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MULTINATIONALS AND PRODUCTIVITY:
EVIDENCE FROM THE TURIN AREA

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Multinationals and productivity: evidence from the Turin Area

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ABSTRACT: This paper presents a non-parametric estimate of efficiency levels and productivity trends of small and medium multinational firms operating in the Turin area in respect to domestic firms active in the same sectors. MNEs appear more technically efficient in combining inputs to obtain output, however this evidence is mainly driven by firm's characteristics and specialisation in certain activities. Moreover, an higher Total Factor Productivity (TFP) growth emerges for the subgroup of MNEs also after different control process, while no clear evidence could be found on the entrance strategy pursued by foreign firms (Greenfield vs Brownfield investments).

Keywords: Multinational firms, Efficiency analysis, Second stage regression.

JEL Codes: D24, F23, C67

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INTRODUCTION

The long run debate on desirability of multinationals presence, arguing on their superior performance and technology, is still ongoing. In general their subgroup show higher productivity levels and a stronger Labour and Total Factor Productivity (TFP). Moreover, foreign owned firms appear to be larger, more capital intensive and they seems to pay more their workers than domestic firms (Caves, 1996). At theoretical level many interpretation could lead to similar conclusion on the desirability of multinational presence: superior managerial or organizational skill and higher technological capabilities are the main base of the so called “proprietary assets model”. All previous advantages could be easily internalized by affiliates, active in foreign countries, leading to higher productivity levels and growth potentials. Strong empirical evidence mainly confirms this interpretation. Dimelis and Luori (2002) analyse the Greek case and show that labour productivity, estimated through a Cobb-Douglass specification, was statistically higher for foreign owned firms, but only in case of a majority ownership. Arnold and Hussinger (2005) on the German manufacturing sectors and Crisuolo and Martin (2009) for the UK, find higher TFP levels for MNEs. Similar results are find for developing countries: Takii (2004) analyses the Indonesian manufacturing sector, while Blomström (1988) the same sector in Mexico. Other contributions add covariates, Chacar *et al.* (2010) find a positive, but diminishing with firm’s age, while Maffini and Mokkalas (2011) include corporate tax rate differentials in explaining TFP differential.

The literature on the Italian case is still limited. Castellani and Zanfei (2006) find that firms located in Italy with foreign owners perform better than the domestic ones, but this difference seems to disappear when the analysis is restricted to the sample of foreign and domestic-owned multinationals. Grasseni (2010) restricts the analysis to the subsample of MNEs, foreign or domestic owned, finding higher labour productivity, higher wages and higher capital intensity in favour of foreign MNEs. However, profitability levels of Italian MNEs is higher, when measured as Return On Sales (ROS) or Return on Investment (ROI).

When a foreign firms decide to enter in local market, the issue of the entrance strategy is important for both the multinational firm and for the foreign country. Previous analysis concerning this point are still limited, but Nocke and Yeaple (2007) show through a general equilibrium model how that choice is endogenous. The underling motivation of FDI (Foreign Direct Investment) strategy versus cross-border M&A, or Greenfield investment versus Brownfield investment, rely in a trade-off between the exploitation of own capabilities and the acquisition of costly country-specific capabilities. Moreover, some capabilities are not mobile internationally, such as institutional competences, distributional network or marketing strategy (Arnand and Delios, 2002)

Benfratello and Sembenelli (2006) also address this issue, reinterpreting the higher productivity showed by multinationals as a possible outcome of the MNE’s localization strategy. The idea of their superior technological and managerial capability, one of the main point of internalization theory, became only one possible interpretation: MNE groups could decide to buy only the best locals firms or to engage their-self in the most productive activities. Moreover, increasing attention was devoted to the problem of firms heterogeneity, arguing a composition effect that boost MNEs’ productivity due to the choice of operating in more dynamic sectors. Other variable, such as capital intensity or size could significantly drive the results in favour of multinationals. Griffit (1999) find that, after controlling for the differences in inputs utilisation, the effect of foreign ownership was negligible; also (Globerman *et al.*, 1994), after controlling for heterogeneity, do not find evidence in favor of higher MNE performances.

