Foreign Direct Investment, Firm Heterogeneity, and Exports: An Analysis of Indian Manufacturing

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Using firm-level data, this paper investigates whether foreign direct investment and the presence of multinational enterprises explains India’s improved export performance during the postreform period. The recent literature stresses that firm heterogeneity gives some firms an edge over others to self-select into export markets. Apart from ownership, this paper considers firm heterogeneity and other firm-specific factors of export performance. Estimation results show that the impact of foreign ownership on export performance does not significantly differ from that of domestic firms across sectors in Indian manufacturing. Rather, firms build their international competitiveness by importing raw materials and foreign technical know-how, and by investing in research and development. Further, firm heterogeneity, measured in terms of sunk costs, significantly impacts firm-level export intensity. The study also reveals that there are ownership-specific factors that determine firm-level exports.

*Keywords*: dynamic panel data estimation, export competitiveness, firm heterogeneity, Hausman–Taylor estimation, multinational enterprises

*JEL codes*: C23, F16, F23, L25

I. Introduction

Foreign direct investment (FDI) through multinational enterprises (MNEs) delivers to recipient economies tangible and intangible assets such as technology...

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and know-how, skills, efficient marketing and distribution networks, and managerial capabilities;\(^1\) and induces international competitiveness (Markusen and Venables 1998) in emerging economies such as India (Feenstra 2006).\(^2\) MNEs access foreign markets with greater ease than their domestic counterparts and often use the host economy as an export platform. Given their scale of operations and a wide array of intangible assets, MNEs have the capability to overcome the large sunk costs required for entering export markets.\(^3\) These advantages give foreign firms an edge over domestic firms in export markets. Apart from ownership, the recent literature shows that firm heterogeneity is a key to export performance (Melitz 2003). Reforms in foreign investment policies initiated in India since 1991 have allowed Indian firms to access global technology and build strategic alliances to penetrate world markets (Ahluwalia 2008), and have improved India’s export competitiveness (Kumar and Joseph 2007). Exports across sectors responding differently to wide-ranging reforms (Sinha Roy 2009) is indicative of various firm-specific factors—such as ownership, productivity, and sunk costs—determining export performance. This paper investigates whether firm ownership (foreign versus domestic) explains postreform export performances across manufacturing industries in India.

There is a rich body of literature analyzing various dimensions of MNE operations on export performance. MNE affiliates with better knowledge of foreign markets have the advantage of established marketing channels (Dunning 1977) and greater experience and expertise in international marketing, thereby gaining a competitive advantage. For a better understanding of such effects on a host economy’s export performance, it is useful to distinguish between horizontally and vertically integrated multinational firms. In cases of horizontally integrated MNEs, the same product is produced in multiple plants located in different economies. The literature indicates that, in the presence of oligopoly competition, FDI boosts exports of the host country, even if the latter faces high transport costs and imposes export tariffs (Markusen and Venables 1998, Markusen 2002). In cases of vertically integrated MNEs, different segments of the production process are carried out in different economies and intermediate products are necessarily traded (Zhang and Markusen 1999, Markusen 2002). In such cases, FDI has positive effects on the host economy’s exports.\(^4\)

Despite evidence in the literature of the export-enhancing role of FDI, there is no conclusive empirical evidence of better export performance among MNEs than domestic enterprises. Varying FDI–export relationships can be traced across

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\(^1\) As the main channel through which FDI flows into host economies, MNEs either acquire a substantial controlling interest in a host-economy firm or set up a subsidiary in a host economy (Markusen 2002).

\(^2\) Feenstra (2006) provides an in-depth analysis of the effects of FDI, particularly the activities of MNEs, in developing economies.

\(^3\) See Greenaway and Kneller (2007) and Roberts and Tybout (1997) for details.

\(^4\) However, FDI can be export limiting if the MNE affiliates trade in high-technology goods (Lall and Streeten 1977).
economies and sectors (Pain and Wakelin 1998). While Jenkins (1979) identified no significant difference between the export performance of foreign-controlled enterprises and their domestic counterparts, Cohen (1975) found domestic firms outperforming foreign firms. For India, Aggarwal (2002) and Siddharthan and Nollen (2004) found better export performances among MNE affiliates than their domestic counterparts.\(^5\) Aggarwal (2002) showed that low-technology industries with high levels of foreign ownership have a greater competitive advantage than high-technology industries. Subramanian and Pillai (1979) and Kumar (1989) earlier arrived at similar results in reviewing the case of Indian manufacturing. The domestic affiliates and subsidiaries of MNEs are also found to have a greater propensity to export in some sectors of Indian manufacturing (Ghosh 2016).

Apart from the mode of ownership, a recent strand of research focuses on the effects of firm heterogeneity, measured in terms of productivity, on industry performance. Bernard and Jensen (2004); Aw, Chung, and Roberts (2000); and others show self-selection among productive firms in the export market.\(^6\) These empirical observations were formalized by Melitz (2003) in a theoretical model with heterogeneous firms. Exporting entails large sunk costs and the firms that are capable of bearing such costs can participate in the export market (Roberts and Tybout 1997; Das, Roberts, and Tybout 2007). In Indian manufacturing, Srinivasan and Archana (2011) show that firm heterogeneity is an important factor in a firm’s decision to export. Firm heterogeneity thus needs to be accounted for while understanding the differences in export performances between MNEs and their domestic counterparts in a host economy.

The above review of studies shows that the nature of the FDI–export relationship across economies is far from conclusive. Further, most of these studies have not considered firm heterogeneity. This paper investigates whether MNEs demonstrate better export performances than their domestic counterparts across manufacturing industries in India during the postreform period. Our study contributes to the existing literature by controlling for the heterogeneity of firms along with various supply-side factors.

The paper is organized as follows. Section II provides some stylized facts on the overall export performance of Indian manufacturing industries during the postreform period. Section III discusses the analytical framework, empirical model and method, and database used for analyzing the determinants of firm-level export performances. Section IV presents the empirical results and discusses the determinants of firm-level export performance. Section V summarizes the major findings of the paper and presents policy implications.

\(^5\) Siddharthan and Nollen (2004) analyze export performances among information technology firms.

