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Abstract

In the present study, we try to provide some empirical evidence for the export spillover effect examining the case of an emerging economy, namely India using firm level data for the period 1994-2006. We disentangle different spillover channels, namely export spillover, R&D spillover and wage spillover. We also consider the heterogeneous technological behaviour of local firms considering how in-house R&D efforts and disembodied technological imports may affect the overall exporting performance. Our findings mainly confirm that the two most important channels for export spillover are mainly the demonstration effect and the R&D spillover effect The decision to export is influenced mainly 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. Moreover, the findings of the analysis suggest that local firms' R&D is highly relevant to internalize the positive spillover effect emanating from MNEs both with regard to decision to export and export propensity

Key Words: *Exports, FDI spillover, MNEs*
JEL Codes: *F14, F23, O14*

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INTRODUCTION

The competition between governments in order to attract Foreign Direct Investment (FDI) has always been very high. As a matter of fact, Multinational Enterprises (MNEs) are considered to be owners of superior firm specific assets which may spill to the domestic firms through various channels. However, according to the available empirical evidence on the issue, there is no consensus regarding the positive benefits that FDI may bring in to the host economy. The lack of consistency in the findings 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 (Görg and Greenaway, 2004). Nevertheless, there is an important aspect that has not received proper investigation, i.e, whether MNEs activities may have other indirect benefits on local firms such as exporting activities?. Indeed, according to export led growth theories[1], it is claimed that, at the country level, exports and economic growth are highly and positively correlated. For these reasons, policy makers encourage exports growth through various incentives such as export subsidies.

A recent strand of microeconomic literature has tried to explain, from a theoretical and empirical point of view, the characteristics that distinguish exporters from non exporters. Since the publication of a seminal paper by Bernard and Jensen (1995), numerous studies report that exporters perform better than domestic market oriented firms. Mainly, it can be attributed to two issues: (i) in order to enter the foreign market, firms need to compensate for sunk costs involved in the exporting activity; and (ii) firms may also raise their productivity due to the higher competition in foreign markets. Further, it may also be due to the fact that a sort of learning by exporting effect may occur while

[1] see Giles and Williams (2000a,b) for an excellent survey of the literature

investing in foreign markets. For example, local firms may become aware of new products and processes and they may try to imitate the same. With regard to this issue, two positions are emerged within this literature: the *first* in favour of the self selection of more productive firms into export markets (e.g. Bernard and Jensen, 1999) and the *second* that supports the learning by exporting hypothesis (e.g. Van Biesebroeck, 2005).

Recently, it has been recognized that the presence of MNEs may impact on the export performance of the firms of the host country. The existing studies on this issue investigate the said effect utilizing a two step modeling strategy through which it is possible to estimate in the first place the role of some foreign firms on the domestic firm's decision to export, and, in the second place, the effect of same on the export intensity, conditioned on the fact that the firm has chosen to export. However, even in this type of studies, some ambiguous results have been found especially regarding the effectiveness of different channels in conveying the effect. It is also interesting to note that the studies carried out to test these propositions mainly confine to the experience of the developed countries.

For all these reasons, using a rich firm level dataset pertaining to the Indian manufacturing industries for the period 1994-2006, we investigate whether MNEs activities through three different spillover channels are the source of rising export activities on the part of the local firms. The export spillover effect is considered to be mediated essentially by a competition effect or by a demonstration effect since MNEs in comparison with local firms possess superior information about the foreign markets. Besides, foreign firms usually show higher economic performance both in terms of R&D intensity or productivity (Barba Navaretti and Venables, 2004). Besides showing empirical evidence for another country, we contribute to the existing literature in two ways: *first*, we add as a channel of export spillover the skill intensity of MNEs subsidiaries. The effect of this channel has never been examined

previosuly. *Second*, we examine the way in which another source of foreign knowledge, namely disembodied technological imports may contribute to the improvement of local firms' export performance. In particular, our aim is that of comparing the contribution of this external source of technology with in-house technological capabilities in absorbing the spillover effect.

Further, India provides an interesting case study because, as examined by various authors (e.g. Poddar 2004; Aggarwal 2002), it has experienced a large surge in FDI inflows, imports and exports since 1991, when the country began to implement a series of macroeconomic, industrial, and trade reforms that contribute to progressively opening the economy. The remainder of the paper is structured as follows: in section 2 we carry out a critical review of the export spillover literature focusing especially on the investigation of the way the role of different spillover channels is taken into consideration; 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 data source. Section 5 provides discussion of the results and section 6 concludes.

EXPORT SPILLOVERS FROM FDI: WHAT DOES EVIDENCE TELL US?

In the past decades, there has been a noticeable policy competition between countries to attract FDI since foreign firms are expected to bring into the host country a series of direct and indirect benefits. The former may constitute, for example, a change in the industrial structure of the country towards more technology intensive sectors, while the latter are popularly known as productivity spillover effects. Indeed, according to the OLI paradigm[2] (Dunning, 1977) MNEs own firm specific advantages

[2] The OLI paradigm is a framework singled out by Dunning (1977) to analyze the conditions according to which a firm decides to engaged in FDI in comparison with other means of investing abroad. The advantages that FDI provide are

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 coming from MNEs' investments[3]. Even though it is difficult to empirically disentangle the different channels through which the spillover effect occurs, it is considered that they may be divided between horizontal (intra-industry) and vertical channels (inter-industry). The former imply that the effect is found in local firms that are located in the same industry in which MNEs invest while the latter occur because of backward or forward linkages between MNEs and local firms respectively in upstream or downstream industries. Some of the recent surveys of the (e.g., Görg and Greenway, 2004; Smeets, 2008) reach 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 reason 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 those specific foreign countries. However, some of the recent studies have found positive spillover effects when backward and forward linkages are taken into consideration. It occurs since MNEs are more willing to share their superior knowledge with suppliers or buyers rather than with their competitors, like in the case of intra-industry channels (Javorcik, 2004).

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based on the ownership of specific technological or managerial asset (O) that are exploited in a specific favourable location (L) inside the same firm (I).

[3] This happens because the MNE's superior knowledge is partially considered as a public good due to its characteristics of non rivalry and non excludability. However, technological knowledge is also characterized, partly, by tacit nature.

