

# Technological Efforts and Global Operations: Indian Auto Component Firms

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*Abstract:* The Indian automotive component industry is a classic example of increasing international competitiveness and of emerging market multinationals. This study based on a sample of auto ancillary producers in India during 2010-11, examines the firm-level determinants of export competitiveness. Along with the total exports, this study additionally views this competitiveness as the Level of exports, i.e. being exporter to OEMs (original equipment manufacturers), or exporting to OEMs and/or Tier-Level firms (not merely being an aftermarket exporter). We analyse the effects of outward foreign direct investment, OFDI by the sample firms in recent years – the OFDI intensity and the number of non-manufacturing and manufacturing-OFDI enterprises – on these dimensions of export competitiveness of the firm. We examine also the role of several measures of technological and marketing efforts & capabilities, ISO14001 certification and Business Group affiliation of the firm.

*Keywords:* Global competitiveness; Outward FDI; OEM exporter; Auto components; India

*JEL Classification:* F21, F23, L62

## 1. Introduction

Export promotion is usually an integral part of the industrial policies. Many developing country governments have been attempting to integrate their national firms into the regional/ global value chains – also true of the auto component industry. However, the skill and technology intensity of exports and the value-capturing are important elements which need to be emphasized as a country aspires to advance into higher stages of industrialization. With a rapid expansion of trade in intermediates, both components and assemblies, in the 1990s and 2000s the emerging pattern of global trade is being called a shift from “trade in goods” to “trade in value added” and “trade in tasks” (Gereffi and Lee, 2012).

This empirical study examines the firm-level determinants of competitiveness of the Indian auto component firms in the world market. Apart from the total exports, we analyse the factors influencing the export participation ‘Levels’, i.e. whether the firm is an exporter to OEMs, or is an exporter to ‘OEMs and/or Tier-firms’. As anticipated by us, the effects of firm-specific characteristics differ across these three explained variables. Therefore, the policies promoting the total exports by an industry may not necessarily be the same as those appropriate for encouraging the exports of skill and technology intensive products in that broad industry.

The 2000s, especially the first half, has witnessed a remarkable rise in the cross-border FDI flows from emerging economies as the home country. We examine the impact of outward foreign direct investment (OFDI) by the firm in recent years on its current exports from the home country. We estimate the effects

of OFDI intensity, and of the number of manufacturing and non-manufacturing OFDI enterprises separately due to their different potential influences. This analysis is relevant from the point of implications of OFDI for the home country, and to the theory of the MNE and global value chain literature. Our findings add to the limited evidence on the effect of OFDI on exports by the MNE from its home country in the case of emerging economies. In general, the role of marketing factors like international Standards has not been adequately appreciated and explored in firm-level exports studies. We examine the influence of several indicators of technological and commercial capabilities and efforts, and the (Indian) Business Group affiliation.

The paper is organized as follows. As the OFDI is a focus explanatory variable, Section 2 reviews the literature on the relationship between the OFDI and exports. Section 3 deals with the methodology. Section 4 discusses the sample, data and variables. Section 5 compares the OFDI-undertaking and other firms in terms of a few select characteristics. Section 6 contains the estimated regressions and their analysis. Section 7 concludes the paper.

## **2. OFDI and exports: Review of Literature**

The early literature on multinational firms – e.g. by Hymer, Dunning and some others – posited the question as ‘exports vs. OFDI (vs. technology licensing)’, implicitly in the context of horizontal greenfield manufacturing-OFDI by a North-based single-product firm in a two-country case. Since then there has been much theoretical debate on and empirical testing of whether the exports-OFDI relationship is of substitutability or complementarity – as the ratio of change in these two quantities (Blonigen, 2001). Fonseca et al. (2010), Neary (2009) and Pradhan (2007) among others provide good analytical surveys.

*Theoretical Reasoning:* For any overseas market, as the exports and host country production can be alternative means of serving that market, (horizontal) OFDI by a firm can substitute its exports from the home country.<sup>1</sup> However, the OFDI may lead to (i)an outward shift of foreign demand for the firm’s product due to better adaptation to local demand preferences and enhancing the credibility as a reliable and committed source of supply, especially in the case of manufacturing-OFDI, (ii)or a downward movement along the foreign demand curve due to reduction in unit cost and price (Head and Ries, 2001; Lipsey and Weiss, 1984; Svensson, 1996).

Again, the international variations in technology or sector-specific factor endowments can generate the complementarity (see e.g. Neary, 2009). The manufacturing-OFDI may increase the exports of raw materials and other intermediates. Vertically integrated OFDI by locating an upstream stage of production outside the home country may improve the firm’s export competitiveness for its final product. MNEs are generally multi-product sellers, having diverse and complex forms of vertical integration. Hence the results pertaining to the effect of manufacturing OFDI on exports by the parent firm may be ambivalent. The trade-supporting OFDI obviously facilitates exports by the parent company from Home to the OFDI-host location and neighbouring areas by ensuring more reliable sales and after-sales services (Pradhan, 2007).

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<sup>1</sup> The displacement effect may be non-existent or negligible in case of a prohibitive tariff on or high transport and related costs of exports of that product. Many studies have examined the determinants of OFDI and/or exports, as suggested by the (customer) ‘proximity-concentration’ (fixed costs of plant location and other scale economies) hypothesis.

Certain additional dimensions of OFDI are pertinent to the substitutability vs. complementarity hypothesis. First, the export platform OFDI is expected to increase the overall exports by the multinational firm (e.g. Neary, 2009), but not necessarily its exports from the home country. Both the exports to and imports from the third countries are pertinent to the 'OFDI-exports from Home' analysis. The OFDI affiliate may buy a large fraction of the imported inputs from a third country, rather than entirely from Home. Both the parent and the overseas affiliate may purchase several critical components and other intermediates from the same MNE but dispatched from different centres.

Second, unlike North-to-South OFDI, the South-to-North OFDI seeks exposure to high-income demand patterns, strategic assets and proximity to technology networks for the R&D spillovers – incidentally also encouraging exports from Home by emerging market MNEs. This is particularly true of overseas R&D affiliates and manufacturing enterprises having in-house R&D.

Third, the cross-border acquisition is an important mode of OFDI by emerging market multinationals. It may provide synergistic knowledge flows to the investing parent company (Neary, 2009; Pradhan and Singh, 2009) and economies of scope. Apart from the brands, skills, and technology of the acquired firm, the acquirer may gain access to the established customer-base and marketing networks of the latter.<sup>2</sup> This potential 'market' access can culminate into the investing parent company later becoming directly involved in the regional procurement by multinational buyer firms. Post-acquisition, along with the downsizing of employment in the target firm in some cases (e.g. Chari et al., 2012), there may be restructuring and expansion of domestic production and export operations of the acquirer. Egger (2001) argues that the relationship between OFDI and exports, being subject to adjustment costs and linkage effects, is dynamic.

Finally the data aggregation matters. The extent to which the displacement of some product exports due to horizontal OFDI is likely to be offset by greater exports of intermediates and capital goods is likely to be greater at the level of the home country, at industry-level defined broadly and for a Business Group (consisting of entities in related businesses; e.g. Singh, 2007) than for the investing firm's own (standalone) exports. Even at the firm-level there are potential 'complementarities' across the firm's related products (Blonigen, 2001; Lipsey and Weiss, 1984); also a high degree of vertical integration induces greater counter-balancing (Head and Ries, 2001).

*Empirical Evidence:* Studies estimating the effect of OFDI on exports from the home country indicate that the positive relationships are far more common (surveys e.g. by Fonseca et al. 2010; Pradhan, 2007). The firm-level studies too indicate mixed patterns. Almost all these studies examine the effect of OFDI from developed home countries, and there is little evidence pertaining to the effect of OFDI from emerging economy multinational firms. To save space, we discuss only the firm-level existing evidence.