At theoretical level, the so called Liability of Foreignness (LFO) is a possible way to explain poorer performances of multinationals (Zaheer, 1995; 2002). They have to face a foreign environment and difficulties of making business abroad increase where the concentration of small and medium enterprises is high. In this situation the interaction among MNEs and domestic firms could be hamper by cultural aspects, and this could be particularly true in a period of crises. Moreover, the absence of specific institutional competences, distributional network or marketing strategy could increase transaction cost for MNEs (Hennart, 2010). Empirical evidence on LOF

suggest it is particularly strong in services, such as banks (Young and Nolle, 1996; Boehe, 2011).

The present analysis is focused on the Turin area that together with Milan area, is characterized by the higher concentration of multinationals in Italy (Basile, 2004), or more properly named foreign owned firms. The less recent debate on them was mainly focused on large enterprises investing abroad large amount of resources, but as it is argued by Li and Hu (2002) for the Asian case, also SMEs are increasingly involved in FDI.

Previous consideration justify the focus on all the foreign owned firms which are present in a well established and concentrated geographical area considering both micro firms and large enterprises. From the one hand that approach guarantee a certain homogeneity of economical and environmental condition faced by each firms, but from the other hand it limit the interpretation of results and the possible extensions.

The methodology adopted here is relatively new for this kind of analysis, normally concentrated on financial and economic performances or TFP levels estimated assuming traditional Cobb-Douglass production function.

In particular only three papers addressing the issue of multinational use parametric or non-parametric productivity analys. Two paper apply SFA to estimate productivity and include directly foreign ownership as determinant of inefficiency: Bottasso and Sembenelli (2004) on Italian manufacturing, they find higher efficiency for foreign subsidiaries focusing on large firms operating in Italy. Banalieva et al. (2011), run a SFA analysis on MNEs from U.S., Japan, Finland, France, Germany, Ireland, Netherlands, Sweden, and UK using database provided by Bureau Van Dijk and they focus on the regional strategy pursued by MNEs. Only one study apply non-parametric technique, Halkos and Tzeremes (2007) use DEA and Malmquist addressing both size and ownership issues. Their focus was on Greek manufacturing firms and they find foreign ownership only positively influence medium size firms, but they only run non-parametric tests.

A lack of literature emerges on the case of small and medium foreign subsidiaries, increasingly involved in FDI (Li and Hu, 2002).

In the present both large and small foreign owned firms are analysed, paying higher attention to the concept of technical efficiency, estimated using non-parametric methods, to

obtain global productivity levels and TFP growth rates. In particular linear programming technique are applied to derive an observable best practice frontier with which every firms is compared. Then the application of one of the most recent econometric procedure, derived from non parametric statistics, has been used to build a robust second stage model to infer some of the possible sources of firms' inefficiency and to test for the significance of foreign ownership. If foreign owned firms can have access to higher managerial skills and better technological techniques without additional costs, their position regarding to the frontier should be better than domestic firms. A similar idea will drive consideration on TFP growth and the formal test of this two research hypothesis is the final aim of that work. Moreover owner's origin and entrance strategy issues will be addressed using non-parametric test given the small number of observations available.

The reminder of the paper is organised as follows. Section 1 briefly present the metrological tools which are well known in the productivity literature, then section 2 shows the database and provides descriptive statistics. Finally Section 3 summarises the main results and Section 4 briefly concludes.

1 METHODOLOGY

1.1 *Efficiency scores: ability to maximize revenues for given inputs*

Previous studies on MNEs and their TFP trend assume a Cobb-Douglass production function, but of course some hypothesis on the shape of technology have to be accepted. Here a fully non parametric Data Envelopment Analysis approach, is applied to get TFP levels and TFP trends, following the approach proposed by Manello (2012). The main advantage of using DEA approach is that it does not require to specify a form for the production process, then no assumptions have to be done on the shape of the technology. Moreover, the DEA approach allows to find a simple efficiency measure also in the case of multi-outputs and multi-inputs underlying technology. A frontier is directly derived by data and all firms in the sample are evaluated in term of it through distance functions.

