# The Dragon is Flying West: Micro-level Evidence of Chinese Outward Direct Investment

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Outward direct investment (ODI) from the People's Republic of China (PRC) is surging. A common perception is that it was driven by the country's resource-seeking and technology-seeking motives. Using a new, unique, and comprehensive data set that covers close to 10,000 Chinese ODI deals from 1998 to 2009, we find that in contrast to the common perception, over half of the ODI deals are in service sectors, with many of them appearing to be export-related. In addition to documenting the pattern and trend of the PRC's ODI, we empirically examine both the determinants and effects of ODI at the firm level. We find that ex ante larger, more productive, and more export-intensive firms are more likely to start investing abroad. Using matching estimation techniques, we find that ODI is associated with better firm performance, including higher total factor productivity, employment, and export intensity, and greater product innovation. To assess the relative contributions of technology transfer, export promotion, and resource seeking to the positive effects of ODI, we use ODI data merged with customs transaction-level trade data. We find that firms' ODI participation is associated with significantly better trade performance, measured by export and import volumes, export and import unit values, and number of export destinations. Contrary to perceived technology-seeking and resource-seeking motives, we find no evidence that ODI firms import more capital or intermediate inputs compared to non-ODI firms.

*Keywords:* Foreign Direct Investment, Trade facilitation, Resource Seeking, China
*JEL codes:* F1, F2

## I. Introduction

The People's Republic of China (PRC) is the world's fifth largest source of foreign direct investment in 2010 (in terms of flow), after the US, France, Germany, and Japan.[1] He et al. (2012) predict that the PRC's cumulative outward direct

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[1] UNCTAD (http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx). The PRC's ODI flow rank is 17th in 2006, 12th in 2008, 5th in 2009, and 11th in 2011.

investment (ODI) would probably exceed $5 trillion in 2020, increasing from a mere $3 billion in 2010. Given the PRC's sheer size, the volume of its ODI may be expected; but considering its relatively early stage of economic development, its recent surge in ODI is surprising to many. While it is still a fairly new phenomenon, reports about Chinese ODI often hit news headlines, such as Lenovo's acquisition of IBM PC units, CNOOC's rejected acquisition of Unocal, Huawei's investment in 3Leaf System, and Dalian Wanda Group's acquisition of AMC Theaters. The target sectors are widespread, and even as mundane a product as pork has attracted tremendous media attention recently due to Shuanghui's acquisition of Smithfield. Tensions in developed countries towards Chinese ODI are rising, similar to the 1980s when Japanese firms were making high-profile acquisitions.

Despite the rising concerns, existing studies about Chinese ODI are either descriptive in nature or based on aggregate data. Among the recent studies that use micro data, the focus has been on understanding the motives of ODI, with the primary goal to verify the media hype about the PRC's attempt to control natural resources and technology around the world.[2] Little research has been done about which firms are engaged in ODI and how ODI may enhance their performance.

This paper has two goals. It first documents several stylized facts about Chinese ODI. A point of departure from all existing studies is that we document our facts based on the most comprehensive micro-level data on Chinese ODI. The data set, which was made available by the PRC's Ministry of Commerce, covers close to 10,000 ODI deals of over 7,000 firms in all sectors over the period of 1998–2009. Consistent with the existing literature, we find that the motives of Chinese ODI can be broadly categorized into three types—resource seeking, technology seeking, and market seeking (export promotion). In contrast with the common perception, both the aggregate statistics and our micro data lend no support for the popular speculation that the recent rise of Chinese ODI is driven by resource seeking. Instead, we find that business services and wholesale/retail trade have accounted for a large and increasing share of Chinese ODI in terms of the number deals as well as the volume of flows. The presence of private firms in Chinese ODI is also increasing. Half of the top 20 destinations of its ODI are in Asia.

The second goal of the paper is to analyze the firm-level determinants and effects of ODI, which have implications for other emerging countries. To obtain a long list of firm performance measures, we rely on manufacturing firms' survey data from the PRC's National Bureau of Statistics, which we merge with the ODI firm list.[3] By estimating a probit model of ODI participation, we find that more productive

[2] See, for example, Cheng and Ma (2007) and Huang and Wang (2013).

[3] Given that a large fraction of the ODI firms in the PRC are non-manufacturing, the drawback of using manufacturing survey is that all ODI firms in the service sectors are dropped in our analysis. Notice that a firm can be classified as a service firm in the ODI list but can still be merged with the NBS data, as long as it has some businesses in manufacturing.

(measured by total factor productivity), larger (measured by employment), and more export-intensive firms are more likely to invest abroad. These findings lend support to the studies that typically assume higher fixed costs of horizontal FDI compared to that of exporting. We also find that relative to domestic private firms, state-owned enterprises (SOEs) are more likely to invest abroad, consistent with the conventional view that the PRC's government is behind a lot of the country's ODI flows. In contrast, foreign firms are less likely to undertake ODI.

We then apply the propensity-score matching techniques commonly used in the program evaluation literature to assess the average treatment effects of ODI on the treated firms' performance. We find that ODI has a positive effect on a wide range of firms' performance measures including value added, employment, productivity, export intensity, R&D intensity, and the propensity to innovate new products.

Since the positive effects of ODI on firm performance can be due to technology transfer, resource seeking, or export promotion, we use customs transaction-level trade data merged with our ODI list to shed light on the relative contributions of the three channels. By employing propensity-score matching techniques again to establish causality, we find that firms' ODI participation is associated with a significant improvement in their trade performance, measured by export and import volume, export and import unit values, and number of export destinations. To the extent that unit value proxies for the quality of goods, these results imply that ODI induces quality upgrading of both imports and exports. In other words, these results show that horizontal FDI from the PRC complements rather than substitutes firm's trade. These findings are consistent with the idea that exporting entails high fixed costs, such as marketing and information signaling, which can be reduced by ODI. Finally, we find no evidence based on the composition of firms' imports and exports that ODI is associated with technology or resource seeking.

In summary, our paper shows that export-promoting ODI from emerging countries can potentially raise and sustain the benefits of exporting, which in turn contribute to the countries' structural transformation from low-skill manufacturing to high-skill manufacturing, and eventually from manufacturing to high-skill services. Our findings have important policy implications for countries beyond China, which have been experiencing rising labor costs after years of FDI and export-promotion policies.

The paper proceeds as follows. Section II reviews the related literature. Section III describes our three data sources. Section IV uses the new ODI data to describe overall patterns of ODI firms. Section V presents the characteristics of ODI from PRC. Section VI examines the determinants and the effects of ODI at the firm level. Section VII focuses on the export-facilitation motive and examines how ODI is related to firms' trade patterns and performance. The final section concludes with some policy discussions.

## II. Literature Review

Our paper is related to various strands of literature. First, it relates to the classical theory of multinational enterprises (MNEs) about how firms use their capabilities and resources to generate competitive advantage over indigenous firms in host countries (Caves 1971, Hymer 1976, Kindleberger 1969 and 1970). More recent studies show that in addition to facilitating foreign sales, firms undertake ODI to acquire resources, assets and technology to develop their competitive advantage (Child and Rodrigues 2005, Makino et al. 2002, Mathews 2006).[4]

Second, our paper contributes to the growing literature on Chinese ODI. Most of the earlier studies were descriptive in nature, sometimes relying on case studies (e.g., Deng 2003 and 2004, Wu and Chen 2001). Cai (1999) proposes that Chinese firms invest overseas mainly to seek markets, natural resources, technology, managerial skills, and financial capital.[5] More recent studies focus on the empirical examination of the determinants of Chinese ODI (e.g., Buckley et al. 2007), but most of these studies rely on aggregate data for analysis. There are a few notable exceptions that use micro-level data. For instance, Luo et al. (2011) show empirically that ODI by private Chinese firms had been prompted to exploit firm-specific advantages as well as to tackle market imperfections due to the underdevelopment of China's domestic institution. Other studies on Chinese overseas M&As support the resource-seeking and technology-seeking motives (Antkiewicz and Whalley 2007, Rui and Yip 2008). Using aggregate data, Cheng and Ma (2007) and Cheung and Qian (2009) show that China's investment was motivated by both market seeking and resource seeking. However, they find no evidence that its investment in Africa and other oil- producing countries account for the rise. In addition, they find that China's international reserves and exports to developing countries tended to complement ODI. Our findings based on firm-level data are largely consistent with the macro patterns they document.

Based on detailed firm-level data from Zhejiang province, Huang and Wang (2013) empirically identify export facilitation as the third motive, which is as important as the other two emphasized by earlier studies. Our paper finds supporting evidence but is unique in two respects. We use a much more comprehensive micro data set from the PRC, which covers all industries and provinces. We merge our ODI data with customs transaction-level data and manufacturing survey data so that we can assess the effects of ODI on firm performance. In particular, we examine how exporters and importers benefit from ODI.

Third, our paper contributes to the large literature on the relation between FDI and trade. Besides the early theoretical literature (Krugman 1980, Helpman

[4] Here, technology is broadly defined to include production technology, management skills, and brand names.

[5] Deng (2004) identified two additional motives: strategic assets (e.g., brands, marketing networks) and diversification. The focus of our paper focuses on the nonfinancial type of ODI. Clearly, because the PRC was itself a low-cost production base, cost minimization was not a major motivation of Chinese ODI.

1984), there is an extensive empirical literature on the relation between FDI and trade. On the one hand, there are studies showing substitution between FDI and exports (Brainard 1997; Markusen and Venables 2000; and Helpman, Melitz, and Yeaple, 2004). The key idea is the proximity concentration trade-off (i.e., a trade-off between transportation costs and firm level returns to scale). These models are explicitly designed for horizontal FDI. On the other hand, some studies show that FDI and exports can be complements (Lipsey and Weiss 1981 and 1984; Yamawaki 1991, Clausing 2000). By using Japanese product-level data on foreign production in the US and exports to the US, Blonigen (2001) finds both substitution and complementarity effects of FDI on exports. Substitution is likely to be found for final-good exports, while complementarity is likely to be found for intermediate inputs and finished products. A more recent strand of literature studies the complex interactions between ODI and exports by highlighting the export-platform type of exports by multinational firms (Antras 2003; Grossman, Helpman, and Szeidl 2003; Ekholm, Forslid, and Markusen 2007; Yeaple 2003; Conconi et al. 2013).[6] Our paper finds that FDI and trade are complements in China.