Employing data on Indian manufacturing (exporting and non-exporting) companies for 1990-91 to 2000-01, Pradhan (2007) explains the export intensity in terms of the OFDI intensity (OFDI stock to net worth ratio). The Tobit estimates in general indicate the OFDI-exports complementarity. The R&D and technology import intensities and foreign ownership have positive effects for the all-industries sample; in transport equipment industry the results are similar, except the technology import intensity

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<sup>2</sup> However, initially an acquired affiliate is likely to import relatively less intermediates from the acquiring parent company due to its established linkages with the local suppliers and sub-contractors. An OFDI enterprise in general may reduce its import dependence on the parent company/ country over time for critical intermediates by developing alternative sources.

coefficient being negative and weak. For a sample of IT firms in India during 2000 to 2005 Narayanan and Bhat (2010) find a strong positive effect of OFDI (dummy) on the export intensity.

Lipsey and Weiss (1984) analyse the firm-level exports from the US to five developed areas in 1970 separately for 15 industries. For total exports (including also to non-affiliates) they generally find a positive and significant effect of total sales of the firm's manufacturing affiliates in that area (net of imports from the US). As for the exports only to the affiliates, the effect on intermediates exports, consistently positive, is significant for most of the industries; for exports of final products it is positive in general and significant in several cases.

Using 1966-1990 panel data for Japanese manufacturing-exporter companies, Head and Ries (2001) explain the log-exports in terms of log of number of its manufacturing and distribution OFDI new investments, i.e. new affiliates<sup>3</sup> (lagged by a year), as focus variables. For the overall sample the effect of distribution-OFDI is positive and highly significant. This also holds true of manufacturing OFDI, at least for highly integrated firms. They also obtain separate estimates for auto and electronic corporate Group (vertical *Keiretsu*) members. For the auto sector 'Followers' (suppliers of parts), both own manufacturing new OFDI investment-counts (i.e. own investments) and that of the Leaders have significant positive effects on their exports<sup>4</sup>, while the distribution-OFDI variable is unimportant. Evidently establishing OFDI affiliate(s) near an overseas assembly plant of the Leader facilitates getting sales orders for the Leader's other overseas/ domestic plants.

Blonigen (2001) examines the effect of Japanese OFDI production on Japanese aggregate exports to the US at the product level. During 1978-1991 for 10 automobile parts separately he finds in general significant negative and positive effects of auto parts and vehicle sector OFDI, indicating substitutability and complementary effects respectively of the same product and downstream product OFDI. The substitutability effect of same product OFDI generally holds also in estimations for 11 consumer goods. He remarks that while individual firms may pursue either exports or OFDI production strategy, the aggregate data may not fully reflect the substitutability (p. 86, fn. 7).

For Swedish MNCs during 1974, 1978, 1986 and 1990 Svensson (1996) examines the effect of foreign production for local sales on exports by the parent firm by using the reduced form Tobit estimates of intensity of OFDI production in the host nation. For exports to that country there is an insignificant net negative effect – negative for final goods and positive for intermediate exports. But in the case of particularly export-oriented affiliates, their exports to third countries partly replace the parent's exports of final goods there, leading to an overall significant net negative effect on exports by the parent firm.

Swedenborg (2001) examines the effect of total foreign production on the parent's total exports from home for Swedish MNCs by pooling data for 6 census years spanning 1965-1994. In view of the likely endogeneity of foreign production, she uses its predicted-values from an equation employing an instrument-variable, namely YR, the age of the firm's oldest manufacturing affiliate. We agree with B.A. Blonigen (Comments; pp. 131-34) that YR, reflecting the MNC's FDI experience in the foreign market,

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<sup>3</sup> They concede that the 'the number of new affiliates' does not capture the increase in overseas activities through the expansion of existing affiliates (p. 115). We may add that compared to the OFDI flow, its stock is probably more relevant to exports.

<sup>4</sup> We may remark that foreign sales of vehicles – through exports or manufacturing-OFDI – may encourage exports of auto components to that country in later years for the aftermarket (repairs).

may not be the best or consistently an appropriate instrument-variable choice; this issue needs further research. The OFDI-exports relationship may have a life-cycle and structural breaks.<sup>5</sup>

Swedenborg finds the R&D expenditure having positive and highly significant effects on total exports and on exports to (manufacturing) affiliates by the parent company. The estimated effect of foreign production on other (than to affiliates) exports by the parent firm is consistently positive and highly significant. For total exports the effect is a significant positive and negligible respectively in equations without and with firm dummies. She argues that the absence of net substitution implies that the foreign production is a net addition to the overall MNC sales, yielding 'economies of size' benefits e.g. in R&D, advertising and distribution. Such activities undertaken by the overseas affiliates – in 1994 Swedish MNCs located 1/4<sup>th</sup> of their R&D expenditure abroad (Table 4.4) – have valuable spillovers for the home country operations, influencing the export competitiveness for R&D intensive products.

### 3. Methodology

We examine the firm-level global competitiveness. A number of studies – e.g. Kumaraswamy et al. (2012), Parhi (2010), Pradhan and Singh (2009), and Singh (2007; 2010; forthcoming) – discuss the catching-up by Indian automotive firms and the government policies. In order to save space we do not summarize this evidence.

Our sample contains only exporters. The present study examines the determinants of Level of exports among exporters. That is whether the firm is an exporter to OEMs (XerO); and, whether it is exporting to 'OEMs and/ or Tier-firms' (XerOT) rather than exporting only for purely aftermarket supplies. Auto component firms which export to OEMs also generally export to Tier-firms and/ or to the aftermarket; similarly those exporting to Tier-firms but not to OEMs, may also export to the aftermarket. Logistic regressions are obtained for the binary variables XerO and XerOT; the data on the value of exports at OEM-Level and 'OEM and/or Tier'-Level are not available. We examine additionally the (log) value of exports, ExportsL.

With increasing liberalization and globalization, learning through exports, integrating into the industry global/ regional value chains and exporting directly to MNEs may become part of the catch-up strategy of domestic firms at different levels of capabilities (e.g. Kumaraswamy et al., 2012). As Singh (2010) argues, a priori, the export supplies to OEMs or even to Tier firms are likely to demand higher R&D and technology import intensities and superior engineering capabilities, as compared to pure aftermarket supplies.<sup>6</sup> The same can be also said of the product complexities, degree of modularization, quality and delivery capabilities and risk-taking abilities – e.g. to share the cost of product warranties offered by vehicle OEMs. The in-house R&D and testing facilities are important for designing and modifying components and modules as per the OEM's specification and suggestions. Critical components are particularly subjected to joint development by the OEM and Tier-1 firms. At the same time the direct

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<sup>5</sup> We may mention that an initial trade-supporting OFDI enterprise may be later converted into an assembly/ manufacturing enterprise. In case of a manufacturing enterprise the intermediates imports from home nation may decrease gradually with increasing familiarity with host country input-sources.

<sup>6</sup> The OEM-supplies can be partly for aftermarket sales by OEMs. Many OEMs seem to be increasing their focus on the aftermarket sales as captive business and to improve customer services; moreover, compared to earlier, the technical advances in automobile sector are leading to greater use of branded and OE components (original equipment components, as used in new vehicles) for repairs (Singh, 2010, fn. 3).

supply linkages with OEMs offer several benefits: much mutual learning (while the trickle-down effect to lower Tier-suppliers is usually modest); higher value added; large and relatively 'assured' contracts. For supplies at lower Tiers and to the aftermarket generally the cost competitiveness may be the most important determinant.

Earlier Singh (2010) has examined the 'Level of Exports' (as dichotomous variable only) for auto component firms in India during 2004-05 based mainly on data from the industry association ACMA publication. Employing data from other sources also (see Section 4) for a recent year 2010-11, the present study examines the effect of OFDI as a focus explanatory variable and of several additional indicators of technological and commercial capabilities and efforts. We have not come across any empirical study examining the effect of OFDI on the 'Level' of exports, i.e. exports to OEMs or exports to 'OEMs and/ or Tier-firms'.

OFDI: We examine the effects of OFDI intensity and the number of manufacturing and non-manufacturing OFDI enterprises. Small doses of OFDI intensity may be mainly for marketing and simple assembly operations, while later a multinational firm may initiate foreign production (Svensson, 1996). We allow for a non-linear effect of the OFDI intensity on exports. By examining the 'Level' of export participation, we shall see whether the substitutability vs. complementarity hypothesis applies differently to OEM-Level and 'OEM and/ or Tier'-Level export participation, as compared to total exports which includes aftermarket exports too. We prefer a measure of outward FDI intensity in relation to sales rather than assets at historical cost. In preliminary equations we alternatively employed a measure in relation to gross fixed assets, with broadly similar results.

