

Graduating to globalisation

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Abstract

In this paper we examine the relationship between firm characteristics and the decision of the firm to sell in the domestic market, export and/or invest abroad. We find that globalisation of Indian firms through the sharp increase in exports and foreign direct investment can be explained by firm characteristics. Data for a set of more than 1600 Indian firms for 10 years shows that exporting and foreign investment are complimentary. We find that there is a hierarchy such that the weakest firms serve the domestic market, better firms export, and best firms also invest abroad. We find that the threshold for FDI is significantly higher than the threshold for exporting.

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1 Introduction

New trade theory literature uses differences in firm characteristics to explain why some firms export while others do not. This analysis has recently been extended to explain why firms invest abroad. The prediction of trade theory that some firms export while others cater only to the domestic market because they are more productive and able to afford the higher unit costs of exporting, has been extended to show that it is these firms that are able to make the transition to the next level and invest abroad. Cross-border trade and cross-border investment are explained by firm heterogeneity. Firms learn by exporting and become more productive. At some point they are able to afford the sunk costs of foreign direct investment (FDI). Empirical studies suggest support for this hypothesis in industrialised countries. In recent years there has been a sharp increase in outbound FDI from developing countries. We investigate this hypothesis for India, a developing country that has experienced dramatic increase in both exports and FDI in the last decade.

Trade liberalisation created a competitive environment for Indian firms. This competition has resulted in the growth of firms and in increase in heterogeneity of firm characteristics. In this environment more firms started exporting. We examine a data set that represents big Indian firms from the CMIE Prowess database of listed companies. Our sample consists of the set of companies in the COSPI set ¹ The data set contains ten years of firm-level data from 1998 to 2007. In 1998 our data set has 1,617 firms, in 2008 it has 2,836 firms. Thus, we observe India at a crucial phase when outbound FDI went from nearly zero to significantly high levels.

We divide our sample into 4 groups of firms. The first is the group of firms who only sell in the domestic market. The second is the group of firms who sell both in the domestic market and export and produce tradables. These firms are more productive than the first group but not productive enough to be able to afford the fixed costs of producing abroad. The third group consists of the firms which, in addition to selling at home and abroad, also invest abroad. The fourth group is the group of firms that do not export but they sell at home and invest abroad. These are firms that produce non-tradables, but are productive enough to cater to foreign markets by undertaking direct investment in those markets.

In 1998, out of 1617 firms 656 firms belonged to the first group that only catered to the domestic market, and 959 firms in our sample belonged to the second group where they were also exporting. The third group consisting of firms that also invested abroad had only one firm. Also there was only one firm in the fourth group that consisted of firms that produced for the home market and undertook foreign investment, but did not export. In other words, liberalisation and competition in Indian industry had already pushed firms to globalise by 1998 but while they had crossed the first threshold from low to high productivity, enough to start exporting, they were still to cross the next threshold where they would start investing abroad.

¹There are publicly listed companies that are traded on at least 66% of the last six months.

By 2007, 250 Indian firms crossed the next threshold and were both exporting and investing abroad. These were some of India's most productive firms producing tradables. They included computer software and automobile firms. Another set of 21 firms were now present in the fourth group, firms that produced non-tradables like electricity or paints and thus either produced for the domestic market at home or the foreign market abroad. They set up operations abroad, but had no exports. The group of firms that exported also rose by 2007. Now, only about one-third of the firms in our sample served only the domestic market. More than two-thirds of Indian firms graduated to globalisation. Over this period the aggregate exports to sales ratio of our full sample of firms had risen from 9.84% in 1998 to 17.28% in 2007. Their foreign assets to total assets had risen from 0.01% in 1998 to 1.87% in 2007.

The data reveals that once a firm graduates to globalisation it was likely to stay there. This is true both for exports and FDI. However, it is more difficult for an exporting firm to move to the next stage of investing abroad (3.3 percent chance) rather than to fall back to giving up on exports and selling in the domestic market (7 percent chance). However, once a firm is both exporting abroad and has foreign investment abroad, it is very unlikely to slip all the way back to only selling domestically. Even if it gives up on setting up production abroad, it continues to export.

One way to link globalisation of firms to productivity is to measure total factor productivity of each group of firms. There are some difficulties in measuring productivity especially at the firm level with a poor data set. First, there are different measures of productivity and the choice of one or the other suffers from subjective judgement. Second, the data required for measurement of total factor productivity such as number of workers is not available for most firms for most years in the data. Third, even when the data is available, there are significant difficulties of estimation. Moreover, productivity levels are industry specific. To obtain homogeneity of product we would need to go deep into the industry tree. This would require that in each industry we should have a sufficient number of firms in each group in our detailed industry tree. While there are a number of exporting firms, this is not the case for firms with foreign investment. Proper productivity measurement would require measurement for the 164 level industry tree. With a total of 250 firms that engaged in outbound FDI, there are not enough firms in group 3 to be able to get statistically meaningful results. Hence, we identify firm characteristics that are comparable across industries and act as proxies for productivity.

Firm characteristics of the different groups show a very distinct pattern. In the remaining analysis we drop the fourth group of 21 firms who engage in domestic sales and foreign investment as sample size is very small for most years. For the remaining three groups we look at medians for different characteristics. We find that the median size of the group engaged in FDI and exports is the biggest. The exporting firms are smaller and the firms that serve only the domestic market are the smallest. This is true whether size is measured by total assets, total sales or by gross value added. The FDI firms also engage in the maximum amount of R&D expenditure as a percent of their sales. Exporting firms

are second in terms of R&D expenditure and domestic firms are the worst. This hierarchy is true for all years.

Gross value added to total assets, a proxy for measuring the productivity of assets shows similar results but only after 2003. Further, we find that the FDI firms are the least leveraged, while the exporting firms are the most leveraged for all years.

An ordered probit model confirms that a single propensity measure explains both exports and FDI. Big values induce exports and even bigger values induce outbound FDI. Age, size, R&D and tangibility of assets determine the propensity measure.

This paper contributes to the existing empirical literature by studying the globalisation of firms in a developing country for a period when it changed sharply and visibly. The economic reforms of the 1990s ushered in greater competition into Indian industry. Increased heterogeneity and productivity led firms to seek foreign market through exports and FDI. We observe a period when globalisation of firms is underway. In this period it began and then picked up momentum, in contrast to studies of industrialised countries where the process is not new.

The rest of the paper is organised as follows. Section 2 describes the recent sharp increase in globalisation of Indian firms. Section 3 lays out the conceptual framework and reviews the literature in this field. Section 4 describes our data set, definitions and broad empirical facts. Section 5 discusses our empirical analysis and results and Section 6 concludes.

2 Exports and outbound FDI by Indian firms

There has been a sharp rise in both exports and outbound foreign direct investment by Indian firms since 2000, and exports of goods and services has nearly doubled (Figure 1). At the same time many firms have invested abroad either through acquiring foreign firms, or directly making investments abroad. As a consequence, outbound FDI by Indian companies has risen sharply in recent years. During this period rules for outbound FDI have also been relaxed allowing Indian firms to internationalise. After 2004 firms were allowed to invest upto 200 percent of their net wealth abroad. As Figure 2 shows a large number of acquisitions are being made by Indian companies abroad. The value of mergers and acquisitions by Indian firms has risen from less than USD 1 million in 2000, to USD 4.7 million in 2006.

Figure 3 shows the time-series of Indian inbound and outbound FDI. Inbound FDI has risen from near-zero levels to values of between \$4 billion and \$8 billion per quarter. This is relatively unsurprising. The surprising phenomenon is the sharp rise in *outbound* FDI, which has also exceeded \$5 billion for two recent quarters.

