Facts and Fallacies about U.S. FDI in China

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Abstract: Despite the rapid expansion of U.S.-China trade ties, the increase in U.S. FDI in China, and the expanding amount of economic research exploring these developments, a number of misconceptions distort the popular understanding of U.S. multinationals in China. In this paper, we seek to correct four common misunderstandings by providing a statistical portrait of several aspects of U.S. affiliate activity in the country and placing this activity in its appropriate economic context.

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"Everything you hear about China is true. But none of it is accurate."

Dr. John Frankenstein, Research Associate
Weatherhead East Asian Institute, Columbia University

U.S. Firms in China: The Hype vs. the Hard Facts

In the late 1970s, China began to adopt economic policies that were more market oriented than policies it had pursued in the past, and this shift has been very successful in promoting economic growth.[1] Rising levels of industrial output have been accompanied by increases in foreign direct investment inflows, leading many to conclude that foreign direct investment has played an important role in China's success. Since China's official entry to the WTO in 2001, China's economy has continued to expand rapidly, FDI inflows have continued on a large scale, and China's role in world trade has continued to increase.

These developments have heightened American public interest in China. Numerous recent books seek to explain the Chinese economy to the general reader, and the popular press has expanded its coverage of Chinese economic developments. Despite this growing level of information, however, significant misconceptions continue to cloud the popular understanding of the role of foreign firms in China, and, particularly, the role of U.S.-based multinationals. Some of these misconceptions have even taken root in the thinking of professional economists who are outside the small community of China specialists.

[1] For extensive descriptions of the history of Chinese policy with respect to FDI, please see Branstetter and Lardy (2006), Lardy (2002), and Naughton (1996). For a more analytical approach which applies formal political economy models of policy formation to the Chinese context, see Branstetter and Feenstra (2002).

In the late 1990s, when popular and professional interest in the general phenomenon of expanding foreign direct investment was increasing, Robert Feenstra wrote a useful article called "Facts and Fallacies about Foreign Direct Investment." The article corrected a number of widely misconceptions about the subject. Inspired by his title as well as his approach, we seek to dispel four widely held beliefs about U.S. affiliate activity in China by using the most recent available data.

Fallacy Number 1. U.S. FDI in China is large.

The attention paid to China and its economic engagement with the rest of the world has led many to conclude that it is a leading destination of U.S. FDI. Casual observers believe that China's abundance of labor, high growth rates, and huge consumer markets attract large amounts of U.S. FDI. This view is even held by many corporate executives. A 2004 AT Kearney study found that China was perceived as the most favored location for FDI. The amount of capital flowing to China from the U.S. in the form of FDI is thought to be sufficient to have a large effect on Chinese capital formation. However, data collected by Chinese statistical agencies indicate that U.S. FDI is a small component of total FDI in China, and data collected by U.S. agencies show that American firms' investment in China is a small part of their total investment abroad.

Statistics from the Ministry of Commerce of the People's Republic of China track investment by approved Foreign Invested Enterprises (FIEs) on an annual basis. Figure 1 breaks down this growth in investment by the nationality of the foreign owner or partial owner of the FIE.[2] Prior to 1989, FDI inflows were limited and dominated by Hong

[2] Because of official restrictions on direct Taiwanese investment in the mainland, some Taiwanese FDI gets routed through Hong Kong or through "tax haven" nations such as the Cayman Islands. Such tax

Kong and Taiwan-based investors seeking to exploit opportunities in China's special economic zones. After the international unease generated by the Tiananmen Incident dissipated, there was a sharp increase in FDI inflows and a pronounced diversification in its sources. It was in these years that Western countries and Japan began to enter the Chinese market in earnest. However, the role of American firms in these inflows has been and remains relatively modest.

It is worth noting that even overall levels of FIE investment are modest. As indicated in Figure 2, FIE investment in fixed assets accounts for only about 10% of total fixed asset investment in China.

Just as American firms collectively account for a relatively small component of FDI in China, American investment in China accounts for a relatively small portion of total U.S. multinational activity around the world. Table 1 shows 2004 total assets, sales, and employment of U.S. affiliates in China and in four regions that are the major destinations of U.S. FDI. China's share of U.S. MNE total affiliate sales and assets were 1.9% and 0.7%, respectively, in 2004. Although the compound annual growth rate of U.S. MNE sales in China over the 1982-2004 period exceeds 40%, this rapid growth has proceeded from a small base, and it has taken place in a context of growing multinational activity worldwide.[3] Chinese affiliates comprise 4.5% of U.S. total affiliate employment, which is a larger share than their share of assets and sales, suggesting that work

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haven jurisdictions are a prominent component of the "other nations" category shown in Figure 1. Some advanced countries also preferred to invest in China through Hong Kong-based subsidiaries, further exaggerating the apparent role played by Hong Kong. Finally, it is widely speculated that as much as one quarter of the FDI originating in Hong Kong consists of Chinese entrepreneurs investing through Hong Kong shell companies in order to qualify as FIEs for tax and other benefits.

[3] The reported profits of U.S. affiliates in China have also grown rapidly, especially in recent years. Between the 1999 and 2004 benchmark surveys, net income grew nearly seven fold. However, net income from Chinese affiliates only accounts for about 2% of the global net income of U.S. affiliates worldwide.

performed in China is relatively labor intensive.[4] As the data in Table 1 suggests, most U.S. MNE activity takes place in other developed countries like Canada and countries in Europe.

Although the data from both Chinese and U.S. sources indicate levels of foreign direct investment that are smaller than the popular press suggests, there are significant discrepancies between data from these sources. The most comparable data sets both attempt to provide measures of FDI flows as opposed to measures of MNE operating activity. Table 2 presents estimates of U.S. FDI outflows to China produced by the Bureau of Economic Analysis and Chinese Ministry of Commerce estimates of U.S. FDI inflows into China from the U.S. over the 1994-2005 period. In each year, Chinese Ministry of Commerce estimates exceed the BEA estimates, often by a factor of more than two.

A number of measurement issues seem to be important to explaining this discrepancy. First, the Ministry of Commerce reports measures of "actually utilized investment" by foreign invested enterprises, and these measures include investment that is financed by capital flows from the foreign parent as well as investment that is financed through local sources, including borrowing from local banks.[5]

Table 3 provides some indication of how important such local sources of capital are for foreign firms in China. In 2004, only 70% of U.S. affiliates based in China were wholly owned. Joint ventures often involve a local partner who provides equity capital as

[4] These employment figures need to be placed in some context. The total Chinese urban workforce in 2005 was 273 million persons. Foreign invested enterprises from all source countries collectively employed about 12.4 million persons, less than 5% of the total. Clearly, U.S. firms' contribution to employment in China is vanishingly small.

[5] We are extremely grateful to Nicholas Lardy for a series of detailed discussions which clarified our understanding of Chinese statistics on FDI, including the degree to which it may reflect investment financed by the local borrowing of FIEs.

well as other inputs, and these types of organizational forms are more prevalent in China than in the other regions displayed in the table. Slightly more than one half of the assets of U.S. affiliates based in China are financed with debt, and 61.4% of this debt is provided by local sources. The widely documented shortcomings of Chinese financial markets make it surprising that Chinese lenders would figure so prominently.[6] However, given the hazards attending other classes of borrowers, the local subsidiaries of foreign multinationals can be seen as relatively creditworthy borrowers, ultimately backed by deep-pocketed foreign parents, and in possession of brand name and technological advantages over potential foreign competitors. Loans from the parent are 18.9% of total debt. While this share exceeds shares of intrafirm debt elsewhere around the world, it is still fairly small.[7] As a consequence of these issues, the official Chinese statistics can be viewed as overstating the contribution of U.S. firms to Chinese investment.

A second factor that might contribute to the discrepancy concerns how source countries are determined in FDI flow data. In the U.S. data, any capital flow from the parent company to an affiliate in China through a holding company located in a third country is captured as a outflow from the U.S. to the third country, not from the U.S. to China. The exact procedures followed by Chinese statistical authorities are not clear, and it is possible that data collectors use information about the ultimate nationality of foreign investors to classify some of the FDI routed through tax haven holding companies according to the nationality of the ultimate parent.

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[6] Scholarship critical of the efficiency of Chinese financial institutions includes Lardy (1998), Lardy (2004), Tsai (2002), and Branstetter (2007), among many other sources.

[7] Desai, Foley, and Hines (2004) document that multinationals tend to make extensive use of parent provided capital in countries with poor financial development, and Antras, Desai, and Foley (2006) provide a theoretical explanation for why this would be the case, this regularity does not seem to hold for China.