There is however one aspect which received less empirical attention, i.e. the effects of MNEs activities on the export performance of domestic firms. In recent years, a new strand of literature emerged exploring the effect of MNEs on the exports. The link between exports and productivity was examined until recently only at the country or industry level (Lopez 2005). With regard to this issue, some theoretical models explores this aspect finding confirmation of the fact that firms with higher productivity self select into export markets (Melitz 2003). Through exports, a firm can gain efficiency through a reallocation of resources and, most of all, because the presence of fixed costs that reduce the price-cost margins, less efficient firms may be pushed out of the market[4]. However, the causality may run also in the opposite direction: firms become more productive after having entered into the export market (learning by exporting effect)[5]. The mechanisms through which the learning by exporting effect operates mainly through the interaction with foreign competitors and customers. It implies that while investing abroad, firms may gain further knowledge about how to improve their products through contacts with other firms that are more technology intensive. In the second place, exporting allows to increase scale of activities by having access to a larger market.

From the point of view of recent studies, even the presence of MNEs inside the industrial structure of a country may stimulate exports. However, the linkage between the effects on exports and those on productivity is not clearly singled out. The two hypotheses are considered as mutually non exclusive but reinforcing. It is to be noted that the empirical estimation are all carried out with the same methodology

[4] Some empirical studies, such as Clerides et al. (1998) and Bernard and Jensen (1999), using different econometric techniques confirm this hypothesis.

[5] For example, studies by Blalock and Gertler (2004) for Indonesia, Bigsten et al. (2004) and Van Bisebroeck (2005) for Sub-Saharan Africa all find positive evidence of the occurrence of this effect.

(Heckman selection model) and considering just the final effects on exports. The channels through which MNEs may have effect on firms' decisions to export and then on export performance are considered to be essentially three: *first*, the informations they can convey about foreign markets due to their higher involvement in international networks, their knowledge about distributions and servicing facilities as well as their higher marketing capabilities. This is popularly called *demonstration effect.* Second, the higher level of exports may be caused by the higher competition coming from MNEs. This should spur local firms to raise their productivity and then even their level of exports. Finally, higher export performances on the side of local firms may be caused by the fact that higher level of technological activities are carried out by MNEs as they are usually more R&D intensive than local firms causing a sort of *imitation effect* to occur. We would like to stress from the beginning, that these three channels are not always all considered in the empirical analysis and most of all that the way they influence the export performance of local firms is not always clearly singled out.

Aitken *et al.* (1997) 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 results of the study reveal positive effect with regard to both variables even though one do not know whether export decision is influenced by the presence of MNEs or by their export activities. The same methodology was applied by Kokko *et al.* (1997), in the case of Uruguay[6]. With regard to UK, Greenaway *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 find positive results for all

[6] However, in their study, the possibility that exports activities of foreign firms may act as a means to spur export activities of the local firms is not explored.

of the three variables with regard to export decision. In the case of export intensity, they find a negative effect stemming from information externalities while the other channels display significant and positive effect. Another study based on the experience of UK, Kneller and Pisu (2007) find contrary results to the findings of Greenaway et al (2004). They add as a channel of export spillover, the backward and forward linkage effect. They find that linkage effect are positively related both to export intensity and export decision. Further, they also find that export oriented foreign firms are not considered to influence the export intensity of local firms.

Some studies also find evidence of negative effects as in the case of Ireland and Spain. A study of Irish firms by Ruane and Southerland (2005) find negative export spillover effects. They motivate these results by arguing that information externalities may not occur since MNEs in Ireland are characterized by export platform motivations and for this reason the possible linkages with local firms are very low. 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. Similarly, negative results are also found by Barrios et al. (2003) for Spanish firms. They find that the most important variable that influence the export decision of local firms is MNEs' R&D intensity. However, little evidence is found with regard to information externalities arising from the export behaviour of foreign firms. In a similar vein, Buck et. al. (2007) search for the export spillover effect in the case of China. The study finds that through various spillover channels, MNEs influence the domestic Chinese firms exports.

From the brief review of the existing studies two issues emerge. Different channels may have different effects according to the country considered, for example it is found little evidence of export spillovers coming directly from the export orientation of foreign firms. The shortcomings of all studies discussed before are also relative to the scarce investigation of local firm heterogeneity: usually this aspect is searched only at the level of R&D and skills intensities but other sources of technology, such as that coming from imports is not taken into

consideration. For example, firms that are also importers of goods or even of disembodied technologies may perform better that those firms that are just exporters. Only recent empirical studies have begun to explore the link between imports and productivity[7]. However, it has been noticed that importing activities as well as exporting activities involve sunk costs that need to be met by local firms. Moreover, the effect may vary according to the type of import considered. It is possible that import of goods and disembodied technological knowledge may cause a sort of technology transfer if a firm has the suitable technological capacity to absorb these technologies. In the present study, we focus on disembodied technological imports by explicitly taking into consideration the contribution of technology coming from abroad to the exporting activities of local firms.

FDI and Trade Flows in India

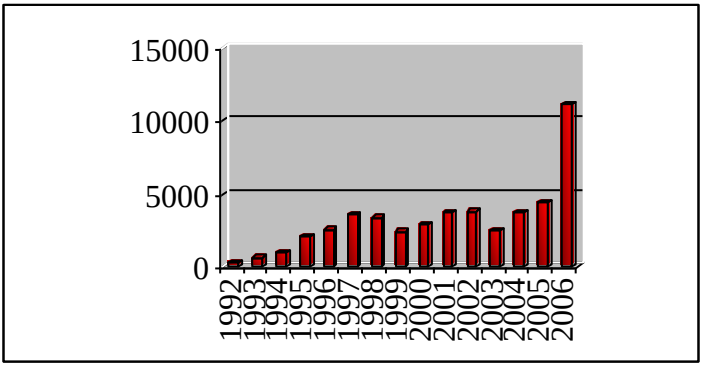
Before 1991, Indian economy was characterized by severe controls and regulations on foreign capital and ownership. Over the first three decades since independence, due to the adoption of such controls on production of goods and services led to the deterioration of India's competitiveness and to poor performance in the world market. 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 regime stood as a major stumbling block in obtaining much needed modern technology. The policy adopted by India government toward FDI changed over time and two specific periods may be singled out: the pre-reform period (1948-1990) witnessed a cautious and restrictive approach towards FDI[8] and the post reform period that started

[7] Studies by Bernard et. al (2007) and Muuls and Pisu (2009) find evidence of the better performance that importers share with exporters. Theoretical studies have dealt with self-selection and learning by importing effects even though only the latter has been empirically investigated.

[8] The pre-liberalization period has been extensively analyzed previously by Kumar (1994).

in 1991 and is characterized by the a more liberal attitude towards FDI. Indeed, this change was caused by the occurrence of the unprecedented economic crisis in 1991 that forced 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. Since its adoption, Indian economy has witnessed a surge in FDI (Figure. 1). It can be observed that the inflows experienced a marked increase till 1997-98. Since then, the inflows have picked up again reaching the highest level in 2006.

