This study sets out identifying three issues of importance with regard to the impact of FDI inflows on Indian manufacturing in the post-reforms period. The study investigates into the role of the foreign firms on improved export performance including export spillovers across sectors in Indian manufacturing, the firm-level technology choices and labour market outcome in terms of employment. Again, as FDI is considered to be a major channel of technology transfers, the role of technology spillovers in determining technological choices of firms is investigated into. These issues are of considerable importance for the Indian economy as the major reasons for the Indian government to liberalize FDI policies was to improve international competitiveness of the domestic firms in terms of exports, use of cost efficient world class technology and generate employment.

In specific, the study analysed the determinants of the increased export intensity of firms across sectors in Indian manufacturing since 1991. In doing so the study investigated into the factors like foreign ownership and heterogeneity of firms in terms of labour productivity and ability to bear sunk costs of foreign market entry in determining the export performance during 1991-2010. As multinational enterprises possess strong marketing and distribution networks and have large scale operations, they have the capability to access foreign markets much more easily than their domestic counterparts. The domestic firms can take advantage of this and the exporting activity of foreign firms
positively influences the exporting activity of domestic firms creating a strong possibility of export spillovers.

With liberalization and MNE operations, the hitherto protected Indian firms faced severe competition. The issue of technology acquisition and choices became very important in this context. The study analyzed the determinants of firm-level technology choices in Indian manufacturing during post-reforms and the endeavor in particular was to understand whether import of foreign technical knowhow came in the way of in-house research and development. Further, the study has also taken into account whether technological spillovers both from domestic and foreign firms have any significant role in determining the technology choices of firms.

Finally, this study addressed the issue of the impact of FDI on firm-level employment. With FDI inflows, there has been an increase in the export intensity of firms with significant dependence on imported technology. This is likely to have immense impact on the labour market outcomes. The study analyzed the impact of foreign ownership, technology acquisition of firm and output on the aggregate employment at the firm-level. These analyses are expected to have significant implications for policy in Indian manufacturing with regards to international competitiveness and sustained growth.

In order to arrive at the factors determining export performance and export spillovers in Indian manufacturing at the disaggregate level, balanced panel data set for six industries namely the chemicals, machinery, transport equipment, food and beverages, textiles and basic metals is used. For estimation purposes, Hausman-Taylor estimation method and the Generalized Methods of Moments (GMM) a la Arellano and Bond (1991) are used. To empirically explore the factors influencing the firms’ technological
choices across industries in the post reforms era and to understand the role of ownership of firms and technological spillovers, a two stage binary choice logit framework is constructed. Finally, to estimate the impact of FDI inflows on firm-level employment, a dynamic labour demand function is estimated using Hausman-Taylor estimation method for all the six industries over the period 2001 to 2010.

The study establishes that with rising FDI inflows across sectors, the average firm-level export intensity in Indian manufacturing industries including food and beverages, textiles, chemicals, metal and metal products, machinery and transport equipment shows a rising trend since 1991, in particular after 2000. However, foreign firms are not found to outperform domestic firms with regards to exports. Rather, in certain low and medium technology sectors, it is the domestic firms which outperformed their foreign counterparts. Technology activity varied across sectors with local R&D intensity increasing for the high technology industries. Strong dependence on imported raw materials is evident across sectors, while import of capital goods declined across sectors during post-2000. The domestic and the foreign firms also behaved differently across sectors. In high and medium technology industries, most technology variables show a rising trend post-2000 for foreign firms. However, raw material import intensity increased for domestic and foreign firms alike for most sectors. There has also been a rise in employment till 2005, followed by a decline in all major sectors thereafter. Further, employment in domestic firms has been lower than that for foreign firms in chemicals, food and beverage and machinery industries. However, the domestic firms have higher employment in transport equipment, basic metal and textiles industries. The employment intensity of foreign firms is mostly low barring machinery and food and beverages.
Evidence from estimation results show that foreign ownership does not have any effect on firm-level export performance across sectors in Indian manufacturing. The manufacturing industries have become internationally competitive with the import of raw materials, capital good and technical know-how. Firm heterogeneity explained in terms of sunk costs significantly impacts on export intensity, even though firm-level productivity and availability of credit do not play any significant role. The better performance of domestic enterprises is largely a result of import of raw materials and imported knowledge and local R&D initiatives. Significant export spillover is observed only in the transport equipment industry. Quite importantly, there is evidence of negative spillovers from foreign firms in case food and beverage exports. The capability to cover sunk costs by domestic firms, productivity and credit availability also turn out to be very significant in explaining exports of domestic firms. The study further suggests that firm-level technology choices in Indian manufacturing is largely on account of foreign ownership, firm size, imported raw materials and spillovers from foreign and domestic firms. Though there are variations across sectors, the firms, on the whole, choose foreign technical knowhow over in-house R&D largely depending on ownership, size and capital goods imports. Though dependence on foreign technology seems to be evident across industries, no definite conclusions are arrived at with regards to substitutability and complementarity between import of knowhow and local R&D.

