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Multinationals and firm heterogeneity: a non-parametric test

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Abstract

This paper, dealing with heterogeneity among multinationals, examines the performance differences between and within foreign owned firms and domestic multinationals in Italy. For the empirical analysis a non-parametric approach based on the concept of first order stochastic dominance has been applied. Results indicate a higher level of labour productivity and a higher average wage for foreign owned firms in respect to domestic multinational firms, which dominate in terms of return on sales and leverage. Robust results are found within domestic multinationals, the parent firms investing only in developed countries show a better performance than those investing only in less developed countries and are characterised by lower leverage. With respect to foreign owned firms, the evidence in favour of US owned firms, in respect to European owned firms, is not so clear. Finally, using a linear regression analysis, it is found that domestic multinationals investing both in developed and less developed countries seem to be the more productive firms.

Keywords: FDI; Multinationals; Productivity; Profitability; Firm heterogeneity
JEL Classification: F23, D21

1. Introduction

Recent theoretical and empirical studies have shown evidence of considerable performance differences among firms acting in the same country and in the same industry. Furthermore, this heterogeneity seems to be strongly correlated with the different types of involvement in the international commerce. Firms with higher productivity become exporters or enter in foreign markets through foreign direct investment, while the least productive firms serve only the domestic market, or are forced to exit. This is consistent with the theory that the heterogeneity among firms leads to self-selection in internationalisation strategies and the firms engaged in some sort of foreign activity need to have some ex-ante advantages in order to overcome their sunk costs (Helpman, Melitz and Yeaple, 2004).

Given the growing attention devoted by the literature to these issues, the purpose of this paper is to analyse productivity and performance differences between foreign owned firms (FO) and domestic multinationals (DO_MNEs) in Italy over the period 1995-1997. In addition, the analyses focus on the heterogeneity that may exist within FO and within DO_MNEs.

The multinationals must have some specific advantages to overcome the high cost of serving foreign markets. Therefore, one might expect that FO and DO_MNEs, operating in the same country, are characterised by potential differences in firm specific factors from which the heterogeneity might arise.[1] At the same time, the differences in terms of productivity and performance among multinationals may exist even within groups of firms. Then, the nationality of the foreign owned firms may be crucial to understand whether there is a performance leader within FO. Such a leadership might be, for instance, the consequence of an advantage of a home country in respect to another. The same analysis is carried out in order to compare Italian domestic multinationals that choose different localisation for their FDI. In fact, the choice of the geographical areas in which new firms are established is usually related to different types of investment; i.e. horizontal or vertical[2]. Therefore, it seems interesting to wonder whether, given the aim and the business environment with which the firms have to deal, the DO_MNEs engaged in horizontal FDI in developed countries would be more productive and have better performance than those engaged in vertical FDI in less developed countries.

[1] The firms specific advantages of multinationals may refer, among others, to product and process innovation, patent and brand, more efficient management and marketing, better access to technological knowledge and benefits from economies of scale.

[2] Horizontal investments are typically market-seeking, characterised by the duplication of the production process abroad, and occur between developed countries. Vertical investments are driven essentially by low input costs, characterised by the fragmentation of the production process, and occur between "North-South" countries.

The contribution to the economic literature of this paper is twofold. First, instead of focusing on average performance differences, it evaluates the effect of multinationality on the entire performance distribution. This is achieved using the Kolmogorov-Smirnov non-parametric test based on the concept of first order stochastic dominance. In particular, the test explicit compares the performance dynamics of Italian multinationals with foreign owned firms. Moreover, in the analysis the FO firms are further distinguished according to the nationality of the ownership, and the DO_MNEs are distinguished among firms investing only in developed countries and in less developed countries. The second novelty introduced in this paper regards the performance measures considered. In fact, the nonparametric testing procedure compares not only the labour productivity levels across these different groups, but also: capital intensity, size, average wages, return on sales (ROS) and leverage. In addition, using a linear regression approach, the analysis shows evidence of a ranking of the most productive firms among Italian multinationals.

The rest of the paper is organised as follows. The next section briefly considers the empirical literature and section 3 discusses the data. Section 4 contains a description of the Kolmogorov-Smirnov test and in section 5 the results are reported. Section 6 reports the results based on the parametric analysis and, finally, section 7 concludes.

2. Review of the empirical literature

The existence of firm heterogeneity has been largely discussed in the empirical literature. Several studies have shown large evidence that exporter outperformed non-exporters (Bernard and Jensen, 1999, for US; Aw, Chung and Roberts, 2000, for Taiwan; Clerides et al., 1998, for Colombia, Mexico end Morocco). Using the concept of stochastic dominance for Spanish firms, Delgado et al. (2002) confirm the same results. Their empirical findings show that the level of productivity is higher for exporting firms than that of non-exporting firms and, in line with previous studies, they confirm the self-selection hypothesis but find weak evidence of learning-by-exporting.