DEA methodology has been used, since the 80's, to assign technical efficiency score to each firm, scores that could be analysed using econometric techniques. For a detailed treatment of DEA see Banker et al. (1984), Färe et al. (1994) and Coelli et al. (1998).

On a base of previous considerations, output-oriented framework has been used here, assuming constant returns to scale (CRS) on the basis of Charnes *et al.* (1978) model. The choice is driven by the necessity of calculating Malmquist indexes, as reported in the next paragraph, which require CRS for more reliable values (Färe and Grosskopf, 1996). Technical efficiency scores TE, are then computed by solving, for each firms in the sample, the following linear problem:

$$\begin{aligned}
 TE &= \text{Max } \theta \\
 \text{st : } & \theta y_0 - Y\lambda \leq 0 \\
 & -x_0 + X\lambda \leq 0 \\
 & \lambda \geq 0
 \end{aligned}
 \tag{1}$$

Where θ is a scalar > 1 , λ is a vector of $n \times 1$ weights allowing convex combination of inputs and outputs, Y is an output matrix, X is an inputs matrix. Further, $\theta-1$ presents the output proportional feasible increment, maintaining constant input level.

Obtained TE take the unity value if no expansion of outputs are technically feasible, then the firm is on the best practice frontier. A value grater than one represent the possibility of increasing outputs, in this case the firm is inefficient in combining inputs. In the present paper the homogeneous bootstrap procedure, described in Simar and Wilson (1998), is applied to correct deterministic estimates for the potential bias due to finite sample. This cause an effective impossibility in observing unity values, due to the quasi-stochastic nature of the frontier, for a detailed discussion of the methodology, see for example Daraio and Simar, (2008).

1.2 TFP growth rate : a Malmquist indexes approach

In the efficiency contest TFP growth indexes can be written using distance between each firms and its contemporaneous frontier taking ratios of distances, see Färe and Grosskopf (1996) for a detailed treatment. Malmquist approach suggest to take the geometric mean of the TFP growth evaluated using both t and $t+1$ frontier as a reference. In notation:

$$M_0^{t,t+1} = \left[\frac{D_0^t(x_0^{t+1}, y_0^{t+1})}{D_0^t(x_0^t, y_0^t)} \frac{D_0^{t+1}(x_0^{t+1}, y_0^{t+1})}{D_0^{t+1}(x_0^t, y_0^t)} \right]^{\frac{1}{2}}
 \tag{2}$$

Where $D_0^t(x_0^t, y_0^t)$ and $D_0^{t+1}(x_0^{t+1}, y_0^{t+1})$ are standard DEA efficiency score at time t and $t+1$ and the other two components are obtained as solution of following mixed period linear programs where the input-output mix at each time is compared with both the frontier relative to t and $t+1$. Improvements in TFP will result in values of $M_0(\cdot)$ exceeding one, value less than unity represents deterioration in the total productivity, that could be easily observed during crisis periods. Malmquist index are often decomposed to separate the effect due to change in efficiency between period t and $t+1$ and to the frontier shift.

$$EFF_0^{t,t+1} = \frac{D_0^{t+1}(x_0^{t+1}, y_0^{t+1})}{D_0^t(x_0^t, y_0^t)}
 \tag{3}$$

$$TECH_0^{t,t+1} = \left[\frac{D_0^t(x_0^{t+1}, y_0^{t+1})}{D_0^{t+1}(x_0^{t+1}, y_0^{t+1})} \frac{D_0^t(x_0^t, y_0^t)}{D_0^{t+1}(x_0^t, y_0^t)} \right]^{\frac{1}{2}}
 \tag{4}$$

The two components represent two different side of TFP improvement in presence of possible inefficiency. The EFF term represent the efficiency recovery in respect to the time t frontier, which lead to TFP improvement also in absence of technical progress through an increasing capacity in using available techniques.

On the contrary the TECH term represent the pure technological progress able to shift upwards the best practice frontier. This is another important driver of the TFP growth.