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

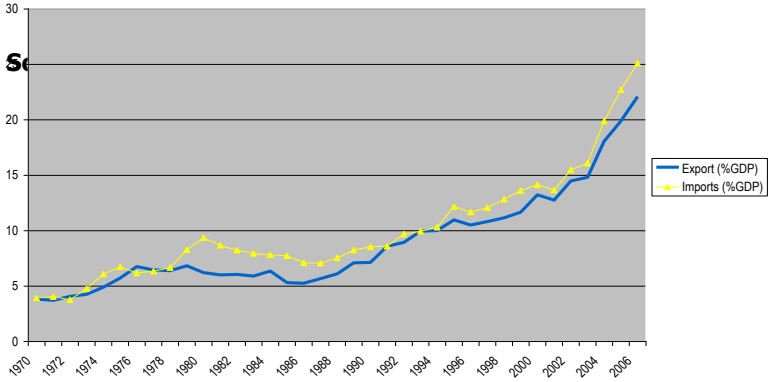


Source: SIA Newsletter (various issues) http://dipp.nic.in

In the same way, India experienced a large increase in exports and imports as well. Especially with regard to exports, one can observe from Figure.2 that exports started picking up even before the beginning of the period of liberalization. With regard to this evidence, some studies have analyzed the post liberalization period performance of Indian firms involvement in international trade activities. Poddar (2004) 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. In a similar fashion, Aggarwal (2002) investigates foreign firms or local firm show different performances in international markets. The study finds that in some cases, MNEs do not outperform local firms especially with regard to the level of technological base. The

author concludes that in India, during the first decade of economic reforms has not succeeded in attracting efficiency seeking (export oriented) FDI. The topic of export determinants in the Indian case is treated also by Bhat and Narayanan (2009) who focus on the Chemical industries. They find that technological capabilities are an important determinant in explaining export behavior both of local and foreign firms. This result of their study based on more recent data (2000-2007) reveal that the behavior of MNEs may have undergone change in the recent years (at least in high tech sectors, more efficiency seeking FDI are attracted in India). However, it should be pointed out that all these studies just compare and examine separately the export performances of local and foreign firms without explicitly considering whether the two could be interrelated.

Fig. 2 India's Economic Openness



DATA SOURCE AND METHODOLOGY

The empirical investigation is carried out using data obtained from the PROWESS database provided by the Center for Monitoring Indian Economy (CMIE). This database contains information of more than 7000 firms registered with the Stock Exchanges. The data is obtained mainly from the annual reports and balance sheets of the companies. The companies included in the database account for 70 % of the industrial output and 95 % of the excise taxes (Center for Monitoring Indian Economy). PROWESS database contains listed and unlisted firms

belonging to manufacturing, services, utilities and financial services. However, in the present analysis, we confine only to the experience of manufacturing sector. The final analysis involves 3053 firms observed during the period 1994-2006 belonging to 13 two digit manufacturing industries. For the present study, all those firms having foreign equity greater that 10%[9] of the total equity are classified as foreign firms. In Table 1 it is possible to have an overview of data. The distribution shows that the foreign firms presence vary from little over 1% in Textile to over 14% in Medical, Precision and Optical Instruments sector. Table 2 presents the summary statistics of industry wise R&D, exports and wages for foreign firms and domestic firms separately. They show how in almost all sectors, MNEs activities are superior in all of the three variables of interest (namely, exports, R&D and wages).

Table 1: Data Overview

NIC Code	Industry Classification	Domestic firms	Foreign firms	All firms	% Foreign firms
15	Food Products and Beverages	403	13	416	3.13
17	Textiles	325	6	331	1.81
21	Paper and Paper Products	103	5	108	4.63
24	Chemicals and Chemical Products	665	45	710	6.34
25	Rubber and Plastic Products	210	15	225	6.67
26	Other Non-Metallic Mineral Products	116	10	126	7.94
27	Basic Metals	338	10	348	2.87
28	Fabricated Metal Products	103	3	106	2.83
29	Machinery and equipment	196	29	225	12.89
31	Electrical Machinery and Apparatus	110	11	121	9.09
32	Radio, Television and Communication Equipment	84	9	93	9.68
33	Medical, Precision and Optical Instruments, Watches and Clocks	40	7	47	14.89
34	Motor Vehicles	176	21	197	10.66
	Total	2869	184	3053	6.03

Source: Authors' calculation from the PROWESS database

[9] This is the standard definition adopted by IMF

Table 2: Descriptive statistics

			Domestic Firms			Foreign Firms		
NIC code	**Industry Classification**	**Statistics**	**R&D**	**Exports**	**Wage and salaries**	**R&D**	**Exports**	**Wage and salaries**
15	Food Products and Beverages	Mean	0.28	9.90	2.87	0.67	33.89	23.46
		SD	12.01	43.68	8.44	1.77	61.73	34.17
17	Textiles	Mean	0.06	22.34	3.54	0.30	62.37	5.55
		SD	0.37	44.54	10.58	0.72	83.52	10.98
21	Paper and Paper Products	Mean	0.07	2.48	2.37	0.10	7.23	3.93
		SD	0.39	10.39	6.83	0.17	17.94	6.45
24	Chemicals and Chemical Products	Mean	1.60	19.20	4.31	3.20	55.23	15.32
		SD	14.13	96.45	16.97	13.20	174.27	54.72
25	Rubber and Plastic Products	Mean	0.22	10.00	2.49	0.23	16.23	4.63
		SD	1.43	34.53	10.46	0.66	23.21	7.61
26	Other Non-Metallic Mineral Products	Mean	0.40	13.76	9.43	3.01	26.73	5.84
		SD	2.03	46.54	32.61	32.49	60.38	8.84
27	Basic Metals	Mean	0.16	27.51	6.37	0.20	155.83	7.44
		SD	1.29	157.53	54.85	0.89	476.11	15.35
28	Fabricated Metal Products	Mean	0.09	9.19	2.42	0.00	8.24	6.60
		SD	0.55	26.19	7.10	0.00	15.66	11.74
29	Machinery and Equipment	Mean	0.44	7.49	4.21	1.01	22.74	7.87
		SD	1.56	24.16	10.17	3.21	53.39	16.09
31	Electrical Machinery and Apparatus	Mean	0.34	6.38	4.03	1.92	31.07	14.22
		SD	1.82	25.12	14.49	4.17	50.61	26.33
32	Radio, Television and Communication Equipment	Mean	0.93	7.33	4.07	0.22	10.50	3.62
		SD	4.15	28.10	16.15	0.36	22.61	7.17
33	Medical, Precision and Optical Instruments, Watches and Clocks	Mean	0.18	3.08	1.74	0.05	4.66	5.11
		SD	0.81	6.76	2.84	0.18	5.75	10.60
34	Motor Vehicles	Mean	2.57	20.33	10.06	5.23	52.04	23.64
		SD	19.39	122.09	48.44	14.24	132.76	58.09