In addition to exporting activities, foreign direct investment has recently become an important issue. Several authors test the prediction of Helpman, Melitz and Yeaple (2004), hereafter HYM, that show that the intra-industry firm heterogeneity plays an important role in the decision to serve foreign markets. The least productive firms choose to operate only in the domestic market, the others serve the domestic and the foreign markets, but the most productive firms choose to invest abroad while the least productive firms become exporters.[3] In particular Head e Ries (2003) investigate productivity differences of Japanese firms and confirm the HYM prediction. In addition,

[3] The theoretical model developed by the authors implies different costs associated with serving domestic or foreign markets.

the authors provide and test a theoretical model according to which there is a relationship between the characteristics of the host country and the type of firms that choose FDI. More specifically, the firms with low productivity are likely to invest in low-wage countries rather than in high-wage countries, while the more productive firms invest in a wide range of countries. Castellani and Zanfei (2004), using data on Italian firms, focus on productivity and measures of R&D and innovative behaviour as a source of heterogeneity. They, basically, confirmed that the multinational firms outperformed domestic firms, even if the productivity of firms that serve only the domestic market is not constantly lower than that of exporting firms.[4] They find similar results regarding the R&D effort and the channel of entry in international markets. In the literature only few studies specifically use the Kolmogorov-Smirnov non-parametric test. Girma et al. (2005), comparing total factor productivity differences among UK domestic firms, provide a clear acceptance of HMY framework. The same analysis is conducted by Merino (2004) using Spanish data. The author, implementing the non-parametric test in 20 manufacturing sectors, finds evidence of self-selection in the structure of international trade. Girma et al. (2004) compare three performance measures across Irish establishments. They find that multinationals dominate domestic exporters and non-exporters in terms of sales per employee, value added per employee and profit per employee, but, contrary to HMY, they do not find clear evidence of differences in performance between exporters and non-exporters.

Finally, a strand of empirical literature has examined the differences between domestic and foreign owned firms. Doms and Jensen (1998), using US data, show that there are substantial differences between domestic and foreign owned establishments. More specifically they find that foreign owned firms have higher labour productivity, pay higher wages and are more capital intensive than US domestic non-multinational plants, while the US domestic multinationals are the productivity leaders. Globerman et al. (1994) find that foreign owned establishments have higher labour productivity and pay higher wages than Canadian owned establishments, but these differences disappear when they control for firm size and capital intensity. Moreover, they do not find differences among US, European and Japanese foreign owned firms. Using UK data, Griffith and Simpson (2001) show that establishments that are always foreign owned exhibit higher labour productivity than those that are always domestic owned. The same pattern is found for the proportion of skilled workers employed and for the wages. Comparing foreign owned and domestic plants in UK, Criscuolo and Martin (2004) find that US owned plants are the productivity leaders in the market and this leadership seems due to the selection of better plants. The UK multinationals are as productive as non-US foreign owned plants. De Backer and Sleuwaegen (2002) analysing

[4] The authors also show that manufacturing multinationals exhibit higher productivity than non-manufacturing multinational firms.

Belgian firms, show that foreign firms are more productive than domestic. However the Belgian multinationals are very similar to foreign owned in terms of efficiency and returns to scale. In the case of Italy, Castellani and Zanfei (2006), focusing on differences in technological performance as a source of heterogeneity among Italian multinationals, find that belonging to multinational groups is related to higher productivity, while the innovation activity is more evident in Italian multinationals than in foreign owned firms.

This paper builds on this literature and provides an empirical analysis to disentangle the potential heterogeneity existing between and within groups of multinational firms.

3. Data and Descriptive Statistics

The data used in this work comes from the "Centro Studi Luca D'Agliano-Reprint" database, which provides information on Italian multinational firms and foreign owned firms located in Italy. The database is the result of the merging of Reprint dataset of Politecnico of Milan, which contains information on multinationals and AIDA database of Bureau Van Dijck, which contains balance sheet data and other economic data of Italian firms. To perform the analysis we use an unbalanced panel of FO firms and of DO_MNEs observed for two years: 1995 and 1997.

The "Centro Studi Luca D'Agliano-Reprint" database also allows identifying the country of the investor of a foreign owned firm and to distinguish between US foreign owned firms and European foreign owned firms. In addition, regarding the domestic multinationals, the database provides information on the location of the foreign subsidiaries. Thus the analysis may take into account the characteristics of domestic multinational firms investing in developed countries or in less developed countries or in both.

Cleaning procedures have been followed. Firstly, from the original sample the firms with an industry activity classified as non-manufacturing following the NACE 2-digit classification have been excluded. Secondly, the amount of information is further reduced by deleting those with missing value.

The indicator used in the empirical analysis are: labour productivity defined as value added per employee, capital intensity defined as total tangible assets over number of employees, size defined as number of employees, average wages, return on sales (ROS), and leverage defined as total debt over equity.

Table 1 shows summary statistics of the several measures used in analysis for FO firms and DO_MNEs. Mean and standard deviation are also reported for US owned firms, US_FO, and European owned firms, European_FO, as well as for domestic multinationals investing in developed

countries, DO_MNEs_DC, and in less developed countries, DO_MNEs_LDC.[5] However, these descriptive statistics only look at the mean of the variables, and the purpose of this work is to analyse the heterogeneity among and within groups of firms, it is more interesting to focus on the entire distribution of the measures rather than just on the conditional mean. To do this, a non-parametric test is implemented in the next sections. At this point, to further illustrate the comparison between the types of firms and examining the differences of the entire distributions, Figs. 1-3 report the graphs of the cumulative functions of labour productivity for FO and DO_MNEs; US_FO and European_FO; DO_MNEs_DC and DO_MNEs_LDC. The first graph shows a weak dominance of FO in respect to DO_MNEs and the same pattern appears from the comparison between US_FO and European_FO. On the contrary, the dominance of the labour productivity of firms investing in developed countries in respect to firms investing in less developed countries seems stronger. However, this graphic comparison is not enough, and without a formal test of stochastic dominance useful and robust conclusions cannot be drawn.

4. Empirical Methodology

As mentioned above, in order to test for differences in all moments of the distribution a non-parametric approach has been used based on the concept of stochastic dominance and, thus, the differences have been formally tested using Kolmogorov-Smirnov tests.