\(^6\) Ranjan and Raychaudhuri (2011) and Srinivasan and Archana (2011) suggest that exporters tend to outperform nonexporters in terms of productivity and size, among other indicators.
II. Export Intensity during the Postreform Period

The existing literature often shows a theoretical possibility and an empirical connection between FDI and export performance. The figure above shows that, despite a downturn after 2008, both FDI intensity and export intensity have increased in India since 1991.

Along with increased FDI inflows, firm-level average export intensity, measured as the ratio of export of goods to sales (expressed as percentage), in Indian manufacturing improved during the postreform period, especially since 2000. Average export intensity for manufacturing increased from 0.07 in the 1990s to 0.12 in the 2000s, with individual ratios for the chemicals, transport equipment, machinery, food and beverages, textiles, and basic metals industries each increasing after 2000 (Table 1).  

The average export intensity of the chemicals industry, of which drugs and pharmaceuticals account for the largest share, more than doubled between the 1990s and 2000s.  Despite improvements in the export intensity of the machinery industry, the firm-level average export intensity for electronics and

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7 Detailed tables on export intensity across industries will be made available upon request.
8 Foreign ownership up to a level of 100% has been legally permitted in the drugs and pharmaceuticals industry since December 2001.
Table 1. Firm-Level Average Export Intensity in India during the Postreform Period, 1991–2010

| Industries         | Food and Beverages | Textiles | Chemicals | Basic Metals | Machinery | Transport Equipment | All  |
|--------------------|--------------------|----------|-----------|--------------|-----------|---------------------|------|
| All firms          |                    |          |           |              |           |                     |      |
| 1990s              | 0.0635             | 0.1661   | 0.0655    | 0.0268       | 0.0422    | 0.0186              | 0.0711|
| 2000s              | 0.0714             | 0.2512   | 0.1312    | 0.0557       | 0.0650    | 0.0684              | 0.1216|
| Domestic firms     |                    |          |           |              |           |                     |      |
| 1990s              | 0.0646             | 0.1678   | 0.0663    | 0.0282       | 0.0406    | 0.0194              | 0.0730|
| 2000s              | 0.0736             | 0.2528   | 0.1298    | 0.0586       | 0.0638    | 0.0709              | 0.1240|
| Foreign firms      |                    |          |           |              |           |                     |      |
| 1990s              | 0.0441             | 0.0274   | 0.0484    | neg.         | 0.0508    | neg.                | 0.0440|
| 2000s              | 0.0311             | 0.0307   | 0.1613    | neg.         | 0.0717    | 0.0132              | 0.0859|

neg. = negligible.

Source: Calculations based on the Centre for Monitoring Indian Economy. Prowess database. https://prowess.cmie.com/

electrical machinery remained low in the 2000s. The export intensity of computers, peripherals, and storage devices was the only exception in this industry. The corresponding improvements for transport equipment were larger. Improvements in the export intensity of textiles can be observed after the complete phaseout of the Multifibre Arrangement in 2004. Such improvements occurred despite low productivity, technological obsolescence, small-scale operations, and rigid labor laws in the textiles industry.

The export intensity of nonferrous items (aluminum products, copper products, and other nonferrous items) and iron and steel products registered a significant increase post-2000. In the case of food and beverages, value-added items like marine food and processed and packaged food exhibited increased export intensity after 2000. A quantum increase in export intensity was also observed for value-added items including drugs and pharmaceuticals, miscellaneous electrical products, computers, peripherals and storage devices, steel, tubes and pipes, marine food, and processed and packaged food. These findings conform with the findings of Aggarwal (2002) and Kumar and Pradhan (2003).

There are further nuances to improvements in performance. Table 1 shows similar increases in average export intensity across industries between the 1990s and 2000s for domestic firms and foreign firms. The only exception to this pattern is the basic metals industry. The export intensity of foreign firms in the food and

9Transport equipment shows an increase in export intensity during the review period, particularly after 2003. This is important as many joint ventures in this industry have been set up in India with foreign technical and financial collaboration.

10Except for pig iron, the export intensity of most iron and steel products increased after 2000. The People’s Republic of China is a major iron and steel market for India, accounting for about 32% of India’s exports of these products in 2006.
beverages industry also showed a marginal decline in the 2000s, while the export intensity of domestic firms in the food and beverages and transport equipment industries outperformed that of foreign firms. Table 2 shows that foreign firms in the relatively high-technology chemicals and machinery industries do not have significantly higher export intensity than domestic firms in the same industries.\footnote{The basic metals industry is excluded in the analysis as the number of foreign firms compared with domestic firms is too small to produce statistically valid results.}

In sum, firm-level export intensity generally increased across all manufacturing industries in India in the postreform period, particularly after 2000. A further exploration is needed of the factors underlying the observed similarities and differences in export performances across different ownership categories in Indian manufacturing.

### III. Determinants of Firm-Level Export Performances

#### A. Analytical Framework

FDI flows to emerging market economies can have a range of impacts on the host economy. Apart from supplementing resource mobilization, facilitating access to world-class technology, and providing better marketing and distribution networks and managerial skills, MNE affiliates and subsidiaries are often able to penetrate external markets with greater ease. The higher productivity of MNEs is expected to lead to improved export performance compared with their domestic counterparts. Furthermore, the export intensity of MNEs is expected to be higher given their greater capacity to bear the sunk costs of exporting. Again, firm-specific supply factors—such as size and age, imported raw materials, imported capital goods and foreign technical know-how, expenditure on advertising and marketing, local research and development (R&D), and credit availability—are crucial in determining firm-level exports. Assessing these factors, which are described in
greater detail below, can help develop a framework for analyzing firm-level export performance in an emerging market economy like India.

1. Ownership

As compared to their domestic counterparts, MNEs can more easily overcome possible barriers to entry in foreign markets due to firm-specific advantages. These advantages can be in the form of the acquisition of knowledge-based assets, better managerial know-how, strong marketing and distribution channels, branding, and the capacity to bear sunk costs. On account of their relatively larger scale of operations, MNEs also generally have lower per unit costs. Thus, ownership and, hence, MNE presence is likely to play an important role in explaining export performance. As has been observed in recent studies, MNE affiliates in India are found to have better export performances than their domestic counterparts.