MNE operations and technology acquisition have implications for labour demand. Estimation results suggest that foreign ownership does not play any significant role in explaining labour demand in Indian manufacturing barring food and beverages. There is path dependence of employment for most manufacturing industries. An increase in the
average wage leads to significant displacement of firm-level labour across all sectors. The only exception to this pattern is chemicals which is suggestive of expansion in this sector leading to higher employment generation. Results further suggest that capital and labour are complementary factors in high technology chemicals as well as low technology textiles. Though an increase in output significantly increases labour demand, technology acquisition by such firms does not have any impact on labour for most sectors. Increase in productivity is found to displace labour across sectors.

In sum, the study reveals that the process of liberalization and inflow of FDI have played a strong role in augmenting exports from India and some spillover effects have been generated on the domestic firms in terms of export. In this context, as MNEs look for countries which can be used as export platforms, the domestic policy endeavor has to be on development of resource base, infrastructure, R&D and skill, which would attract efficiency seeking FDI. As the firms achieve competitiveness by importing raw materials and capital goods, policies relating to lowering import tariffs on raw materials need to be brought forth. Further, the study reveals that, with MNE operations, the choice of technology of the firms has been more inclined towards dependence on foreign technical knowhow. However, foreign ownership does not have any positive influence on employment generation of firms across sectors in Indian manufacturing. Technology acquisition of firms is not labour displacing across major sectors. The evidence of varying performance across sectors in the Indian manufacturing is indicative of the continuing existence of various constraints operating in each sector, which by itself creates a case for industrial policy interventions.
APPENDIX I

A NOTE ON DATA

An empirical research work is largely contingent upon time comparable good database. In this dissertation, I have primarily used firm-level data from the PROWESS Database from the Centre for Monitoring Indian Economy (CMIE). PROWESS provides information from audited financial statements and thereby uses company balance sheets and income statements as sources of information. The database covers both listed and unlisted firms from a wide cross-section of manufacturing, services, utilities and financial industries covering 60-70 per cent of organized sector in India, 75 per cent of corporate taxes and 95 per cent of excise duties collected by the Government of India (Goldberg et al., 2010).

In this study, information on only manufacturing firms is used. The industries chosen for the purpose of analysis are chemicals (including drug and pharmaceuticals), machinery, transport equipment, food and beverages, textiles and basic metals. The choice of these industries has been primarily guided by the fact that these industries cover approximately more than 70 per cent of Indian manufacturing sector. Further, FDI inflows in these sectors have been increasing during post reforms. Again, as these industries widely differ in terms of their technology intensities (ISIC Revision 2), the selected industries cover high/medium-high technology industries like chemicals, machinery and transport equipment as well as medium-low/low technology industries like basic metals, food and beverages and textiles.

