MNEs and Export Spillovers: An Analysis of Indian Manufacturing Industries

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Abstract

The attraction of foreign MNEs have been seen mainly from the point of view of the effects related directly to productivity of local firms. Instead a new strand of literature has deepened the issue focusing on the export behaviour of local firms, claiming that FDI may have an impact on exports, even though the link with productivity is left aside. Following this line of reasoning the existing literature primarily focus on the influence of foreign firms on domestic firms' decision of entering the export market as well as the export intensity. In the present paper, we try to provide some empirical evidence for the export spillover effect examining a case of an emerging economy, namely India for the period 1994-2006. By using a firm level dataset of around 3000 firms belonging to the manufacturing industries, we test for the export spillover hypothesis using a two step modelling strategy (Heckman selection model).

In building the spillover variables we disentangle different channels, namely information spillover, technology spillover and a sort of skill spillover effect. We also consider the heterogeneous technological behaviour of local firms considering different types of technological variables that may affect the overall exporting performance. Our findings mainly confirms that the two most important channels for export spillover are relative to the demonstration effect and to the technological spillover effect with regard especially to export intensity. Instead, the decision to export is influenced mainly if we take into account the role played by technological activities of local firms, confirming that R&D is a key variable that help firms to overcome fixed costs that are crucial to start exporting.

Keywords: Exports, spillover, MNEs
JEL classification: F23, O14, O53

1. INTRODUCTION

The competition between governments in order to attract Foreign Direct Investment (FDI) has always been very high. As a matter of fact, MNEs are considered to be owners of superior firm specific assets that they cannot completely protect from spilling over to local firms. However, there is some ambiguity regarding the positive benefits of FDI in the host economy according to the available empirical evidence on the issue. In particular, the results are highly dependent on the level of development of the country examined. The lack of consensus across studies may be attributed to several factors: for example, the absorptive capacity of the domestic firms, the technology gap between foreign and local firms, the role of spatial proximity effects and the motivations for which MNEs invest in a specific host country (Gorg and Greenaway, 2004). Nevertheless, there is an important aspect that has not received proper investigation: that is, whether the final effect on productivity may be mediated by an effect on host country exports. Indeed, it is commonly accepted that the level of exports of a country represents an indicator of economic development. It is due to the fact that, usually, at the country level, exports and economic growth are highly and positively correlated. For these reasons, policy makers encourage exports through various incentives such as export subsidies. However, a recent microeconomic literature has tried to explain, from a theoretical and empirical point of view, the characteristics that distinguish exporters from non exporters. Especially, beginning from the widely cited paper by Bernard and Jensen (1995), a wide range of studies found out that exporters perform better than domestic market oriented firms. Mainly, it is due to two reasons: (i) in order to enter in the foreign market firms need to be able to compensate for sunk costs involved in the exporting activity, and (ii) the higher competition in the foreign markets lead the firms to raise their productivity. The ongoing debate in the international trade literature is based

on this crucial question: do successful firms export, or does exporting lead to higher firm productivity? Up to now, two strands of literature are present: one favouring self selection of better firms into export markets (e.g. Bernard and Jensen, 1999) and the other in favour of the learning by exporting hypothesis (e.g. Van Biesebroeck, 2005).

However, in the above mentioned literature, the role of MNEs in influencing the export performance of local firms' is virtually absent. As a matter of fact, very few papers have appeared in the literature searching for the above aspect. The usual model chosen to estimate the effect is made up of two equations: in the first it is tested the role of some foreign firms variables (calculated at sectoral level) on the decision to export or not, while in the second it is tested the role of the same variables on the export intensity, conditioned to the fact that the firm has chosen to export. Studies carried out in this field are very scarce and they usually report mixed results both with regard to export decision and export intensity. These studies confine mainly to the experience of developed countries, while, with regard to developing countries, they are nearly non-existent.

For all these reasons, using a rich firm level dataset relative to Indian manufacturing industries for the period 1994-2006, we investigate whether MNEs activities proxied by seven different spillover variables are the source of rising export activity on the part of the local firms. Besides showing empirical evidence for another country, we add to the existing literature in two ways: first, we do not use the usual spillover variables employed in the literature, such as sales, R&D and exports, but we include additional variables in relation to MNEs activities that may result of importance to explain export behaviour. In particular, we take into account imports spillovers (we expect to have a negative sign), as well as capital and royalties spillovers. The latter variable take into account the fact that MNEs

with more linkages with the local industrial environment raise the possibilities of greater spillovers, in this way improving export activities of local firms. Further, India provides an interesting case study because, as cited in Poddar (2004), it has experienced a large surge in FDI inflows, imports and exports since 1991 when the country, started to implement a series of macroeconomic, industrial, and trade reforms. The present paper is structured as follows: in section 2 we carry out a critical review of the export spillover literature; the third section is devoted to a description of the FDI regime in India. Section 4 provides the description of the empirical methodology along with description of the dataset and descriptive statistics. Section 5 provides some comments on results and section 6 concludes.

2. EXPORT SPILLOVER FROM FDI: WHAT DOES EVIDENCE TELL US?

In the past decades, there has been a noticeable policy competition between countries to attract FDI. The reason is related to the fact that multinational investments are expected to bring in the host country a series of benefits, both direct and indirect. While the former constitute an increase demand for labour or by a higher level of R&D of the host country, the latter are popularly known as productivity spillover effects. Indeed, MNEs possess certain firm specific advantages such as higher technological knowledge, superior managerial know-how or better information about foreign markets, that allow them to successfully invest abroad. However, economic theory considers that these assets may be only partially protected, allowing local firms to internalize the leakage of knowledge accruing from them. Even though it is difficult to empirically disentangle the different channels of the spillover effects, it is considered that they may be divided between horizontal (intra-industry) and vertical spillover (inter-industry). Despite the numerous