1.3 Second stage, the bootstrap truncated regression model

Technical inefficiency, estimated using DEA, could be analysed in a second stage phase, but some problem arise if a simple regression model is estimated. Normally some independent variable on which managers cannot have control, or that cannot be influenced in the short run, are included as explanatory variables. The problem is that they could be correlated with input or outputs measure, then they influence inefficiencies and the results is a complicated residual structure in the estimated second stage regression, see Simar and Wilson (2007) for details. The solution rely in a Maximum Likelihood estimate after throwing out efficient observation, then by assuming a truncated regression model as the following:

$$TE_i = \beta'w_i + \varepsilon_i \geq 1 \tag{5}$$

where $\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$ before truncation, TE_i are the estimated technical efficiency scores by DEA, β' are the parameters to compute, w_i are explicative and control variables, ε_i is the error term and σ_ε is the error variance (Barros and Dieke, 2008).

According to Kumar (2006) in the field of environmental efficiency, no particular technique have to be applied to run second stage regression

analysis on TFP growth indexes obtained via Malmquist procedure and OLS represent a valid instrument.

2 DATA AND DESCRIPTIVE STATISTICS

2.1 Data source and stylised facts

The empirical analysis is based on the AIDA database from Bureau Van Dijk which provide balance sheet data for a large and representative sample of firms located in Italy. According to the illustrated purposes, the attention is focused on the subsample of firms located in the Turin province area, operating in all economic sectors. The information on the foreign or domestic ownership comes from the Piedmont Agency for Investment and Tourism (CEIP), an agency promoted by Piedmont Region and Chambers of Commerce which maintain direct or indirect contacts with each multinational firms. The presence of FDI is particularly relevant near Turin, thanks to a massive presence of automotive-related international manufactures, but also foreign services firms.

The period of investigation, 2007-2009, coincide with the recent international crisis, where the 2007 data represents the pre-crisis observation. The sample is restricted to firms with a complete balance sheet for all the three years considered, then at the end around 6500 domestic firms, and a group of 292 foreign owned firms for which some additional information are also available. In particular the entrance strategy pursued was object, during the years, of specific interviews and the data is reliable for the 80% multinational subgroup, 225 firms. Moreover the origin of the parent multinational and the typology of control strategy choose are listed in the original database from CEIP. Greenfield investment are an important way to enter within the Turin area, such that around 120 firms take this strategic choice.

Table 1 – Descriptive statistics of inputs, outputs and other characteristics (year 2009)

	Domestic firms			Multinationals firms		
	mean	p5	p95	mean	p5	p95
<i>Inputs (th. of €)</i>						
Labor costs (L)	734	20.6	1,816	6,440	96.9	26,900
Assets (K)	2,496	6.8	3,966	11,900	13.3	53,500
Intermediate goods (M)	7,370	93.3	12,200	37,200	509.8	182,000
<i>Output (th. of €)</i>						
Production (Y)	9,020	188.8	16,400	49,500	754.4	241,000
Firms structural characteristics (indicators)						
Capital Intensity (K/L)	3.10			1.58		
Vertical Structure (M/Y)	68%			70%		
Number of firms	6520			292		

In the table 1 summary statistics are showed for the set of inputs and output variables used in the DEA framework to obtain efficiency measures and TFP growth rate. All values reported are in current euro and relative to the last observation year 2009. Previous observation, 2007 and 2008, and provided in 2009 constant prices, using specific price indexes by ISTAT series. The 5th and the 95th are provided with the means for the 2 groups of MNEs and domestic firms. Input variables introduced in the DEA for the computation of *TE* scores must represent both the production capacity of firms and the resources needed for the production process, for this reason the efficiency model is computed assuming the usage of 3 inputs to obtain 1 output. Regarding inputs: capital is proxied by total operative assets (tangible and un-tangible), labour usage is proxied by total wages, a more reliable data in financial statements and intermediate goods are given by the sum of raw materials, net of changes in inventories, services and other operative costs. The output variable coincide with the production value from balance sheet, given by the sum of revenues from goods and services at the end of the year, net of changes in inventory.