The concept of first order stochastic dominance allows one to establish a ranking for compared distributions. Let F and G denote the cumulative distribution functions for two groups, e.g. labour productivity of foreign owned firms, FO, and domestic multinationals, DO_MNEs. First order stochastic dominance of F relative to G is defined as: $F(z) - G(z) \leq 0$ uniformly in $z \in \Re$, with strict inequality for some z. To test whether there are statistically robust differences between the distributions I follow Girma et.al. (2004) and adopt the non-parametric one-sided and two-sided Kolmogorov-Smirnov tests[6].

The two-sided test can be formulated as:

$$H_0 : F(z) - G(z) = 0 \forall z \in \Re \qquad \text{vs.} \qquad H_1 : F(z) - G(z) \neq 0 \quad some \quad z \in \Re$$

The one-sided test can be expressed as:

[5] For simplicity, the summary statistics for other foreign owned firms and domestic multinationals investing in both developed and less developed countries are not reported.
[6] See also Delgado et.al. (2001)

$$H_0 : F(z) - G(z) \leq 0 \quad \forall \quad z \in \Re \qquad \text{vs.} \qquad H_1 : F(z) - G(z) > 0 \quad some \quad z \in \Re$$

Hence, the two-sided test permits one to determine whether both distributions are identical or not. While, the one-sided test determines whether a distribution dominates the other.

Therefore, to conclude that *F* stochastically dominates *G*, a rejection of the null hypothesis for the two-sided test is required and the null for the one-sided test cannot be rejected. This indicates that, graphically, *F* is to the right of *G*.

The Kolmogorov-Smirnov test statistics for the two-sided, KS_2, and the one-sided test, KS_1, are:

$$KS_2 = \sqrt{nm/N} \max_{1 \leq i \leq N} \left\{ F_n(z_i) - G_m(z_i) \right\}$$

$$KS_1 = \sqrt{nm/N} \max_{1 \leq i \leq N} \left| \left\{ F_n(z_i) - G_m(z_i) \right\} \right|$$

Where *n* and *m* are the sample sizes of the two groups of firms, *N* is given by *n*+*m*, F_n and G_m represent the empirical distribution of functions for *F* and *G*, respectively.

As the observations for different years correspond to the same firms and the distribution of the Kolmogorov-Smirnov statistics is only known under this independence of the observations, the tests have to be performed each time. However, reporting cross-section results enables one to consider changing across time.

5. Results

Table 2 shows the results of the Kolmogorov-Smirnov test for first order stochastic dominance calculated in order to test for the differences in all moments of the performance distributions for FO and DO_MNEs.

In both years the labour productivity distribution of FO firms stochastically dominate those of domestic MNEs. This suggests that foreign owned firms are more productive than domestic multinational firms. The same pattern is found looking at the wage distributions, confirming, in line with the literature, that foreign firms pay higher wages.

As far as capital intensity is considered, the equality of distribution of FO and DO_MNEs cannot be rejected at any significant level. Thus, between the two groups of firms there are not clear differences. In terms of size, the DO_MNEs seems to employ a higher number of employees than FO firms.

Finally, the distributions of the profitability measure, ROS, and the distributions of the financial indicator, leverage, of DO_MNEs stochastically dominate those of FO. The Italian multinational firms seem to have greater profitability than foreign owned firms but also are more in debt.

In order to consider the possible heterogeneity among firms within the same sector, the K-S tests for the two groups of firms are applied separately for each sector to which the firms belong. Four sectors are considered according to the Pavit classification: traditional, high returns to scale, specialised and high-tech sector. The results are reported in Table 3.

Here the K-S test statistics confirm that the labour productivity distribution of FO firms dominates that of DO_MNEs but only in the traditional sector. An interesting result refers to the average wage paid by the two groups of firms. FO firms pay higher wages than DO_MNEs in every sector except for the specialised sector in which the null hypothesis of equality between distributions of both groups of firms cannot be rejected.

There are no differences in capital intensity and size of both the groups of firms in each sector. Even if the results show a statistical dominance of DO_MNEs in specialized sectors but only for 1997.

The results concerning the income and the financial indicator show that DO_MNEs stochastically dominate FO firms especially in 3 out of 4 sectors.

However, one might expect to find heterogeneity within firms belonging to the same group. Therefore, to further compare the performance of the firms considered, the Kolmogorov-Smirnov test has been applied to evaluate the ownership of the FO firms and the localisation of the outward FDI of the DO_MNEs. More specifically, as an extension of the results just discussed, the differences between US foreign owned firms and European foreign owned firms, and between Italian parents investing in developed countries and Italian parents investing in less developed countries have been considered.

The tests for divergence between European foreign owned firms and US foreign owned firms are reported in Table 4. It might be interesting to compare these groups of firms as the different ownership might be associated with different characteristics of the foreign affiliates established in a foreign country. In addition, in the literature there is evidence of a productivity

leadership of US_FO in respect to other firms (Criscuolo and Martin, 2004; Doms and Jensen, 1998).

The results indicate that the hypothesis of equality of labour productivity distributions for the two groups of firms can be rejected but only in 1997, where the US_FO dominates the European_FO. The statistical tests also point out that the US owned firms pay higher wages and have larger size than European firms. While European_FO stochastically dominate US_FO in terms of capital intensity and in terms of leverage, but the result is confirmed only for 1997. Regarding the profitability measure, ROS, the null hypothesis of identical distributions can never be rejected. Overall, we can conclude that US_FO firms tend to outperform European_FO firms, even if this evidence is not robust for every year.