studies on productivity spillover effects, only mixed results have been found with regard to empirical evidence. Some recent surveys (e.g. Görg and Greenway, 2004; Smeets, 2008) arrive at the conclusion that it may be due to two reasons: first, the differences in the empirical methodology used to carry out such studies, in particular the use of cross section or panel data (Görg and Strobl, 2001) or the way the externality term is specified (Castellani and Zanfei, 2007). The second is linked to the characteristics of the host country (Lipsey and Sjöholm, 2005) like the absorptive capacity of domestic firms, the technology gap between foreign and domestic firms, the role of agglomeration economies and the motivations for which MNEs invest in foreign countries. The only result that is worth mentioning is about the positive spillover effect found when backward and forward linkages (inter-industry spillover) are taken into consideration. It occurs since MNEs are more willing to share their superior knowledge with suppliers and buyers rather than with their competitors. This effect is considered to happen even in the case of developing countries (Javorcik, 2004; Blalock and Gertler, 2005). However, it needs to be stressed that even in this case some papers found negative or contrasting results, especially with regard to emerging and transition countries (Sasidharan, 2006; Merlevede and Schoors, 2005). As Castellani and Zanfei (2006) point out it could be due to the scarce absorptive capacity of local firms; as a consequence, MNEs decide to source their inputs from abroad (increasing imports) by softening the linkages with local firms. There is however, one indirect channel that has been disregarded both by theoretical and empirical analysis. Very recently, a new strand of literature emerged exploring whether productivity effect may be mediated by exports.

The link between exports and productivity was examined until recently only at the country or industry level (e.g. Lopez, 2005). The investigation of this issue at microeconomic level has gained momentum

since the publication of studies by Bernard and Jensen (1995, 1999). Their research question probes into the differences between exporting and non exporting firms. They find that the former usually perform better than the latter. The crucial question addressed is: do exporters enter the export market because they are more productive or because being exporters favor a rise in productivity? Since the appearance of pioneering studies, two different but non-mutually exclusive positions are emerged: the first is relative to the fact that the presence of sunk costs such as the transport costs or those associated to distribution, could be the source of self-selection into the export markets. According to this view, the direction of causality runs in only one direction: that is, if a firm has a higher productivity it will be present in foreign markets. It means that firms need to become more productive to become exporters.

There are some theoretical models (e.g. Melitz, 2003) in which it is found that firms with higher productivity self select in export markets. It happens because, through exports a firm can gain efficiency through a reallocation of resources and, most of all, because the presence of fixed cost, reducing the price-cost margins force, the less efficient firm to be pushed out of the market. Some empirical studies, such as Clerides et al. (1998) and Bernard and Jensen (1999), using different econometric techniques confirm this hypothesis.

The second hypothesis is that causality may run also in the opposite direction: it means that firms become more productive after having entered in the export market, reporting a sort of learning by exporting effect. For example, Blalock and Gertler (2004) for Indonesia, Kraay for China (1999) and Bigsten et al. (2004) for Sub-Saharan Africa confirm this hypothesis. A subsequent study by Van Bisebroeck (2005) for the same region also reach a similar conclusion. The mechanism through which the learning by exporting

effect may be generated are first of all relative to the interaction with foreign competitors and customers. It implies more knowledge of what is needed at national level. In the second place, exporting allows to increase scale by having access to a larger market.

From our point of view, we think that even the presence of MNEs inside the industrial environment of a country may stimulate exports. It is interesting to note that empirical literature on the effects of FDI on export activities of local firms is very few, especially with regard to the experience of developing countries. The link with productivity is considered in this way: Greenway et. al (2004) considers the fact that if exports are higher then even productivity will growth. If local firms decide to become exporters or to increase their export intensity because of export spillover effect coming from MNEs, the resulting and final effect is that their productivity may also rise. Considered in this sense, mean that a sort of learning by exporting is present. Instead Kneller (2007) build on the fact that different channels impact differently on productivity. Even tough the theoretical position claimed in the papers are different, the empirical estimation are all carried out with the same methodology and considering just the final effects on exports.

For these reasons, we undertake to empirically examine whether the MNEs may affect the export behaviour of local firms. The channels through which this may occur are considered essentially two: the first is with respect to informations they convey about foreign markets. Moreover, benefiting from network communications MNEs may have better know – how about distributions and servicing facilities as well as higher marketing capabilities. Another possible channel that may result in higher level of exports, is due to the higher competition that MNEs produce with their presence. They may also give rise to a higher imitation process in order to gain presence in exports markets.

We review the papers written on this subject trying to identify especially the different channels through which the final export spillover effect occur.

One of the key paper on the issue of export spillover is the study by Aitken and Harrison (1997), in which they examine the manufacturing Mexican industry in the period 1986-1990. By using a probit model, they test whether a firm decision to export is influenced by MNEs. The found that it is important both with respect to two measures of MNEs activities: sales and exports. In this case no channels are considered, even though the two types of measures used in the empirical analysis may be reducted to two types of channels, that are information and competition spillover effect.

The results are positive with regard to both variables even though we do not know whether export decision is influenced by the presence of MNEs or by their export activities. A cross section study about Uruguay was carried out by Kokko et al. (1997) searching only on the probability that MNEs act as a way to make local firms ready to enter in the export market. However, in their study the possibility that exports activities of foreign firms may act as a mean to spur higher export activities on the part of local firms is not explored. In this sense the demonstration effect is not searched for, and the specific econometric technique used is not useful to establish causal relationship.

With regard to United Kingdom, Greenway et al. (2004) use three variables to proxy spillover effect: the R&D expenditure to measure innovation spillover, the employment share of MNEs to account for higher competitive pressure and the role of exporting activities to account for information externalities. By using the two step Heckman estimation procedure, they found positive results for all of the three variables with

regard to export decision. Instead, with regard to export intensity they found a negative effect with regard to information externalities while the other channels display significant an positive coefficients. They explain their results by saying that information externalities may be useful only when a firm decides to export or not, even though there is evidence of the fact that in general information externalities play a certain role in spurring domestic exports. This study is also important because it takes into consideration the fact that even local technological effort may play a role in explaining export propensity even tough they are not crucial to explain export propensity.

Another study of UK is examined Kneller and Pisu (2007) that instead find results contrary to the previous paper. They add as a channel of export spillover, the backward and forward linkage effect. By using a database from 1992 to 1999, they find out that they are positively related both to export intensity and export decision. Further, they find that export oriented foreign firms are not considered to influence the export intensity of local firms. In this case the channel of technological behavior of foreign firm is not explicitly considered; instead it is disentangled whether horizontal and vertical linkages between firms may have different impact on the capabilities of local firms of start exporting or enhance their capability to.

