Ownership Network and Firm Performance: Evidence from Italy

Massimo Riccaboni[1], Stefano Schiavo[2], Xu Wang[1] and Zhen Zhu[1]

[1]IMT School for Advanced Studies Lucca, Italy
[2]University of Trento, Italy

Abstract

In this paper we investigate the relation between ownership network and firm performance using the data of Italian firms. We construct the ownership network based on the direct inter-firm shareholding relationships and provide a comprehensive categorization of firms based on the network structure. Depending on whether a firm has upstream controlling firms, whether it has downstream controlled firms, and whether foreign firms are involved in the structure, each firm can be classified into one of the nine types of ownership structures. Then we analyze the data of Italian firms and find that the firms involved in a corporate group have on average higher labor productivity than the stand-alone firms, and the multinational firms outperform the domestic groups. More interestingly, among the multinational firms, the Italian firms controlled by foreign firms are on average more productive than the ones controlling foreign firms. Furthermore, we find a positive relation between a firm's centrality in the ownership network and its performance.

Keywords: *Ownership, Network, Multinationals, FDI*

Introduction

A vast literature has discussed the advantage of multinational enterprises (MNEs) over the domestic firms. Based on the flows of foreign direct investment (FDI), MNEs in a given country can be generally divided into two types: firms controlled by foreign companies (i.e. inward FDI) and firms controlling foreign companies (i.e. outward FDI). A widely discussed advantage for firms controlled by foreign companies is the spillover effect (Bernstein and Mohnen, 1998; Markusen, 1995). The controlled firms can not only receive physical capital but also superior knowledge and managerial skills from their foreign investors, which is especially important for firms in developing countries (Arnold and Javorcik, 2005). As for firms controlling foreign companies, opening affiliates in foreign countries can increase their profitability because of economies of scale (Dunning, 1989; Lovelock and Yip, 1996). What's more, some firms can transfer intangible assets to their affiliates in tax haven for the purpose of tax evasion (Desai et al., 2004, 2006). These advantages of MNEs lead to their better performance than the domestic firms.

However, the traditional classification of MNEs into two types may be too rough because a firm may have a very complex ownership structure. For example, a firm can control and be controlled by some foreign firms at the same time. But the traditional way has not provided a clear categorization for such kind of firms.

In our work, we provide a comprehensive classification for firms based on whether they have upstream controlling firms, whether they have downstream controlled firms, and whether foreign firms are involved in the ownership structure. Then we empirically investigate the relation between the categories of ownership structure and firm performance by using the data of Italian firms. We first derive the data of 19 million global firms in 2014 from ORBIS database. Based on their direct inter-firm shareholding relationships, we construct

the global firm ownership network and calculate firms' centrality using different measures. Then we focus on the Italian firms and extract the upstream and/or downstream ownership structures for each of them. Combining the data of Italian corporate groups from ORBIS and the data of the Italian stand-alone firms from AIDA (Analisi Informatizzata delle Aziende Italiane) , we compare the performance of nine categories of 548,720 Italian firms. We find that the firms involved in a business group are on average more productive than the stand-alone ones and the multinational firms are even more productive than the domestic ones. More interestingly, among the multinational firms, the Italian firms controlled by foreign firms have on average better performance than those controlling foreign firms. We make a further analysis by exploring the location of their upstream controlling firms and downstream controlled firms. We find that MNEs' higher productivity are more due to that their controlling or controlled firms are situated in more developed countries, and having controlling firms in more advanced countries has a larger effect on firm performance than having controlled firms in more advanced countries. Furthermore, we find a positive relation between a firm's centrality in the network and its performance.

Our paper makes two main contributions to the past literature. First, we provide a comprehensive categorization for firms based on their ownership structure. Second, we construct the global ownership network and investigate the effect of firm centrality on firm performance.

The remainder of the paper is structured as follows. In Section 2 we review the existing literature. Then Section 3 provides the definition to classify firms and introduce the econometric specifications. In Section 4, we present some descriptive statistics of the data. In Section 5, we provide the estimation results and a thorough analysis of them. Finally, Section 6 concludes the work.

Literature Review

We review the existing literature from three aspects. First, some studies focus on the effect of inward FDI on firm performance. Globerman et al. (1994) find that the establishments controlled by foreign firms have higher labor productivity than the Canadian domestic counterparts primarily because they tend to be capital intensive and large in size. Once these factors are controlled, there is no more significant effect. Doms and Jensen (1998) find that the foreign MNEs are less productive than the U.S. MNEs in the United States. Girma et al. (2001) find that the foreign firms have higher productivity than the domestic UK firms and pay higher wages. Arnold and Javorcik (2005) analyze Indonesian firm data and find that foreign ownership leads to significant productivity improvements in the acquired plants. Greenaway et al. (2014) take the degree of foreign ownership into consideration and find that joint-ventures generally perform better than wholly foreign-owned and purely domestic firms using Chinese firm data.

