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Preliminary draft

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Abstract

According to the main economic literature, foreign direct investment (FDI) from Multinational Enterprises (MNEs) can generate positive externalities to host countries, increasing the domestic firms' productivity. Recently, the attention of researchers has moved from the analysis of "horizontal" spillovers – i.e. those benefits to local enterprises at an intra-industrial level - towards the investigation of "vertical" spillovers phenomenon – i.e. the diffusion of positive effects on domestic economies at an inter-industry level. In this paper we investigate the presence of both these two kinds of spillovers using a firm-level panel data of domestic and foreign firms in the Italian manufacturing sector. The results show the lack of "horizontal" spillovers and, at the same time, the presence of "vertical" ones.

Keywords: FDI; MNEs; Spillovers, Italian manufacturing sector

1. Introduction*

In the late 1980s and during the 1990s foreign direct investment (FDI) by multinational enterprises (MNEs) has grown rapidly throughout the world, mainly in the developed countries which represent the major source of FDI as well as the major recipients of them. According to the main literature (Blomstrom Globerman and Kokko, 2001; Gorg and Greenaway, 2004), MNEs can generate positive externalities to host countries increasing the domestic firms' productivity. These beneficial effects, known under the name of "spillovers", can take place both at an intra-industry and at an inter-industry level. In other words, local firms may benefit from the presence of foreign companies in their sector or through linkages between MNEs and their local suppliers. For this reason, economic literature defines these two distinct phenomena, respectively, as "horizontal" and "vertical" spillovers to underline the intra-industrial dimension of the firsts compared to the inter-industrial dimension of the seconds.

The first empirical studies on spillovers have generally tested the presence of "horizontal" spillovers in several countries, often ignoring the possible contacts between domestic suppliers and MNEs. Only in very recent years, empirical literature appears to be more oriented towards the investigation of "vertical" spillovers, testing their potential incidence in a host country.

The purpose of this study consists in investigating whether the presence of MNEs in the Italian manufacturing sector contributes to transfer knowledge to domestic firms not only at an intra-industry level but also at an inter-industry level, through the analysis of the linkages between MNEs and their local suppliers.

The reminder of this work is organized in the following way: the second section analyses the theoretical framework of the productivity spillovers, presenting a brief review of the reasons why host countries should benefit from the presence of MNEs; the third section depicts the empirical application, focusing on the data used, on the

* This work was jointly conceived and produced by the two authors. However, sections 1 and 2 were written by Filippo Reganati and sections 3 and 4 by Edgardo Sica.

econometric methodology adopted and on the results obtained; finally, the fourth section ends with some concluding remarks.

2. Productivity spillovers from MNEs: theoretical issues and empirical findings

From a theoretical point of view, productivity spillovers from FDI represent the positive effects of foreign firms on the productivity of the host country's local firms. In general terms, in fact, MNEs can generate several benefits to the domestic firms' productivity.

According to Blomstrom, Globerman and Kokko (2001), spillovers can raise the productivity of the local firms mainly through three channels: *learning of more efficient technologies*, *labour mobility* and *competition*. Foreign enterprises own intangible assets - such as technological know-how, marketing and managerial skills, international experience and so on - which, transmitted to domestic firms, can raise their productivity. The transfer of know-how and technology from foreign firms to local ones occurs mainly through imitation of nearby technology (so called "demonstration effect") but also through labour mobility of highly-skilled staff from MNEs to domestic firms. Moreover, the injection of capital and technology stimulates competition in the local market: on one hand, the entry of MNEs in a foreign market provides incentives for efficiency-enhancing investments in host-country firms because of the increased risk of a loss of market share; on the other hand, it increases average productivity of local plants since only the best firms can survive the competition (so called "selection effect").

Other remarkable productivity spillovers are represented by the *worker training effect* and by the *export-effect*. The first derives from the training of the affiliates' local employees, which contributes to the general knowledge diffusion in the host country since can affect most levels of employees, from simple manufacturing operatives to top-level managers (Aitken et al., 1996). The second comes from the fact that, since foreign firms have a multi-market presence, they are a natural

channel for information about foreign markets, consumers and technology (Aitken et al., 1997). In this sense, the local concentration of MNEs activity can reduce the cost of foreign market access for nearby firms: in other words, it enhances the export prospects of local firms which benefit from general linkages that MNEs maintain with parent or other firms.

