CHAPTER 4

Foreign Direct Investment in China's High-Technology Manufacturing Industries

Mary E. Lovely and Zixuan Huang

INTRODUCTION

Since 1990, inward foreign direct investment (FDI) has been a key driver of China's export expansion. The share of China's total exports accounted for by wholly foreign-owned enterprises operating in China and Sino-foreign joint ventures has risen steadily over time, from about 31 percent in 1995 to 58 percent in 2005 (Wang and Wei 2010). By 2015, the share of Chinese exports originating from foreign-invested enterprises had fallen somewhat but remained high at 46 percent, with wide variation across sectors.[1] While noting that the contribution of exports and FDI to growth can be overstated, Branstetter and Lardy (2008) argue that "there is no question that expanding trade and FDI have contributed to Chinese living standards…. China has been able to alter its pattern of trade to conform to its comparative advantage" (p. 648).

Over the past two decades, however, foreign investment into China has perhaps clouded our understanding of how much and how rapidly China's comparative advantage has changed. Shifts toward more technologically sophisticated and higher value products suggest that Chinese indigenous innovation capabilities have progressed rapidly.[2] Given the extent of foreign engagement in China's high-technology sectors, however, shifts in export composition may be misleading indicators of domestic development.

This paper provides a survey of foreign investment activity in China's high-tech manufacturing. It begins with an overview of foreign investment trends and their relationship to China's involvement in global

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1. *Source:* Authors' analysis of Chinese Customs data.

2. See Wang and Wei (2010) for an extensive decomposition of Chinese trade patterns and the role of foreign investment, processing trade, human capital development, and high-technology zones.

value chains. Next, for high-tech manufacturing industries, it examines trends in the share of assets and profits held by foreign-invested enterprises compared to Chinese domestic firms in the sector to assess the latter's progress. Exports reveal productive capabilities as well as global connections, so the share of exports originating in foreign-invested enterprises is examined in some detail. This paper finds that while the value of foreign investment in high-tech manufacturing in China has grown, the share of assets in foreign-invested firms in the sector declined between 2011 and 2016. Nevertheless, foreign-funded enterprises remain the source of most high-tech manufactured exports, primarily from wholly foreign-owned firms. In sum, despite indigenous development, Chinese high-tech manufacturing and exports remain deeply tied to foreign investment.

FDI AND THE GROWTH IN CHINESE HIGH-TECH EXPORTS

Inward foreign investment benefits the Chinese economy in many ways. Foreign investors provide access to innovative technology, advanced management practices, connections to global supply chains, and employment. Chinese industrial policies reflect a clear understanding of these advantages. From the "22 Regulations" in the late 1980s—a major regulatory change in FDI applied throughout China (Branstetter and Lardy 2006)—to the current reduced negative list of sectors off limits to foreign investors, China has progressively eased restrictions on inward foreign investment. Most recently, at the 2018 Boao Forum, Chinese president Xi Jinping promised foreign companies greater access to China's market, in particular announcing that a 50 percent foreign investment cap on automotive joint ventures would be lifted by 2022.

