Liberalisation, FDI and Export Performance : A Study of Indian Manufacturing Industries

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Abstract: This paper analyses the effect of foreign direct investment on firm level export performance across manufacturing sectors in India. FDI inflow in India during post reforms is expected to improve export competitiveness. Such improvements are found to vary across sectors with varying levels of FDI and hence MNE participation across sectors. Further, the evidence of inter-firm variations in export performance across sectors is indicative of the existence of factors specific to firms. In determination of export performance a firm specific model has been set up for econometric estimation. Panel data estimation results show that import of technology (embodied and disembodied), in-house R&D, import of raw materials and expenditure on marketing, advertising and distribution are the major determining factors of firm level exports. Firm level productivity and credit availability also play significant roles in certain sectors.

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1 Introduction

In a fast globalizing world, export competitiveness of a nation determines its long run economic performance (Balassa, 1978; Frankel & Romer, 1999; Marin 1992). Export is considered to be one of the major growth variables as it leads to productivity growth (de Melo and Robinson, 1992; Tybout, 1992) by exploiting economies of scale, enlarging the size of the market and reducing technical inefficiencies. Foreign Direct Investment (FDI) is a major instrument that provides impetus in accelerating export performance in an economy. This is particularly true for emerging market economies like India as FDI brings in a bundle of intangible assets such as new technology and know-how, skill, wider and more efficient marketing and distribution networks, better managerial capabilities etc., which are relatively scarce in these economies but are indispensable for improvements in export performance.

Multinational Enterprises (MNEs) form the major channel through which FDI flows into emerging market economies. Multinational enterprises (MNEs), possessing a wide array of intangible assets access foreign markets with much more ease than their domestic counterparts and often uses the host country as export platform. These transnational firms, given their scale of operations, can also overcome the sunk costs while entering export markets. Further, local firms can learn from the export activities of foreign subsidiaries in the host country through information externalities, demonstration and competition channels. This paper investigates into these various dimensions of firm-level export performance across manufacturing industries in India during post-reforms period. After maintaining a restrictive approach towards trade till the mid-1980s and selective approach towards Foreign Direct Investment till late 1980s, a number of changes were introduced in India's industrial policy since 1991. This was part of an entire gamut of policy changes since the early 1980s with industrial delicensing to start with and followed by trade policy changes in 1985 and both carried forward in 1991 along with wide-ranging complementary changes in other policies, thus embarking upon a phase of openness in the economy. The foreign investment policy measures initiated in the 1990s made India more open and proactive with a view not only to get better access to technology but also to build strategic alliances to penetrate the world market (Ahluwalia, 2008) and improve India's export competitiveness (see Kumar and Joseph, 2007). Even though reforms provided incentives equally across sectors, the sectors responded differently to the stimuli resulting in varied export performance. Such evidence is indicative of the continuing existence of various sector specific factors that determine performance across sectors. Further, within each sector, there are firm specific factors that determine export performance.

There is a rich body of literature, analyzing the various dimensions of the effect of FDI on export performance. The export enhancing role of FDI is well documented in the literature. However, these studies focus on the foreign affiliates only. Studies analyse the export performance of the foreign firms vis-à-vis, the local firms, though there is no conclusive evidence on better export performance of MNEs over local enterprises. While some studies, for instance by

Reidel (1975), Jenkins (1979) on Mexico, Kirim (1986) on Turkish pharmaceutical industry, find no significant difference between the export performance of foreign controlled enterprises and their local counterparts, Cohen (1975), based on some export oriented firms in South Korea, Taiwan and Singapore, concludes that local firms predominated over foreign firms in exporting. Aggarwal (2002) finds better export performance of MNE affiliates than their local counterparts for Indian manufacturing. However, no strong evidence was found to suggest that India was attracting efficiency-seeking outward-oriented FDI. Further, Aggarwal (2002) shows that low-tech industries with high foreign ownership have better competitive advantage than high-tech ones. Earlier, Subrahmanian and Pillai (1979) and Kumar (1989) also arrived at similar results in case of Indian manufacturing sector. This is in line with other empirical works relating to India and other developing countries [Newfarmer and Marsh, (1981), quoted in Lall and Mohammad, (1983)]. Singh (1986), in a slightly different analysis on export and import propensities and balance of trade for a sample of Indian pharmaceutical firms, finds that, compared to the local firms, the foreign firms have higher export intensity along with a much higher import intensity. Again, among the foreign firms, affiliates of relatively big MNEs seem to have lower balance of trade deficit, arising from lesser dependence on imported raw materials.

Further research on the issue of FDI and export performance in an emerging country such as India has to investigate into both export propensity of MNEs vis-à-vis their local counterparts at a further disaggregate level as well as the factors that determine firm-level export performance. The focus of this research work is to understand whether inflows of FDI following economic reforms have provided the required trigger for an improvement in overall export performance of Indian manufacturing industries. In doing so, the study identifies the factors that determine export performance of Indian manufacturing enterprises highlighting on whether foreign technology, firm productivity and credit availability are important for export performance. This is where the study particularly contributes to the existing literature.