## III. Data

We use data on outward direct investments by Chinese companies provided by the Chinese Ministry of Commerce (MOFCOM). The data set covers all ODI transactions that were approved by the MOFCOM between January 1, 1998 and December 31, 2009. For each ODI deal, the data set reports the name of the investing firm, the firm's sector of business, the province of origin, and the recipient country of the ODI flow. There is, however, no information on the amount of the deal or the name of the target for mergers and acquisitions. There are altogether 9,744 deals from 7,202 unique firms for the 12-year period (1998–2009) included in the data set. Since all Chinese firms need to be approved by MOFCOM for each cross-border deal, this data source is the most official and comprehensive among all other firm-level sources that have been used. To verify the representativeness of our data, we compare the number of deals in our data with those studied by Huang and Wang (2013). Our data set covers 90% of the deals from Zhejiang, the province they focus on over the same sample period.[7]

[6] By considering a dynamic model with uncertainty and learning, Conconi et al. (2012) show that ODI and export are substitutes in the short run but can be complements in the long run.

[7] Tsui and Wei (2012) compare the aggregate ODI data from the PRC's Ministry of Commerce (MOFCOM) and the transaction-level data put together by the Heritage Foundation and show that the former data set systematically underreports China's ODI in mining. Their main explanation for the discrepancy is that while MOFCOM did not track the final destination of ODI that went through tax havens (e.g., Hong Kong, China; Virgin Islands, etc.). While we verify that the overall patterns and the regression results remain robust to the exclusion of tax havens—in particular Hong Kong, China—two more remarks are in order. First, their datasets begin in 2005, which make the comparison between ours and theirs difficult. Second, it is not clear why the Heritage Foundation data set provides a more comprehensive coverage of China's ODI transactions compared to MOFCOM data. Selection could be an issue in the Heritage Foundation data as well.

The second data source is the Annual Survey of Industrial Enterprises, conducted by the National Bureau of Statistics (NBS) of China over the period of 1998–2009. The survey includes all industrial firms that are either state owned or non-state owned with sales above CNY5 million (around $600,000 during the sample period). The survey covers all manufacturing, mining, and utilities sectors. The number of firms covered in this data set ranges from around 150,000 in 1998 to 431,000 in 2007. The data set contains information on ownership structure, tangible assets, number of employees, R&D, advertising, value-added, sales, new product sales, and exports. Readers are referred to Ma et al. (2013) for a more detailed description.

The third data source is the transaction-level trade data from China's customs over the period of 2000–2006. This data set contains information on values (in US dollars), quantities, and prices of all import and export transactions between China and over 200 destination countries at the HS 6-digit level (over 5,000 products).[8] This level of disaggregation is the finest for empirical studies in international trade—i.e., transactions at the firm-product-country-month level. For each trading firm, the data set also provides information on ownership type (state, private, foreign) and customs regime (processing and non-processing).[9] Mainly based on firm names, we merge the ODI data with the firm-level manufacturing data and the transactions-level trade data, respectively. More details will be described below.

## IV. Overall Patterns of ODI Firms

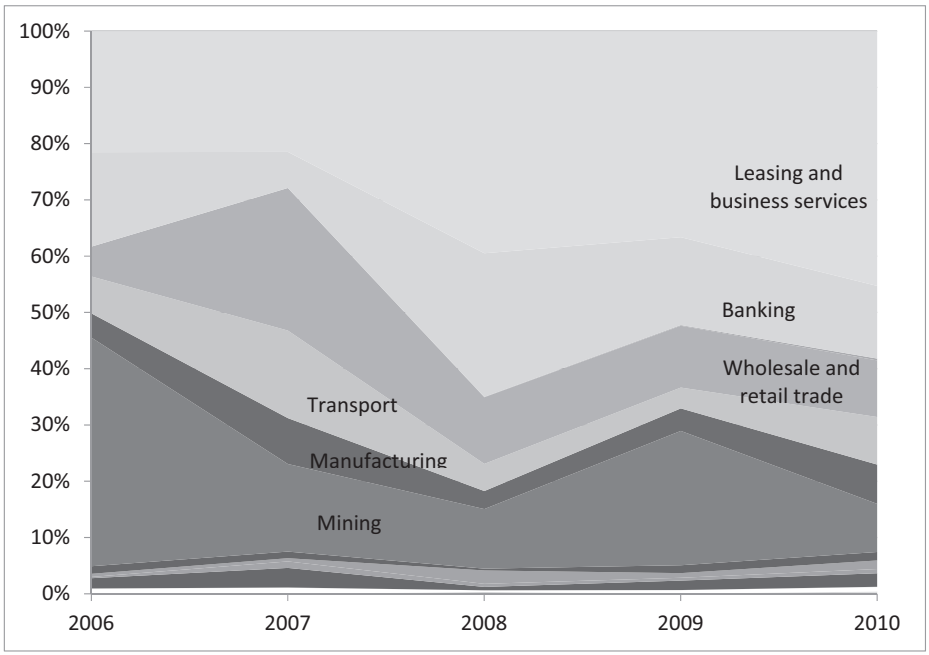
Before analyzing the three micro-level datasets, let us highlight an overlooked pattern simply based on aggregate data. Using sector-level data on Chinese ODI reported by MOFCOM for the period of 2006–2010, Figure 1 reveals that the "mining" sector used to account for about 40% of total Chinese ODI flows in 2006, followed by "leasing and business services" which contributed about 21% of the total. Since then, the share of "mining" in ODI flows declined gradually, while that of "leasing and business services" increased continuously until it became the most prevalent sector in terms of Chinese ODI flows (44% of the total). Together with "wholesale and retail trade", these two broad sectors accounted for over half of the aggregate volume of China's ODI in 2010, compared to 27% in 2006. Mining and banking, on the other hand, accounted for only 8% and 13% of the PRC's total ODI flows in 2010, respectively. These findings, based on official statistics, do not support the common perception that the rising ODI from the PRC is due to rising financial outflows or resource seeking.[10] Instead, these aggregate patterns and trends

[8] Example of a product: 611241 – Women's or girls' swimwear of synthetic fiber, knitted, or crocheted.

[9] Readers are referred to Fernandes and Tang (2013) for details of this data set.

[10] There are concerns that the MOFCOM data set is not representative. We will discuss the quality of the data and other related research in Section 3.

Figure 1. **Share of ODI Flows (2006–2010)**




Source: The PRC's Ministry of Commerce.

suggest that the recent rise in Chinese ODI could be related to its continuous growth in exports. Motivated by these aggregate patterns, we will verify how firms' ODI are related to their overall and export performance.

The aggregate patterns outlined above say nothing about which firms are engaged in ODI, where they invest, how ODI may enhance their performance. In the rest of the paper, we will use our firm-level ODI data along with official micro-level balance sheet and trade data to analyze the determinants and effects of ODI. Our dataset contains 9,744 deals conducted by 7,202 unique companies that were approved by the PRC's MOFCOM between 1998 and 2009. Table 1 reports the distribution of the deals per year during our sample period of 1998–2009.[11] As expected, the number of ODI deals increased significantly from 19 deals in 1998 to 3,060 deals in 2009. The increase is particularly sharp in 2005, when the number of deals increased from 244 to 1,091 (over a 300% increase). Table A2 in the appendix shows that most of the increase is due to the massive liberalization of ODI by domestic private firms.[12]

[11] Cheng and Ma (2007) pointed out that the gap between official statistics and figures found in news reports appears to be big. We therefore focus mostly on the distribution of ODI across sectors and countries, and their associated impact, rather than the actual amount of ODI when reporting our summary statistics.

[12] According to Cheng and Ma (2007), the Ministry of Commerce along with the All-China Federation of Industry and Commerce started a discussion on policy reforms that encourage private firms to go overseas. A draft

Table 1. **ODI Deals Breakdown, by Year**

| Year | Freq. | Percent |
|---|---|---|
| 1998 | 19 | 0.19 |
| 1999 | 9 | 0.09 |
| 2000 | 20 | 0.21 |
| 2001 | 21 | 0.22 |
| 2002 | 66 | 0.68 |
| 2003 | 79 | 0.81 |
| 2004 | 244 | 2.5 |
| 2005 | 1,091 | 11.2 |
| 2006 | 1,412 | 14.49 |
| 2007 | 1,632 | 16.75 |
| 2008 | 2,091 | 21.46 |
| 2009 | 3,060 | 31.4 |
| Total | 9,744 | 100.0 |

ODI = outward direct investment.
Source: The PRC's Ministry of Commerce.

Table 2. **Top 20 Destinations of the PRC's ODI**

| Country | Frequency | Percent |
|---|---|---|
| Hong Kong, China | 1,946 | 19.97 |
| United States | 918 | 9.42 |
| Russian Federation | 551 | 5.65 |
| Viet Nam | 464 | 4.76 |
| United Arab Emirates | 370 | 3.8 |
| Japan | 360 | 3.69 |
| Korea, Rep. | 299 | 3.07 |
| Germany | 270 | 2.77 |
| Lao PDR | 267 | 2.74 |
| Australia | 236 | 2.42 |
| Indonesia | 180 | 1.85 |
| Canada | 167 | 1.71 |
| Singapore | 167 | 1.71 |
| Thailand | 143 | 1.47 |
| Nigeria | 137 | 1.41 |
| United Kingdom | 134 | 1.38 |
| India | 128 | 1.31 |
| Mongolia | 102 | 1.05 |
| Kazakhstan | 101 | 1.04 |
| Malaysia | 95 | 0.97 |

ODI = outward direct investment.
Source: The PRC's Ministry of Commerce.

Table 2 tabulates the distribution of Chinese ODI deals by host country in our data. Between 1998 and 2009, Hong Kong, China appears as the major recipient of ODI from China, accounting for close to 20% of total deals. One may argue

document surfaced in 2006, which called for stronger support for domestic private and foreign firms in the areas of taxation, finance, insurance, and foreign exchange.

that it may not be the final destination of Chinese ODI, as there can be a lot of transit or round-trip FDI. First, firms in the PRC may take advantage of the low tax regime and more developed legal and financial institutions in Hong Kong, China to raise funds. Second, many firms in PRC may choose to set up subsidiaries and even headquarters to channel capital to a third country or even back to the PRC. Both transit and round-trip FDI through Hong Kong, China are well-known. A drawback of our dataset is that we have no information to separate both types of ODI from genuine ODI to Hong Kong, China. We will check the robustness of our main results by excluding Hong Kong, China as the host country of ODI.

After Hong Kong, China, the US comes as the second most important recipient of ODI, accounting for 9.4% of the total number of deals. Following the US are the Russian Federation and Viet Nam, respectively. Interestingly, the United Arab Emirates (UAE) is the fifth important recipient country. To the extent that UAE is a major oil exporter, the high ranking of UAE as a major recipient of the PRC's ODI provides some support for the resource-seeking hypothesis (Antkiewicz and Whalley 2007, Rui and Yip 2008). It is worth noting that out of the top 20 Chinese ODI destinations (in terms of the number of deals), 12 are in Asia. The prevalence of Asian countries among the top hosts is consistent with the sectoral pattern that horizontal ODI (leasing and business services, along with wholesale and retail trade) accounts for the majority of ODI flows in recent years, rather than technology-seeking or resource-seeking ODI as commonly speculated.