From table 1 also come a confirmation about some of the stylised facts highlighted by the recent literature. Turin MNEs are larger, both in term of production and assets and less capital intensive: in fact they need less capital for unit of capital, suggesting the existence some “proprietary assets” non included, as the

internationalization theory says. Wages and vertical structure of domestic and foreign firms are similar.

2.2 Variables affecting technical efficiency and TFP growth

According to the recent literature, some potential determinants of inefficiency are investigated by including some variables which are present, to some extent, in the majority of the work dealing with second stage approach.

The degree of vertical integration is defined according to the Adelman index (Adelman, 1995) as the ratio of value added to sales. Here the structure of the firms will be caught by purchases of intermediate goods over total turnover, then the index catch *vertical disintegration* (*M/Y*). The economic reason for considering the vertical structure are numerous, Calabrese (2001) try to enumerate some advantages for more integrated firms: quicker adjustment to customer needs, scope economies, reduction in transaction costs and an easier quality control. On the same issue (Calabrese and Erbetta, 2005) conclude that in the modern automotive sector, for example, highly integrated and highly de-verticalised firms seems to perform better.

The *capital intensity* is measured by the K/L relationship, here computed using asset to labor cost ratio and is included to control for different technology feature. The underlying idea is that to a different capital endowment for unit of labor

correspond a different technology and then a slightly different production process (Latruffe, 2008).

The relationship between *Size* and technical efficiency has been for long debated in the literature, but in many recent empirical work results appear to be contradictory. On the Italian situation recent works seems to confirm the relevance of size effect in the manufacturing sector (Pieri and Zaninotto, 2011). Larger firms are more able to exploit scale and scope economies and this enhance performances, especially under the DEA framework, strongly focused on the technical ability of combining inputs to obtain outputs. From previous descriptive statistics a different size emerge for the two subgroups, then some differences in terms of productivity can be due to a different dimensional distribution across MNEs and domestic firms. The variable *SIZE*, given by the log of the average (2007-2009) own capital assets, is then included as a control. From the logarithmic features of the variable, differences in the log scale are much more smaller than in the Euro scale: micro firms and big MNEs are more far than *SIZE* variable says. For this reason also an additional square term *Size sq.* is included to catch non-linear relationship with size and to control for larger dimension.

The *Ownership* variable, the key point of present work, is included. Following the approach by Bottasso and Sembenelli (2004), ownership issue is analysed by including a dummy variable in the model, but here the ownership variable reflect a foreign versus domestic ownership status, rather than the inclusion in an industrial group. In the present analysis as a dummy variable equal to unity in case of foreign owned firms is defined.

The strategy of entrance on the local market is identified by a dummy variable *Greenfield*, that indicate if the FDI is pursued through a direct investment in building a new plant, in contrast to cross-border M&A.

3 EMPIRICAL RESULTS

3.1 Firms efficiency

Linear problems in the form of equation 1 are solved for each firm and for each year using R, while the bootstrap procedure by Simar and Wilson (1998) is applied using the routine in the package FEAR. Given the heterogeneity of firms involved, efficiency and bootstrap are run separately for each sector, following the approach by section 1. Outliers are detected using the routine in the package FEAR and to refine results, only those firms for which bias correction was computed are included in the final results.

The estimated efficiency scores are showed in table 2, reporting the median, less dependent from the presence of outliers or un-reliable results, for the total sample and for the subgroup of multinationals.

Both for MNEs and for domestic firms, very good possibility of increasing production arise: in all the years considered output could be more or less doubled if the best technology was applied by each firms. Of course this results must be interpreted with care, due to the nature of DEA that is born to compare small sample of homogenous firms producing physical quantity of outputs and implying physical quantity of inputs. In the present work, physical quantities are replaced by monetary proxies from balance sheet data.