The paper is organized as follows. Section 2 provides some stylized facts on the overall export performance of the Indian manufacturing industries from 1991-2010. Section 3 discusses the analytical framework, the empirical model and method, and the database for analyzing the determinants of firm level export performance. Section 4 presents the empirical results. Section 5 summarizes the major findings of the paper and puts forth the policy implications.

2 Export Intensity during Post-Reforms: Some facts

Average export intensity at the firm level across sectors improved during the post-reforms period. The sectors considered for the purpose are food and beverages, textiles, chemicals, metal and metal products, machinery and transport equipment industries, which account for about 70 per cent of India's merchandise exports. The choice of these industries also gives us the insight about post-reform export performance of low technology industries in comparison to the medium and high technology industries.

Earlier studies have shown that India's FDI inflows increased substantially since reforms in 1991, with wide-ranging changes in sectoral composition (Kumar, 2005). The shift has been from the primary to the secondary to the service sector. Within manufacturing, FDI stocks were the largest in chemicals industry during the mid-1990s. FDI stocks in food and beverages and the transport equipments industry became predominant in 2000. Along with increase in FDI stocks, export intensity of Indian manufactures shows a rising trend, in particular after the year 2000 as evident in Table 1.

Table 1: Average Export Intensity during Post-Reforms

Period	Food & Beverage	Textile	Chemical	Ferrous Metal	Non Ferrous Metal	Electrical Machinery	Electronics	Non Electrical Machinery	Transport Equipment	All Industries
1990s	0.24	0.22	0.09	0.04	0.13	0.06	.007	0.07	0.10	0.10
2000s	0.28	0.29	0.18	0.04	0.26	0.07	0.01	0.12	0.11	0.15

Source: Calculations based on PROWESS database, CMIE.

The average export intensity for food and beverages, textiles, chemicals, non-ferrous metals and non electrical machinery industries as a whole increased after 2000. Average export intensity of chemicals and non ferrous metals doubled in the decade of 2000s over the decade of the 1990s. The average export intensity in chemicals increased from 0.09 in 1991 to 0.18 in 2010, with drugs and pharmaceutical industry accounting for the largest share along with a better performance than the sectoral average. It is important to mention here that foreign investments up to 100 per cent have been allowed since December 2001 (Kumari, 2007). The improvements in export intensity in textiles are as per expectations of the potential benefit during the post-MFA regime. Such improvements in textiles, though slow in comparison to China, is impressive because it occurred despite the factors like low Indian productivity in textiles, technological obsolescence, low scale of operation and rigid labor laws (Tewari, 2005).

The improvements in the average export intensity are relatively small for electrical machinery and transport equipments . The average export intensity for electronics continues to remain low in the decade of 2000. In sharp contrast to the non ferrous metal sector, average firm-level export performance of the ferrous metal sector does not indicate any improvement. This is despite most ferrous sub groups especially steel showing an increasing trend in export intensity (Table A.5). This is as per expectations because India turned out to be one of the major exporters of steel to China , which was heavily investing in infrastructure development.

There are nuances behind such overall trends of improvement in performance. It is important to understand whether export performance depends on ownership of firms, given the common contention that foreign firms perform better than the domestic firms. Table 2 reflects that in the food and beverages, metal and metal products and textile industries the domestic firms are significantly (at 5 percent level) better performers in export than the foreign firms. For the transport equipment industry also domestic firms are better performers than the foreign firms through not significantly. For the Chemical industry and the machinery industry, the foreign firms are better performers in terms of exports. However the difference is not significant. This result of no better performance of the foreign firms over the domestic firms is in conformity with the works of Kumar (1990), Pant (1993) and Siddharthan (1994).

Table 2: Ownership-wise difference in firm-level average export intensity

Industry	Mean export intensity of the domestic firms	Mean export intensity of the foreign firms	t value	Inference
Food and Beverages	.06	.05	3.1	Significant difference[a]
Machinery	.05	.06	1.5	No Significant difference
Metal and metal products	.04	.01	6.4	Significant difference[b]
Textiles	.21	.02	9.5	Significant difference[c]
Chemicals	.10	.11	0.62	No Significant difference
Transport Equipment	.04	.007	2.26	No Significant difference

Note:

- t values calculated using two-sample (export intensity of the domestic and the foreign firms)mean comparison test with unequal variances).
- H0: mean (export intensity of domestic firms)- mean (export intensity of foreign firms)=0
  HA: mean (export intensity of domestic firms) - mean (export intensity of foreign firms) 0
- For large sample the critical t value at 5% level of significance is 1.96 and at 1%level is 2.57.
- a: Ha: diff > 0,Pr(T > t) = 0.0009
- b: Ha: diff > 0,Pr(T > t) = 0.0000
- c: Ha: diff > 0,Pr(T > t) = 0.0000

