Foreign Multinationals and Domestic Enterprises: Comparison of their Technological and other Characteristics in the Indian Machinery Industry

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Abstract

The objective of this paper is to empirically examine the differences in technological and other characteristics of two ownership groups of firms, foreign multinational enterprises (FMEs) and domestic enterprises (DEs) in the Indian machinery industry (IMI) during the period 2000/01 to 2006/07 in which FMEs enjoyed level playing field vis a vis DEs and India became the second most attractive destination for inward foreign direct investment (FDI). We apply three alternative techniques for comparison: univariate mean value (of a variable) method, the multivariate linear discriminants analysis (LDA) and dichotomous logit and probit models. The significant findings of the study are that FMEs exhibit greater technical efficiency (TE), firm size (SZ), export intensity (XI), intensity to import intermediate goods (IMIG) and intensity to import disembodied technology (IMDT) but the lower advertisement and marketing intensity (AMI) and financial leverage (LEV). However, choice of techniques (CAPI), research and development intensity (RDI), gross profit margin (GPM) and firm-specific index of market concentration (IMC) do not differ between the two ownership groups. The study has two major implications for IMI: first, FDI has led to higher efficiency in resources use rather than creating monopoly profit (by raising price) for FMEs; secondly, FMEs tend to spend more on imported technology but do not spend more on in-house R&D.

Keywords: foreign multinationals enterprises, domestic enterprises, FDI, Indian machinery industry, linear discriminants analysis, probit/logit model

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1. Introduction

The issue of divergence in the characteristics of FMEs and DEs has considerable importance for the policy and decision makers in the host developing countries and for the researchers interested in the study of multinational enterprises (MNEs), a major vehicle of FDI. If FMEs and DEs do not differ significantly, efforts to attract FDI and the study of MNEs as a separate field of enquiry would be largely futile. Main reasons for the recent interest in this topic is that the governments' world over are promoting FDI and associated activities of MNEs in their respective countries. The decade of 1990s and the first decade of the 2000s have particularly witnessed sharp increase in the number of regulatory changes favouring FDI and international investment agreements (e.g. bilateral investment and double tax avoidance treaties) in developing and developed countries alike (UNCTAD 2009, Chapter-1). Some countries even offer concessions and incentives (e.g. tax rebates and tax holidays, assured return on investment, government guarantees) for promoting FDI (Kobrin 2005).

The efforts undertaken by Government of India (GoI) since the onset of economic reforms in 1991 in the form of deregulation of industrial, trade and FDI policies, substantial liberalization of foreign exchange control regime and removal of trade related investment measures (TRIMs)[2] have all created level playing field for FMEs vis a vis DEs. Besides, GoI has adopted stronger intellectual property rights (IPR) regime as per trade related intellectual property rights (TRIPs) agreement administered by World Trade Organisation (WTO) for protecting the interest of foreign investors. Further, it has also entered bilateral investment treaties with increasing number of countries. GoI has of late been permitting 100 foreign equity participation in manufacturing firms, except in MSE sector, on an automatic basis with a view to "supplement domestic capital, technology and skills for accelerating economic growth" (GoI 2013, p.5). In the above background, it is important to understand the nature of differences between FMEs and DEs and the effects foreign ownership have in the Indian economy, particularly on its domestic industrial sector.

[2] Major TRIMs in past included fulfillment of technology, local content, dividend balancing and export obligations on the part of foreign firms with FDI.

FDI being an important source of stable long term equity capital and critical firm-specific assets (FSAs), which are mostly technological and managerial in nature, is viewed beneficial to the developing countries on the basis of an important strand of theoretical literature and some empirical findings that FMEs are superior to DEs in terms of their holding of FSAs and several aspects of performance derived from these FSAs such as efficiency and exports (Dunning 2000, Kobrin 2005). Therefore, locating more FMEs in the host developing economies may lead to direct benefits on account of increased number of firms with superior FSAs and performance. Besides, the presence of FMEs in the host developing economies may indirectly cause benefits to DEs through horizontal and vertical linkages and by improving their efficiency level and export performance through increased competition and knowledge spillovers (Keshari 2012, Keshari 2013, Smeet 2008).

The extant empirical literature, however, suggests that the differences in the characteristics of FMEs and DEs are: a) contextual that is country, industry and FDI specific and b) differences between FMEs and uni-national DEs do exist but not between FMEs and multinational DEs [Lall and Narula (2004), Jungnickel (2002) and Bellak (2004a)]. In view of substantially increased attractiveness of India for FDI[3] in recent years, existence of level playing field between FMEs and DEs and paucity of firm-level and industry-specific studies in the Indian context[4], this study attempts to identify major firm-specific characteristics which could discriminate between FMEs and DEs or enable a firm to fall in the category of FMEs or DEs in an industry. The major aspects of characteristics covered in this study are: nature of technology (in-house R&D, choice of technique, import of embodied and disembodied technology), product differentiation, firm size, age, financial leverage, export intensity, efficiency in the use of inputs of production and gross profit margin. We apply three alternative techniques for comparison, univariate mean value method, the multivariate linear discriminants analysis (LDA) and binary outcome probabilistic models (probit and logit) so as to know if FDI affiliations make significant difference between the characteristics of two ownership groups of firms irrespective of the methods used.

[3] India became the second most attractive destination (next to China) among MNEs for FDI in terms of A. T. Kearney's 2007 FDI Confidence Index (Global Business Policy Council 2008).

[4]To the best of my knowledge, there is only one firm level study in the recent periods comparing a few aspects of performance and conducts that is by Ray and Rahman (2006).

Rest of the study is organised as follows. Section-2 presents the analytical framework, reviews the relevant empirical literature and formulates hypotheses on individual aspects of discriminating characteristics of FMEs and DEs. Section-3 explains the industry, data sources, major characteristics of the sample and the reasons for the period selected for the study. Section-4 explains the statistical method and econometric procedures used in the study. Section-5 analyses, discuses and compares the results obtained from the use of univariate method, LDA and the estimation of probit and logit models. Section-6 presents the conclusions and implications of the study for IMI.

2. Analytical Framework and Empirical Literature,

2. 1 *Analytical Framework*

Analytical framework for the empirical analysis in this paper mainly follows a mix of the transaction cost/internalization (TCI) theory as explained in Hennart (2007) and eclectic approach of FDI as discussed in Dunning (2000). This literature along with additional literature on the subject suggests the following factors to be generally important in creating the major differences in the characteristics of FMEs and DEs. First, FMEs have privileged access to two categories of superior FSAs. The first category is named as *explicit and observable assets* that may inter alia include machinery and equipments, intellectual property rights and skilled labour. These assets can be bought or acquired by DEs from FMEs and thereby the latter may lose competitive advantage derived from these assets in a short span of time. However, the FMEs can maintain their *competitive advantage* based on *tacit and unobservable* FSA for much longer period (e.g. trade secrets, know-why, R&D capabilities, organizational and management practices, routines and culture, etc.).

Secondly, FMEs may be more flexible and aggressive in utilising the FSAs, not being hindered by the inertia that derives from being integrated into the local system, and associated path dependent political and social obligations (Wang and Yu 2007). Thirdly, by combining location-specific advantages and working in the institutional set up and policy environment applicable to a host country, FMEs may develop their unique set of advantages by enhancing and modifying the FSAs originally received from their parents network. The institutional perspective of business strategy emphasizes that the resource endowment of the host economy and

its institutional framework moderate the characteristics of FMEs, facilitates the development of their resources and capabilities and even generate new capabilities and new markets opportunities, especially in the emerging economies (Meyer et al. 2009). Rugman and Verbeke (2001) argue that export from a particular FME may arise from affiliate specific regional advantages that are grounded in FSA acquired from both the parent and host country location-bound advantages.

The eclectic theory of FDI emphasises that the FMEs and DEs may differ in terms of their competitive advantages based on the ownership or access to *monopolistic advantages*, possession of a bundle of scarce, unique and sustainable *resources and capabilities* and *competence* to identify, evaluate, and harness resources and capabilities from throughout the world and to integrate them with their existing resources and capabilities (Dunning 2000). This literature also points out that the competitive advantages of FMEs over DEs are partly generic but partly context specific (Ibid).

2.2 *Empirical Literature*

In recent years, there has been a growth in empirical literature on relative performance of FMEs and DEs in the manufacturing sector of developed and developing economies. These studies have mostly used firm-level data and econometric methods. There have also been a few important studies surveying relatively recent literature on the subject. Jungnickel's (2002) edited volume of studies compare the behaviour of FMEs and DEs in a number of European countries. Bellak's (2004a) survey, based on the 54 studies mainly using firm-level data in panel framework, compares the various aspects of performance chiefly for the industries based in the developed countries. The research papers in Jungnickel's (2002) edited volume (e.g. Bellak and Pfaffermayr 2002) predominately address both the theoretical and methodological issues associated with comparison between FMEs and DEs. They also empirically test the differences between FMEs and DEs in terms of selected indicators, such as productivity, wages and R&D. These papers arrived at the following major conclusions: First, the real difference in behaviour and performance lies between FMEs and uni-national DEs and not between FMEs and multinational DEs (Jungnickel 2002, Bellak 2004a). Second, the superior economic performance of FMEs over DEs is observed in the areas of productivity, technology, wages, skills and

growth rates but mixed results in case of profitability (Bellak 2004a). Thirdly, the comparison between FMEs and DEs is inherently context specific, and hence there are different finding in different countries, industries, etc. Notably, the performance gaps disappear when firm and industry characteristics are controlled in a regression equation (Jungnickel 2002, Bellak 2004a).