2. Productivity

Empirical literature shows that trade forces the least productive firms to exit the market (e.g., Aw, Chung, and Roberts 2000), implying that a few productive firms, which expect a profit stream sufficiently high to cover the sunk costs of entry into a foreign market, find it profitable to export. Models that follow Melitz (2003) postulate that firms are heterogeneous and only productive firms self-select into export markets. In this study, firm heterogeneity, measured in terms of productivity, is postulated to have a positive impact on exports. However, such studies linking productivity and exports in the Indian context are rare.

3. Specific Costs

Exploiting a foreign market requires strong marketing and distribution networks. A firm’s expenditure on advertisement, marketing and distribution, and the creation of service networks often leads the firm to attain cost competitiveness. These costs are sunk in nature. Roberts and Tybout (1997); Bernard and Jensen (2004); and Das, Roberts, and Tybout (2007) suggest that there exist large sunk costs for exporting in developed and developing economies alike. Heterogeneity also exists in terms of the capacity to bear these specific costs, which possibly explains the export performance of firms. Following studies such as Srinivasan and Archana (2011), a positive relationship is expected between such costs borne by Indian manufacturing firms and exports.

4. Availability of Credit

There are empirical studies explaining the impact of credit constraints on a firm’s export performance (e.g., Manova 2013, Minetti and Chun 2011). The
main results of such studies show that in addition to heterogeneity of firms, credit constraints also affect exports. In the Indian context, Ranjan and Raychaudhuri (2011) have established a causal link between the availability of subsidized credit and real outcomes for exporting firms. In this study, increased credit availability is expected to improve firm-level export performance.

5. **Research and Development**

In an increasingly knowledge-based world, technological capacity is an important factor underlying an economy’s international competitiveness. In-house R&D makes a firm cost competitive and therefore improves its export performance (Fagerberg 1988). With MNE operations, the transfer of embodied and disembodied technology to MNE affiliates takes place through both internalized and externalized modes. Such technology transfers are often complemented by a firm’s R&D through product improvement and/or adaptation, process improvement, and original equipment manufacturing, which is of particular importance for export expansion in emerging economies. Roper and Love (2002) provide evidence that R&D expenditure has a significant positive impact on a firm’s export intensity. In this study, a positive relationship between in-house R&D and firm-level export performance is postulated.

6. **Imported Technology**

Introducing foreign technology to domestic production processes can increase total factor productivity. Firms in most developing economies, including India, rely extensively on imported technology and acquired knowledge. Imported technology can be in both embodied and disembodied form. It is believed that, like in-house R&D, imported technology makes a firm more cost competitive and thereby induces greater exports. In the postreform period in India, imported technology is likely to have a positive impact on firm-level exports. The relationship can be nonlinear as well.

7. **Firm Size**

Larger firms are perceived to have a bigger resource base and a better risk perception of international markets. Size is a proxy for several effects (Bernard and Jensen 2004), including economies of scale, that determine the export attitude and performance of a firm (Kumar and Pradhan 2003). Given their resource constraints, smaller firms are mostly scale inefficient, while larger firms can exploit economies of scale. Thus, larger firms have lower average and/or marginal costs, which aids exports (Srinivasan and Archana 2011). Furthermore, larger firms have more capacity to bear the sunk costs associated with entry into foreign markets. Hence,
a positive relationship between firm size and export performance is hypothesized, though the empirical literature often shows mixed findings and nonlinearity in the relationship (e.g., Kumar and Aggarwal 2005).

8. Age

The age of a firm is a proxy for the extent of a firm’s learning experience, including experimental and tacit knowledge (Bhaduri and Ray 2004). The age of a firm is found to be positively associated with exporting. Older firms with experience in exporting have better knowledge of export markets and are also more capable of bearing the sunk costs of exporting given their established marketing and distribution channels. A similar relationship is expected to be found in this study.

B. Estimation Models

In the estimable form, the export intensity of a firm depends on production and various supply-side factors including age, size, technology imports, and credit availability. Firm heterogeneity in terms of firm productivity and sunk costs are controlled for when estimating the impact of ownership on exports.

The model as estimated is as follows:

\[
Expi_{it} = \alpha_0 + \alpha_1(size_{it}) + \alpha_2(impr_{it}) + \alpha_3(ki_{it}) + \alpha_4(fptr_{it}) + \alpha_5(mktcost_{it}) \\
+ \alpha_6(age_{it}) + \alpha_7(pdtivity_{it}) + \alpha_8(crdt_{it}) + \alpha_9(rdi_{it}) + \alpha_{10}(own_{it}) + \mu_{it}
\]

where \(\alpha_k, k = 1\) to 10 > 0.

The independent variables are defined as follows:

- **Expi**: export intensity measured as the ratio of exports to sales at the firm level;
- **size**: size indicated by the ratio of firm sales to industry sales;
- **impr**: raw material import intensity measured as the ratio of expenditure on imports of raw materials to sales;
- **ki**: capital goods import intensity measured as the ratio of expenditure on imports of capital goods to sales;
- **fptr**: foreign technical know-how intensity measured as the ratio of technical fees and royalties paid abroad to sales;
- **mktcost**: specific costs measured as the ratio of the sum of advertising, marketing, and distribution expenditure to sales;
- **age**: absolute age of the firm in number of years since incorporation.
**pdtivity**: labor productivity measured as the ratio of output to salaries and wages;\(^{12}\)**

**crdt**: availability of credit measured as the ratio of total borrowing to output;

**rdi**: R&D intensity measured as the ratio of R&D expenditure to sales; and

**own**: ownership is a dummy variable taking the value of 1 if the firm is foreign and 0 otherwise.

As specified in equation (1), ownership is the time-invariant variable. As the industries analyzed in this study vary widely, equation (1) has been modified for some industries as well as for Indian manufacturing as a whole. Two variables are used for the purpose:

**fortech**: foreign technology intensity measured as the ratio of the sum of expenditure on imported capital goods, raw materials, and foreign technical know-how to sales; and

**sci**: sunk costs intensity measured as the share of the sum of expenditure on advertising, marketing, distribution, and R&D to sales of the firm.