On the whole, firm-level export intensity across manufacturing industries in India shows an increase in the post reforms period. The prominent industries that show an increase in intensity throughout the reforms period are the non-traditional items like drugs and pharmaceuticals, rubber and rubber products, computer peripherals, storage devices, steel, steel tubes and pipes along with traditional export items like cotton & blended yarn, readymade garments, coffee, and marine food. See Appendix A quantum improvement in the rising export intensity is, in particular, observed across industries for the period after 2000. However, there are inter-industry variations in the pattern, with export intensities of electronics, ferrous metals and transport equipments not showing an increasing trend in the post-2000 period. The

above observations call for an analysis of determinants of firm-level export performance and identify the factors, if any, that explain the difference in firm-level export performance across industries.

3 Determinants of firm level export performance

3.1 Analytical framework

Economic theory provides two basic approaches to find out the effect of FDI on the domestic country. One is the partial equilibrium comparative static analysis, which tries to find out how the marginal increments in investment from FDI are distributed. The other approach starts with the basic query as to why the firms try to invest abroad and produce the same product that they produce in their own country. The answer is that a firm to be able to invest in a foreign market should possess some assets in the form of product/process technology, marketing skills, managerial skills etc. that can be profitably used by the foreign affiliate. Thus, entry of an MNC in the domestic country not only brings with it capital investment but much more than that. So, there is a common contention that FDI in the form of MNEs can potentially help the domestic firms particularly in terms of exporting.

Our estimable model is essentially a supply side model based on Aitken, Hanson and Harrison (1997). The profit function of a typical firm is as follows:

$$\Pi = P_d Q_d + P_f Q_f - C(Q_d + Q_f) - S \qquad (1)$$

s.t. $Q_d, Q_f > 0$

The subscripts *d* and *f* are for the domestic and the foreign markets respectively. The cost in this framework is as follows:

$$C = C(h(Q_d + Q_f), j(Q_d + Q_f))$$

The function signifies the production costs. As production cost is independent of the market the commodity is sold, is a function of both Q_d and Q_f .Again, a representative firm has to bear certain costs to stay in the market .For instance, a firm has to bear R&D expenditure, costs for advertising, creating export infrastructure, and developing market channels. This is represented by j (.). Further, in order to export a firm has to bear certain costs which are sunk in nature and hence cannot be recouped. For example the costs of learning bureaucratic procedures and adapting their products in the foreign market are sunk costs. Again, in each period to maintain presence in foreign market, minimum freight charges, insurance charges, costs of monitoring foreign customs procedure etc are to be borne (Das, Roberts and Tybout, 2007). Such sunk costs are represented by S in the model. The cost function in equation (1) is specified as follows:

$C(Q) = a/2\,(Q)^2 + g[h(Q), j(Q)]$, where a and g are scalar parameters.

Thus, rewriting the profit function we have:

$$\Pi = P_d Q_d + P_f Q_f - a/2\,(Q_d + Q_f)^2 - g[h(Q_d + Q_f), j(Q_d + Q_f)] - S$$

$$\ddot{a}\text{Đ}/\ddot{a}Q_f = P_f - a(Q_d + Q_f) - \ddot{a}g/\ddot{a}h[h'(Q_d + Q_f)] + \ddot{a}g/\ddot{a}j[j'(Q_d + Q_f)] = 0$$

Hence, $\mathbf{Q_f^* = [P_f - aQ_d - \ddot{a}g/\ddot{a}h[h'(.)] - \ddot{a}g/\ddot{a}j[j'(.)]}$

Again, $\ddot{a}\text{Đ}/\ddot{a}Q_d = P_d - a(Q_d + Q_f) - \ddot{a}g/\ddot{a}h[h'(Q_d + Q_f)] + \ddot{a}g/\ddot{a}j[j'(Q_d + Q_f)] = 0$

Hence, $\mathbf{Q_d^* = [P_d - aQ_f - \ddot{a}g/\ddot{a}h[h'(.)] - \ddot{a}g/\ddot{a}j[j'(.)]}$

Thus the exports of a representative firm essentially depends on P_f *h* and *j*. However, there can be other supply side factors like size and age of a firm, productivity, import of technology and ownership of a firm which might play important roles. Now, as the analysis is at the firm level and we consider India to be a small country case we would assume prices to be given. Thus in the estimable form we would consider export intensity of a firm to be dependent on production costs, other costs borne to stay in the market and other supply side factors like age, size, ownership etc.

3.2.1 Firm size

The literature on export performance shows a positive relationship between firm size and export performance. Firm size is often considered to be a proxy for the resource base, risk perception and economies of scale that determines the export attitude and performance of the firm (Kumar and Pradhan, 2003). Smaller firms with their resource constraints are mostly scale inefficient, while larger firms can exploit economies of scale. Empirical literature however has mixed findings on the relationship between firm size and export performance with some reporting a positive relationship while some others estimating an insignificant relationship . Still some studies including Kumar and Sidhharthan, (1994); Sterlacchini, (2001); Bonaccorsi, (1992); report a nonlinear relationship. In view of the presence of this possible nonlinearity our analysis considers a nonlinear relationship between SIZE and firm-level export performance.