The aim of the paper is also to provide some useful information about the heterogeneity within DO_MNEs. Thus, in the following part of this section, the non-parametric tests have been implemented to show the possible differences between DO_MNEs engaged in FDI in different geographical areas. In fact, one may expect some performance gaps between firms that have chosen the same internationalisation strategies, i.e. outward FDI. The sources of heterogeneity might be several but this is not the aim of this analyses. However, if one believes that the choice of the geographical areas in which foreign activity may be localised is related to different types of investment, i.e. horizontal or vertical, the comparison between DO_MNEs according to the area of the investment might make sense.

Table 5 summarizes the results for the K-S tests on the performance of DO_MNEs according to the locations of their foreign direct investment: in particular the analysis concentrates on DO_MNEs investing only in developed countries, DO_MNEs_DC, and domestic multinationals investing only in less developed countries, DO_MNEs_LDC.

Looking at statistics reported, the null hypothesis that Italian parents investing only in developed countries have greater performance than Italian parents investing only in less developed countries cannot be rejected at any reasonable significance level. This stochastic dominance of DO_MNEs_DC is confirmed especially in terms of labour productivity, average wage paid, and capital intensity. Regarding the return on sales, ROS, and the size of the firms, the DO_MNEs_DC seem to performe better than DO_MNEs_LDC especially in 1997, in 1995 the null hypothesis of equality distributions between the two groups of firms cannot be rejected. The K-S tests also show a greater level of leverage for Italian parents with foreign subsidiaries localised in less developed countries, and this evidence is confirmed every year. To sum up, the results can be interpreted as evidence supporting the hypothesis that in the whole population of DO_MNEs there exist

heterogeneity and that the firms investing in developed countries performed better than those investing in less developed countries.

6. Evidence from a linear regression model

At this point of the work, it may be interesting to perform the usual linear regression analysis to confirm the results found in the previous section and to further illustrate the heterogeneity among FO and DO_MNEs especially in terms of labour productivity. More specifically, although the OLS method concentrates only on the conditional mean of the dependent variables, with a linear estimation the analysis may be conducted using a panel data instead of a cross section, and, in addition, OLS enables one to control for several firms characteristics impacting on firms' productivity, while the K_S test requires the comparison only between two groups.

In particular, the attempt of this section is to show whether even in Italy the US foreign owned firms are productivity leaders, as found for example for Britain (Criscuolo and Martin, 2004), and to draw a sort of ranking across multinational firms.

The estimated equation is the following:

$$y_{it} = \beta_0 + \beta_1 k_{it} + \beta_2 l_{it} + \beta_3 FO_i + \beta_4 age_{it} + \beta_5 Sectors_i + \beta_6 Time_t + \varepsilon_{it} \qquad (1)$$

Where y_{it} is the log of value added per employee; k_{it} the log of capital; l_{it} is the log of number of employees; age_{it} indicates how many years the firm belongs to the status of multinational firms, $Sectors_i$ and $Time_t$ are a set of sector and time dummies and ε_{it} is the error term.

The variable of interest is, of course, FO_i, which is a dummy variable taking value 1 if the multinational is owned by a foreign parent. Thus the coefficient β_3 picks up the differences in level productivity between FO and DO_MNEs.

In Table 7 the results are reported even for different specification of equation (1), in which are included foreign ownership dummies according to the nationality of the parent of the affiliates, as well as dummies related to the locations of outward FDI.

The coefficient of FO dummy in column 1 is not significant, but when US foreign ownership dummy is included, column 2, the results show an advantage of around 8% of US_FO relative to the reference group of all multinational firms[7]. However, this finding is not very robust as shown in column 3, when the FO are distinguished in several country groups according to the

[7] The percentage difference is given by $(e^{\beta}-1)$, where β is the coefficient of a dummy variable in a log linear regression.

nationality of the parent. In particular, equation (1) is estimated focusing on US_FO; German, British and French firms, GBF_FO[8]; other European foreign firms, OtherEU_FO; and other home countries, Other_FO. As shown, the OtherEU_FO and the Other_FO exhibit a lower productivity than the domestic multinational, while the coefficients of US_FO and GBF_FO are not significant.

Some interesting results are reported in column 4 where the reference group are the non_US foreign owned firms. US_FO seems the most productive firms among the foreign owned firms, the percentage is around 11%. In addition, in the regression reported the domestic multinationals are distinguished according to the location of their foreign investment. Thus, it is possible to evaluate also the differences in labour productivity between the reference group of non-US foreign owned firms and domestic multinational investing only in DC, only in LDC or in both areas: DO_MNEs_DC; DO_MNEs_LDC; DO_MNEs_Both. This enables one to find that DO_MNEs_Both are 22% more productive than non-US foreign owned firms, DO_MNEs_DC exhibit a higher labour productivity of around 10%, while the DO_MNEs_LDC have a lower productivity than the reference group of around 7%.

The domestic multinationals investing both in developed and less developed countries confirm their leadership also in column 5, where they enjoy an advantage of 19% relative to FO.

Finally, in column 6 the most interesting results are reported. In this specification the reference group are the DO_MNEs_LDC. The most productive firms in the sample seem to be the Italian multinationals investing in both DC and LDC. However, US_FO are significantly the most productive firms among the FO, in fact they have a significant advantage of around 19% relative to DO_MNEs_LDC. US_FO are followed by DO_MNEs_DC, which are 18% more productive than the reference group. Finally, even German, British and French foreign owned firms, GBF_FO, exhibit a higher labour productivity than DO_MNEs_LDC and the percentage is around 9%. The coefficients on other FO are positive but not significant.

The results so far suggest the following. Firstly, controlling for capital, labour, sectors and age effects, the US_FO confirms their leadership but only in respect to non-US foreign owned firms. Moreover, they are also more productive than domestic multinationals investing only in LDC. Secondly, the DO_MNEs_Both seems to be the most productive firms, while the DO_MNEs_LDC have the lowest level of labour productivity. This result confirm the prediction of Head and Ries (2003) according to which the more productive firms are able to invest in countries with different level of income, while the unproductive firms are likely to choose low wages countries.