The model specified in equation (1) is irrespective of ownership categories. However, domestic firms and foreign firms should theoretically have different motives. The affiliates and subsidiaries of firms that are headquartered in foreign countries often depend on the resources of the parent firm. This is surely not the case with domestic firms. Often, ownership-specific models are estimated in the literature (Siddharthan and Nollen 2004) to identify the behavioral differences of foreign and domestic firms. Such ownership-specific models can be as follows:

\[
Expi_{ijt} = \alpha_0 + \alpha_1(Expi_{ijt-1}) + \alpha_2(size_{ijt}) + \alpha_3(age_{ijt}) + \alpha_4(impr_{ijt}) \\
+ \alpha_5(mktcost_{ijt}) + \alpha_6(rdi_{ijt}) + \alpha_7(pdtivity_{ijt}) + \alpha_8(crdt_{ijt}) \\
+ \alpha_9(fortech_{ijt}) + \mu_{it} 
\]  

\[(2)\]

where \(\alpha_k, k = 1 \text{ to } 10 > 0\), \(j\) denotes either domestic or foreign ownership, \(t\) denotes time, and \(x_{ijt}\) is the export intensity of the \(i\)th firm with the \(j\)th category of ownership at time \(t\). The study estimates the above models for the pre-2000 and post-2000 periods based on an earlier observation that the export intensity of both categories of firms improved in the 2000s compared with the 1990s.\(^{13}\)

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\(^{12}\)Srinivasan and Archana (2011) also used labor productivity in their estimation instead of total factor productivity, which is more commonly used in the heterogeneity literature.

\(^{13}\)In this study, the pre-2000 period considers the years 1991–1999 while the post-2000 period refers to 2000–2010.
C. Method and Data

The Hausman–Taylor and dynamic panel data estimation techniques are used in this analysis. The Hausman–Taylor estimation technique has been used in analyzing manufacturing as a whole as well as sector-specific analysis. This is primarily because of the inclusion of the time-invariant ownership variable in the models. The ordinary fixed- and random-effects estimation methods were initially used to identify the control variables. Hausman and Taylor (1981) first proposed an estimation procedure where some of the regressors are correlated with the individual effects. The Hausman–Taylor estimator is based upon an instrumental variable estimator that uses both between and within variations of the strictly exogenous variables as instruments. Specifically, the individual means of the strictly exogenous regressors are used as instruments for the time-invariant regressors that are correlated with the individual effects. As fixed-effect models do not generate coefficients of time-invariant regressors, the Hausman–Taylor estimation is the more appropriate method of estimation.

As time-invariant regressors are absent in the ownership-specific model (equation 2), the dynamic panel data estimation technique is used. This method helps to simultaneously accommodate large data sets across time and distinguishes between time series movements and cross-sectional differences in the data. Dynamic effects can be examined in panel data analysis by introducing lagged dependent variables in the set of explanatory variables, where the lagged dependent variable, $Y_{it-1}$, captures the entire historical impact of the explanatory variables. Dynamic panel data estimation is usually carried out using the generalized method of moments instead of the least square dummy variable or feasible generalized least square methods. This is done by estimating the model in first difference to avoid the problem of endogeneity arising from the presence of a lagged endogenous variable in the set of explanatory variables. The Arellano and Bond (1991) generalized method of moments instrumental variables estimation method is applied to obtain unbiased consistent estimators. A two-stage iteration method is used to obtain Arellano and Bond two-step estimators. To obtain original Arellano and Bond estimates, no correction for the degree of freedom is carried out. In this type of estimation, a Sargan test of overidentifying restrictions is conducted.

Firm-level data across manufacturing sectors for the period 1991–2010 were obtained from the Prowess database published by the Centre for Monitoring Indian Economy. Prowess provides information from audited financial statements.

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14This study controls for important measurable factors that might give MNEs an edge over their domestic counterparts. Yet, ownership is considered a separate variable in this study as there can be a host of other factors, measurable and qualitative, relating to foreign ownership that can play a crucial role in explaining export performance. Such factors include better managerial capacities, reputation and brand name, proprietary knowledge, scale economies at the plant level, and an internationalization advantage.
and thereby uses company balance sheets and income statements as sources. The database covers both listed and unlisted firms from a wide cross section of the manufacturing, services, utilities, and financial sectors, covering 60%–70% of the organized sector in India, 75% of corporate taxes paid, and 95% of excise duties collected by the Government of India (Goldberg et al. 2010). However, the database has some limitations, especially with regard to this analysis. First, an important step involves identifying firms according to their ownership; that is, finding the “FDI firms” as opposed to the “non-FDI firms.” Prowess provides data for a foreign promoter’s equity holdings. If, for a company, the equity holdings of the foreign promoter exceed 25%, it is classified as a foreign-owned or FDI firm. However, a foreign promoter’s equity holdings are reported in the database only from the year 2001. As this study covers a 20-year period (1991–2010), the information on equity holdings to identify firm ownership cannot be used. Numerous missing values for firms’ equity participation also reduces the sample size significantly. The database instead provides separate information on the ownership of firms, including the following categories: private Indian, private foreign, and state-run enterprise. Such ownership classifications, however, do not differentiate between MNE affiliates and the licensees of foreign firms, between wholly owned foreign enterprises and joint ventures, or between foreign investment firms and investment from Mauritian firms. (India attracts a significant amount of FDI from Mauritius.) Second, the information on firms is based on their balance sheets and is not product specific. Therefore, comparisons between MNEs and domestic firms are not product specific even though most firms are multiproduct by nature. Given the nonavailability of detailed product-wise data for individual firms, broad product groups are considered. Third, Prowess does not provide data on output. However, firm-level data on sales over time is available. Data on changes in stock can be calculated from the available data on opening stock and closing stock for each firm in each year. Output is calculated using such information. Again, the database does not provide information on the number of employees. However, it provides data on salaries and wages. Labor productivity is calculated as the ratio of output to salaries and wages.

The problems with data notwithstanding, the industries used in this study include chemicals, machinery, transport equipment, food and beverages, textiles, and basic metals industries. Taken together, all six of these industries comprise the manufacturing sector. Statistical information was collected only for exporting

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15 The Annual Survey of Industries database of the Government of India’s Central Statistical Organisation is an alternate source of unit-level data. However, this database could not be used in this study as the units are not identifiable over time. Further, the unit-level data do not provide information on exports.