The next important step involves identifying the firms according to ownership or finding the “FDI firms” as against “non-FDI firms”. PROWESS provides data for foreign
promoter’s equity holdings. If for a company, equity holding of the foreign promoter exceeds 25 percent, it is classified as a foreign owned firm or a “FDI firm”. However, PROWESS reports data on foreign promoter’s equity holdings only for post 2001 period. As this study covers a twenty year period (1991 to 2010), the information on equity holdings to identify company ownership could not be used. Further, numerous missing values of equity participation also do not auger well with the empirical analyses being carried out. However, the database provides separate information on the ownership group of firm in the sense of whether a firm is ‘Private Indian’, ‘Private Foreign’ or a ‘State-run’ enterprise etc. This information is used in the study to identify domestic and foreign ownership of firms. We use a dummy variable indicating ownership taking the value one if the firm is foreign and the value zero if the firm is domestic. The year of incorporation is used to arrive at the age of a firm. Size of a firm is derived as the ratio of firm sales to industry sales.

For analyzing the impact of FDI on export performance and export spillovers, data are collected only for the exporting firms. Hence, export data for each firm are collected at the initiation. However, for analyzing technological choices and spillovers of Indian manufacturing and the effect of technological acquisitions on labour market, data for all firms in each sector for the period under consideration have been collected. Data on total sales is used for arriving at various intensities like marketing cost intensity (mktcost), R&D intensity (rdi), capital goods import intensity (ki), foreign technical knowhow intensity (fptr) and import of raw material intensity (impr) of a firm. The intensity variables are described as follows:

\[ mktcost: \text{Ratio of summed up advertising expenditure, marketing expenditure and distribution expenditure to sales.} \]
rdi: Ratio of R&D expenditure to sales.

ki: Ratio of expenditure on imports of capital goods to sales.

fpstr: Ratio of technical fees and royalties paid abroad to sales.

impr: Ratio of expenditure on imports of raw materials to sales.

Fortech : Ratio of the sum of expenditure on import of capital good, import of raw materials and import of foreign technical know-how to sales.

In this study firm heterogeneity is captured both in terms of productivity (Melitz, 2003) as well as the capacity of a firm to bear sunk costs (Das, Roberts and Tybout, 2007). In recent years, a lot of attention has been given to the estimation of Total Factor Productivity (TFP). Estimation of production function using Ordinary Least Squares (OLS) gives inconsistent and biased estimates of explanatory variables. There are likely to be a host of firm, industry and time specific effects which might influence the usage of production inputs. Since OLS assumes that production inputs are uncorrelated with omitted unobservables, it fails to address the endogeneity issue resulting in inconsistent and biased estimation. To solve this problem, the semi-parametric method of Olley and Pakes (1996) and Levinsohn and Petrin (2003) is widely used in the literature. Further, for productivity estimation capital stock is arrived at derived using the perpetual inventory method. However, TFP is not estimated in this study. We arrive at productivity (pdtivity) estimates as the ratio of value of output to salaries and wages.

This study considers sunk costs to be an important determinant of firm heterogeneity explaining exports. Das et al. (2007) consider the average fixed costs of entering a foreign market as the sunk cost of exports. In this study, advertising expenses, marketing expenses (including commission, rebates, discounts, sales promotional, expenses on direct selling agents and entertainment), distribution expenses (including
outward freight) and Research and Development expenses are used to arrive at estimates of the sunk cost variable. Hence, the sunk cost intensity ($sci$) in this analysis is the share of sum of advertising expenses, marketing expenses, distribution expenses and R&D expenses to sales of the firm.

Following Kapoor, Ranjan and Raychaudhuri (2011), data on total borrowing including data on secured bank borrowing, secured financial institution borrowing, deferred credit, foreign currency borrowing, inter corporate loans and unsecured loans have been collected to arrive at the credit availability ($crdt$) variable. Hence, $crdt$ is the ratio of total borrowing to value of output. Technology intensity is also used in this study as an important control variable. A firm can acquire technology by importing technology in both embodied and disembodied forms on one hand, while on the other, it can do indigenous R&D. Technology intensity ($tech$) is thus arrived at as the ratio of the sum of expenditures on R&D, import of raw material, import of capital good and forex payment for technical know-how and royalty payments to firm sales. Apart from the technology variables, the study also makes use of the following variables for the purpose of analyzing the effect of FDI on technological choices and spillovers:

*Technology embodied in domestic inputs* (DOMIN): Technology embodied in domestic inputs measured by adding the domestic expenses on raw materials and domestic payment for technical know-how and royalty.