There is no published survey of empirical literature available in the context of developing countries for the recent decades.[5] An unpublished Ph. D. thesis containing survey of firm-level empirical studies conducted during two decades of 1990 to 2010 pertaining to the manufacturing sector of developing countries using econometric technique suggest that in majority of cases: i) the scholars focus on one aspect of firms' characteristics at a time in a study, ii) FMEs, as compared to DEs, are larger in size, more capital intensive, not more R&D intensive, more export oriented and spend more on import of intermediate goods and disembodied technology, iii) FMEs are more productive/efficient but not necessarily more profitable (Keshari 2010, Chapter-5, pp. 88-148).

In the case of Indian manufacturing sector, only two empirical studies have examined the issue of differences in the several characteristics of FMEs and DEs simultaneously by applying multivariate LDA technique. The pioneering research of Kumar (1990, Chapter II) reveals that the FMEs as compared to DEs are more vertically integrated; operate at larger scales; employ more skilled personnel; earn higher profit margin; and have product differentiation advantage due to possession of higher amount of intangible assets. This study, however, is dated and uses aggregated firm-level data for an ownership category in an industry. In such a study, the use of firm-level (or sometimes plant level) data is considered appropriate (Bellak and Pfaffermayr 2002).

At firm level, Ray and Rahman (2006) evaluate the discriminating conducts of foreign and local enterprises mainly in terms of innovative activities and in establishing linkages with the domestic (or foreign sector) sector. The study uses a stratified random sample of 338 firms, each one with at least Rs. 40 crore of annual sales turnovers for the year 1997/98, belonging to the Indian chemical, electronics and transport equipment industries. The findings of this study suggest that: a) FMEs spend

[5] There has been two old surveys of literature by Jenkins (1989 &1990) focusing on the developing countries' experience in the 1970s.

more on import of disembodied technologies than DEs; b) they however do not significantly differ in terms of R&D intensity, indicating that FMEs do not make efforts to adapt their technologies to the Indian condition; c) FMEs foster backward horizontal linkages with local suppliers of final goods but make less efforts to develop backward vertical linkages. Although Ray and Rahman's (2006) study uses firm-level data, it excludes performance aspects and does not include IMI in the scope of their study. Moreover, they do not use pooled/panel data and are unable to control industry or sub-industry level influences on the categorical dependent variable capturing the foreign or domestic ownership, probably due to the limitation of LDA.

3. Variables and Hypotheses

The following sub-sections discuss a priori arguments and the empirical findings pertaining to various firm-specific characteristics of FMEs and DEs. These characteristics are divided into two categories namely, technological and others

Technological

Choice of Technique (CAPI)

The choice of technique of production used by a firm in an industry is generally captured by its capital intensity. Theoretically, all firms belonging to an industry, by reasons of common technology, are expected to operate with the same level of capital intensity. However, the capital intensity of FMEs may be higher than that of DEs for the following reasons. First, DEs economize on use of capital (than labour) in developing countries because they generally face higher cost in raising capital (than FMEs) in the financial market. Secondly, FMEs may have affinity towards more capital-intensive segments of an industry as they are mostly affiliated to the firms headquartered in the developed countries have comparative advantage in producing capital-intensive goods. Based on a survey of a number of empirical studies pertaining to the developing countries mainly for the decade of 1970s, Jenkins (1990) concludes that when local and foreign firms are often in direct competition, producing similar products at similar scale of output, both ownership groups tend to employ equally capital-intensive techniques. There are not many studies examining the issue of choice of techniques in later periods. However, some recent studies, for examples, Ramstetter (1999a) for Thailand and other East Asian countries and Ngoc and Ramstetter (2004) for Vietnam, suggest FMEs to be relatively more capital intensive than DEs.

Research and Development Intensity **(RDI)**

Traditionally, R&D activities have been centralized in the headquarters of the MNEs located in the developed countries for the following reasons. First, FMEs have privileged access to the stock of technology and R&D laboratories located at their respective headquarters. Secondly, centralization of R&D activities at home location enables maintenance of secrecy, prevents leakage of FSAs to the competitors, minimize coordination costs and principal-agent problem.

Hence, FMEs have been undertaking only *asset exploiting* R&D activities in the host countries which involves minor expenditure for absorbing the technology, adapting intermediate goods obtained from the MNE systems and customization of final products to the peculiarities of local demand, regulations and standards of the host countries. Since the 1990s, MNEs have been shifting R&D activities from their respective headquarters to the locations of their FMEs in select developing countries, including India and China (UNCTAD 2005 and Siddharthan 2009).[6] It is also reported that the FMEs are complementing the traditional *asset exploiting* R&D activities with *asset augmenting* ones (Castellani and Zanfei 2006 and Siddharthan 2009).

Despite the recent trend in the decentralization of R&D activities a large number of empirical studies, relating to both the developed as well as developing countries, reveal that FMEs are not more R&D intensive than DEs. In most of the OECD countries FMEs are characterized by lower R&D intensities as compared to the DEs (OECD 2005). In a study of five small European countries (Austria, Denmark, Finland, Norway and Sweden), Dachs et al. (2008) find no difference in R&D intensity of FMEs and DEs. In the case of Indian manufacturing sector, overwhelming evidences suggest that the R&D intensity of FMEs is not more than that of DEs [viz. Kumar and Saqib (1996), Ray and Bhaduri (2001), Pradhan (2002b),

[6] The main driving force behind this dispersion has been a set of push and pulls factors. Push factors involve increased competitive pressure, rising costs of R&D in developed countries, scarcity of skilled manpower, increasing complexity of R&D activity (UNCTAD 2005). On the pull side, availability of skilled manpower at lower cost in economies in transition and select developing countries, the ongoing globalisation of manufacturing processes, possibility of splitting of R&D functions into self contained divisible activities enabled by advances in communications and information technologies, emerging opportunities for collaborations with R&D laboratories in developing countries, availability of highly skilled manpower at lower cost in some developing countries, strengthening of intellectual property rights regime in fast growing economies and proactive policies in some developing countries (including India) towards encouragement of FDI with higher degree of equity participation and technology transfer (UNCTAD 2005, p29).

Kumar and Agarwal (2005), Ray and Rahman (2006), Kathuria (2008), Rasiah and Kumar (2008)]. Interestingly, Kumar and Sharma (2013) in a recent study find FMEs to be more R&D intensive than DEs in the Indian medium and high technology industries.

Intensity to Import Intermediate Goods **(IMIG)**

The use of superior raw materials and capital equipments ensures better quality of products leading to barriers to entry (or mobility) through differentiation advantage. The quality factor is more important in the context of machinery industry, since the efficiency of the user industries of machinery industry largely depends on the quality, reliability, durability, precision and overall efficiency of machineries and equipments supplied by the machinery industry. The following major explanations for higher import orientation of FMEs over DEs are offered in the literature. First of all, FMEs normally perceive the reliability and quality of supply in the host developing country to be inferior (Rugman 1981, Hennart 1986). Secondly, even if cost, quality and reliability of supplies are the same, a MNE affiliates may prefer to obtain inputs from their parents or parents network so that the MNE system could capture supplier's profits and utilize economies of scale and scope in production and distribution. Third, continuing to import intermediate inputs provides opportunities for transfer pricing which may be lost with local sourcing (Jenkins 1990).

Contrary to FMEs, DEs may prefer to procure the inputs from the local producers. First of all, they may not be well equipped to bear or tackle the uncertainty of exchange rate fluctuations and hassles of importing from the international market about which they obviously have less information than the FMEs. Secondly, DEs normally operate on the lower end of the industry that may not require such inputs for which they have to depend heavily on import.

The majority of the earlier studies in developing countries reveal that the FMEs are more import intensive than DEs (Jenkins 1990, Kumar and Siddharthan 1997). The latest studies on Indian manufacturing sector and the literature survey therein [Ray and Rahman (2006)] report that FMEs are more import intensive than DEs.

Intensity to Import Disembodied Technology **(IMDT)**

FMEs tend to spend more on import of disembodied technology than DEs for the following reasons: a) FMEs have better information on and access to frontier

technologies that can give them competitive edge over DEs; b) buying of disembodied technologies through MNE system at transfer prices offers good opportunity to boost global profit; c) developing technology at host location through R&D involves extra expenditure and risk. The empirical literature on transfer of technology in developing countries suggests that FMEs spend more on import of disembodied technology than DEs [Ray and Rahman (2006) and Kumari (2007)].