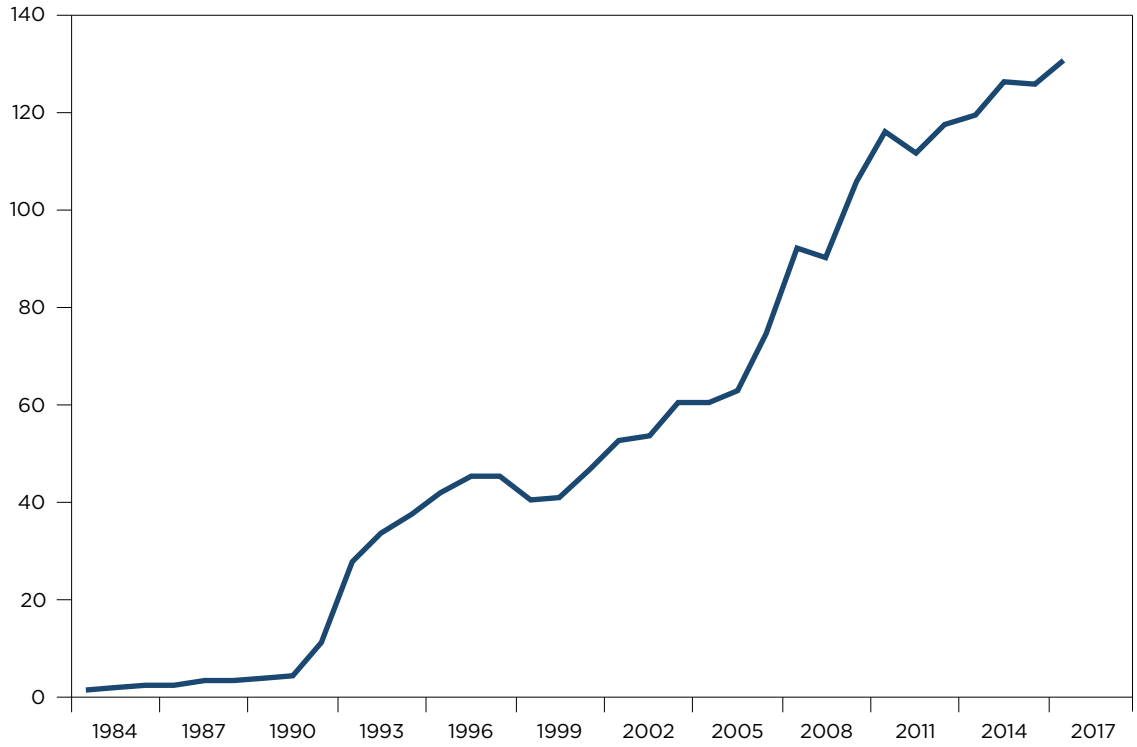
The evolution of China's manufacturing exports clearly illustrates the relationship between inward investment flows and China's comparative advantage. Between 1997 and 2007, the share of Chinese exports tied to labor-intensive activities, such as apparel and footwear, fell rapidly, while the export shares of computers and telecommunications devices rose dramatically. These shifts led observers to wonder if changing export shares signaled extraordinary technological progress. Schott (2006) finds that by 2001 China's export structure increasingly resembled that of high-income countries. Rodrik (2006) argues that by 2002 China's exports exhibited an unusually high degree of technical sophistication for its level of development. A researcher for the Manufacturers Alliance, looking at similar data, concludes that China's changing export pattern signaled a new challenge to American commercial and security interests (Preeg 2004), an early indication of current conflict over Chinese high-tech industrial policy.

A fuller picture of Chinese trade patterns, however, shows more gradual change in Chinese indigenous technical capabilities. Domestic value added in Chinese exports changed less rapidly than gross export shares, consistent with the country's location in global supply chains. As shown in figure 1, uninterrupted rising inflows of foreign investment characterized the period following China's accession to the World Trade Organization (WTO) in 2001. In 2017, China absorbed $131 billion of new foreign investment. As shown in table 1, which provides the top 15 FDI investors in China as of 2015, the official source of 48 percent of FDI stock is Hong Kong, China.[3] The third largest source of investment is Japan, accounting

3. Zhang (2005) explores the reason why China's foreign direct investment primarily comes from Hong Kong. He argues that China's export-promotion FDI strategy, the large pool of cheap labor, Hong Kong's specific advantages in export-oriented FDI, and its unique links with China determine its dominant role. Other observers, however, suggest that the flows represent significant "round-tripping" of investment from the mainland through this offshore location.

Figure 1 Chinese foreign direct investment inflows, 1984–2017

billions of US dollars



Source: National Bureau of Statistics of China, data.stats.gov.cn.

for about 6 percent of the stock. The United States was the fifth largest investor, accounting for about 4.5 percent of total FDI stock.

Some independent analysts believe the US share is larger than official records indicate. According to a report by the Rhodium Group and the National Committee on United States–China Relations, between 1990 and 2017, US entities invested more than $250 billion in China. Flows remain unbalanced with Chinese FDI stock in the United States at twice the level of US investment in China ($29 billion versus $14 billion).[4]

Dean and Lovely (2010) note that this inflow of investment coincided with "fragments" of production moving to China, particularly into high-tech sectors. Shifts in China's import and export shares between 1995 and 2004 reflected these trends, further evidence of the country's deepening involvement in complex global value chains. In particular, the export share of office and computing machinery grew by more than a factor of four (from 3.5 to 15.1 percent), while the import share of these products more than doubled (from 2.4 to 6.2 percent). These shifts in trade shares were accompanied by an increase in the average share of trade treated as "processing trade," trade that occurs as a result of the favorable tax treatment of imports destined entirely for reexport.

4. US-China investment trends reported by the Rhodium Group, April 2018, available at https://rhg.com/research/two-way-street-2018-update-us-china-direct-investment-trends (accessed May 21, 2018).