All these benefits on domestic firms' productivity represent the so called "horizontal spillovers", since takes place mainly at an intra-industry level. But MNEs can produce many positive effects on local economies also at an inter-industry level, through the so called "vertical spillovers": more precisely, these occur when the diffusion of productivity benefits from MNEs in a host country reaches both the upstream and downstream sectors.

The main channels through which vertical spillovers take place are represented by the *expansion of producer service* and, *linkage externalities*. The first effect occurs since the entry of MNEs can provide a stimulus for local producers in order to expand their services to the newcomers. With regard to the second aspect, MNEs can provide technical assistance, training and help in management to their suppliers that raise the quality of domestic products. These linkages between MNEs' foreign affiliates and their local suppliers represent the so called "backward linkages". Moreover, MNEs can easily afford the necessary R&D to develop modern products, with great benefits for local customers ("forward linkages").

Some authors (Kugler, 2001) believe that the vertical spillovers are more likely to happen compared to the horizontal ones. This could be due to several reasons, now briefly explained. First, since MNEs generally prefer to locate where potential domestic rivals cannot reduce their market, the intra-industry spillovers could become less probable. On the opposite, since MNEs can benefit if knowledge diffusion reaches upstream suppliers, inter-industry spillovers to complementary sectors (and also to non-competing sectors that do not damages them) are more likely to take place. Second, the entry of MNEs in a domestic market - as already underlined - tend to raise the demand for local intermediate inputs and services, inducing a productivity increase in upstream and downstream sectors and, therefore,

mainly at an inter-industry level. In the end, when demand in a host country is inelastic because of the absence of substitutes goods, MNEs prefer those localisations characterized by limited domestic competition and many input suppliers, resulting in limited intra-industry spillovers. Hence, if MNEs can have a positive impact on domestic firms' production, such spillovers are most likely to generate productivity improvements in non-competing and complementary sectors.

Starting from the seminal works of Caves (1974) and Globerman (1979), in the last two decades there have been many studies which have analyzed the presence of intra-industry spillovers in manufacturing industries in developing, developed and transition economies. Although empirical results have been mixed, an important conclusion that it may be drawn is that spillovers are not automatic, but depend on various firm, industry and, country characteristics such as: i) the size of the technological gap between domestic and foreign firms[1]; ii) the degree of market competition [2]; iii) the ownership sharing of foreign affiliates[3]; iv) the trade regime in the host country[4]; v) the technological intensity of the sector[5]; vi) the nationality of the FDI[6].

[1] Kokko (1994) and Kokko et al. (1996) found, for Mexico and Uruguay respectively, that spillovers from FDI are difficult to identify in industries where the technology gap is large. In the case of the Italian manufacturing sector, Imbriani and Reganati (1996;1997) found that productivity levels are higher the lower the size of the technology gap between domestic and foreign firms. Using industry level panel data for the UK, Liu et al (2000) found that spillovers were higher in industries in which the technology gap between foreign and domestic firms is small. By contrast, Sjöholm, (1999) found that in Indonesia product spillovers were larger the larger the size of the technology gap.

[2] Kokko (1996) and Sjöholm (1999) found for Mexico and Indonesia, respectively, that spillovers from FDI are larger the higher the degree of competition in the industry.

[3] Analysing cross sectional data for Indonesian manufacturing, Blomström and Sjöholm (1999) did not find evidence to their hypothesis that minority owners and joint-ventures may provide better scope for spillovers. Using cross-sectional data, Dimelis and Louri (2002) conclude that Greek manufacturing firms benefit from productivity spillovers from multinationals, in particular from minority owned foreign MNEs.

[4] Kokko et al. (2001) showed that there is evidence for positive spillovers only from multinationals which located in Uruguay during the import substituting trade regime, and no evidence for spillovers of export oriented multinationals.

[5] Dividing the Indian manufacturing industry into "scientific" and "non scientific" sectors, Kathuria (2000) found positive spillovers in the scientific sectors but none in the non-scientific sectors. Examining data for the Czech Republic, Kinoshita (2001) finds statistically insignificant effects of foreign presence on domestic productivity on average but positive spillovers for local firms that are R&D intensive. Imbriani and Reganati (1996) found that spillovers were higher the higher the degree of sectors' technological intensity. Taking into account absorptive capacity through interacting the foreign presence

Very recently, the attention of researchers has moved towards the verification of the vertical spillovers phenomenon as well. Using manufacturing panel data in Colombia, Kugler (2001) finds the presence of limited intra-industry externalities and widespread inter-industry spillovers from MNEs. The absence of a positive impact from FDI on the domestic sectorial competitors of MNEs comes from the lack of dissemination of sector-specific technologies, while, thanks mainly to linkage effects, the diffusion of generic technical knowledge has a positive impact among other domestic producers in general. Smarzynska (2004) employs a firm-level panel dataset to investigate for the presence of backward linkages in Lithuanian manufacturing sector. Her findings show the existence of vertical spillovers: increases in the foreign presence in downstream sectors, in fact, are associated with a rise in output of domestic firms in the supplying sector and these spillovers seem to be not restricted from a geographical point of view. For the UK, Driffield and Roberts (2002) use industry level panel data for the period 1984 to 1992 and find evidence for positive spillovers only through forward linkages.

