flow in and out of China. In his view, were he to return to China and take up a local post, his status would be much lower.[22]

Case I: Serving China from Silicon Valley

To understand how diaspora businesspeople promote China's economic modernisation, we employ a data set compiled by Dr Annalee Saxenian of the University of California at Berkeley, who used contacts with immigrant associations in Silicon Valley to obtain detailed responses from 386 Chinese entrepreneurs and employees about their links with the mainland.[23] Among this group, 69 per cent had come to the US between 1990 and 1999, and another 9.4 per cent in the 1980s. The vast majority (79 per cent) had come to attend school in the US and stayed on, while another 9 per cent had been brought directly by American companies. Eighty-nine per cent had scientific, technical or engineering degrees, and 82 per cent had earned their highest degree in the US. Two-thirds were technical professionals in non-managerial positions.

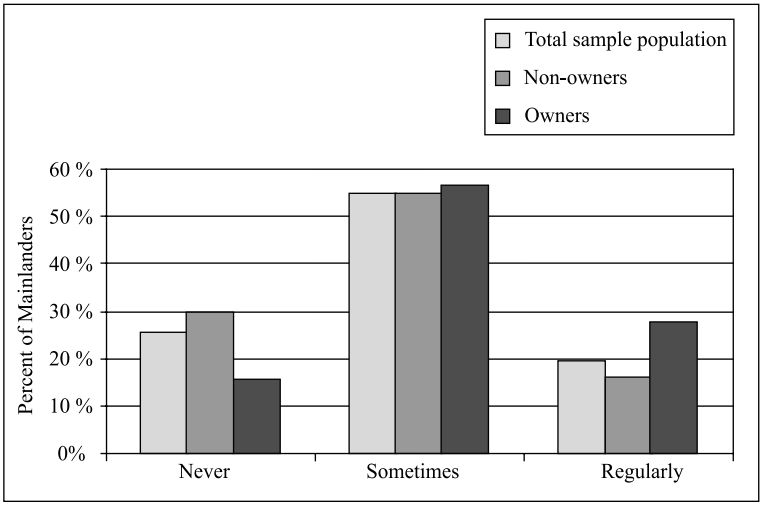
We compared two groups with the overall cohort: the first consisted of mainlanders in Silicon Valley who had owned, or still own, their own companies. If company owners are more entrepreneurial, they are more likely to engage the mainland. Second, we compared individuals who actively 'served China' with 'non-servers' to understand what motivates people in the diaspora to 'serve the country' (see Figure 2).

China wants to increase the inflow of technology. But do mainlanders in Silicon Valley exchange technology 'regularly' (versus 'sometimes' or 'never') with classmates, friends or business associates in China? Among all respondents, 19 per cent do so on a 'regular' basis. However, since 28 per cent of one-time company owners do, as compared to 16 per cent of non-company owners (Figure 2), owning a company significantly increases the likelihood that a technology flow will be established.

Also, among people considering setting up a company in China, 23 per cent *regularly* exchange technology with colleagues on the mainland, many more than those not considering setting up a company on the mainland (9 per cent). So, technology exchanges are an important step for those in the diaspora who want to establish a new company in China.

Among respondents, 39 per cent have helped others arrange business contacts in China, with 61 per cent of company owners and 22 per cent of non-owners having done so. Thirty-two per cent of company owners have consulted for Chinese companies, as have 15 per cent of the entire population. But only 8 per cent of non-owners have played this role. However, these people are not yet an important source of capital for

Figure 2
Mainlanders in Silicon Valley Who Exchange Information about Technology with Friends, Classmates or Business Associates in China



Source: Data collected by A. Saxenian, funded by the Public Policy Institute, California.
Note: $N = 368$.

China. Among 117 company owners, 15 per cent have invested once in a start-up in China, while another 14 per cent have invested more than once. Of 267 non-owners, only eight (3 per cent) have invested in a start-up, of whom only two invested more than once.

The 'Servers'

To understand who is 'serving' China, we selected all the people who engaged in activities listed by the Chinese government in its 2001 policy. We broke this group into four, based upon the number of activities they carried out, in order to compare 'servers' and 'non-servers', and seek differences among the servers.

Of the 386 respondents, 179 (46 per cent) had responded positively to one of our four questions about types of engagement,[24] with 100 employing one mode, forty-eight involved in two, nineteen involved in three, and twelve involved in all four modes. This shows significant links between mainlanders in Silicon Valley and China.