16 Statistical information on India’s overseas FDI can be availed. However, the database does not provide any information on source- and destination-wise FDI. As a result, there is no scope to arrive at an estimation of redirected investment or estimates of actual foreign investments in India.
firms. A total of 1,473 observations for the chemicals industry, 777 observations for the machinery industry, 326 observations for the transport equipment industry, 154 observations for the food and beverages industry, 596 observations for the textiles industry, and 143 observations for the basic metals industry were obtained. These observations across sectors include both domestically owned and foreign-owned firms. Panel structures for each of these six industries and the manufacturing sector as a whole were constructed for the period 1991–2010. For the ownership-specific model (equation [2]), domestic and foreign firms engaged in manufacturing in India are treated separately for dynamic panel data analysis.

IV. Empirical Results

The Hausman–Taylor estimation results of equation (1) showing the determinants of firm-level export performance are presented in Table 3. The empirical exercise in our study was carried out in three stages. First, the determinants of firm-level exports for all manufacturing and across sectors were estimated using the Hausman–Taylor estimation method for the entire postreform period. Second, export determination for all manufacturing during both the pre-2000 and post-2000 phases was conducted. The third and final stage included separate analysis of export determination for all manufacturing by ownership category (domestic versus foreign) during both the pre-2000 and post-2000 phases using the dynamic panel data method of estimation.

As Table 3 demonstrates, the Wald statistic justifies the overall significance of the model. The Hausman–Taylor estimation results suggest that the mode of ownership has no impact on firm-level exports in Indian manufacturing. This finding is in sharp contrast to the common contention in the literature that foreign ownership promotes exports. However, this finding is in conformity with Athukorala, Jayasuriya, and Oczkowski (1995), who find no significant relationship between MNE affiliation and the export orientation of firms. This counterintuitive result will be explained after the impacts of other supply-side factors are analyzed.

The existing literature shows that firm heterogeneity, measured in terms of firm productivity, impacts a firm’s export performance. The estimation results in Table 3 show that productivity does not explain the export performance of firms during the postreform period for the manufacturing sector as a whole and across individual industries, with the exception of the machinery industry. This is in sharp contrast to the theoretical conjecture of Melitz (2003). At the same time, labor...
Table 3. Factors Determining Firm-Level Export Performance Using a Hausman–Taylor Estimation

| Determinant   | Chemicals | Machinery | Transport Equipment | Food and Beverages | Textiles | Basic Metals | All Manufacturing |
|---------------|-----------|-----------|---------------------|---------------------|----------|--------------|-------------------|
| Own           | −0.07     | 0.006     | 2.16                | −0.11               | −18.25   | 0.01         | −0.064            |
| (Time-invariant exogenous variable) | (−0.76) | (0.14) | (0.21)              | (−1.47)             | (−0.38)  | (0.07)       | (−0.82)           |
| Age           | 0.003***  | 0.0003    | 0.71***             | 0.0004              | −0.01    | 0.0005***    | 0.0004***         |
|               | (5.93)    | (0.71)    | (8.79)              | (0.64)              | (−0.43)  | (5.09)       | (2.17)            |
| Size          | 1.32***   | −1.36     | −21.01              | 0.45**              | 65.33    | 0.34***      | 0.258**           |
|               | (3.18)    | (−0.07)   | (−1.06)             | (2.41)              | (1.34)   | (2.78)       | (2.06)            |
| Size²         | −0.00007**|          |                     |                     |          |              |                   |
|               | (−2.06)   |           |                     |                     |          |              |                   |
| Mktcost       | 1.17****  | 0.49***   | −                    | −                   | 63.79*** | −            | 0.00006           |
|               | (7.56)    | (2.63)    |                     |                     | (3.75)   | (0.04)       |                   |
| Mktcost²      | −3.34***  | −1.49**   | −                    | −                   | −20.75***| −            | −                 |
|               | (−8.40)   | (−2.45)   |                     |                     | (−3.48)  | (−3.86)      |                   |
| Rdi           | 0.54***   | −0.46     | −                    | −                   | 322.35   | −            | 0.743***          |
|               | (2.94)    | (−0.98)   |                     |                     | (0.45)   | (3.86)       |                   |
| Rdi²          | −0.17***  | −         | −                    | −                   | −        | −            | −2.62***          |
|               | (−2.98)   |           |                     |                     | (−4.35)  |              |                   |
| Sci           | −         | −         | 59.55***             | 0.94***             | −        | −0.0002      | −                 |
|               | (−2.99)   |           |                     |                     | (3.97)   | (−0.34)      |                   |
| Ki            | 0.36***   | 0.06      | −                    | −                   | 15.39**  | −            | −                 |
|               | (4.34)    | (0.97)    |                     |                     | (1.89)   | (1.89)       |                   |
| Fptr          | 0.002     | −0.91*    | −                    | −                   | −100.15  | −            | −                 |
|               | (0.76)    | (−1.69)   |                     |                     | (−0.53)  | (−0.53)      |                   |
| Fptr²         | −         | −         | −                    | −                   | −        | −            | −                 |
| Impr          | 0.08***   | 0.0005*** | −                    | −                   | 0.18***  | −            | −                 |
|               | (5.45)    | (3.06)    |                     |                     | (5.22)   |              |                   |
| Impr²         | −         | −1.18***  | −                    | −                   | −0.00003***| −            | −                 |
|               | (−3.05)   |           |                     |                     | (−5.27)  |              |                   |

Continued.
Table 3. Continued.