In general terms, the variety of findings on spillovers has a methodological nature and concerns with the nature of data (cross-sectional or panel) used in the empirical analysis. Görg and Strobl (2001) found that research design can crucially affect whether or not spillovers are found; in particular, they argue that panel studies, using data on a firm rather than an industry level, appear to be the most appropriate to determine the true extent of productivity spillovers. This is due to two main reasons. First, panel data studies allow a researcher to follow the development of domestic firms' productivity over a longer time period, rather than studying only one data point in time in cross sectional data. Second, panel data allow the researcher to investigate in more detail whether spillovers take place by controlling for other factors. Cross sectional data, in particular if they are aggregated at the

variable with a firm's R&D expenditure, Damijan et al (2001) found that there is evidence for negative spillovers for the Czech Republic and Poland and positive spillovers for Romania.

[6] Girma and Wakelin (2001) found that spillovers are strongest from Japanese FDI while there do not appear to be any positive effects on domestic productivity from US investment.

sectoral level, fail to control for time-invariant differences in productivity across sectors which might be correlated with, but not caused by, foreign presence. If such time-invariant factors exist and are not properly controlled for, coefficients on cross-section estimates may be biased.

3. Empirical application

Data used

The empirical analysis carried on in this work is based on an unbalanced firm-level panel data. The two main sources of data are represented by *A.I.D.A* - which is a database containing economic and financial data on private and public firms in Italy - and by the Italian National Statistical Institute, (*ISTAT*, for short) – which has provided the intersectoral input-output matrix used to derive a measure of backward linkages from MNEs, other than information on producer price adopted to deflate those variables expressed in nominal values. In this study, we have restricted our attention only to those firms belonging to the manufacturing industry (ATECO 2002 sectors 15-36) for the period 1997-2002. To identify the ownership structure of each firm, we also used two additional sources of information: Who Owns Whom (Dun & Bradtreet) and Reprint database (developed at the Department of Economics and Production of the Politecnico of Milano). Firms either wholly or partially foreign-owned were classified as "firms with foreign ownership", while the remaining part of firms as "locally-owned firms". Together with the foreign ownership, the dataset contains information on added value, capital, number of employees, material inputs, and location. To avoid any possible distorted result, dataset was carefully cleaned excluding firms with missing observations, coding mistakes, and abnormal values.

Econometric methodology

Following the usual method employed in literature to investigate for the presence of spillovers in a country and, mainly, using a model similar to that adopted by Smarzynska (2004), we estimate the following log-linear Cobb-Douglas production function augmented of foreign presence and other controls:

$$\ln Y_{it} = \alpha + \beta_1 \ln K_{it} + \beta_2 \ln W_{it} + \beta_3 \ln M_{it} + \beta_4 D_{it} + \\ + \beta_5 HORIZ_{jt} + \beta_6 VERT_{jt} + year + \varepsilon_{it} \quad [3.1]$$

where:

- $\ln Y_{it}$ is the natural logarithm of the nominal added value in firm i at the time t, deflated using industries information on producer price;
- $\ln K_{it}$ is the natural logarithm of the stock of capital in firm i at the time t deflated using industries information on producer price;
- $\ln W_{it}$ is the natural logarithm of the number of employees in firm i at the time t;
- $\ln M_{it}$ is the natural logarithm of material inputs in firm i at the time t, deflated using industries information on producer price;
- D_{it} is a foreign ownership dummy which takes the value 1 if a firm is foreign owned and zero if not;
- $HORIZ_{jt}$ captures the extent of foreign presence within an industry through the share of total employment accounted for by foreign affiliates in each industry j at the time t;
- $VERT_{jt}$ is employed to capture the possible links between MNEs and domestic suppliers. It was calculated as: $VERT_{jt} = \sum_{k\, if k \neq j} \alpha_{jk} HORIZ_{kt}$ where α_{jk} is the amount of output generated in sector j supplied to sector k taken from the

1992 Italian input-output matrix[7]. Unfortunately, this kind of table was available only for 1992: therefore, it was employed under the assumption that relationship across sectors have not radically changed over time.