Differences in measured FDI inflows could also be a consequence of other deviations between Chinese and international statistical practice. The view that much of the discrepancy lies in differences in statistical practice was strengthened recently by massive revisions of the Chinese government's own official estimates of the net inward FDI stock. Beginning in 2005, the Ministry of Commerce released revised estimates of China's net FDI stock that reduced its size by half. Previous estimates of the stock had been based on accumulated inflows, and these data may not have captured reductions in FDI capital provided by foreigners. The new, revised FDI stock measures are not broken down by source country, but the magnitude of this revision amounts to an admission that the previously reported figures were far too high, and suggests that the true level of FDI may lie closer to that indicated by U.S. data.[8] Given this, and the extent to which, even in the Chinese data, U.S. FDI is a relatively small component of cumulated total inflows, we remain quite confident in our conclusions regarding the relative size of U.S. FDI in China.

In order to explore why U.S. FDI in China appears to be small, we run gravity specifications to explain levels of U.S. MNE activity by country.[9] In these tests, we use confidential data from BEA's 2004 Benchmark Survey of U.S. Direct Investment Abroad on the operations of majority-owned nonbank affiliates of nonbank U.S. parents, which we aggregate to the country level.[10] We employ three different measures of U.S. MNE activity as dependant variables, the log of affiliate sales, the log of affiliate assets, and the log of affiliate employment compensation. Our base line specification controls for geographic distance from the U.S. and the log of GDP (measured at market exchange

[8] The United Nations Conference on Trade and Development (UNCTAD) issued a briefing pointing out this and other issues regarding Chinese FDI data and the challenges involved in comparing Chinese FDI statistics with those of other sources. See UNCTAD (2007).

[9] We thank Shang-Jin Wei and Robert Feenstra for suggesting that we explore this question.

[10] For a detailed explanation of these data, see Mataloni (1995).

rates). It also includes a China dummy that is equal to one for China and zero for other countries. If the coefficient on the China dummy is negative, this would indicate that measures of U.S. MNE activity in China are lower in China than a simple gravity specification would suggest they should be.

Once we have estimates from this base line specification, we include other country characteristics that could explain the extent to which U.S. MNEs engage in activity in China. Given the potential importance of taxes and corruption noted by Desai, Foley, Hines (2004) and Wei (2000), we include a measure of each country's corporate income tax rate and the corruption index taken from the ICRG political risk data set. In order to control for factors related levels of wealth and economic development more generally, we also include the log of GDP per capita (measured at market exchange rates). Descriptive statistics for the data used in the analysis presented in Table 5, as well as the analysis presented in Table 7, appear in Table 4.

The results of the gravity specifications appear in Table 5. The dependent variable used in columns 1-4 is the Log of Affiliate Sales, in 5-8 the Log of Affiliate Assets, and in 9-12 the Log of Affiliate Employment Compensation. Our base line specifications appear in columns 1, 5, and 9. In each of these specifications, the coefficient on the Log of Distance is negative and significant, and the coefficient on the Log of GDP is positive and significant. These findings are consistent with previous work and indicate that U.S. MNEs engage in more activity in larger countries that are closer to the U.S. In each of these specifications, the coefficient on the China dummy is negative and significant. These results point out that levels of U.S. MNE activity in China are

lower than would be predicted by a simple model in which levels of MNE activity vary with distance and country size.

The specifications in columns 2, 6, and 10 include measures of corporate tax rates. This variable is not significant in these specifications, and its inclusion does not change the negative coefficient on the China Dummy very much. Controlling for corruption, as in columns 3, 7, and 11, reduces the magnitude and significance of the China dummy. This dummy becomes insignificant although still negative in Column 3 and marginally significant in column 11 while the coefficient on the corruption index is positive and significant. China has a corruption index of 2 on a scale of 0 to 6 where higher numbers imply lower levels of corruption. These results suggest that China's low level of US MNE activity is at least in part a consequence of corruption or a factor that is correlated with corruption. The specifications presented in columns 4, 8, and 12 also include the Log of GDP per capita. Once this variable is included, the coefficient on the China Dummy is no longer significant. These results indicate that US MNE activity is actually not lower than one would expect if one accounts for the fact that per capita income is low in China and corruption is high.

While caution is surely warranted in using regression coefficients derived from cross-sectional evidence to make predictions about the evolution of economic variables over time, it is interesting to consider what our regression coefficients imply about the future of U.S. FDI in China. Given its rapid rate of current economic growth, it is likely that per capita income and aggregate GDP in China will rise sharply over the next 10 years. If the overall Chinese economy were to maintain growth rates of 10% per year

over the next decade, the combined effects of the estimated coefficients on GDP and GDP per capita would predict that U.S. affiliate sales in China would more than triple.

Fallacy Number 2. U.S. FDI in China is Export-Oriented

As the U.S.-China trade deficit has grown in recent years, a number of commentators have suggested that it has been driven by U.S. purchases of goods produced by U.S. affiliates in China. For example, in a 2000 briefing paper for the Economic Policy Institute, James Burke wrote, "The activities of U.S. multinational firms, together with China's protectionist trade policies, have had a significant role in increasing the U.S. trade deficit with China."[11]

Foreign firms in China have indeed played an increasingly dominant role in China's trade. Figure 3 shows the role of foreign firms in Chinese imports and exports, respectively. In a period in which Chinese exports and imports have been growing rapidly, these shares have been rising. By 2000, the share of FIEs in Chinese exports had reached more than 50%, and it continued to expand. Clearly, FIEs have accounted for a disproportionately large share of export growth during the years in which China has come to loom so large in world trade.

What role do U.S. affiliates play in this incredible surge of export growth? Almost none. Table 6 presents statistics on the extent to which U.S. affiliates in China sell their goods to customers located in the U.S. and the extent to which they trade with the U.S. The data illustrate that in 2004, about $39.7 billion of local affiliate sales were directed to the local market and only $3.7 billion were directed to the U.S. market. In

[11] See Burke (2000).

that year, U.S. exports to affiliates and U.S. imports from affiliates comprised less than 5% of affiliate sales. These patterns are not consistent with the hypothesis that U.S. affiliates operating in China are contributing to the large U.S. trade deficit by producing there and selling back to the U.S. Intrafirm trade by U.S. multinationals does not loom nearly as large in intermediating U.S.-China trade as the overall role of FIEs in Chinese trade might suggest. In fact, a comparison of the total exports to and imports from China ascribed to U.S. multinationals seems rather small in comparison to the magnitudes of bilateral trade flows in 2004. Total U.S. imports from China were $196.7 billion and total U.S. exports were $34.7 billion.[12] U.S. imports and exports between U.S. affiliates in China and their U.S. parents were $2.6 billion and $2.5 billion respectively.

What is true of U.S. multinationals seems to broadly true of multinationals from other Western countries. Every year the Chinese Ministry of Commerce publishes a list of the top 200 largest mainland Chinese firms by export value. The 200 firms included in the 2005 list accounted for one-third of total mainland exports in that year, providing a useful, if incomplete, sample of important exporting firms of all nationalities. Inspections of this list suggest that the total share of U.S., European, and Japanese multinationals in the exports of the top 200 is only 11%.[13] The majority of firms in this list are indeed foreign invested, but the foreigners hail from Taiwan, Hong Kong, and South Korea. Like American firms, the leading European multinationals in China appear to be focused primarily on the domestic market, not exports. The Chinese export miracle

[12] These figures were obtained from the U.S. Census Bureau web site at http://www.census.gov/foreign-trade/balance/c5700.html#2004. In 1999, U.S. exports to China totaled about $13 billion and imports from China were almost $82 billion.

[13] See Anderson (2006), from whom the statistics in this paragraph and the next are taken. The language here closely follows his.

largely reflects the activity of the foreign affiliates of firms based in Asia's other newly industrialized countries.

The role played by Japanese firms in Chinese exports appears to lie somewhere in between the roles played by Western firms and firms headquartered in developing countries in Asia. Ahn, Fukao, and Ito (2007) have used Japanese data and South Korean data to undertake an extensive study of the role played by these firms' affiliates in regional trade flows. Because many Japanese firms route their exports through Hong Kong, these authors aggregate Chinese and Hong Kong trade statistics. They find that the exports of Japanese firms' Chinese affiliates collectively account for nearly 41% of total Chinese/Hong Kong exports to Japan. Likewise, about 30% of total Japanese exports to China go to the Chinese affiliates of Japanese firms. The relatively greater role of Japanese affiliates in mediating Japan-China trade is likely to be related to geographic proximity and history. China is the closest major economy to the Japanese home islands, and many Japanese companies were quite active in parts of China prior to the end of World War II.