| Determinant | Chemicals | Machinery | Transport Equipment | Food and Beverages | Textiles | Basic Metals | All Manufacturing |
|-------------|-----------|-----------|---------------------|--------------------|---------|-------------|------------------|
| Fortech     |           |           | -13.75**            | 2.34***            |         | 1.01***     | 0.0004***        |
|             |           |           | (-2.35)             | (4.91)             |         | (2.52)      | (4.50)           |
| Fortech²    |           |           | 2.74**              | -                  | -       | -           | -9.50***         |
|             |           |           | (1.90)              |                    |         | (1.90)      | (-4.57)          |
| Crdt        | -5.26     | -2.33     | -5.91***            | -0.0001            | -0.008  | 0.00005     | -0.0004***       |
|             | (-0.10)   | (-0.17)   | (-3.31)             | (-0.51)            | (-0.30) | (0.48)      | (-3.05)          |
| Crdt²       |           |           |                      | 1.91***            |         | -           | 1.53             |
|             |           |           |                      | (4.07)             |         | (1.90)      | (0.45)           |
| Pdtivity    | -0.00002  | 0.00001*  | -0.002              | -0.00006           | 0.009   | -0.0001     | -0.00008         |
| (Endogenous)| (-0.44)   | (1.71)    | (-0.06)             | (-0.10)            | (1.31)  | (-0.29)     | (-0.26)          |
| Wald Chi²   | 183.37*** | 24.44**   | 108.27***           | 58.17***           | 47.86***| 53.37***    | 61.42***         |
| Observations| 1,473     | 777       | 326                 | 154                | 596     | 143         | 4,119            |

Notes: The z-values are provided in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.
Source: Authors’ calculations.
productivity across sectors in organized manufacturing is not necessarily rising, which possibly explains the disconnect between firm-level productivity and export performance.\textsuperscript{19} Rising exports in organized sectors during the postreform period can be attributed to other supply-side factors.

The heterogeneity of firms, measured in terms of sunk costs, is also an important factor explaining export performance (Das, Roberts, and Tybout 2007). In this study, the sum of expenditure for advertisement, marketing, and distribution comprise the sunk costs incurred to penetrate foreign markets. Expenditure on R&D is also considered a sunk cost. As hypothesized, the intensity of such sunk costs is found in our study to be a significant factor across sectors.\textsuperscript{20} This result holds for both high-technology and low-technology industries. Nonlinearity in the relationship is found to exist with specific sunk costs for marketing in the chemicals, machinery, and textiles industries. This relationship further suggests that there exists a threshold beyond which specific costs do not impact export intensity in these industries at the firm level. This finding is particularly important as it shows that investment by firms beyond a threshold often raises per unit costs, which can lead to a decline in cost competitiveness. On the other hand, the relationship is found to be linear for transport equipment and food and beverages, which conforms to theoretical conjecture as well as the empirical finding of Srinivasan and Archana (2011) on firm heterogeneity in terms of sunk costs and the capability of overcoming such costs in entering a foreign market is an important factor explaining export intensity. Therefore, sunk costs incurred by firms turn out to be a significant determinant of export intensity for all manufacturing industries. Given the operations of MNEs and the import of frontier technology, one of the choices available to firms to gain international competitiveness is to invest in R&D. Such investment can be complementary to importing foreign technology. A nonlinear relationship is observed in this case as well.

Credit availability was not found to impact the exporting behavior of Indian manufacturing as a whole. A finance–trade linkage is empirically evident only for the transport equipment industry (with nonlinearity in the relationship), possibly because transport equipment exports consist of automobile parts and components, which are largely dependent on short-term trade finance. Nonlinearity in the relationship also exists for all manufacturing, although a significant relationship is not evident.

\textsuperscript{19}On the other hand, labor productivity in unorganized manufacturing, as Goldar and Sengupta (2016) suggest, has been relatively higher than that of organized manufacturing in the 2000s, particularly for textiles, leather, paper, printing and publishing, chemicals and chemical products. Further, there has been a significant increase in informal labor through contractual labor in Indian industries (Goldar and Ghosh 2015) in recent years, which often explains productivity growth and exports across sectors. However, this is outside the scope of this analysis.

\textsuperscript{20}In this econometric exercise, the measure of sunk costs as used in the estimation for chemicals, machinery, and textiles includes marketing, distribution, and advertisement costs, while that for transport equipment and food and beverages includes R&D expenses as well. R&D expenditure is treated as a separate factor for chemicals, machinery, and textiles.
Other firm-specific factors, including the size and age of firms, are also important in explaining firm-level export performance. Firm size, measured as a share of firm sales to industry sales, is significant in positively impacting firm-level export performance in the chemicals, food and beverages, and basic metals industries. The relationship across these industries is linear, which is not in conformity with the findings of Bernard and Wagner (2001). On the other hand, firm size remains an insignificant factor for exports in the machinery, transport equipment, and textiles industries. For all manufacturing, firm size is found to be significant in explaining firm-level export intensity and the relationship is nonlinear as suggested in the literature. The estimation results further show that the age of a firm, measured as the number of years in operation since inception, plays a significant role in determining firm-level export performance in low- to medium-technology industries like metals and metal products, and high-technology industries like chemicals and transport equipment. Firm age is also a significant factor in export intensity for all manufacturing. These findings suggest that older firms have acquired the capability to penetrate the world market, particularly in high-technology industries.

In industries like machinery, textiles, and food and beverages, the relationship between age and firm-level export intensity is insignificant. Older firms in the machinery industry that may have started operations during the period of import substitution, continue to cater to the domestic market despite subsequent reforms. This finding is in conformity with that of Kumar and Pradhan (2003), suggesting that older firms in these industries have continued to concentrate on the domestic market during the postreform period.

Technological factors are also important in attaining international competitiveness. Dependence on imported technology for export competitiveness is evident in Indian manufacturing. Importing raw materials, capital goods, and foreign technical know-how is one of the major ways for firms to acquire knowledge from the rest of the world in pursuit of cost competitiveness. Disembodied foreign technology aids the process. Table 3 shows that these factors impact export intensity positively for all manufacturing as well as across industries. For chemicals, machinery, and textiles, importing raw materials has a significant positive impact on firm-level export intensity. A significant nonlinear relationship exists between importing raw materials and export intensity in the cases of machinery and textiles. Most knowledge-based industries as well as textiles gain international competitiveness from imported raw materials. Taking a cue from Sen (2008), it can be argued that imported raw materials have led to technical changes that improved efficiency in Indian manufacturing.