What are their key characteristics? Age is statistically significant, as servers are older than non-servers; in the 36- to 50-year-old cohort, servers outnumbered non-servers 39 to 29 per cent. Seventy-two per cent of servers are male, 28 per cent female but, among non-servers, men comprise 59 per cent. The percentage of women declines progressively among those who are more active. Immigration status was found to be important; US citizens are more involved than those holding non-US passports (40 per cent versus 31 per cent). Thus, US citizens comprise 40 per cent of servers, but only 29 per cent of non-servers, and among those holding Permanent US residency, 40 per cent are non-servers while only 30 per cent are servers. MBAs and Ph.D.s are more likely to engage China than other degree holders, while managers or executives in corporations are more likely to work with China than those with technical or other professional experience. Thus, among ninety-two business executives and managers, 72 per cent served China while 28 per cent did not.

The size of the firm is inversely proportional to the level of engagement, as small firms, more than large firms, may need contacts in China. Particularly, individuals with ten to forty-nine people in their firm are much more likely to serve China than not (21 per cent versus 7.5 per cent), perhaps because they want cheaper labour. But the firms least likely to serve have over 1,000 employees (54 per cent of all non-servers versus 37 per cent of servers).

Participation in professional associations makes one more likely to serve China, either because the organisation encourages involvement or because those who want to work with China join such organisations. Among more active servers (using two or more modes), 41 per cent attend professional meetings once or more per month, while 60 per cent attend meetings at least four times a year.

Founding a company increases the likelihood of being a server, with full- and part-time owners comprising 17 per cent of non-servers, but 47 per cent of servers. Among servers, part-time owners are slightly more active (26 per cent) than full-time ones (21 per cent). People planning to set up a business are more likely to serve; 60 per cent of people planning to open a company are engaged with China versus 46 per cent of non-servers. Also, those considering returning to live in China are more active, perhaps building relationships that will help them after they return. Among those who say that they are 'quite likely to return to the mainland', 21 per cent say that they are serving China, while non-servers comprise

only 8.5 per cent of this group. Moreover, among the twelve people who are most active, ten are 'quite likely to return', so in future they may not serve from overseas. Finally, knowing returnees makes one more likely to serve China—perhaps these returnees form the channels that the servers use.

Case II: Academics from North America

To understand the role of academics living outside the mainland, we conducted research on mainland scholars in the US and Canada. In the US, we adopted a stratified sampling strategy, selecting universities according to the value of their endowments as ranked by the National Association of College and University Business Officers in 2004. We divided the top 300 universities into three groups and randomly selected twenty schools from each group of 100, tapping into universities of various qualities. From the website of each school, we compiled a list of faculty with *pinyin* (Mandarin Chinese) names. In all, we contacted 756 academics in sixty universities and received ninety-four surveys, a response rate of 12.5 per cent. Although web-based surveys yield response rates that are lower than traditional survey methods, such as face-to-face interviews, they generate an overall picture of the population. After formulating the list, we invited the faculty through email to complete an online survey. Web-based surveys offer advantages, such as low cost, anonymity and accessibility. The survey was online for three months, from 9 May to 9 July 2004.

In 2005, we selected twenty-three Canadian universities based on their size and adopted the same methodology as in the US survey. In all, we contacted 428 academics in the twenty-three universities and received fifty-nine responses, a response rate of 14 per cent, a bit higher than in the US. Among the fifty-nine academics, half were full or associate professors (13 per cent were full professors). Thirty-nine per cent had received their degree in Canada, and another 20 per cent had received their degree in the US.

Types of Interactions

Our respondents reported their interactions with China over the previous five years. Among the group, 78 per cent of US respondents had had at

least one type of interaction. The most common form was an academic exchange, such as running a seminar, course or conference in China, accounting for 49 per cent of the respondents. Forty-four per cent had carried out collaborative research with mainland scholars, 30 per cent ran training programmes in the US for mainlanders, 17 per cent published academic papers on the mainland, and 14 per cent have edited a book with a mainland scholar. Table 3 shows the types of interaction in detail, and compares responses in the US and Canada.

TABLE 3
Patterns of Interaction with China by Overseas Mainland Academics in the US and Canada

	Percent	
Modes of interaction	*US*	*Canada*
Collaborative research projects	44	38
Running seminars or mini-courses in China	49	49
Training mainland students overseas	30	32
Giving academic papers in the mainland	17	19
Editing a book with a mainland scholar	14	8
Consulting with companies in the mainland	5	8
Visiting family	79	71

Source: Web-based survey with mainlanders in the US (2004) and Canada (2005).
Notes: $N = 94$ for the US; and $N = 59$ for Canada.
Individuals could select more than one form of interaction.