The limited role played by U.S. firms in mediating U.S.-China trade is surprising given the extent to which large U.S. retail chains distribute Chinese goods. According to some estimates, Wal-Mart accounts for almost $20 billion of Chinese exports to the U.S. However, Wal-Mart and other large-scale U.S. retailers typically procure their goods from China-based export-oriented manufacturing plants that are not U.S.-owned to any significant degree.[14] They tend to purchase from the same Taiwanese, Hong Kong, and Korean firms they sourced from a decade or two ago, expect that the final production is now based in mainland China.

[14] See Anderson (2006).

In order to explore in more detail if U.S. affiliates based in China are more focused on serving the local market that one should expect, we again make use of gravity specifications. In Table 7, we report results of tests that are identical to those presented in Table 5 except that dependant variables measure the extent to which U.S. affiliates based in different countries focus on serving markets outside of their host country. These tests use data aggregated to the country level for the year 2004.

The dependent variable used in columns 1-4 is the log of affiliate sales to persons outside the affiliate's host country; in 5-8 it is the share of affiliate sales to persons outside the host country and the U.S., and in 9-12 it is the share of affiliate sales to persons in the U.S. Our baseline specifications are given in columns 1, 5, and 9, and these include the log of distance from the U.S., host country GDP, and a China dummy as controls. The coefficient on the China dummy in column 1 is negative and marginally significant; it is negative and significant in column 5; but it is positive and insignificant in column 9. Therefore, there is only some evidence that U.S. affiliates in China are less focused on serving consumers outside their host country than are U.S. affiliates elsewhere. In fact, the share of sales to persons in the U.S. is not lower than one would expect once one accounts for country size and distance from the U.S.

Levels of sales to countries other than the host country are higher for affiliates located closer to the U.S. and for affiliates in larger countries. Shares of sales to persons in the U.S. are higher for affiliates located closer to the U.S., but distance from the U.S. does not, perhaps unsurprisingly, affect the share of sales to persons in countries other than host countries and the U.S. The log of GDP is also not significant in explaining shares of sales to the U.S. or countries other than the host country and the U.S.

Adding corporate tax rates to our specifications reduces the coefficients on the China dummy. The negative coefficients on this dummy presented in columns 2 and 6 are both statistically significant. The negative coefficients on host country tax rates imply that sales to persons outside the host country are higher in low tax countries. Tax rates faced by multinationals are relatively low in China. Therefore, accounting for corporate tax rates would lead one to predict that affiliates based in China should be more focused on serving markets outside of China. When we add the corruption index to the specifications, the coefficients on this variable are positive and significant in columns 3 and 7, indicating that affiliates in countries with less corruption sell more output outside the host country. Once this variable is included, none of the coefficients on the China dummy are significant. The specifications presented in columns 4, 8, and 12 also include a control for the log of GDP per capita. In each of these specifications, the coefficient on the China dummy is positive, although these coefficients are not significant. These results suggest that once one accounts for levels of corruption and country wealth, as well as tax rates, distance, and country size, U.S. affiliates in China are not less export oriented that affiliates based in other countries.

Fallacy Number 3. U.S. multinational investment in China displaces investment elsewhere.

U.S. workers often express concerns about increased competition for workers located in countries like China. Given the vast supply of labor in China, the low costs of production, and the alleged existence of technologically skilled workers, few employees outside of China feel secure. In the extreme, these concerns would predict that increased

activity in China by U.S. multinationals would displace activities that had been performed elsewhere.

The results of the previous sections suggest these concerns may be misplaced. As we have already demonstrated, levels of U.S. affiliate activity in China are modest. Furthermore, these affiliates have been and remain overwhelmingly focused on the domestic market. Given this, one would not expect increased activity in China to displace activity in other countries to a significant degree. However, we can approach this question much more directly. Using the BEA data, it is possible to see if multinationals that expand employment in China cut it at home or among their other affiliates. The data presented in Table 8 address this issue by providing number counts of incidents in which firms that increase or decrease employment in China increase or decrease employment in other locations. The data include observations computed using firm-level data from the 1989, 1994, 1999, and 2004 benchmark survey results, so there are three periods over which increases and decreases are considered, the 1989-1994, 1994-1999, and 1999-2004 periods. Entries into China by existing multinationals are counted as increases in employment in China and exits from China are counted as decreases.

The data in the top panel reflect the growth in employment that has taken place among Chinese affiliates of U.S. multinationals. It also points out that firms that expand in China are almost as likely to expand employment domestically as they are to cut it. This evidence is not what one would expect if growth in China were strictly displacing activity in the U.S. The bottom panel displays similar data, but instead of considering the tradeoff between activity in China and activity in the U.S., it considers the tradeoff

between activity in China and activity among other affiliates. It appears that firms that are increasing employment in China are increasing, and not decreasing, it elsewhere. Although somewhat crude, these statistics suggest that at least extreme notions that would give rise to concerns of multinational employees in the U.S. and elsewhere in the world are unfounded.

Fallacy Number 4: U.S. multinationals are aggressively exploiting China's growing technological prowess

In the U.S., China is often perceived as being an emerging technological superpower. Industrialists, economists, and policy makers believe that China is becoming an attractive location to perform innovative activity. In 2003, Intel CEO Craig Barrett identified China's rising technological strength as constituting a competitive threat to U.S.-based high-technology industries.[15] Harvard economist Richard Freeman (2006) has outlined the potential consequences of the globalization of the science and engineering workforce for America's historical pattern of comparative advantage in high-technology industries. Freeman points to the striking rise in the number of multinational R&D centers in China – more than 700 by the end of 2004 – and argues that this is only the harbinger of greater reallocation yet to come.[16] Trefler and Puga (2005) point to the rise of R&D activity in China and declare that the economics profession should "wake up and smell the ginseng!" In its 2005 annual survey of global FDI trends, the World Investment Report produced by UNCTAD highlighted the internationalization of R&D, and singled out the growth of foreign R&D centers in China as a development of

[15] This speech by Barrett was widely noted at the time. See http://money.cnn.com/2003/10/03/technology/barrett/index.htm.

[16] See also the discussion of this trend in the 2005 World Investment Report published by UNCTAD.

particular significance. Management scholar Minyuan Zhao (2006) has studied the patents generated by these centers for clues as to how American multinationals have apparently learned to engage in large-scale, sophisticated R&D in a national context with notoriously weak intellectual property rights.

Proponents of the view that China is quickly emerging as a favorable location for high tech activity often point to evidence on the growing sophistication of China's exports as proof of their claims. Schott (2006), for example, finds that over time Chinese exports exhibit rising sophistication relative to countries with similar aggregate endowments.[17] Rodrik (2006) finds an unusually high degree of technological sophistication in China's export pattern. Cui and Syed (2007) suggest that recent changes in China's trade patterns indicate that it is rapidly becoming a surprisingly mature economy. Preeg (2004, 9), a researcher with the Manufacturers Alliance, charges that China's emergence as a major supplier of information technology, communication, and electronic products poses a major challenge to U.S. commercial and security interests.

Several considerations suggest these views are overblown. First, the extent of innovative activity performed in China by U.S. multinationals is surprisingly modest. Table 9 provides 2004 data on expenditures for research and development performed by U.S. affiliates in China, U.S. affiliates based in other regions, and the U.S.-based parent operations of U.S. MNEs. Only $622 million was spent by U.S. MNEs on R&D in China, an amount that is about 3 tenths of one percent of the total R&D undertaken globally by U.S. MNEs.[18] Nearly 85% of R&D performed by U.S. multinationals in 2004 was

[17] However, Schott qualifies this finding by documenting a decline in the prices of Chinese exports relative to OECD exports of similar products.

[18] The fraction takes as its denominator the sum of expenditures on R&D preformed by the U.S. parent and the R&D expenditures performed by all affiliates of U.S. firms in all countries.

performed by the U.S.-based parent company. Less than 13% of the $4.9 billion of the R&D that U.S. multinationals performed in the Asia and Pacific region was performed in China.