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21 Small-scale industries, which account for 40% of Indian exports (Government of India 2010), and industries like textiles, general purpose machinery, and transport equipment, where small firms constitute a majority share (Bhavani 2016), are not taken into account. Further, labor legislation has prevented large firms from operating in the textiles industry. Also, there is no small-scale unit included in the database. Therefore, the results have limitations.
Importing capital goods is another important way to access global frontier technology in embodied form. It is evident from the above results that the import of capital goods has a positive impact on firm-level export performance in the chemicals and textiles industries. The relationship, however, does not hold true for other industries. Further, the import of technology in disembodied form does not play any role in explaining export performance across industries. It is striking to note that the import of foreign technology has a significant negative impact on exports of machinery, although this is significant only at the 10% level. Careful scrutiny might reveal that this result holds true for only certain subsectors where imported foreign technology has perhaps aided in capturing the domestic market rather than in increasing export intensity.

Again, imported embodied and disembodied technology together plays an important role in explaining the export performance of the transport equipment, food and beverages, and basic metals industries. While the relationship is nonlinear for transport equipment, it is linear for the other two sectors. For all manufacturing, imported (embodied and disembodied) technology significantly explains exports, although the relationship is nonlinear. In conformity with the findings of Hughes (1986), the results show the significant impact of R&D intensity on firm-level export performance. The relationship is nonlinear. Similar results are found in the case of chemicals, of which pharmaceuticals is an important component. As the chemicals industry is knowledge based, R&D turns out to be significant along with technology imports. This result shows that developing technological capabilities is essential for gaining international competitiveness.

The above analysis shows that while ownership does not have a bearing on firm-level export performance, various other supply factors explain improvements in postreform export performance for all manufacturing as well as across industries. The import of raw materials turns out to be an important factor along with the capacity to bear sunk costs. The observation of improvements in export intensity, particularly in the post-2000 period, leads us to investigate the factors underlying such improvements. However, the small number of observations for certain sectors restricts the analysis to all manufacturing. As mentioned earlier, the variables as specified in equation (1) have been modified for the purpose of this analysis.

The results presented in Table 4 show that the mode of ownership does not have a significant impact on firm-level export intensity in the post-2000 period, while it is found to be negative and significant in the earlier period.

The results indicate that foreign firms in India were essentially catering to the domestic market in the pre-2000 period rather than using their Indian operations as an export platform. The nature of the ownership—export performance relationship, however, underwent a change in the post-2000 period, with MNE affiliates and subsidiaries becoming more export oriented. Both MNEs and their domestic counterparts were found to be more export intensive during the post-2000 period. Meanwhile, MNEs were not necessarily better performers than the latter
Table 4. Factors Determining Firm-Level Export Performance in Indian Manufacturing—Pre-2000 and Post-2000

| Determinant | Pre-2000 | Post-2000 |
|-------------|----------|-----------|
| Own         | −1.16∗   | −0.11     |
| Age         | −.001    | .0001     |
| Size        | −0.00002 | 0.21      |
| Sci         | 2.18***  | 0.68***   |
| Sci²        | −10.9*** | −0.0005***|

Endogenous variables

| Variable | Pre-2000 | Post-2000 |
|----------|----------|-----------|
| Pdvtivity| 0.00002  | 0.0001*** |
| Crdt     | 0.02**   | −0.004*** |
| Crdt²    | −0.001** | 0.00001***|
| Fortech  | 0.001**  | 0.0002*** |
| Wald Chi²| 23.04*** | 122.70*** |

Notes: z-values are provided in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively. The number of observations varies in the two periods due to missing values for the dependent variable (omitted for estimation) in the two periods.

Source: Authors’ calculations.

(Tables 1 and 2). The results further suggest that for the pre-2000 period, while firm heterogeneity, measured in terms of labor productivity, does not explain the export intensity of Indian manufacturing, it does impact export intensity in the post-2000 period. In both periods, however, firm heterogeneity, measured in terms of sunk costs, explains the export intensity of Indian manufacturing. Credit availability also significantly affects the export performance of firms during both the pre-2000 and post-2000 periods. The estimation results suggest nonlinearity in the relationship. However, the relationship between credit availability and export intensity is inverted and U-shaped for the pre-2000 period and U-shaped for the post-2000 period. Imported foreign technology—comprising imported raw materials, capital goods, and payments for foreign technical know-how—is positive and significant during both phases, while age and size remain insignificant.

The period-wise results are indicative of the fact that while MNEs and their domestic counterparts improved their export performance during the post-2000 period, the export performance of Indian manufacturing depends on imported
foreign technology and the capacity to bear the sunk costs of exporting. The export intensity of firms also depends on imported technology. Explanations for there being no difference in performance across ownership categories can also be offered. For example, with easy access to standardized technology, foreign firms are unlikely to outperform domestic firms in terms of export performance. Further, MNEs plan their operations worldwide, with the parent firm often discouraging the export activities of subsidiaries or affiliates if such activities are perceived to be in competition with operations in other locations. For MNE subsidiaries, the strategy of the parent firm is important, particularly for high-technology goods (Lall and Streeten 1977) and when the MNE and its affiliates are horizontally integrated. The basic strategy in such cases might not just be efficiency seeking, but also domestic market seeking. In the presence of tariffs, foreign firms often produce in the host economy to capture the domestic market and do not have an incentive to use the host economy as an export platform. On the other hand, if domestic firms are being edged out of the domestic market, they might explore foreign markets. This might explain why, despite higher productivity, better technological know-how, and increased capacity to bear sunk costs, the foreign ownership of firms does not explain firm-level export intensity. With no significant difference in ownership-wise export performance, the factors that underlie export performance across the two categories of Indian firms can vary.

Dynamic panel data estimation results of equation (2) for domestic and foreign firms for the pre-2000 and post-2000 periods are presented in Table 5 and Table 6, respectively.

Significant path dependence is noted for both domestic and foreign firms in Indian manufacturing with regard to exporting for both time periods. This implies that firms with export experience are likely to export irrespective of their ownership. The estimation results suggest that the size of firms does not impact the export intensity of domestic firms in either period, while firm size is found to have a significant positive impact for foreign firms in the pre-2000 period. This result, however, does not hold for foreign firms in the post-2000 period, where firm size is negative and significant. Similar is the case with the age of firms, which turns out to be negatively significant for domestic firms in the pre-2000 period and insignificant in the post-2000 period. This result can be best understood by keeping in mind the inward-looking policies in Indian manufacturing for more than 3 decades following independence (Kumar and Pradhan 2003). Older Indian firms have accumulated experience in catering to highly protected domestic markets through well-developed networks. Such experience is unlikely to give firms a competitive edge in export markets. Age also turns out to have a negative and significant impact on foreign firms for both periods.