However, scholars concentrated on academics, not business; only 5 per cent of academics consulted with mainland or foreign companies in the mainland, and no one had a company working with China.

Canadian interactions with the mainland mirror American ones. Academics in the US have more collaborative projects, are more likely to edit books, and visit family more frequently, but the rates do not differ much. As a result, we combine the data together in the following discussion.

Factors Affecting Interaction

Many factors affect scholars' interactions with mainland, such as their academic and administrative position, their immigration status and their long-term plans. However, belonging to an organisation is not statistically significant in our data.

In North America, both academic and administrative positions affect interactions with the mainland. People with administrative posts in the university, or heads of departments, were more likely to interact with China. Table 4 shows the number of interactions with the mainland by academic rank: 38 per cent of assistant professors had no interactions, significantly higher than associate professors (19 per cent) and full professors (0.6 per cent). In contrast, 50 per cent of full professors had three or more interactions with the mainland, substantially higher than associate professors (33.3 per cent) or assistant professors (9.6 per cent). The difference in the number of interactions across academic positions is statistically significant at the 0.001 level.

Table 4
Interactions with China by Overseas Mainland Academics by Academic Rank in the US and Canada

Number	*Assistant professor*	*Associate professor*	*Professor*
0	28 (37.8)	9 (18.8)	1 (0.6)
1	31 (41.9)	13 (27)	6 (21.4)
2	8 (10.8)	10 (20.8)	7 (25)
3	4 (5.4)	7 (14.6)	7 (25)
4	1 (1.4)	6 (12.5)	4 (14.2)
5	1 (1.4)	3 (6.3)	3 (10.7)
6	1 (1.4)	0	0
Total	**74 (100)**	**48 (100)**	**28 (100)**

Source: Web-based survey with mainlanders in the US (2004) and Canada (2005).
Notes: Postdoctoral fellows and research associates are purged from the data, yielding 150 people in the US and Canada. The number in parentheses is the column percentage.
$p < 0.001$.

People holding administrative posts interact more with China than people who do not. Table 5 shows the number of interactions by administrative post in the US and Canada. On the one hand, 38 per cent of overseas mainland scholars holding administrative posts have none or only one interaction, while 63 per cent of those without posts have one or no interactions. On the other hand, 62 per cent of mainlanders holding administrative posts have two or more interactions, while only 37.4 per cent of those without a post engage this frequently. The differences are statistically significant at the 0.001 level.

TABLE 5
Interactions with China by Overseas Mainland Academics by Administrative Posts in the US and Canada

	Holding an administrative post	
Number of interactions	*Yes*	*No*
0	11 (19)	29 (31)
1	11 (19)	40 (42)
2	15 (26)	10 (11)
3	8 (14)	10 (11)
4	8 (14)	3 (3)
5	4 (7)	3 (3)
6	1 (2)	0
Total	**58 (100)**	**95 (100)**

Source: Web-based survey with mainlanders in the US (2004) and Canada (2005).
Notes: Number in parentheses is the column percentage.
$p < 0.001$.

Current immigration status affects behaviour, as advanced immigration status holders are more likely to interact with the mainland. The same was true for our Silicon Valley respondents. Most of our respondents are permanent residents (26 per cent) or citizens (58 per cent), and those groups are actively involved with the mainland, compared with those holding only a work visa.[25]

Belonging to an organisation was important in Saxenian's study, but she found her informants via professional associations, so conclusions based on her data about the role of organisational affiliation in promoting interactions could be biased (Saxenian et al. 2002: 5–8). Also, business people might have more connections with the mainland via their professional organisations, as networks play an important role in conducting business in the mainland.

As for North American academics, conventional wisdom holds that scholars belonging to organisations of mainland scholars are more likely to interact with China, as the organisation fosters interactions. However, in our data, only 29 per cent of scholars joined an organisation of mainland scholars, of whom 80 per cent have more than one interaction. But the 71 per cent who did not belong to any organisation also have more than one interaction. In fact, the relationship between number of interactions and organisational affiliation is not statistically significant at the 0.05 level.