[8] The choice to distinguish between German, British and French foreign owned firms is related to the fact that these countries are the main home countries of inward FDI in Italy.

7. Conclusions

This paper deals with the presence of heterogeneity among multinational firms in Italy.

The first part of the analysis compares labour productivity and several performance differences between and within the groups of foreign owned firms and domestic multinationals. The empirical analysis is based on the concept of stochastic dominance between cumulative distributions and a non-parametric approach is employed using firm level data for 1995 and 1997. The results suggest that FO firms outperform DO_MNEs, at least in terms of labour productivity and average wages paid. While DO_MNEs stochastically dominate FO in terms of income and financial indicators. Within the foreign owned firms the US firms seem to perform better than European firms even if the result is not confirmed every year. The highest heterogeneity is found within the DO_MNEs. In particular for all the several indicators except one, the domestic multinationals investing in developed countries stochastically dominates those investing in less developed countries. The DO_MNEs_LDC dominate only in terms of leverage.

In the second part of the paper a linear regression analysis is performed allowing one to consider the nationality of FO firms and the location of outward FDI. The analysis focus on the labour productivity and try to disentangle which group of firms may be considered as leader. The ranking of productivity advantages may be summarized as follows: the DO_MNEs investing both in developed and in less developed countries are the most productive firms among multinationals and the US_FO are the leaders among the foreign owned firms. Finally, the domestic multinationals investing only in less developed countries are the least productive.

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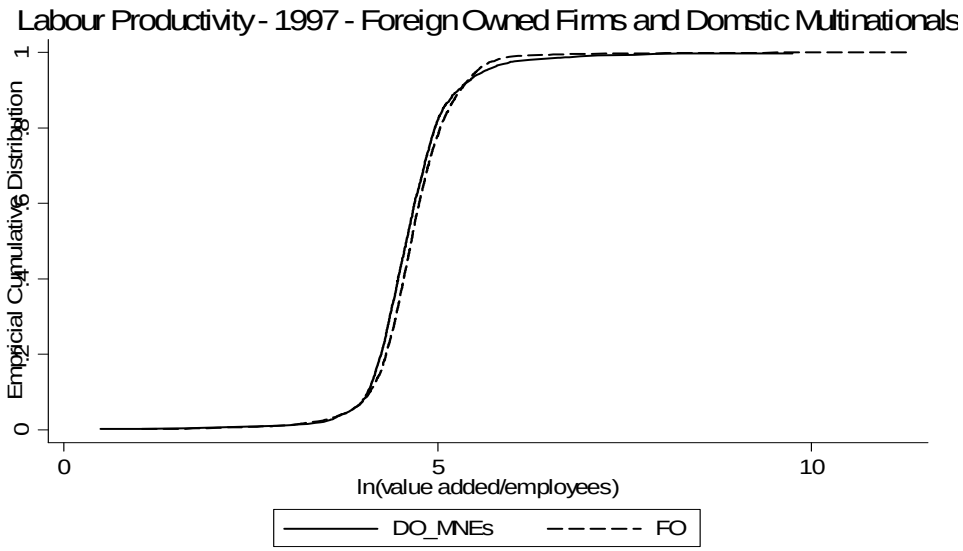
Figs. 1-3


Labour Productivity - 1997 - Foreign Owned Firms and Domstic Multinationals
Empricial Cumulative Distribution
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ln(value added/employees)
DO_MNEs
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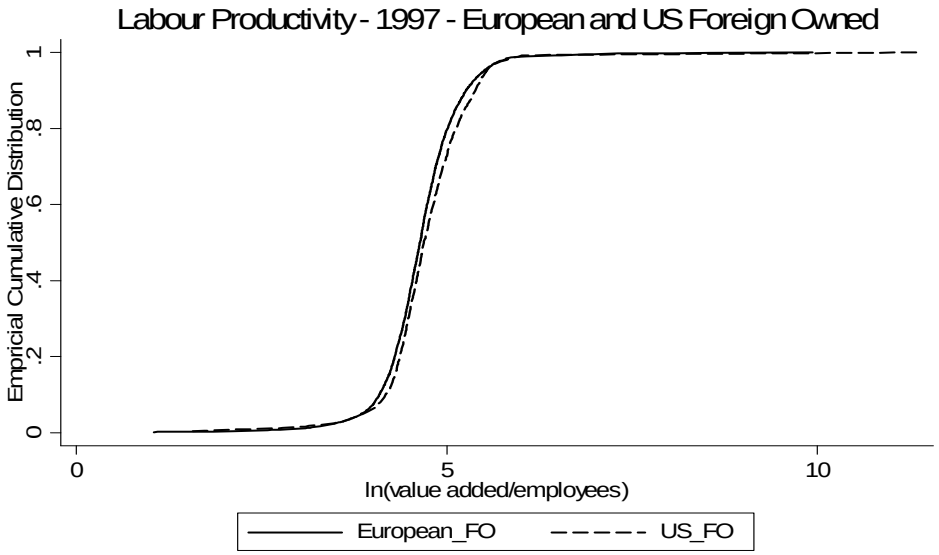
Labour Productivity - 1997 - European and US Foreign Owned
Empricial Cumulative Distribution
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ln(value added/employees)
European_FO
US_FO