U.S. patent data also indicate that China's innovative capability is more limited than some have suggested and that U.S. firms are not performing much innovative activity there. Anyone seeking to protect intellectual property within the borders of the United States must apply for patent protection from the U.S. Patent and Trademark Office (U.S. PTO). Given the importance of the U.S. economy to the world in general and to China in particular, it is reasonable to regard patents taken out by China-based inventors in the U.S. as a useful indicator of inventive activity. The CASSIS CD-ROM produced by the U.S. PTO provides information about U.S. patents, and we use the December 2006 version to produce Figure 4.

Figure 4 tracks China-generated patents in various categories over time. The dramatic growth in patenting over time is evident in this graph, but levels of patenting activity remain low. From the beginning of 2000 to the end of 2006, the U.S. PTO granted 3,447 patents to inventors based in China or teams of inventors that included at least one member with a Chinese address. Over the same period, inventors with ties to Japan received nearly 241,000 patents, inventors with ties to Taiwan received over 39,000 patents, and inventors with ties to Israel received over 8,000 patents.

It is informative to break out patents generated in China into patents in which all listed inventors at the time of invention were based in China and also to break out patents that were assigned to U.S. corporate entities. As Figure 4 indicates, a large and growing fraction of patents with Chinese inventors reflect collaborative work with inventors

located elsewhere.[19] U.S. corporate entities appear to be associated with fewer than 1,000 the granted patents, and only a relatively small percentage of China-generated patents assigned to U.S. multinationals reflect the inventive of input of a purely Chinese team of inventors. This could reflect a deliberate attempt on the part of U.S. R&D centers in China to conduct research that only has value when combined with a complementary research input from the U.S. or from another relatively advanced country. Zhao (2006) describes this strategy as a way for U.S.-based multinationals to cope with the poor intellectual property rights regime in China. Another interpretation is that Chinese scientists and engineers, despite impressive levels of raw talent and basic skills, find it difficult to innovative effectively at the technological frontier on their own, and often require the input of R&D managers and experts based elsewhere in the world to go beyond the existing state of the art.

While China may not yet be an important generator of U.S. patents in the aggregate, it is possible that China-based research activities may be important for particular American firms. To assess this, we examined the total patent portfolios of U.S. corporate entities that hold patents in China. As of late 2006, about 120 U.S. corporate assignees have been granted at least 2 patents for which at least one inventor was based in China. The Chinese patents of these firms comprise only slightly more than 1% of the annual patenting activity of these firms in 2006.[20]

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[19] Nearly 40% of China-generated U.S. patents identify inventors based in at least one other country. In contrast, nearly 90% of U.S. patents granted to U.S. firms in the last three years are generated by inventors based solely in the U.S. and a similar percentage of Japan-generated U.S. patents represent the product of only Japanese inventors.

[20] One can combine the patent data with the R&D data to generate crude estimates of the patents per R&D dollar generated by U.S. affiliate R&D spending in China and compare that to the patents per R&D dollar generated by R&D spending by the parent firm in the U.S. According to our estimates, the ratio of U.S. patents per R&D dollar in China is less than half this ratio in the U.S. This difference is consistent with the view that the R&D conducted in Chinese affiliates tends to be more focused on modification of the parent

By far, the leading U.S. firm, in terms of China-generated patents, is Microsoft. Table 10 lists the top 10 corporate assignees in terms of China-generated U.S. patents. Microsoft has nearly three times as many China-generated patents as IBM and Intel. After years of fractious relationships with the Chinese government, Microsoft sought to cultivate more harmonious ties with key government officials by opening multiple research centers in the PRC.[21] Microsoft lavished rather large sums of money on these facilities and sought to attract high-profile researchers to them, an effort described at length in a recent book by Buderi and Huang, *Guanxi: The Art of Relationships*. Senior Microsoft executives, including former CEO Bill Gates, have regularly reiterated their commitment to conducting world class research in China at the very frontier of software technology. In the context of that public commitment, it is interesting to note that Microsoft's China-generated patents amount to less than 4% of its total cumulative patents to date.[22] If we restrict ourselves to patents with solely Chinese inventor teams, this fraction drops to about 1.5%.

Interestingly, the leading patent-generating firm in China, with more than four times Microsoft's cumulated patent stock and a commanding lead over any indigenous mainland Chinese firm, is the Taiwanese contract manufacturing firm, Hon Hai, also known by its English trade name, Foxconn. Hon Hai is one of four Taiwanese manufacturing firms to appear on this top 10 list. As is the case with export-oriented

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firm's technology for the Chinese market or the development of technology specifically for that market than it is on the kind of fundamental, strategically sensitive research conducted in the parents' own labs.

[21] An interesting account of Microsoft's early missteps in the People's Republic is provided by Khanna (1997). Poor relationships with the central government of the PRC ensured that rates of piracy of Microsoft products in China remained among the highest in the world for years.

[22] In private conversations with the authors, some U.S. corporate managers have referred to the R&D centers opened by their firms in China as "PR&D" centers – that is, they were as much about public relations efforts directed at a mainland regime reluctant to enforce intellectual property rights as they were about "real" research and development.

manufacturing, it appears the Taiwanese firms are more aggressively exploiting the opportunities to conduct research in China, such as they are, than are their U.S. counterparts.

Although the amount of innovative activity performed in China is lower than it is often perceived to be, the types of goods China exports are fairly technologically advanced. This has posed a puzzle to some economists. However, China is able to export huge quantities of high tech goods only because it imports most of the high value-added parts and components that go into these goods.[23] Figure 5 displays the level of Chinese exports and imports in electronic and information industry products. The domestic value-added component of the value of exported electronic and information technology products, while growing, remains quite low.[24] Even in the most recent years for which data are available, more than 70% of the value of these exports is comprised of imported inputs.[25]

While U.S. multinationals, with a few exceptions, do not play a major role in Chinese exports of high-tech goods, we also see in U.S. affiliate data a strong correlation in high-tech industries between imports from the parent and sales. Regression analyses of affiliate sales on measures of imported intermediates from the parent show a dramatically stronger connection for more R&D intensive industries, underscoring the relatively higher dependence of such activity in China on key inputs from the parent.

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[23] This section of the text reflects the influence of Nicholas Lardy's writings on this subject. Some of the facts and figures in the following paragraphs reproduce points made in Lardy's presentations and in Branstetter and Lardy (2006).

[24] An entertaining specific example of this is provided by Linden, Kraemer, and Dedrick (2007), who break down the production process for an Apple iPod, all of which are assembled in and exported from China. The authors' careful, if incomplete, cost accounting suggests that Chinese value added represents at most a few dollars of the roughly $150 factory cost for the typical iPod.

[25] In light manufacturing, in contrast, domestic content accounts for nearly 70% of the value of exports. See Anderson (2007) for a useful review of the most recent data.

Taken together, levels of R&D conducted in China, the amount of patenting associated with innovation based in China, and the low Chinese value added in high tech Chinese exports suggest that China is far from becoming a technological superpower that will be home to a large share of U.S. MNE innovative activity.

Conclusions

The emergence of China as an important trading economy has been one of the most significant economic developments of our time. Nevertheless, the scale of U.S. affiliate activity in China remains relatively modest. U.S. affiliates based in China account for less than 2% of total U.S. affiliate sales, they contribute relatively little to aggregate Chinese investment, and they play a surprisingly small role in mediating the expansion of U.S.-China trade. Partly because of their strong focus on the domestic market and partly because of the small scale of their operations, U.S. affiliates in China do not appear to have significantly displaced investment elsewhere as they have increased the scale and scope of their operations in China.

Limited levels of U.S. affiliate activity in China do not indicate an unusual degree of "China aversion" on the part of U.S. investing firms. Rather, it reflects the fact that most U.S. affiliate activity takes place in countries that are large, that are geographically proximate to the United States, that have low levels of corruption, and that are wealthy. Controlling for distance, GDP, tax rates, corruption, and GDP per capita, U.S. MNE activity in China and the extent to which U.S. affiliates in China sell goods to the U.S. and other countries besides China is neither especially low, nor especially high. Rapid growth in Chinese aggregate GDP and income per capita is likely to motivate U.S. firms

to continue to expand the base of their operations in China. But given the existing scale of U.S. activity elsewhere, the relative size of affiliate activity in China is likely to remain modest for some time to come.