***Technical Efficiency* (TE)**

Dunning (2000) and others identify two major reasons for higher productivity/efficiency performance of FMEs as compared to DEs: First, FMEs may have access to efficiency enhancing *technology*, managerial and organizational skills and expertise from their corresponding MNEs systems; Secondly, FMEs with longer period of presence in the host country may also identify, evaluate and harness information, technology and skills present therein and combine these with their internal technological *capabilities* for enhancing their efficiency in production. In this study, we capture the efficiency by a measure technical efficiency which for a given firm (in a given year) is defined as the ratio of its mean output (conditional on its level of factor inputs and firm effects) to the corresponding mean output if the firm utilizes its levels of inputs most efficiently (Battese and Coelli1992). This measure of technical efficiency by design has values between zero and one.

Several studies in recent years for the developing countries report FMEs to be more productive/efficient than DEs [e.g. Takii (2004), Takii and Ramstetter (2003) for Indonesia; Kokko et al. (2001) for Uruguay; Ramstetter (1999a) for East Asian countries; Chuang and Lin (1999) for Taiwan; Ngoc and Ramstetter (2004) for Vietnam; Keshari (2013) for Indian machinery industry, Kathuria (2001), Ray (2004), Goldar et al. (2004), Sasidharan and Ramnathan (2007) for Indian manufacturing sector]. On the contrary, some studies [e.g. Ito (2002), Ramstetter (2002b, 2003), Oguchi, et al. (2002) for Malaysia; Konings (2001) for Bulgaria and Rumania] suggest that FME are not more productive than DEs.

Others

Product differentiation

Advertising and marketing tactics are considered as the two major elements of non-price strategies followed by MNEs for differentiating their products and competing with their rivals. Thus being part of MNE system, FMEs are also expected

to follow more intensive advertising and marketing strategies to promote sales of their products than what is followed by DEs. Against this logic, one may also expect FMEs to be pursuing less intensive advertising and marketing strategies than those adopted by DEs in the IMI for the following reasons: i) In the international as well as Indian market, brand equity of products sold by FMEs and corporate image of MNE system may have already been established and thereby MNE system to which FMEs belong may be well known as a reputed supplier of producer goods. Therefore, it may not be necessary for FMEs to spend substantial amount on current advertising and marketing; ii) FMEs may be concentrated in segments of machinery industry, which may not require substantial advertising and marketing campaign for the enhancement of sales. Only a small number of empirical studies have compared the product differentiation of FMEs vis a vis DEs in the manufacturing sector of developing countries and findings of these studies are not conclusive (Jenkins 1990; Kumar and Siddharthan 1997).

Export Intensity **(XI)**

FMEs have the following advantages over DEs in undertaking exports (Greenaway and Kneller 2007, Kneller and Pisu 2007): First, FMEs' access to superior technology and organisational and management practices leads to higher productivity[7], cost competitiveness, better quality and quick delivery of their products and after sale services. Secondly, production and marketing network of the MNE system itself provides an outlet for the intermediate and final products of FMEs. Thirdly, entry in third country export market requires incurring sunk cost. Since MNEs are better placed than DEs in terms of financial resources and have already incurred major part of sunk cost by virtue of multinational scope of their operation, FMEs may find it easier (than DEs) to penetrate in the international market, particularly in the markets with high barriers to entry or of highly differentiated and technologically sophisticated products. Fourthly, FMEs are better equipped to resist protectionist pressures in their home countries in such a way as to favour imports from their affiliates (Helleiner 1988).

Against the above arguments, there are the following reasons to believe that the export intensity of FMEs may not be more than that of DEs. First of all, a MNE operates with the help of its worldwide network so as to maximise the global profits

[7] Finding in this indeed shows that FMEs are more technically efficient than DEs.

but not necessarily the profits of its individual subsidiaries (Hymer 1976). Thus, a parent MNE, which has control over its FMEs, may not allow them individually to maximise exports and profits resulting from exports, if these are expected to reduce the MNE's global profitability. This is sometimes accomplished by under pricing the exports from MNE affiliates to parent firm or to other affiliates in the MNE's network. Secondly, technology transfer and financial agreements between the MNEs and their FMEs often include restrictive clauses controlling the export behaviour of the latter. Thirdly, if the nature of FDI is market seeking, export intensity of FMEs and DEs may not differ significantly.

The recent studies on developing countries, which mostly use firm-level data and econometric techniques, indicate FMEs to be more export oriented than DEs. These studies include Ramstetter (1999a and 1999b) on selected East and South East Asian Countries; Sun (2009), Du and Girma (2007) and Fung et al. (2008) for Chinese manufacturing; Lutz and Talavera (2004) on Ukraine; Jensen (2002) on Poland; Rasiah and Gachino (2005) for textiles and garments, food and beverages and metal engineering firms in Kenya; Rasiah (2004) for electronics exporting firms in Malaysia, Phillipines and Thailand; Chudnovsky and Lopez (2004) for MERCOSUR countries; Ngoc and Ramstetter (2004) for Vietnam; Rasiah and Malakolunthu (2009) for electronics exporting firms in Malaysia; Wignaraja (2008a) for a sample of clothing firms in Sri Lanka.

Kumar's (2005) literature survey on Indian studies reveals statistically insignificant difference in the export performance of FMEs and DEs during pre-reform period in majority of the cases. However, the Indian studies pertaining to post-reform period report mixed and industry-specific findings. Employing a cross-section spline regression method, Chhibber and Majumdar (2005) concludes when property rights devolves unequivocally to foreign owners (i.e. with majority ownership of equity) the Indian firms display higher export orientation. Siddharthan and Nollen (2004) report the export intensity of FMEs to be greater than those of DEs in the case of Indian information technology sector. Bhaduri and Ray's (2004) firm-level study finds no difference in export intensity of FMEs and DEs in the case of electrical/electronic industry. Using OLS method, Rasiah and Kumar (2008) find FMEs to be better than DEs in automotive parts industry. Ray and Rahman (2006),

however, came to the conclusion that FMEs are less export intensive than the DEs belonging to the chemicals, electronics and transport equipment industries.

***Capital Structure* or *Financial Leverage* (LEV)**

We expect FMEs and DEs to differ in terms of financial leverage. In comparison to DEs, FMEs being part of MNE system are expected to have lower volatility in their earnings and increased access to international capital market, both of which, in turn, would enable FMEs to sustain a higher level of debt without increasing their default risk (Eiteman et al. 1998, pp. 583-606).

In contrast to the above, the following arguments suggest financial leverage in FMEs to be lower than that in DEs: First of all, as per the Myers's (1984) *pecking order theory* of capital structure, if a firm is more profitable, it is more likely that it would finance its assets more from the internal sources (e.g. retained earnings which is part of networth or owned fund of a firm), which is easier, readily available and more cost effective than the external sources. As FMEs are expected to be more profitable than the DEs, the former may retain lower financial leverage. Secondly, the financial and fiscal expertise coupled with multinationalisation enables better utilization of taxation regulations across countries and reduction in tax liabilities in MNEs, implying FMEs can have higher NDTS than the DEs (Singh and Hodder 2000). As the tax benefits of maintaining higher leverage are relatively less valuable for firms with higher NDTS, the FMEs (i.e. firms with higher NDTS) are expected to have lower financial leverage than DEs. Finally, firms with higher *agency costs* of debt are expected to have lower debt levels (Doukas and Pantzalis 2003). FMEs' agency costs are expected to be higher relative to DEs due to higher auditing costs, language differences, and varying legal and accounting systems (Burgman 1996). In sum, since the some determinants of capital structure vary between FMEs and DEs, the former may have different capital structure than the latter.

***Firm's Size* (SZ)**

The size of a firm is a complex variable and may reflect the influence of several factors, including the amount of resources owned by a firm. Firm size is an indicator of managerial and financial resources available in the firm, and to the extent that excess resources are available, a firm will look for opportunities for expansion (Penrose 1959). Besides capturing amount of resources owned by a firm, the large size acts as an advantage in attracting bigger clients, gathering and processing of

information, achieving economies of scale and scope in production and marketing, exerting political pressure and winning favours from the government (Mueller 1986, p.139). As substantial resources and sunk cost are involved in establishing and operating in a foreign location, FMEs are likely to be larger than DEs. Some studies in East Asian countries have found that FMEs tend to be relatively large in comparison to DEs (Ramstetter 1999a; Takii and Ramstetter 2003).

Firm's Age **(AGE)**

IMI was initially established with the investments from Government of India through the formation of public sector enterprises (PSEs). As a result, the oldest and biggest firms in the IMI are a few PSEs [e.g. Hindustan Machine Tools (HMT), Bharat Earth Movers Ltd. (BEML), Bharat Heavy Electricals Ltd. (BHEL), and Bharat Heavy Plates & Vessels (BHPV)]. Yet, a major portion of the industry, being part of the high priority and high technology sector, has been open to foreign participation with minority equity holding of up to 40 per cent even before 1991 under the old industrial policy regime; and at least for 51 per cent foreign equity participation on automatic basis since July 1991 under the new industrial policy[8] (Kapila 2001, Chapter 19). Private including foreign participation in this industry has been increasing after the year 1991 at the cost of public sector participation. Hence, we may not find any significant difference in the average age of FMEs and DEs.