This paper seeks to offer insights into the phenomenon of the globalisation of Indian firms. While the phenomenon of interest is a macroeconomic one, in this paper, we harness firm

Figure 1 Exports of goods and services by India

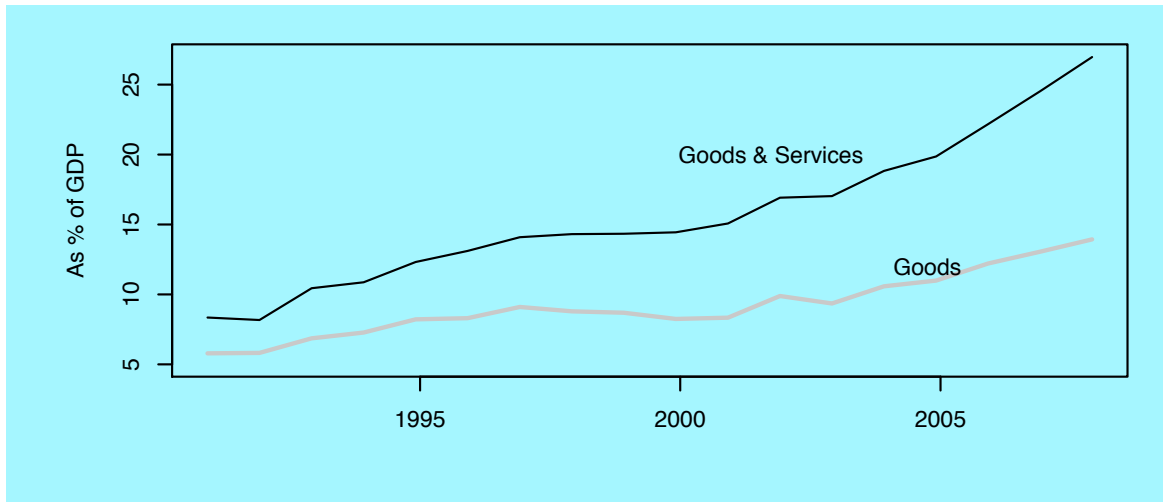


Figure 2 M&As by Indian firms

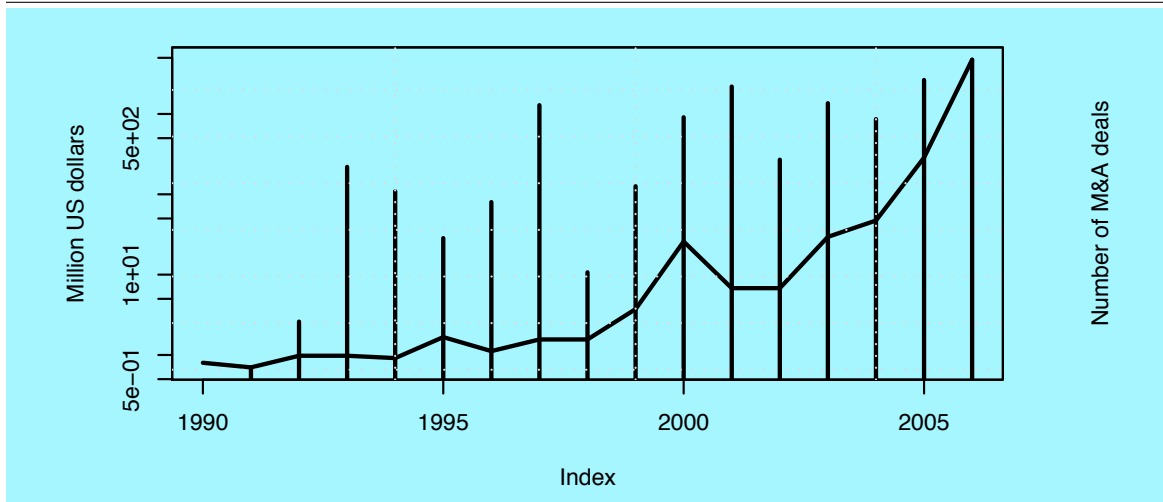
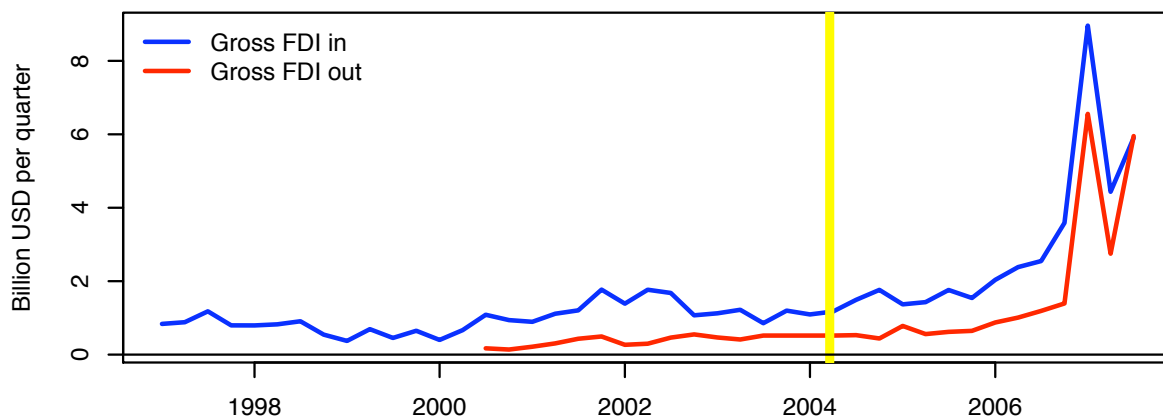


Figure 3 India's inbound and outbound FDI



level data in order to obtain insights into it.

The analysis of this paper thus additionally sheds light on a particularly important decade of India's experience, where a pronounced growth acceleration was observed, and where various metrics of international economic integration rose sharply. The behaviour of Indian firms, and particularly the internationalisation of Indian firms, constitutes an important component of understanding this decade.

3 Conceptual framework

Until recently, the study of the decision of a firm to serve foreign customers was implemented through two distinct directions: cross-border trade and cross-border investment. In recent years, a new literature has emerged, which emphasises the complementarity between export and investment decisions of heterogeneous firms.

3.1 Cross-border trade

In contrast to the New Trade Theory literature of the 1980s that assumed that all firms export, the trade literature in the 1990s has emphasised the fact not all firms export. Bernard *et al.* (1995) show that even in one industry, some firms export while others do not owing to different costs and productivity levels. Only firms with sufficiently high profits to cover the sunk costs of entering export markets are exporters. Once a firm enters an export market, there is learning by exporting. In addition, the incentives to innovate could go up

with a firm that is exporting owing to greater size, greater heterogeneity of customers and greater competition faced in diverse markets. This could result in accelerated productivity growth (Clerides *et al.*, 1998).

Greenaway and Kneller (2004) examine the evidence in the UK and find that (i) sunk costs are important, (ii) as a result of self-selection in an industry, only larger and more productive firms enter export markets and (iii) firms have to become more productive in order to continue being exporters. Wagner (2007) provides a useful survey of the empirical strategies applied, and the results produced, in 45 microeconomic studies with data from 33 countries published between 1995 and 2004 on the link between firm level exports and productivity.

3.2 Cross-border Investment

The cross-border investment literature focuses on the drivers and determinants of firms participating in international markets through investment abroad. The classical theory of international trade had implied that firm investment decisions follow the comparative advantages of different locations. Similarly, the New Trade Theory which emphasises that firms exhibit specific capabilities (e.g. with respect to technology, finance, etc) which can be successfully exploited at home as well as at foreign locations, implies that firms get involved directly in foreign activities to minimize transaction costs (e.g. securing quality standards by integrating suppliers of key components into the own firm).

A more recent and comprehensive approach to the determinants of international activities of firms combines ownership, location and internalization advantages (Dunning, 1977, 1980, 1993, 1998, 1999, 2000). This strand of the literature looks at three groups of explanatory variables. The first group contains various firm characteristics (such as endowments of human, knowledge and physical capital; specific capabilities related to marketing, organization, information processing, finance, etc; export orientation; firm size, etc) which are assets to be used at all locations where there are no superior domestic competitors (ownership-specific advantages); the next group emphasizes the importance of comparative advantages of different locations based on differences with respect to factor endowments, institutional setting, etc (location-specific advantages); and, the final group focuses on the internalising of market transactions (internalising advantages).

3.3 Complementarity of cross-border trade and investment

Why do some firms decide to export or invest abroad while others produce for domestic markets? A recent literature emphasises the role of heterogeneity amongst firms. It is assumed that firms are different in productivity, size and capital and skill intensity, which play an important role in firms participation in global markets and export decisions. For example, when the size of the foreign market increases, or the costs of exporting increases,

the conditions for foreign production and outward investment become preferable compared to exporting. When the cost of producing abroad becomes costly, then exports might be preferred (Melitz, 2003; Helpman *et al.*, 2004). Heterogeneity in productivity levels generates self-selection, as firms are faced with different costs in serving domestic and foreign markets. Only the most productive firms invest abroad. Less productive firms export, while the least productive ones serve their domestic markets. This relationship also finds support in Head and Ries (2003, 2004); Kimura and Kiyota (2004); Tomiura (2007); Girma *et al.* (2004).

Previous literature assumed that firms either became MNCs and invested abroad or remained exporter. Therefore the firms that invested abroad might be completely different from the firms that exported. Recent developments in this area added heterogeneity into the analysis. It is assumed that firms differ in productivity, size, capital and skill intensity. These play an important role in firm's participation in global markets and export decisions. Heterogeneity can be a new source of competitive advantage for firms within the same industry. Melitz (2003) and Helpman *et al.* (2004) postulate that firms serve foreign markets through export or through horizontal FDI on the basis of their productivity levels. Heterogeneity in productivity levels ensure self-selection, as firms face with different costs in serving domestic and foreign markets. Helpman *et al.* (2004) find that only the most productive firms become MNCs and invest abroad. Less productive ones start exporting, and least productive ones serve their domestic markets. Head and Ries (2003, 2004) find similar results for Japanese and US firms.