Source: Authors' calculation on the base of the PROWESS database; nominal values are expressed in Rs-Crore

Model

We consider that exporting activities involve a two stage decision process: (i) the firm decides whether to export or not and, (ii) then the amount that it is willing to export. Therefore, to take into account the two stage process, we adopt the standard Heckman selection model (Heckman 1979). The model is represented by the following two equations:

$$DEXP_{ijt} = \alpha+ß_1K_{ijt} +ß_2Wage_{ijt} +ß_3RD_{ijt}+ß_4Size_{ijt}+ß_5Size^2_{ijt}+ß_6Age_{ijt} +ß_7Age^2_{ijt}+ß_8Sp_{jt-1}+ß_9DEXP_{ijt-1}+ß_{10}Profits_{ijt}+ß_{11}Sei_{jt}+ß_{12}Ssect_{jt}+v_i \quad \dots (1)$$

$$EXPINT_{ijt} = \alpha + ß_1K_{ijt} + ß_2Wage_{ijt} + ß_3RD_{ijt} + ß_4Size_{ijt} + ß_5Size^2_{ijt} + ß_6Age_{ijt} + ß_7Age^2_{ijt}+ ß_8Sp_{jt-1} + ß_9Sei_{jt}+ß_{10}Ssect_{jt} + u_i \quad \dots (2)$$

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 ($DEXP_{ijt}$) is a binary variable which is assigned value 1 if firms report positive exports and 0 in all the other cases. In the second equation, the dependent variable is measured as export intensity ($EXPINT_{ijt}$). The description of the variable definitions used in the estimation of the above equations is reported in Table 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 since we are analyzing how the presence of MNEs affects the export behavior of all firms, not just the export oriented firms alone. We carry out our estimation using the maximum likelihood methodology instead of the two step since the former method is more efficient[10](Kneller and Pisu, 2007). The two equations include the same regressors with the exception of two

[10] 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 included in the export propensity equation as a dependent variable.

variables that are added to the specification of the selection equation (equation1) in order to identify the complete model as required by the selection models (Estrin et al., 2008).

Table 3: Variable definitions

Variables	Symbol	Definition
Decision to export	DEXP	DEXP=1 if the firm has exported during the year; 0 otherwise
Export intensity	EXPINT	FOB value of exports divided by sales turnover
Capital intensity	K	Calculated with perpetual inventory methods using gross fixed assets
Wage intensity	WAGE	Expenditures on wage and salaries divided by sales turnover
R&D intensity	RD	Expendures on R&D divided by sales turnover of the firm
Age	AGE	Difference between the year of incorporation and the year in the study
Size	SIZE	Ratio of each firm's sales on average sales in the sector
Profitability	PROFIT	Profits before direct tax divided by sales turnover of the firm
Size of the sector	Ssect	Share of domestic sales in sector j on total manufacturing sales
Sectoral exports	Sei	Share of domestic exports in sector j on total manufacturing exports
Export spillover	Expspill	Share of MNEs exports on total exports of the sector
R&D spillover	Rdspill	Share of MNEs' R&D expenditures on total R&D expenditure of the sector
Wage spillover	Wagespill	Share of MNE's expenditures on wages and salaries on total expenditures on wages and salaries of the sector

The first is the lagged export status ($DEXP_{ijt-1}$), to take into account the fact that the decision to export show persistence in time. It means that if a firm exports at time 't' it will export at time t+1 as well. The second regressor is profitability ($Profits_{ijt}$): 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 issue that we encounter is the problem of endogeneity. In order to take into account this aspect, we use the lagged value of the spillover variable. In this way, we take into account the time lag involved in spillovers to materialize and impact the export status and decision of local firms.

In both models, we include two types of variables: firm specific 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*). Since both firm and sectoral level variables as used in the same regression, one may expect a problem of underestimation of standard errors. For this reason, we estimate all specifications accounting for possible correlation of errors within each sector. We also include a set of sectoral and time dummies to account for possible industry and time invariant effects.

Firm specific variables

The choice of firm level variables used in the model is based on the literature related to the export determinants. In particular, based on the international trade literature (e.g. Krugman, 1979), we recognize the importance of technology as a factor that can have significant influence on the export performance of local firms. In the first place, we take into account the role played by capital intensity [11](K_{ijt}), that it is considered to

[11] Capital stock is arrived at using perpetual inventory method. We added up Ko and It, in which Ko is the benchmark year capital stock, which, in our case, is 1994. The It value is: It = GFAt – GFAt-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.

be positively related both to the decision to export and to the export intensity. It may be especially true in the case of developed countries since 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 effect may turn out to be negative or insignificant. This effect has been found in some studies such as those by Kumar and Siddarthan (1994). To operate and compete in international markets, firms need to produce technologically advanced and quality products. Hence, we anticipate that the level of technological activities has a positive and significant influence on the competitiveness (Braga and Wilmore 1992). Therefore, we include investment in R&D *(RD_{ijt})* as a proxy for the internal technological activities of the firm. However, it should be underlined that in the case of developing countries formal internal R&D activities form only a minor part of the technological capability efforts of the firm and for this reason it may not give the expected positive contribution to export enhancement. However, the literature is not unanimous in finding positive results for this variable: positive (Bleaney and Wakelin 2002; Aggarwal, 2002) as well as non significant results (e.g. Narayanan, 2006) are found. Moreover, as accounted in most of the evolutionary literature, learning is of crucial importance to the acquisition of technology. In order to effectively take advantage of technology, firms have to hire skilled people. We use as a proxy the wage intensity ($Wage_{ijt}$) to take into account how the quality of the workers may affect export performance (Roberts and Tybout, 1997).

We also include some control variables such as age (Age_{ijt}) and size ($Size_{ijt}$). Following the industrial organization literature, we expect that older and larger plants are more likely to show higher productivity performance and thus higher exporting activity. Nevertheless, we expect that the effects produced by age and size are non-linear. In particular, advantages of size hold only to a certain extent, i.e. 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

that lowers distribution and production costs. However, as Power (1998) argues, age shows an inverted U shape relationship with exports as well. Accordingly, we include a quadratic term for both variables.

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, we add a measure of technological imports intensities ($Tech_{ijt}$). This effect may be particularly relevant in the case of India since the country has relied on imports as a source of foreign technological knowledge in the period before 1991 and this technological flow has continued to grow even after that year (Lall, 2001). The effect has also been empirically investigated with respect to India in various studies that usually find positive effects stemming from this variable (e.g. Aggarwal, 2002).