As argued in Section 2, we expect a favourable effect of the number of non-manufacturing (primarily trading) OFDI enterprises on total exports. The wide prevalence of Just-in-time inventory management among automotive buyer-firms is expected to strengthen the potential favourable effect of trade-supporting type OFDI on the exports by the parent company, as these affiliates can act as resellers/ conduit for sales to non-affiliates in the host country. For the manufacturing-OFDI, there is no clear *prior* for the effect on exports. However, many large auto component firms in India produce a number of related items for final sales, and are vertically integrated; they produce in-house a part of their intermediate requirements and can also export these items. Hence any 'overall substitutability' effect of manufacturing-OFDI on total exports may be dampened in their case, or even reversed.

*A priori*, in the auto component sector the effect of manufacturing-OFDI on the OEM-Level and 'OEM and/ or Tier'-Level export participation is ambiguous. It may depend upon the manufacturing facilities and capabilities of the OFDI enterprise to be a Tier-1 or Tier-2 supplier. Since the vehicle OEMs may prefer to buy modules, having a manufacturing foreign affiliate capable of assembling modules for supply may decrease the likelihood of the investor firm exporting from the home country to OEMs and Tier-firms in the host nation and its neighboring countries/ areas of preferential trade agreements. The crucial components and parts may be imported by the affiliate partly from the parent MNE from Home.

The trade-supporting OFDI through local exposure and networking may increase the probabilities of the parent company being an OEM-Level exporter and 'OEM and/ or Tier'-Level exporter. The expected signs for the above-mentioned OFDI-related variables are stated below. Alternatively, in lieu of No. of manufacturing and non-manufacturing OFDI enterprises separately, we explore the impact of total number of OFDI enterprises, OFDI<sub>noE</sub> or of OFDI<sub>noC</sub> – the number of countries where OFDI undertaken.

OFDI variable	ExportsL Eq	XerO Eq	XerOT Eq
- Intensity	+	+	+
- Intensity square	-	-	-
- Manufacturing Enterprises (No.)	?	?	?
- non-Manufacturing Enterprises (No.)	+	+	+

R&D: R&D influences the export competitiveness as it leads to newer products and lower production cost. Kleinknecht and Oostendorp (2002), among others, argue that there may be a two-way relationship between the exports and R&D. They find that a high R&D intensity acts as an entry ticket to export markets but has no significant impact on the export intensity among exporter firms in Netherlands. A large number of empirical studies of export behavior of developing country firms yield no conclusive evidence. Earlier for India Bhaduri and Ray (2004), Pradhan (2007), Deeksha Singh (2009) and Singh (2006) have found a positive effect of R&D on exports. The literature on trade and international investment and on national innovation systems particularly in the context of developing countries refer to various informal mechanisms for technology acquisition and learning. Wignaraja (2012) provides a survey of this literature; for Chinese automotive and electronics firms in 1993 he finds the probability of exporting to be favourably affected by the technology index – based on several activities related to technological learning – but the formal R&D expenses to sales ratio has no significant influence.

Globally, the vehicle manufacturers have been partly shifting the R&D and designing costs and responsibilities to their direct suppliers (Tier-1 firms and system integrators, called 0.5-Tier firms). Accordingly the effect of R&D intensity on the OEM-exporter status and XerOT is of special interest to us. We employ two alternative measures: total or only current (non-capital) R&D expenses to sales ratio (RDint or RDint\_C). The R&D capital expenses intensity generally varies more from one year to another. After preliminary regressions we preferred to retain the RDint\_C measure.

Tech-import: *A priori*, the technology import is expected to improve the export competitiveness, also through access to marketing networks of the collaborator and export logistics, information and marketing intelligence. The effect is likely to be particularly important for exporting to OEMs and Tier-1 firms, as the technical collaboration might facilitate approaching the established customers of the foreign collaborator. However, the subtle export restraints by the collaborator may adversely affect the value of exports (to some areas).

The Indian automotive industry is marked extensively by foreign collaborations – both financial and technical (see e.g. Kumaraswamy et al., 2012). We employ the following measures of technology import: *TCno*, number of foreign technical agreements, *TechMint*, technology import (remittances) intensity, and *EmbTechMint*, (capital goods) embodied technology import intensity. These intensities are in relation to (own) output, *Output*, exclusive of purchase of finished goods and outsourced manufacturing jobs.

Informal Technology-related Variables: The technological learning emanates not just from formal R&D and foreign collaborations, but in myriad other ways too (e.g. Wignaraja, 2012; Rasiah, 2011) – including through the highly-skilled employees, acquiring intangible assets and computerization. We attempt to capture these characteristics through the following variables: *Skill*, measured as average compensation per employee; *INTANint* and *Comp/ITint*, the intangible assets and computer/IT assets intensity, both in relation to gross fixed assets. The hypothesized effects are positive.

Marketing Capabilities: We also examine the influence of several proxy variables indicating marketing/commercial capabilities and efforts. Lefebvre and Lefebvre (2002) argue that marketing capabilities also play an indirect role, via influencing the success of innovation. They analyse the determinants of export participation and intensity of Canadian manufacturing SMEs. The variables of interest are innovative and marketing capabilities. Of these sets, the following are generally important: R&D and CAD/CAM/CAE dummies, number of engineers & scientists and quality norms; and having a trademark, distributor and manufacturing agent, networking and value of imports. Parhi (2010) maintains that participation in trade fairs and such fora makes the firm more informative about the existing and upcoming technologies and their functionalities. She finds supporting evidence in the context of adoption of advanced manufacturing techniques (AMTs) by Indian auto component firms.<sup>7</sup> We may mention the likely favourable effect on the productivity and export competitiveness. We capture the marketing efforts and capabilities through: advertisement, international Standards, Emark, Trademark, exports Incharge and quality Award.

Advertisement Intensity, ADint: The auto components are advertised in industry journals. Besides, firms participate in domestic and international Auto Expo, Buyer-Supplier meets, etc. Such exposure is particularly important to exhibit the products to international buyers. Therefore we expect a favourable effect of advertisement intensity, also on the OEM-Level and 'OEM and/ or Tier'-Level export participation.

International Standards, *ISO14001*: Many large industrial buyers, especially importers, while selecting the suppliers impose the pre-condition of having environmental and quality management international Standards and product quality certifications, and sometimes even meeting their customer-specific 'private' standards. We test whether having the environmental management system ISO14001 certification increases the export competitiveness; 84 firms in our sample, i.e. 67.74% firms have this certification. We have not examined the impact of automotive sector-specific quality management system ISO/TS16949 because 118 out of 124 firms in the sample have this certification; there is extensive adoption of this certification by large and medium-sized firms in India (Singh, forthcoming). Of the remaining 6 firms, only two do not have any ISO9001, ISO14001, QS-9000 or Emark certification.

Emark: While management standards like ISO/TS-16949 and ISO14001 apply to a plant, the Emark and CEmark are product certifications for conforming to the essential EU standards for safety, health and environmental protection. Emark and CEmark are applicable to automotive and electronic products respectively; the automobile industry uses a number of electronic products. These certifications are expected to enhance the export competitiveness. The variable *Emark* is a dummy for having Emark (or CEmark) certification.

We additionally examine the potential favourable effects of having a *Trademark*, an export-incharge (*Xincharge*) and an *Award*, as 1-0 dummies. The variable *Award* - having the much-coveted Deming/ JIPM/ TPM Excellence Award or Ford Q1 certification - indicates excellence in quality and delivery parameters. The variable *Trademark* may be relevant only to the value of exports, and not to the OEM-Level export participation.