3.2.2 Age

Age of a firm is often used in literature to capture the extent of a firms' learning experience. Older firms might have superior cost structure, as they are experienced from exporting and therefore able to bear the sunk costs of exporting. As firms with experience are regarded as enjoying greater experimental and tacit knowledge, age is considered to be positively associated with exporting (Rasiah, 2003). In our study we consider age of a firm (AGE) to be positively related to export intensity. Age is represented by the absolute age of the firm in number of years.

3.2.3 Import of technology

For developing countries, Research and Development is mainly adaptive rather than fundamental in nature and since the late sixties most developing countries have relied extensively on technology import (Kathuria, 1998). In countries like India, import of technology forms one of the major channels through which knowledge is acquired. Technology can be imported in both embodied and disembodied forms. Embodied technology is imported in the form of raw materials, intermediate goods and mostly capital goods, while imported disembodied technology includes patented knowledge, technical know-how, drawings and designs etc. It is believed that imported technology is of better quality and thereby makes a firm cost competitive. In our analysis we have considered three variables namely imports of raw materials (IMPR), import of capital goods (KI) and foreign technical know-how (FPTR) to account for both embodied and disembodied technology import that determines export performance.

We hypothesize that, in the post-reforms period with lower tariff rates and relative ease in importing, raw materials, intermediate inputs and capital goods imports positively impact on firm level exports. However, we do not expect a linear relationship between these explanatory variables and export performance looking at the heterogeneity of firms based on the scatter plots of the raw data.

3.2.4 Research and Development

In an increasingly knowledge based world, technological capacity is seen as an important component of a country's international competitiveness and growth (Kumar & Aggarwal, 2005). Thus, Government provides heavy thrust on the innovative capacity of the enterprises which is often referred to as techno-protectionism (Kumar & Sidhharthan, 1997). It is believed that with research and development a firm becomes cost competitive and thereby has an improved export performance (Fargerberg, 1988; Soete, 1981). In our study, we postulate RDI (Ratio of R&D expenditure to Sales) as a determinant of export performance. The expenditure of a firm on research and development is basically sunk in nature. Since cost functions are inherently non linear, we postulate a nonlinear relationship between export performance and R&D expenditure of a firm.

3.2.5 Specific costs

Exploring a foreign market requires strong marketing and distribution networks. If a firm incurs expenditure on marketing and distribution, advertises for its product then it might attain cost competitiveness in exporting its product in a foreign market. Hence, in our model we have considered advertising expenditure, marketing expenditure, and distribution expenditure as determinants positively influencing export performance. The data collected for the purpose of analysis suggests that there is wide heterogeneity among the firms spending on marketing distribution and advertising. As a result, we expect non-linearity. For the purpose of our analysis and to avoid multi-collinearity we have added expenditures on marketing, distribution and advertising and constructed a single marketing cost (MKTCOST) variable.

3.2.6 Productivity

The 'New New' trade theory models pioneered by Melitz (2003) have emerged in a big way in recent literature. These models postulate that firms are heterogeneous and only productive firms self select into export markets. Empirical works incorporating heterogeneity suggest that trade forces least productive firms to exit (Aw, Chung and Roberts (2000) for Taiwan, Clerides, Lack and Tybout (1998) for Columbia, Mexico and Morocco).These works imply that a few productive firms within a sector which expect a profit stream sufficiently high to cover the sunk costs of entry into a foreign market find it profitable to export. In order to incorporate heterogeneity of firms in our model we use firm productivity (PDTIVITY) as a control variable. We postulate that more productive a firm is, more is the export.

3.2.7 Availability to Credit

There is a growing body of recent theoretical literature that looks at the impact of credit market imperfections on firms within the Melitz (2003) framework (e.g. Chaney (2005); Helpman, Melitz and Rubenstein (2006); Manova (2006). The main results of these studies show that in addition to heterogeneity in productivity and capability to overcome sunk costs; credit constraints also affect exports of firms. There are empirical studies as well which explain the

trade- finance linkage and show the impact of credit constraints on firms' exports e.g. Mirabelle (2008) for Belgian firms, Greenaway, Guariglia and Kneller (2008) for UK firms and Paravisini, Rappaport, Schnabl and Wolfenzen (2011) for Peruvian firms. In the Indian context, Kapoor, Ranjan and Raychaudhuri (2011) have established a causal link from credit constraints to real outcomes of exporting firms following two exogenous policy changes in India that affected the availability of subsidized credit to small firms. Given this emerging literature, in our study we have considered availability of credit to a firm (CRDT) to affect its export intensity. We hypothesize that more the credit availability, better is the firm-level export performance.