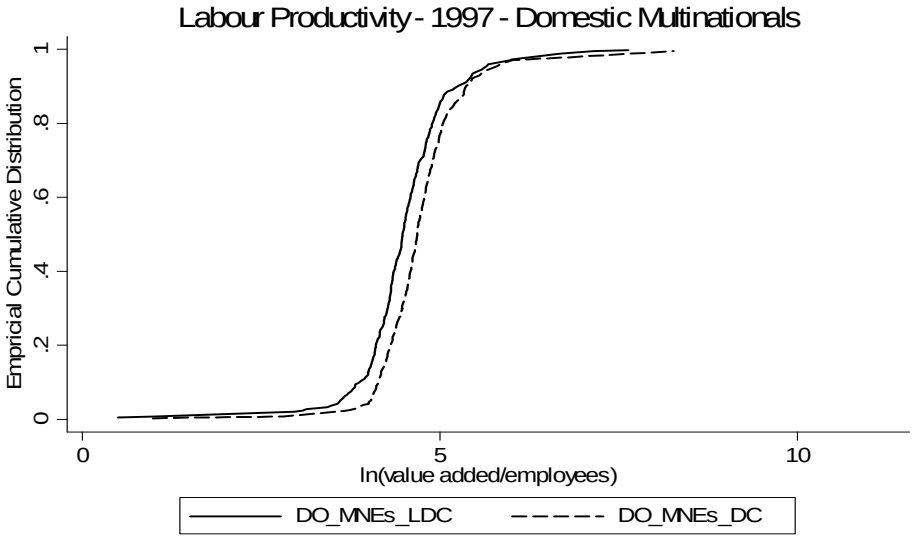
Labour Productivity - 1997 - Domestic Multinationals
Empricial Cumulative Distribution
0
.2
.4
.6
.8
1
0
5
10
ln(value added/employees)
DO_MNEs_LDC
DO_MNEs_DC

Table 1

Descriptive Statistics: Mean; Standard Deviation; N. of Observations

	1995						1997					
	FO	USA FO	European FO	DO_MNEs	DO_MNEs _ DC	DO_MNEs _LDC	FO	USA FO	European FO	DO_MNEs	DO_MNEs _ DC	DO_MNEs _LDC
ln labour productivity	4.705 (0.612) 933	4.719 (0.635) 220	4.711 (0.576) 652	4.731 (0.788) 413	4.798 (0.787) 166	4.625 (0.652) 166	4.683 (0.650) 1157	4.743 (0.713) 280	4.666 (0.626) 797	4.623 (0.716) 511	4.722 (0.698) 189	4.465 (0.692) 224
ln average wage	4.226 (0.340) 932	4.249 (0.384) 220	4.233 (0.356) 651	4.148 (0.604) 413	4.200 (0.556) 166	3.999 (0.406) 166	4.245 (0.431) 1156	4.296 (0.520) 280	4.238 (0.400) 796	4.159 (0.439) 510	4.215 (0.399) 189	4.048 (0.382) 223
ln capital intensity	4.100 (1.089) 933	4.023 (0.961) 220	4.132 (1.106) 652	4.052 (1.167) 413	4.103 (1.214) 166	3.917 (1.070) 166	4.058 (1.160) 1157	3.971 (1.184) 280	4.077 (1.121) 797	4.098 (1.075) 511	4.186 (1.011) 189	3.947 (1.124) 224
ln size	4.895 (1.240) 933	5.147 (1.163) 220	4.788 (1.243) 652	5.014 (1.608) 413	4.890 (1.447) 166	4.502 (1.320) 166	4.852 (1.271) 1157	5.154 (1.210) 280	4.727 (1.263) 797	4.980 (1.646) 511	4.852 (1.493) 189	4.509 (1.324) 224
ROS	0.044 (0.131) 933	0.049 (0.117) 220	0.042 (0.139) 652	0.061 (0.117) 413	0.072 (0.148) 166	0.059 (0.084) 166	0.039 (0.106) 1157	0.044 (0.095) 280	0.037 (0.109) 797	0.064 (0.064) 510	0.128 (1.024) 189	0.015 (0.346) 224
ln leverage	1.805 (1.238) 932	1.918 (1.454) 220	1.785 (1.138) 651	2.149 (1.159) 413	2.155 (1.234) 166	2.352 (1.075) 166	1.783 (1.327) 1156	1.861 (1.528) 280	1.774 (1.231) 796	2.193 (1.158) 511	2.209 (1.180) 189	2.364 (1.143) 224

Table 2

Kolmogorov – Smirnov test for comparison between FO firms and DO_MNEs

Year	N. of Obs. FO	DO_MNEs	Equality of distributions	Difference favourable to: **FO**	**DO_MNEs**
Labour Productivity					
1995	933	413	0.0806 (0.049)	0.0343 (0.510)	-0.0806 (0.024)
1997	1157	511	0.0980 (0.002)	0.0194 (0.765)	-0.0980 (0.001)
Average wage					
1995	932	413	0.2274 (0.000)	0.0119 (0.923)	-0.2274 (0.000)
1997	1156	510	0.2118 (0.000)	0.0142 (0.866)	-0.2118 (0.000)
Capital Intensity					
1995	933	413	0.0634 (0.200)	0.0153 (0.874)	-0.0634 (0.100)
1997	1157	511	0.0559 (0.218)	0.0334 (0.454)	-0.0559 (0.109)
Size					
1995	933	413	0.0662 (0.162)	0.0662 (0.081)	-0.0473 (0.278)
1997	1157	511	0.0694 (0.066)	0.0694 (0.033)	-0.0503 (0.166)
ROS					
1995	933	413	0.1402 (0.000)	0.1402 (0.000)	-0.0296 (0.605)
1997	1157	511	0.1055 (0.001)	0.1055 (0.000)	-0.0357 (0.406)
Leverage					
1995	932	413	0.1545 (0.000)	0.1545 (0.000)	-0.0070 (0.973)
1997	1156	511	0.1738 (0.000)	0.1738 (0.000)	-0.0112 (0.915)

P-values are in parenthesis. All the variables are in log, except for ROS.