3.4 Internationalisation of firms from developing countries

The mainstream literature on FDI has focused on the setting where a developing country is the recipient. In the traditional view, countries are seen to go through five stages (from least developed to developed), in which the propensity of being a net recipient to ultimately becoming a net source of FDI evolves (Dunning, 1986; Dunning and Narula, 1996; Dunning, 1998).

In the first stage, there is likely to be very little inward and outward FDI. This is because, at this stage, there are very few country-level factors (i.e. location-specific advantages such as a sizeable market or clusters of development) that might attract inward FDI, with possible exceptions being assets such as natural resources. Local firms have not created or acquired many firm-specific advantages that might allow them to invest overseas. In the second stage, inward FDI starts to rise (because of the increase of per capita incomes and other location-specific assets), while outward FDI remains low or negligible (firms are still developing). At stage three, the rate of growth of inward FDI is expected to decline (as local firms become more competitive), and that of outward FDI to grow faster. In the fourth stage, outward FDI stock should exceed or equal the stock of inward FDI in the country. By this stage, most domestic firms are now capable of competing with foreign firms abroad as well as in their own market. Finally, at stage five, the net investment position

of a country tends to fluctuate around zero, reflecting relatively similar magnitudes of the stocks of inward and outward FDI (UNCTAD, 2006). By this logic, the outward and inward FDI position of any country is closely and directly related to its level and structure of economic development. Outward FDI is expected to be undertaken only when a country has reached a certain minimum level of development.

Structural changes in the composition of outbound investment are also an important element of these transformations. Inbound FDI is first directed to low/medium knowledge-intensive or resource based industries; later they may move into the high-technology-intensive industries, and/or more efficiency-seeking FDI takes place. Similarly, outward FDI first takes place in low-technology or resource-based industries and then in high value added activities (UNCTAD, 2006).

The rapid rise of outbound FDI from developing countries in recent years (UNCTAD, 2006) raises questions about these perspectives. The evidence indicates that countries at similar levels of development or GDP per capita display dissimilar patterns of net outbound investment per capita. This reflects different levels and patterns of industrial development, as well as the consequences of government policies. Countries such as Brazil, China, India, Mexico, South Africa and Turkey are home to leading MNCs and are investing significant amounts of FDI overseas and have begun outward FDI earlier than might be expected (UNCTAD, 2006). Other studies such as Moon and Roehl (2001); Mathews (2002); Buckley (2004); Mathews (2006); Mortimore (2005) have also pointed out that the many developing-country MNCs appear to be investing overseas at a very early stage. Further, it is argued that their sources of firm-specific or other competitive advantages seem to cover a wider range than the technological and expertise-based competencies that the prevailing theory has normally considered.

In developing countries outbound investment by firms can be driven by the small home market, competitive pressure triggered by trade liberalisation and government policies aimed at encouraging foreign expansion.

Helpman *et al.* (2004) argue that there is a hierarchy of firms sorted by productivity where more productive firms export and the most productive firms invest abroad. They find empirical evidence to support this hypothesis. Head and Ries (2003) find empirical support for the Helpman *et al.* (2004) model from Japanese firms but also suggests that these predictions can be reversed when a firm in an advanced country is investing in a low-wage country. In such a setting, the most unproductive firms may find it useful to invest in low-wage countries, thus using low wages to offset their inherent lack of productivity. When thinking about outbound FDI from a developing country, this kind of compulsion is not in the picture.

3.5 Cross border investment by Indian firms

Empirical work on the internationalisation of Indian firms has focused on outbound FDI. Explanations for Indian firms investing abroad have focused on firm characteristics such as age, size, R&D intensity and export orientation (Pradhan, 2004), strategic and knowledge based foreign assets and trade supporting infrastructure (Pradhan, 2006). Kumar (2007) finds support for the role of diffusion of imported technologies, cost effective strategies of their production processes and accumulated production experience on managerial skills.

4 Broad empirical facts

Centre for Monitoring Indian Economy (CMIE) computes a broad market index named the COSPI. This consists of all firms where there is non-zero stock market turnover on at least two-thirds of the trading days of the last six months. In February 2008, this index had 2,836 firms and a market value of Rs.59 trillion or \$1.46 trillion. Roughly speaking, this is the universe of large Indian firms. We obtain all firm-years for this set of firms available in the CMIE database from 1997-98 till 2006-07, a period of ten years.² This gives us a rich unbalanced panel dataset. Table A shows the number of firms observed in various years and in various industries in this dataset.

In 2006-07, the firms in our dataset had \$0.5 trillion in total assets – roughly half of GDP – and had exports of \$87 billion. In the first year of our dataset (1997-98), these firms accounted for 30.1% of India’s exports of goods and services.³ In 2006-07, this fraction had risen to 37.9% of India’s exports. While the overall exports of goods and services from India had grown by 18.65% per year (measured in rupees), the exports of goods and services by the firms in this dataset had grown by 21.4%.

Following the methodology in Head and Ries (2003) who investigate productivity and internationalisation of Japanese firms, we divide firms into 4 groups:

D A purely domestic firm;

DX A firm that produces domestically for both the home country and foreign markets through exports;

DXI A firm that serves foreign customers by exporting and by producing in their country (i.e. through outbound FDI);

DI A firm that serves foreign customers by producing in their country only.

²Two kinds of restrictions were applied in constructing the dataset. Capital controls prevent the export of financial services from India, hence we restrict ourselves to the non-financial firms in the COSPI set. Firm-years where sales or assets were below Rs.10 million are dropped.

³This is estimated by summing the following entries from BOP statistics: merchandise exports, travel earnings, transportation earnings, insurance earnings, miscellaneous earnings.

Table 1 Count of firms classified into four categories

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	Sum
D	656	696	761	741	735	730	750	735	744	677	7225
DI	1	1	4	6	13	16	20	24	22	21	128
DX	959	1003	1013	1009	972	1028	1042	1058	1076	1070	10230
DXI	1	3	23	87	129	147	170	196	233	250	1239
Sum	1617	1703	1801	1843	1849	1921	1982	2013	2075	2018	18822

The '**D**' firms are generally firms that have been shielded from trade competition by virtue of production of relatively non-tradeable goods such as electricity, natural gas or telecommunications services. ⁴

The **DX** are firms that produce tradeables such as steel or petroleum products. For these firms, India is a low-wage production site. While transportation costs from India to markets that are located physically far away are large, these firms have sufficiently high productivity to be able to overcome this friction and are exporting. ⁵

DXI firms are the firms which are exporting and investing outside the country. Production at locations across the world helps avoid the costs of transportation costs suffered when producing in India and serving foreign customers. While producing abroad involves large fixed costs, and induces the use of higher-cost labour than is found in India, these firms have a large enough edge in productivity that they are able to overcome this. ⁶

Finally, there are **DI** firms. The big firms of this set are engaged in production of non-tradeables such as electricity or paint, but have embarked on outbound FDI as a way to serve foreign customers. This decision is based on a belief that the firm is a high productivity firm by international standards. ⁷

Table 1 shows counts of firms falling into the four categories in all years. The striking fact seen in the table is the rarity of **DI** firms: in 2006-07 there were just 21 of them in a dataset of 2018 firms. With only 21 firms in this category, any statistical estimation would be imprecise. Hence, we drop the firms in this category in the remaining analysis.

The tiny number of **DI** firms is consistent with the argument that firms progress to outbound FDI through a stage of first exporting. There is a hierarchy from **D** \rightarrow **DX** \rightarrow **DXI**; it is hard for firms to jump to outbound FDI without knowing how to export.

Table 2 Exports by Indian firms

Year	Exports	Sales	X/S (%)
1998	500.32	5086.97	9.84
1999	515.42	5635.61	9.15
2000	589.94	6699.18	8.81
2001	756.78	7804.03	9.70
2002	830.22	8051.02	10.31
2003	1031.67	9154.18	11.27
2004	1298.39	10526.68	12.33
2005	1977.22	13181.95	15.00
2006	2431.55	15793.82	15.40
2007	3476.69	20114.06	17.28

4.1 Exports and investment at the firm level

Table 2 aggregates the exports and sales of the firms of our dataset. While nominal sales grew by 14.7% per year on average over this period, exports grew even faster at an average rate of 21.4% per year. This gave a sharp rise in the exports-to-sales ratio, from 9.84% in 1998 to 17.28% in 2007. The decade under examination was one where the firms made considerable progress on outward orientation.

From Table 1 we can see that the number of exporting firms has risen from 960 in 1998 to 1320, while the number of non-exporting firms has been broadly stable, going from 657 to 698. This suggests that the exports growth of 21.4% per year on average was obtained by an intensification and enlargement of exports by exporting firms.⁸

At the same time, some firms have built up very large positions abroad. For example, Tata Tea has 52.4% of total assets outside the country in 2006-07. Other firms have more modest positions: e.g. Infosys has 1.64% of total assets outside the country in 2006-07, and this number has actually dropped when compared with the situation in 2001-02.⁹

Table 3 sums up the foreign assets of all the firms in our dataset. This number went up dramatically from Rs.0.56 billion in 1997-98 to Rs.387.87 billion (roughly \$10 billion) in 2006-07. The total assets of these firms also rose sharply: this tripled in a decade. The sum of foreign investments of the firms stood at 1.87% of the sum of total assets of the

⁴Appendix B shows the biggest ten **D** firms in India in 2007.