Despite widespread interest in the possible emergence of China as a center of technological innovation, U.S. affiliates conduct relatively little R&D in the country, and affiliate activity in technology-intensive industries appears to remain quite dependent on the supporting activities of the parent firm. China's ability to innovate, as evidenced by numbers of U.S. patents with at least one China-based inventor, remains well behind the much more developed capabilities of other East Asian countries like Japan, Taiwan, and South Korea. Rapid growth of R&D and invention proceeds in China, but from an extremely small base. The picture traced out by rapid changes in the structure of Chinese exports of an emerging technological superpower belies a more modest reality. China's exports of high-technology goods are still quite dependent on imported components, technology, and expertise. Despite impressive progress and spectacular growth in human capital, China's transition to status as a significant net exporter of innovative goods and services almost certainly lies many years in the future.

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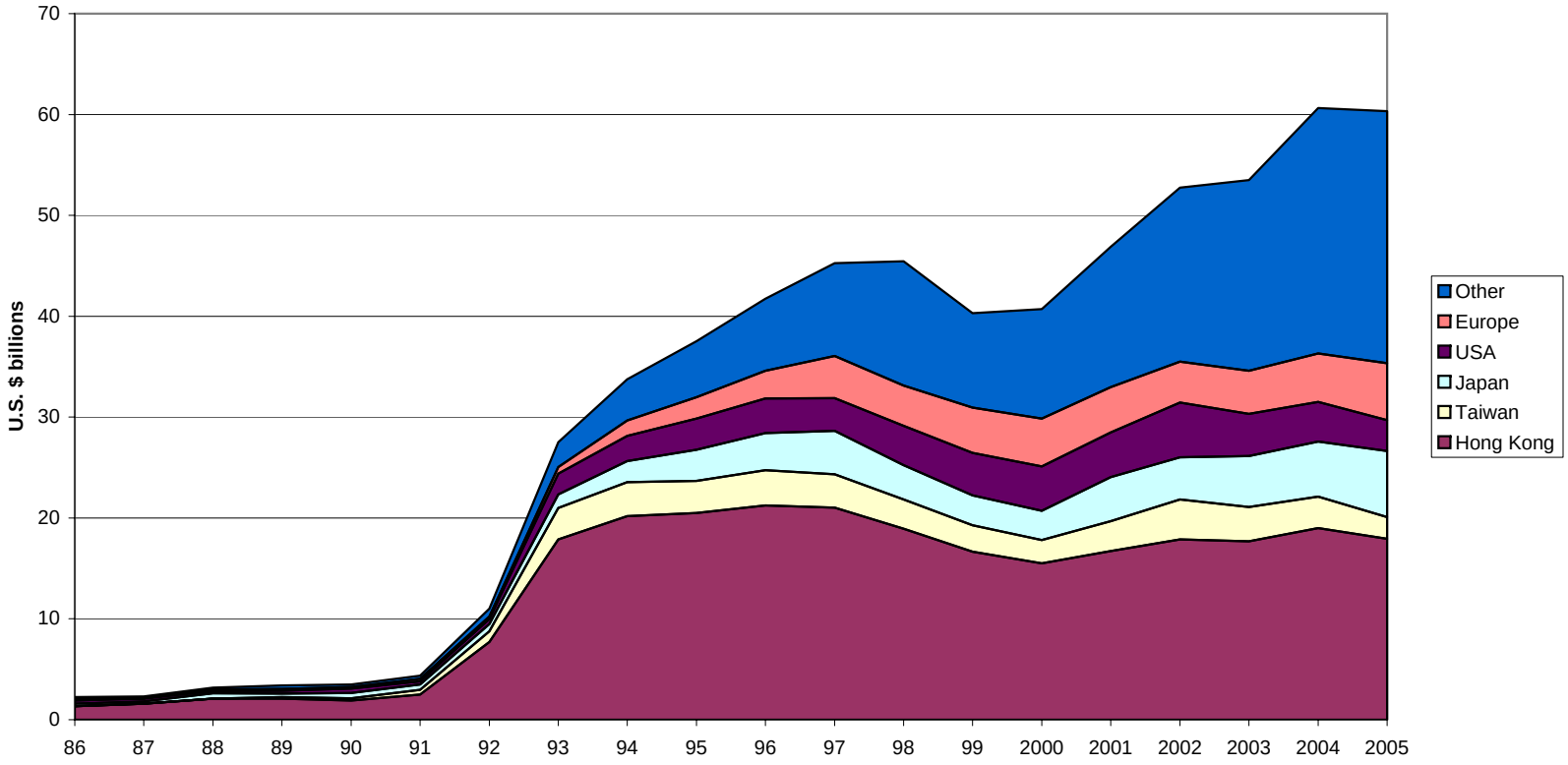
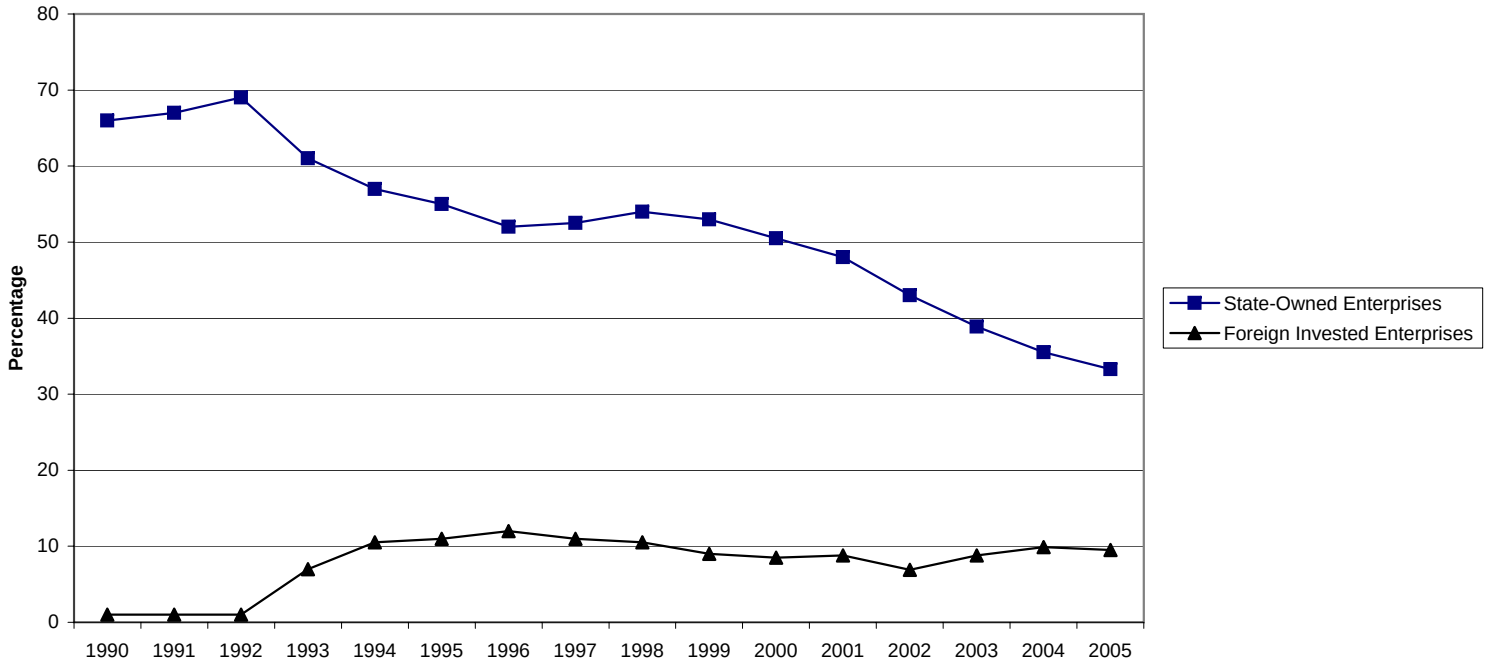
Figure 1 FDI by Source Country