Some studies also find evidence of negative effects on exports such as in the case of Ireland and Spain. A study of Irish firms by Ruane and Southerland (2005), who consider separately the output and export activities of foreign firms find positive effects coming from horizontal spillover and negative results coming from export spillover both with regard to export decision and export intensity. They motivate these results by arguing that information externalities may not occur due the particular role played by Ireland as export-platform because exporting firms do not have enough contact with foreign firms. However, they do not consider that these same

MNEs may be the source of export demonstration effects that may be not necessarily mediated by explicit contacts Negative results are also found by Barrios et. al.(2003) who find that the most important variable to account for export spillover is R&D intensity of foreign firms, while little evidence is found with regard to information externalities coming from export behaviour of foreign firms. They are also able to account for the fact that exporting to different markets may lead to different spillover effects because it is necessary for the firms to upgrade its technological capabilities to meet the standard of the exporting market. The said effect may be also influenced by the destination country where the firm exports as it is demonstrated in their empirical application. In particular, it is shown how R&D spillover are particularly relevant for those firms that exports in OECD countries while they are negligible for those exporting to non OECD countries. In this paper it is also considered the fact that even local firms may act as export spillover channels. However, this type of analysis uses a different econometric model that do not use a twostep modeling strategy and most of all is static. It means that past export experience is not taken into consideration, even though as many studies confirms export is an activity that involves sunk cost and for this reason show a high degree of persistency.

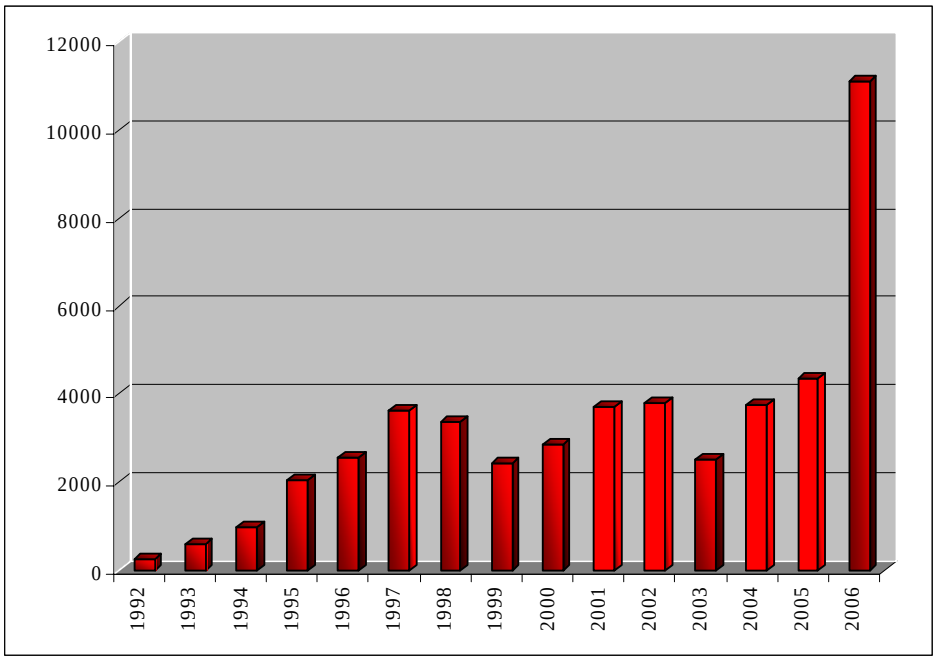
To sum up, we claim that overall there is little evidence of export spillover coming directly from the export orientation of foreign firms. This is may be due to the fact that linkages and horizontal sales spillover first have an impact on productivity and then on exports: this is an indirect proof of the fact that better firms self select in the export market.

3. FOREIGN DIRECT INVESTMENT AND EXPORTS IN INDIA

Until 1990, Indian economy was characterized by severe controls and regulations on foreign capital and ownership. The adoption of controls on production of goods and services during the first three decades since independence led to the deterioration of India's competitiveness and lackluster performance in the world market. This was complemented by the adoption of policies like industrial capacity licensing and regulations on capital goods imports and foreign collaborations. During the regulated regime, foreign investment was considered as a means to obtain technology previously unavailable in India. The most preferred mechanism to acquire technology during this period was through imports of capital goods and licensing agreements (Kumar 1994). However, in reality, the dirigiste regime stood as a major stumbling block in obtaining much needed modern technology. While tracing the government policies toward FDI in India, one can broadly classify the periods as pre-reform (1948-1990) and the reform period (from 1991 to present). The period from 1948 till 1990 witnessed a cautious and restrictive approach towards FDI. The pre-liberalization framework has been extensively analyzed previously by Kumar (1994). The period from the beginning of nineties witnessed the beginning of the liberal attitude towards FDI. The occurrence of the unprecedented economic crisis in 1991, forced the policy makers to transform the highly regulated regime. Accordingly, the adoption of new liberalized regime since 1991, dismantled the industrial licensing system and removed restrictions on foreign equity participation. At present, FDI is allowed in almost all the sectors except those reserved for strategic factors. Since its adoption, Indian economy has witnessed a surge in the foreign direct investment. The adoption of a liberal FDI regime has led to an increase in the amount of FDI flows to India (Fig. 1). It can be observed that the inflows experienced a marked increase till

1997-98. Since then, the inflows have picked up again reaching an all time high of US $ 11,119 million during the financial year 2006-07.

Fig. 1 FDI Inflows to India 1992-2006 (US $ Million)