Table 1 Top 15 investors in China, 2015

Country/Region	Share of total FDI stock (percent)
Hong Kong, China	47.87
British Virgin Islands	8.57
Japan	5.85
Singapore	4.55
United States	4.45
Republic of Korea	3.67
Taiwan Province of China	3.60
Cayman Islands	1.73
Germany	1.46
Samoa	1.46
United Kingdom	1.13
Netherlands	0.89
France	0.85
Mauritius	0.76
Macao, China	0.73
Others	12.41

FDI = foreign direct investment

Source: Chinese Ministry of Commerce (2016a).

Yet the domestic content, and technical sophistication, of Chinese value added embodied in exports evolved less quickly than trade shares alone indicate. Koopman, Wei, and Wang (2012) estimate the domestic value added in Chinese exports and find that the share of domestic content in its manufactured exports was about 50 percent before China's WTO membership and rose to nearly 60 percent by 2007. However, they also find that those sectors considered relatively sophisticated have low domestic content (about 30 percent or less in 2007), largely due to the prevalence of foreign-invested enterprises and processing trade in these industries. The most recent data on the domestic value-added share of gross exports are available for 2011 from the Organization for Economic Cooperation and Development's (OECD) Trade in Value Added project. For all Chinese exports, domestic value added comprises only 68 percent of gross exports. For electronics and optical equipment manufacturing (the sector that most closely matches those examined by other researchers), the domestic share of gross exports is significantly lower, 46 percent. An important goal of China's economic development strategy is raising the share of domestic value added produced by its own high-tech sectors.

THE DEFINITION OF HIGH-TECH MANUFACTURING IN CHINA

The term "high-technology manufacturing" means different things at different times. China Statistics Catalogue of High-technology Industry Statistical Classifications (2002) defines five manufacturing sectors as the high-tech sector: medicine, aircrafts and spacecrafts, electronic equipment and communication equipment, computers and office equipment, and medical equipment and measuring instruments. Identification of key sectors was expanded in 2013, and renamed High-technology Industry Classifications. The classification has two components: one for high-tech manufacturing, the other for high-tech services. This paper focuses on high-tech manufacturing, so details for the coverage of high-tech services are not articulated here. The 2013 version of high-tech manufacturing industry classifications adds the manufacture of electronic chemicals to the five aforementioned sectors.

The 2013 revisions also included some specific changes in several subsectors. For example, for computer manufacturing, the manufacture of computer external equipment in the 2002 document was subdivided into the manufacture of computer components and parts and the manufacture of computer peripheral equipment. For manufacturing of aircrafts and spacecrafts and related equipment, one subcategory—repair of aircrafts and spacecrafts—was added in the 2013 classification. In general, the 2013 classification is more detailed and more comprehensive.

FOREIGN INVESTMENT REMAINS IMPORTANT IN CHINA'S HIGH-TECH MANUFACTURING

The Thirteenth Congress of the Communist Party of China in 1987 adopted the first proposal to "develop high-technology industries and emerging technological industries" (Zhao 1987). In 1992, the State Council released the "Outline for the National Medium and Long-Term Development of Science and Technology," articulating the role of high technology in China's development. This document also highlighted several high-tech industries where China should pursue breakthroughs: microelectronics and computer technology, biological technology, new materials, aerospace, etc. (State Council 1992). Later the same year, the Fourteenth Congress of the Communist Party of China placed priority on constructing economic and technology development zones as well as high-tech and emerging industry development zones (Jiang 1992). Hu and Ren (2016) argue that these developments were key to promoting the active absorption of foreign investment into China's high-tech industries.