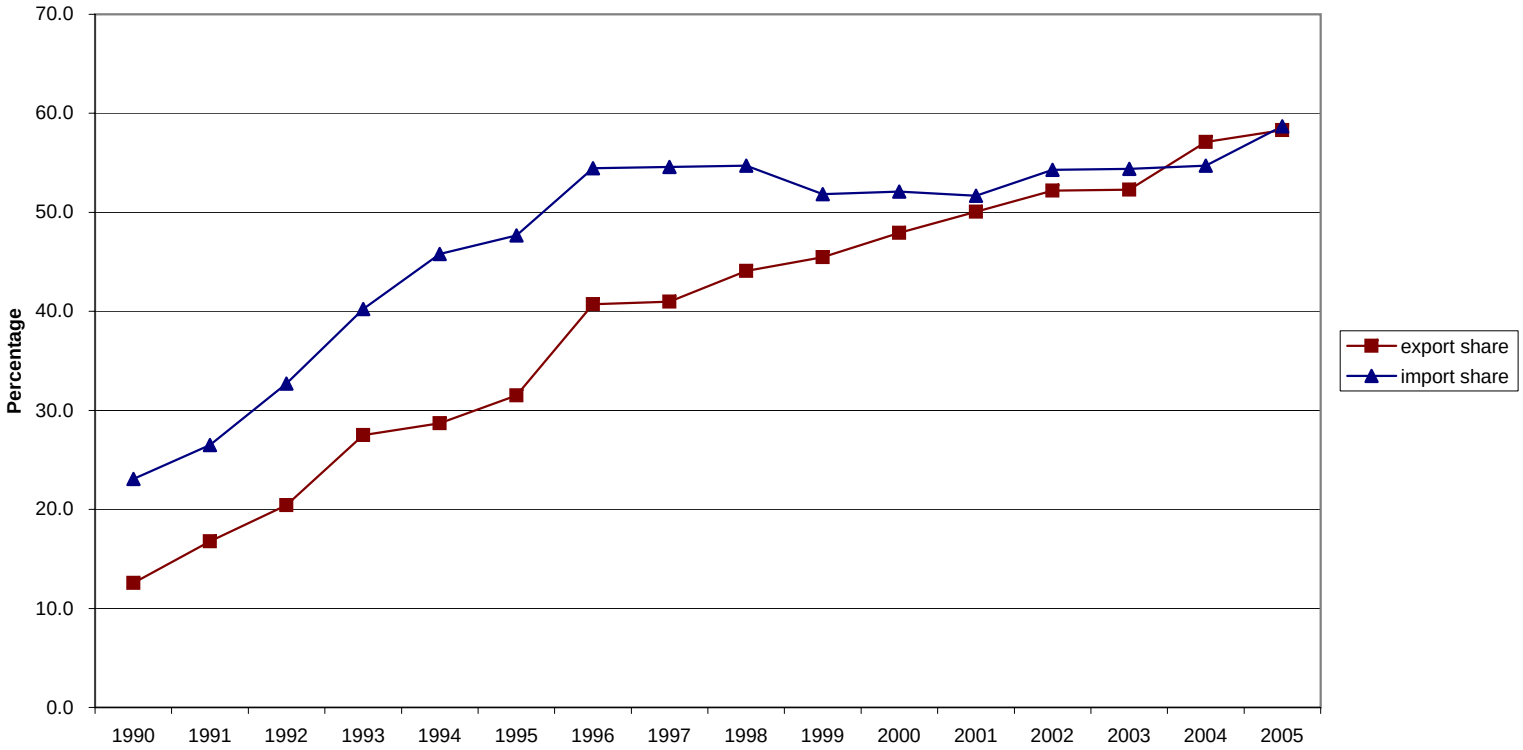
Source: Data on FDI inflows are collected by the Ministry of Commerce of the People's Republic of China and reported in the China Statistical Yearbooks, various issues.

Figure 2 Fixed Asset Investment by Organizational Form



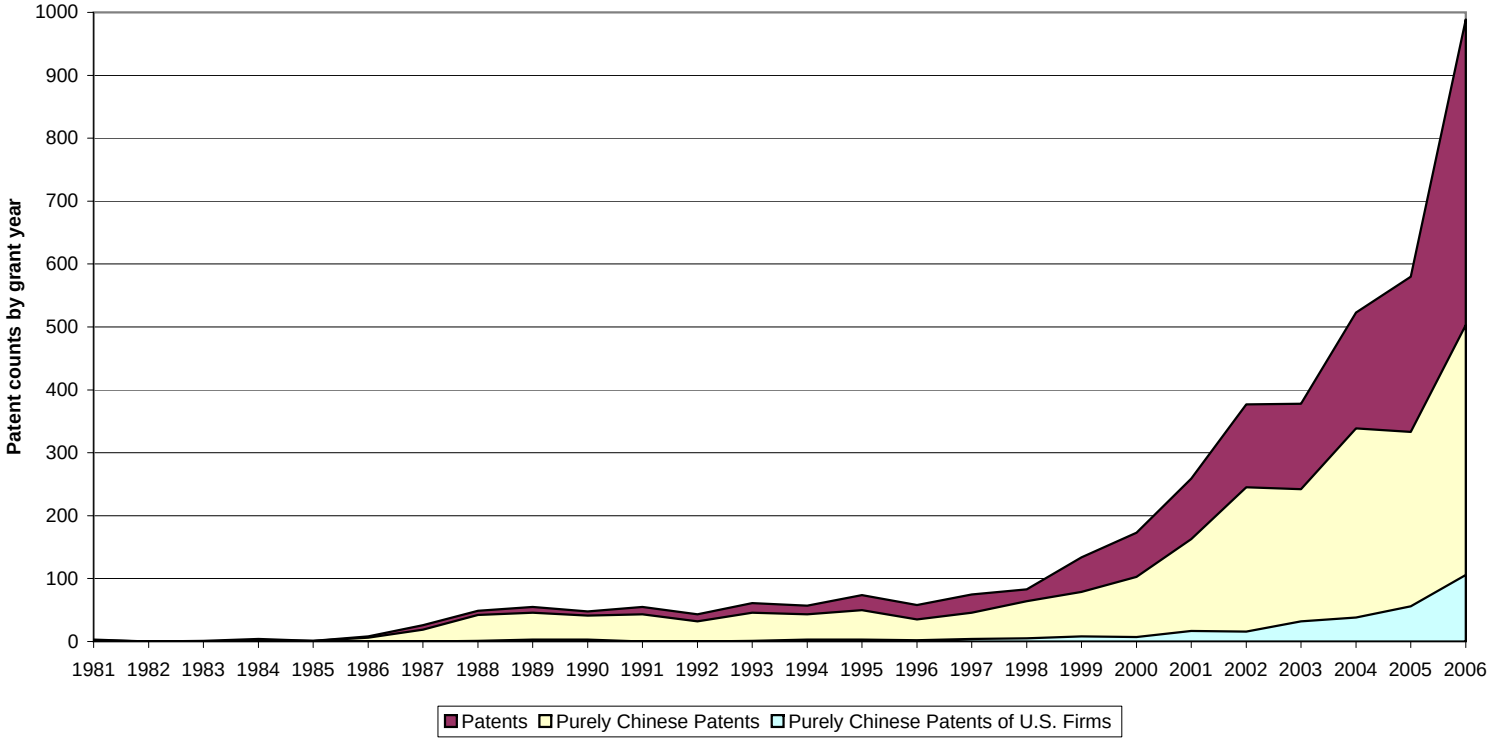
Source: Data on the fraction of fixed asset investment undertaken by state-owned enterprises and foreign-invested enterprises are taken from the China Statistical Yearbooks, various issues.