Spillover and Industry specific variables

With regard to the proxy for foreign presence, we calculate three different spillover variables (SP_{jt}) in order to take into account the different channels through which the spillover effect operates. They are included separately in our baseline specifications because considering them together could pose problems of collinearity. In this way we estimate three different models.

In particular, we calculate the first spillover variable as the ratio of MNEs exporting activities on total export of the sector (*Expspill*). This variable captures 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, have 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 information. In particular, we expect this effect

to influence the export intensity since it acts as a sort of demonstration effect that may contribute to lower sunk cost leaving the productivity unchanged. Thus, we hypothesise that export performance and propensity of domestic firms is positively associated with the exporting activities of foreign firms.

The second channel through which spillover effect may occur is through R&D activities of foreign firms. It is measured as the share of foreign firms R&D to total R&D of the sector (*Rdspill*). As confirmed by the other studies (e.g. Barrios et al., 2003), foreign R&D may impact on the capacity of export in an indirect way by facilitating the increase of productivity or increasing the technological quality of products that may be sold in foreign markets. Therefore, we expect a positive influence since higher the level of technological activities of foreign firms, the higher the possibilities of imitation. However, when compared to the demonstration effect, we expect that "imitation" effect is significant especially for those firms which need to rise their productivity in order to start exporting.

The third spillover variable we take into consideration is relative to the level of skills that are embodied in human capital of foreign firms (*Wagespill*). It is measured as the share of foreign firm expenditures on wages and salaries to total wages and salaries expenditure of the sector. It is usually considered that employees of foreign firms receive a higher level of training that may be conveyed to local labour work force when face to face contacts occur. In particular, it may rise even the local level of skills of employees by facilitating the understanding of new ideas and technologies brought in by foreign firms. Like the case of R&D activities of foreign firms, it may positively affect the productivity of local firms allowing them to start exporting.

Further, as controls, we also include two sectoral variables: *first*, Sei_{jt} measures the importance of each sector with regard to total

manufacturing exports. 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* is represented by the industry size ($Ssect_{jt}$) and it accounts for possible general spillover effects that are not directly related to export activities.

ECONOMETRIC RESULTS

The econometric estimations are carried following four different specifications: the first entails the estimation of the benchmark model (equation 1-2). In the second specification, we add a regressor that measures the interaction between local firms' R&D and the spillover variables[12]. By doing so, we seek to capture the effect that internal technological capabilities may have in internalizing the likely spillover effects. Further, in the third specification, the variable that measures disembodied technological imports is added as a determinant of export decision and export intensity. In the fourth specification, we interact the said technological variable with all spillover variables to capture its significance in influencing local firms export performance. In this way, we are able to compare first if there is any difference between the two technological variables in affecting the export performance of local firms and which of the two has the higher impact in helping firms to internalize the spillover effects. The results of each model are reported respectively in Tables 4 to 7 are shown at the end of the paper. As it is possible to observe, in all specifications the Wald test validates the choice of the Heckman selection model. This reflects that a spillover potential is indeed present, even though it needs to match with local firms' capabilities.

[12] When interacted with spillover variable, R&D intensity of local firms is lagged by one year

Export decision

Considering the firm level variables, we notice that the role played by capital, even though not significant in all specifications, is always negative. It confirms the fact that in an emerging country the role played by capital is secondary in favouring exporting activities. Contrary to expectations, but in line with recent empirical evidence on India (e.g. Bhat and Narayanan, 2009), we find that the role played by R&D is positive and significant in all specifications. It implies that even if the level of technological activities of firms in India is lower with respect to firms in developed countries, the internal source of technology is of crucial importance in giving cost advantages to the lead them to become exporters. Nevertheless, the coefficient measuring skills turns out to be negative and significant in all specifications. It means that, the level of technological development is not coupled by the same level of adequate skills reflecting that the Indian labour market is still characterized for most part by semi-skilled labour that negatively affects firms' international performance. On the other hand, both profit intensity and lagged export decision status is positive and highly significant, proving two hypotheses: (i) exporting activities show a high degree of persistence in time and, (ii) higher firms' profitability allow them to meet the higher costs associated with the entry into the export markets. With regard to other firm-specific factors that may impact on the decision to export, we find that age is not significant while the coefficient of size behaves as expected confirming the non linearity. We find that a firm belonging to an export oriented sector may not influence the firms' export decision. It may be true in a country that for so much time has been closed to foreign investments and most of all may be due to the closeness of technological level and behaviour between local firms. Therefore, the effects of exporting activities of local firms do not act as means through which other local firms may learn how to export. However, contrary to the case of developed countries, the effect of size of the sector is relevant. In order to start exporting, local firms may first need to reach a certain threshold level inside the home country. The

significance of this coefficient also stands for the fact that there may be other influences, not directly related to exporting activities which arise from the domestic sector that require further investigation.

We now turn to explain the results related to the spillover variables. In the case of the basic model, we find that the only case of positive and significant coefficient is represented by R&D activities of foreign firms. This supports the view that foreign firms may have impact on the export decision of local firms because of occurrence of imitation effect. Further, it is also a proof of the fact that the role of demonstration effect of higher technological levels matters especially for the decision to export. We find a negative and positive effect respectively for export and wages spillover variables, even though their coefficient value turns out to be statistically insignificant. The former result indicates that even higher MNEs' skills may influence firm's skills and in this way be relevant in enhancing firm level productivity up to the point needed to enter into foreign markets. The second result may be motivated by the fact that MNEs may cause crowding out effect that force domestic productivity to go down (Aitken and Harrison, 1999). However, this last specific effect is in line with what is found even for studies that examine the case of developed countries (e.g. Kneller and Pisu, 2007).

In the second specification, we add as a regressor the interaction between local firms' R&D with spillover variables. While, all the other firms's and sectoral factors turn out to have the same sign and level of significance as in the previous specification, the highly significant and positive effect provides evidence that local firms' R&D activities lead them to absorb more easily foreign technological knowledge. Our results are in conformity with the findings of the previous studies on Indian manufacturing industries (Basant and Fikkert 1996; Kathuria 2002). This may also cause a decrease in total costs as well as an increase in productivity that positively affect their decision to exporti. This reinforces the consideration according to which having strong internal technological capabilities is important in order to have benefits coming from FDI.

In third model, we include the variable measuring the intensity of disembodied technological imports (lagged) which results positive and significant (even though only at 10% level). The findings supports the idea according to which, as argued by Lall (2001), India relied a lot on external sources of technology in order to rise its competitive advantage. It also confirms that technology, even though not internally produced, is particularly relevant in triggering the exporting activities of local firms. With regard to spillover variables the same results are found in comparison with the baseline specification.