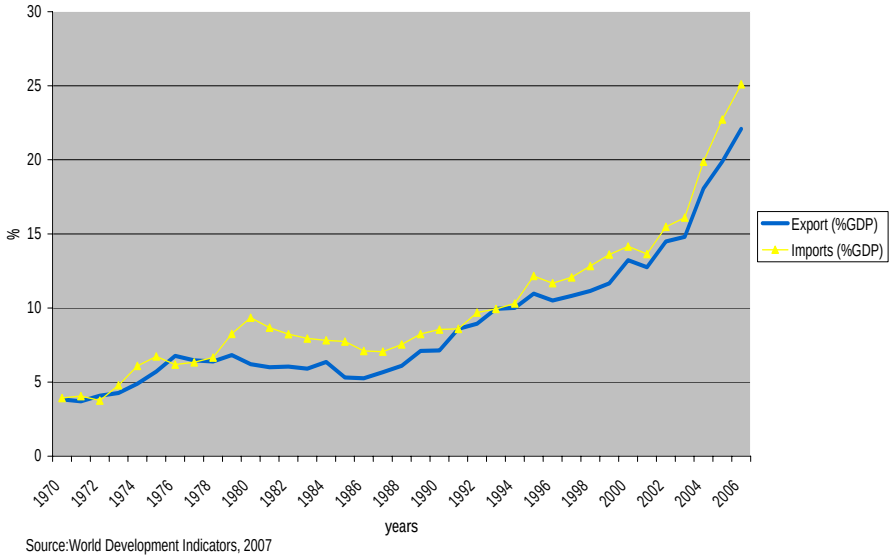


Source: SIA Newsletter (various issues) http://dipp.nic.in

In the same way, India experienced a large increase in exports and imports as well. Especially with regard to exports, it is possible to see from Fig.2 that they started rising even before the beginning of the period of great liberalization and that imports rising have been even greater across the whole span of time. It indicates that local firms drawn a lot from foreign sources both of technology and intermediate inputs. With regard to this trend, some studies have analyzed the Indian post liberalization period characterized by the grater involvement in international trade activities. Only a few papers deal with this issue: Poddar (2004) analyses the determinant of export increase by looking at the micro foundations of export success. He

finds that the increase in export intensity in Indian manufacturing is mainly due to the higher export intensity of incumbent firms rather than the entry of more export oriented firms that causes a rising of the overall export performance. In the same way Aggarwal (2002) investigates whether foreign firms or local firm perform in a different way with regard to international market. He finds that in some cases, multinational firms do not outperform local firms especially with regard to the level of technological base with which they are endowed. He concludes that India, as far as the first decade of greater economic openness, has not succeeded in attracting efficiency seeking FDI but just FDI that are more market oriented. To sum up, from these we might expect that FDI will affect more firm productivity fostering their entrance in the export market but having less effect on the export intensity because of lower demonstration effect.

Fig.2 India's rising economic openness



Source:World Development Indicators, 2007

4. DATA AND METHODOLOGY

The empirical estimation is carried out using data coming from the PROWESS database provided by the Center for Monitoring Indian Economy (CMIE). This database contains information on more than 9000 firms registered with the Bombay Stock Exchange. However, for our study, we use data relative only to the manufacturing sector firms (Sector 15-36 in the NIC classification). At the end of the data cleaning process, we were left with a sample of 3053 firm. We built an unbalanced panel keeping only those firms with at least four consecutive observations with regard to sales, then we deleted also those sectors where the presence of foreign firms were negligible[1]. The data cover the period from 1994 to 2006. For the present study, all those firms having foreign equity greater that 10%[2] of the total equity are classified as foreign firms.

The empirical model used to search for any export spillover effect draw from the empirical methodology that is recently applied to this type of studies (e.g. Greenway at al. 2004; Kneller and Pisu, 2007). As we are interested in the explanation of the export performance of firms, by using the Heckman selection model we take into account of the two stage decisional process in which firms are involved in, avoiding selectivity bias that would occur if we had considered them separately.

The two equations of the model are the following:

$$EXP_{ijt} = \alpha + ß_1 K_{ijt} + ß_2 Wage_{ijt} + ß_3 RD_{ijt} \quad ß_4 Size_{ijt} + ß_5 Size^2_{ijt} + ß_6 Age_{ijt} + ß_7 Age^2_{ijt} + ß_8 Sp_{jt-1} + ß_9 EXP_{ijt-1} + ß_{10} Profits_{ijt-1} + \nu_i \quad (1)$$

[2] We deleted the following sectors: 16,18,19, 20, 22,23,32,35,36
[2] This is the standard definition adopted by IMF

$$EXPINT_{ijt} = \alpha + ß_1 K_{ijt} + ß_2 Wage_{ijt} + ß_3 RD_{ijt} \quad ß_4 Size_{ijt} + ß_5 Size^2_{ijt} + ß_6 Age_{ijt} + ß_7 Age^2_{ijt} + ß_8 Sp_{jt-1} + ß_9 EXP_{ijt-1} + \nu_i \quad (2)$$

Where subscript i refers to firm, j to sectors and t to time. Moreover, $v_i \sim N(0,1)$ and $u_i \sim N(0,\delta)$. In the first equation the dependent variable (EXP) is a binary variable which is assigned value 1 if firms report positive exports and 0 in all the other cases. This first equation, estimated both for exporting and non exporting firms, performs the sample selection for the second model in which the depended variable that is export intensity measured as a ration on total sales[3]. The distribution of error terms is assumed to be bivariate normal with correlation ρ. It means that the two equations are related if $\rho \neq 0$. It is for these reasons that estimating just the export intensity would lead to sample selection bias.

We carry out our estimation using the maximum likelihood methodology instead of the two step since it is more efficient.[4]

The value of profitability ($Profits_{ijt}$) is built using profit before tax as a share in total sales by sector. This variable is a proxy of the capacity of the firm to meet the fixed cost associated with the entrance in the export market and, for this reason, discriminates between the two exports equations.

Another problem that we may need to deal with is endogeneity: in order to take into account this aspect we use the lagged depended value of the spillover variable. In this way we also account for the fact that spillovers take sometime to impact on the export status and decision of local firms.

[3] Sales are deflated using World Production Index at the five digit level

[4] In this last case, it is first estimated the probit of the export decision and then, after having computed the inverse Mill's ratio it is inserted inside the export ratio regression as a dependent variable.

In both models, we include two types of variables: firm's level variables and spillover variables measuring different economic activities of MNEs in the host country. In the latter case, variables are all measured at the two digit sectoral level (j) on an annual basis (t).

We also include a set of sectoral and temporal dummies to account for possible business cycle effects and in order to take into consideration possible time invariant sector effects.

(a) *Firm level variables*

The choice of firm level variables that enter into the model are guided mainly by the consideration of the literature related to the export determinants. First, we include two proxies for age and size. The former is measured as the difference between the current year and the year of incorporation (Age_{ijt}), while the latter is built as the ratio of each firm's sales and the average sales by sector. Following the industrial organization literature, we think that older and larger plants are more likely to show higher productivity performance and thus higher exporting activity. Nevertheless, we also think that the effect produced by age and size is non-linear. In particular, advantages of size hold only to a certain extent, that is when coordination costs exceed profitability. In the same way, older firms tend to be more efficient than younger firms because of a sort of learning by doing effect, lowering distribution and production costs. However, as Power (1998) argues, age shows an inverted U shape relationship with exports as well. Accordingly, we insert a quadratic term for both variables.