Figure 3 The Role of FIEs in China's Exports and Imports



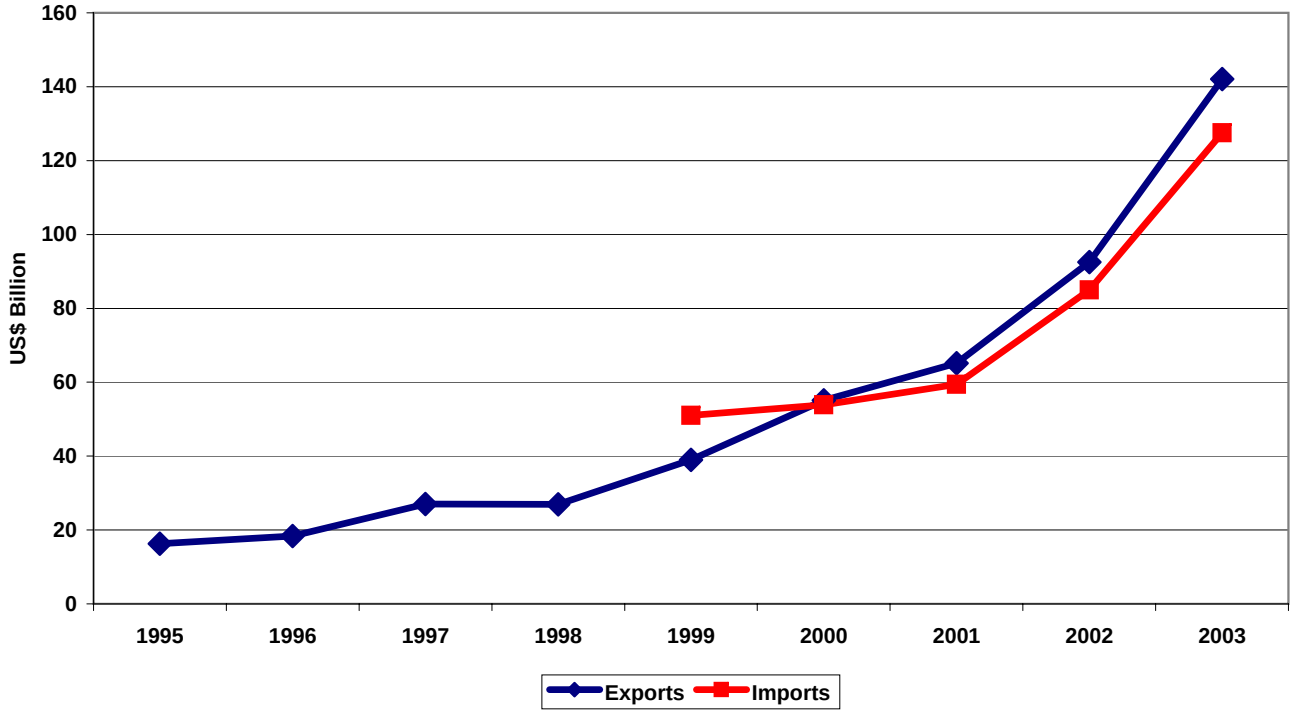
Source: Data measure the share of export value and import value accounted by foreign invested enterprises. Data are taken from the China Statistical Yearbooks, various issues

Figure 4 China-Generated U.S. Patents, 1981-2006



Source: Data are taken from the U.S. Patent and Trademark Office CASSIS CD-ROM database, December 2006 version. China generated U.S. patents are U.S. utility patents for which at least one listed inventor was resident in China at the time of patent application. Purely Chinese patents are those patents for which all listed inventors have addresses in the People's Republic of China. Purely Chinese patents of U.S. firms are "purely Chinese" patents assigned to a U.S. corporate entity.

Figure 5 China's Trade in Electronics and Information Industry Products, 1995-2003



Source: Data are taken from China customs statistics and the Chinese Ministry of Information Industries (MII)

Table 1

Measures of U.S. multinational affilate activity in 2004

These data are drawn from preliminary results of BEA's 2004 Benchmark Survey of U.S. Direct Investment Abroad. They cover all nonbank affiliates of nonbank U.S. parents. Sales and assets are in millions of U.S. dollars, employment is in thousands.

	Number of Affiliates	Sales	Assets	Employment
China	688	71,721	63,783	455
Europe	12,367	1,909,697	5,376,372	4,291
Canada	1,839	442,607	634,677	1,092
Latin America and Other Western Hemisphere	3,693	417,185	1,208,716	1,936
Asia and Pacific	5,093	886,596	1,362,061	2,396
Total Affiliate Activity	23,928	3,768,733	8,757,063	10,028

Table 2

U.S. and Chinese Estimates of FDI flows from the U.S. to China

This table presents data on aggregate annual FDI flows from the U.S. to China. The U.S. data are taken from the U.S. Bureau of Economic Analysis. These data are compared with the data reported by the Chinese Ministry of Commerce on investment by foreign firms with U.S. parents for the same years; the Chinese data are taken from various years of the China Statistical Yearbook. Both series are reported in millions of U.S. current dollars at prevailing exchange rates.

	U.S. Data	Chinese Data
1994	1,232	2,491
1995	261	3,084
1996	933	3,444
1997	1,250	3,461
1998	1,497	3,989
1999	1,947	4,216
2000	1,817	4,384
2001	1,912	4,433
2002	875	5,424
2003	1,273	4,199
2004	3,670	3,941
2005	1613	3,061

Table 3

External finance of affiliates in 2004

These data are drawn from preliminary results of BEA's 2004 Benchmark Survey of U.S. Direct Investment Abroad. The data on the use of whole ownership covers all nonbank affiliates of nonbank U.S. parents, and the data on patterns in external financing only cover majority owned nonbank affiliates of nonbank U.S. parents. Total external finance, total current liabilities and long term debt, and owners equity excluding retained earnings and translation adjustments are measured in millions of U.S. dollars.

	Share of Affiliates that are Wholly Owned	Total External Finance	Owners Equity Excluding Retained Earnings and Translation Adjustments	Total Current Liabilities and Long Term Debt	Share of Total Current Liabilities and Long Term Debt Owed to Parents	Share of Total Current Liabilities and Long Term Debt Owed to Local Persons	Share of Total Current Liabilities and Long Term Debt Owed to Other Persons
China	70%	42,634	17,026	25,609	19%	61%	20%
Europe	89%	4,036,186	1,469,373	2,566,813	14%	46%	40%
Canada	90%	425,659	136,922	288,737	14%	74%	12%
Latin America and Other Western Hemisphere	81%	816,610	413,788	402,822	17%	40%	43%
Asia and Pacific	78%	746,650	227,323	519,328	12%	61%	28%
Total Affiliate Activity	85%	6,113,840	2,285,402	3,828,438	14%	49%	36%

Table 4

Descriptive Statistics

This table presents descriptive statistics for variables used in the analysis of 2004 affiliate activity aggregated to the country level. Sales, assets, and employment compensation are measured in thousands of US dollars. The Log of Distance is the log of distance between US and affiliate host country capital cities measured in miles. The Log of GDP and the Log of GDP per Capita measure host country gross domestic product and gross domestic product per capita, and these variables are drawn from the World Bank's World Development Indicators. The Country Tax Rate is a measure of the median effective corporate tax rate paid by US multinationals in a host country. The Corruption Index is an index of corruption that ranges from 0 to 6, with lower numbers indicating higher levels of corruption, and it is taken from the ICRG political risk data.

	Mean	Median	Standard Deviation
Log of Affiliate Sales	14.8417	14.7465	2.5201
Log of Affiliate Assets	15.2026	15.2270	2.7386
Log of Affiliate Employment Compensation	12.1616	12.1126	2.7121
Log of Affiliate Sales Outside Host Country	12.4630	13.4019	4.7275
Share of Sales to Countries Other Than Host Country and the US	0.2719	0.2105	0.2390
Share of Sales to the US	0.0785	0.0290	0.1250
Log of Distance	8.4632	8.4972	0.5089
Log of GDP	24.3406	23.8887	1.8934
Country Tax Rate	0.2143	0.2354	0.1319
Corruption Index	2.5636	2.4792	1.1395
Log of GDP per capita	8.0364	8.0819	1.5652

Table 5

Levels of Affiliate Activity

This table presents results of specifications explaining measures of 2004 affiliate activity aggregated to the country level. The dependant variable in the specifications presented in columns (1)-(4) is the log of affiliate sales, and it is the log of affiliate assets and the log of affiliate employment compensation in the specifications (5)-(8) and (9)-(12). Sales, assets, and employment compensation are measured in thousands of US dollars. The China Dummy is equal to one for China and zero for other countries. The Log of Distance is the log of distance between US and affiliate host country capital cities measured in miles. The Log of GDP and the Log of GDP per Capita measure host country gross domestic product and gross domestic product per capita, and these variables are drawn from the World Bank's World Development Indicators. The Country Tax Rate is a measure of the median effective corporate tax rate paid by US multinationals in a host country. The Corruption Index is an index of corruption that ranges from 0 to 6, with lower numbers indicating higher levels of corruption, and it is taken from the ICRG political risk data. Heteroskedasticity-consistent standard errors are presented in parentheses.