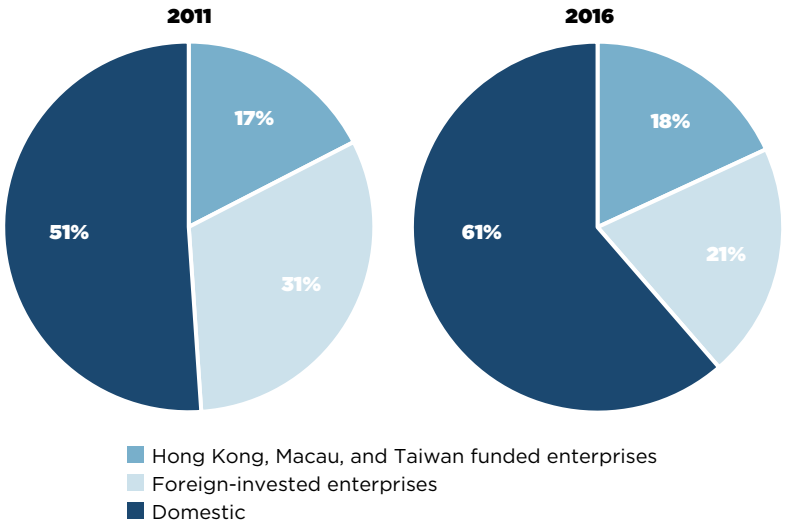
The 1993 Law of the People's Republic of China on Science and Technology Progress further encouraged high-tech research and manufacturing, as it implemented a variety of supports for these industries (Standing Committee of the Eighth National People's Congress 1993). The law provided further impetus to establish high-tech industry development zones.

Following a decade of reforms and rapid growth, China faced rising wages, the need to control pollution emissions, and demand for skilled employment for an increasingly educated labor force. In response, the central government recognized the need to rebalance the economy and transition to higher value-added manufacturing and services. In manufacturing, the government called for innovation and technological advancement as the main route for enhancing manufacturing capabilities. In 2006, the State Council released "The Plan for the National Mid- and Long-Term Development of Science and Technology 2006-2020" (State Council 2006), identifying 402 core technologies for prioritized development (Lai and Deng 2017). The 12th Five-year Plan on the Development of the National Strategic Emerging Industries (Ministry of Industry and Information Technology 2012) expressed concern about a lack of major technologies and limited innovatory abilities, urging greater policy support for innovation and the development of emerging industries. High-tech manufacturing is a focus of the plan, including the manufacture of high quality integrated circuits and biological medicine.

Recent data shows Chinese companies expanded their presence in high-tech manufacturing, relative to foreign investors, perhaps in response to the changing policy focus. Figures 2 and 3 show the assets and profits shares, respectively, of foreign-invested companies; Hong Kong, Macau, and Taiwan (HMT) funded companies; and domestic companies in high-tech sectors. The figures illustrate a declining role for foreign investors but the steady presence of HMT investors. In 2011, for both profits and assets held by foreign-invested and HMT-funded enterprises, the shares were nearly 50 percent. In 2016, their combined share declined to less than 40 percent, for both the share of profits and the share of assets.

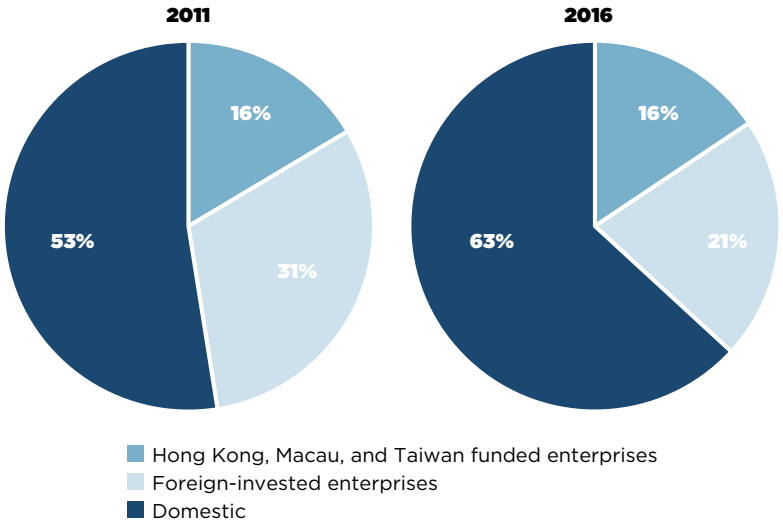
Interestingly, most of this decline did not come from the share of HMT-funded enterprises, which barely changed. The big decline of 10 percent came primarily from the weakening role of foreign-invested enterprises. Assets of foreign-invested enterprises accounted for 31 percent of total assets in high-tech manufacturing in 2011 but declined to 21 percent by 2016. Similarly, the profits of foreign-invested enterprises, as a share of total profits in high-tech manufacturing, decreased from 31 percent to 21 percent during the