The capital intensity (K_{ijt}) is added to the specification and is considered to be positively related both to decision to export and to the export intensity. It may be especially true in the case of developed countries

because it embodies accumulated technological knowledge or stands for the presence of economies of scales (Wakelin, 1998). Instead, in the case of developing countries that are capital scarce the capital coefficient may turn out to be negative or insignificant. In the PROWESS database, this variable is not directly available, the capital stock is arrived at using a perpetual inventory method. We added up K_o and I_t, in which K_o is the benchmark year capital stock, which is in our case is 1994. The It value is: $It = GFA_t - GFA_{t-1}$, where GFA is gross fixed assets. In order to have the replacement cost of plant and machinery GFA of the company has been multiplied by a number which is (a) 3 if incorporation year is 1965 or earlier, (b) 2 if incorporation year is later that 1965 but earlier than 1980 and (c) 1.5 if incorporation year is later than 1980.

Moreover, as it is accounted in most of the evolutionary literature, learning is of crucial importance to the acquisition of technology. In order to effectively taking advantage of technology, firms have to hire skilled people. We use as a proxy the wage intensity ($Wage_{ijt}$) to take into account that the quality of firm workers may affect export performance (Roberts and Tybout, 1997).

In the end, we need to include a proxy for technological activities internal tot the firm. We use R&D intensity considering that the higher the technological activities the higher the export intensity (Bleaney and Wakelin, 2002). However, it should be underlined that in the case of developing countries R&D are only a small part of the technological capability effort and for this reason it may not give the expected positive contribution to export enhancement.

We also add a measure of technological imports intensities ($techint_{ijt}$) in order to take into consideration the fact that local firms may draw even from other foreign sources of technology that may help them to grasp the positive effects coming from MNEs. This is particularly true in the case of India because the country has relied on imports in the period before 1991 and imports have continued to grow even after that date. As a matter of fact a recent literature has started to investigate the role played by imports in the explanation of firm performances. In particular, much of the empirical literature has focused on the hypothesis of learning by importing finding positive results (Halpern et. al. 2005).

(b) *Spillover variables*

As to what concern the variables related to foreign presence, we calculate three different spillover variables in order to take into account the different channels according through which the spillover effect occurs. They are inserted once at a time in our baseline specifications also because considering them all together they could show some degree of collinearity. In this way we estimate three different models.

Following Atkinson (1997), we calculate the spillover variable as the ratio of MNEs exporting activities in a certain sector scaled by the relative importance of MNEs exports in total exports. This variable should capture the informations externalities (or market access spillover) coming from higher knowledge of foreign markets possessed by foreign firms. Indeed, it is usually believed that foreign firms has already established distribution networks, possess a higher degree of knowledge about the functioning of foreign market and customers and they hold more sophisticated marketing research techniques. For this reason, we expect a positive sign for this variable because this effect should lower the cost of obtaining such informations.

The second channels through which spillover effect may occur is through R&D activities of foreign firms (calculated as the share of foreign firms R&D to total R&D of the sector). As it is confirmed by other studies, foreign R&D may impact on the capacity of export in an indirect way but by facilitating the increase of productivity. Even in this case we expect a positive sign because the hypothesis we make is that the higher the level of technological intensity of foreign firms the higher the possibilities of imitation.

The last spillover variable we take into consideration is relative to the level of skills (measured as the share of foreign firm wages to total wages of the sector) embodied in human capital of foreign firms. It is usually considered that employees of foreign firms are receive a higher level of training that may be conveyed to local labour work force when face to face contact occurs. In particular, it may rise even the local level of skills of employees by facilitating the understanding the new ideas and technologies brought in by foreign firms.

As controls, we also use the lagged value of two sectoral variables: the first (Sei_{jt}) is the export share of domestic firms on total exports. It measures the importance of each sector inside the export structure of the country; by including this variable we are able to control for other variables that may affect the overall export performance and for the possibility that MNEs choose to invest in those sectors that are more export oriented. The second ($Ssect_{jt}$) is the industry size measured as the ratio of domestic sales to total sales. It accounts for possible general spillover effects that are not directly related to export activities.

5. ECONOMETRIC RESULTS

The econometric estimations are carried out in two different ways: first, we estimate by pooling the 13 years of data and considering sectors all together. In any case, as explained above, we control for time and sectoral effect using time and sectoral dummies. Then we estimate the same model diving between high and low tech sectors. The last step is that of estimating considering other possible sources of technology for local firms and to see whether interacting them with the spillover variables we obtain significant results.

It should be pointed out that we decide not to test simultaneously for the presence of spillover effect coming from FDI, but we estimate three different models. In each of them, we insert only one spillover variable.

In all models the Wald test for overall significance indicates that coefficients of regressors are significant if taken together and the log-likelihood ratio test validates the choice of the Heckman selection model.

(a) *Export decision*

Considering first the firm level variables, we first notice that the role played by capital is negative and significant. It confirms the fact that being in a developing country affect the role played by capital is marginal. In the same way we found that the role played by R&D is not significant even though it is positive as expected. It is due to the low level of technological activities of firms in India and in particular the role played by the technology in spurring exports may not be so strong. Even the role played by skills is not significant even though positive. On the other hand, both profit intensity and lagged export decision status are strongly significant and positive, meaning that persistence plays a significant role and that firms need a higher level of

productivity in order to start exporting. Even in the case of size and age we found of the fact that larger and older firms are more likely to export and that this effect is non linear. Instead, no role is played by the size of sector or by the fact that being a sector that exports more may be exert a positive effect on the export decision. In the first case the result is expected because it is a proof of the fact firm in larger sectors may be more focused on servicing the local market, while in the second case it means that other local firms do not have effect on the capability to export that it may be true in a country that for many year has been closed to foreign influences. In the case of the basic model, we found that the only case of positive and significant result is when we consider R&D spillover: it means that foreign firms may have impact on the level of internal R&D because they imitate what they do and in this way they are able to start exporting. It is also a proof of the fact that the role of demonstration effect of higher technological levels matters to start exporting. Instead, considering the other spillover variables we found that, even though insignificant their coefficient turn out to be negative in the case of export spillover and positive in the case of wage spillover.