- *year* is used to catch the time effect;
- α is an intercept;
- $\varepsilon_{it} \sim$ IID(0, σ^2) is the error term.

As easily observable from model [3.1], variables capturing either the horizontal and vertical spillovers are sector specific but time-varying variables.

Estimation Results and interpretations

Model [3.1] was firstly estimated adopting a pooled OLS estimator. Table 3.1 below, reports the results obtained.

Table 3.1. Results from the pooled OLS estimation of model [3.1]

Dependent variable: $\ln Y_{it}$		
Regressors	*Coefficient*	*Robust Stand Err.*
$\ln K_{it}$	.0824006*	.0010713
$\ln W_{it}$	.7407496*	.0018826
$\ln M_{it}$	.1130849*	.0016087
D_{it}	.2147105*	.0096276
$HORIZ_{jt}$	.2156323*	.0146728
$VERT_{jt}$	.0842138*	.0013702
year	-.0223402*	.0006044
cons	47.97001*	1.209796
R^2	0.81	
n OBS	262401	
F-test of jointly significance	98607.21*	

Note: standard errors are corrected for heteroskedasticity using White specification
** = statistically significant at 0.01 per cent level.*
*** = statistically significant at 0.05 per cent level.*
**** = statistically significant at 0.10 per cent level.*

[7] The formula excludes inputs supplied within each sector since they are already captured through the variable $HORIZ_{jt}$. Moreover, the variable $HORIZ_{jt}$ employed in the calculation of $VERT_{jt}$ represents a "weight" to measure the yearly changes in foreign presence, since the coefficients of the input-output table are fixed over time

Variables - both jointly and individually considered - result significant at a 1 per cent level. Specifically, the coefficient on D_{it} is positive: being interpretable as the elasticity of output with respect to the presence of foreign investment, it suggests that there are productivity gains associated with foreign equity participation. The coefficients on $HORIZ_{jt}$ and $VERT_{jt}$ are also positive, revealing the presence of spillovers from MNEs to local firms both at an intra-industry and at an inter-industry level ("horizontal" and "vertical" spillovers). More precisely, the point estimate suggests that an increase in the share of foreign investment from 0 to 10 per cent determines a 2.1 percentage-point increase in the productivity of domestic firms in a particular industry while an increase in the share of foreign investment in downstream industry from 0 to 10 per cent leads to a 0.8 percentage-point increase in the productivity of domestic firms in the supplying industry.

Anyway, since the OLS estimator considers intercepts and slope coefficients as homogeneous across all N cross-sections, this approach throw-outs the space dimension, discarding many useful information. More precisely, since the space dimensions captures the "between" variation in the data, the pooled OLS estimator exploits this dimension but in an inefficient way. Moreover, the consistency of this estimator requires that the explanatory variables are uncorrelated with any cross-section specific effects. For this reason, regression [3.1] was reestimated employing both a fixed and a random effects approach. The use of the first econometric methodology instead of the second one can lead to significantly different results. In fact, if the omitted factors are independent of the explanatory variables, the random effects estimator is consistent and efficient while the fixed effects estimator is consistent but not efficient. On the opposite, if unobservable effects are correlated with the independent variables, the fixed effects estimator is consistent and efficient while the random effects estimator is inconsistent. Therefore, a chi-squared Hausman test was performed to test for inconsistency in the random effects model. This test - based on the comparison between the estimated slope parameters for the

fixed and the random effects model – has pointed out the superiority of the fixed effects model in this application, which results are presented in table 3.2

Table 3.2. Results from the Fixed Effects estimation of model [3.1]

Dependent variable: $\ln Y_{it}$		
Regressors	*Coefficient*	*Robust Stand Err.*
$\ln K_{it}$	.0744417*	.0042422
$\ln W_{it}$	.2265817*	.0035028
$\ln M_{it}$	.3199654*	.0069452
D_{it}	.0399402	.0475422
$HORIZ_{jt}$	.0709095	.0452023
$VERT_{jt}$	.0245326*	.0050917
year	.0069964*	.0007158
cons	-10.55522*	1.416295
R^2	0.67	
n OBS	262401	
F-test of jointly significance	2225.53*	

Note: standard errors are corrected for heteroskedasticity using White specification
** = statistically significant at 0.01 per cent level.*
*** = statistically significant at 0.05 per cent level.*
**** = statistically significant at 0.10 per cent level.*