Figure 2 Share of assets of high-tech companies by ownership, 2011 and 2016



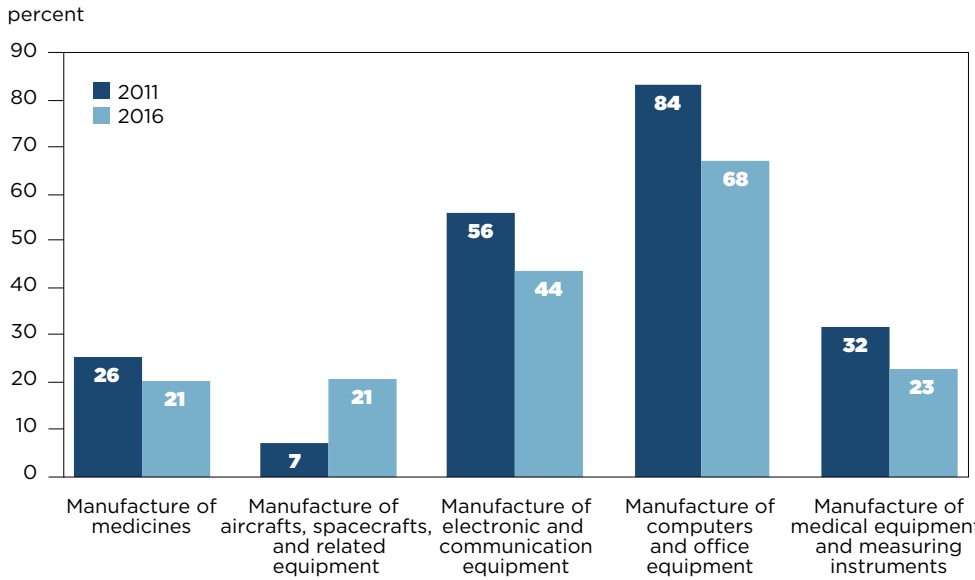
Sources: National Bureau of Statistics of China, National Development and Reform Commission, and Ministry of Science and Technology (2012); Department of Social Technology and Cultural Industry Statistics of National Bureau of Statistics (2017).

Figure 3 Share of profits of high-tech companies by ownership, 2011 and 2016



Sources: National Bureau of Statistics of China, National Development and Reform Commission, and Ministry of Science and Technology (2012); Department of Social Technology and Cultural Industry Statistics of National Bureau of Statistics (2017).

Figure 4 Share of assets of foreign-invested and HMT-funded enterprises across high-tech manufacturing sectors, 2011 and 2016



HMT = Hong Kong, Macau, and Taiwan

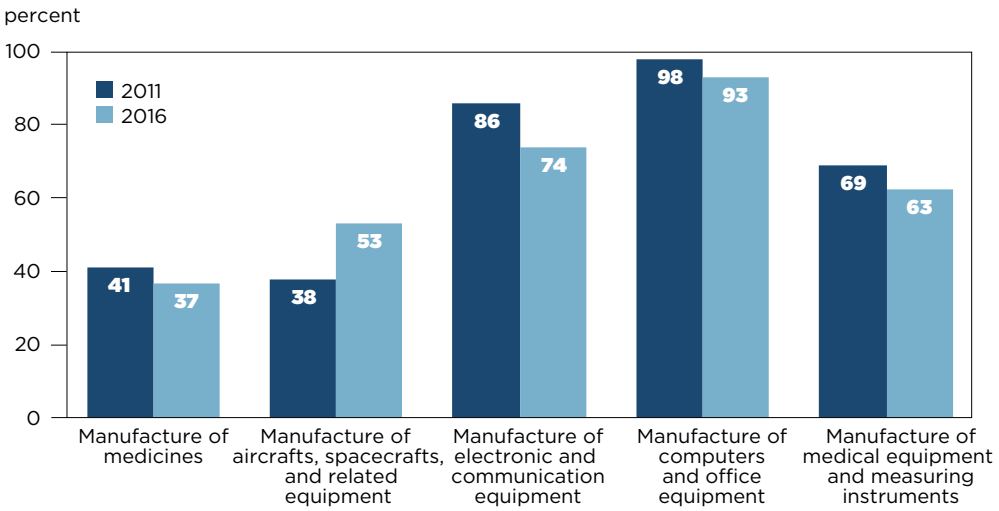
Sources: National Bureau of Statistics of China, National Development and Reform Commission, and Ministry of Science and Technology (2012); Department of Social Technology and Cultural Industry Statistics of National Bureau of Statistics (2017).

period of 2011–16. The decline in shares of assets belies the fact that, comparing 2016 and 2011, the absolute value of assets of foreign-invested companies in high-tech sectors went up about 40 percent, and the assets of HMT-funded firms more than doubled during this period. That their share of assets was nevertheless in decline illustrates how much more rapidly the value of assets of domestic companies in high-tech manufacturing was growing. The value of assets of domestic high-tech firms in 2016 was about 2.5 times as much as in 2011, leading the share of assets in domestic high-tech companies to increase from 51 percent to 61 percent.