Gross Profit Margin **(GPM)**

The reasons for higher profitability in case of FMEs compared to DEs may be the following. First of all, FMEs may enjoy higher technical efficiency/productivity. Secondly, customers of developing countries may also perceive products of MNEs as superior in terms of non-price attributes such as quality, technological sophistication, reliability, durability, just-in-time delivery and after-sales service. Therefore, they may not mind paying higher than market price for the same goods supplied by DEs. Finally, the group of FMEs enjoys greater protection from "mobility barriers"[9] against DEs and thereby may attain greater profitability on account of market power, notably in the knowledge-based industries (Kumar 1990).

[8] The prime movers, boilers, turbines, combustion engines and steam generating plants; agricultural machinery; industrial machineries and machine tools have been the part of high priority sector.

[9] Mobility barriers are defined as entry barriers, which not only impede fresh entry to the industry but also restrict inter strategic group mobility of the existing firms. Thus, firms in a particular strategic group may not only enjoy protection from new entrants to the industry but also from existing firms belonging to other strategic groups in the same industry (Kumar 1990).

Empirical evidence concerning the existence of profitability differential between DEs and FMEs is mixed but in majority of the cases FMEs outperform the DEs in terms of profit performance. Jenkins (1989) in his survey concluded that FMEs do enjoy higher profitability (than the DEs) based in the manufacturing sector of the developing countries, mainly on account of their productivity advantages and higher demand for their products. However, these studies are quite dated and use rudimentary methods of comparisons. Bellak's (2004a) survey includes more recent studies which employ econometric methods for comparing the profit performance of FMEs and DEs. However, he too finds mixed results. He explains the reasons for mixed results in terms of differences in the quality of data used across the studies and rent shifting through the use of transfer pricing mechanism adopted by the MNEs.

Some studies in the context of East Asian countries [e.g. Wiwattanakantang (2001) for Thailand, Ramstetter (1999a), Ramstetter and Matsuoka (2001) for other ASEAN countries] suggest that FMEs enjoy higher profitability than DEs. Similarly, Anastassopoulos (2004) in the case of Greek food industry finds that the profitability of FMEs to be higher than that of DEs even after controlling for other determinants of profitability. In contrast, a study by Barbosa and Louri (2005), employing a quantile regression analysis suggests that foreign ownership ties in general do not make a significant difference with respect to performance of firms operating in Portugal and Greece. In the context of Indian manufacturing sector, Chhibber and Majumdar (1999) reveal significant association between foreign ownership and firms' profitability.

***Index of Market Concentration* (IMC)**

Hymer (1976) stresses that the MNEs are prevalent in concentrated markets where the few firms command major share of the sales (Caves 1996, chapter 4). In such markets, sellers are not price takers; and the best response of each seller is conditional upon the actions of other sellers. Lall (1978 & 1979), Newfarmer (1983) and others suggest that the operations of FMEs are likely to increase the industrial concentration in the long-run and thereby they may be found mostly in the concentrated industries. The following factors are considered chiefly responsible for this phenomenon: (i) inefficient small firms may exit or merge in the face of increased competition from FMEs having competitive advantage over DEs; (ii) FMEs may use their privileged access to financial resources to outlast their rival by resorting

to price and non-price warfare, and predatory practices. The distortions in market for firms considerably favour MNEs in buying out of local companies; (iii) the conducts of FMEs may have an indirect effect on concentration by stimulating defensive amalgamations among DEs and raising barriers to entry for new entrants. The TCI approach of FDI, however, seems to suggest that entry of MNEs creates more competition and breakdowns the existing oligopolistic structure, particularly in the developing countries (Hennart 2007). Therefore, it is more likely that FMEs are present in less concentrated and more efficient industries. Hence, it is difficult to predict whether firms in a concentrated industry or sub-industry will have more (or less) probability to observe as FMEs.

The method of construction and measurement of firm and sub-industry specific variables and hypotheses on the relative characteristics of firms between two groups of FME and DEs are explained in Table 1.

Table-1: Measurement of Variables and Hypotheses

Vari-able	Definition/measurement	Hypotheses
FCD	Dependent variable FCD is a dichotomous additive dummy variable which takes the value 1 for FMEs and 0 for DEs. A firm is defined as a FME (or DE) if a foreign promoter holds at least 26 per cent (or less than 26 per cent) share in the paid-up capital of the company.	
CAPI	Ratio of a firm's original (historical) cost of plant and machinery to its wage bill in FY	**$CAPI_{FME}$ > $CAPI_{DE}$** FMEs are likely to be more CAPI because the technology of production may have originated in the developed countries having abundance of capital and skills.
RDI	Ratio of R&D expense to net sales in a FY	**RDI_{FME} < RDI_{DE}** FMEs may not undertake R&D in host country due to centralization of R&D function in the headquarters or fear of loss of intellectual property in an alien location.
IMIG	Ratio of a firm's combined expenses on import of intermediate goods including raw material, components, spare parts and capital goods to	**$IMIG_{FME}$ > $IMIG_{DE}$** FMEs may import higher amount of intermediate

	net sales.	goods due to their better quality or/and at higher prices to benefit their parents.
IMDT	Ratio of a firm's expenses on payments of royalty and technical fees for the import of disembodied technology to net sales in a FY	**$IMDT_{FME}$ > $IMDT_{DE}$** FMEs being affiliates of foreign firms may import disembodied technology repetitively due to its suitability/ready availability or/and at higher prices to benefit their parents. The parent may also like to part the technology due to no fear of loss.
TE	To calculate firm and year specific TE, we estimate Cobb-Douglas form of three inputs (labour, capital and raw material) stochastic frontier production function (SFPF) model by adopting Battese and Coelli's (1992) method involving the use of unbalanced panel data. Empirical model, method of construction of variables and estimates of SFPF and are given in Appendix A1, A2 and A3 respectively. Empirical method of deriving firm-specific TE is described in detail in Keshari (2012&2013).	**TE_{FME} > TE_{DE} as** former is expected to possess superior technology, management and organizational expertise
AMI	Ratio of a firm's expenditure on advertising and marketing to net sales.	**AMI_{FME} > AMI_{DE}** Since product differentiation advantage created through advertising and marketing is considered as major factor in determining the competitive advantage of FMEs
XI	Ratio of a firm's export to net sales in a FY	**XI_{FME} > XI_{DE}** FMEs may have higher XI because of its higher efficiency and better worldwide internal markets and external contacts.
LEV	LEV is measured by the ratio of medium and long-term debts to net worth. The medium and long term debts of a company include the debt of over one year maturity. Net worth is the summation of equity capital and reserves and surplus, excluding revaluation reserves. The higher LEV of a firm (relative to other firms)	**LEV_{FME} < LEV_{DE}** Foreign firms are considered more prudent and have better access to equity finance.

	means that it is financing greater proportion of its assets by debt than by owned fund (i.e. net worth).	
SZ	Natural logarithmic value of net sales of a firm in a year. This measure of firm size, instead of net sales, reduces degree of variability in size across firms and thereby avoids the problem of heteroskedasticity in the estimation of a regression equation.	$\mathbf{SZ_{FME} > SZ_{DE}}$ (based on empirical studies)
AGE	Age of a firm is measured by the difference between its year of presence in the sample and its year of incorporation. As every year of operation may not add significantly to the experience (or plant vintage), natural logarithm of firm's age (AGE) is taken to reduce the variability.	$\mathbf{AGE_{FME}}$ **may be equal to** $\mathbf{AGE_{DE}}$
GPM	GPM is measured by a ratio of gross profit-to-net sales. The numerator gross profit is defined as profit before depreciation/amortisation, interest, lease rental and direct taxes.	$\mathbf{GPM_{FME} > GPM_{DE}}$ as the former may enjoy price raising capabilities based on its monopoly position and customer preferences.
IMC	IMC is calculated as the sales weighted average of an index of a four-firm seller concentration ratio (SCR4) of each of the sub-industries of IMI in which a firm operates. The SCR4 is defined as the share of sales of four largest firms taken together in gross sales of a sub-industry of machinery industry. The procedure of calculating IMC is clearly illustrated by the following example. If a firm's gross sales of Rs.15 crore generated from sale of Rs.10 crore worth of bearings (SCR4 = 0.90) and Rs. 5 crore worth of pumps (SCR4 = 0.30), IMC applicable to the firm would be 0.70 (10/15*0.90 + 5/15*0.30).	$\mathbf{IMC_{FME} > IMC_{DE}}$ FMEs may like to concentrate in more oligopolistic industries for earning higher profit.
Sub-industry dummy variables	To control sub-industry specific influences on FCD, we use 7 sub-industry level dummy variables. For this purpose, IMI is categorized into 8 sub-industries including prime movers, engines, boilers and turbines(SI0); fluid power equipment, pumps, compressors, taps and valves (SI1); bearings, gears, gearing and driving elements (SI2); agricultural and forestry machinery (SI3); metal forming machinery and machine tools (SI4); machinery for lifting and handling goods/humans, earthmoving, mining, quarrying, construction (SI5); machinery for food, beverages, tobacco processing, textiles	**Not predicted**

	apparel and leather production (SI6) and other industrial machineries (SI7). A minimum 51 per cent of gross sales made up from a sub-industry in a particular financial year is used as the norm for this reclassification. Thereafter, we construct 7 dummy variables, SID1,…,SID7, corresponding to 7 sub-industries SI1,…,SI7. The observations on a dummy variable (say SID1) assumes the value 1 if a sample firm belongs to the corresponding sub-industry (say SI1), otherwise 0. The sub-industry SI0 is treated as the reference sub-industry, therefore, we do not use dummy variable for this sub-industry so as to avoid dummy variable trap.	