Reasons for Collaboration

What motivates Chinese scholars in North America to collaborate with the mainland? When asked why they interact with China, people's responses reflect a desire to 'serve China' rather than self-interest. Table 6 reports the results. 'Promoting the quality of research in China' is the dominant response, scoring 225 points.[26] In fact, nearly 37 per cent of respondents say that this is the most important reason for their collaboration. 'Making China stronger' comes second, scoring 102 points, with building personal relations and attracting good Chinese graduate students coming third and fourth respectively. While some respondents may have given politically correct answers, 'serving China' apparently does motivate mainlanders to collaborate with scholars in China.[27]

Table 6
Reasons Selected by Overseas Mainland Academics for Cooperating with China, Combining the US and Canada

Reasons for cooperation	*Score*
Promote the quality of research in China	225
Make China stronger	102
Establish personal relationships	80
Attract good graduate students	70
High quality of collaborators	48
Costs are cheaper	36
I study China, so I need to cooperate	29
I want to be visible on the mainland	18
Access to research money	13
Total	**621**

Source: Web-based survey with mainlanders in the U.S. (2004) and Canada (2005).
Notes: $N = 94$ for the US; and $N = 59$ for Canada.
First choices were given 5 points, second choices were given 3 points, and third choices were given 1 point.

The 'Diaspora Approach:' An Option for China?

The world scientific community and people who study the brain drain see the diaspora option as having advantages. It is relatively inexpensive, allows expatriates to contribute to their home society without giving

up their overseas situations, and yet mitigates feelings of guilt (Gaillard and Gaillard 2003). But if their home country's scientific community is not large, it cannot support links with overseas researchers.

> Sustained political support and an administrative capacity to manage the network are essential. And even with this support, ensuring the long-term survival of a diaspora network is a serious challenge since its population is very mobile, and may not always focus on national science and technology interests.[28]

Government agencies and expatriates must be highly motivated, and updating lists of expatriates abroad is necessary (Meyer et al. 1997).

Can the diaspora model succeed in China? Relative to African and Latin American countries, China's large indigenous and relatively developed scientific community allows for very fruitful interactions for mainlanders living abroad. They can learn from collaborators in China, and even though the overseas sojourners themselves may be doing cutting-edge research, Chinese colleagues can move the research into new arenas. China's indigenous S&T sector is developing rapidly (Sigurdson 2002), although opinions are mixed about whether it can truly become an innovative society (Wilsdon and Keeley 2007). Yet continuing interaction between mainlanders inside and outside China creates a conducive environment for people overseas to work with China. One mainland professor in Canada commented that colleagues in China propelled his research; he also got access to talented graduate students and research assistants who were more stable and less expensive than those in Canada, some of whom he brings to Canada. Second, China's booming economy creates incentives for overseas mainlanders to transfer new technology; they can make money and China gets the expertise. Third, globalisation of scientific techniques and the positioning of many Chinese in leading research centres in the West mean that they have much to share with China. Finally, China is no longer very poor; it can pay salaries and research costs incurred by scientists or academics who return for short periods.

China's government seems unconcerned about the monetary motivations of servers. The 2001 policy includes people setting up companies as a way of 'serving the nation'. No doubt, these people are serving

themselves; otherwise, they would take their business elsewhere. But as Chinese, and former or current citizens of the PRC, they are more favourably disposed to serving the nation. Similarly, the views of China's leaders have evolved; their goal is to modernise and strengthen the Chinese state, and why overseas mainlanders contribute to that goal is not the state's primary concern. Whether their motivation is socialism, patriotism or self-interest, the state wants the information and technology.

Yet it remains unclear how organised the government is on this issue. Analysts of the diaspora option assert that the home country must establish a strong network among overseas scholars if it is to get them to consider returning (Song 2003). And, while Cao reports that the Chinese Academy of Sciences has established an expatriate expert database (Cong 2004: 8), interviews with consular officials in Canada suggest that China does not have a rich data bank of overseas mainland scholars; nor do overseas officials actively pursue such a list. In light of growing concerns over industrial espionage in the US, Chinese officials working abroad may prefer to play down their activities.[29] Yet the Chinese market is robust enough to attract many overseas mainlanders.

Despite the current reverse brain drain, many of the mainland's top researchers and entrepreneurs currently living in the diaspora are not prepared to return home. The longer one stays abroad, the more difficult it is to return. Family obligations and professional affiliations are not easily set aside. Therefore, the diaspora option of building a transnational scientific community becomes one more way Western technology can flow into China and strengthen it through 'science and education'. It allows mainlanders overseas to profit from China's growing market. Finally, as China's science and technology advances, the benefits of these exchanges to the West will expand as well.