3.3 *The Estimation Model*

Our estimation model, in its general form, is:

$$EXPI=\acute{a}_0 + \acute{a}_1(SIZE) + \acute{a}_2(IMPR)+ \acute{a}_3(KI)+ \acute{a}_4(FPTR) + \acute{a}_5(MKTCOST)+ \acute{a}_6(AGE)+ \acute{a}_7(PDTIVITY) + \acute{a}_8(CRDT) + \acute{a}_9(RDI) + u_{it} \quad (2)$$

where:

EXPI: Ratio of exports of goods to sales.
SIZE: Ratio of firm sales to industry sales.
IMPR: Ratio of imports of raw materials to sales.
KI: Ratio of imports of capital goods to sales.
FPTR: Ratio of forex payment for technical fees and royalties to sales.
MKTCOST: Ratio of sum of advertising expenditure, marketing expenditure and distribution expenditure to sales.
AGE: Absolute age of the firm in number of years.
PDTIVITY: Ratio of value of output to salaries and wages.
CRDT: Ratio of total borrowing to value of output.
RDI: Ratio of R&D expenditure to sales.

3.4 The Method and Data

In our analysis we have used the Ordinary Panel data estimation technique. To estimate time series and cross sectional data in a single equation framework, Panel data estimation technique is widely used in literature. It helps to simultaneously accommodate large volume of data set across time and distinguishes between time-series movement and cross-sectional movement of the data.

For estimation purposes of the model, both Fixed effect specifications and Random effect specifications are considered. When cross-sectional heterogeneity is correlated with the other explanatory variables of the model, then fixed effect model provides an efficient estimator. On the other hand, if the unobserved cross-sectional heterogeneity is assumed to be uncorrelated with other explanatory variables of the model, then random effect model provides efficient estimator of the parameters. In our model, the Hausman Specification test is taken into consideration to distinguish between fixed and random effects. Both the fixed and random effects estimators are efficient Feasible GLS estimators. The F statistic and the Wald statistic for the fixed and random effects respectively are significant at 1% level suggesting that the explanatory variables significantly explain variations in the dependent variable, which in this case is export intensity. The problem of multicollinearity is avoided by studying the correlation matrices.

Firm level data is obtained from Prowess Database published by the Centre for Monitoring Indian Economy (CMIE) for the period 1991-2010 for the food and beverages, textiles, chemicals, metal and metal products, machinery and transport equipments industries. Statistical information is collected only for exporting firms in this database. A total of 204 observations for the food & beverages industry, 763 observations for the textiles and garments industry, 1830 observations for the chemicals industry, 219 observations for the metal and metal product industry, 972 observations for the machinery industry and 439 observations for the transport equipments industry are thus obtained. These observations include both domestically owned and foreign owned firms. Panel structure for each of the six industries is constructed. In what follows is a discussion of the findings from various estimations of model (2).

4 The Empirical Results

In this section we would try to analyze the determinants that induced the export performance of the Indian manufacturing industries in the post reforms era. Table 3 presents the estimation results on determinants of export performance. Both fixed and random effect results are considered depending on the Hausman specification test. The fixed effect results would imply that there are cross section specific factors that also determine the dependent variable, which in our

case is export intensity of firms. The random effect results would imply that there are certain random factors, which also influence firms' export intensity.

4.1 Determinants of Export Performance

4.1.1 Firm size

Size turns out to be significantly affecting the export performance of the chemical and the metal industries. Both of these industries are high tech industries and as size acts as a proxy for resource base it is expected that size would affect the export intensity of the high technology firms positively. However, the relationship is not characterized by nonlinearity, which is not in conformity with the earlier works of Kumar and Siddharthan (1994) for Indian manufacturing, Bernard and Wagner (2001) for German manufacturing firms. However, the relationship remains positive for most of the industries.

4.1.2 Age

Our estimation results show that age of the firm plays a very significant role in determining the export behaviour of the high technology industries like chemicals, metal & metal products and transport equipments. This suggests that as the firms are getting older, the high tech industries are growing and integrating more to the world market. For the low/medium tech industries like food & beverages and textiles the relationship between age and export intensity remains positive though insignificant. This might suggest that the low/medium tech industries of Indian manufacturing are concentrating more on the domestic markets with time (Kumar and Pradhan, 2003).