⁵Appendix C shows the biggest ten **DX** firms in India in 2007.

⁶Appendix D shows the biggest ten **DXI** firms in India in 2007.

⁷Appendix E shows the biggest ten **DI** firms in India in 2007.

⁸Appendix F shows the evolution of the exports-to-sales ratio across industries. In 2006-07, this ranges from low values like 0.38% for a non-tradeable like electricity to 33.14% for non-financial services. By 2006-07, all industries except three (electricity, transport equipment and ‘diversified’) had exports to sales ratios that were above 10%.

⁹Appendix G and Appendix H show how the foreign asset position of some well known Indian firms has evolved over time

Table 3 Foreign assets of Indian firms

Year	For. inv.	Total Assets	FI/TA (%)
1998	0.56	6526.31	0.01
1999	3.42	7136.94	0.05
2000	8.74	7712.96	0.11
2001	82.18	8426.56	0.98
2002	105.02	9190.19	1.14
2003	127.48	10230.08	1.25
2004	123.66	11451.36	1.08
2005	165.45	13438.72	1.23
2006	245.06	16267.77	1.51
2007	387.87	20790.48	1.87

Table 4 Transition probabilities across firm categories

	D	DX	DXI
D	86.45	13.33	0.23
DX	7.08	89.62	3.30
DXI	0.32	8.47	91.22

firms in 2006-07. ¹⁰

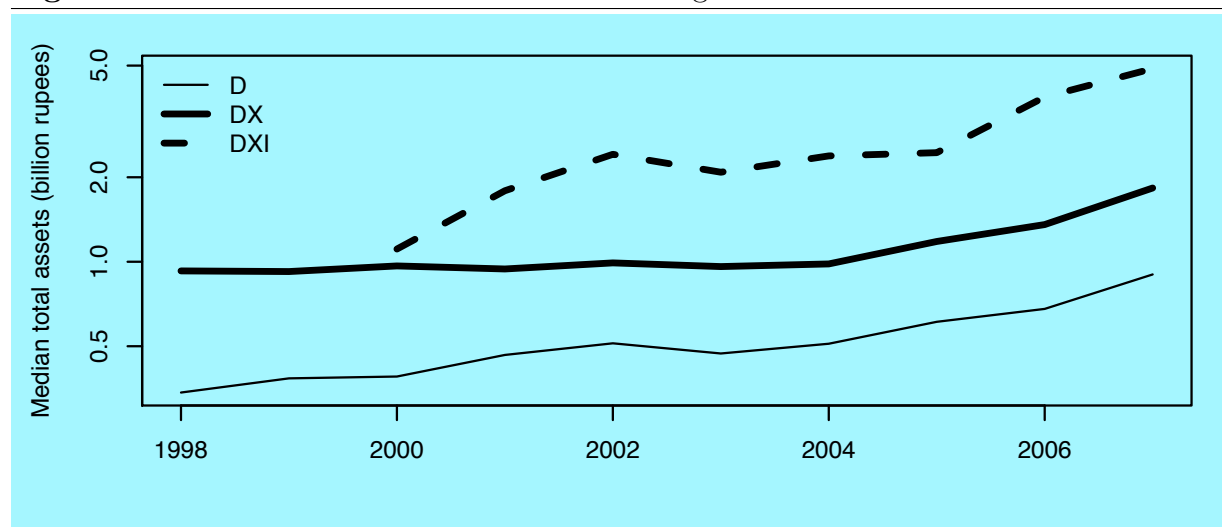
4.2 Transitions between categories

Table 4 shows the transition probability matrix for firms across the three categories. Each row of this matrix shows transition probabilities from the stated category at time t to all possible categories at time $t + 1$.

There is significant on-diagonal mass. Firms do not seem to fluctuate around; there is an 86 / 90 / 91 percent chance of staying in a given state. For a firm starting in the **D** state, there is a 13.33% chance of graduating to exporting in the next year, and only a 0.23% chance of graduating to both exporting and outbound FDI in the next year. Conversely, once a firm is in **DXI**, there is an 8.47% chance of dropping down to **DX** (with only exports), but a tiny 0.32% chance of dropping down to **D**.

While these transition probabilities show the forward motion of firms graduating to globalisation, reversals also do occur. There is a 7.08% probability of a **DX** dropping back to a **D**, and a 8.47% probability of a **DXI** dropping back to a **DX**.

Figure 4 Median assets of firms in the three categories



4.3 Characteristics of firms in the three categories

We now embark on a broad understanding of the firm characteristics in the three categories **D**, **DX** and **DXI**. Figure 4 shows the median value of total assets in each category in all years. While firm size has risen sharply in all three categories, there is a clear hierarchy where the biggest firms are found in **DXI**, smaller firms are found in **DX** and the smallest firms are **D**. This ordering holds in all the years.¹¹

Figure 5 shows the median revenues of firms in the three categories. This also shows the same pattern, where the biggest firms are **DXI**, smaller firms are **DX** and the smallest firms are **D**.

The value added by a firm is generally a better reflection of firm size rather than sales. Figure 6 shows the median value added of firms in the three categories. This also shows the same pattern. Thus, whether we measure size by total assets, sales or value added, the identical ordering is found in all years, with the biggest firms being **DXI**, smaller firms being **DX** and the smallest firms being **D**.

Figure 7 shows the ratio of R&D expenses to sales. This ratio is believed to convey investments into technological sophistication which is expected to be linked to productivity. Here also, a clear pattern is seen: firms with the highest R&D to sales ratio are **DXI**; lower values are **DX** and the smallest values are **D**. A fascinating feature of this graph is that the differences between the three groups appear to be diverging through time. In 1997-98,

¹⁰Appendix I shows the evolution of the foreign assets to total assets ratio across industries. In 2006-07, this ranges from low values like 0.25% for a non-tradeable like electricity to 4.95% for non-financial services.

¹¹Early values are now shown for **DXI** because there were below 20 firms in that category.