Table 2 – DEA bias corrected efficiency score, median over sectors

Sector	Domestic firms			Multinationals firms		
	2007	2008	2009	2007	2008	2009
Advanced services	5.442	7.924	4.969	5.471	8.971	5.227
Automotive Manuf.	1.850	1.652	1.486	1.790	1.624	1.443
Manufacturing	2.257	2.249	2.531	2.263	2.062	2.262
Services	2.197	2.051	2.871	1.788	1.819	2.235
Wholesale & retail	1.952	2.016	1.589	1.916	2.208	1.713
Total	2.100	2.242	2.196	1.974	1.965	1.960

Moreover, heterogeneous firms are compared and, also if some outliers are detected using the Wilson (1993) outlier detection methods, the presence of some “strange” financial situations cannot be excluded. For these reasons the levels of inefficiency must to be interpreted with care, and relative comparison are preferred to absolute conclusions.

Inefficiency results are in general stable along the years, but of course this statement is driven by the fact that the frontier change each year. However, from table 2, some large differences emerges over sector, especially during the recent crisis. A larger inefficiency score, for example in Services and Manufacturing in 2009, suggest the coexistence of more heterogeneous firms and it indicate an higher potential efficiency recovery if the best technique will be adopted.

From simple descriptive statistics, based on the median, MNEs seems to perform better, but in this case also more formal non-parametric tests confirms first impressions. Considering the whole sample MNEs are more efficient, and this hypothesis could be accepted for each year. Nevertheless, if separate tests for efficiency differentials are run for each sectors and years, the situation become less clear. In 2009, only in manufacturing and services significant differences remain, according to non-parametric Kruscal-Wallis test. In 2007 significant differences only survive for services, while in 2008 they are significant for Wholesale&Retail, Services and Manufacturing.

However, the interaction between size and efficiency could determine that evidence, given the larger dimension of MNEs affiliates in comparison to domestic owned firms and the

differentiated distribution of large firms over sectors.

3.2 Tfp growth: Malmquist results

Table 3 present estimated trends on TFP for the period 2007-2009 without considering the intermediate observation for 2008, with the aim of increasing robustness of results. As expected also TFP is decreasing during the recent crises, with an average reduction of 5% during three years. Geometric means of individually computed Malmquist indexes are reported for each sector, values smaller than 1 represent a situation of TFP contraction. Table 3 reveals a better performances of multinationals, in accordance with many empirical contributions (Globerman *et al.*, 1994 and Girma *et al.*, 2001). Over the period 2007-2009 only the firms operating in the Advance Services sectors are able to increase the level of their global productivity. No significant difference could be observed for the subgroup of multinational firms, but firm’s heterogeneity could determine the results. In fact, next section will shed light on this point.

The column 3-4 and 6-7 of table 3 shows the TFP decomposition in Efficiency change and Technical progress, directional results are mixed: in some sectors EFF sustain productivity (Manufacturing and Wholesale&Retail), in other TECH (Services). The average results, using geometric average for all the population, show a positive efficiency recovery over the period, while a deterioration of technical possibilities emerge simultaneously.

Table 3 – TFP and its component, geometric mean by sector, period 2007-2009

Sector	Domestic firms			Multinationals firms		
	ML	EFF	TECH	ML	EFF	TECH
Advanced services	1.027	1.107	0.928	1.021	1.043	0.979
Automotive Manuf.	0.882	1.262	0.700	0.885	1.199	0.738
Manufacturing	0.913	0.895	1.019	0.959	0.954	1.005
Services	0.953	0.797	1.195	0.997	0.854	1.167
Wholesale & retail	0.963	1.132	0.851	0.967	1.066	0.907
Total	0.949	1.013	0.937	0.955	1.020	0.937

This results is unusual and in standard settings it is unreliable, but during one of the deeper economical crises after the Second War World, it could be accepted. Moreover, the consideration of economical variable instead of physical quantities could hamper that evidence. A further econometric analysis should be useful, as in the case of pure efficiency, to obtain more reliable conclusion aside from observable individual characteristic.