4.1.3 Import of technology

Import of raw materials is one of the major sources of achieving knowledge and cost competitiveness by the domestic firms. Being better in quality than the local available substitutes, imported raw materials improve productivity of the firms and thereby affect export positively. In our study we find that for the textile, chemical, machinery and the transport equipment industry import of raw materials is significantly positive. This is as per our expectation as most of these industries are high tech knowledge based industries and they crucially depend on imported raw materials to stand global competitiveness. A significant non-linear relationship between import of raw materials and export intensity exists in case of the textile, machinery and transport equipment industry. For the transport equipment industry the relationship is U shaped, while for the textile and the machinery industry it is inverted U shaped which implies that there is a threshold beyond which the export intensity either rises or falls. Import of raw materials is insignificant for the food and the metal industries. Import of capital good is another important way to bring in foreign knowledge in embodied form and use of foreign design and technological expertise is import of knowledge in disembodied form. In our analysis we have added the expenditures made by a firm on both embodied and disembodied technology import. The ratio of this expenditure to sales is used to construct the variable TECH. We have also used the disaggregate form (See Appendix). With the exception of the food & beverages and the machinery industries TECH turns out to be significantly positive explaining Indian manufactured exports. Non-linearity also exists in the relationship of TECH and export intensity for most industries. For the transport equipment industry TECH is negatively significant. However, import of capital good and foreign technical know-how significantly explains export intensity of the transport equipment industry. Non-linearity also holds good.

4.1.4 Research and Development

As expected, RDI has come up with positive and statistically significant effects for the Chemical industry. Non-linearity holds good in this relationship. As chemical industry is considered to be the most knowledge based industry, this result suggests that technology imports provoke chemical firms to do Research and Development. This is in conformity with our hypothesis of complementarity between import of foreign technology and local R&D. This result is in line with the evolutionary school of thought, which suggests that building up own technological capabilities is essential for competitiveness. RDI however does not significantly explain the export intensity of the food, textile, machinery, metal & metal product and the transport equipment industries though the relationship is positive for most of the industries. This might suggest that the knowledge base of most of the Indian industries is adaptive rather than indigenous in nature. With huge dependence on imported raw material and foreign knowledge, indigenous technological capabilities seem to be limited due to financial and scientific resource constraints.

Table 3: Determinants of firm-level export performance

	Food and Beverages	**Textiles**	**Chemical**	**Transport equipment**	**Machinery**	**Metal and metal products**
	Fixed effect results	**Fixed effect results**	**Fixed effect results**	**Fixed effect results**	**Random effect results**	**Random effect results**
SIZE	1.69 (0.07)	41.05 (0.81)	**.194.39*** (4.08)	**-**33.12 (-1.60)	-.0006 (-0.03)	**58.63*** (4.26)
$SIZE^2$						
AGE	.028 (0.15)	.115 (0.58)	**.5919*** (7.40)	**.694*** (8.48)	.042 (0.84)	**.641*** (5.58)
IMPR	2.6 (0.05)	**.168*** (4.60)	**7.07*** (4.71)	-1.24 (-0.19)	**.047*** (2.80)	.019 (0.41)
$IMPR^2$		**-.00003*** (-4.65)		**7.62**** **(**1.89**)**	**-.00001*** (-2.19)	-.0006 (-0.47)
TECH	71.07 (1.43)	**75.61*** (3.54)	**37.13*** (4.24)	**-13.97*** (-3.05)	4.95 (0.75)	**74.22***** (1.76)
$TECH^2$		**-50.76*** (-3.03)	**-.901*** (-4.22)			
MKTCOST	**314.97*** (3.23)	**68.04*** (3.85)	128.26 (7.86)	**264.12*** (6.20)	**52.17**** (2.75)	-.271 (-0.29)
$MKTCOST^2$	**-1617.19*** (-2.94)	**-22.14*** (-3.57)	**-353.41*** (-8.59)	**-1452.4*** (-5.15)	**-153.12*** (-2.50)	.0034 (0.26)
RDI	**-**-351.07 (-0.26)	154.3 (0.21)	**34.7*** (1.78)	132.94 (0.85)	-44.2 (0.35)	.964 (0.14)
RDI^2			**-11.65*** (-1.86)			
PDTIVITY	.001 (0.17)	.010 (1.38)	-0.14 (-0.96)	-.054 (-0.61)	**.011*** (1.72)	.001 (0.48)
$PDTIVITY^2$			6.35 (0.91)	.0004 (0.56)		
CRDT	.028 (1.08)	-.007 (-0.24)	-1.23 (-0.22)	**1.82*** (3.80)	-.0002 (-0.19)	.002 (0.14)
$CRDT^2$				**-.054*** (-0.61)		
R^2 (overall)	0.10	0.002	0.002	0.18	.05	0.26
F/wald statistic	1.64*	25.69*	34.32*	148.65*	21.12**	73.61*
Hausman test Chi square	18.77**	35.88*	51.33*	84.06	5.61	3.25
Number of observations	204	763	1830	439	972	219

Note: 1. t/z values are provided in parentheses

2. * denotes 1% level of significance, ** denotes 5% level of significance, *** denotes 10% level of significance.

4.1.5 Specific costs

In our analysis we have used MKTCOST to explain the sunk cost of marketing a product in foreign market. We find that

as hypothesized MKTCOST turns out to be highly significant for all the industries excepting metals. Non- linearity fits well in most of the cases where both MKTCOST and MKTCOST 2 are significant. While local R&D did not grow in most of the sectors, advertising, marketing and distribution networks become important for exporting. This conforms to the theoretical conjecture that firms are heterogeneous in terms of sunk costs and the capability of overcoming this sunk cost of entering a foreign market is quite an important factor to explain export intensity.