Foreign Ownership: For exports by a foreign affiliate, the technological and marketing resources of the associated MNE are likely to be enablers. The MNE's global production strategy might influence it either way. Unlike earlier, during our study period there are no trade-balancing requirements in India. The so-

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<sup>7</sup> Also a bigger size and being a 'foreign OEM-supplier' increase the probability of adoption of AMTs.

called networking through inward FDI may facilitate being an OEM-Level exporter and 'OEM and/ or Tier'-Level exporter. A larger equity stake, implying a larger share in profitability too, may lead to greater assistance by the foreign collaborator towards export competitiveness. However, minority foreign-owned affiliates in the Indian automotive industry have usually local strategic partners backed by resourceful Industrial Business Groups.<sup>8</sup>

We consider the foreign equity ownership by corporate bodies, FE (%). The effect of degree of foreign ownership is estimated through minority (10-50%) and majority foreign ownership dummies (MINFD, MAJFD), or through foreign ownership dummy, along with quadratic form of adjusted foreign equity (FD, FEadj, FEadj2); FEadj = FE minus 10. The locally-owned firms form the base group. Alternatively we explore the effect of nationality of foreign collaborator. The Japanese vehicle OEMs are known to have somewhat different procurement policies – e.g. more intensive customer-audits of quality and delivery performance. We distinguish the effects of Japanese and non-Japanese foreign financial collaboration by employing FC\_Japan and FC\_~Japan dummies.

Firm-size: We expect the exports to increase with the firm size total sales. The moot question is whether the exports increase more or less than proportionately with firm-size. We allow for a non-linear quadratic relationship between the log-sales and log-exports. Deeksha Singh (2009) analyzes the interdependence between domestic sales and exports for a large inter-industry sample of firms in India during 1990-2005; the 2SLS export regression shows large and significant positive effects of R&D expenditure and business group affiliation.

As for the 'Level' of export participation, there seem to be perceptible economies of scale in dealing with large international buyers and being part of global value chains – in terms of meeting the quality, delivery and environmental standards. These requirements are generally more stringent for sales to OEMs and even to Tier-1 MNEs, as compared to (direct) aftermarket exports. Again, the selection of component vendors is costly in terms of time and effort, and the OEMs have moved towards vendor rationalization (limiting the number). These buyers tend to weigh whether a firm once selected will be able to supply large quantities also for other production centres, if required at a later date; i.e. whether it has the potential to become a regional/ global supplier (e.g. Narayanan and Vashisht, 2008; Singh, 2010). Large firms may also withstand better the shock /vicissitudes of handling the litigation in case of product-recall. Hence we expect the probability of being OEM-Level exporter and also that of being 'OEM and/or Tier'-Level exporter to increase with the firm-size.

Age: We consider age since the commencement of production as a measure of accumulated learning in production and business. We prefer this measure to age since incorporation, as employed generally in previous studies given the data availability. While greater production and problem-solving experience facilitates the exports, the effect is likely to taper off. Therefore we employ log-age, AgeL variable, alternatively adding its square term. However, the born-global firms obviate the usual evolution from being a pure domestic supplier to a 'shaky' exporter to being an established exporter, and may directly target international OEMs or Tier-firm buyers right at the outset. Hence the probability of being OEM-Level exporter or 'OEM and/ or Tier'-Level exporter may not be closely related with the age of the firm.

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<sup>8</sup> For our sample the proportion of Business Group (BG)-affiliates is 62%, 81% and 25% among local, minority foreign and majority foreign-owned firms.

In fact, the rapidly changing emission and safety norms for vehicles since the last two decades may give an edge to younger firms while exporting to OEMs or high Tier firms.<sup>9</sup>

**Productivity/ Profitability:** The role of productivity has been explored in the literature on 'Exports vs. horizontal OFDI' choice employing the proximity-concentration trade-off model type arguments. In an industry among the surviving firms the least productive tend to confine to the domestic market while the others serve the foreign markets as well; among the latter, the most productive undertake OFDI (see e.g. Helpman et al., 2004). A large number of economists also maintain that exports increase the productivity over time; Merino (2012) finds that among Spanish firms the productivity dynamism path is not different for exporters than for multinationals.

Ours is a sample of exporters. Since we are also capturing the partial effect of OFDI on exports, we would expect a positive partial effect of productivity. Due to data limitations we are unable to compute the technical efficiency. Also the efficiency of operations, as relevant for the export competitiveness, is multi-faceted. We employ the gross profit margin on sales, *PM\_G* as a measure of productivity and expect a favourable effect.

**Business Group Affiliation:** For a Business Group affiliated firm the rest of the Group's resources and competencies - forming the derived resources and generating the Group network externalities - enhance the effective resources of the firm (Singh, 2011). The internationalization by a firm may be spurred by the prior and current internationalization of its Group associates – both via exports and OFDI. Singh (2011) provides supporting evidence in a case study of OFDI by Tata Motors, a vehicle MNE from India. Pradhan and Singh (2011) find that the Business Group (BG) affiliation affects the OFDI-locational pattern of emerging economy multinationals. Unlike the standalone firms, the acquisition-location of BG-affiliates is favourably influenced by the host growth rate and bilateral investment treaty, apparently attracted to distant nations, and not significantly affected by the cultural proximity. In the context of exports by a firm we may add that the Corporate Group-name being known to many potential buyers and their business relationships with the firm's Group associates may also facilitate the firm being an exporter to OEMs and Tier firms.

Business Groups are quite strong in the Indian automotive industry. It is estimated that 15 Indian promoter Groups accounted for approx. 57% of auto components production in India during financial year 2009–10, while MNCs and unorganized sector had respectively 24% and 19% shares (Berger and Bhide, 2010, p. 3). We estimate the effect of Indian Business Group affiliation, *BG*. We also explore the influence of *IOGint*, i.e. 'investment overseas in Group companies' intensity (%) – the stock of these investments (in shares and debt instruments) as ratio to total assets of the investing firm. Such foreign investments in associated enterprises engaged in related downstream/ upstream activities can be strategic to the success of the firm's own internationalization through exports and OFDI involving controlling equity stake.

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<sup>9</sup> We also explored the effect of recentness of equipment, the ratio of net to gross fixed assets, as it may be related to the adoption of more advanced manufacturing techniques, thereby favouring greater exports (e.g. Lefebvre and Lefebvre, 2002). However, the coefficient was statistically insignificant.

#### 4. Data and Variables

**Data Sources:** This study employs company-level data sourced from CMIE Prowess (for automobile ancillaries, NIC code 30913) and a publication by the industry association ACMA.<sup>10</sup> The Prowess data relate to public listed companies, while the ACMA data cover ACMA members, and a few non-members. ACMA provides data on certain variables of interest to us, like the ‘Level’ of exports. We extracted the intersecting set of primarily automotive component producers. In case of a few gaps in data, we accessed the company websites and internet sources. For a few observations not having 12-months financial year, the flow variables have been adjusted pro-rata. The Prowess data employed by us for standalone operations of the company pertain to financial year April-March 2010-11, or ending later in 2011 for almost all the firms. Applying these firms average growth rate, we revised upwards the flow variables like sales and income for firms whose last-available data were till any quarter of calendar year 2010. We excluded firms having older last-available data, those having purchase of finished goods  $\geq 50\%$  of own output and cases of zero/ missing sales figures. Subsequently we were left with 136 observations of which only 12 were non-exporters, whom we dropped.

Our sample consists of 124 producers; all of them are exporters. Therefore we have not examined the overall export participation (Yes-No). Only the export participation at OEM-Level and at ‘OEM and/ or Tier’-Level are analyzed. There is ample size variation in the sample; the sales vary from Rs. 6 crores to Rs. 7722 crores during 2010-11.<sup>11</sup> It is a sample of large and medium-sized auto component firms.

The OFDI data are obtained from the Reserve Bank of India (RBI) website, as compiled by its Overseas Investment Division. The RBI has recently uploaded these monthly data on outward FDI from India since July 2007 – available now regularly on monthly basis. These firm-level data as reported by authorized dealers are financial commitments in the form of Equity, Loans and Guarantees Issued. A limitation of these OFDI data by the RBI is that these exclude the funds raised overseas by firms to finance the OFDI.