3.3 Intra-multinational comparisons

A focus on foreign owned firms (table 4), and in particular on the origin of the owner, shows that if the owner comes from particularly dynamic countries, such as BRIC, MNEs subsidiaries are more technically efficient. That evidence, with the analysis of TFP performances,

partially confirms the evidence by Chen, (2011) on emerging countries for which TFP growth is lower; differences are robust to non parametric Kruskal-Wallis test. The unexpected results rely in the poor performance of North American MNEs that are not more efficient near Turin as previous literature suggest for whole Italy (Benfratello & Sembenelli, 2006). However, subsidiaries from North America are concentrated on Automotive Manufacturing sector, where the recent crisis was particularly strong. Poor performances are observed for UK and Japanese firms, mainly for TFP growth, but also in this case the industry effect cannot be considered for the small number of observations.

The best performance is reached by BRIC's firms, the most efficient subgroup within MNE firms, and this better performances are confirmed by non parametric test based on Kruskal-Wallis non parametric tests.

Table 4 – MNEs focus: DEA corrected score (median) and Malmquist (geometric mean)

Owner origin	Year			Malmquist 2007-09		
	2007	2008	2009	M	EFF	TECH
Benelux	2.146	2.489	2.368	0.999	0.992	1.008
BRIC	1.54	1.719	1.409	0.909	0.878	1.036
France	1.915	1.895	1.925	0.993	1.038	0.957
Germany	1.966	2.024	1.892	0.936	1.033	0.906
Japan	1.989	2.268	2.097	0.870	0.937	0.928
North America	2.023	1.887	1.871	0.982	1.035	0.949
Other Countries	1.901	2.033	2.014	0.924	0.981	0.942
Scandinavian countries	2.026	1.789	1.957	0.925	1.081	0.856
UK	2.989	2.236	2.614	0.846	0.964	0.878
Total foreign firms	1.991	1.998	1.973	0.955	1.020	0.937

Table 5 – MNEs focus: DEA corrected scores (median)

Entrance strategy	Year		
	2007	2008	2009
Not available	2.024	2.037	1.960
Brownfield	2.031	2.019	2.065
Greenfield	1.953	1.935	1.910
MNEs	1.991	1.998	1.973

Considering the strategy of entrance near Turin (from table 5), the Greenfield investment, pursued when capabilities are easily transferable (Nocke and Yeaple, 2007), shows an higher technical efficiency.

This partially confirms the idea of a more effective technology transfer from parent company, its quickness and its more pervasive nature. Moreover, from a policy viewpoint, the strategic entrance with Greenfield instruments is related to an higher effect on job creation (Basile, 2004), then it represent a win-win opportunities for MNEs and for the local economy.

However, this first impression in favor of higher efficiency for Greenfield plants cannot be deeply investigate due to database issues. In particular the industry effect is significant, but the limited information on the year of entrance together with the limited number of observation does not allow further analysis. A dummy variable Greenfield is included in the following

second stage analysis, but the richness of the real strategy cannot be caught without direct data collection on the field.

3.4 Explaining efficiency and TFP trends

Results for the second stage model explaining TE score are not reported here for a matter of space. Truncated regression, on the basis of Simar and Wilson (2007), were run separately over each industry and for each year, using bias corrected DEA scores as dependent variables. The total number of run regression is 15 (3 years, 5 industry), but no common evidence can be reached on ownership or modality of entrance in the Turin area. One can conclude that foreign ownership does not affect technical efficiency after controlling for simple individual characteristics such as size, vertical integration and capital intensity.

Table 6 – Second stage analysis of TFP trends

VARIABLES	(1) MALM - 0709	(2) MALM - 0709	(3) MALM - 0709	(4) MALM - 0709
MNE	0.0343* (0.0191)	0.0351** (0.0154)	0.0370** (0.0155)	0.0254 (0.0194)
M/Y	-0.0617* (0.0346)	-0.0941*** (0.0305)		-0.0529 (0.0344)
K/L	-6.10e-05 (0.000770)	-2.25e-05 (0.000787)		-0.000281 (0.000726)
greenfield	-0.00440 (0.0290)			-0.00136 (0.0294)
Industry dummies	YES			YES
size	-0.0324* (0.0192)	-0.0419** (0.0196)	-0.0344* (0.0189)	
size_2	0.000867 (0.000672)	0.00102 (0.000682)	0.000807 (0.000658)	
size dummies	---	---	---	YES
Constant	1.250*** (0.146)	1.407*** (0.147)	1.276*** (0.136)	0.963*** (0.0246)
Observations	2,806	2,806	2,806	2,816
R-squared	0.077	0.018	0.011	0.072

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

More interesting is the regression phase to explain TFP trends. Four different models are run to check for the sensitivity of results and the evidence on the MNE status is robust to different specifications. The control for the firm's size is obtained using two approaches: using a continuous variable size and size square (as explained in the data section) and using size class dummies.