3. The Industry, Period, Data and Sample

IMI represents *manufacture of machinery and equipment n.e.c*. that is the division 28 in National Industrial Classification: All Economic Activities-2008 (NIC-2008). The division-28 comprises two types of machinery producing industries, namely, general-purpose machinery (or group 281) and special purpose machinery (or group 282) at three digit level of classification. Keeping in view the contextual nature of the impact of FDI, we select only one industry, the IMI, for this study. Selection of only one industry enabled us to reduce heterogeneity across industries arising out of differing product profiles, levels of product differentiation, industry specific policies, tax and tariff rates, levels of backward and forward integration, capital intensity, levels of technological capabilities, export orientations, etc. Focusing on only one industry also reduces heterogeneity in FDI, including the types and motives of FDI.

The major reasons for the selection of IMI *inter alia* is that there exists no firm-level study to the best of my knowledge that employs common sample of pooled data for the recent period and uses sophisticated econometric methods for simultaneous examination of several important aspects of comparative characteristics of DEs and FMEs in the IMI. Since machinery industry is categorized as the medium/ high technology industry, FDI could contribute in this industry in a better way either by setting up Greenfield ventures or by offering latest technology, management and marketing expertise, international business contacts and market intelligence. Hence, differences in conducts and performance of FMEs and DEs may be more discernible in the IMI than in the traditional low technology industries.

The IMI constitutes about 3.76 per cent weight in India's index of industrial production (base 2004/05). In the market size of IMI (approximately Rs. 90000 crore) in the year 2006/07, the share of exports constituted only about 11 per cent, while the share of imports was 37 per cent.[10] During the post-1991 reform period of August 1991 to July 2007, IMI has been relying heavily on import of disembodied technologies, but much less on FDI, for building its competitive advantage. As a result, IMI occupied the highest share of 16.6 per cent in the cumulative number of foreign technological collaboration agreements (7886), followed by electrical equipment (15.9%) and chemicals (11.2 %).[11] On the other hand, the IMI's share in cumulative inflow of FDI (Rs. 28364 crore) of manufacturing sector constituted only 5.1 per cent, which compares poorly with the shares of other medium/high-tech industries (viz. electrical equipments with 32 per cent and transport equipments with 14 per cent).[12] As a consequence, during the period of study, FMEs as a group constituted only about 20 per cent in the aggregate sales of this industry whereas FMEs' shares are quite high in the other closely related industries, for examples, 41 per cent in the automobile and auto ancillaries and 42 per cent in the electrical machinery.[13]

The specific time period of our study covers seven financial years (FY) 2000/01 to 2006/2007. During this period India has become one of the most attractive destinations for FDI. The period of study is important from the point of view of Indian companies adopting better accounting standards, which has made the presentations and descriptions of financial statements more detailed, transparent, accurate and uniform across the firms (Mukherjee 2008, Chapter 3). As our study uses firm-level data originally sourced from the annual reports of the companies, these developments add additional feature to our study over the studies that have used data pertaining to the period prior to the year 2000. The study has not included the period after 2006/07 as the use of longer period could lead to instability in estimated slope coefficients, particularly in view of the adverse developments in the world economy including Indian economy due to sub-prime crisis.

[10] Refer to Keshari, P. K. (2013), p. 224
[11] Ibid, p. 225
[12] Ibid, p. 225
[13] These shares are calculated from the data obtained from PROWESS on mean of net sales of each firm for the maximum 7 years and minimum 2 years period between 2000/01 to 2006/07.

The major portion of the data and information is sourced from the PROWESS - an electronic database on information about the financial statements and various other aspects of Indian firms designed by the Centre for Monitoring the Indian Economy (CMIE). We also acquire data from CMIE's *Industry Market Size and Share* chiefly for constructing IMC. Further, we also use some price deflators for which data is collected from various publications of the GoI. For each year of analysis, we compile relevant product/industry-wise data on *Wholesale Price Index* (base year 1993-94) from the WPI series published by the Office of Economic Advisor (OEA), GoI. Similarly, we access year-wise data on the *All India Consumer Price Index Numbers (General) for Industrial Worker* (base year 1982) from the Labour Bureau, GoI. With the help of these raw data, we design appropriate firm-level and sub-industry level variables as explained in section 2.3.

We extract a list of all firms belonging to the IMI available in PROWESS database. Thereafter, we include all those firms in the sample for which data on each of the relevant variables are available for at least 2 years of the 7 financial years of the study. Further, we deleted sick companies, i.e., the companies with negative networth in a financial year, mainly with a view to remove outlier effect from the analysis. These exclusions left us with a usable sample of unbalanced panel of 177 firms with 936 observations spread over the 7 years period 2000/01 to 2006/07. Thus, the size of overall sample (as well as the size of each sub-sample of DEs and FMEs) varies from year to year during the period 2000/01 to 2006/07 of the study. Despite sample size being smaller than that of the PROWESS database, share of sample firms in respect of some aspects of corporate financial indicators (say sales turnover or net worth) of the IMI during the period of the study ranges from 66 per cent to 90 per cent depending on the individual aspects of financial indicators.

Table-1 summarizes the descriptive statistics of individual variables used in the study. The descriptive statistics include mean, standard deviations (overall, between and within), minimum and maximum values of each variable. The table reveals that the FCD as well as all the sub-industry specific dummy variables have no within group variation in their respective data. To know the severity of multicolinearity problem associated with the sample, we obtain variance inflation

factor (VIF)[14]. As a rule of thumb, if the VIF of a variable exceeds 10, that variable is deemed highly collinear (Gujarati 2004, p. 362). In terms of this rule of thumb, the values of VIF presented in Table-2 do not reveal any serious multicolinearity problem.

4. Statistical and Econometric Methods

4.1 Univariate Method of Analysis

To compare each aspect of characteristics of two groups of firms in a univariate framework, we conduct Welch's t-test using two-samples having possibly unequal variances. To conduct this test we first of all need to calculate mean and standard deviation of individual variables for each sub-sample of FMEs and DEs. Thereafter, we are to obtain t-statistics with the help of STATA software that utilises the following formula:

$$t = \frac{\overline{X}_1 - \overline{X}_2}{s} \quad \text{where} \quad s = \sqrt{\frac{s_1}{n_1} + \frac{s_2}{n_2}}$$

Where $\overline{X}_1$ and $\overline{X}_2$ are the sample means of the FMEs and DEs respectively; s_1^2 and s_2^2 are the sample variances of the FMEs and DEs; n_1 and n_2 are number of observations in each group. The degrees of freedom (ν) associated with variance estimates are approximated using the Welch-Satterthwaite equation. Once t and ν are computed, these statistics are used with t-distribution to test the null hypotheses (H_o) for each variable that the difference in mean between the groups of FMEs and DEs is zero (using a two-tailed test) against the alternative hypothesis (H_a) that the groups have different means. In other words:

H_0: mean (FME) – mean (DE) = diff = 0 against H_a: diff ! = 0

We preferred to use two-tail test because of the possibility that mean of a variable for FMEs may be less or more than that of DEs. The tests yields p-value that may (or may not) provide evidence sufficient to reject null hypothesis.