Figure 5 Median sales of firms in the three categories

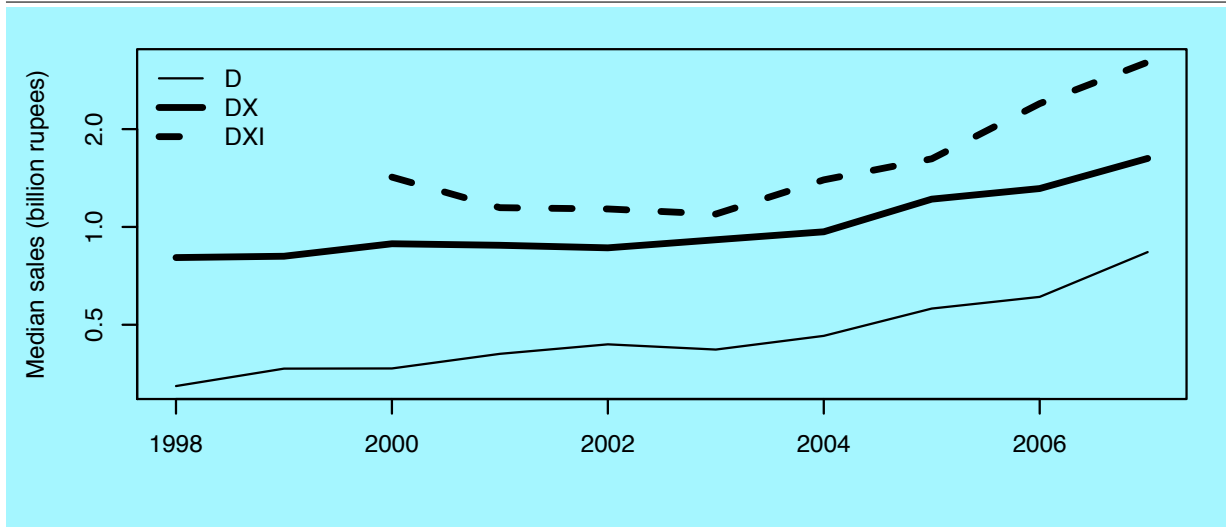


Figure 6 Median gross value added (GVA) in the three categories

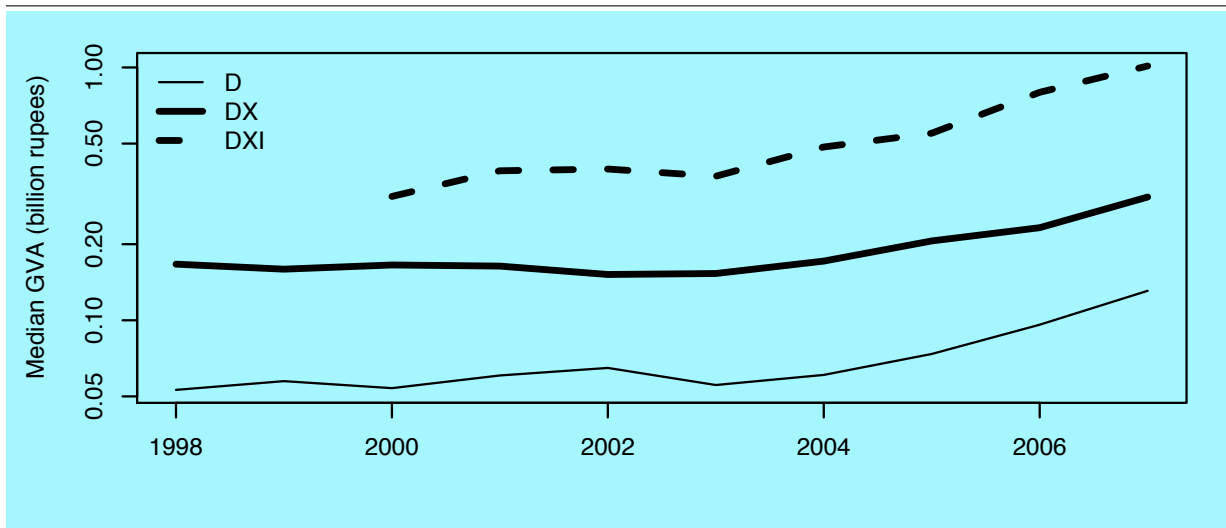
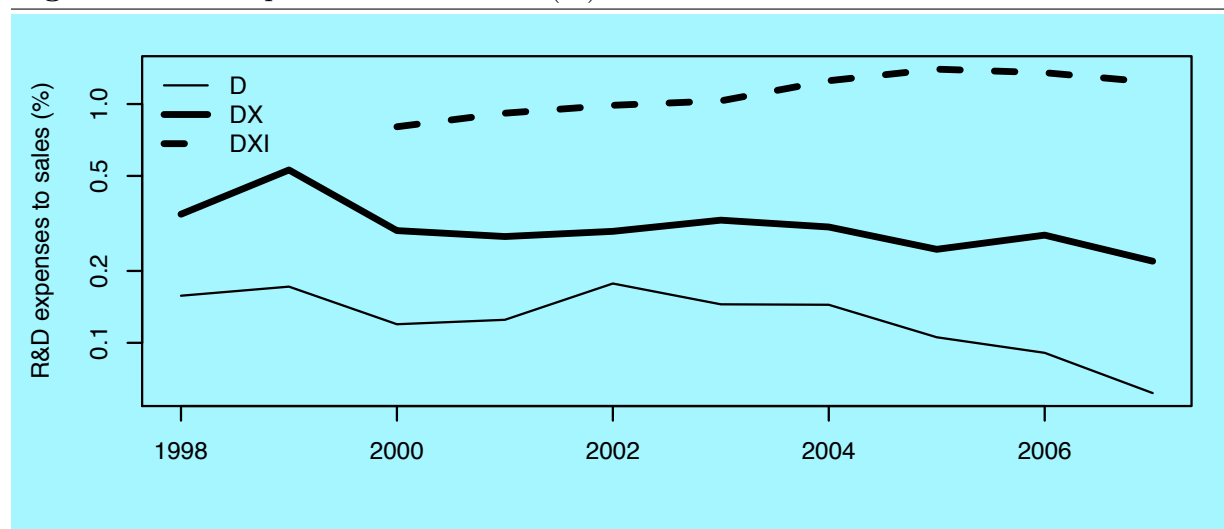


Figure 7 R&D expenses to sales ratio (%)



the three values were 0.9, 0.35 and 0.18. By 2006-07, the **DXI** value had risen to 1%, but the other two categories had dropped to 0.2% and 0.05%.

Figure 8 shows the output per total assets ratio for the three groups. After 2003, a separation has opened up where **DXI** firms have the highest output per unit total assets, **DX** firms are second and **D** firms have the lowest value. While this could reflect productivity differences, it also reflects differences in industries: **D** firms tend to be in more capital-intensive industries.

Finally, Figure 9 shows that **DXI** firms have the lowest leverage. This may reflect the lack of tangibility of their assets, and the difficulties of the Indian debt market which has emphasised loans against tangible collateral. From 2000 onwards, leverage of this group has risen, but there is still less leverage than the other two groups. This could also reflect the greater comfort of the equity market, and thus access to adequate equity financing, for the **DXI** firms.

5 Explaining the D - DX - DXI progression

In terms of modeling, one clear possibility is to define one dummy variable for firms that export, and another dummy variable for firms that do outbound FDI, and estimate either separate probit models for these two or to do a bivariate probit model for the two jointly. However, these strategies do not express the intuition that there is a *hierarchy* where firm characteristics that appear to be related to productivity push firms along from **D** to **DX** to **DXI**.

Figure 8 Output per unit assets

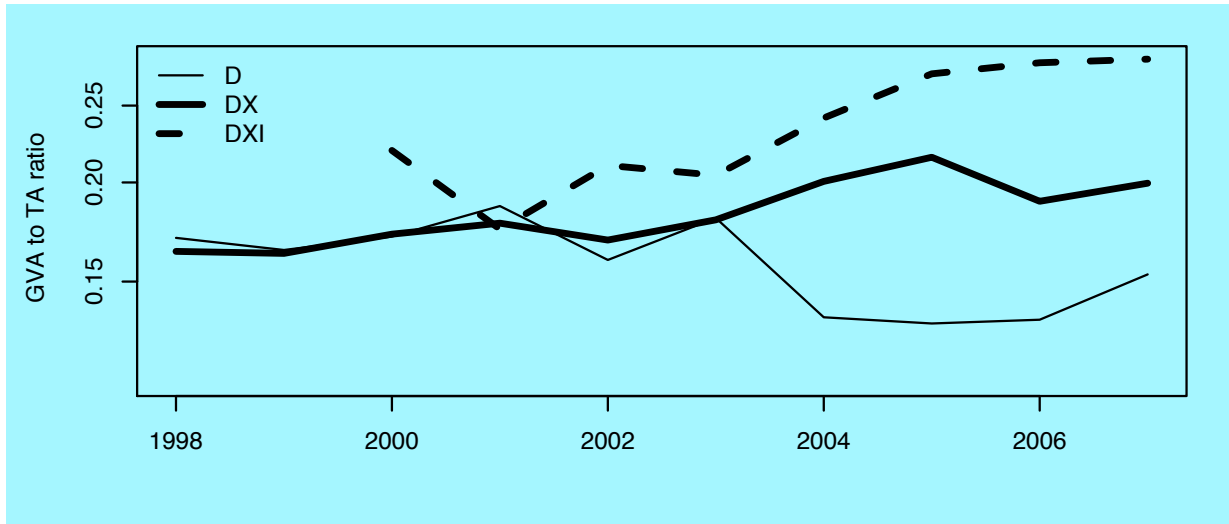
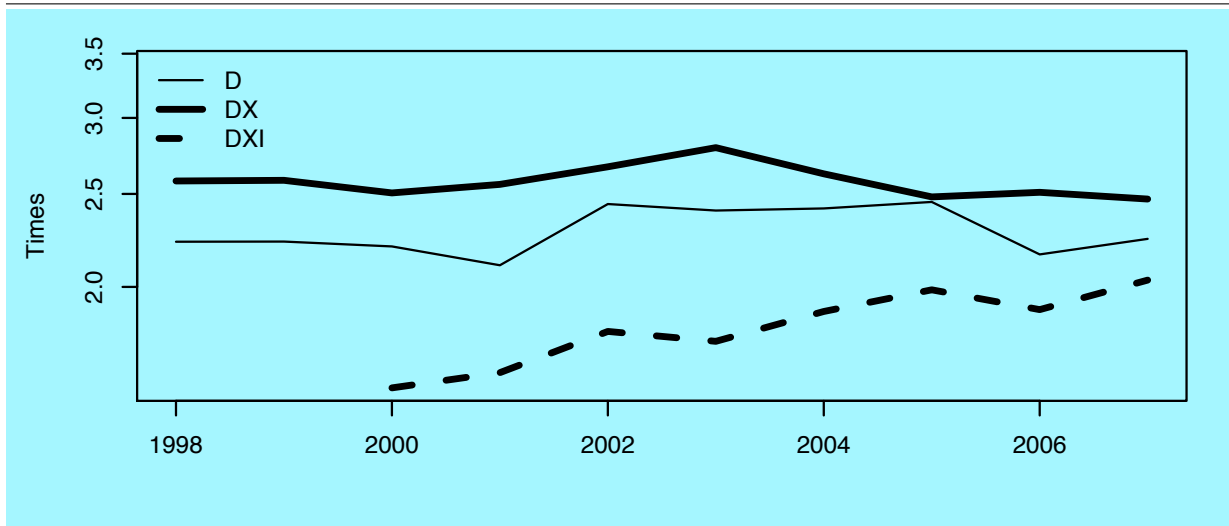


Figure 9 Leverage (total assets per net worth)



Hence, we define an ordering (1, 2, 3) for these three categories and estimate an ordered probit model. This involves a latent variable y^* :

$$y^* = \beta'X + u \quad u \sim N(0, 1)$$

and a pair of cutoffs (τ_1, τ_2) . When $y^* < \tau_1$, this predicts **D**. When $\tau_1 < y^* < \tau_2$, the model predicts **DX**. When $\tau_2 < y^*$, the model predict **DXI**. The parameter vector (β, τ) is estimated by maximum likelihood.