#### Variables and Definitions:

<i>Variable</i>	<i>Definition</i>
<b>Exports-related Variables</b>	
ExportsL	Log <sub>e</sub> of exports of goods in Rs. Lakhs
Xint	Export Intensity (%); ratio of exports of goods to Sales
XerO	Exporter to OEMs 1-0 dummy
XerOT	Exporter to ‘OEMs and/ or Tier-firms’ 1-0 dummy
<b>OFDI-related Variables</b>	
OFDIEint	OFDI equity investment intensity (%); ‘yearly average OFDI equity investment flow during July 2007 to March 2012’ as ratio to current Sales in dollars (during 2010-11); <b>OFDIEint2</b> is square of OFDIEint
OFDIint	OFDI investment intensity (%); defined similarly as OFDIEint, except the investment being Equity, Loans and Guarantees Issued; <b>OFDIint2</b> is square of OFDIint
OFDIinC	No. of countries in which OFDI undertaken (July 2007 to March 2012)
OFDIinE	No. of enterprises (overseas companies) in which OFDI undertaken

<sup>10</sup> ACMA (2012), ‘Buyers Guide 2012’, Automotive Component Manufacturers Association of India, Delhi. This data is also available on a CD entitled ‘Source India’.

<sup>11</sup> Note: 100 Lakhs = 10 Millions = 1 Crore. The financial year 2010-11 average rupee-US\$ exchange rate was 45.5768

OFDI <sub>noE_Mfg</sub>	No. of enterprises (overseas companies) in which OFDI undertaken as manufacturing activity
OFDI <sub>noE_~Mfg</sub>	No. of enterprises (overseas companies) in which OFDI undertaken as non-manufacturing activity
<b>Foreign Collaboration Variables</b>	
FC_Japan, FC_~Japan	Japanese and non-Japanese financial collaboration 1-0 dummies; if >1 collaborator, the higher (highest) ownership collaborator considered.
FD	Financial collaboration 1-0 dummy (percentage foreign equity ownership by corporate bodies, <b>FE</b> ≥ 10%)
FEadj	Percentage foreign equity holding adjusted (= FE – 10); <b>FEadj2</b> is square of FEadj
MAJFD, MINFD	Majority (>50%) and Minority (10 to 50%) foreign equity 1-0 dummies
<b>Technology Acquisition Variables</b>	
EmbTechMint	Embodied technology import intensity (%); ratio of import of capital goods to value of output, <b>Output</b>
RDint	R&D intensity (%); total R&D expenses as ratio to Sales
RDint_C	R&D current expenses intensity (%); ratio to Sales
TCno	Technical collaborations number; ongoing pure technical and tech-cum-financial foreign collaborations
TechMint	Technology import intensity (%); ratio of foreign exchange spending on technology import (royalty, technical fees and licensing fees remittances) to value of output, <b>Output</b>
<b>Marketing Variables</b>	
Adint	Advertisement expenses intensity (%); ratio to Sales
Award	Award 1-0 dummy; having Deming/ JIPM/ TPM Excellence Award or Ford Q1 certification
Emark	Emark (or Cemark) certification 1-0 dummy
ISO14001	ISO14001 certification 1-0 dummy
Trademark	Trademark 1-0 dummy
Xincharge	Exports Incharge 1-0 dummy
<b>Other Variables</b>	
AgeL	Log <sub>e</sub> of <b>Age</b> in years in 2011 since commencement of production (Age truncated to 50 years; a few cases)
BG	Indian Business Group affiliation 1-0 dummy
Comp/ITint	'Computer/ IT systems assets' intensity (%); ratio to gross fixed assets
Gsales	Growth rate of Sales (%)
INTANint	Intangible assets intensity, ratio to gross fixed assets (%)
IOGint	'Investment overseas in Group companies' intensity (%); stock of investments (in equity & preference shares and debt instruments) as ratio to total assets of the investing firm
Output	Value of output (Rs. Crores); Sales + addition to stock of finished goods minus purchase of finished goods & outsourced manufacturing jobs
PM_G	Gross profit margin (%); ratio of 'profits before interest, tax, depreciation and amortization' to total income; both net of prior period and extra-ordinary income
SizesL	Log <sub>e</sub> of size as <b>Sales</b> in Rs. crores; <b>SizesL2</b> is square of SizesL
Skill	Skill level; Compensation to employees (Rs. crores) / No of employees

## 5. OFDI vs. Other Firms: A Comparison

Out of 124 firms in our sample, 1/6<sup>th</sup> (21) firms have undertaken OFDI during July 2007 to March 2012. They have invested in 39 foreign enterprises during this period (in many cases repeatedly). A large majority (34) of these foreign enterprises is wholly-owned subsidiaries, and 5 enterprises operate as JVs. By the type of activity, about half of these enterprises (18) are engaged in manufacturing activity, and most of the remaining OFDI enterprises are engaged in trading activities (15 out of 21). Of the 21 OFDI-undertaking firms during July 2007 to March 2012, 19 sample firms have undertaken equity OFDI, while another 2 firms had OFDI only in the form of loans or guarantees issued. We compare these alternative sets of OFDI firms (equity OFDI and Total OFDI firms) with the respective remaining exporting firms in the sample in terms of certain important characteristics.

The data indicate certain interesting differences (Table 1). Compared to the other firms, those firms which have undertaken OFDI in recent years are much bigger, as expected, and have substantially higher (about double) R&D intensity – similarly the current expenses R&D intensity. They have also higher export intensity. The average technology import intensity of these sub-sets is alike – both the disembodied and embodied technology import. These patterns are similar to those reported by Narayanan and Thomas (2010) for the Indian pharmaceutical firms. Thus it is noteworthy that compared to non-OFDI firms, the OFDI undertaking firms seem to rely far more on the in-house R&D efforts, while their dependence on technology import is similar (both intensity measures).

Considering the 'Level' of exports, we find that relatively, a larger proportion of OFDI firms are exporting to OEMs, and also to 'OEMs and/ or Tier-firms'. Narayanan and Thomas (2010) find the average age since incorporation to be relatively greater for OFDI firms. Our data indicate similar age since the commencement of production for the two sets of firms.

Surprisingly the incidence of Indian Business Group affiliation is not higher among the OFDI firms; contrary to expectations, it is lower for the OFDI set. Here we may mention that a large number of independent entrepreneurs (usually engineers), many of them having foreign education and/or having experience of working in MNEs, have entered the Indian automotive industry since the 1990s liberalization. These factors facilitate the emergence of born-global firms and having linkages with foreign OEMs and high Tier firms for sales since the inception.

In the entire sample of 124 exporters, there are 42 foreign-owned enterprises – 26 minority and 16 majority foreign-owned (Table 1). Of the 19 Japanese nationality affiliates, 14 have minority foreign ownership. The OFDI-participation (Yes-No) is low among majority foreign-owned firms – with only 1 OFDI firm each of Japanese and non-Japanese nationality. Among minority foreign-owned firms undertaking OFDI from India, 5 have Japanese foreign financial collaboration. The incidence of OFDI seems to be comparatively less among non-Japanese foreign affiliates in India.

The average total OFDI intensity among the OFDI-undertaking firms in the sample is 1.79%. Those who have undertaken equity OFDI in recent years, their average equity OFDI investment intensity is 0.83% (Table 1). Thus for the OFDI-undertaking firms, the average yearly outflow of investment funds from India over 5 years (July 2007 to March 2012) in relation to sales is not small, considering also that some part of the OFDI may be actually financed outside the home country.

**Table 1: OFDI vs. other Firms in the Sample: A Comparison**

	Equity OFDI Firms	Others	Total OFDI Firms	Others	Total Sample
<i>No. of Firms, of which</i>	19	105	21	103	124
i) Indian-owned	11	71	12	70	82
ii) Minority (10-50%) Foreign [Japanese + Others]	6 [5+1]	20 [1+11]	7 [5+2]	19 [9+10]	26 [14+12]
iii) Majority (>50%) foreign [Japanese + Others]	2 [1+1]	14 [4+10]	2 [1+1]	14 [4+10]	16 [5+11]
<i>Simple Averages</i>					
OFDI Equity Investment Intensity, OFDIEint (%)	0.830	0	0.751	0	0.127
OFDI Investment Intensity, OFDInt (%)	1.574	0.073	1.791	0	0.303
Age (Years)	29.26	31.86	29.57	31.84	31.46
Sales (Rs. crores)	1208.49	511.32	1192.41	501.06	618.14
R&D total expenses Intensity, RDint (%)	0.86	0.38	0.78	0.38	0.45
R&D current expenses Intensity, RDint_C (%)	0.58	0.28	0.54	0.28	0.32
Technology import intensity, TechMInt (%)	0.26	0.30	0.24	0.31	0.30
Embodied technology import intensity, EmbTechMInt (%)	1.39	1.25	1.29	1.26	1.27
Export Intensity, XI (%)	15.27	11.40	14.34	11.51	11.99
Proportion of OEM-Level Exporter Firms, XerO	0.737	0.600	0.762	0.592	0.621
Proportion of OEM or Tier-Level Exporter Firms, XerOT	0.842	0.714	0.857	0.709	0.734
Proportion of Firms associated with Indian Business Groups, BG	0.526	0.629	0.524	0.631	0.613

Note: The OFDI firms are those having undertaken OFDI any time in recent years (July 2007 to March 2012).