4.2 The Empirical Models of Multivariate Analysis

The univariate mean value method compares one characteristic at a time while LDA and logit and probit models compare a firm-specific variable by controlling

[14] VIF shows the speed with which variances and covariance increase and can be defined as VIF = $1/(1-r^2_{23})$, where r^2_{23} is the coefficient of correlation between X_2 and X_3. It is called variance inflating factor because it shows how the variance of an estimator is inflated by the presence of multicolinearity. If there is no colinearity between X_2 and X_3 VIF will be 1. When r^2_{23} approaches 1, VIF approaches infinite (Gujarati 2004, Chapter 10).

other firm and the sub-industry level influences. The empirical equations corresponding to the LDA, logit and probit models are presented below:

Linear Discriminant Function

$$Z = b_0 + b_1 CAPI_{it} + b_2 RDI_{it} + b_3 IMIG_{it} + b_4 IMDT_{it} + b_5 TE_{it} + b_6 AMI_{it} + b_7 XI + b_8 LEV_{it} + b_9 SZ_{it} + b_{10} AGE_{it} + b_{11} GPM_{it} + b_{12} IMC_{it} \quad (1)$$

Logit regression

$$Pr = E (FCD_{it} = 1 | X) = 1/[1 + \exp^{-Z}] \quad (2)$$

where, $Z = b_0 + b_1 CAPI_{it} + b_2 RDI_{it} + b_3 IMIG_{it} + b_4 IMDT_{it} + b_5 TE_{it} + b_6 AMI_{it} + b_7 XI + b_8 LEV_{it} + b_9 SZ_{it} + b_{10} AGE_{it} + b_{11} GPM_{it} + b_{12} IMC_{it} + b_{13} SID1_{it} +,...,+ b_{19} SID7 + v_{it}$ or

$$L = \ln [Pr / (1- Pr)] = b_0 + b_1 CAPI_{it} + b_2 RDI_{it} + b_3 IMIG_{it} + b_4 IMDT_{it} + b_5 TE_{it} + b_6 AMI_{it} + b_7 XI + b_8 LEV_{it} + b_9 SZ_{it} + b_{10} AGE_{it} + b_{11} GPM_{it} + b_{12} IMC_{it} + b_{13} SID1_{it} +,...,+ b_{19} SID7 + v_{it} \quad (3)$$

Probit regression

$$Pr = E (FCD_{it} = 1 | X) = 1- f [- (b_0 + b_1 CAPI_{it} + b_2 RDI_{it} + b_3 IMIG_{it} + b_4 IMDT_{it} + b_5 TE_{it} + b_6 AMI_{it} + b_7 XI + b_8 LEV_{it} + b_9 SZ_{it} + b_{10} AGE_{it} + b_{11} GPM_{it} + b_{12} IMC_{it} + b_{13} SID1_{it} +,...,+ b_{19} SID7 + v_{it})] \quad (4)$$

The LDA identifies the discriminating characteristics of two groups (say FMEs and DEs) of firms based on certain criteria. The equation (1) is estimated for LDA. Equation 2 (or 3) and 4 represent logit and probit models respectively in which $Pr = E (FCD_{it} = 1 | X)$ denotes conditional expectation of FCD_{it} given X (a vector of explanatory variables) or conditional probability that a firm will appear as FME given X. The logit model is expressed in two forms, notably by non-linear equation (2) and linear equation (3). In equation 3, the odd ratio Pr/(1-Pr) shows the ratio of the probability that a firm will appear as FME to the probability that a firm will not appear as FME.

The probabilistic models (notable the logit model) are considered as the better substitutes of discriminant analysis. Yet, the estimation results of the probabilistic models are interpreted in a slightly different manner than that of LDA. The probabilistic models, both logit as well as probit regression models, relate a qualitative dependent (usually dichotomous) variable to a set of continuous and/or categorical independent variables. Probit model uses a normal cumulative distribution function (CDF), whereas the logit model employs logistic CDF, to model such

relationships between a dichotomous dependent variable and the independent variables. In case of this study, both the models estimate the probability of observing a firm in the group of FMEs (or DEs). Thus the positive sign of the estimated coefficient of an independent variable in these models will denote that the variable increases the probability of the firm to appear as FME.

Each of the 3 models is estimated with the help of unbalanced sample of pooled data on individual variables used in the model. Despite the superiority of panel data models we are restricted to use only the pooled data model, as our data on FCD does not have any within group variation.

5. Results and Discussions

5.1 Univariate Analysis

Table-3 summarizes the results on mean, standard deviation and tests of equality of group means of FMEs and DEs with respect to 11 firm specific variables representing various firm-level characteristics. T-statistics in respect of each variable is obtained by applying the formula explained in section 4.1. Thereafter, we test the null hypothesis that the difference in mean value of each variable between the two group of FMEs and DEs would be zero. The null hypothesis is rejected in the case of 9 variables. As compared to DEs, FMEs have greater RDI, IMIG and IMDT. As the R&D activity and use of imported technology require higher level of skill, we may assume that skill intensity of FMEs may also be greater than that of DEs. These results probably suggest that FMEs do have firm-specific ownership advantage over DEs in terms of technology. In relation to DEs, FMEs on an average spend less portion of their revenue on advertising and marketing. In other words, DEs spend more towards creation of product differentiation advantage. In comparison to DEs, FMEs are also bigger in terms of their size of their operation. Results on relative AGE and CAPI indicate that FMEs and DEs do not significantly differ in terms of years of operations and choice of technique. The results also indicate that FMEs, as compared to DEs, on an average achieve greater TE, GPM and XI. As compared to DEs, FMEs are also found less financially leveraged, implying that the latter finance their operations more from owned fund than from the borrowed. As the univariate analysis places emphasis on each individual characteristic independently from the others, it is imperative to build upon the findings of univariate analysis and combine several characteristics in a meaningful predictive model.

5.2 Linear Discriminants Analysis

Table-4 presents the results of LDA following the Mahalanobis Distance (or D square) procedure. Panel A of Table-4 shows that model is significant but does not fulfill the criteria of equal population covariance matrices. Focusing on the results incorporated in Panel B of Table-4, we find that 7 firm-specific variables: TE, SZ, XI, IMIG, AMI, IMDT, LEV ultimately turn out to be significant discriminator between FMEs and DEs in the stepwise procedure. Panel C reports the values of the estimated coefficients associated with each of these variables in the discriminant functions of FMEs and DEs. We find that FMEs as compared to DEs have more TE, XI, IMIG and IMDT. FMEs are also larger than DEs. However, FMEs have less LEV and AMI. It is to be noticed that LDA does not find GPM and RDI to be a significant discriminator between FMEs and DEs. On the other hand, the univariate analysis has found GPM as well as RDI of FMEs to be greater than GPM and RDI of DEs. However, both the univariate analysis and LDA show that the AGE and CAPI are not significant discriminators between FMEs and DEs.

5.3 Probit and Logit models

We estimate the probit and logit models represented by the equations (2 and 4) by maximum likelihood technique with the help of STATA software. We also obtain heteroskedasticity-corrected standard errors by following White-Huber method with the help of robust option available in the software. Table-5 presents the results obtained from the estimation. We may note at the outset that the estimated logit and probit models offer similar results. The values of pseudo R^2 show that both the logit and probit models achieve same value of 0.26, implying one cannot differentiate between these models on the basis of overall goodness of fit. The values of Wald chi^2 and corresponding p-value of zero suggests that the each model (probit as well as logit) as whole is statistically significant, as compared to the model with no regressors. Thus, there is a little to choose between probit and logit approaches.

The results on explanatory variables show that the coefficients of 5 firm-specific variables CAPI, RDI, AGE, GPM, IMC and all the sub-industry-specific dummy variables are statistically insignificant. On the other hand, the coefficients of IMIG, IMDT, TE, SZ, XI are positive and significant and coefficient of LEV and AMI are negative and significant in both the models.

Comparing the results of LDA against the results of probabilistic models, we find that: a) GPM and RDI are not discriminating factors between FMEs and DEs in LDA. Similarly, GPM and RDI do not impact the probability of a firm to appear as FME in the presence of other variables in both the probabilistic models; b) AGE and CAPI do not differ significantly between FMEs and DEs in the LDA as well as in the probabilistic models; c) the signs of the statistical significant coefficients of TE, SZ, XI, IMIG, IMDT, AMI, LEV are identical in both types of analysis. In sum, the results obtained from LDA and the estimation of probabilistic models are the same.

As discussed earlier, the multivariate analyses based on probabilistic models are considered more appropriate and theoretically sound, we thus consider the results obtained from the probabilistic model to be the final. We therefore discuss these results elaborately and draw conclusions and policy implications from the same. The estimation results of probit model on the factors that influence the probability of being a firm in foreign ownership also gives marginal effects (Table-5). The marginal effects are calculated for discrete change of dummy variable from 0 to 1 at the sample means and measured in terms of absolute value of a coefficient. Among the statistically significant explanatory variables, the IMDT has the greatest effects followed by AMI, IMIG, TE, XI, LEV and SZ in descending order.

IMDT with the highest positive marginal effect indicates that the likelihood of being FME is the greatest for a firm that makes higher payment (as a ratio of its sales) for import of foreign disembodied technology. This result is in line with the findings of two Indian studies [e.g. Kumari 2007, Ray and Rahman 2006]. This could be reflection of import of better technology through intra-firm transactions (or an indication of over payment for technology for appeasing parents). Inflation of payment on royalty and technical fee by FMEs has been used as good means for reducing local taxes in the host country and transferring earned profit out of the host country (Bellak 2004a). In addition, the higher intensity of payment for import of disembodied technology by FMEs, coupled with no difference in R&D intensity of FMEs and DEs, imply that FMEs not only rely more on foreign technological know-how but also do not make major attempts to adapt or absorb the imported technology. To draw a firm conclusion on these issues, we need further investigation, which is beyond the scope of this paper.