Table 3 shows the numbers of deals by regions (e.g, Asian versus non-Asian, OECD versus non-OECD, and so on) in our sample. The average fraction of Chinese firms investing in OECD countries across all years (1998–2009) is only 30% (last

Table 3. **Fraction of ODI Deals, by Region and Year**

| Year | Non-OECD | OECD | Non-Asia | Asia | Non-SSA | SSA | Total (No.) |
|---|---|---|---|---|---|---|---|
| 1998 | 95 | 5 | 21 | 79 | 95 | 5 | 19 |
| 1999 | 56 | 44 | 89 | 11 | 78 | 22 | 9 |
| 2000 | 75 | 25 | 45 | 55 | 85 | 15 | 20 |
| 2001 | 71 | 29 | 29 | 71 | 100 | 0 | 21 |
| 2002 | 70 | 30 | 58 | 42 | 88 | 12 | 66 |
| 2003 | 58 | 42 | 61 | 39 | 91 | 9 | 79 |
| 2004 | 69 | 31 | 41 | 59 | 90 | 10 | 244 |
| 2005 | 69 | 31 | 38 | 62 | 93 | 7 | 1091 |
| 2006 | 64 | 36 | 37 | 63 | 94 | 6 | 1411 |
| 2007 | 69 | 31 | 38 | 62 | 91 | 9 | 1632 |
| 2008 | 72 | 28 | 35 | 65 | 92 | 8 | 2091 |
| 2009 | 70 | 30 | 39 | 61 | 91 | 9 | 3058 |
| Average | 69.83 | 30.17 | 44.25 | 55.75 | 90.69 | 9.31 | 9741 |

ODI = outward direct investment, OECD = Organisation for Economic Co-operation and Development, SSA = Sub-Saharan Africa.

Note: Numbers are in % in the first eight columns, while they are in whole numbers in the last column.

Source: The PRC's Ministry of Commerce ODI data (1998–2009).

row). Among the non-OECD countries, Asian countries accounted for about 80% (55.75/69.83). After 2004, Asian countries consistently accounted for over 60% of Chinese ODI deals, while OECD countries never accounted for more than 30% again. Sub-Sahara Africa rarely accounted for more than 10% of the total Chinese ODI deals over the sample period. Just by considering the number of deals across host countries, the relatively small fractions of ODI to OECD countries and the concentration of ODI in Asia lend little support to the hypothesis that technology seeking or resource seeking are the main drivers of the recent rise of ODI from the PRC. We are aware of the fact that some of the resource-seeking deals, for example those in Sub-Sahara Africa, are much larger in monetary value than the export-related deals in Asia. However, the trends in shares shown in Figure 1 imply that the relatively large resource-seeking deals are unlikely to overturn the conclusion based on the number of deals.

Next we turn to analyzing the distribution of ODI deals across industries. Consistent with Figure 1 that show shares in total flows, Table 4 shows that a majority of China's ODI deals belong to the service sectors. In particular, based on a sample pooling observations from all years, "business services" and "wholesale trade" stand out as the top two sectors in which most ODI deals are found. Together, they account for 5,235 deals and thus over half of the country's total. The third largest ODI sector in terms of the number of deals is "building and civil engineering," but

Table 4. **Industry Breakdown of ODI (Top 20 only)**

| Industry | Frequency | Percent |
|---|---|---|
| Business Services | 2,816 | 28.94 |
| Wholesale Trade | 2,419 | 24.86 |
| Building and civil engineering | 285 | 2.93 |
| Nonferrous Metals Mining and Dressing | 212 | 2.18 |
| Nonmetal Mineral Products | 202 | 2.08 |
| Garments, shoes and caps manufacturing | 189 | 1.94 |
| Forestry | 181 | 1.86 |
| Real Estate | 169 | 1.74 |
| Electric Equipment and Machinery | 162 | 1.66 |
| R&D | 159 | 1.63 |
| Geologic Prospecting | 157 | 1.61 |
| Other financial activities | 143 | 1.47 |
| Metal Products | 135 | 1.39 |
| Retail trade | 122 | 1.25 |
| Transport Equipment | 118 | 1.21 |
| Food Production | 106 | 1.09 |
| Water way transport | 101 | 1.04 |
| Agriculture | 86 | 0.88 |
| Ordinary Machinery | 86 | 0.88 |
| Software | 84 | 0.86 |

ODI = outward direct investment.
~~Note:~~ Industry classification is based on ODI firms' description of the main business scope.
Source: The PRC's Ministry of Commerce OFDI data (1998–2009).

it accounts for only 3% of the total. The sectors that are often suspected as the main driver of rising the PRC's ODI—"nonferrous metals mining and dressing", "nonmetal mineral products" and "geologic prospecting"—together account for less than 6% of the total, consistent with the continuous decline in the share of mining in the country's aggregate ODI flow depicted in Figure 1. One can argue that some of the firms in the mining sector can invest in other industries abroad. Moreover, mining-related ODI could induce other types of ODI, such as "waterway transport." However, given that the "business services" and "wholesale trade" account for the bulk of ODI deals, the required complementary effects of ODI from mining to other sectors will need to be very large to support the hypothesis that the PRC's ODI is ultimately driven by resource seeking but not export promotion. In sum, over half of China's ODI deals are in service sectors. ODI in manufacturing, mining, or high-tech sectors have not been rising as has been postulated by many.

In Table A2 in the appendix, we also show the distribution of the origin of ODI across provinces in China. The origins tend to be concentrated in coastal provinces (e.g., Zhejiang, Jiangsu, Shandong, Guangdong, and Shanghai). These findings are consistent with the common perception that the PRC's engagement in globalization started in coastal provinces and is still largely concentrated there.

## V. Characteristics of ODI Firms

The ODI data set does not contain balance sheet information. To study the relationship between the causes and effects of ODI at the firm level, we merge the ODI data with the PRC's National Bureau of Statistics (NBS) manufacturing firm survey data. Since there is no common firm identifier in the two datasets, the merging is done based on firm names. The statistics of the merging is reported in Table A5 in the appendix. The NBS data are available for the period of 1998–2009. On average, about 35% of the ODI deals can be merged to a firm in the NBS data, with the success rate ranging from 11% (in 1999) to 55% (in 2002).[13] We present the list of challenges we face when merging the two datasets in online appendixes.[14] Besides the imperfect match, another drawback of using the merged data set is that all "services" firms will be excluded from our sample.

Before dealing with selection and endogeneity issues, let us simply compare the means of several key variables between firms that conduct ODI (after they got at least one deal approved) and those that do not. Table 5 reports the results. Compared to non-ODI firms, ODI firms are significantly larger (in terms of sales, value added or employment). Specifically, the log difference in sales, value added, and employment between ODI and non-ODI firms are 2.3, 2.5, and 1.6, respectively.

[13] These success rates are in the same order of magnitude of merging the PRC's customs data with NBS data done by other scholars (e.g., Ma, Tang, and Zhang 2014, Manova and Yu 2013).

[14] Appendixes A and B, available at http://www.hwtang.com/adb_appendix.html.

Table 5. **The t-test of Key Characteristics between ODI and non-ODI**

| | ODI | non-ODI | Diff |
|---|---|---|---|
| **Size** | | | |
| ln(Sales) | 12.32 | 10.006 | 2.314*** |
| No. or s.e. | 7464 | 2,345,223 | (0.017) |
| ln(Value Added) | 11.081 | 8.587 | 2.494*** |
| No. or s.e. | 3,323 | 1,705,234 | (0.026) |
| ln(Employment) | 6.339 | 4.726 | 1.613*** |
| No. or s.e. | 7,561 | 2,711,011 | (0.014) |
| **Ownership Type** | | | |
| Foreign | 0.119 | 0.034 | 0.085*** |
| No. or s.e. | 10,418 | 7,696,402 | (0.002) |
| HKMT | 0.112 | 0.099 | 0.013*** |
| No. or s.e. | 7,566 | 2,744,253 | (0.003) |
| SOE | 0.04 | 0.12 | –0.08*** |
| No. or s.e. | 7,566 | 2,744,253 | (0.004) |
| **General Performance Measures** | | | |
| ln(Labor Productivity) | 5.425 | 4.39 | 1.035*** |
| No. or s.e. | 7,539 | 2,524,320 | (0.017) |
| Export/ Sales | 0.393 | 0.144 | 0.249*** |
| No. or s.e. | 7,464 | 2,345,223 | (0.004) |
| Value Added/Sales | 0.286 | 0.295 | –0.009*** |
| No. or s.e. | 3,299 | 1,548,148 | (0.002) |
| R&D/Sales (multiplied by 1000) | 0.0211 | 0.00501 | 0.000*** |
| No. or s.e. | 3,241 | 899,075 | (0.00) |
| Raw materials/Sales | 0.618 | 0.616 | 0.002 |
| No. or s.e. | 3,384 | 1,171,453 | (0.003) |

*** = $p < 0.001$, ODI = outward direct investment, HKMT = Hong Kong, China; Macau, China; and Taipei,China invested firms.

Note: Data on value added are only available from 1998–2007. Data on R&D are only available from 2002–2007. Standard errors in parentheses.

Source: Author's computations using manufacturing survey data (1998–2009).

Interestingly, proportionately more ODI firms are foreign firms, including those that have investors from Hong Kong, China; Macau, China; and Taipei,China. Against the common perception that a lot of the ODI deals are initiated by the state, we find proportionately fewer ODI firms that are SOEs. It is possible that the government does not need to invest in the ODI firms directly in order to influence it. What they need to do is provide capital and other types of support to firms that invest abroad.

ODI firms are also on average more productive (in terms of labor productivity) and more export-intensive. Specifically, the average export-to-sales ratio of ODI firms is 0.25 higher than that of non-ODI firms. These findings are consistent with the export-promotion motive of ODI firms, which we will further confirm using transaction-level trade data below. ODI firms are also on average more R&D-intensive (measured by the ratio of R&D expenses to total sales) and have a slightly lower value-added/sales ratio. This finding is consistent with the theory of horizontal

FDI that firms may offshore the most downstream part of global supply chains (e.g., marketing) to foreign affiliates.

As Table 4 already showed, ODI deals are unevenly distributed across sectors. Other unobserved factors may shape the revealed differences in observables between ODI and non-ODI firms. Besides the simultaneity bias, there could be selection bias behind the observed differences in the means reported in Table 5. Suppose more productive firms choose to undertake ODI overseas, which would be the case based on Helpman, Melitz, and Yeaple (2004) who emphasize higher fixed cost for horizontal FDI than that for exporting, the observed superior performance among ODI firms could be driven by selection. Without a feasible instrument in the data set, we will rely on matching techniques (i.e., Heckman et al. 1997 and subsequent studies) to identify the effects of ODI on firm performance, relative to the control group that shares similar ex ante characteristics.