In the following specifications, interesting results are found with regard to the interaction terms: all spillover variables are positive and significant. This effect can be understood if we recognize the fact that R&D of local firms, even though not significant if considered only as a regressor, play a role in absorbing spillover coming from foreign firms. Even in this case, all the other variables turn out to have the same sign and level of significant as in the previous specification.

If we add to the regressions the variable measuring the intensity of technological imports, we can find that the role played by that variable is particularly relevant in the case of export decision contrary to R&D. With regard to spillover variable the same results are found in comparison with the

baseline specification. However if we consider the case of interaction with spillover, while no effect is found when we consider the interactions with spillover variables. For these reasons we have to think that imported technology is needed for the firm to start exporting but that the role played by the same technology in order to grasp the benefit of activities of foreign firms is less evident.

(b) *Exports intensity*

In the case of export intensity, we found that contrary to the case of export decision it is possible to see that skills play a positive and significant role while R&D is again not significant even though the positive sign remains. Contrary to the previous case we found that only age is significant and non linear in explaining export intensity. However, the sign of the coefficient is first negative and then positive, reflecting that in order to raise the amount of export the firm do not need to enhance first the size but may focus it activities in serving the domestic market. Then, when it has gained significant experience in producing internally, it can shift to serving the foreign market. Moreover, the coefficient of size even though not significant confirm the trend of age.

Another difference with the case of export decision is that the role played by the size of the domestic market and the amount of export spillover coming from domestic firms are both positive and significant. These results confirm what we found for age and size: it means that even being inside a larger market may be positive for local firms because unlike the case of developed countries they may improve first their level of local sales and ten start exporting. In this case the role played by the past exporting experience is positive but not significant: it means that the role played by the. Moreover, there is no sign of persistence in the amount of exports, proving that Indian firms are volatile in their exporting performance.

With regard to spillover variables, considering the basic model, we find that the three channels work in different directions: we have the positive effect for demonstration effect, negative for skill effect, non significant for R&D spillover. Looking at signs of coefficient it is possible to realize that they act in different direction with respect to export decision. Firstly, the role played by export spillover is now positive and significant, reflecting that informations and market access spillover are more important when the firm is already an exporter. While the role played by R&D, even though not significant is negative. This result is contrary to those found for developed countries, indicating that local firms even though they may benefit of foreign R&D to improve their technological capabilities and hence start exporting, they do not upgrade their technological level of export, remaining concentrated on exports mainly in low tech sectors.

Considering the case of R&D interactions with spillover variables, we found that contrary to the case of export decision no significant effects occur. This is due to the fact that, as explained above the role played by R&D is marginal with regard to the technological level of Indian exports.

If we add the role played by other foreign sources of technology like in the case of disembodied technological imports, we observe that the coefficient relative to spillover variables show the same level of significance and direction of sign as before. Thus, we can deduce that imported technology do not impact on export intensity, given that the sign of the coefficient is negative (but not significant). This result reflects that the role played by foreign technological imports need to be coupled by an internal R&D effort in order to be able to fully internalize it. The last results that interact technological imports with spillover variables confirm that the role

played by external sources of technologies is not relevant in order to grasp the spillover effects.

6. CONCLUSIONS

The literature about spillover effect coming from FDI has reached only inconclusive and mixed results. Many reasons have been considered to explain this fact, especially the econometrics methods used to measure such effect and the types of countries considered. However, all studies are mainly concerned with the explanation of the final effect of foreign firms on TFP. Other possible effect are mainly disregarded.

Very few studies take into account the possibility that the effect of MNEs on local firms may be related also to exports. In particular, papers that examine developing countries are almost non-existent.

For these reasons, we attempted to examine the export spillovers from MNEs based on a firm level data for the Indian manufacturing industries during the period 1994-2006. We tried to measure the effect of export spillover on the base of three different channels through which the effect may occur: R&D activities, export activities or the level of skills of the foreign firms. Each of this channel may act in different ways.

We go beyond the existing literature because we consider also technology coming from the foreign sources that may be relevant in explaining why some firms are better able to take advantage of the demonstration effect of foreign multinationals.

The case study of India is particularly relevant because it is a country that has experienced a large surge in FDI in recent years, especially after the economic reforms started in 1991.

In particular, we found that the role played by the interaction of R&D with spillover variable is greater than with respect to the role played by technology coming from the outside. In this respect some recent literature has evidenced that the role played by importing technologies in the enhancement of local technological capabilities could be fundamental in order to improve the technological capabilities of local firms. We found quite different results with regard to the coefficient of the two equations: the first important result is that export demonstration effect is significant and positive only when a firm is already an exporter while the role played by R&D is important when the firm have to decide whether to export or not. It means that the sectorial pattern of Indian firms has not changed, but it is mainly concentrated in low tech sectors. Instead, when we consider the role of R&D in grasping the benefits of spillover we find that the role played by R&D is positive and significant in the case of export decision confirming that upgrading technological capabilities is important to enter into export market. In the end, it is important to underline the fact that the role of imports is negligible in the case of India, not confirming the hypothesis recently claimed in the literature of learning by importing. In order to such effect to happen it need to be coupled by a significant internal technological effort.