However, if we consider the case of interaction of this variable[13] with each of the three spillovers variables, even though all coefficients values are positive, turn out be statistically insignificant, (except for export spillover). This points to one main conclusion: the role played by imports in absorbing the benefits of foreign firms activities is less evident as compared to in-house R&D[14]. This also reinforces the idea according to which, in order to fully take advantage of the spillovers from MNEs, local firms first need to fully "internalize" these further flows of technology, otherwise it may not be possible to fully accrue the benefits from MNEs investments.

Exports intensity

In the case of export intensity, we find that contrary to the case of export decision, it is possible to see that skills as well as capital now play a positive and significant role. R&D coefficient remains positive and strongly significant. With regard to variables age and size we find a noteworthy difference, when compared to export decision equation. In particular, the coefficient of age shows a non linear trend as expected.

[13] Even in the estimation of the fourth model, the signs and level of significance of firm level variables remain unchanged with respect to those of the basic model.

[14] Studies related technology imports, R&D and FDI in India have found either complemetary or substitution or no effects (Sasidhran and Kathuria 2008)

The analysis reveals that reveals that younger firms are more export oriented than older firms. This result is in line some of the recent studies related to the Indian case (Bhaduri and Ray, 2004). This effect may due to the structural reforms implemented since 1991 that helped newer firms endowed with latest technologies which enable them to export more. The same trend is shown by the coefficient of size: this may be due firstly to the fact that younger firms, that are those that export more, are also of smaller size. Another difference with the results found for export decision is the role played by the size of the domestic market and the influence of exporting activities of domestic firms. The coefficients are respectively negative and positive. These findings are similar to those found for developed countries in which being inside a large sector negatively influences the export intensity of local firms, while the opposite is true with regard to the importance of each sector in aggregate exports. In this case, being inside a more export oriented sectors positively influence the export intensity of local firms. Thus, the findings of the present study confirm that those local firms which have already decided to export only benefit from the exporting activities of other firms.

We observe in the estimation of the basic model that the three spillover channels work in different directions with respect to export propensity: firstly, we recognize the positive effect for demonstration effect, even though the coefficient is not significant. This reflects two issues: the first is that information and market access spillover are more important when the firm is already an exporter. The second pertinent issue as evidenced from the previous studies (Aggarwal 2002; Ranganathan and Murthy 2008) that MNEs located in India are mainly market oriented and, therefore, their demonstration effect may not be so strong. Instead, the coefficient for foreign R&D, even though not significant, is negative. This result is contrary to those found for developed countries, indicating that local firms may benefit of foreign R&D to improve their technological capabilities and hence start exporting

but they do not show any benefits in the export intensity (e.g. Barrios et al. 2003). Finally, the negative effects found with regard to wage spillover can be explained if we think to the possibility that skills needed inside Indian firms are not matched by those of foreign workers. Based on our findings, it is possible to confirm our initial hypotheses according to which the so called "demonstration effect" directly impact export intensity but not the decision to export.

Considering the case of R&D interactions with spillover variables, we find, as in the case of export decision, that the results are all positive even though the level of significance is higher with for export spillover and R&D spillover (1%) while it is lower for wage spillover (10%). It reiterates the message coming from previous results about export decision in which the improved efficiency stemming from the use of more advanced technologies is relevant in absorbing the spillover effect from whatever channel.

When we include the variable measuring disembodied technological imports, we observe that the coefficient relative to spillover variables show the same level of significance and direction of sign as the previous specification. We recognize that the coefficients are always positive and strongly significant, and its role in enhancing export intensity is crucial. However, the results obtained with the interaction of the same with the spillover variables is not significant. In particular, contrary to the case of export decision equation, the coefficients usually report a negative sign. This result reflects that the role played by foreign technological imports, does not help local firms in taking advantage of spillover effects coming from MNEs. As stated previously, one of the main reason is relative to the fact that those foreign sources of technological knowledge need to be themselves absorbed into the production processes of the firm in order to be effective in the absorption of technological knowledge spilling over from MNEs investments.

CONCLUSIVE REMARKS

The vast literature on FDI spillover effect 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, the type of data and the nature of the countries considered. Further, all the existing studies are mainly concerned with the explanation of the final effect of foreign firms on Total Factor Productivity (TFP). Other likely effects have not received proper empirical attention. Very few studies take into account the possibility of MNEs effect on local firms' exports. In particular, studies pertaining to the experience of the developing countries are scanty.

Therefore, in the present study we attempted to examine the effects MNEs may have on export decision and export intensity of local firms using firm level data for the Indian manufacturing industries over the period 1994-2006. We measured the effect of export spillover on the basis of three different channels through which the effect may occur (R&D activities, export activities or the level of skills of the foreign firms). We also considered the role played by disembodied technology imports in influencing the exporting behaviour. They account for a further source of technological capabilities that may help domestic firms in internalizing spillover effects. The case study of India is particularly relevant since it has experienced a surge in FDI since the onset of economic reforms.

Some significant results that emerge from the empirical analysis: *first*, the fact that different spillover channels have different impacts on export performance of local firms. In particular, we find that the role played by exports externalities (demonstration effect) is only weakly influence the level of export intensity. On the other hand, we find that MNEs' R&D activities positively influence the decision of a firm to enter into the export market. This reflects the fact that in order to change the export structure of the country both types of MNEs activities are

important. This is so, since in the first case it provides stimuli to the level of exports while in the second case, there is an effect that goes into the direction of increasing the number of firms entering into the international markets. Therefore, it is partly confirm our argument that MNEs investing in India are more market oriented creating only a negligible demonstration effect.

It has also been found that the role played by skills intensity of MNEs negatively influence the export intensity. This effect is particularly relevant because it may stands for the fact that MNEs may also have a crowding out effect on local firms that may lead them to reduce the level of productivity and exports. These findings indicate that different channels may have different impacts on the decision to export and on export intensity. In particular, firms that are already exporters will get more benefits from exporting activities of MNEs. While, non exporter firms benefits mainly from R&D activities and higher MNEs' skills. It also provides support that in the former case, the impact is first on productivity and then on exports, while the latter stems from the demonstration effect from the experience of MNEs in international markets.

The interaction of local firms' R&D with each spillover variable provides some interesting insights. The findings indicate that technological capabilities upgrading is vital to enter into export market. Similarly, the internal technological level of Indian firms is relevant with regard to export intensity. The study also finds that Indian firms mainly rely on technological capabilities (disembodied technological imports) for their exporting activities. However, when the same variable is interacted with each spillover variable, the positive effect is found only for R&D spillover effect. The general conclusion we may draw from this empirical analysis is that Indian firms rely heavily on internal and external technological sources and they both play an important role with respect to export decision and export intensity. However, the two sources of technology do not equally contribute in reaping the benefits of FDI.