Before introducing the matching estimation results, we estimate the following linear specification, which fully controls for firm-specific time-invariant determinants of post-ODI performance:

$$Y_{it} = [f_i + f_t] + \beta ODI_{it} + \varepsilon_{it}, \tag{1}$$

where $f_i$ and $f_t$ stand for firm and year fixed effects, and $\varepsilon_{it}$ is the regression residual. $Y_{it}$ is the measure of firm performance, including (log) sales, (log) value-added, (log) employment, (log) total factor productivity (TFP), export to sales ratio, value added to sale ratio, R&D to sales ratio, new output sales to total sales ratio, and new product dummy, and material to sales ratio. Notice that any sector-level and province-level effects are already absorbed by firm fixed effects.[15] The ODI dummy equals 1 *in and after* the year the firm reported positive ODI, 0 otherwise. By including firm fixed effects, we are identifying the within-firm relationship between ODI and firm performance. In addition to all non-ODI firms, in the control group we also include observations of ODI firms before their engagement in ODI. Thus, the coefficients on the ODI dummy should be interpreted as the difference-in-difference in the average outcomes between ODI and non-ODI firms.[16]

Table 6 reports the results. Standard errors are clustered at the 2-digit industry level. Controlling for firm and year fixed effects, we find that engaging in ODI increases firms' employment and propensity to innovate new products. The effects on sales and exports are also positive, but only marginally significant. We cannot find supporting evidence for a positive effect on R&D activities or productivity. This is inconsistent with the idea that ODI from emerging markets transfers technology from their affiliates in advanced economies. Although we are still far from establishing any

[15] In unreported results, we verify that a majority of firms in the sample are single-plant firms.

[16] The first difference is the difference from firms' means (across the sample periods). The second difference is the difference from the non-ODI firms' demeaned average within each year.

Table 6. **ODI Effects on Firm Performance (FE Regressions)**

| Dependent Variable: | ln(Sales) | ln(Value Added) | ln(Emp) | ln(TFP) | Exp/Sales |
|---|---|---|---|---|---|
| ODI | 0.047* | 0.071 | 0.118*** | –0.001 | 0.019 |
| | (0.022) | (0.037) | (0.016) | (0.033) | (0.012) |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.883 | 0.851 | 0.904 | 0.787 | 0.8639 |
| No. of obs. | 2,419,825 | 1,719,528 | 2,400,966 | 1,713,660 | 2,445,197 |
| **Dependent Variable:** | **VA/Sales** | **R&D/Sales** | **New product sales share** | **New product dummy** | **Materials/Sales** |
| ODI | –0.005 | 0.001 | 0.013* | 0.034*** | 0.003 |
| | (0.005) | (0.001) | (0.006) | (0.007) | (0.005) |
| Firm FE | Yes | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes | Yes |
| R-squared | 0.628 | 0.702 | 0.598 | 0.484 | 0.609 |
| No. of obs. | 1,706,349 | 857,519 | 1,845,020 | 2,445,197 | 1,640,541 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, ODI = outward direct investment, FE = fixed effects.

Note: ODI = 1 for all firm-years when and after a firm reported overseas investment, 0 otherwise. The number of observations fluctuates because data for some variables are not available in all years (e.g., R&D only for 2003–2005). Standard errors, clustered at the industry level (2-digit), are in brackets.

Source: Authors' computations.

causal relationship or tackling the selection bias, the regression results provide some preliminary evidence that whenever a significant effect of ODI on firm performance is identified, it is positive.

The next step is to implement the propensity-score matching methods to deal with the selection bias, which potentially drives the results reported so far. To this end, we will need to estimate propensity scores for each firm so that we can match ODI with similar non-ODI firms. To this end, we estimate a probit model, using a dummy for the firm's first year of ODI as the dependent variable. Specifically, we estimate the following specification:

$$Pr(ODI_{it}) = [f_s + f_p] + \mathbf{X_{it-1}}\boldsymbol{\alpha} + \varepsilon_{it}, \tag{2}$$

where $i$, $s$, $p$, and $t$ stand for the firm, industry (2-digit, 29 categories), province (30), and year (12), respectively. Sector fixed effects (29 categories), $f_s$, and province fixed effects (30 categories), $f_p$, are always included to capture all regional (e.g., ODI promotion policies) and sectoral unobserved determinants (e.g., comparative advantage) of ODI participation.

$ODI_{it}$ equals 1 if a firm starts engaging in ODI in year $t$, 0 otherwise. Notice that an ODI firm will only appear once in the sample, and firms that never report any ODI can appear multiple times in the sample. $\mathbf{X_{it-1}}$ is a vector of (lagged) firm characteristics that are suspected to affect a firm's participation in ODI. Based on previous models on FDI and exports (e.g., Helpman, Melitz, and Yeaple 2004), we

Table 7. **Participation in ODI based on Manufacturing Firm Characteristics (Probit)**

| **Dependent Variable** | **ODI Dummy** | |
|---|---|---|
| Sample | 1 year before ODI | 2 years before ODI |
| ln(TFP) | 0.270*** | 0.255*** |
| | (0.014) | (0.014) |
| ln(Employment) | 0.114*** | 0.106*** |
| | (0.011) | (0.011) |
| Export intensity | 0.424*** | 0.368*** |
| | (0.028) | (0.027) |
| Capital intensity | 0.409*** | 0.354*** |
| | (0.052) | (0.050) |
| Material intensity | 0.691*** | 0.616*** |
| | (0.093) | (0.088) |
| SOE | 0.0744** | 0.0837** |
| | (0.027) | (0.026) |
| HKMT | –0.0868** | –0.0385 |
| | (0.033) | (0.032) |
| Foreign | –0.105*** | –0.0513 |
| | (0.031) | (0.030) |
| Industry FE | Yes | Yes |
| Province FE | Yes | Yes |
| Number | 1,075,673 | 877,378 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, FE = fixed effects, ODI = outward direct investment, TFP = total factor productivity, SOE = state-owned enterprises, HKMT = Hong Kong, China; Macau, China; and Taipei,China invested firms.

Note: The ODI dummy is equal to 1 for a firm in the year when it reports positive ODI, 0 for the same firm otherwise. ODI is equal to 0 for all observations of firms that never conducted any ODI during the sample period. All independent variables are lagged by one year in column 1, and by two years in column 2. Standard errors in parentheses.

Source: Authors' computations, based on Manufacturing Firm Survey from the PRC's National Bureau of Statistics (NBS).

include firm TFP and employment as regressors.[17] To capture the idea that exporters may have stronger incentive to invest overseas to facilitate trade, we include the ratio of exports to total sales. Specific to the institutional background of the PRC, where foreign firms and SOEs have better financial access (e.g., Zhu 2012) and even preferential policy treatments (Huang and Tang 2012), we include three firm ownership type dummies to indicate SOEs, foreign-owned (both wholly-owned and joint ventures) firms, and firms owned by investors from Hong Kong, China; Macau, China; and Taipei,China (i.e., domestic private firms are the excluded firm group). Moreover, to account for ODI that is driven by resource or technology seeking, we include firm-level measures of material and capital intensities, respectively.

Table 7 reports the probit estimation results. Similar to our explanations for the t-test and the regression results, we find that ex ante (lagged by one year) more

[17] Since data on firms' value added and thus TFP are only available for 1998–2007, the last two years of the sample 2008–2009 are automatically dropped.

productive (measured by TFP) and larger (measured by employment) firms are more likely to start investing in foreign markets. More export-intensive firms are also more likely to undertake ODI.

We also find that compared to domestic private firms, SOEs are more likely to undertake ODI, consistent with the conventional view that the PRC's ODI has a strong government backing. The first finding implies that the t-test results reported in Table 5 are pure correlation and cannot be inferred as a rejection that SOEs are less likely to invest abroad.[18] Foreign firms and firms with major investors from Hong Kong, China; Macau, China; and Taipei,China (or HKMT) are less likely to invest in a third market. These findings are consistent with the idea that foreign firms (e.g., Foxconn which assembles all products for Apple) tend to outsource assembly and processing tasks to the PRC and import the finished products back to the headquarters or export them directly to a third market. If these are their incentives to conduct ODI, they tend to initiate the investment directly from the headquarters, rather than doing it through their processing plants in PRC. Column 2 shows that the results remain robust to using the same set of regressors lagged by two years instead of one year.

Before moving to the next section about the effects of ODI on firm and export performance, a final remark is in order. All results from Tables 5 to 7 are robust to the exclusion of firms that had ODI in Hong Kong, China. This eliminates the concern that some of the documented patterns are an artifact of investment intermediation in Hong Kong, China. In other words, our claim that a majority of ODI projects belong to the service sectors is robust to excluding the main tax haven for the PRC's ODI.

## VI. The effects of ODI on Firm Performance

We use the concept of the average treatment effect on the treated (ATET) to gauge the effects of ODI on firm performance. To this end, we use the propensity-score matching methods, proposed by Rosenbaum and Rubin (1983) and applied by Heckman, Ichimura, and Todd (1997) in the program evaluation literature, to compare the post-ODI average outcomes of ODI firms with ex ante similar non-ODI firms.[19]

We first obtain the propensity score from each firm by estimating the probit model as specified in eq. (2). We then compute the average effect of ODI based on Rosenbaum and Rubin (1983), in which the authors propose reweighting estimators

[18] During the sample period, the PRC's central government embarked on an active privatization program (Zhu 2012). The fraction of SOEs in the total number of enterprises dropped significantly, which may explain the seemingly contrasting results about SOEs' likelihood to invest abroad between Tables 5 and 7.

[19] Previous studies have used the matching approach to search for causal effects of exporting on productivity include Girma, Greenaway, and Kneller (2003), Konings and Vandenbussche (2005), and De Locker (2007), among others.

using propensity scores. Specifically, the estimator for the average treatment effect on the treated (ATET) is

$$\hat{\Delta}^{ATET} = \frac{1}{n}\sum_{i=1}^{n}\left[ y_i F_i - \frac{\frac{\hat{P}(X_i)}{1-\hat{P}(X_i)}}{\sum_{j=1}^{n}\frac{\hat{P}(X_j)}{1-\hat{P}(j)}} y_i(1-F_i)\right]. \tag{3}$$

The first term is just the mean of the outcomes for the ODI firms (i.e., when $F = 1$). The second term is the weighted average of the outcomes of the control units, i.e., firms that do not conduct ODI, where the weights have been normalized by dividing each of them by the sum of all individual weights, so that they add up to one. A firm that is more likely to conduct ODI receives a larger weight by virtue of reweighting the propensity score with the probability of being a control unit. For instance, for a firm with zero probability of treatment, the control unit gets a weight of 0 (before normalization) because it is always observed as a control unit. In contrast, a control unit with a probability of treatment of 0.9, for instance, gets its outcome divided by 0.1 (before normalization) to reflect the fact that we observe only 1 in 10 of such units as control units. Thus, control units with higher probabilities of treatment receive more weight since they resemble the treated units more. Propensity score reweighting has the advantage of avoiding the bandwidth selection problem, as well as the need to decide what type of kernel to use or how many neighbors to select.