The European thresholds, based on the value of revenues, are used to obtain this dummies.

Micro-firms are excluded by regressions for their heterogeneity. Foreign ownership increase TFP potential, and this evidence is robust to all the model specifications. Also the magnitude of estimated coefficient is similar along different models, confirming that being a subsidiary of a foreign firms gives an additional TFP growth around 3%. These consideration are of course valid only for SMEs and Large firms.

Size negatively affect productivity, suggesting that during crisis, flexibility is more important than scale in sustaining TFP growth. No evidence could be find regarding entrance strategy in the Turin area in relation to TFP growth.

The capacity of the two models to explain variability of data is not so high, as the R-square under 10% underlines, but it seems to be sufficient considering the cross-sectional nature of data, the high number of firms considered and the index nature of TFP. Of course, some further analysis in this direction are suggested.

4 CONCLUSIONS

Theoretical and empirical literature converges in underling a competitive advantage for MNE owned firms that could have access to superior technologies and higher managerial skills. Other contributions highlight some difficulties of making business abroad: the liability of foreignness could increase especially during crises periods or in some particular geographical regions.

The aim of this study was to analyse productivity from a different perspective in comparison with previous empirical literature on MNEs choosing a well defined particular area. Also the idea of productivity is relatively new in this contest, because instead of classical parametric estimate of Total Factor Productivity, here the variable of interest was the technical efficiency in combining inputs to obtain output.

A well established non parametric method based on linear programming (DEA) is applied to obtain the relative position of each firms compared to a piecewise linear frontier, that represents best practices within the selected sample. The efficiency scores are computed for each year of the period 2007-2009 and, applying an extension of DEA, TFP growth indexes are also estimated via deterministic linear models. Both applications were run separately for each sector.

From preliminary analysis of results, one can draw a conclusion in line with internalisation theory, providing evidence of better technical efficiency performances for MNEs, probably due to their tangible and intangible resources from parent company. Some suspect arise on this evidence that could be determined by other individual characteristics or environmental factors which differentiate MNEs from domestic firms.

Non normal distribution of estimated efficiency scores and residual correlation structure cause standard econometric technique to fail in estimating a regression model where individual variables are included as a control. The solution lies in the recent study by Simar and Wilson (2007) where the consistency of a truncated regression model estimated through Maximum Likelihood is demonstrated in comparison with standard OLS and Tobit approaches. This technique is applied in the paper in order to isolate the effect of size, vertical integration and capital intensity, and then, estimating more precisely the influence of ownership. The outcome of the model is an efficiency advantage in favour of foreign owned firms, that became negligible when heterogeneity and industry effect are took into account. However, a similar model to explain TFP growth within standard OLS settings, allow to find a significant effect of foreign ownership on the potential TFP growth. This evidence is robust to different model specifications which represent a valid sensitivity analysis of obtained results.

Finally, a weak evidence in favor of more efficient foreign firms from BRICs is find, but the results cannot be confirmed in a rigorous second stage phase due to the limited number of available observations. Regarding entrance strategy on the local market, foreign firms that chose a greenfield investment shows an superior level of efficiency, that is confirmed by non-

parametric test within the subgroup of foreign owned firms. However, this evidence is not confirmed when other firm's characteristics are considered. The presented results add some new interesting features to the debate on foreign ownership that, of course, cannot be easily

generalized due to the specificity of geographical area and data limits. This latter point will suggest further analysis in this direction that could be performed by drawing on the wide literature of efficiency and productivity analysis.

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