## 6. Analysis of Results

Estimates of the preferred specifications are presented in Tables 2-4. The variables found to be consistently insignificant have been dropped.

**Being exporter to OEMs, XerO Equation:** We first analyse the determinants of being OEM-Level exporter, XerO (Table 2). These results indicate that the firm size, log of sales (SizesL), has a large favourable effect. *Ceteris paribus*, older firms are less likely to be OEM-Level exporter.

The estimation of influence of OFDI on exports from home by the investing company reveals certain interesting tendencies. The OFDI-equity intensity (OFDIEint) has an inverted U-shaped effect on the probability of being OEM-Level exporter, XerO. The estimated effect is positive for almost the entire sample range of OFDIEint. However, the two largest sample values of OFDIEint, namely 5.223 and 3.667%, correspond to the downward-sloping segment of inverted U-curve. In fact, *ceteris paribus*, for the highest OFDI-equity intensity firm the predicted likelihood of being OEM-Level exporter is less than that for a firm without any OFDI in equity mode. Similar tendencies emerge if we consider instead the total OFDI intensity, OFDIint; the three largest sample values of OFDIint are 7.689 (incidentally having no OFDI-Equity during the relevant period), 7.371 and 5.991%.

The number of manufacturing and non-manufacturing (mainly trading activity) OFDI enterprises as separate variables, OFDInoE\_Mfg and OFDInoE\_~Mfg have opposite effects which are both large and significant. The estimated coefficients are negative and positive respectively. Thus the larger the number of OFDI enterprises having manufacturing activity, the less is the probability of the OFDI firm being an OEM-Level exporter from the home nation, while the number of non-manufacturing enterprises has a favourable effect. The unfavourable effect of No. of manufacturing enterprises is far bigger than the favourable effect of non-manufacturing enterprises. Alternatively the impact of total number of OFDI enterprises, OFDInoE is negative and the significance varies from weak to strong in different formulations. The variable OFDInoC – number of countries in which OFDI undertaken – has a negative influence. Thus the geographical diversification of OFDI seems to lessen the OEM-Level export participation from the home country by the investing firm.

In the context of substitutability vs. complementarity hypothesis we may point out that while the results pertaining to some dimensions of OFDI support the complementarity claim, the substitutability effect seems evident for some other dimensions. Overall the results indicate that small doses of OFDI intensity and a large number of trading-activity OFDI enterprises enhance the likelihood of being exporter to OEMs. However, rather high doses of outward FDI intensity and a large number of manufacturing-OFDI enterprises or of OFDI-countries tend to lessen the probability of being OEM-Level exporter from the home country – indicating the substitutability influence.

The effect of technological variables is mixed. The number of foreign technical collaborations (TCno) exerts a large favourable effect, and its significance level is 5% or close to it. Thus having multiple ongoing technical collaborations (with the same or different foreign collaborators) seems to increase the probability of bagging OEM contracts. But the technology import intensity, TechMint has a significant negative effect. Even in-house R&D intensity, RDint\_C appears to reduce the probability of being OEM-Level exporter, *albeit* a weak tendency. Thus while the No. of foreign technical collaborations increase

**Table 2: Logistic Regression Estimates of OEM Level Export Participation, XerO**

N=124

Explan.Var.↓	Eq. 1	Eq. 2	Eq. 3	Eq. 4
SizesL	0.908 (2.76)***	0.738 (2.63)***	0.777 (2.67)***	0.867 (2.64)***
AgeL	-1.266 (2.31)**	-1.119 (2.10)**	-1.140 (2.10)**	-1.231 (2.21)**
ISO14001	1.676 (2.33)**	1.720 (2.60)***	1.713 (2.55)**	1.728 (2.35)**
Xincharge	2.148 (2.86)***	1.692 (2.59)***	1.807 (2.64)***	2.302 (2.94)***
TechMint	-1.537 (2.78)***	-1.612 (2.55)**	-1.589 (2.52)**	-1.521 (2.57)***
Adint	2.643 (2.89)***	2.288 (2.51)**	2.251 (2.47)**	2.509 (2.62)***
Gsales	-0.028 (2.07)**	-0.024 (2.05)**	-0.024 (2.05)**	-0.024 (1.84)*
OFDIEint	17.011 (3.73)***	6.949 (1.75)*	9.753 (2.15)**	
OFDIEint2	-4.4379 (3.37)***	-1.5419 (1.53)	-2.2541 (1.86)*	
OFDlint				23.087 (2.66)***
OFDlint2				-3.0188 (2.70)***
OFDInoC			-1.381 (2.05)**	
OFDInoE		-0.721 (1.42)		-3.207 (2.73)***
OFDInoE_Mfg	-5.640 (3.78)***			
OFDInoE_~Mfg	2.652 (3.09)***			
TCno	0.436 (2.07)**	0.373 (2.10)**	0.386 (2.19)**	0.417 (1.94)*
FEadj	0.084 (2.27)**	0.070 (1.96)**	0.070 (1.95)*	0.074 (1.98)**
FEadj2	-0.0016 (2.72)***	-0.0013 (2.50)**	-0.0013 (2.51)**	-0.0014 (2.47)**
RDint_C	-1.666 (1.77)*	-0.976 (1.54)	-0.971 (1.52)	-1.622 (1.93)*
EmbTechMint	-0.209 (1.68)*			-0.204 (1.62)
Emark	1.682 (1.39)	1.170 (1.45)	1.237 (1.50)	2.033 (1.64)
Comp/ITint	-0.306 (1.53)			-0.308 (1.55)
Constant	-1.791	-1.731	-1.938	1.918

	(0.93)	(0.94)	(1.03)	(0.95)
Pseudo R <sup>2</sup>	0.4035	0.3272	0.3373	0.3882
Wald Chi-2	49.24	37.13	41.11	29.57
(df)	(18)	(15)	(15)	(17)
Prob> Chi-2	0.0000	0.0012	0.0003	0.0296

Notes: Robust Z-values for b-coefficients. \*, \*\* and \*\*\* indicate 10, 5 and 1% level of significance.

the likelihood of being exporter to OEMs, the technology import (expenses) intensity appears to lessen this probability. Even the in-house R&D intensity has no favourable effect. The capital goods import intensity (EmbTechMint) and computer/IT assets intensity (Comp/ITint) too have negative effects, though weak. The Skill variable was insignificant.

In the context of technological factors, we must mention that during 2004-05 to 2010-11 the Indian auto component industry turnover has grown at over 20% average p.a., largely on the strength of the fast growing domestic demand (Singh, forthcoming); also the variety and sophistication of vehicles sold domestically has improved substantially since the 2000s. Again the recent global recession has affected adversely the vehicle demand in industrialized countries and consequently their imports of auto components. Therefore in the recent past the Indian auto component producers might have focused their R&D and related activities mainly on the relatively buoyant home market. Also the effect of these activities may be partly captured by other variables like the firm productivity.

The marketing efforts/ capabilities seem to be important for the OEM-Level export participation, XerO. Higher advertisement intensity (Adint) and having an exports Incharge (Xincharge) have favourable impacts. Also the ISO14001 and Emark certifications increase the likelihood of being OEM-Level exporter. The ISO14001 coefficient is consistently significant at 5% level while the Emark effect is weak. The Award coefficient was positive and weak in preliminary regressions but quite insignificant subsequently. The intensity of investment in overseas Group companies (IOGint) and Business Group affiliation (BG) coefficients have positive and negative signs but are not different from zero at a conventional level of significance; the same is true for XerOT equations.