Productivity turns out to be positively significant for domestic firms in both periods, while it remains insignificant for foreign firms in both periods. Thus, firm heterogeneity when measured in terms of productivity holds only
Table 5. Factors Determining the Export Performance of Domestic Firms—Pre-2000 and Post-2000

| Determinant | Pre-2000 | Post-2000 |
|-------------|----------|-----------|
| Exp₁₋₁      | 0.678*** (14.58) | 0.630*** (13.60) |
| Age         | −0.001* (−1.77) | −0.0001 (−0.20) |
| Size        | −0.00001 (−0.76) | 0.033 (−0.37) |
| Pdivity     | 0.0003** (1.90) | 0.001*** (2.76) |
| Fortech     | 0.001*** (2.66) | −0.0001 (−0.29) |
| Sci         | 2.96*** (3.71) | 0.77*** (4.13) |
| Sci²        | −14.18*** (−4.14) | - |
| Crdpt       | 0.003 (0.96) | 0.023*** (3.52) |
| Wald Chi²   | 440.63*** | 348*** |

Notes: z-values are provided in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.
Source: Authors’ calculations.

Table 6. Factors Determining the Export Performance of Foreign Firms—Pre-2000 and Post-2000

| Determinant | Pre-2000 | Post-2000 |
|-------------|----------|-----------|
| Exp₁₋₁      | 15.49*** (15.73) | 0.628*** (13.55) |
| Age         | −0.044* (−2.48) | −0.001** (1.97) |
| Size        | 8.34*** (4.16) | −0.46** (−2.13) |
| Pdivity     | −0.007 (−1.29) | −0.0002 (−0.46) |
| Fortech     | −107.35*** (−4.19) | 0.66 (0.34) |
| Fortech²    | 1,095.57*** (4.00) | - |
| Sci         | 35.19* (3.71) | 2.74*** (3.35) |
| Sci²        | −578*** (−6.61) | −8.09** (−1.90) |
| Crdpt       | 0.578*** (6.83) | −0.001 (0.93) |
| Wald Chi²   | 1,222.49*** | 431.12*** |

Notes: z-values are provided in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.
Source: Authors’ calculations.
for domestic firms in Indian manufacturing. However, firm heterogeneity when measured in terms of the sunk costs of exporting plays a significant role in explaining export intensity. This finding holds for both periods across ownership categories. Interestingly, a nonlinear relationship holds for foreign firms in this case. Further, imported foreign technology is an important factor for both domestic and foreign firms in explaining exports during the pre-2000 period. A significant nonlinear relationship holds for foreign firms in this case. This is indicative of a complementary relationship between imported technology and local R&D efforts for exports in Indian manufacturing irrespective of ownership. Similar is the case of credit availability, which has a significantly positive impact on export intensity for both foreign and domestic firms. However, this significant relationship holds only for domestic firms in the post-2000 period and for foreign firms during the pre-2000 period. These results can vary across industries within the manufacturing sector.

In sum, foreign ownership does not play a significant role in explaining firm-level export performance across industries in Indian manufacturing. Rather, there are ownership-specific factors that explain exports at the firm level. Productivity, though not an important factor in explaining export performance across manufacturing industries, significantly explains the exports of domestic firms. Heterogeneity, measured in terms of capacity to bear sunk costs, has induced Indian manufacturing firms to export during the postreform period irrespective of their mode of ownership. Imports of technology and raw materials and capital goods are important factors in explaining firm-level exports. The above analysis, however, does not capture whether domestic and foreign firms are exporting in different segments within the same industry groups.

V. Conclusions and Policy Implications

This paper attempts to explore the role of FDI and MNE operations in determining firm-level export intensity in Indian manufacturing since 1991. MNE operations in emerging market economies like India are expected to expand output and accelerate exports. It has been increasingly recognized that the presence of foreign firms contributes, directly or indirectly, to the export performance of the host economy. The literature suggests that apart from ownership, factors like firm heterogeneity, measured in terms of productivity and the capacity to bear the sunk costs of exporting, also significantly explain export performance at the firm level. This paper estimates whether firm ownership has impacted the firm-level export performance of Indian manufacturing during the postreform period (1991–2010).

Export performance of both MNEs and their domestic counterparts are found to have improved since 2000. The export intensity of industries like food and beverages, textiles, chemicals, metal and metal products, machinery, and transport equipment has been rising since 1991, particularly after 2000. Such stylized facts
led us to inquire whether exports have responded to the presence of foreign firms in the manufacturing sector. Again, as domestic and foreign firms are likely to be guided by different motives, the factors underlying the export performances of two sets of firms are estimated separately in this study for the pre-2000 and post-2000 periods. Hausman–Taylor and dynamic panel data estimation techniques are used for export determination.

Estimation results show that foreign ownership does not have any effect on firm-level export performance across industries in Indian manufacturing. As the focus of foreign firms operating in India is primarily on the domestic market, even in industries like chemicals and machinery, export intensity cannot be explained by foreign ownership. This result contradicts the common contention based on cross-economy evidence that MNE operations promote export performance, possibly among other explanations, due to the domestic-market-seeking behavior of most manufacturing MNEs investing in India. Firm heterogeneity, measured in terms of bearing the sunk costs of exporting, is an important determining factor of export intensity; productivity is not. Importing raw materials and capital goods has turned out to be an important factor explaining firm-level exports, perhaps through improvements in productivity and efficiency. Separate panel data estimation results reveal that factors like imported technology explain firm-level exports across modes of ownership.

India is attracting FDI that is domestic market seeking rather than efficiency seeking. This calls for important policy prescriptions with regard to FDI and exports to enhance production efficiency and international competitiveness through the sourcing of raw materials and capital goods, R&D, importing technology and skills, and developing infrastructure.

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