As with many two-step estimation procedures, using the simple formula for the variance of the estimator is incorrect. We adjust the standard errors in the second step by bootstrapping to account for measurement errors from the first stage estimation.[20] Table A7 in the appendix shows the balancing test results for the matching. It clearly shows significant reductions in the differences in the average ex ante characteristics between ODI and non-ODI firms after matching.

Table 8 reports the ATET estimation results, using the same set of dependent variables from Table 6. In general, we find statistically more significant effects of ODI on firm performance. For a firm that invests abroad (including the year of investment), we find positive ATET of ODI on the firm's value added (0.29 log points), employment (0.42 log points), and TFP (0.16 log points). All these results are statistically significant at the 0.1% level. Compared to the matched non-ODI firms, ODI firms derive on average a slightly larger share of their sales from exports (a 0.02 log-point increase; significant at the 1% level). They also spend slightly more on R&D (a 0.2% higher share in total sales; significant at the 5% level), create new products, and derive a larger portion of sales from new products (significant at the 1% level). All results remain robust to the exclusion of Hong Kong, China

[20] The implementation of the propensity score reweighting is closely based on the inverse probability regression as proposed in Brunell and DiNardo (2004). We use the Stata routine *treatrew* following Cerulli (2012).

Table 8. **ODI Effects on Firm Performance (Based on Propensity-score Matching 1 year before ODI)**

| Dependent Variable: | ln(Sales) | ln(Value Added) | ln(Emp) | ln(TFP) | Export/Sales |
|---|---|---|---|---|---|
| ATET | 0.288*** | 0.257*** | 0.067*** | 0.163*** | 0.021*** |
| | (0.026) | (0.036) | (0.016) | (0.027) | (0.005) |
| No. of obs. | 1,145,251 | 934,158 | 1,140,946 | 934,689 | 1,148,377 |
| **Dependent Variable:** | **VA/Sales** | **R&D/Sales** | **New output share** | **New output dummy** | **Materials/Sales** |
| ATET | –0.008* | 0.002* | 0.018** | 0.028** | 0.005 |
| | (0.004) | (0.001) | (0.007) | (0.009) | (0.004) |
| No. of obs. | 929,661 | 553,322 | 864,991 | 1,148,377 | 899,973 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, ODI = outward direct investment, TFP = total factor productivity, VA = value added, ATET = average treatment effect on the treated.

Note: ODI = 1 for all firm-years when and after a firm reported overseas investment. The number of observations fluctuates because data for some variables are not available in all years (e.g., R&D only for 2003–2005). Bootstrapped standard errors are in brackets.

Source: Authors' computations.

as the host economy of ODI. These results are consistent with the hypotheses that ODI transfers technology or complements sales abroad by decreasing fixed cost of exporting. We will provide more evidence to disentangle these two channels in the following section.

## VII. The effects of ODI on Firms' Trade Performance

The positive effects of ODI on firm performance documented in the previous section can be due to technology transfer or market expansion. For instance, the finding that a firm tends to create more products after ODI can be induced by new ideas or market expansion, which makes innovative activities profitable. In this section, we focus on the market-seeking (export-promotion) motive of ODI and examine how ODI affects a firm's export performance, and through the export channel enhances firm performance as documented above. Since the ODI data set has no information on exports and imports, we merge the ODI data with the customs transaction-level trade data by firm names. Table A5 in the appendix shows the fractions of firms in the ODI data that can be merged to the customs data. Notice that the customs transaction-level data are only available for the year 2000–2006 (7 years).

The match success rate is fairly high for the last two years of the customs sample (2005–2006). Around 40% of the deals in our ODI data set can be matched with an observation in the customs trade data set. Table A4.2 in the appendix shows the distribution of the successfully matched observations across industries. The industrial distribution of deals in the matched sample is very close to the ones in

the original ODI sample, providing some support that the matched observations are systematically unbiased across sectors. The challenges that arise for this merging are very similar to those encountered when we merge the ODI data and with the customs data.[21]

Similar to the analysis on the ODI effects on firms' overall performance, we apply the matching techniques outlined in Section 5 again to assess the ATET of ODI on firms' export performance. To implement the matching estimation exercise, we need to first obtain the propensity score for each exporter (or importer), which requires an estimation of the ODI participation equation using probit again. While we try to include regressors as close as possible to those from manufacturing survey data, customs trade data only include information related to firms' trade and we are restricted to use proxies. To proxy for TFP and firm size, we use the exporter's total export value (to the rest of the world). To proxy for material intensity (or reliance on imported inputs), we include the exporter's ratio of imports to exports. Similar to Table 7, we include a set of ownership type dummies, with private firms being the excluded group with no dummy included.

Consistent with Table 7, we find that larger (or more productive) exporting firms are more likely to start investing abroad. Similarly, compared to domestic private exporters, foreign exporters are less likely to undertake ODI. SOEs are also less likely to conduct ODI, compared to domestic private exporters. This result should not be taken as a rejection of the earlier finding that SOEs are more likely to invest abroad, as here we focus on a subset of firms—only those that export. Finally, in column 2, we show that the results remain robust to using the same set of regressors lagged by two years instead of one year.

Next we use the propensity scores estimated from Table 9 to assess the ATET of ODI on firms export performance. The dependent variables include ODI firm's export volume, export unit value, number of products (HS6) exported, and number of foreign countries served. All these variables are in log. We also conduct the same regression analysis by using the same four measures but for imports. By matching ODI exporters with non-ODI exporters based on ex ante characteristics, we aim to tackle the bias due to firms' selection into ODI.

Table 10 reports the matching estimation results. We find evidence that after investing overseas, existing exporters' total export volume (in US dollar), export unit value, and number of destinations all increase. In particular, ODI exporters on average export about 0.6 log points more than non-ODI. Their unit value of the same product (a HS6 category) is 0.4 log points higher, while the number of export destinations increases by 0.2 log points. To the extent that unit value proxies for quality, we postulate that ODI can lead to quality upgrading, but higher unit values can also arise from more effective marketing. In the presence of fixed exporting costs, the increase in the number of export destinations after ODI suggests that

[21] See (online) Appendix A (http://www.hwtang.com/adb_appendix.html).

Table 9. **Participation in ODI for Customs (Probit)**

| **Dependent Variable** | **ODI Dummy** | |
|---|---|---|
| Sample | 1 year before ODI | 2 years before ODI |
| Export | 0.114*** | 0.121*** |
| | (0.007) | (0.007) |
| SOE | –0.0801** | –0.090** |
| | (0.036) | (0.040) |
| Foreign | –0.565*** | –0.574*** |
| | (0.035) | (0.039) |
| Collective | 0.085** | 0.123** |
| | (0.047) | (0.050) |
| Import/Export | –0.075 | –0.0764058 |
| | (0.052) | (0.057) |
| Industry FE | Yes | Yes |
| Province FE | Yes | Yes |
| Number | 366,566 | 289,344 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, ODI = outward direct investment, SOE = state-owned enterprises, FE = fixed effects.

Note: The ODI dummy is equal to 1 for a firm in the year when it reports positive ODI, 0 for the same firm otherwise. ODI is equal to 0 for all observations of firms that never conducted any ODI during the sample period. Industry is an HS2 category. Domestic private firms are the excluded ownership type. Standard errors in parentheses.

Source: Authors' computations, based on the PRC's Customs transaction-level trade data.

Table 10. **Export Performance (Based on Propensity-score Matching 1 year before ODI)**

| **Sample** | **All firms** (ODI = 0 for non-ODI firms and observations before ODI) | | | |
|---|---|---|---|---|
| **Dependent Variable:** | **Exp Value** | **Exp Unit Val** | **No. of HS6 Exp** | **No. of Exp Countries** |
| ATET | 0.586*** | 0.396*** | 0.031 | 0.239*** |
| | (0.058) | (0.075) | (0.051) | (0.047) |
| No. of obs. | 314,240 | 314,240 | 316,011 | 316,011 |
| **Dependent Variable:** | **Imp Value** | **Imp Unit Val** | **No. of HS6 Imp** | **No. of Exp Countries** |
| ATET | 0.363*** | 0.286*** | –0.070 | 0.057 |
| | (0.084) | (0.010) | (0.052) | (0.040) |
| No. of obs. | 307,119 | 307,119 | 307,119 | 310,766 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, ODI = outward direct investment, ATET = average treatment effect on the treated.

Note: The ODI dummy is equal to 1 for a firm in the year when it reports positive ODI, 0 for the same firm otherwise. ODI is equal to 0 for all observations of firms that never conducted any ODI during the sample period. Bootstrapped standard errors reported in brackets.

Source: Authors' computations, based on the PRC's Customs transaction-level trade data.

ODI may be associated with an across-the-board reduction in those fixed costs. Collectively, these results confirm our conjecture that ODI from the PRC has been mostly related to export promotion. We find no effect in terms of the number of exported products after ODI.

In the lower panel of Table 10, we repeat the same exercises but for importers. We find that importers that invest abroad have higher import volume and unit values

Table 11. **Capital Goods and Raw Materials in Exports and Imports and ODI**

| **Sample** | **All firms** (ODI = 0 for non-ODI firms and observations before ODI) | | | | **All firms** (ODI = 0 for non-ODI firms and observations before ODI) | | | |
|---|---|---|---|---|---|---|---|---|
| **Dep. Variable** | **Share of Capital Goods** | | **Share of Materials** | | **Share of Capital Goods** | | **Share of Materials** | |
| | Firm Import Volume | No. of Imported Goods | Firm Import Volume | No. of Imported Goods | Firm Export Volume | No. of Exported Goods | Firm Export Volume | No. of Exported Goods |
| ATET | 0.027 | –0.004 | 0.014 | –0.003 | 0.042*** | –0.003 | –0.009 | 0.001 |
| | (0.015) | (0.005) | (0.012) | (0.005) | (0.013) | (0.005) | (0.006) | (0.003) |
| No. of obs. | 301,043 | 301,043 | 301,043 | 301,043 | 309,817 | 309,817 | 309,817 | 309,817 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, ODI = outward direct investment, ATET = average treatment effect on the treated.

Note: The ODI dummy is equal to 1 for a firm in the year when it reports positive ODI, 0 for the same firm otherwise. ODI is equal to 0 for all observations of firms that never conducted any ODI during the sample period. Bootstrapped standard errors reported in brackets.