As for the effect of foreign ownership, with (FD, FEadj and FEadj2) set of variables, FD being highly insignificant has been dropped. FEadj has an inverted U-shaped effect. The maximum favourable effect of the degree of foreign ownership appears around 35-38% FE (25-28% FEadj value). Compared to locally-owned firms, *ceteris paribus*, those firms having high majority foreign ownership (about >65% FE) seem to exhibit no superior performance; in fact, firms having  $\geq 75\%$  foreign equity are less likely to be OEM-Level exporter. In alternative formulations, we did not find significant difference in XerO probability among local, minority and majority foreign owned firms or across local, Japanese and non-Japanese foreign owned firms, *ceteris paribus*. Thus the Indian and majority Indian-owned firms are at par with majority foreign-owned affiliates in India in establishing supply linkages with foreign OEMs in order to move up the value chain.

The Growth rate of sales (Gsales) seems to have a negative impact on the OEM-Level export participation. In other words, *ceteris paribus*, among exporters the high growth firms are more likely to have been those exporting (only) to the aftermarket or Tier firms. Perhaps the causation was reverse, as the period in question was still affected by the global recession, also in the automobile sector. Those exporting to OEMs might have faced low (/negative) growth of exports, and thus overall lower growth rate of sales.

**Table 3: Logistic Regression Estimates of OEM/ Tier Level Export Participation, XerOT**

N=124

Explan.Var.↓	Eq. 1	Eq. 2	Eq. 3	Eq. 4
SizesL	0.481 (1.32)	0.459 (1.38)	0.444 (1.35)	0.527 (1.39)
AgeL				-0.505 (0.90)
ISO14001	2.129 (2.93)***	2.065 (2.95)***	2.032 (2.88)***	2.078 (2.82)***
Xincharge	1.600 (2.07)**	1.893 (2.69)***	1.859 (2.67)***	1.856 (2.38)**
TechMint	-1.810 (2.44)**	-1.431 (2.50)**	-1.443 (2.48)**	-2.031 (2.53)**
Adint	2.002 (2.04)**	2.245 (2.07)**	2.231 (2.06)**	2.255 (2.30)**
OFDIEint	42.666 (3.36)***	36.473 (3.57)***	71.863 (2.85)***	71.268 (3.16)***
OFDIEint2	-8.4169 (3.50)***	-7.2223 (3.74)***	-13.9520 (2.95)***	-13.8496 (3.24)***
OFDInoE			-2.369 (2.29)**	
OFDInoE_Mfg	-2.656 (2.15)**	-2.577 (2.41)**		-2.532 (1.86)*
OFDInoE_~Mfg				-1.910 (1.36)
FC_~Japan	2.056 (1.52)			1.963 (1.42)
Skill	-68.600 (2.20)**	-50.972 (2.17)**	-50.316 (2.16)**	-65.451 (2.07)**
Emark	1.770 (1.66)*	1.763 (1.28)	1.859 (1.34)	1.939 (1.86)*
Comp/ITint	-0.474 (2.19)**	-0.401 (2.11)**	-0.410 (2.15)**	-0.490 (2.17)**
INTANint	0.120 (1.84)*	0.092 (1.68)*	0.087 (1.61)	0.126 (1.85)*
Constant	-2.266 (1.25)	-2.699 (1.59)	-2.567 (-1.53)	-1.063 (0.44)
Pseudo R <sup>2</sup>	0.4027	0.3676	0.3683	0.4095
Wald Chi-2 (df)	78.16 (13)	88.15 (12)	109.01 (12)	105.31 (15)
Prob>Chi-2	0.0000	0.0000	0.0000	0.0000

Notes: Robust Z-values for b-coefficients. \*, \*\* and \*\*\* indicate 10, 5 and 1% level of significance.

**Being Exporter to OEMs and/ or Tier-Firms, XerOT Equation:** The results presented in Table 3 indicate that having ISO14001 certification and exports Incharge, and high advertisement intensity are enablers for the 'OEM and/ or Tier'-Level export participation; Emark too has a favourable effect, though weak. These tendencies are common with XerO results. However, the effect of firm size, though positive, is weak and the growth of sales and age variables are not significant determinants of XerOT.

As in XerO equation, the OFDI-equity intensity has an inverted U-shaped influence here too, and the slope sign changes within the sample range of OFDIEint. Thus beyond a certain level of OFDI-equity intensity, an increase in this intensity dampens the probability of making direct exports from the home country to 'OEMs and/ or Tier-firms'. The total OFDI intensity has similar influence; those results are not tabulated in the interest of space. The number of OFDI enterprises (or countries) has a negative influence. The negative effect seems to apply for both manufacturing and non-manufacturing enterprises, though is significant only for the number of manufacturing-OFDI enterprises. Thus the larger the number of OFDI enterprises for manufacturing activity the less is the probability of exports to 'OEMs and/ or Tier-firms' by the investing firm from its home nation – a kind of support for the substitutability hypothesis. The inverted U-shaped effect of OFDI intensity supports this hypothesis similarly.

Foreign ownership, as employed in various formulations, does not seem to affect the 'OEM and/ or Tier'-Level export participation. The only notable tendency is a weak favourable effect of non-Japanese foreign ownership (FC\_~Japan). While the number of foreign technical collaborations and R&D intensity do not significantly affect the XerOT probability (results not tabulated), the technology import intensity has a significant negative effect. Even the computer/ IT assets intensity and skill level of employees, Skill have negative significant effects. Incidentally the intangible assets (copyrights etc.) intensity, INTANint has a favourable effect, though weak.

**Exports-log, ExportsL Equation:** As expected, bigger and older firms export more (Table 4). The quadratic term, SizesL2 does not add much to the explanatory power. The elasticity of exports with respect to total sales seems to be below unity, as in Singh (2010). But Eq. 2 employing SizesL and SizesL2 variables indicates a weak tendency of the exports increasing more than proportionately to total sales for big firms. Business Group (BG) association tends to increase total exports, as expected, but the tendency is statistically weak (Eq. 3); the intensity of 'investment in overseas group companies' (IOGint) has a favourable effect (Eqs. 1-2).

The OFDIEint variable has a positive, large and highly significant coefficient; the square term of this variable does not add much to the explanatory variable and was therefore dropped. This implies that an increase in the OFDI-equity investment intensity consistently enhances the export performance of the firm. Given the OFDIEint, the No. of countries or total enterprises in which OFDI has been undertaken in recent years by the firm, does not exert a significant effect (these results not tabulated). Considering separately the effects of manufacturing and non-manufacturing OFDI enterprises, the No. of manufacturing-OFDI enterprises is found to be an unimportant determinant and hence dropped. The number of non-manufacturing (mainly trading) OFDI enterprises, OFDInoE\_~Mfg seems to have a positive influence on the total exports. Though its coefficient is large and positive, it fails to acquire 5% or higher level of significance (e.g. in Eq. 3).

**Table 4: Regression Estimates of Log-Exports, ExportsL**

N=124

Explan.Var.↓	Eq. 1	Eq. 2	Eq. 3
SizesL	0.762 (5.01)***	-0.413 (0.56)	0.756 (4.69)***
SizesL2		0.1023 (1.73)*	
AgeL	0.736 (2.88)***	0.683 (2.66)***	0.693 (2.62)***
BG			0.296 (1.00)
IOGint	0.046 (2.04)**	0.042 (1.82)*	
OFDIEint	0.409 (3.42)***	0.376 (2.87)***	0.364 (2.13)**
OFDInoE_~Mfg			0.353 (1.30)
FC_Japan	-1.142 (2.84)***	-1.088 (2.83)***	-1.201 (3.08)***
RDInt_C	0.510 (1.80)*	0.517 (1.84)*	0.500 (1.79)*
Adint	0.429 (2.10)**	0.396 (1.99)**	0.452 (2.20)**
Trademark	0.714 (1.92)*	0.736 (1.98)**	0.687 (1.81)*
PM_G	0.044 (2.78)***	0.056 (3.09)***	0.045 (2.70)***
Constant	-0.891 (0.79)	2.386 (1.04)	-0.861 (0.72)
R <sup>2</sup>	0.4332	0.4410	0.4331
F-value	13.02	13.95	11.05
Prob> F	0.0000	0.0000	0.0000

Notes: Robust t-values for b-coefficients.