Dependent Variable:	Log of Affiliate Sales				Log of Affiliate Assets				Log of Affiliate Employment Compensation			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-5.2715	-5.3051	-5.1289	-5.2290	-6.6216	-6.4111	-6.1649	-6.3221	-8.8940	-8.8730	-8.5979	-8.7062
	(2.5952)	(2.6137)	(2.5348)	(2.5886)	(2.7525)	(2.7103)	(2.5884)	(2.6119)	(2.8202)	(2.8286)	(2.6407)	(2.7182)
China Dummy	-0.7304	-0.6996	-0.3181	0.1592	-1.4867	-1.6798	-1.1471	-0.3979	-1.2344	-1.2537	-0.6584	-0.1420
	(0.3040)	(0.3645)	(0.4006)	(0.5909)	(0.3132)	(0.3640)	(0.3537)	(0.5044)	(0.3161)	(0.3659)	(0.3706)	(0.5350)
Log of Distance	-0.8477	-0.8471	-0.7660	-0.7026	-0.8491	-0.8530	-0.7398	-0.6402	-1.0653	-1.0657	-0.9392	-0.8706
	(0.1919)	(0.1924)	(0.1870)	(0.1722)	(0.2230)	(0.2226)	(0.2200)	(0.1961)	(0.2126)	(0.2129)	(0.2053)	(0.1919)
Log of GDP	1.1213	1.1206	1.0558	0.9757	1.1924	1.1970	1.1066	0.9807	1.2359	1.2364	1.1353	1.0485
	(0.0717)	(0.0723)	(0.0792)	(0.0921)	(0.0818)	(0.0792)	(0.0834)	(0.0902)	(0.0798)	(0.0798)	(0.0809)	(0.0851)
Country Tax Rate		0.2148	0.2722	0.9495		-1.3462	-1.2660	-0.2028		-0.1345	-0.0449	0.6879
		(1.0890)	(1.0641)	(1.4285)		(1.2924)	(1.2308)	(1.4796)		(1.1550)	(1.0928)	(1.4394)
Corruption Index			0.2725	0.1294			0.3806	0.1560			0.4253	0.2705
			(0.1118)	(0.1416)			(0.1351)	(0.1714)			(0.1025)	(0.1486)
Log of GDP per Capita				0.2155				0.3382				0.2331
				(0.1690)				(0.1719)				(0.1692)
No. of Obs.	116	116	116	116	116	116	116	116	116	116	116	116
R-Squared	0.7260	0.7261	0.7387	0.7445	0.6871	0.6913	0.7121	0.7243	0.7665	0.7666	0.7931	0.7990

Table 6

Affiliate sales by destination and trade activity

These data are drawn from published results of BEA's benchmark surveys of U.S. direct investment abroad for 1989, 1994, 1999, and 2004. The data only cover majority owned nonbank Chinese affiliates of nonbank U.S. parents. Sales, exports and imports are measured in millions of U.S. dollars

	1989	1994	1999	2004
U.S. Multinational Affiliate Sales				
Sales to the U.S.	1	219	2,703	3,694
Local Sales	242	2,520	14,306	39,719
Sales to other foreign countries	13	486	3,371	11,293
U.S. Exports of goods to affiliates				
Total	39	371	3,103	2,974
Shipped by U.S. Parents	35	288	2,529	2,541
Shipped by unaffiliated U.S. persons	4	83	574	433
U.S. Imports of goods shipped by affiliates				
Total	1	448	2,640	3,188
Shipped to U.S. Parents	1	403	1,778	2,640
Shipped to unaffiliated U.S. persons	NA	45	862	548

Table 7

Affiliates Sales by Location

This table presents results of specifications explaining measures of 2004 affiliate sales aggregated to the country level. The dependant variable in the specifications presented in columns (1)-(4) is the log of affiliate sales outside of the host country, and it is the share of affiliate sales to countries other than the host country and the US and the share of affiliate sales to the US in the specifications (5)-(8) and (9)-(12). Sales are measured in thousands of US dollars. The China Dummy is equal to one for China and zero for other countries. The Log of Distance is the log of the distance between US and affiliate host country capital cities measured in miles. The Log of GDP and the Log of GDP per Capita measure host country gross domestic product and gross domestic product per capita, and these variables are drawn from the World Bank's World Development Indicators. The Country Tax Rate is a measure of the median effective corporate tax rate paid by US multinationals in a host country. The Corruption Index is an index of corruption that ranges from 0 to 6, with lower numbers indicating higher levels of corruption, and it is taken from the ICRG political risk data. Heteroskedasticity-consistent standard errors are presented in parentheses.

Dependent Variable:	Log of Affiliate Sales Outside Host Country				Share of Sales to Countries Other Than Host Country and the US				Share of Sales to the US			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-13.6344	-12.9538	-12.5654	-12.8197	-0.0849	-0.0289	0.0008	-0.0267	0.6123	0.6360	0.6305	0.6289
	(7.6975)	(7.1763)	(6.9449)	(6.9341)	(0.3983)	(0.3913)	(0.3800)	(0.3683)	(0.3165)	(0.3100)	(0.3128)	(0.3137)
China Dummy	-1.2602	-1.8846	-1.0439	0.1684	-0.0826	-0.1340	-0.0698	0.0611	0.0304	0.0087	-0.0030	0.0046
	(0.7222)	(0.9812)	(1.0882)	(1.3090)	(0.0419)	(0.0515)	(0.0619)	(0.0885)	(0.0299)	(0.0262)	(0.0300)	(0.0457)
Log of Distance	-1.3042	-1.3168	-1.1381	-0.9769	0.0567	0.0557	0.0693	0.0867	-0.0485	-0.0490	-0.0515	-0.0505
	(0.6683)	(0.6549)	(0.6483)	(0.6390)	(0.0338)	(0.0346)	(0.0326)	(0.0320)	(0.0213)	(0.0212)	(0.0217)	(0.0215)
Log of GDP	1.5261	1.5410	1.3983	1.1947	-0.0050	-0.0038	-0.0147	-0.0367	-0.0051	-0.0045	-0.0025	-0.0038
	(0.2061)	(0.2017)	(0.2124)	(0.2380)	(0.0111)	(0.0106)	(0.0121)	(0.0172)	(0.0080)	(0.0074)	(0.0080)	(0.0096)
Country Tax Rate		-4.3521	-4.2255	-2.5052		-0.3585	-0.3489	-0.1631		-0.1511	-0.1529	-0.1421
		(3.2355)	(3.2056)	(3.3893)		(0.1911)	(0.1871)	(0.1986)		(0.1114)	(0.1113)	(0.1302)
Corruption Index			0.6006	0.2372			0.0459	0.0067			-0.0084	-0.0107
			(0.2663)	(0.4416)			(0.0229)	(0.0253)			(0.0076)	(0.0140)
Log of GDP per Capita				0.5473				0.0591				0.0034
				(0.4405)				(0.0269)				(0.0156)
No. of Obs.	116	116	116	116	116	116	116	116	116	116	116	116
R-Squared	0.3852	0.3997	0.4172	0.4278	0.0169	0.0557	0.0954	0.1441	0.0448	0.0699	0.0748	0.0754

Table 8

Changes in affiliate employment in China and changes in firm employment elsewhere

This table present number counts of the incidents in which changes in a firm's employment in China are associated with changes in the firms employment in the U.S. and among its other affiliates. Changes are measured over three distinct time periods, 1989-1994, 1994-1999, and 1999-2004.

Change in employment in China	Change in domestic employment: Increase	Change in domestic employment: Decrease
Increase	203	213
Decrease	27	74

Change in employment in China	Change in employment among other affiliates: Increase	Change in employment among other affiliates: Decrease
Increase	316	155
Decrease	42	84

Table 9

U.S. MNE Research and Development

These data are drawn from the published results of the 2004 BEA Survey of U.S. Direct Investment Abroad. The affiliate data only cover majority owned nonbank affiliates of nonbank parents, and the parent activity measure covers all nonbank parents of nonbank affiliates. Research and development expenditures are measured in millions of U.S. dollars.

	2004
China	622
Europe	18,148
Canada	2,702
Latin America and Other Western Hemisphere	882
Asia and Pacific	4,934
Total Affiliate Activity	27,529
Parent Activity	152,384

Table 10

Top 10 Chinese Generators of U.S. Patents

Rank	Name	Nationality	Numbers of U.S. Patents
1	Hon Hai/Foxconn*	Taiwan	644
2	Microsoft Corporation	U.S.	151
3	Inventec Corporation**	Taiwan	94
4	China Petrochemical	China	79
5	SAE Magnetics***	Japan	39
5	China Petroleum and Chemical Corp	China	39
6	Huawei Technologies	China	34
7	IBM	U.S.	33
7	Winbond Electronics	Taiwan	33
8	Intel	U.S.	30
9	United Microelectronics	Taiwan	27
10	Proctor and Gamble	U.S.	24

*Hon Hai Precision Industries in Taiwan takes out patents in the U.S. under its Taiwanese name and its English trade name. Figures here represent the sum of China-generated patents taken out under both names.

**Inventec Corporation has multiple subsidiaries and affiliates that take out patents in the U.S.; the figures reported here represent the sum of these patents.

***SAE Magnetics, based in Hong Kong, is a wholly owned subsidiary of TDK, a Japanese multinational electronics manufacturer.