According to the F-test, all variables are jointly significant at a 1 per cent level, but now not all coefficients are individually significant. In particular way, the coefficient on D_{it} is not statistically significant, suggesting that there are not productivity gains associated with foreign equity participation. The coefficient on $HORIZ_{jt}$ is also not statistically significant and reveals the total absence of spillovers from MNEs to local firms at an intra-industry level ("horizontal spillovers"). The latter result confirms the previous findings of Imbriani and Reganati (2002) about the lack of horizontal spillovers in the Italian manufacturing sector. On the opposite, the positive and statistically significant coefficient on the variable $VERT_{jt}$ confirms the existence of positive vertical spillovers in the Italian manufacturing sector from foreign firms to domestic ones. In this case, the point estimate suggests a 0.24 percentage-point increase in the productivity of domestic

firms in the supplying industry as a consequence of an increase in the share of foreign investment in downstream industry from 0 to 10 per cent.

In order to strengthen our empirical findings, model [3.1] was differenced once, assuming the following new specification:

$$\Delta \ln Y_{it} = \alpha + \gamma_1 \Delta \ln K_{it} + \gamma_2 \Delta \ln W_{it} + \gamma_3 \Delta \ln M_{it} + \gamma_4 D_{it} + \\ + \gamma_5 \Delta HORIZ_{jt} + \gamma_6 \Delta VERT_{jt} + year + \varepsilon_{it} \qquad [3.2]$$

The reason of first differencing is to address the problem of the potential omission of unobserved variables, which could influence the relationship between the foreign presence and the domestic firms' productivity. Time-differencing the variables permits to remove these potential unobservable effects. Again, the Hausman test has indicated a rejection of the proposition that the random effects are independent of the explanatory variables and, therefore, the consistence of the fixed effects estimation, which results are reported in table 3.3.

Table 3.3. Results from the Fixed Effects estimation of model [3.2]

Dependent variable: $\Delta \ln Y_{it}$

Regressors	*Coefficient*	*Robust Stand Err.*
$\Delta \ln K_{it}$	.0944934*	.0086244
$\Delta \ln W_{it}$	.1054255*	.0031867
$\Delta \ln M_{it}$	.3110361*	.0128833
D_{it}	.0494235	.0350147
$\Delta HORIZ_{jt}$	-.0694622	.0582044
$\Delta VERT_{jt}$	.1117236 *	.0107461
year	-.0108433*	.0007819
cons	21.71524 *	1.563908
R^2	0.22	
n OBS	192480	
F-test of jointly significance	354.98*	

Note: Figures in parentheses are standard errors corrected for heteroskedasticity using White specification
** = statistically significant at 0.01 per cent level.*
*** = statistically significant at 0.05 per cent level.*
**** = statistically significant at 0.10 per cent level.*

The results presented in table 3.3 look very similar to those obtained from the estimation of the regression model [3.1]. Again, all variables are jointly significant at a 1 per cent level, but the coefficients on D_{it} and on $HORIZ_{jt}$ are not statistically significant, suggesting the same conclusions as before. The positive and statistically significant coefficient on the variable $VERT_{jt}$ confirms the existence of positive vertical spillovers from foreign firms to Italian ones. In this case, the point estimate shows an increase of 1.12 per cent in the productivity of domestic firms in the supplying industry.

4. Concluding remarks

This paper aimed to verify the presence of spillovers from MNEs in the Italian manufacturing sector both at an intra-industry and at an inter-industry level. Results suggest two interesting conclusions. Firstly, local firms seem to not benefit from the presence of foreign companies in their sector; secondly, increases in the foreign presence in downstream sectors determine productivity rise of domestic firms in the supplying industry. In other words, the Italian case suggests the absence of "horizontal spillovers" and the contemporary presence of "vertical spillovers" in manufacturing sector: foreign firms act as a driving-force to their domestic producers, stimulating them to reach up technological progresses, to improve their management quality, and, generally, to supply more advanced services to the newcomers.

With regard to the first conclusion, it seems to confirm the results from previous works which fail to find evidence of positive effects from MNEs to the Italian firms' productivity at the same industry level: the findings from the present study, in fact, are perfectly in line with the main literature on the effects of FDI on the domestic economy.

With respect to the second conclusion, to the best of our knowledge this study represents one of the first empirical investigations about the effects of the foreign firms' presence on Italian economy at an inter-industry level. In this sense, no comparison with earlier works is possible.

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