\*, \*\* and \*\*\* indicate 10, 5 and 1% level of significance.

Thus the OFDI intensity has a complementary effect on the parent company's total exports from the home country – a finding in conformity with the existence evidence, in general. A similar though statistically weak tendency is found for the effect of No. of non-manufacturing OFDI enterprises. For manufacturing OFDI, our results indicate no significant effect, contrary to a significant positive influence found by Head and Ries (2001) for Japanese auto component producers (Followers).

The (current expenses) R&D intensity coefficient is found to be consistently positive in ExportsL equations. The RDint\_C coefficient is large and significant – at 5% level if one applies the one (right)-tail test. Thus more R&D intensive firms seem to enjoy greater global competitiveness. However, the other technological variables like the No. of foreign technical collaborations and technology import intensity variables are not significant. The firm profitability has a large positive effect on its total exports; its effects on XerO and XerOT are insignificant. As we employ the profitability as a proxy for productivity, we may say that among exporters, the more productive firms have much larger total exports.

In preliminary regressions the degree of foreign ownership (%) effect, considered linearly or quadratic, is found to be insignificant. With (MINFD, MAJFD) formulation, the MAJFD variable has a weak negative coefficient, while MINFD was quite insignificant and hence dropped.<sup>12</sup> With (FC\_Japan, FC\_~Japan) set, the latter variable is found to be highly insignificant and has been dropped. The FC\_Japan coefficient indicates a large adverse effect of Japanese foreign ownership on total exports by the firm (Table 4). Thus, given other things, compared to locally-owned firms and non-Japanese foreign affiliates operating in India, the Japanese foreign affiliates export relatively less, apparently being more focused on the Indian domestic market. Among the marketing variables the advertisement intensity and having a trademark have sizable favourable effects. The Xincharge variable is positive but generally not significant at 20% level; also the Emark, Award and ISO14001 coefficients are found to be insignificant.

**Comparison across XerO, XerOT and ExportsL Equations:** Next we compare the results across different export 'Level' equations: exporting to OEMs, exporting to 'OEMs and/ or Tier firms', and log-exports at any 'Level'. Some variables are found to have quite different effects on XerO and ExportsL. Here we refer to the results of preferred specification Eq. 1 in Tables 2-4.

As expected, the firm size has greater and more significant influence on the probability of being OEM-Level exporter (XerO) than that of 'OEM and/ or Tier'-Level exporter (XerOT), as in Singh (2010). Among exporters, the older firms export much more but younger firms are more likely to export to OEMs. The advertisement intensity has a consistently positive and significant effect across all three equations. However, ISO14001 and Xincharge variables, having positive coefficients, are significant only in XerO and XerOT equations, while Trademark has a significant positive influence only on the total exports.

The OFDI intensity has a positive linear effect on the total exports but has an inverted U-shaped effect on the XerO and XerOT probabilities. The number of manufacturing-OFDI enterprises significantly reduces the likelihood of being an OEM-Level exporter, and that of being 'OEM and/ or Tier'-Level exporter, but does not affect the total exports by the parent company from the home country. The number of non-manufacturing OFDI enterprises enhance significantly the XerO probability, while the favourable effect on total exports is weak. The number of countries of OFDI lessens the probability of

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<sup>12</sup> This was also true with MINFD alternatively defined as >25-50% foreign shareholding dummy.

being an OEM-Level exporter from the home country but it does not significantly affect the total exports.

The Business Group affiliation (BG) has a favourable effect only on the total exports, though it is statistically weak. A higher intensity of investment in overseas Group companies by a BG-affiliate increases its total exports from home. Higher profitability is accompanied by greater exports but not by higher probability of being exporter to OEMs or of exporting to 'OEMs and/ or Tier-firms'. The degree of foreign ownership (%) has an inverted U-shaped effect on the probability of being OEM-Level exporter. Non-Japanese foreign-owned firms are more likely to be 'OEM and/ or Tier'-Level exporter; the Japanese foreign affiliates in India have significantly lower total exports.

Higher R&D intensity leads to greater total exports, as in Pradhan (2007) but neither disembodied or (capital goods) embodied technology import intensity has a significant effect on the total exports. The technology import (remittances) intensity affects adversely and significantly both XerO and XerOT probabilities. However, firms having a larger number of technical collaborations are more likely to be OEM-Level exporters. Ceteris paribus, those with lower Skill of employees and computerization, and higher intangible assets (like copyrights) intensity are more likely to be 'OEM and/ or Tier'-Level exporters.

## **7. Conclusions**

This Section summarizes the findings relating to the focus explanatory variables and draws a few policy implications. A simple comparison of the OFDI-undertaking and other firms in our sample reveals much higher R&D intensity for the former, while similar technology import intensity of the two sub-sets. The OFDI firms have higher export intensity, as well as higher proportions of firms exporting to OEMs and those exporting to 'OEMs and/ or Tier-Firms'.

This empirical study finds support for the OFDI-exports complementarity hypothesis, as indicated by a significant favourable effect of the OFDI intensity, and a positive, though weak, effect of the number of non-manufacturing OFDI enterprises on the total exports from Home by the parent company. These results are consistent with the existing evidence, in general. We have additionally examined the influence of OFDI on the probabilities of export participation at OEM and 'OEM and/ or Tier'-Level. Again the positive effects of OFDI intensity up to a certain value on these probabilities, and the No. of non-manufacturing OFDI enterprises enhancing the likelihood of being exporter to OEMs suggest a kind of complementarity. Pradhan (2007) recommends a proactive strategy towards OFDI in order to make better use of OFDI as an engine of exports growth.

Our results also indicate that an increase in the OFDI intensity beyond a certain level and the No. of manufacturing-OFDI enterprises lower the probabilities of the investing parent firm being exporter to OEMs and to 'OEMs and/or Tier-firms'. Again, a higher number of countries of OFDI investment lessen the likelihood of being exporter to OEMs. These tendencies – pointing to the OFDI-exports substitutability – are understandable as the manufacturing-OFDI enterprises may supply to international OEMs/ Tier-firms operating outside the home country, in lieu of the parent company supplying the latter from Home. The parent company is still likely to be involved in the mutual learning through component designing and modifications for these international buyers.

If a higher OFDI intensity consistently increases the total exports from Home by the MNE and the manufacturing-OFDI does not substitute these exports while the distribution-OFDI tends to encourage these total exports, as found by us, it implies that the OFDI leads to an increase in the global scale of operations of the MNE (see Swedenborg, 2001 for a similar argument). This leads to fuller enjoyment by the MNE of economies of scale and scope in R&D, marketing, distribution activities etc.; the Home operations of the MNE are likely to gain from such activities undertaken by the foreign affiliates.

As for the impact of technological variables, this study indicates that a higher R&D intensity increases total exports but not the probability of exporting to OEMs or even that of exporting to 'OEMs and/or Tier-firms'. Higher technology import intensity lessens these two probabilities, though it does not significantly affect the total exports. However, the number of foreign technical collaborations has a favourable impact on the probability of being exporter to OEMs. Thus we may say that encouraging SMEs to have in-house R&D and testing facilities and to conclude foreign technical collaborations would increase their export competitiveness. Business Group affiliation has a weak positive effect on the total exports.

This study finds the marketing factors to be important determinants of export competitiveness, not just in terms of the total exports but also the probabilities of being OEM-Level and 'OEM and/ or Tier'-Level exporter. Given the significant role of marketing factors, also for establishing the OEM or high-Tier linkages, the industrial policies should pay adequate attention to enhancing the marketing capabilities of firms. The favourable role of ISO14001 certification for the OEM-Level export participation is pertinent to the policies promoting international Standards.

In view of the data constraints we are unable to take care of the endogeneity of OFDI, and the dynamic effects of OFDI and type of OFDI on exports. Again the data limitations prevented us from analyzing the value of exports separately at different 'Levels'. Also several explanatory variables of the model like R&D intensity and productivity (/ profitability) may have two-way relationships with exports. Our suggestions for future research are: extending this analysis to other sectors and countries, and incorporating the potential improvements, as stated above.

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