In this model, $y^* = \beta'X$ is the single propensity measure. Big values induce exports and bigger values induce outbound FDI also.

A key facet of the estimation is the parameters (τ_1, τ_2) . The data could reject the model by giving τ values which are smeared together. If, on the other hand, we are able to clearly see $\tau_2 > \tau_1$ then it reinforces our conceptual framework of y^* as being the propensity for firms to first export and then to go on to outbound FDI.

The estimation results are significantly affected by extreme values and nonlinearities. Many accounting variables have extreme values. As an example, in this dataset, the return on equity ranges from -32900% to 118500%. In order to address this, we do ‘winsorisation’ for such variables, which involves clipping the distribution to the (.01, .99) quantiles. Nonlinearities of response are modeled by using orthogonal polynomials in the estimation.

Table 5 shows estimates for the full dataset. There are five key explanatory variables, all of which have fourth degree orthogonal polynomials. These include two measures of size: log total assets and gross value added. Asset tangibility matters, and this is measured by the ratio of gross fixed assets upon total assets. The last two explanatory variables are the year of incorporation and the ratio of R&D expenses to sales. Finally, a dummy variable for above-median return on equity is in the model.

As Table 5 shows, $\hat{\tau} = (-0.29, 1.66)$ and the estimates have t statistics of -22 and 93 respectively. Figure 10 shows that the distribution of the two taus do not overlap at all. This supports the idea of a hierarchy from **D** to **DX** to **DXI**. This gives us a sense of scale for interpreting y^* values. A shift in y^* of 2 shifts a firm from the threshold of exporting to the threshold of outbound FDI.

The two measures of size that we use in the model are total assets and gross value added. In the case of size, the propensity to export and do outbound FDI increases gradually as size grows, until a size of Rs.10 billion of total assets. Beyond this, there is a surprising and strong fall off. The biggest firms in India, measured by total assets, are much less internationally oriented. This falloff is not found with gross value added as a measure of size: bigger firms have a bigger propensity all the way to the biggest values of GVA in the dataset.

Asset tangibility also has a surprising result. The biggest propensity is found where gross fixed assets are roughly 30% of total assets. Beyond that, bigger values for gross fixed

Table 5 Ordered probit estimates for full dataset

	Value	Std. Error	t value
poly(lta, polyterms)1	28.43	2.12	13.39
poly(lta, polyterms)2	-26.27	2.41	-10.90
poly(lta, polyterms)3	-18.78	2.01	-9.33
poly(lta, polyterms)4	-8.27	1.65	-5.03
poly(year.of.incorporation, polyterms)1	8.23	1.29	6.36
poly(year.of.incorporation, polyterms)2	-1.21	1.21	-1.00
poly(year.of.incorporation, polyterms)3	-7.34	1.18	-6.20
poly(year.of.incorporation, polyterms)4	0.80	1.19	0.67
poly(w.rnd.to.sales, polyterms)1	21.33	1.20	17.81
poly(w.rnd.to.sales, polyterms)2	-7.17	1.21	-5.91
poly(w.rnd.to.sales, polyterms)3	6.54	1.19	5.50
poly(w.rnd.to.sales, polyterms)4	-3.29	1.19	-2.76
poly(gva, polyterms)1	25.58	3.19	8.01
poly(gva, polyterms)2	-7.34	1.66	-4.41
poly(gva, polyterms)3	4.26	1.44	2.97
poly(gva, polyterms)4	-2.42	1.34	-1.81
poly(w.gfa.to.ta, polyterms)1	-12.45	1.22	-10.20
poly(w.gfa.to.ta, polyterms)2	-10.88	1.24	-8.79
poly(w.gfa.to.ta, polyterms)3	6.66	1.24	5.35
poly(w.gfa.to.ta, polyterms)4	-7.36	1.22	-6.04
more.profitableTRUE	0.05	0.02	2.71
D DX	-0.29	0.01	-22.23
DX DXI	1.66	0.02	92.78
logLikelihood	-15239.90		
AIC	30525.81		
N	18694.00		
Prediction accuracy	59.10		

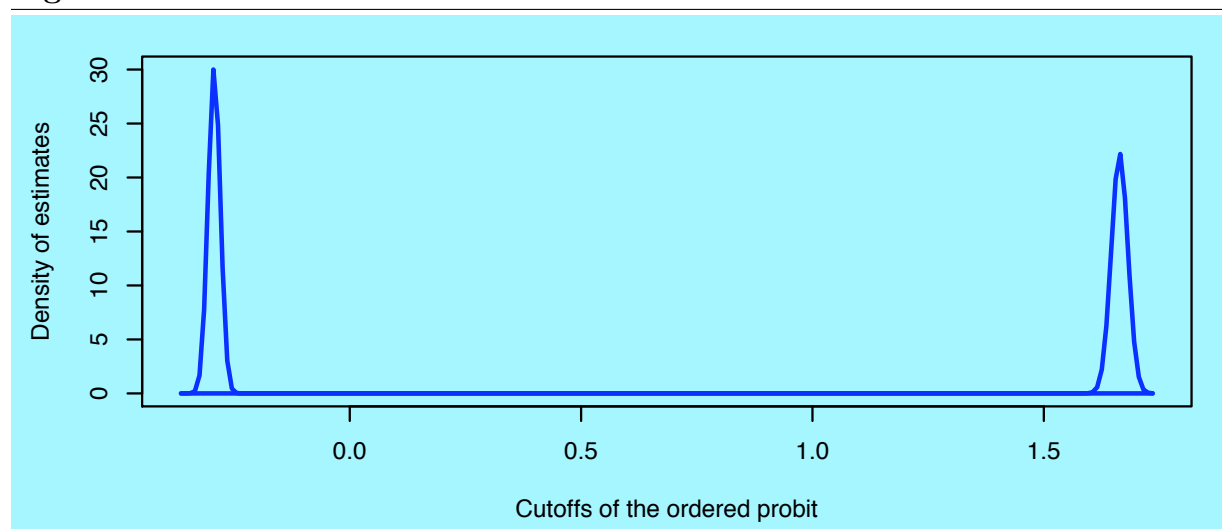
Figure 10 Distribution of estimated $\hat{\tau}$ 