Although overall high-tech manufacturing in China has become less dependent on foreign investment, the situation varies across industries. Combining the effects of granting foreign investors market access and the development of domestic firms, some sectors are dominated by domestic firms, while only one sector—the manufacture of aircrafts and spacecrafts and related equipment—has seen the role of foreign investors expand from a very low base (figure 4).[5] In 2011, foreign and HMT firms owned only 7 percent of the total assets in this sector. The foreign share increased by about four times, rising to 21 percent as a share of total assets in 2016. This increase is consistent with the Chinese gradually opening up this industry, and the trend is ongoing. In June 2017, the State Council released a new negative list, in which the Chinese government further opened up this sector by reducing the number of items regulated by the special management measurements (特别管理措施) in the manufacture of spacecrafts (State Council 2015, 2017).

5. Due to the change of classification, 2011 data on high-tech manufacturing do not include the manufacture of electronic chemicals, which is covered in 2016 data. Therefore, only the five sectors covered in both in 2011 and 2016 statistics are compared.

Figure 5 Share of exports of foreign-invested and HMT-funded enterprises across high-tech sectors, 2011 and 2016



HMT = Hong Kong, Macau, and Taiwan

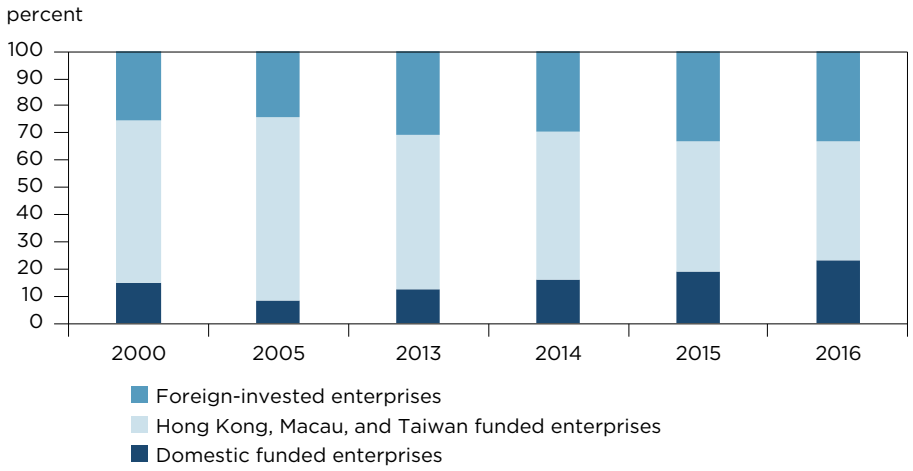
Sources: National Bureau of Statistics of China, National Development and Reform Commission, and Ministry of Science and Technology (2012); Department of Social Technology and Cultural Industry Statistics of National Bureau of Statistics (2017).

Export data show the same story. As shown in figure 5, with the exception of the manufacture of aircrafts and spacecrafts and related equipment again, the share of exports of enterprises funded by foreign and HMT investors declined in all other high-tech sectors. Although their role has declined, foreign-invested and HMT-funded enterprise shares remain very high, especially in the manufacture of computers and office equipment, where foreign and HMT invested firms accounted for 48 percent and 45 percent, respectively, of total exports in 2016.

FOREIGN-INVESTED ENTERPRISES LEAD HIGH-TECH EXPORTS

As in the case of assets and profits, the share of exports from foreign firms reflects two competing forces. First, with the government opening up the economy and offering foreign investors preferential policies that are different from rules set for domestic companies, foreign direct investment flowed into high-tech industries, which account for a large share of exports. Much of this investment is vertical FDI, the main purpose of which is to locate production according to comparative costs, resulting in production that is mostly intended for sale in the source country or third-country markets (Gu, Awokuse, and Yuan 2008). Second, foreign investment may offer positive productive spillovers: Local firms may increase their exports by observing the export behaviors of foreign-funded enterprises (Haddad and Harrison 1993). These spillovers may be due to foreign firms' advanced production technologies or management and marketing competence, for example (Gu, Awokuse, and Yuan 2008). In addition, foreign investment may also improve local companies' abilities through the transfer and diffusion of technologies, management know-how, entrepreneurial skills, and employee training from foreign-funded enterprises (Sun 2001, Zhang and Song 2001). Foreign investment spillovers help local companies become more competitive, which in turn means the share of exports by foreign-invested firms may shrink.