*Foreign Technology Spillovers* (FORSPILL): Foreign technology spillover variable for a particular firm has been constructed by aggregating foreign technology purchase at the industry level and subtracting foreign technology purchase expenses at the firm level.
*Domestic Technology Spillovers* (DOMSPILL): Total expense made on local R&D by the industry to which the ith firm belongs minus the local R&D expenses of the ith firm is the measure of domestic spillovers for the ith firm.

The PROWESS database provides information on salaries and wages and provides no information on the number of employees. In order to analyze the effect of FDI on firm-level employment, labour data was required. We make use of the Annual Survey of Industries (ASI) database of the Central Statistical Organization (CSO) to mitigate the problem. The data on Total emoluments and Total persons engaged for the relevant industry were collected from the ASI database. This requires data matching. Such matching has been done at the two digit level. Since the time period under consideration is 1991 to 2010, concordance between NIC 1998, NIC 2004 and NIC 2008 classification of industries at two digit level has been done. The classification concordance between NIC 1998, NIC 2004 and NIC 2008 of the relevant industries at 2 digit level is as follows:

**Table A.1:** Classification Concordance between NIC 1998, NIC 2004 and NIC 2008

<table>
<thead>
<tr>
<th>Description</th>
<th>NIC 1998 2-digit</th>
<th>NIC 2004 2-digit</th>
<th>NIC 2008 2-digit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical and Chemical Products</td>
<td>24</td>
<td>24</td>
<td>20+21</td>
</tr>
<tr>
<td>Basic Metals</td>
<td>27</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>Food Products and Beverages</td>
<td>15</td>
<td>15</td>
<td>10+11</td>
</tr>
<tr>
<td>Motor Vehicles, Trailers and Semi Trailers+Other Transport Equipment</td>
<td>34+35</td>
<td>34+35</td>
<td>29+30</td>
</tr>
<tr>
<td>Textile Products+Wearing Apparel, Dressing and Dyeing of Fur</td>
<td>17+18</td>
<td>17+18</td>
<td>13+14</td>
</tr>
<tr>
<td>Machinery and Equipment NEC +Accounting and Computing Machinery</td>
<td>29+30</td>
<td>29+30</td>
<td>26+27+28</td>
</tr>
</tbody>
</table>
Average wage rate is calculated as Total emoluments/ Total persons engaged. Number of persons engaged per firm is arrived by dividing salaries and wages at the firm-level by the average wage rate of the industry to which the firm belongs.

For the calculation of the Real user cost of capital the nominal user cost of capital was deflated by industry specific WPI, with the base year for the index changing from 1993-94=100 to 2004-05=100. WPI data used in the study are availed from the Office of the Economic Advisor, Ministry of Industry, Government of India. The study period covers time points of indices with all the two base years. The indices with earlier base periods were converted to bring these time series to uniform base period, 2004-05=100.

The variables constructed for the purpose of analysis are as follows:

*Labour*: Number of persons engaged in a firm is arrived at by dividing expenditure on salaries and wages of the firm by the average wage rate of the industry (at 2 digit level) to which the firm belongs.

*Wage*: Average wage rate of the relevant industry.

*Output*: Total Sales of a firm is used as an indicator of output.

*Real user cost of capital*: This variable is constructed by deflating the nominal user cost of capital by industry specific WPI. Nominal user cost of capital is arrived at by multiplying WPI of machinery and machine tools with the sum of average prime lending rate and the rate of depreciation. Following Hasan et al. (2007), the rate of depreciation is considered at 10 per cent. Data on prime lending rate is obtained from Reserve Bank of India database.