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Table 4: Results of the Basic Model

	(1)	(2)	(3)	(4)	(5)	(6)
	Export intensity	Export decision	Export intensity	Export decision	Export intensity	Export decision
K	0.00012***	-0.00019	0.00012***	-0.00019	0.00012***	-0.00019
	(0.00002)	(0.00014)	(0.00002)	(0.00014)	(0.00002)	(0.00014)
Wage	0.09039	-0.72487**	0.08994	-0.72534**	0.09115	-0.72528**
	(0.06251)	(0.31158)	(0.06237)	(0.31189)	(0.06192)	(0.31352)
RD	0.09260**	1.63191***	0.09250**	1.63750***	0.09269**	1.63256***
	(0.04156)	(0.56628)	(0.04153)	(0.56692)	(0.04161)	(0.56433)
Age	-0.00443***	0.00229	-0.00443***	0.00231	-0.00444***	0.00230
	(0.00066)	(0.00248)	(0.00066)	(0.00248)	(0.00066)	(0.00247)
agesq	0.00003***	-0.00001	0.00003***	-0.00001	0.00003***	-0.00001
	(0.00001)	(0.00002)	(0.00001)	(0.00002)	(0.00001)	(0.00002)
Size	-0.01625***	0.28044***	-0.01625***	0.28039***	-0.01625***	0.28035***
	(0.00318)	(0.02771)	(0.00318)	(0.02768)	(0.00318)	(0.02744)
Sizesq	0.00044***	-0.00648***	0.00044***	-0.00647***	0.00044***	-0.00647***
	(0.00009)	(0.00061)	(0.00009)	(0.00061)	(0.00009)	(0.00061)
exportdec		2.37633***		2.37693***		2.37629***
		(0.02818)		(0.02810)		(0.02821)
Profit		0.00487**		0.00490**		0.00486**
		(0.00196)		(0.00196)		(0.00195)
Sei	0.38587***	-0.37340	0.37751***	-0.03867	0.40849***	-0.41388
	(0.08257)	(0.45611)	(0.09830)	(0.56141)	(0.08153)	(0.42074)
Ssect	-0.53634***	1.33055**	-0.51461**	0.65865	-0.49241***	1.24890**
	(0.16605)	(0.64732)	(0.20060)	(0.63564)	(0.15748)	(0.60576)
Expspill	0.01906	-0.02715				
	(0.03110)	(0.18942)				
RDspill			-0.00363	0.15826**		
			(0.01708)	(0.07306)		
Wagespill					-0.01751***	0.03706
					(0.00517)	(0.06638)
Observations	22525	22525	22525	22525	22525	22525
Wald test	46.20***		46.21***		46.01***	
Log-Likelihood	-7142.55		-7141.88		-7141.43	
P	-0.24		-0.24		-0.24	

All regressions include sectoral and time dummies

Clustered robust standard errors in parentheses

Variables that measures spillover effect (Expspill, RDspill and Wagespill) and export status (exportdec) are all lagged one year

* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Results Basic Model with R&D Interaction

	Export intensity (1)	Export decision (2)	Export intensity (3)	Export decision (4)	Export intensity (5)	Export decision (6)
k	0.00081	-0.00244**	0.00081	-0.00240**	0.00081	-0.00242**
	(0.00052)	(0.00100)	(0.00052)	(0.00098)	(0.00052)	(0.00098)
wage	0.07523	-0.69166**	0.07594	-0.69183**	0.07558	-0.69268**
	(0.07644)	(0.27095)	(0.07581)	(0.27191)	(0.07628)	(0.27354)
RD	0.07986***	1.73625***	0.08319***	1.78630***	0.08362***	1.78505***
	(0.02423)	(0.43034)	(0.02999)	(0.43966)	(0.02709)	(0.43466)
age	-0.00432***	0.00303	-0.00432***	0.00305	-0.00434***	0.00302
	(0.00066)	(0.00257)	(0.00067)	(0.00257)	(0.00066)	(0.00254)
agesq	0.00003***	-0.00002	0.00003***	-0.00002	0.00003***	-0.00002
	(0.00001)	(0.00002)	(0.00001)	(0.00002)	(0.00001)	(0.00002)
size	-0.01644***	0.27755***	-0.01632***	0.27757***	-0.01649***	0.27764***
	(0.00312)	(0.02692)	(0.00313)	(0.02692)	(0.00308)	(0.02673)
sizesq	0.00044***	-0.00641**	0.00044***	-0.00642***	0.00045***	-
0.00642***						
	(0.00009)	(0.00061)	(0.00009)	(0.00061)	(0.00009)	(0.00061)
exportdec		2.38757***	2.38821***		2.38749***	
		(0.02967)	(0.02955)		(0.02982)	
profit		0.00810***	0.00808***		0.00808***	
		(0.00294)	(0.00291)		(0.00291)	
sei	0.36504***	-0.47393	0.35453***	-0.16426	0.38610***	-0.50562
	(0.08569)	(0.42094)	(0.10155)	(0.53225)	(0.08487)	(0.39829)
ssect	-0.54857***	1.41840***	-0.52055**	0.78314	-0.47366***	
1.40208***						
	(0.17103)	(0.52733)	(0.20423)	(0.55459)	(0.17159)	(0.50351)
Expspill	0.01896	-0.04398				
	(0.03272)	(0.19490)				
RD*Expspill 1.55918***	3.96853***					
	(0.45337)	(0.89895)				
Rdspill			-0.00858	0.13887*		
			(0.01619)	(0.07199)		
RD*Rdspill			0.86019***	3.76334**		
			(0.16987)	(1.52636)		
Wagespill				-0.02428***	0.01394	
				(0.00569)	(0.05716)	
RD*Wagespill				1.69734*	3.86655***	
				(1.02653)	(1.43846)	
Observations	22329	22329	22329	22329	22329	22329
Wald test	32.86***		32.72***		32.74***	
Log-Likelihood	-6939.79		-6941.84		-6941.92	
ρ	-0.26		-0.26		-0.26	

All regressions include sectoral and time dummies; Robust clustered standard errors in parentheses
Variables that measures spillover effect (Expspill, RDspill and Wagespill), export status (exportdec) and R&D intensity when interacted with spillover variables, are all lagged one year
* significant at 10%; ** significant at 5%; *** significant at 1%