Figure 6 Share of exports in high-tech manufacturing by ownership, 2000, 2005, and 2013–16



Source: Department of Social Technology and Cultural Industry Statistics of National Bureau of Statistics (2017).

In recent years, the share of exports by domestic firms in high-tech manufacturing has risen rapidly. The share almost doubled in the period of 2013 to 2016, as shown in figure 6. However, even though domestic enterprises play an increasing role in China's high-tech manufactured exports, foreign-funded enterprises still dominate. In 2016, 77 percent of high-tech exports were manufactured by foreign-invested or HMT-funded enterprises.

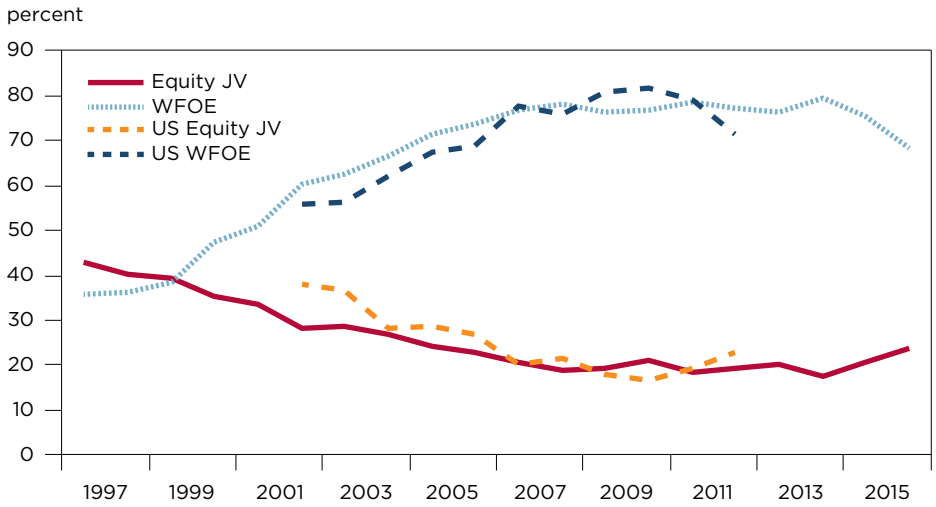
The decline in the share of exports by high-tech foreign manufacturers resulted solely from those manufacturers funded through Hong Kong, Macau, and Taiwan firms. In 2016, the exports of HMT-funded enterprises in high-tech manufacturing accounted for 44 percent of total exports, declining from 57 percent in 2013. However, the share of exports conducted by other foreign-invested enterprises increased slightly from 31 percent in 2013 to 33 percent in 2016.

WHOLLY FOREIGN-OWNED ENTERPRISES VERSUS EQUITY JOINT VENTURES

Chinese foreign direct investment can be divided into six categories by form: equity joint venture (JV), contractual joint venture, wholly foreign-owned enterprises (WFOE), shareholding enterprises, joint exploration, and others. Equity joint ventures and wholly foreign-owned enterprises account for the lion's share of activity, with other firm types contributing a small share of total Chinese FDI. Foreign firms have preferred investment in the form of a wholly foreign-owned enterprise as a mode of entry into China since 2000, reversing previous trends in relative WFOE/JV shares. According to the most recently available data, WFOE FDI was 68 percent of total FDI in 2016, while equity JV FDI accounted for 24 percent.

Figure 7 provides the share of total Chinese FDI by entry mode and the shares for US investment in China alone. In 2014, 79 percent of all inward investment took the form of wholly foreign-owned subsidiaries, up dramatically from its 47 percent share in 2001. Although data for Chinese FDI from the United States by type of enterprise are not available for recent years, wholly foreign-owned enterprises are clearly also a major conduit of US investment in China.

Figure 7 Chinese foreign direct investment inflows by wholly foreign-owned enterprises (WFOE) and equity joint ventures (JV), 1997–2016



Note: The data on the United States is from the 2013 Report on Chinese Foreign Investment, the source of time series data from 2002 to 2012 shown for all investment sources. A full time series for US investment is not provided in the report.

Sources: Ministry of Commerce (2013, 37), National Bureau of Statistics of China (2017, 369) and National Bureau of Statistics of China, data.stats.gov.cn.