Source: Authors' computations, based on the PRC's Customs transaction-level trade data.

for a given product. These results show that ODI serves not only as a platform for exports, but also for imports, an aspect of ODI that has not received its deserved attention in the literature. However, there is no effect on import variety or the number of source countries for imports.

While Table 10 shows very strong export promotion effects of ODI, we still cannot rule out technology transfer or resource seeking as the source of the positive effects. To this end, we rely on firms' imports to provide indirect evidence. If technology and resource seeking are important, we should expect ODI firms to import more capital goods and intermediate inputs, compared to non-ODI firms. To verify these speculations, we repeat the same estimation as in Table 10 but with dependent variables replaced by the shares of capital goods and intermediate inputs (materials) in firms' exports and imports, respectively.

To classify a product (HS6) as capital good, raw material, and others, we use the list from the United Nations Broad Economic Categories (UN BEC) classification.[22] If the increase in import volume documented in Table 10 is really associated with technology transfer, we should observe an increase in the share of capital goods in imports. The findings about the share of raw materials will then inform us about whether the PRC's ODI could be associated with resource seeking.

Table 11 reports the results. The first four columns report the results regarding the share of capital and materials in firms' imports, in terms of total value or the total number of imported varieties. The last four columns report the results regarding those shares in exports. We find no evidence for a higher import share or fraction of capital goods in total imports by ODI firms. There is also no significant effect of

[22] Available at http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=10. See also (online) Appendix B for details (http://www.hwtang.com/adb_appendix.html).

ODI on imports of material. Based on trade of tangible goods, we find no evidence that Chinese ODI is technology seeking. However, it is worth noting that there can still be transfer of intangible asset from foreign affiliates to the headquarters in the PRC that are not observed in trade data, as pointed out by Atalay et al. (2013).

For completeness, we also examine the ODI effects on firms' composition of exports. Interestingly, as reported in the last four columns, we find a significantly positive effect on firms' capital export share, consistent with the export promotion or quality upgrading effects reported in Table 10. However, there is no effect when it is measured as a fraction of total export varieties. There is no evidence of an effect on exports of materials.

## VIII. Conclusion

Using a new panel data set of Chinese multinational firms that covers close to 10,000 deals from all provinces and industries over 1998–2009, we find that over half of the ODI deals are in service sectors, with many of them appearing to be related to export promotion. In addition to documenting the pattern and trend of the PRC's ODI firms, this paper empirically examines both the determinants and effects of the PRC's ODI at the firm level.

We find that ex ante larger, more productive, and more export-intensive firms are more likely to start engaging in ODI. Using matching estimation techniques, we find that ODI enhances firm performance in terms of TFP, export intensity, product creation, and employment. To shed light on the relevant importance of technology transfer and export promotion of ODI, we use customs transaction-level trade data merged with the ODI firm list for analysis. We find that firms' ODI participation is associated with better performance in both exports (in terms of volume, unit value, and number of destination countries) and imports (in terms of volume and unit value). We find no evidence of technology upgrading and resource seeking based on the pattern of imported products.

What lessons do we learn from the PRC about development strategies that are applicable for other developing nations and emerging markets? One of the intriguing findings in the literature about the PRC is its fast transition from processing exports, which mostly originate from foreign-invested exporting firms, to non-processing exports by indigenous Chinese firms. Our finding of the export promotion effects of ODI in the PRC imply that ODI may have played an important role in driving this transition.

It has been shown that inward foreign direct investment (FDI) into China has transferred know-how, technology, and management skills to the country. However, the benefits of promoting exports and inward FDI are diminishing for the PRC, about 20 years after the country's economic integration with the rest of the world, initiated by Deng's famous southern trip in 1992. This phenomenon is not specific to the PRC

and has been or will be faced by many developing countries that lose comparative advantage in labor-intensive sectors due to increasing labor costs. When the average wage level of low-skilled workers continues to increase, a country will have to transit to more skill-intensive and capital-intensive sectors. While this transition can happen naturally (with some adjustment cost), there could be room for policies to make the transition smoother. In Chen and Tang (2013), we find evidence of skills upgrading and capital deepening through ODI, as revealed in the pattern of exported products from the PRC's exporters that engage in ODI. In summary, our paper shows that export-promoting ODI can potentially raise and sustain the benefits of exporting, which may in turn contribute to a country's structural transformation from low-skill manufacturing to high-skill manufacturing and eventually from manufacturing to high-skill services.

## References


Antkiewicz, Agata and John Whalley. 2007. Recent Chinese Buyout Activity And The Implications For Wider Global Investment Rules. *Canadian Public Policy* 33(2):207–26.

Antràs, Pol. 2003. Firms, Contracts, and Trade Structure. *Quarterly Journal of Economics* 118 (4):1375–418.

Atalay, Enghin, Ali Hortaçsu, and Chad Syverson. Forthcoming. Vertical Integration and Input Flows." *American Economic Review*.

Blonigen, Bruce. 2001. In Search of Substitution between Foreign Production and Exports. *Journal of International Economics* 53(1):81–104.

Brainard, S. Lael. 1997. An Empirical Assessment of the Proximity-Concentration Trade-off between Multinational Sales and Trade. *American Economic Review* 87(4): 520–44.

Brunell, Thomas, and John DiNardo. 2004. A Propensity Score Reweighting Approach to Estimating the Partisan Effects of Full Turnout in American Presidential Elections. *Political Analysis* 12(1):28–45.

Buckley, Peter, L. Jeremy Clegg, Adam Cross, Xin Liu, Hinrich Voss, and Ping Zheng. 2007. The Determinants Of Chinese Outward Foreign Direct Investment. *Journal of International Business Studies* 38(4):499–518.

Cai, Kevin. 1999. Outward Foreign Direct Investment: A Novel Dimension of China's Integration into the Regional and Global Economy. *China Quarterly* 160: 856–80.

Caves, Richard. 1971. International Corporations: The Industrial Economics of Foreign Investment. *Economica* 38(149):1–27.

Cerulli, Giovanni. 2012. TREATREW: Stata module to estimate Average Treatment Effects by reweighting on propensity score. Boston College. Unpublished.

Chen, Wenjie, and Heiwai Tang. 2013. Export Promotion of ODI from Emerging Markets—Transaction-level Evidence from China. Johns Hopkins University. Unpublished.

Cheung, Yin-Wong, and Xinwang Qian. 2009. Empirics of China's Outward Direct Investment. *Pacific Economic Review* 14(3):312–41.

Cheng, Leonard, and Zihui Ma. 2007. China's Outward FDI: Past and Future. In *China's Growing Role in World Trade*, edited by Robert Feenstra and Shangjin Wei. Chicago: University of Chicago Press.

Child, John, and Suzana Rodrigues. 2005. The Internationalization of Chinese Firms: A Case for Theoretical Extension? *Management and Organization Review* 1(3):381–410.

Clausing, Kimberly. 2000. Does Multinational Activity Displace Trade? *Economic Inquiry* 38(2):190–205.

Conconi, Paola, Andre Sapir, and Maurizio Zanardi. 2013. The Internationalization Process of Firms: from Exports to FDI. CEPR Discussion Paper no. 9332. London, UK: Centre for Economic Policy Research.

De Loecker, Jan. 2007. Do Exports Generate Higher Productivity? Evidence from Slovenia. *Journal of International Economics* 73(1):69–98.

Deng, Ping. 2003. Foreign Direct Investment by Transnationals from Emerging Countries: The Case of China. *Journal of Leadership and Organizational Studies* 10(2):113–24.

Deng, Ping. 2004. Outward Investment by Chinese MNCs: Motivations and Implications. *Business Horizons* 47(3):8–16.

Ekholm, Karolina, Rikard Forslid, and James Markusen. 2007. Export-Platform Foreign Direct Investment. *Journal of the European Economic Association* 5(4):776–795.

Fernandes, Ana, and Heiwai Tang. 2013. Scale, Scope, and Trade Dynamics of Export Processing Plants." Johns Hopkins University. Unpublished.

Girma, Sourafel, David Greenaway, and Richard Kneller. 2003. Export Markets Exit and Performance Dynamics: A Causality Analysis of Matched Firms. *Economics Letters* 80(2):181–187.

Grossman, Gene, Elhanan Helpman, and Adam Szeidl. 2006. Optimal Integration Strategies for the Multinational Firm. *Journal of International Economics* 70(1):216–38.

He, Dong, Lillian Cheung, Wenlang Zhang, and Tommy Wu. 2012. How would Capital Account Liberalization Affect China's Capital Flows and the Renminbi Real Exchange Rates? *China & World Economy* 20(6):29–54.

Heckman, James, Hidehiko Ichimura, and Petra Todd. 1997. Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme. *Review of Economic Studies* 64(4):605–54.

Helpman, Elhanan. 1984. A Simple Theory of International Trade with Multinational Corporations. *Journal of Political Economy* 92(3):451–71.

Helpman, Elhanan, Marc Melitz, and Stephen Yeaple. 2004. Exports versus FDI with Heterogeneous Firms. *American Economic Review* 94(1):300–16.

Huang, Yasheng, and Heiwai Tang. 2012. FDI Policies in China and India: Evidence from Firm Surveys. *World Economy* 35(1):91–105.

Huang, Yiping, and Bijun Wang. 2013. Investing Overseas without Moving Factories Abroad: The Case of Chinese Outward Direct Investment. *Asian Development Review* 30(1):85–107.

Hymer, Stephen Herbert. 1976. *The International Operations of National Firms: A Study of Direct Foreign Investment*. Cambridge, Mass.: MIT Press.

Kindleberger, Charles. 1969. *American Business Abroad: Six Lectures on Direct Investment*. New Haven, Connecticut: Yale University Press.

Kindleberger, Charles, ed. 1970. *The International Corporation: A Symposium*. Cambridge, Mass.: MIT Press.

Konings, Jozef, and Hylke Vandenbussche. 2005. Heterogeneous Responses of Firms to Trade Protection. *Journal of International Economics* 76(2):371–83.

Krugman, Paul. 1980. Scale Economies, Product Differentiation and the Pattern of Trade. *American Economic Review* 70(5):950–59.

Lipsey, Robert, and Merle Weiss. 1981. Foreign Production and Exports in Manufacturing Industries. *Review of Economics and Statistics* 63(4):488–94.

———. 1984. Foreign Production and Exports of Individual Firms. *Review of Economics and Statistics* 66(2):304–07.

Luo, Yadong, Hongxin Zhao, Yagang Wang, and Youmin Xi. 2011. Venturing Abroad by Emerging Market Enterprises: A Test of Dual Strategic Intents. *Management International Review* 51(4):433–59.

Ma, Yue, Heiwai Tang, and Yifan Zhang. 2014. Factor Intensity, Product Switching, and Productivity: Evidence from Chinese Exporters. *Journal of International Economics*, 92(2):349–62.