Table. 6: Results of the Basic Model with Disembodied Technological Imports

	Export intensity (1)	Export decision (2)	Export intensity (3)	Export decision (4)	Export intensity (5)	Export decision (6)
k	0.00074	-0.00251**	0.00074	-0.00250**	0.00074	-0.00251**
	(0.00047)	(0.00104)	(0.00047)	(0.00104)	(0.00046)	(0.00104)
wage	0.07833	-0.69089**	0.07779	-0.69175**	0.07915	-0.69087**
	(0.07437)	(0.26941)	(0.07428)	(0.26999)	(0.07370)	(0.27110)
RD	0.09231**	1.87498***	0.09218**	1.88471***	0.09235**	1.87780***
	(0.04118)	(0.47955)	(0.04114)	(0.47852)	(0.04120)	(0.47837)
tech	0.00219***	0.00508*	0.00218***	0.00509*	0.00215***	0.00509*
	(0.00012)	(0.00278)	(0.00012)	(0.00277)	(0.00012)	(0.00280)
age	-0.00432***	0.00307	-0.00432***	0.00309	-0.00433***	0.00308
	(0.00067)	(0.00255)	(0.00067)	(0.00256)	(0.00067)	(0.00254)
agesq	0.00003***	-0.00002	0.00003***	-0.00002	0.00003***	-0.00002
	(0.00001)	(0.00002)	(0.00001)	(0.00002)	(0.00001)	(0.00002)
size	-0.01627***	0.27791***	-0.01627***	0.27789***	-0.01627***	0.27790***
	(0.00314)	(0.02711)	(0.00314)	(0.02708)	(0.00314)	(0.02686)
sizesq	0.00044***	-0.00642***	0.00044***	-0.00642***	0.00044***	-0.00642***
	(0.00009)	(0.00061)	(0.00009)	(0.00061)	(0.00009)	(0.00061)
exportdec		2.38859***		2.38913***		2.38856***
		(0.03002)		(0.02998)		(0.03002)
profit		0.00818***		0.00819***		0.00818***
		(0.00305)		(0.00304)		(0.00305)
sei	0.36172***	-0.48437	0.34938***	-0.17167	0.38820***	-0.51014
	(0.08526)	(0.40758)	(0.10211)	(0.51781)	(0.08330)	(0.38886)
ssect	-0.54336***	1.42580***	-0.51240**	0.79525	-0.49152***	1.37626***
	(0.16866)	(0.52064)	(0.20364)	(0.53685)	(0.15828)	(0.48951)
Expspill	0.02410	-0.03638				
	(0.03327)	(0.19543)				
Rdspill			-0.00541	0.14726**		
			(0.01637)	(0.07076)		
Wagespill					-0.02051***	0.02045
					(0.00528)	(0.05827)
Observations	22329	22329	22329	22329	22329	22329
Wald test	31.96***		31.98***		31.89***	
Log-Likelihood	-6944.12		-6943.62		-6942.72	
ϱ	-0.26		-0.26		-0.26	

All regressions include sectoral and time dummies
Robust clustered standard errors in parentheses
Variables that measures spillover effect (Expspill, RDspill and Wagespill), export status (exportdec) and disembodied technological import intensity, are all lagged one year
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 7: Results with Disembodied Technological Imports Interaction

	Export intensity (1)	Export decision (2)	Export intensity (3)	Export decision (4)	Export intensity (5)	Export decision (6)
K	0.00074	-0.00248**	0.00074	-0.00249**	0.00074	-0.00251**
	(0.00047)	(0.00102)	(0.00047)	(0.00104)	(0.00047)	(0.00104)
Wage	0.07844	-0.69266**	0.07775	-0.69086**	0.07913	-0.68951**
	(0.07438)	(0.27084)	(0.07432)	(0.26965)	(0.07368)	(0.27054)
RD	0.09407**	1.93366***	0.09343**	1.83737***	0.09338**	1.79539***
	(0.04407)	(0.49077)	(0.04372)	(0.45995)	(0.04297)	(0.47122)
Tech	0.01061*	0.04471	0.00565	-0.01185	0.00217***	0.00507*
	(0.00567)	(0.04126)	(0.00361)	(0.01737)	(0.00012)	(0.00281)
Age	-0.00432***	0.00307	-0.00432***	0.00310	-0.00433***	0.00309
	(0.00066)	(0.00255)	(0.00067)	(0.00255)	(0.00066)	(0.00254)
agesq	0.00003***	-0.00002	0.00003***	-0.00002	0.00003***	-0.00002
	(0.00001)	(0.00002)	(0.00001)	(0.00002)	(0.00001)	(0.00002)
size	-0.01627***	0.27773***	-0.01628***	0.27810***	-0.01627***	0.27801***
	(0.00314)	(0.02721)	(0.00314)	(0.02717)	(0.00314)	(0.02684)
sizesq	0.00044***	-0.00642***	0.00044***	-0.00643***	0.00044***	-0.00643***
	(0.00009)	(0.00062)	(0.00009)	(0.00061)	(0.00009)	(0.00061)
Exportdec		2.38868***		2.38921***		2.38874***
		(0.03004)		(0.02998)		(0.02999)
profit		0.00816***		0.00818***		0.00817***
		(0.00301)		(0.00304)		(0.00305)
sei	0.36140***	-0.49809	0.34898***	-0.17139	0.38783***	-0.50543
	(0.08561)	(0.40250)	(0.10261)	(0.51729)	(0.08365)	(0.38325)
ssect	-0.54234***	1.42974***	-0.51120**	0.78787	-0.49111***	1.36858***
	(0.16873)	(0.50841)	(0.20454)	(0.52984)	(0.15874)	(0.48922)
Expspill	0.02445	-0.03476				
	(0.03343)	(0.19484)				
tech*Expspill	-0.14072	-0.40578				
	(0.09249)	(0.37913)				
Rdspill			-0.00530	0.14655**		
			(0.01635)	(0.07106)		
tech*Rdspill			-0.08086	0.40573		
			(0.08509)	(0.44384)		
Wagespill					-0.02023***	0.01784
					(0.00531)	(0.05918)
tech*Wagespill					-0.03897***	0.38675
					(0.01403)	(0.46729)
Observations	22329	22329	22329	22329	22329	22329
Wald test	32.01***		32.00***		31.89***	
Log-Likelihood	-6942.55		-6943.41		-6942.25	
ρ	-0.26		-0.26		-0.26	

All regressions include sectoral and time dummies; Robust clustered standard errors in parentheses
Variables that measures spillover effect (Expspill, RDspill and Wagespill), export status (exportdec) and disembodied technological import intensity also when interacted with spillover variables, are all lagged one year
* significant at 10%; ** significant at 5%; *** significant at 1%

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