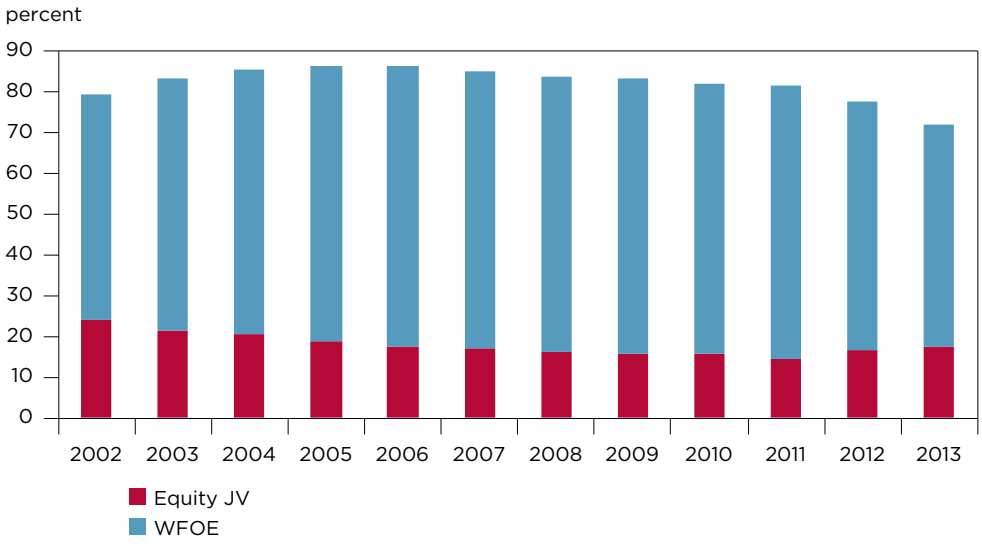
In some specific sectors, the Chinese government restricts the form of foreign direct investment by not permitting foreign investors to enter the Chinese market as wholly foreign-owned enterprises. Investment can occur only in cooperation with domestic companies, as equity joint ventures, contractual joint ventures, or other forms of cooperative relationships, and the Chinese domestic company is required to be the controlling partner. These restrictions have raised concerns in source countries about inappropriate technology transfers. In this light, it is noteworthy that the share of total FDI through wholly foreign-owned investment vehicles fell relative to FDI entering through joint ventures in 2015 and 2016. Indeed, this inflection point appears earlier in the data for flows from just the United States: The WFOE share of American investment begins to decline in 2010. The cause of this changing trend deserves further consideration.

Looking at export shares by firm type provides a bit more insight into how these changing ownership trends affect external sales. As mentioned above, foreign-funded enterprises play a crucial role in Chinese exports in high-tech manufacturing. When it comes to the type of enterprises exporting high-tech goods, exports by wholly foreign-owned enterprises exceed exports by equity joint venture, as shown in figure 8. Of particular relevance is the stability of the WFOE share of exports, which was 55 percent in 2002 and remains close to 55 percent in 2013. In contrast, the share of exports originating from Sino-foreign joint ventures fell over the 10 years shown in the figure.

CONCLUSION

To the extent that Chinese high-technology exports reflect foreign research and development and design, they complement innovation in high-income countries. Notwithstanding the potential for trade conflict stemming from China's rapid entry into particular segments of global high-tech value chains, the mutual and cooperative development of high-tech products benefits consumers worldwide. The deep integration of

Figure 8 Share of exports by wholly foreign-owned enterprises (WFOE) and equity joint venture (JV) in high-tech manufacturing, 2002–13



Source: Ministry of Commerce (2016, 47).

China into global production, as evidenced by the continuing high shares of exports from foreign-invested enterprises, especially wholly foreign-owned firms, suggests that this complementarity remains strong.

China's efforts to raise the productivity and innovative capacity of indigenous enterprises is consistent with rising domestic shares of high-tech assets and profits. However, the latest data show that exports are still primarily originating in foreign invested enterprises. Their presence indicates that even in key growth markets—computer equipment, electronics, and electrical machinery—the foreign content of goods assembled and reexported from China is still high. Indeed, information from the Trade in Value Added project of the OECD indicates that in 2011 for computer and electronic equipment, Chinese domestic content embodied in exports was slightly below 50 percent. The interconnected nature of these trade and investment flows bears repeating at a time when high-tech conflict threatens to sever relationships built with China over the past 20 years.

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