Figure 11 Response to total assets

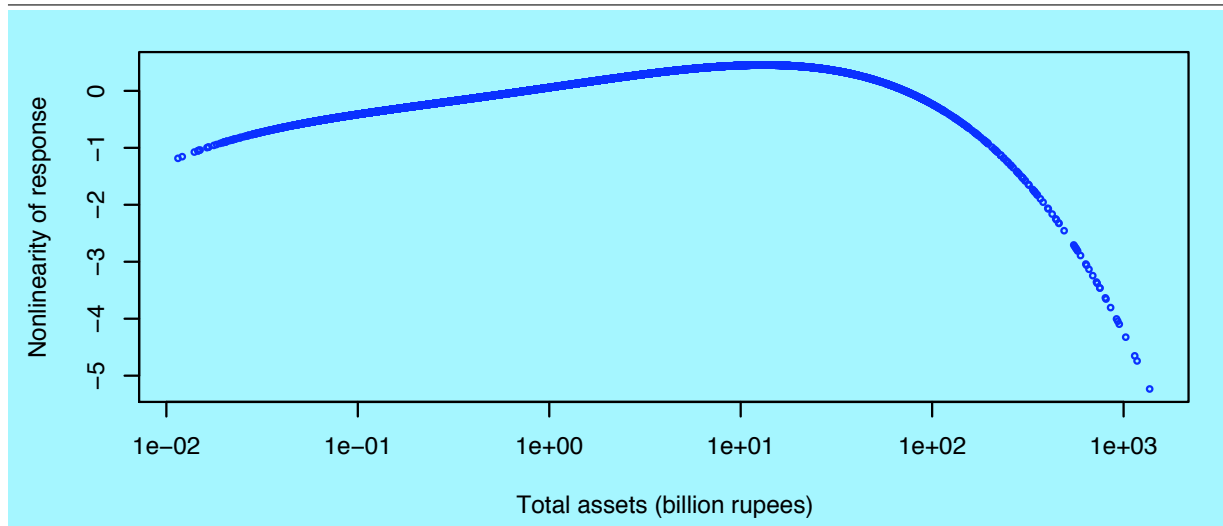


Figure 12 Response to gross value added

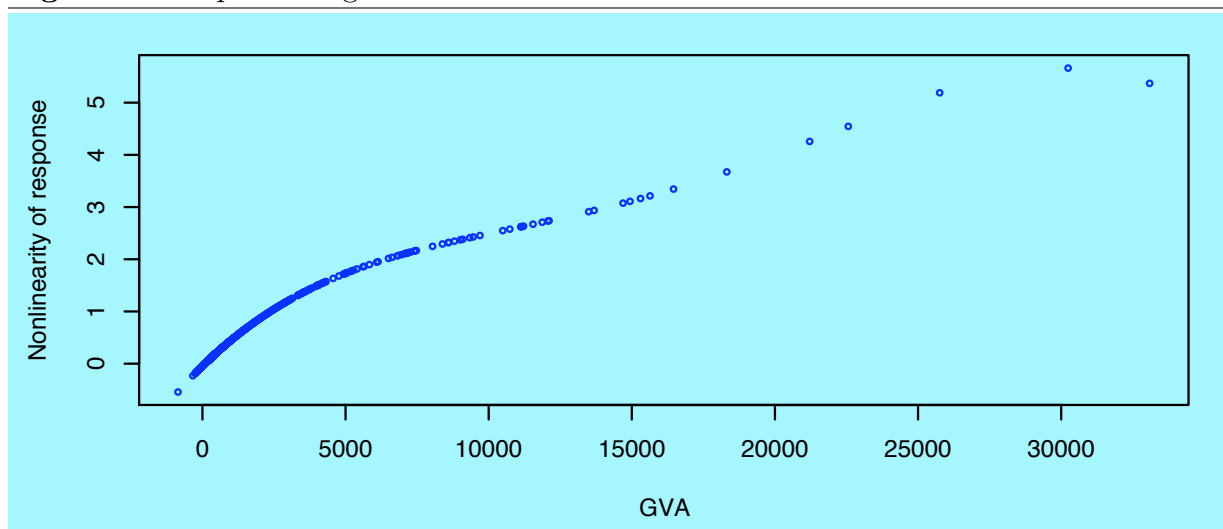
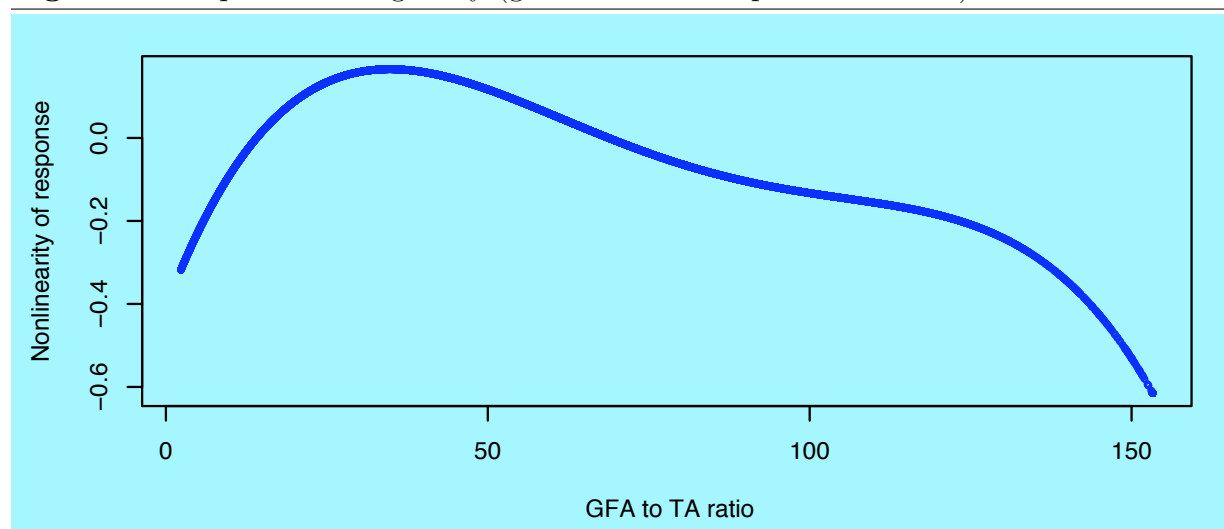


Figure 13 Response to tangibility (gross fixed assets per total assets)



assets are associated with lower propensities to export and to do outbound FDI.

These results may be related to the fact that the most productive Indian firms have tended to be in areas such as computer software, where output is large, while total assets are low, and asset tangibility is low.

Figure 14 shows the response to the ratio of R&D expenses to sales. At first, y^* goes up by 0.4 when this ratio goes from 0% to 2%. Beyond this, values of beyond 4% till the highest values seen in the data (of 6%) generate an additional response of 0.4

Figure 15 shows the response to the year of incorporation. There is a surprising result here in that very old firms have a much greater propensity for internationalisation. The lowest values are seen with firms that were incorporated between 1900 and 1920.

While these results pertain to the full dataset, similar results are obtained when this model is estimated on separate datasets, one for each industry. The advantage of the pooled estimation lies in allowing us see the economic implication of financial measures which are generic across industries, such as the ratio of R&D to sales.

The relationships seen in the model can be interpreted as productivity measures. Hence, these results are broadly supportive of the HMY model.

6 Conclusion

Firm characteristics of Indian firms either exporting or investing abroad show a distinct pattern. More productive firms appear to be driving both developments: more productive

Figure 14 Response to R&D expenses to sales ratio

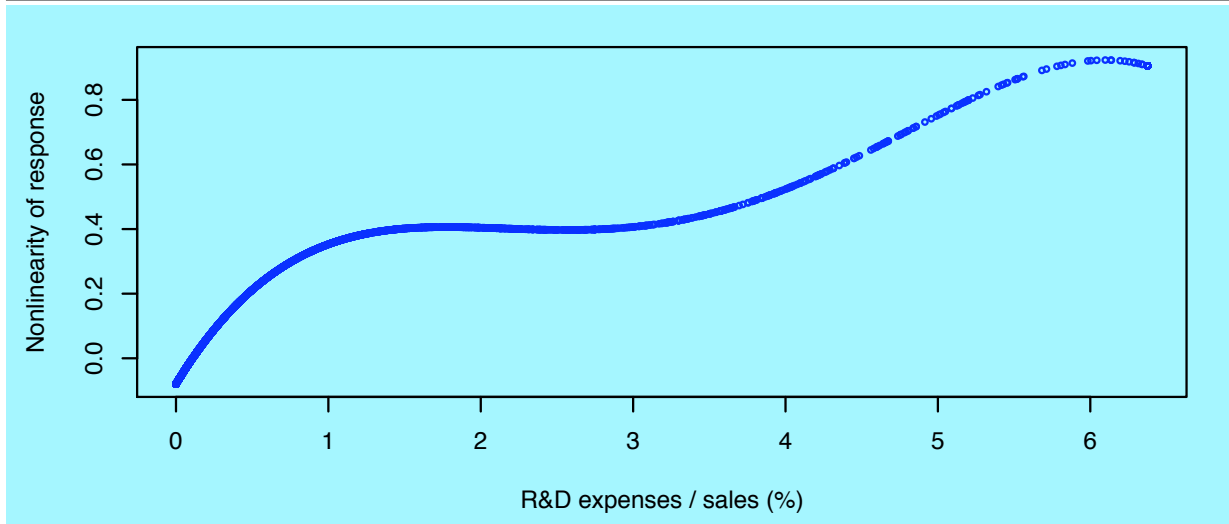
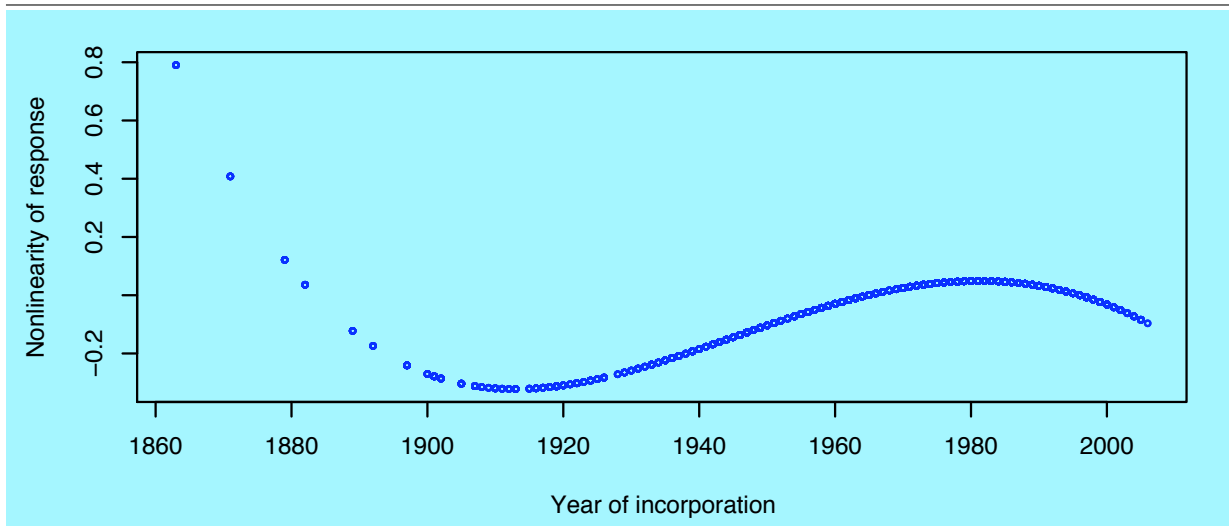