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APPENDIX

Table 1: Data Overview

NIC Code	Industry Classification	All Firms	%Foreign firms
15	Food Products and Beverages	423	3,22
17	Textiles	331	1,84
21	Paper and Paper Products	108	4,85
24	Chemicals and Chemical, Products	708	6,78
25	Rubber and Plastic Products	225	7,14
26	Other Non-Metallic Mineral Products	125	8,69
27	Basic Metals	347	2,96
28	Fabricated Metal Products	106	2,91
29	Machinery and equipment	223	14,94
31	Electrical Machinery and Apparatus	121	10
32	Radio, Television and Communication Equipment	91	10,97
33	Medical, Precision and Optical Instruments, Watches and Clocks	46	17,94
34	Motor Vehicles	196	12
	Total	3053	

Source: Author's calculation on the base of PROWESS database

Table 2: Descriptive statistics

		expint	rdint	sales	wageint
Local firms	mean	41.8644	1.035303	0.700822	14.8196
	sd	429.6299	14.47106	2.647787	62.59065
	Obs.	25353	25353	25353	25353
Foreign firms	mean	61.60259	3.03639	1.827108	19.18045
	sd	518.8091	50.95034	5.336116	82.81653
	Obs.	2281	2281	2281	2281

Table 3: Results basic model

	(1)	(2)	(3)	(4)	(5)	(6)
	Export int.	Export dec.	Export int.	Export dec.	Export int.	Export dec.
kint	-0.00495	-0.00004***	-0.00492	-0.00004***	-0.00500	-0.00004***
	(0.02197)	(0.00001)	(0.02197)	(0.00001)	(0.02198)	(0.00001)
Wageint	4.13779**	0.00011	4.14033**	0.00010	4.13977**	0.00011
	(1.69470)	(0.00025)	(1.69689)	(0.00025)	(1.69538)	(0.00025)
rdint	9.28645	0.00463	9.27903	0.00467	9.27894	0.00463
	(8.24022)	(0.00299)	(8.23895)	(0.00300)	(8.23913)	(0.00299)
Lexpsp	245.98226**	-0.01357				
	(21.72678)	(0.04822)				
lrdsp			-27.67814	0.25027**		
			(55.91483)	(0.12353)		
lwagesp					-41.22745***	0.01515
					(13.19738)	(0.07076)
age	-3.58483***	0.00463**	-3.61392***	0.00470**	-3.63329***	0.00464**
	(1.26857)	(0.00188)	(1.28064)	(0.00188)	(1.27816)	(0.00188)
agesq	0.02061**	-0.00004*	0.02093**	-0.00004*	0.02115**	-0.00004*
	(0.00873)	(0.00002)	(0.00885)	(0.00002)	(0.00883)	(0.00002)
size	-1.67623	0.23115***	-1.68731	0.23100***	-1.64925	0.23117***
	(2.11231)	(0.02354)	(2.11119)	(0.02352)	(2.11550)	(0.02353)
Sizesq	0.02927	-0.00213***	0.02933	-0.00213***	0.02898	-0.00213***
	(0.02449)	(0.00021)	(0.02444)	(0.00021)	(0.02447)	(0.00021)
lsei	745.31943***	0.07385	670.15121**	0.40665	764.98587***	0.06341
	(260.72397)	(0.44631)	(277.98314)	(0.47112)	(256.00490)	(0.45384)
Lssect	675.79621**	0.00946	663.11596**	-0.31139	533.41920*	0.05510
	(329.19985)	(0.82851)	(312.94116)	(0.84488)	(313.48678)	(0.84013)
Lexpint	0.02444		0.02465		0.02457	
	(0.01584)		(0.01587)		(0.01579)	
lexportdec		2.50420***		2.50560***		2.50414***
		(0.02865)		(0.02869)		(0.02864)
profitint		0.00037***		0.00037***		0.00037***
		(0.00008)		(0.00008)		(0.00008)
Obs.	21332	21332	21332	21332	21332	21332
Wald test	357.92		358.46		378.47	
Log Likelihood	-97476.07		-97476.87		-97477.58	

All regressions include sectoral and time dummies
Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Results with R&D interaction

	(1) Export int.	(2) Export dec.	(3) Export int.	(4) Export dec.	(5) Export int.	(6) Export dec.
kint	-0.00507	-0.00004***	-0.00502	-0.00004***	-0.00513	-0.00004***
	(0.02202)	(0.00001)	(0.02201)	(0.00001)	(0.02202)	(0.00001)
Wageint	4.13537**	0.00011	4.13809**	0.00010	4.13684**	0.00011
	(1.69390)	(0.00025)	(1.69589)	(0.00025)	(1.69431)	(0.00025)
rdint	9.35629	0.00433	9.33730	0.00441	9.36637	0.00442
	(8.30187)	(0.00299)	(8.29624)	(0.00303)	(8.31118)	(0.00300)
Lexpsp	246.16848**	-0.01719				
	(21.76304)	(0.04834)				
Lrdexpsp	2-1.16266	0.00531**				
	(0.84421)	(0.00228)				
lrdspill			-20.54999	0.23618*		
			(55.43543)	(0.12411)		
lrdintrdspill			-6.05747	0.03156**		
			(4.77970)	(0.01454)		
lwagespill					-35.78630***	0.00731
					(13.20392)	(0.07158)
lrdintwagespill					-7.81428	0.02266**
					(5.24267)	(0.01055)
age	-3.48703***	0.00378**	-3.54305***	0.00386**	-3.52081***	0.00384**
	(1.21363)	(0.00189)	(1.23855)	(0.00189)	(1.21902)	(0.00189)
agesq	0.01982**	-0.00003	0.02034**	-0.00003	0.02023**	-0.00003
	(0.00831)	(0.00002)	(0.00851)	(0.00002)	(0.00837)	(0.00002)
size	-1.09444	0.22861***	-1.26253	0.22844***	-1.05002	0.22905***
	(2.35988)	(0.02350)	(2.30778)	(0.02347)	(2.35123)	(0.02352)
Sizesq	0.02244	-0.00212***	0.02427	-0.00212***	0.02171	-0.00212***
	(0.02715)	(0.00021)	(0.02657)	(0.00021)	(0.02710)	(0.00021)
lsei	737.06803***	0.04187	663.19395**	0.38065	760.55862***	0.02819
	(261.56637)	(0.44696)	(279.05830)	(0.47238)	(256.49227)	(0.45491)
Lssect	639.45842**	0.04818	649.85253**	-0.31097	481.65795	0.11083
	(315.95916)	(0.83939)	(307.05650)	(0.85626)	(296.85569)	(0.85027)
Lexpint	0.04874**		0.03907**		0.05623***	
	(0.01951)		(0.01630)		(0.02180)	
lexportdec		2.49693***		2.49825***		2.49717***
		(0.02842)		(0.02855)		(0.02848)
profitint		0.00037***		0.00037***		0.00037***
		(0.00008)		(0.00008)		(0.00008)
Obs.	21182	21182	21182	21182	21182	21182
Wald test	356.32	354.01		379.39		
Log Likelihood	-97445.12		-97447.96		-97444.94	

All regressions include sectoral and time dummies

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5 Results basic model with disembodied technological imports