Another strand of literature studies the relation between outward FDI and firm performance. Navaretti and Castellani (2005) find that the home performance of Italian firms that invest abroad for the first time during the period analyzed improves after the investment. Hijzen et al. (2007) find that outward FDI tends to strengthen the economic activities of Japanese firms at home in terms of both output and employment. Navaretti et al. (2010) find that outward FDI in cheap labour countries has a positive long term effect on value added and employment of Italian firms; and a positive effect on the output and employment of French firms but not on TFP.

Some empirical studies have considered both inward and outward FDI. Castellani and Zanfei (2003) find that both the firms belonging to domestic Italian MNE and the foreign-owned subsidiaries outperform the domestic uni-national Italian firms. Temouri et al.

(2008) find that the German domestic firms are less productive than MNE, but there is no significant difference between the domestic German MNEs and the foreign-owned affiliates. Criscuolo and Martin (2009) find that the MNEs in UK are significantly more productive than the domestic firms. The US-owned subsidiaries are on average more productive than all the other MNEs. Furthermore, the U.S. MNEs tend to take over plants that are already more productive prior to acquisition.

Method

We define that the global ownership network as a directed graph $\mathbf{G}$. Each firm is a node in the network. If firm i controls firm j, we construct a directed link from node i to node j. For each node i, we can derive the set of n_i nodes $\mathbf{A_i} = \{i_1, i_2, \cdots, i_{n_i}\}$ that have direct links with it, regardless of their direction. We define $f(i)$ is the country in which firm i is situated. Firm i can be divided into one of the three categories $g(i) = c_m$ $(m = 0, 1, 2)$ depending on whether they have links and foreign links. If a firm has no links, that is, the stand-alone ones, we define that it belongs to category c_0; If a firm has only links with other domestic firms, we define that it belongs to category c_1; If a firm has at least one link with foreign firms, we define that it belongs to category c_2. The mathematical definition of the three categories is as follows:

$$g(i) = \begin{cases} c_0, & \mathbf{A_i} = \varnothing \\ c_1, & f(i_1) = f(i_2) = \cdots = f(i_{n_i}) = f(i) \\ c_2, & \exists k : f(i_k) \neq f(i) \end{cases}$$

Then we take into account the direction of the links. We define that set $\mathbf{M_i} = \{i_{m_1}, i_{m_2}, \cdots, i_{m_s}\}$

contains all the firms that control firm i and set $\mathbf{N_i} = \{i_{n_1}, i_{n_2}, \cdots, i_{n_t}\}$ contains all the firms that are controlled by firm i. Hence, firm i can be classified into one of the nine categories $g(i) = c_{m,n}$ $(m, n = 0, 1, 2)$, where m and n represent respectively the category of firm i's in-links set $\mathbf{M_i}$ and out-links set $\mathbf{N_i}$ according to the aforementioned definition. The definition of the nine categories is as follows.

$$
g(i) = \begin{cases}
c_{0,0}, & \mathbf{M_i} = \mathbf{N_i} = \varnothing \\
c_{1,0}, & f(i_{m_1}) = f(i_{m_2}) = \cdots = f(i_{m_s}) = f(i), \mathbf{N_i} = \varnothing \\
c_{0,1}, & f(i_{n_1}) = f(i_{n_2}) = \cdots = f(i_{n_t}) = f(i), \mathbf{M_i} = \varnothing \\
c_{1,1}, & f(i_{m_1}) = f(i_{m_2}) = \cdots = f(i_{m_s}) = f(i_{n_1}) = f(i_{n_2}) = \cdots = f(i_{n_t}) = f(i) \\
c_{2,0}, & \exists k : f(i_{m_k}) \neq f(i), \mathbf{N_i} = \varnothing \\
c_{2,1}, & \exists k : f(i_{m_k}) \neq f(i), f(i_{n_1}) = f(i_{n_2}) = \cdots = f(i_{n_t}) = f(i) \\
c_{0,2}, & \exists k : f(i_{n_k}) \neq f(i), \mathbf{M_i} = \varnothing \\
c_{1,2}, & \exists k : f(i_{n_k}) \neq f(i), f(i_{m_1}) = f(i_{m_2}) = \cdots = f(i_{m_s}) = f(i) \\
c_{2,2}, & \exists k : f(i_{m_k}) \neq f(i), \exists l : f(i_{n_l}) \neq f(i)
\end{cases}
$$

This method provides a comprehensive categorization of all firms since it considers not only whether they have links or foreign links but also distinguishes upstream controlling firms and downstream controlled firms. In Figure 1 we present several methods to classify firms based on their ownership structure.