Makino, Shige, Chung-Ming Lau, and Rhy-Song Yeh. 2002. Asset-exploitation versus Asset seeking: Implications for Location Choice of Foreign Direct Investment from Newly Industrialized Economies. *Journal of International Business Studies* 33(3):403–21.

Manova, Kalina, and Zhihong Yu. 2013. "Firms and Credit Constraints along the Global Value Chain: Processing Trade in China." Stanford University mimeo.

Markusen, James, and Anthony Venables. 2000. The Theory of Endowment, Intra-industry and Multi-national Trade. *Journal of International Economics* 52(2):209–34.

Mathews, John. 2006. Dragon Multinationals: New Players in 21st Century Globalization. *Asia Pacific Journal of Management* 23(1):5–27.

Rui, Huaichuan, and George Yip. 2008. Foreign Acquisitions by Chinese Firms: A Strategic Intent Perspective. *Journal of World Business* 43(2):213–27.

Rosenbaum, Paul, and B. Donald Rubin. 1983. The Central Role of the Propensity Score in Observational Studies for Causal Effects. *Biometrika* 70(1):41–55.

UNCTADstat, http://unctadstat.unctad.org/ReportFolders/reportFolders.aspx.

Wu, Hsiu-Ling, and Chien-Hsun Chen. 2001. An Assessment of Outward Foreign Direct Investment from China's Transitional Economy. *Europe-Asia Studies* 53(8):1235–54.

Yamawaki, Hideki. 1991. Exports and Foreign Distributional Activities: Evidence on Japanese Firms in the United States. *Review of Economics and Statistics* 73(2):294–300.

Yeaple, Stephen Ross. 2003. The Complex Integration Strategies of Multinationals and Cross Country Dependencies in the Structure of FDI. *Journal of International Economics* 60(2):293–314.

Zhu, Xiaodong. 2012. Understanding China's Growth: Past, Present, and Future. *Journal of Economic Perspectives* 26(4):103–24.

## Appendix

Table A1. **Industry Breakdown**

| Industry | Freq. | Percent |
|---|---|---|
| Business services | 2,816 | 0.289 |
| Wholesale trade | 2,419 | 0.248 |
| Building and civil engineering | 285 | 0.029 |
| Nonferrous metals mining and dressing | 212 | 0.022 |
| Nonmetal mineral products | 202 | 0.021 |
| Garments, shoes and caps manufacturing | 189 | 0.019 |
| Forestry | 181 | 0.019 |
| Real estate | 169 | 0.017 |
| Electric equipment and machinery | 162 | 0.017 |
| R&D | 159 | 0.016 |
| Geologic prospecting | 157 | 0.016 |
| Other financial activities | 143 | 0.015 |
| Metal products | 135 | 0.014 |
| Retail trade | 122 | 0.013 |
| Transport equipment | 118 | 0.012 |
| Food production | 106 | 0.011 |
| Waterway transport | 101 | 0.010 |
| Agriculture | 86 | 0.009 |
| Ordinary machinery | 86 | 0.009 |
| Software | 84 | 0.009 |
| Plastic products | 82 | 0.008 |
| Professional and technical services | 82 | 0.008 |
| Timber processing, bamboo, cane, palm fiber and straw products | 82 | 0.008 |
| Food processing | 77 | 0.008 |
| Textile industry | 75 | 0.008 |
| Telecom and other information transmission | 67 | 0.007 |
| Securities | 61 | 0.006 |
| Leather, furs, down and related products | 58 | 0.006 |
| Medical and pharmaceutical products | 57 | 0.006 |
| Raw chemical materials and chemical products | 57 | 0.006 |
| Telecom, computer and other electronic equipment | 57 | 0.006 |
| Ferrous metals mining and dressing | 55 | 0.006 |
| Cultural, educational and sports goods | 53 | 0.005 |
| Instruments, meters, cultural and clerical machinery | 48 | 0.005 |
| Waste materials recycling and reprocessing | 48 | 0.005 |
| Catering | 47 | 0.005 |
| Smelting and pressing of ferrous metals | 44 | 0.005 |
| Computer services | 42 | 0.004 |
| Special purposes equipment | 42 | 0.004 |
| Smelting and pressing of nonferrous metals | 41 | 0.004 |
| Art & craft and other manufacturing | 34 | 0.003 |
| Other services | 34 | 0.003 |
| Building installation | 33 | 0.003 |
| Science & technology exchange and promotion services | 33 | 0.003 |
| Petroleum and natural gas extraction | 32 | 0.003 |
| Nonmetal minerals mining and dressing | 29 | 0.003 |
| Fishing | 28 | 0.003 |
| Furniture manufacturing | 26 | 0.003 |

*Continued.*

Table A1. *Continued.*

| Industry | Freq. | Percent |
|---|---|---|
| Rubber products | 25 | 0.003 |
| Air transport | 22 | 0.002 |
| Papermaking and paper products | 22 | 0.002 |
| Leasing | 20 | 0.002 |
| Railway transport | 18 | 0.002 |
| Chemical fiber | 17 | 0.002 |
| Building decoration | 15 | 0.002 |
| Loading & unloading and carrying, and other transport | 15 | 0.002 |
| Animal husbandry | 14 | 0.001 |
| Beverage production | 13 | 0.001 |
| Hotels | 13 | 0.001 |
| Services to households | 13 | 0.001 |
| Storage | 13 | 0.001 |
| Culture and art | 12 | 0.001 |
| Highway transport | 12 | 0.001 |
| Production and supply of power, steam and electricity | 11 | 0.001 |
| Services for agriculture, forestry, animal husbandry and fishing | 10 | 0.001 |
| Urban public transport | 10 | 0.001 |
| Education | 9 | 0.001 |
| Other construction | 9 | 0.001 |
| Banking | 7 | 0.001 |
| Broadcasting, television, film and audio | 7 | 0.001 |
| Health | 7 | 0.001 |
| News and publishing industry | 7 | 0.001 |
| Petroleum refining, coking, and nuclear energy | 7 | 0.001 |
| Printing and record medium reproduction | 7 | 0.001 |
| Tobacco processing and production | 7 | 0.001 |
| Post | 6 | 0.001 |
| Entertainment industry | 5 | 0.001 |
| Production and supply of water | 5 | 0.001 |
| Production and supply of gas | 4 | 0.000 |
| Coal mining and processing | 3 | 0.000 |
| Pipeline transport | 3 | 0.000 |
| Sports | 3 | 0.000 |
| Management of public facilities | 2 | 0.000 |
| Management of environment | 2 | 0.000 |
| Other | 13 | 0.001 |
| Total | 9,744 | 1 |

Note: Industry classification is based on NBS 4-digit code.
Source: PRC's Ministry of Commerce, PRC National Bureau of Statistics and Authors' own calculation.

Table A2. **Distribution across Provinces**

| Province | Freq. | Percent | Cum. |
|---|---|---|---|
| Zhejiang | 1,993 | 20.45 | 20.45 |
| Shandong | 996 | 10.22 | 30.68 |
| Jiangsu | 938 | 9.63 | 40.3 |
| Guangdong | 920 | 9.44 | 49.74 |
| Central Enterprises | 568 | 5.83 | 55.57 |
| Shanghai | 508 | 5.21 | 60.79 |
| Beijing | 489 | 5.02 | 65.8 |
| Fujian | 410 | 4.21 | 70.01 |
| Liaoning | 341 | 3.5 | 73.51 |
| Heilongjiang | 302 | 3.1 | 76.61 |
| Hunan | 295 | 3.03 | 79.64 |
| Tianjin | 253 | 2.6 | 82.24 |
| Yunnan | 201 | 2.06 | 84.3 |
| Henan | 171 | 1.75 | 86.05 |
| Hebei | 170 | 1.74 | 87.8 |
| Jilin | 164 | 1.68 | 89.48 |
| Sichuan | 159 | 1.63 | 91.11 |
| Guangxi | 139 | 1.43 | 92.54 |
| Xinjiang | 123 | 1.26 | 93.8 |
| Anhui | 103 | 1.06 | 94.86 |
| Chongqing | 95 | 0.97 | 95.83 |
| Jiangxi | 89 | 0.91 | 96.75 |
| Hubei | 73 | 0.75 | 97.5 |
| Shaanxi | 73 | 0.75 | 98.25 |
| Shanxi | 72 | 0.74 | 98.98 |
| Gansu | 35 | 0.36 | 99.34 |
| Hainan | 28 | 0.29 | 99.63 |
| Ningxia | 13 | 0.13 | 99.76 |
| Guizhou | 12 | 0.12 | 99.89 |
| Qinghai | 9 | 0.09 | 99.98 |
| Xizang | 2 | 0.02 | 100 |
| Total | 9,744 | 100 | |

Source: PRC's Ministry of Commerce and Authors' own calculations.

Table A3. **Number of ODI Firms by Ownership Type**

| Year | State-owned | Domestic Private | Foreign |
|---|---|---|---|
| 1998 | 0 | 0 | 0 |
| 1999 | 0 | 0 | 0 |
| 2000 | 0 | 3 | 2 |
| 2001 | 2 | 2 | 1 |
| 2002 | 0 | 28 | 1 |
| 2003 | 4 | 22 | 3 |
| 2004 | 2 | 39 | 13 |
| 2005 | 20 | 273 | 82 |
| 2006 | 21 | 366 | 79 |
| 2007 | 23 | 366 | 93 |
| 2008 | 12 | 335 | 79 |
| 2009 | 26 | 336 | 110 |

ODI = outward direct investment.
Source: PRC's Ministry of Commerce.