4.1.6 Productivity

Firm productivity is one of the major ways to explain firm heterogeneity. Estimation of our model suggests that productivity of firms is significant in explaining the export intensity of only the machinery industry. For the food, textiles and metal industry the relationship is positive though not significant. This is despite the fact that technology variables are found to be significant determinants of firm-level export intensity.

4.1.7 Credit availability

Availability of credit stands out to be significantly affecting the export intensity of transport equipment industry. In this case also non-linearity persists. For the food & beverages and the metal industry the relationship is positive though insignificant. Hence, credit availability does not contribute much in the exporting behavior of the overall Indian manufacturing.

5 Conclusions and Implications for Policy

The present study shows that the average export intensity of the Indian manufacturing industries (food & beverages, textile, chemical, metal & metal product, machinery and transport equipment) show a rising trend in the post reforms period, in particular after 2000. The major players in this respect have been non-traditional high technology items like drugs & pharmaceuticals, rubber & rubber products, computer peripherals, storage devices, steel, steel tubes & pipes along with the traditional medium technology items like cotton & blended yarn, readymade garments, tea, coffee, and marine food. This encouraging export performance in the post reforms regime prompted us to study these industries at a disaggregate level. Our basic objective was to understand the determinants of export performance at the firm level for the Indian manufacturing industries. Panel data analysis for each industry is conducted. Evidence from the estimation results show that with liberalization the manufacturing industries for almost all technology groups have grown competitive with the import of raw materials, foreign capital good, capability to bear sunk costs and technical know-how. This is true for both the medium and high tech industries. Firm productivity and availability of credit do also play significant role in the high tech industries like machinery and transport equipments. Size also plays a major role particularly for the high tech industries. However, these results have a possibility of improvement with dynamic panel data estimation.

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 should be rationalized. 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.

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Appendix Table A.1

Industry	Export intensity	
Chemical	Pre 2000 average	Post 2000 average
Alkalis	0.06	0.05
Cosmetics	0.09	0.11
Dyes & Pigments	0.23	0.32
Drugs & Pharmaceutical	0.14	0.29
Fertilizers	0.01	0.01
Other Chemical	0.07	0.12
Pesticides	0.09	0.22
Inorganic chemicals	0.05	0.11
Lubricants	0.02	0.08
Organic Chemical	0.08	0.19
Paints & Varnishes	0.02	0.02
Plastic Films	0.11	0.24
Plastic Packaging	0.06	0.12
Plastic Tubes & Sheet	0.12	0.13
Polymer	0.03	0.17
Refinery	0.03	0.08
Rubber & Rubber Pdts	0.09	0.21
Tyres & Tubes	0.08	0.10

Calculations based on PROWESS database, CMIE.

Industry	Export intensity	
Non electrical machinery	**Pre 2000 average**	**Post 2000 average**
Construction Equipment	0.02	0.02
General Purpose Machinery	0.06	0.11
Industrial Machinery	0.08	0.16
Machine Tools	0.17	0.19
Other Industrial Machinery	0.02	0.07
Prime movers	0.06	0.08
Tractor	0.02	0.05

Calculations based on PROWESS database, CMIE.

Appendix Table A.2

Industry	Export intensity	
Electrical machinery	**Pre 2000 average**	**Post 2000 average**
Wires & Cables	0.03	0.05
AC & Fridge	0.01	0.04
Domestic Electrical	0.05	0.03
Dry Cells	0.02	0.04
Generators	0.07	0.09
Miscellaneous Electrical	0.06	0.12
Storage Batteries	0.06	0.05

Calculations based on PROWESS database, CMIE.

Appendix Table A.3

Industry	Export intensity	
Electrical machinery	**Pre 2000 average**	**Post 2000 average**
Wires & Cables	0.03	0.05
AC & Fridge	0.01	0.04
Domestic Electrical	0.05	0.03
Dry Cells	0.02	0.04
Generators	0.07	0.09
Miscellaneous Electrical	0.06	0.12
Storage Batteries	0.06	0.05

Calculations based on PROWESS database, CMIE.

Appendix Table A.4

Industry	Export intensity	
Electronics	**Pre 2000 average**	**Post 2000 average**
Communication Equipment	0.02	0.02
Computer, peripherals, storage device	0.10	0.22
Consumer Electronics	0.03	0.03
Other Electronics	0.05	0.10

Calculations based on PROWESS database, CMIE.

Appendix Table A.5

Industry	Export intensity	
Ferrous metals	**Pre 2000 average**	**Post 2000 average**
Casting & forging	0.11	0.16
Metal product	0.11	0.11
Pig Iron	0.04	0.04
Sponge Iron	0.00	0.01
Steel	0.07	0.12
Steel, tubes & pipes	0.08	0.17

Calculations based on PROWESS database, CMIE.