Figure 15 Response to year of incorporation



firms export and the most productive firms do outbound FDI. Further, there appears to be a hierarchy where firms go from autarky to exporting to outbound FDI and a unified model of both phenomena. Our work supports the Helpman *et al.* (2004) hypothesis that explains globalisation of firms in terms of both exports and FDI based on characteristics of heterogeneous firms. This paper contributes to the literature by examining evidence in the case of a developing country India which is at an early stage of the investment development path but has seen a sharp globalisation of its firms. The period under consideration was one in which there was an increase in competition among firms leading to an increase in firm heterogeneity.

Future work in this area should include improvements in measurement of productivity. As more and more firms globalise and the number of firms in each industry sub-group increase, such analysis will become feasible.

A Number of firms in each industry group

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Chemicals	371	382	392	390	388	406	415	416	426	417
Construction	67	73	77	77	81	90	91	96	104	105
Diversified	26	25	24	26	24	25	24	25	24	23
Electricity	9	8	10	11	12	12	15	15	15	15
Food	129	133	137	139	137	142	151	155	157	152
Machinery	219	228	234	236	242	245	239	244	247	235
Metals	138	149	152	145	151	155	163	170	175	173
Mining	15	16	17	17	14	15	15	17	17	15
MiscManuf	69	71	74	74	72	79	81	78	84	84
NonFinServ	215	254	309	341	351	362	385	392	413	395
NonMetalMin	81	88	90	91	92	91	96	98	98	98
Textiles	180	178	184	191	183	194	201	203	205	200
TransportEq	98	98	101	105	102	105	106	104	110	106
Sum	1617	1703	1801	1843	1849	1921	1982	2013	2075	2018

B Gross value added of top ten D group firms

Firm	Gross_Value_Added
Container Corpn. Of India Ltd.	952.11
Shipping Corpn. Of India Ltd.	1369.06
Neyveli Lignite Corpn. Ltd.	1438.89
Chennai Petroleum Corpn. Ltd.	1464.16
Unitech Ltd.	1475.02
Mahanagar Telephone Nigam Ltd.	2803.76
N M D C Ltd.	3393.02
G A I L (India) Ltd.	3559.67
Power Grid Corpn. Of India Ltd.	3727.95
N T P C Ltd.	11549.00

C Gross value added of top ten DX group firms

Firm	Gross_Value_Added
I T C Ltd.	4990.62
Bharat Petroleum Corpn. Ltd.	5049.45
Reliance Communications Ltd.	5399.74
Bharat Heavy Electricals Ltd.	5648.65
Hindustan Zinc Ltd.	6841.52
Bharti Airtel Ltd.	8383.78
Steel Authority Of India Ltd.	15304.77
Indian Oil Corpn. Ltd.	16457.74
Reliance Industries Ltd.	22562.97
Oil & Natural Gas Corpn. Ltd.	33091.63

D Gross value added of top ten DXI group firms

Firm	Gross_Value_Added
H C L Technologies Ltd.	2072.97
Mahindra & Mahindra Ltd.	2276.12
Grasim Industries Ltd.	3077.70
Larsen & Toubro Ltd.	3472.00
Tata Motors Ltd.	4201.54
Satyam Computer Services Ltd.	5277.01
Tata Steel Ltd.	8804.57
Wipro Ltd.	9339.30
Infosys Technologies Ltd.	10737.88
Tata Consultancy Services Ltd.	11870.35

E Gross value added of top ten DI group firms

Firm	Gross_Value_Added
Chowgule Steamships Ltd.	27.93
Reliance Industrial Infrastructure Ltd.	32.24
Venus Remedies Ltd.	44.19
Sical Logistics Ltd.	91.13
Berger Paints India Ltd.	192.46
Balmer Lawrie & Co. Ltd.	193.98
Kansai Nerolac Paints Ltd.	254.29
Asian Paints Ltd.	638.11
United Spirits Ltd.	639.71
Reliance Energy Ltd.	972.84

F Ratio of exports to sales by industry

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Chemicals	5.33	4.91	4.79	5.98	6.99	7.78	8.84	10.89	12.33	15.02
Construction	14.57	13.10	13.67	12.38	11.16	13.43	10.11	14.04	11.89	11.41
Diversified	11.05	9.24	9.47	10.64	9.68	10.01	10.29	10.04	8.48	7.84
Electricity	0.32	0.23	0.84	0.40	0.51	0.28	0.20	0.32	0.33	0.38
Food	11.96	8.64	7.31	7.68	8.52	9.03	8.84	8.96	9.75	10.26
Machinery	6.67	5.96	6.16	7.29	9.26	8.22	9.72	9.56	9.25	10.91
Metals	10.90	8.66	11.07	10.28	11.20	16.36	15.50	19.40	20.06	23.41
Mining	3.29	6.35	2.72	3.08	2.39	2.75	3.47	4.77	7.68	10.76
MiscManuf	11.23	11.91	10.61	10.04	10.03	12.07	11.61	13.14	12.56	13.95
NonFinServ	26.90	25.79	25.33	30.56	30.51	31.24	32.00	36.33	34.05	33.14
NonMetalMin	15.01	15.43	15.77	14.02	14.79	18.91	22.74	25.70	25.82	22.58
Textiles	25.06	24.54	23.17	24.72	24.93	25.64	25.31	27.38	27.19	29.35
TransportEq	6.35	6.42	5.02	5.23	4.42	5.96	6.80	7.68	8.09	8.61

G Outbound FDI (Rs bl)

	Tata Tea	Ranbaxy	Tata Steel	Infosys
1998	0.00	0.00	0.00	0.00
1999	0.00	2.36	0.00	0.00
2000	0.00	2.33	0.00	0.00
2001	4.41	2.66	0.00	0.00
2002	5.07	2.33	0.02	0.67
2003	5.07	2.33	0.02	0.54
2004	5.12	2.33	0.03	1.01
2005	5.01	5.73	1.52	1.50
2006	5.12	6.62	9.73	1.81
2007	14.28	25.59	10.46	2.13

H Outbound FDI (percent of total assets)

	Tata Tea	Ranbaxy	Tata Steel	Infosys
1998	0.00	0.00	0.00	0.00
1999	0.00	10.81	0.00	0.00
2000	0.00	10.41	0.00	0.00
2001	32.94	11.13	0.00	0.00
2002	35.63	9.24	0.01	2.63
2003	34.43	8.14	0.01	1.51
2004	35.75	6.36	0.02	2.03
2005	32.53	13.52	0.91	2.28
2006	30.06	13.65	5.05	1.99
2007	52.43	36.14	3.26	1.64

I Foreign investment as a percent of total assets by industry

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Chemicals	0.01	0.15	0.16	0.45	0.74	0.65	1.11	1.16	1.41	2.06
Construction	0.02	0.02	0.08	0.24	0.16	0.20	0.20	0.19	1.46	1.68
Diversified	0.00	0.00	0.02	0.29	0.40	0.50	0.50	0.38	0.31	0.25
Electricity	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28
Food	0.00	0.03	0.03	1.56	1.56	1.56	1.38	1.22	1.39	2.60
Machinery	0.00	0.00	0.05	0.22	0.30	0.33	0.30	0.37	0.58	0.84
Metals	0.00	0.00	0.00	0.03	0.33	0.51	0.51	0.62	1.01	0.64
Mining	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.12	0.17
MiscManuf	0.00	0.00	0.03	0.08	0.13	0.12	0.08	0.32	0.59	0.90
NonFinServ	0.02	0.02	0.47	5.74	5.94	6.70	4.25	4.76	4.75	4.95
NonMetalMin	0.03	0.08	0.13	0.09	0.32	0.31	0.35	0.40	1.08	1.24
Textiles	0.01	0.00	0.02	0.28	0.18	0.40	0.41	0.36	0.52	1.02
TransportEq	0.00	0.00	0.01	0.06	0.06	0.07	0.70	0.76	1.26	1.67

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