Table A4.1. **Breakdown of Industries by NBS Classifications of NBS ODI Dataset**

| Sector | Freq. | Percent |
|---|---|---|
| Manufacturing | 2,544 | 98.76 |
| Mining | 19 | 0.74 |
| Power, gas & water | 13 | 0.5 |

NBS = National Bureau of Statistics, ODI = outward direct investment.
Source: PRC's Ministry of Commerce, PRC National Bureau of Statistics and Authors' own calculation

Table A4.2. **Breakdown of industries by ODI Assigned Classifications of Customs ODI Dataset**

| Industry | | Freq. | Percent | Cum. |
|---|---|---|---|---|
| 74 | Business services | 718 | 39.56 | 39.56 |
| 63 | Wholesale trade | 421 | 23.2 | 62.75 |
| 18 | Garments, shoes and caps manufacturing | 46 | 2.53 | 65.29 |
| 47 | Building and civil engineering | 45 | 2.48 | 67.77 |
| 31 | Nonmetal mineral products | 32 | 1.76 | 69.53 |
| 39 | R&D | 31 | 1.71 | 71.24 |
| 75 | Electric equipment and machinery | 31 | 1.71 | 72.95 |
| 65 | Retail trade | 28 | 1.54 | 74.49 |
| 14 | Food production | 25 | 1.38 | 75.87 |
| 34 | Metal products | 23 | 1.27 | 77.13 |
| 19 | Transport equipment | 22 | 1.21 | 78.35 |
| 37 | Leather, furs, down and related products | 22 | 1.21 | 79.56 |
| 30 | Plastic products | 20 | 1.1 | 80.66 |
| 60 | Telecom and other information transmission | 19 | 1.05 | 81.71 |
| 24 | Cultural, Educational and Sports Goods | 18 | 0.99 | 82.7 |
| 2 | Forestry | 17 | 0.94 | 83.64 |
| 20 | Timber processing, bamboo, cane, palm fiber and straw products | 17 | 0.94 | 84.57 |
| 35 | Ordinary machinery | 17 | 0.94 | 85.51 |
| 9 | Nonferrous metals mining and dressing | 16 | 0.88 | 86.39 |
| 17 | Textile industry | 15 | 0.83 | 87.22 |
| 40 | Telecom, computer and other electronic equipment | 14 | 0.77 | 87.99 |
| 78 | Geologic prospecting | 14 | 0.77 | 88.76 |
| 41 | Instruments, meters, cultural and clerical machinery | 13 | 0.72 | 89.48 |
| 13 | Food processing | 12 | 0.66 | 90.14 |
| 71 | Other financial activities | 11 | 0.61 | 90.74 |
| 1 | Agriculture | 10 | 0.55 | 91.29 |
| 36 | Special purposes equipment | 10 | 0.55 | 91.85 |
| 26 | Raw chemical materials and chemical products | 9 | 0.5 | 92.34 |
| 27 | Medical and pharmaceutical products | 9 | 0.5 | 92.84 |
| 72 | Real estate | 8 | 0.44 | 93.28 |
| 76 | Professional and technical services | 8 | 0.44 | 93.72 |
| 8 | Software | 7 | 0.39 | 94.1 |
| 29 | Waterway transport | 7 | 0.39 | 94.49 |
| 32 | Rubber products | 7 | 0.39 | 94.88 |
| 54 | Smelting and pressing of ferrous metals | 7 | 0.39 | 95.26 |
| 62 | Ferrous metals mining and dressing | 7 | 0.39 | 95.65 |
| 22 | Papermaking and paper products | 6 | 0.33 | 95.98 |

*Continued.*

Table A4.2. *Continued.*

| Industry | | Freq. | Percent | Cum. |
|---|---|---|---|---|
| 33 | Waste materials recycling and reprocessing | 6 | 0.33 | 96.31 |
| 43 | Smelting and pressing of nonferrous metals | 6 | 0.33 | 96.64 |
| 69 | Securities | 6 | 0.33 | 96.97 |
| 83 | Other services | 5 | 0.28 | 97.25 |
| 4 | Services to households | 4 | 0.22 | 97.47 |
| 42 | Fishing | 4 | 0.22 | 97.69 |
| 61 | Computer services | 4 | 0.22 | 97.91 |
| 82 | Art & Craft and Other Manufacturing | 4 | 0.22 | 98.13 |
| 7 | Building installation | 3 | 0.17 | 98.29 |
| 21 | Science & technology exchange and promotion services | 3 | 0.17 | 98.46 |
| 28 | Furniture manufacturing | 3 | 0.17 | 98.62 |
| 48 | Catering | 3 | 0.17 | 98.79 |
| 58 | Chemical fiber | 3 | 0.17 | 98.95 |
| 67 | Storage | 3 | 0.17 | 99.12 |
| 77 | Petroleum and natural gas extraction | 3 | 0.17 | 99.28 |
| 10 | Highway transport | 2 | 0.11 | 99.39 |
| 16 | Nonmetal minerals mining and dressing | 2 | 0.11 | 99.5 |
| 52 | Tobacco processing and production | 2 | 0.11 | 99.61 |
| 5 | Loading & unloading and carrying, and other transport | 1 | 0.06 | 99.67 |
| 15 | Air transport | 1 | 0.06 | 99.72 |
| 55 | Post | 1 | 0.06 | 99.78 |
| 57 | Leasing | 1 | 0.06 | 99.83 |
| 59 | Beverage production | 1 | 0.06 | 99.89 |
| 73 | Culture and art | 1 | 0.06 | 99.94 |
| 90 | Services for agriculture, forestry, animal husbandry and fishing | 1 | 0.06 | 100 |
| Total | | 1,815 | 100 | |

ODI = outward direct investment.
Source: PRC's Ministry of Commerce, PRC National Bureau of Statistics and Authors' own calculation

Table A5. **Success Rates of Matching between ODI and Customs Data, and ODI and Manufacturing Survey Data**

| Year | NBS matches | Customs Matches Export | Customs Matches Import |
|---|---|---|---|
| 1998 | 0.16 | | |
| 1999 | 0.11 | | |
| 2000 | 0.35 | 0.01 | 0.01 |
| 2001 | 0.29 | 0.01 | 0.01 |
| 2002 | 0.55 | 0.06 | 0.06 |
| 2003 | 0.47 | 0.05 | 0.05 |
| 2004 | 0.32 | 0.09 | 0.08 |
| 2005 | 0.47 | 0.39 | 0.37 |
| 2006 | 0.44 | 0.41 | 0.42 |
| 2007 | 0.39 | | |
| 2008 | 0.34 | | |
| 2009 | 0.27 | | |
| Average | 0.35 | 0.15 | 0.14 |

NBS = National Bureau of Statistics, ODI = outward direct investment.
Source: PRC's Ministry of Commerce, PRC National Bureau of Statistics, PRC Customs and Authors' own calculation.

Table A6. **ODI Effects on Export Performance (FE Regressions)**

| **Sample** | **All firms** (ODI = 0 for non-ODI firms and observations before ODI) | | | |
|---|---|---|---|---|
| **Dependent Var:** | **Export Total Value** | **Exp unit val** | **# of Exp HS6** | **Exp # of country** |
| ODI | 0.017 | 0.103 | 0.079** | 0.067** |
| | (0.069) | (0.057) | (0.027) | (0.023) |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| R-squared | 0.727 | 0.806 | 0.839 | 0.838 |
| No. of obs. | 717355 | 717355 | 751589 | 751588 |
| **Dependent Var:** | **Imp total value** | **Imp unit val** | **Imp # of hs6 value** | **Imp # of country** |
| ODI | 0.630*** | 0.047 | 0.301*** | 0.064* |
| | (0.074) | (0.083) | (0.034) | (0.030) |
| Firm FE | Yes | Yes | Yes | Yes |
| Year FE | Yes | Yes | Yes | Yes |
| R-squared | 0.826 | 0.795 | 0.835 | 0.716 |
| No. of obs. | 659392 | 659392 | 659392 | 677740 |

* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$, FE = fixed effects, NBS = National Bureau of Statistics, ODI = outward direct investment.

Note: ODI = 1 for all firm–years when and after a firm reported overseas investment. All dependent variables are in log form. All custom firms and treated firms prior to ODI are included in the control group. Robust standard errors reported in brackets.

Source: Authors' computations.

Table A7. **Balancing Test of Matching ODI and non-ODI (NBS Sample)**

| | | **Mean** | | **%reduction** | | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **Sample** | **treated** | **control** | **%bias** | **bias** | **t** | **p>t** |
| Export intensity | Unmatched | 0.441 | 0.202 | 62.1 | | 21.89 | 0.000 |
| | Matched | 0.441 | 0.443 | −0.6 | 99.1 | −0.05 | 0.962 |
| Ln Employment | Unmatched | 5.722 | 4.703 | 85.8 | | 32.65 | 0.000 |
| | Matched | 5.716 | 5.736 | −1.7 | 98.1 | −0.01 | 0.989 |
| Capital intensity | Unmatched | 0.217 | 0.204 | 8.5 | | 2.78 | 0.000 |
| | Matched | 0.217 | 0.213 | 2.9 | 65.4 | 0.34 | 0.735 |
| Material intensity | Unmatched | −0.248 | −0.279 | 11.4 | | 3.2 | 0.001 |
| | Matched | −0.248 | −0.262 | 5.1 | 55 | 0.21 | 0.834 |
| TFP | Unmatched | 6.258 | 5.477 | 72.3 | | 26.02 | 0.000 |
| | Matched | 6.254 | 6.298 | −4.1 | 94.4 | 0.03 | 0.976 |
| SOE | Unmatched | 0.252 | 0.176 | 18.5 | | 6.64 | 0.000 |
| | Matched | 0.251 | 0.244 | 1.8 | 90 | 0.13 | 0.893 |
| HKMT | Unmatched | 0.133 | 0.128 | 1.3 | | 0.45 | 0.653 |
| | Matched | 0.133 | 0.134 | −0.3 | 74.3 | −0.01 | 0.99 |
| Foreign | Unmatched | 0.169 | 0.119 | 14.4 | | 5.23 | 0.000 |
| | Matched | 0.169 | 0.176 | −2 | 86.1 | −0.46 | 0.643 |

NBS = National Bureau of Statistics, ODI = outward direct investment, TFP = total factor productivity, SOE = state-owned enterprises, HKMT = Hong Kong, China; Macau, China; and Taipei, China invested firms.

Source: Authors' computations.

Table A8. **Balancing Test of Matching ODI and non-ODI (Customs Sample)**

| | | Mean | | %reduction | | | |
|---|---|---|---|---|---|---|---|
| **Variable** | **Sample** | **treated** | **control** | **%bias** | **bias** | **t** | **p>t** |
| Import share | Unmatched | 0.280 | 0.404 | −41.6 | | −10.36 | 0.000 |
| | Matched | 0.280 | 0.283 | −1.1 | 97.4 | −0.19 | 0.85 |
| Export | Unmatched | 15.324 | 13.467 | 76.9 | | 18.63 | 0.000 |
| | Matched | 15.324 | 15.261 | 2.6 | 96.6 | 0.48 | 0.629 |
| SOE | Unmatched | 0.329 | 0.136 | 46.9 | | 13.58 | 0.000 |
| | Matched | 0.329 | 0.331 | −0.5 | 99 | −0.07 | 0.946 |
| POE | Unmatched | 0.445 | 0.166 | 63.6 | | 18.13 | 0.000 |
| | Matched | 0.445 | 0.427 | 4.2 | 93.5 | 0.63 | 0.532 |
| Foreign | Unmatched | 0.226 | 0.687 | −104.5 | | −24.04 | 0.000 |
| | Matched | 0.226 | 0.241 | −3.5 | 96.7 | −0.61 | 0.541 |

ODI = outward direct investment, SOE = state-owned enterprises, POE = privately-owned enterprises.
Source: Authors' computations.