Appendix Table A.6

Industry	Export intensity	
Non ferrous metals	**Pre 2000 average**	**Post 2000 average**
Aluminum & aluminum products	0.15	0.27
Copper & copper products	0.02	0.27
Other non-ferrous products	0.02	0.14

Calculations based on PROWESS database, CMIE.

Appendix Table A.7

Industry	Export intensity	
Food and Beverages	**Pre 2000 average**	**Post 2000 average**
Bakery	0.04	0.00
Beer & Alcohol	0.02	0.01
Cocoa & Confectionery	0.01	0.01
Coffee	0.26	0.64
Dairy Products	0.08	0.07
Floriculture	0.10	0.37
Marine food	0.71	0.87
Milling Product	0.03	0.12
Other agro product	0.38	0.32
Poultry & meat product	0.41	0.57
Processed & packaged food	0.20	0.34
Starch	0.03	0.06
Sugar	0.01	0.04
Tea	0.16	0.13
Tobacco	0.09	0.07
Vegetable oil and product	0.09	0.09

Calculations based on PROWESS database, CMIE.

Appendix Table A.8

Industry	Export intensity	
Textiles	**Pre 2000 average**	**Post 2000 average**
Cloth	0.18	0.16
Cotton & Blended Yarn	0.23	0.29
Other textiles	0.23	0.30
Readymade Garments	0.52	0.43
Synthetic textile	0.06	0.10
Textile Processing	0.05	0.13

Calculations based on PROWESS database, CMIE.

Appendix Table A.9

Industry	Export intensity	
Transport	**Pre 2000 average**	**Post 2000 average**
Two & three wheelers	0.04	0.04
Auto Ancillary	0.15	0.15
Commercial vehicle	0.08	0.07
Other transport equipment	0.03	0.06
Passenger cars & multiutility vehicle	0.05	0.06

Calculations based on PROWESS database, CMIE.

Table A.10 Determinants of firm level export performance (considering KI, FPTR)

	Food and Beverages	**Textiles**	**Chemical**	**Transport equipment**	**Machinery**	**Metal and metal products**
	Fixed effect results	**Fixed effect results**	**Fixed effect results**	**Fixed effect results**	**Random effect results**	**Random effect results**
SIZE	-14.00 (-0.50)	40.15 (0.79)	**.194.23*** (4.08)	**-**33.12 (-1.60)	-.0005 (-0.03)	**56.56*** (3.86)
$SIZE^2$						
AGE	.046 (0.80)	.114 (0.58)	**.594*** (7.43)	**.704*** (7.33)	.044 (0.88)	**.763*** (5.87)
IMPR	1.88 (0.04)	**.169*** (4.62)	**7.07*** (4.71)	**-20.70.4**** (-2.47)	**.051*** (3.02)	
$IMPR^2$		**-.00003*** (-4.66)		**55.4*** (1.89)	**-.00001*** (-3.00)	
FPTR	284.09 (0.26)	-40.51 (-0.20)	.181 (0.64)	**-107.12*** (-3.06)	-87.56 (-1.61)	-384.38 (-0.91)
$FPTR^2$				**123.91**** (2.06)		
KI	70.44 (1.42)	**76.87*** (3.58)	**36.76*** (4.27)	**18.96**** (1.96)	6.40 (0.96)	66.08 (1.37)
KI^2		**-51.64*** (-3.06)		**-25.7*** (-3.35)		
MKTCOST	**315.5*** (13.24)	**67.75*** (3.83)	**128.43*** (7.88)	**259.21*** (6.22)	**50.66**** (2.67)	-.030 (-0.34)
$MKTCOST^2$	**-1637.6*** (-2.98)	**-22.04*** (-3.55)	**--354.42*** (-8.60)	**-1495.85*** (-5.52)	**-152.15*** (-2.48)	
RDI	-1753.32 (-0.95)	155.91 (0.83)	**34.52*** (1.77)	142.53 (0.95)	-47.03 (0.98)	-1129.64 (-2.31)
RDI^2			**-11.5*** (-1.84)			
PDTIVITY	.0008 (0.11)	.010 (1.38)	-0.14 (-0.96)	-.1036 (-1.13)	**.011*** (1.67)	.003 (0.81)
$PDTIVITY^2$			6.31 (0.90)	.0007 (1.02)		
CRDT	.028 (1.10)	-.007 (-0.24)	-1.23 (-0.22)	**-9.51*** (-5.03)	-.0002 (-0.19)	.007 (0.54)
$CRDT^2$				**2.55*** (5.23)		
R^2 (overall)	0.10	0.003	0.002	0.16	.04	0.33
F/wald statistic	1.60•	4.28•	16.71•	35.03•	24.13••	73.93•
Hausman test Chi square	15.30**	34.40*	51.66*	60.61	9.91	3.52

Note: 1. t/z values are provided in parentheses

2. * denotes 1% level of significance, ** denotes 5% level of significance, *** denotes 10% level of significance.