The second most important factor explaining probability of a firm to be in foreign ownership is the advertising and marketing intensity (AMI). The significantly negative coefficients of AMI observed in the estimated probit and logit models show that the FMEs spend less for creating product differentiation advantage than DEs. FMEs operating in India, being part of the established international network, gain from the spillovers of the worldwide advertisements of their corresponding MNE system. As a result, they do not require to spend much for boosting their corporate image and brand equity of their products in the Indian market. Another reason could be that the threat from the entry of large number of MNEs after liberalisation from 1991 has forced oligopolistic DEs to spend heavily on advertising and marketing for the protection of their market share (Ray and Rahman 2006).

The third factor is intensity to import intermediate goods (IMIG). We may interpret the result on this aspect of firm characteristics as follows: a) FMEs prefer to use larger amount of imported intermediate goods as these are either unavailable in the domestic market or goods available in the domestic market are inferior in theie perception; b) FMEs' may be indulging in intra-firm trade at transfer prices (higher than market price) for boosting the global profit of their corresponding MNE system. Our finding on IMIG is in line with the latest findings in the Indian studies [e.g. Ray and Rahman 2006].

Our finding on TE is consistent with the prediction of internalization (or transaction cost) approach of FDI and findings of several empirical studies that FMEs are more productive/efficient than the DEs [viz. Keshari (2013) for IMI, Ray (2004) for a sample of Indian manufacturing sector firms, Goldar et al. (2004) for Indian engineering industry]. Combining this result with the insignificance of the coefficients of GPM and IMC in the estimated logit/probit models (as well as LDA), we can conclude that FMEs are more efficient than DEs due to the efficiency in utilisation of inputs of production but FMEs do not enjoy monopoly profits.

Significant and positive coefficient of export intensity (XI) suggests that FMEs are not only selling in the Indian market, but also have gained competitive advantage over DEs on the export front by using the India's locational advantages as well as the advantages of being part of the MNE system. This finding is consistent with the findings of the larger set of latest Indian studies [e.g. Siddharthan and Nollen

(2004), Chhibber and Majumdar (2005) and Rasiah and Kumar (2008)]. However, our study contradicts the findings of Ray and Rahman (2006) in this respect.

FMEs are also found less financially leveraged than DEs, indicating that the FMEs use greater amount of internal funds for financing their operations. Results of our study is in line with the finding of the majority of empirical studies which report FMEs to be maintaining lower financial leverage than the DEs in the context of the developed countries [e.g. Akhtar and Barry (2009) for Japan; Chkir and Cosset (2001) and Doukas and Pantzalis (2003) for USA].

Size of the firm, generally reflecting the firm's ownership of financial and non-financial resources, has positive influence on the firms' probability to appear in the group of FMEs (than DEs). The reason for this could be that doing business in a foreign location also require holding of higher amount of financial and non-financial resources so as to overcome the *liability of foreignness* (Zaheer 1995). Our finding on firm size is similar to that of a study on the Indonesian manufacturing sector (Takii and Ramstetter 2005).

The coefficients of IMC turn out to be insignificant in the estimated probit as well as logit model. This indicates that the probability of a firm's appearance in the group of FMEs (or DEs) is not dependent on the market concentration. Similarly, the coefficients of none of the sub-industry specific dummy variables are found statistically significant either in the estimated probit or logit model. These results hint that the FMEs do not show any preference for locating in one or other sub-industries of IMI. This might have happened because the sub-industries of the IMI may not be differing sufficiently in terms of overall index of characteristics so as to warrant the special attention of MNEs.

6. Conclusions

In view of the common significant findings of the multivariate analyses from the LDA and probabilistic models in respect of most of the variables, we conclude that our empirical analysis supports the proposition that the FMEs and DEs differ in terms several aspects of technological and other characteristics in IMI. As compared to DEs, FMEs also spend more on import of disembodied technology. This could be reflection of import of better technology through intra-firm transactions (or an indication of over payment for technology for appeasing parents). FMEs' also spend higher amounts on import of intermediate goods including capital goods, raw

material, components and spare parts. This suggests that they have fewer linkages with domestic suppliers of intermediate goods, probability because the intermediate goods used FMEs are unavailable domestically or the domestic firms are unable to supply quality/suitable products. FMEs, however, do not spend higher amounts on R&D (as compared to DEs) which support the hypothesis on centralization of R&D in the headquarters of FMEs. In the post-WTO scenario, the regulations such as TRIMs, are neither possible nor desirable for forcing FMEs to use domestic resources or undertake R&D within FMEs. To encourage FMEs to use local resources domestic suppliers of intermediate goods need to improve the quality of their products for attracting FMEs. To encourage FNEs to spend more on R&D, the GoI needs to take steps to improve R&D infrastructure, regulatory and legal framework and proper implementation of IPR regime in the country so that the MNE system find India attractive enough to locate their major R&D functions.

Combining India's comparative advantage with their resource advantage and higher efficiency in production, FMEs also realize higher export intensity as compared to DEs in IMI. FMEs are able to perform better than DEs in terms of technical efficiency (but not in terms of GPM). Probably, the internal and external competition introduces in the Indian manufacturing sector (through liberal industrial, trade, FDI and associated policies followed over the years) have helped FMEs to maintain higher level of efficiency with the help of their superior *resources and capabilities* but the same has also prevented FMEs to exercise monopoly power in the market. Hence, outward orientation in economy with liberal and transparent FDI policy in IMI needs to be continued.

Table 1: Descriptive Statistics of Variables for full Sample, 2000/01-2006/07

Variable		Mean	Std. Dev.	Min	Max
FCD	overall	0.2788	0.4487	0.0000	1.0000
	between		0.4301	0.0000	1.0000
	within		0.0000	0.2788	0.2788
TE	overall	0.7096	0.0816	0.5377	0.9934
	between		0.0838	0.5447	0.9932
	within		0.0028	0.7025	0.7156
GPM	overall	0.1904	0.1173	-0.4871	0.7081
	between		0.0979	-0.1754	0.4736
	within		0.0683	-0.2759	0.6389
SZ	overall	3.4278	1.6245	-0.1372	8.8828
	between		1.5575	0.2772	8.5254
	within		0.2773	2.1015	4.9944
AGE	overall	3.1944	0.7298	0.0000	4.6250
	between		0.7373	0.8959	4.6000
	within		0.1266	2.0978	3.8896
CAPI	overall	4.7216	5.0334	0.2844	50.0000
	between		5.0590	0.3259	39.5469
	within		1.2665	-4.5606	15.1747
AMI	overall	0.0309	0.0333	0.0000	0.2506
	between		0.0314	0.0000	0.2197
	within		0.0127	-0.0548	0.1597
IMDT	overall	0.0031	0.0074	0.0000	0.0743
	between		0.0060	0.0000	0.0372
	within		0.0040	-0.0215	0.0547
RDI	overall	0.0035	0.0060	0.0000	0.0398
	between		0.0053	0.0000	0.0284
	within		0.0027	-0.0093	0.0260
LEV	overall	0.3338	0.2526	0.0000	0.9863
	between		0.2432	0.0000	0.9577
	within		0.1070	-0.1947	0.7288
XI	overall	0.1247	0.1736	0.0000	0.9922
	between		0.1523	0.0000	0.7551
	within		0.0886	-0.3857	0.6732
IMIG	overall	0.0930	0.1027	0.0000	0.5823
	between		0.0918	0.0000	0.4633
	within		0.0455	-0.1904	0.4421
IMC	overall	0.4038	0.1596	0.1256	0.8955
	between		0.1523	0.1580	0.7762
	within		0.0568	-0.0171	0.6845

Table 2: Indicator of Multicolinearity

Variable	Variance Inflation Factor (VIF)
SID7	4.02
SID5	3.86
SID1	3.31
SID2	2.71
SID4	2.59
SID6	2.24
SID3	1.98
SZ	1.81
IMC	1.66
TE	1.63
GPM	1.60
IMIG	1.40
RDI	1.34
CAPI	1.29
AGE	1.21
LEV	1.15
AMI	1.15
IMDT	1.11
XI	1.09
Mean	1.96

Table 3: Comparing Characteristics of FMEs and DEs-Univariate Method (Tests of Equality of Group Means)

Variable	Domestic Enterprises			Foreign Multinational Enterprises			Tests of Equality of Group Means	
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Welch's d. o. f.	T-stat
TE	675	0.6976	0.0777	261	0.7405	0.0835	445.23	7.176*
GPM	675	0.1800	0.1187	261	0.2175	0.1094	511.39	4.600*
SZ	675	3.1821	1.6779	261	4.0633	1.2766	619.45	8.630*
AGE	675	3.1911	0.7251	261	3.2028	0.7431	463.90	0.218
CAPI	675	4.7699	5.5087	261	4.5967	3.5243	713.20	-0.569
AMI	675	0.0331	0.0347	261	0.0254	0.0287	568.06	-3.455*
IMDT	675	0.0016	0.0052	261	0.0070	0.0104	312.36	8.070*
RDI	675	0.0032	0.0058	261	0.0043	0.0065	427.06	2.376**
LEV	675	0.3655	0.2498	261	0.2516	0.2415	489.15	-6.409*
XI	675	0.1131	0.1744	261	0.1548	0.1683	489.91	3.369*
IMIG	675	0.0705	0.0873	261	0.1513	0.1159	380.61	10.197*