NOTES

1. N. Li 'Why is it Hard for the "Going Abroad Fever" to Cool Down', in *Gaige Neican* (internal reference materials on reform), 1998, 4, pp. 18–21, cited in Rosen (1998).
2. 'China's Grim Situation: Shortages and Loss of Talent' (Wo guo rencai duanque he liushi de xingshi yanjiu), *Lingdao Juece Xinxi* (Information for Leadership Decision Making), no. 16 (1999), p 21, cited in Rosen (2000).
3. There is a serious definitional problem here. Chinese sources call these people '*liu xue renyuan*', which includes those who are currently studying abroad, and those who

have graduated and are now working abroad. Moreover, they apply the term to scientists, academics, current students and business people. But in English, the term frequently used is 'overseas students', even though the majority of these people have long since graduated. In fact, of 160,000 mainlanders described in English as 'overseas students' in the US in 2001, over 115,000 had graduated.

4. This paragraph is based on an interview in Cambridge, MA, 12 December 1989, and an unpublished paper written by a former education official in 1989.
5. The slogan was, 'Support going overseas, encourage returning to China, allow people to come and go freely' (*zhichi chu guo, guli hui guo, lai qu ziyou*).
6. Interview, 2005, with Chinese consular officials in Canada.
7. As of 2001, the number was reportedly 3,000, suggesting that another 4,000 had come in two and a half years. See http://www.why.com.cn/abroad_3/weiguofuwu/10_1/2.htm.
8. See the website of Zhejiang University, http://www-2.zju.edu.cn/zxw.
9. 'Cheung Kong' is the Cantonese pronunciation, which in Mandarin is pronounced as 'Changjiang'.
10. When we tried to interview returnee factory owners in China's hi-tech zones in 2001, it was rare to find them at their enterprises.
11. This has become known as the 'dumb-bell' model (*moling moshi*) because the individuals have a foot in two worlds.
12. The ministries included the Ministries of Personnel, Education, Science and Technology, Public Security and Finance.
13. From the CSA and Chinese American Professors/Scholars Network, 8 January 2002.
14. Interview with the head of a Chinese student organisation in Toronto, Canada, August 2003.
15. Interview, WXELA-2004. Another official in a Chinese consulate in Canada relied on a small network of nationalistic academics, but never spent time mobilising anyone.
16. For an earlier study of these groups, see *China Exchange News* (1991). Taiwan's National Youth Council helped Taiwanese overseas organise more than twenty professional societies and hold annual academic conferences to promote trans-Pacific exchanges. See Tsay (2003: 128).
17. Among 273 mainlanders interviewed in 1993 in the United States, 19.2 per cent said that 4 June had 'a very important effect' on their decision to stay in the US, while another 17.7 per cent said that it had 'a somewhat important effect'. See Zweig and Chen (1995: 132).
18. For a study of the impact of PRC and Indian nationals on the economy of the East Coast of the United States see Tambar (2007).
19. Interview, Mississauga, Ontario, August 2003.
20. E-mail message to the authors, August 2004.
21. Information provided by Chen Changgui, who participated in this interview.
22. Interview by Stan Rosen in Los Angeles, 2002.
23. We are deeply grateful to Dr Saxenian, whose work was funded by the Public Policy Institute of California, for sharing her data set with us. Much of her analysis combined mainlanders and Taiwanese into a Greater China category, which she juxtaposed to

Indians in Silicon Valley. We used only her responses from mainlanders for our analysis. Her total data set is composed of 2,273 responses by Chinese, Indians and Taiwanese. While approximately 530 mainlanders filled out the web-based questionnaire, 144 respondents did not complete all aspects of the survey, as certain questions about their links to China failed to appear on the screen while they were filling in the survey. Therefore, 386 mainlanders, who responded to the entire survey, comprise our data set.

24. The four questions were:
    1. Have you helped arrange business contracts in China?
    2. Have you ever served as an adviser or consultant for companies from China?
    3. Have you invested your own money in start-ups or venture funds in China?
    4. Do you regularly exchange information with friends, classmates or business associates about technology?

    For this last question, where the choices were 'never', 'sometimes' and 'regularly', we included only people who said 'regularly'. 'Sometimes' could reflect casual conversations, while 'regularly' suggests that some significant transfer was under way. The first two questions reflect ways people helped others do business, rather than ways they promoted their own business.
25. In the US, J1 visa holders were deleted from the data, as are those holding 'other' immigration status, so we got ninety people in the US and fifty-nine people in Canada.
26. We gave five points for a first choice, three points for a second choice, and one point for a third choice. In a few cases, people did not make a third selection.
27. A mainlander professor in Hong Kong insisted that he, like many mainlanders, really wanted to improve the research climate in China and that this is a major reason for working with the mainland (interview by David Zweig).
28. Ibid.
29. Amazingly, one consular official in Canada responsible for science and technology said he had never heard of the policy of '*wei guo fuwu*'.

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