Table 3.

Kolmogorov – Smirnov test for comparison between FO firms and DO_MNEs across sectors

	Traditional sectors					***High return to scale sectors***				
Year	N. Obs. FO	DO_MNEs	Equality of distributions	Difference favourable to: **FO**	**DO_ MNEs**	N. Obs. FO	DO_MNEs	Equality of distributions	Difference favourable to: **FO**	**DO_ MNEs**
Labour Productivity										
1995	130	124	0.1486 (0.121)	0.0979 (0.296)	-0.1486 (0.061)	534	169	0.0894 (0.256)	0.0285 (0.812)	-0.0894 (0.128)
1997	157	160	0.1987 (0.004)	0.0560 (0.608)	-0.1987 (0.002)	661	198	0.0758 (0.345)	0.0146 (0.937)	-0.0758 (0.174)
Average wage										
1995	130	124	0.3360 (0.000)	0.0176 (0.961)	-0.3360 (0.000)	533	169	0.1964 (0.000)	0.0199 (0.903)	-0.1964 (0.000)
1997	157	160	0.3515 (0.000)	0.0188 (0.946)	-0.3515 (0.000)	660	198	0.1807 (0.000)	0.0116 (0.960)	-0.1807 (0.000)
Capital Intensity										
1995	130	124	0.1445 (0.141)	0.0586 (0.647)	-0.1445 (0.071)	534	169	0.0987 (0.164)	0.0149 (0.945)	-0.0987 (0.082)
1997	157	160	0.1191 (0.211)	0.0590 (0.576)	-0.1191 (0.106)	661	198	0.0760 (0.342)	0.0539 (0.413)	-0.0760 (0.172)
Size										
1995	130	124	0.1289 (0.242)	0.1289 (0.121)	-0.1016 (0.270)	534	169	0.0914 (0.234)	0.0914 (0.117)	-0.0324 (0.764)
1997	157	160	0.1390 (0.094)	0.1390 (0.047)	-0.0998 (0.207)	661	198	0.0919 (0.153)	0.0919 (0.076)	-0.0269 (0.803)
ROS										
1995	130	124	0.2272 (0.003)	0.2272 (0.001)	-0.0329 (0.872)	534	169	0.1179 (0.056)	0.1179 (0.028)	-0.0295 (0.800)
1997	157	160	0.1495 (0.058)	0.1495 (0.029)	-0.0841 (0.326)	661	197	0.1386 (0.006)	0.1386 (0.003)	-0.0304 (0.755)
Leverage										
1995	130	124	0.2242 (0.003)	0.2242 (0.002)	0.0000 (1.000)	533	169	0.1336 (0.020)	0.1336 (0.010)	-0.0182 (0.919)
1997	157	160	0.2133 (0.001)	0.2133 (0.001)	0.0000 (1.000)	660	198	0.1768 (0.000)	0.1768 (0.000)	-0.0278 (0.791)

	Specialised sectors					***High-Tech sector***				
Year	N. Obs. FO	DO_MNEs	Equality of distributions	Difference favourable to: **FO**	**DO_ MNEs**	N. Obs. FO	DO_MNEs	Equality of distributions	Difference favourable to: **FO**	**DO_ MNEs**
Labour Productivity										
1995	207	97	0.0601 (0.971)	0.0601 (0.621)	-0.0333 (0.864)	62	23	0.1494 (0.779)	0.0982 (0.724)	-0.1494 (0.473)
1997	259	122	0.0598 (0.928)	0.0598 (0.552)	-0.0326 (0.928)	80	31	0.2036 (0.267)	0.1101 (0.582)	-0.2036 (0.157)
Average wage										
1995	207	97	0.1126 (0.372)	0.0145 (0.973)	-0.1126 (0.187)	62	23	0.2910 (0.092)	0.0968 (0.730)	-0.2910 (0.058)
1997	259	122	0.0759 (0.725)	0.0425 (0.741)	-0.0759 (0.384)	80	31	0.3109 (0.020)	0.0718 (0.794)	-0.3109 (0.013)
Capital Intensity										
1995	207	97	0.0955 (0.584)	0.0955 (0.300)	-0.0380 (0.826)	62	23	0.1578 (0.726)	0.1578 (0.434)	-0.0252 (0.979)
1997	259	122	0.2074 (0.002)	0.2074 (0.001)	-0.0194 (0.940)	80	31	0.1911 (0.332)	0.1911 (0.195)	-0.0520 (0.886)
Size										
1995	207	97	0.1125 (0.373)	0.1125 (0.188)	-0.0226 (0.935)	62	23	0.1992 (0.442)	0.0982 (0.724)	-0.1992 (0.264)
1997	259	122	0.1511 (0.045)	0.1511 (0.023)	-0.0008 (1.000)	80	31	0.2597 (0.080)	0.0520 (0.886)	-0.2597 (0.049)
ROS										
1995	207	97	0.2172 (0.004)	0.2172 (0.002)	-0.0506 (0.714)	62	23	0.2426 (0.225)	0.2426 (0.139)	-0.0435 (0.939)
1997	259	122	0.0651 (0.874)	0.0651 (0.495)	-0.0237 (0.911)	80	31	0.1621 (0.536)	0.1621 (0.309)	-0.1040 (0.617)
Leverage										
1995	207	97	0.2412 (0.001)	0.2412 (0.000)	-0.0277 (0.904)	62	23	0.1704 (0.635)	0.1318 (0.558)	-0.1704 (0.377)
1997	259	122	0.2298 (0.000)	0.2298 (0.000)	-0.0348 (0.818)	80	31	0.1694 (0.476)	0.1694 (0.278)	-0.0198 (0.983)

P-values are in parenthesis. All the variables are in log, except for ROS.