Note: * and ** denote significance levels at 1% and 5% respectively

Table 4: Results of LDA based on Stepwise Procedure

Panel A: Canonical Distance Function

Eigenvalue	Canonical Correlation	Wilks' Lambda	χ^2 (19)	Prob > χ^2
0.394	0.532	0.717	308.666	0.000

Panel B: Test of Equality of Group Covariance Matrices Using Box's M

FCD	Rank	Log determinant
0	9	-37.027
1	9	-36.572
Pooled within-groups	9	-36.395
Test Results (tests null hypothesis of equal covariance matrices)		
Box's M	Approximate F (45, 864988.6)	Prob > F
471.810	10.344	0.00

Panel C: Mahalanobis D Squired Stepwise LDA

	Variable Entered	Mahalanobis D Squired Statistics between FMEs and DEs	Exact F			
			Statistic	df1	df2	Sig.
1	IMIG	0.706	132.867	1	934	7.767E-29
2	IMDT	1.241	116.635	2	933	6.136E-46
3	LEV	1.428	89.427	3	932	7.333E-51
4	SZ	1.567	73.485	4	931	3.809E-54
5	TE	1.659	62.193	5	930	5.348E-56
6	AMI	1.804	56.279	6	929	2.230E-59
7	XI	1.919	44.812	8	927	5.698E-61

Notes: a) At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered; b) Maximum number of steps is 38; c) Minimum partial F to enter is 3.84; d) Maximum partial F to remove is 2.71; e) F level, tolerance, or VIN is insufficient for further computation.

Panel-D: Discriminant Functions of FMEs and DEs

Category	TE	SZ	XI	IMIG	AMI	IMDT	LEV	Constant
DEs	127.526	1.013	5.997	-10.357	-42.088	32.387	15.655	-48.517
FMEs	133.223	1.196	7.418	-2.438	-53.502	135.385	14.509	-55.05

Table 5: Logit and Probit Models: Estimation Results

	Logit Model			Probit Model-1			Probit Model-2		
Expl. Variable	**Coef.**	**Het. corr. Std. Err.**	**z-stat**	**Coef.**	**Het. corr. Std. Err.**	**z-stat**	**dF/dx**	**Het. corr. Std. Err.**	**z-stat**
TE	6.185	1.324	4.67*	3.728	0.761	4.90*	1.120	0.228	4.90*
GPM	-0.251	1.042	-0.24	-0.205	0.579	-0.35	-0.062	0.174	-0.35
SZ	0.194	0.076	2.55*	0.122	0.042	2.90*	0.037	0.013	2.90*
AGE	-0.004	0.004	-0.99	-0.003	0.002	-1.35	-0.001	0.001	-1.35
CAPI	-0.030	0.019	-1.64	-0.016	0.011	-1.51	-0.005	0.003	-1.51
AMI	-10.645	2.811	-3.79*	-6.383	1.586	-4.02*	-1.918	0.481	-4.02*
IMDT	81.725	16.623	4.92*	44.564	9.347	4.77*	13.394	2.871	4.77*
RDI	-11.963	13.775	-0.87	-7.511	8.229	-0.91	-2.257	2.476	-0.91
LEV	-1.321	0.450	-2.93*	-0.669	0.240	-2.79*	-0.201	0.071	-2.79*
XI	1.140	0.555	2.05**	0.757	0.301	2.51*	0.228	0.091	2.51*
IMIG	6.525	1.055	6.19*	3.675	0.594	6.19*	1.104	0.181	6.19*
IMC	-0.727	0.875	-0.83	-0.518	0.436	-1.19	-0.156	0.132	-1.19
SID1	0.295	0.560	0.53	0.103	0.279	0.37	0.032	0.088	0.37
SID2	0.286	0.570	0.50	0.127	0.287	0.44	0.040	0.093	0.44
SID3	-0.551	0.648	-0.85	-0.299	0.316	-0.95	-0.081	0.075	-0.95
SID4	0.042	0.468	0.09	-0.062	0.246	-0.25	-0.018	0.071	-0.25
SID5	-0.656	0.522	-1.26	-0.438	0.264	-1.66	-0.117	0.063	-1.66
SID6	-0.181	0.555	-0.33	-0.060	0.287	-0.21	-0.018	0.083	-0.21
SID7	-0.001	0.494	0.00	-0.034	0.247	-0.14	-0.010	0.073	-0.14
Const.	-5.811	1.146	-5.07*	-3.423	0.636	-5.38			
Number of observations			936	Number of observations					936
Wald Chi^2 (19)			193.88	LR Chi^2 (19)					228.39
Prob > chi^2			0.00	Prob > chi^2					0.00
Pseudo R^2			0.26	Pseudo R^2					0.26
Log likelihood			-407.56	Log likelihood					-408.63

Note: *, ** denote level of significance at 1 per cent and 5 per cent per cent respectively.

: dF/dX is for discreet change of dummy variable from 0 to 1

Appendix-A1

Stochastic Frontier Production Function and Technical Efficiency

The following log linear form of Cobb-Douglas production function is estimated in accordance with the estimation methods described above is expressed as follows:

$$\ln Y_{jit} = b_0 + b_1 \ln M_{jit} + b_2 \ln L_{jit} + b_3 \ln K_{jit} + V_{jit} - U_{jit} \quad (6)$$

where Y, M, L, K represent output, material input, labour input and capital input respectively. The subscript j (j = 1,…,177) refers to the j^{th} sample firm; i (i = 1,…,936) denotes i^{th} observation and t (t = 1,…,7) represent year of operation. The ln symbolises natural logarithm. V_{jt} and U_{jt} are the random variables whose distributional properties are described in the previous section. We use Coelli's (1996) "FRONTIER 4.1" software for estimating above equation by MLE method and thereafter obtaining the parameters of the model and predictors for the year-specific and firm-specific TE. In this framework, TE of a given firm (in a given year) is defined as the ratio of its mean output (conditional on its level of factor inputs and firm effects) to the corresponding mean output if the firm utilizes its levels of inputs most efficiently (Battese and Coelli1992). The measurement of output and inputs are described in Appendix A2. Results of maximum likelihood estimates of parameters of SFPF are presented in Appendix-A.3. The results show that the coefficients of each of the three inputs explaining production behaviour of sample firms are statistically significant. In our model, ML estimates of coefficients also signify elasticity of output with respect to material, labour and capital input. The comparison of these elasticity show that elasticity of output with respect to material input (0.71) is the highest and substantial, followed by elasticity of output with respect to labour (0.14) and capital input (0.10) respectively. Although the value of the coefficient associated with material input is substantial, it is much less than the unity. Notably, when we use two input production function, ignoring raw material, we implicitly assume that the coefficient associated with material input is close to unity. Further, return to scale, measured as a sum total of these elasticities (0.95), is quite close to unity, indicating that the production technology is characterised by constant returns to scale.

Appendix-A2
Construction of Vraiables

Output (Y): Wholesale Price Index (WPI) deflated Value of Production (VoP) represents the output (Y) of a firm in our study. To deflate VoP, year-wise data on WPI is used for a firm's major product group. For this purpose, the major product group of each company is matched with the WPI classification, and the matching price series is chosen for the deflation. If the appropriate deflator is not available, the deflator corresponding to the nearest product group is utilized for the purpose. WPI of IMI has been used as deflator in case of a few very diversified companies operating in IMI.

Material Inputs (M): As material input (M) constitutes one of the important inputs in production, many Indian studies have been estimating production function with M as an important independent variable. To remove the effect of year-to-year change in prices, M is deflated by WPI corresponding to the main product group to which M belonged. For this purpose, M of each company is divided into various categories and matched with the WPI classification and the best available price series is chosen for deflation.

Labour Input (L): Following firm-level Indian studies in recent years (e.g. Ray 2004), this study approximates L by total wage bill of a firm deflated by the Consumer Price Index of Industrial Workers (CPI). Reason being that the wage bill captures the skill composition of employees at firm level.

Capital Input (K): The study captures K by the historical cost of plant and machinery (or gross fixed stock of capital or plant and machinery as reported in the balance sheet). Thus, the cost of land and building are excluded from the gross fixed assets. The measure used in this study has limitation since K should be ideally be measured by the current replacement cost of the fixed assets of a firm.

Appendix-A.3: Maximum Likelihood Estimates of Parameters of SFPF

Variable/Parameters	Coefficient	t-ratio
Ln M	0.7059	85.68*
Ln W	0.1399	8.13*
Ln C	0.1004	6.83*
Constant	1.2017	29.17*
Sigma-squared (σ_s^2) $\therefore$ $\sigma_v^2 + \sigma^2$	0.0315	5.62*

Gama (©) = σ^2 / σ_s^2	0.7765	32.13*
Mu (μ)	0.3127	9.44*
Eta (η)	0.0064	0.8357
Log likelihood function		705.57
LR test of the one-sided error		462.36
Number of iterations		10
Number of cross-section		177
Number of Years		7
Number of Observations		936
Number of Observations not in the panel		303

Note: * shows that the coefficient is significant at one per cent level.

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