	(1) Export int.	(2) Export dec.	(3) Export int.	(4) Export dec.	(5) Export int.	(6) Export dec.
kint	-0.00134	-0.00004***	-0.00130	-0.00004***	-0.00138	-0.00004***
	(0.02015)	(0.00001)	(0.02015)	(0.00001)	(0.02016)	(0.00001)
wageint	4.31939**	0.00010	4.32215**	0.00009	4.32174**	0.00010
	(1.80759)	(0.00026)	(1.80973)	(0.00026)	(1.80836)	(0.00026)
rdint	9.16204	0.00457	9.15457	0.00461	9.15443	0.00457
	(8.11928)	(0.00299)	(8.11796)	(0.00300)	(8.11800)	(0.00299)
techint	-2.41194	0.00139**	-2.41653	0.00140**	-2.41717	0.00139**
	(1.75861)	(0.00057)	(1.75969)	(0.00057)	(1.76123)	(0.00057)
lexpspill	244.86845**	-0.01315				
	(21.19676)	(0.04823)				
lrdspill			-25.87498	0.25095**		
			(55.87927)	(0.12357)		
lwagespill					-41.19228***	0.01560
					(13.18832)	(0.07074)
age	-3.77012***	0.00470**	-3.79870***	0.00477**	-3.81841***	0.00471**
	(1.37940)	(0.00188)	(1.39115)	(0.00188)	(1.38883)	(0.00188)
agesq	0.02169**	-0.00004*	0.02201**	-0.00004*	0.02223**	-0.00004*
	(0.00937)	(0.00002)	(0.00949)	(0.00002)	(0.00948)	(0.00002)
size	-1.23783	0.23109***	-1.24824	0.23094***	-1.20964	0.23110***
	(2.36065)	(0.02354)	(2.35963)	(0.02352)	(2.36463)	(0.02353)
sizesq	0.02387	-0.00213***	0.02391	-0.00213***	0.02357	-0.00213***
	(0.02739)	(0.00021)	(0.02734)	(0.00021)	(0.02740)	(0.00021)
lsei	738.74684***	0.08199	666.97197**	0.41552	759.24203***	0.07091
	(259.01100)	(0.44650)	(277.24972)	(0.47137)	(254.42178)	(0.45401)
lssect	700.90564**	0.00777	687.55959**	-0.31463	559.61402*	0.05392
	(335.18401)	(0.82877)	(320.48853)	(0.84514)	(318.91672)	(0.84040)
lexpint	0.02411		0.02431		0.02423	
	(0.01568)		(0.01571)		(0.01563)	
lexportdec		2.50422***		2.50564***		2.50417***
		(0.02880)		(0.02884)		(0.02879)
profitint		0.00038***		0.00038***		0.00038***
		(0.00009)		(0.00009)		(0.00009)
Observations	21332	21332	21332	21332	21332	21332
Wald test	372.96		375.13		393.70	
Log Likelihood	-97444.59		-97445.28		-97445.98	

All regressions include sectoral and time dummies
Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 6: Results with disembodied technological imports interaction

	(1)	(2)	(3)	(4)	(5)	(6)
	Export int.	Export dec.	Export int.	Export dec.	Export int.	Export dec.
kint	-0.00140	-0.00004***	-0.00137	-0.00004***	-0.00143	-0.00004***
	(0.02019)	(0.00001)	(0.02023)	(0.00001)	(0.02018)	(0.00001)
wageint	4.32042**	0.00009	4.32344**	0.00009	4.32196**	0.00010
	(1.80930)	(0.00026)	(1.81343)	(0.00026)	(1.80847)	(0.00026)
rdint	9.16131	0.00469	9.15362	0.00471	9.15501	0.00465
	(8.11820)	(0.00306)	(8.11619)	(0.00306)	(8.11830)	(0.00305)
techint	-2.41839	0.00101*	-2.42542	0.00094	-2.41459	0.00141**
	(1.77647)	(0.00057)	(1.80116)	(0.00064)	(1.76033)	(0.00056)
lexpsp2	44.90345**	-0.01447				
	(21.21989)	(0.04831)				
ltechintexp2	0.04516	0.00057				
	(0.23042)	(0.00044)				
lrdspill			-25.97816	0.24977**		
			(56.17009)	(0.12406)		
ltechintrdspill			0.29948	0.00764		
			(3.96720)	(0.00506)		
lwagespill					-40.49671***	0.01144
					(13.14944)	(0.07152)
ltechintwagespill					-0.69375*	0.00391
					(0.40152)	(0.00489)
age	-3.75081***	0.00399**	-3.78137***	0.00409**	-3.80867***	0.00398**
	(1.36157)	(0.00189)	(1.37089)	(0.00189)	(1.38227)	(0.00189)
agesq	0.02152**	-0.00003	0.02186**	-0.00003	0.02213**	-0.00003
	(0.00923)	(0.00002)	(0.00933)	(0.00002)	(0.00942)	(0.00002)
size	-1.27257	0.22945***	-1.26711	0.22952***	-1.18815	0.22996***
	(2.27776)	(0.02345)	(2.28201)	(0.02341)	(2.35755)	(0.02343)
sizesq	0.02427	-0.00211***	0.02412	-0.00212***	0.02332	-0.00212***
	(0.02643)	(0.00021)	(0.02648)	(0.00021)	(0.02732)	(0.00021)
lsei	739.61045***	0.05463	667.46885**	0.38923	760.10381***	0.04405
	(259.15634)	(0.44714)	(277.18879)	(0.47267)	(254.39103)	(0.45480)
lssect	701.57174**	0.01398	687.83228**	-0.32007	560.48826*	0.05259
	(335.71119)	(0.83854)	(320.56908)	(0.85563)	(319.12064)	(0.84976)
lexpint	0.02404		0.02428		0.02430	
	(0.01572)		(0.01576)		(0.01568)	
lexportdec		2.49806***		2.49954***		2.49789***
		(0.02900)		(0.02905)		(0.02893)
profitint		0.00038***		0.00037***		0.00037***
		(0.00009)		(0.00009)		(0.00009)
Obs.	21182	21182	21182	21182	21182	21182
Wald test	369.79		372.62		391.92	
Log Likelihood	-97424.36		-97424.67		-97425.77	

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%