Table 4

Kolmogorov – Smirnov test for comparison within FO firms: US_FO and European_FO

Year	N. of Obs. US_FO	European_FO	Equality of distributions	Difference favourable to: **US_FO**	**European_FO**
Labour Productivity					
1995	220	652	0.0619 (0.554)	-0.0120 (0.954)	0.0619 (0.283)
1997	280	797	0.1065 (0.018)	-0.0123 (0.940)	0.1065 (0.009)
Average wage					
1995	220	651	0.0950 (0.103)	-0.0111 (0.961)	0.0950 (0.051)
1997	280	796	0.0974 (0.039)	-0.0070 (0.980)	0.0974 (0.020)
Capital Intensity					
1995	220	652	0.1084 (0.042)	-0.1084 (0.021)	0.0238 (0.829)
1997	280	797	0.0671 (0.309)	-0.0671 (0.155)	0.0250 (0.772)
Size					
1995	220	652	0.1510 (0.001)	-0.0094 (0.972)	0.1510 (0.001)
1997	280	797	0.1802 (0.000)	-0.0085 (0.971)	0.1802 (0.000)
ROS					
1995	220	652	0.0514 (0.777)	-0.0279 (0.773)	0.0514 (0.419)
1997	280	797	0.0690 (0.278)	-0.0165 (0.893)	0.0690 (0.139)
Leverage					
1995	220	651	0.0734 (0.339)	-0.0464 (0.492)	0.0734 (0.170)
1997	280	796	0.0958 (0.045)	-0.0611 (0.213)	0.0958 (0.022)

P-values are in parenthesis. All the variables are in log, except for ROS.

Table 5

Kolmogorov – Smirnov test for comparison within DO_MNEs: DO_MNEs_DC and DO_MNE_LDC

Year	N. of Obs. DO_MNEs_DC	N. of Obs. DO_MNEs_LDC	Equality of distributions	Difference favourable to: **DO_MNEs_DC**	Difference favourable to: **DO_MNEs_LDC**
Labour Productivity					
1995	166	166	0.2048 (0.002)	0.0120 (0.976)	-0.2048 (0.001)
1997	189	224	0.2381 (0.000)	0.0069 (0.990)	-0.2381 (0.000)
Average wage					
1995	166	166	0.2892 (0.000)	0.0120 (0.976)	-0.2892 (0.000)
1997	189	224	0.3042 (0.000)	0.0037 (0.997)	-0.3042 (0.000)
Capital Intensity					
1995	166	166	0.1446 (0.062)	0.0241 (0.908)	-0.1446 (0.031)
1997	189	224	0.1941 (0.001)	0.0341 (0.788)	-0.1941 (0.000)
Size					
1995	166	166	0.1325 (0.108)	0.0060 (0.994)	-0.1325 (0.054)
1997	189	224	0.1283 (0.068)	0.0157 (0.951)	-0.1283 (0.034)
ROS					
1995	166	166	0.1265 (0.140)	0.0361 (0.805)	-0.1265 (0.070)
1997	189	224	0.1754 (0.004)	0.0088 (0.984)	-0.1754 (0.002)
Leverage					
1995	166	166	0.1566 (0.034)	0.1566 (0.017)	-0.0482 (0.680)
1997	189	224	0.1438 (0.029)	0.1438 (0.014)	-0.0324 (0.806)

P-values are in parenthesis. All the variables are in log, except for ROS.

Table 7

Linear Regression Analysis – Labour Productivity

	(1)	(2)	(3)	(4)	(5)	(6)
k_{it}	0.255***	0.256***	0.256***	0.252***	0.251***	0.253***
	(0.024)	(0.024)	(0.024)	(0.023)	(0.023)	(0.023)
l_{it}	-0.313***	-0.315***	-0.317***	-0.322***	-0.318***	-0.322***
	(0.030)	(0.030)	(0.031)	(0.031)	(0.031)	(0.031)
FO	-0.031					
	(0.027)					
US_FO		0.082***	0.044	0.104***		0.173***
		(0.031)	(0.036)	(0.032)		(0.045)
GBF_FO			-0.035			0.088**
			(0.030)			(0.039)
OtherEU_FO			-0.073**			0.053
			(0.033)			(0.041)
Other_FO			-0.117*			0.010
			(0.064)			(0.069)
DO_MNEs_DC				0.099***	0.074**	0.169***
				(0.037)	(0.036)	(0.046)
DO_MNEs_LDC				-0.070*	-0.093**	
				(0.037)	(0.037)	
DO_MNEs_Both				0.203***	0.174***	0.271***
				(0.059)	(0.057)	(0.066)
Age	0.008***	0.007***	0.008***	0.007***	0.007***	0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	3.949***	3.918***	3.949***	3.969***	3.985***	3.892***
	(0.087)	(0.090)	(0.088)	(0.089)	(0.088)	(0.088)
Sectors Dummies	yes	yes	yes	yes	yes	yes
Time dummy	yes	yes	yes	yes	yes	yes
Obs.	3014	3002	3002	3002	3014	3002
R^2	0.2048	0.2063	0.2082	0.2145	0.2116	0.2152

Robust standard errors in brackets. ***,** and * denote significance at 1%, 5% and 10% level. Dependent variable: ln(value added/employees).