We perform two econometric models to investigate the difference in firm performance among various categories of firms. First we compare all the nine categories of firms. The

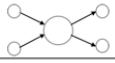
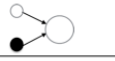
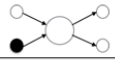
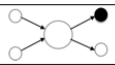
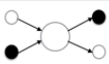
whether a firm has shareholding links	whether a firm has shareholding links and foreign links	whether a firm has upstream and/or downstream firms, and whether foreign firms are involved		Prototypes
stand-alone	stand-alone	stand-alone		
business group	domestic group	up-domestic		
		down-domestic		
		up-domestic-down-domestic		
	MNE	inward FDI	up-foreign	
			up-foreign-down-domestic	
		outward FDI	down-foreign	
			up-domestic-down-foreign	
		both inward and outward FDI	up-foreign-down-foreign	

Figure 1: Classification of Firms

logarithm form of labor productivity[1] y_i is used to measure firm performance. The regression equation to model y_i is:

$$y_i = \sum_{j=1}^{8} \delta_{ij} + \mathbf{x}_i\boldsymbol{\beta} + u_i$$

where δ_{ij} are the dummy variables of firms' categories and the stand-alone ones are considered as benchmark. $\mathbf{x}_i$ are the covariates, including firm size, capital intensity, level of integration[2], firm age, dummies of sectors and regions. The error term u_i is normal with mean zero.

[1] labor productivity is defined as value added/number of employees.

[2] The level of integration is defined as value added/sales. We use productivity as a proxy of sales.

In the second model we consider only corporate groups, that is, the domestic groups and MNEs. This is due to that we will also explore the effect of their position in the network and it is necessary for them to have at least one link with other firms. We compare the performance of the five categories of MNEs and the three categories of domestic groups. A linear regression is performed to estimate the difference among these categories.

$$y_i = \sum_{j=1}^{7} \delta_{ij} + \gamma c_i + \mathbf{x}_i \boldsymbol{\beta} + u_i$$

where δ_{ij} are the dummy variables of firms' categories and *up-domestic*, the purely domestic groups with only controlling companies, are considered as benchmark. We also make a robustness check by merging the three categories of domestic groups as the baseline. The covariates $\mathbf{x}_i$ are the same as the ones in the previous model. c_i represents the measure of centrality and we use degree centrality, closeness centrality and eigenvector in different specifications.

We make a further analysis to explore the effect of the location of foreign firms. Here we introduce two dummy variables *oecd* and *adv*. The variable *oecd* is equal to 1 if a firm has any foreign controlling or controlled firm situated in any of the 34 OECD countries[3] other than Italy, and 0 otherwise. The other variable *adv* is based on the economic complexity index (ECI). According to the ranking of Atlas of Economic Complexity[4], there are 15 countries with ECI larger than Italy, which are considered to have more advanced knowledge accumulated in their population and expressed in their industrial composition. If a firm has any foreign controlling or foreign controlled firm situated in any of the 15 countries, *adv* is equal to 1, and otherwise 0. We include the interaction terms of different categories of MNE and *oecd* or *adv* in model 2 and the domestic groups are used as

[3] http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm
[4] http://atlas.cid.harvard.edu/rankings/

benchmark. The specifications can be written as follows:

$$y_i = \sum_{j=1}^{5} \delta_{ij} + \sum_{j=1}^{5} \delta_{ij} * oecd_i + \gamma c_i + \mathbf{x}_i \boldsymbol{\beta} + u_i$$

$$y_i = \sum_{j=1}^{5} \delta_{ij} + \sum_{j=1}^{5} \delta_{ij} * adv_i + \gamma c_i + \mathbf{x}_i \boldsymbol{\beta} + u_i$$

Data

We derive the ownership data from ORBIS Database. We construct the global firm network based on the direct inter-firm shareholding relationship in 2014. This network consists of 19 million nodes and 11 million linkages among them. Then we extract the upstream and downstream ownership network of each Italian firm. Here we remove all the links with share less than 10%, according to the definition of FDI by OECD[5]. Then we combine the ownership network data with the AIDA database and collect all the Italian firms' financial data. After dropping the observations with negative productivity, negative fixed assets and incomplete records, there remain 548,720 Italian firms in the data set.

In Table 1 we present the frequency of the nine categories in our sample. The majority of the firms are the stand-alone ones, taking up to 81.9% of all the firms. The domestic groups represent 16.0% while MNEs represent only 2.1% of all the firms. We also present in Table 1 the mean and standard deviation of the logarithm form of labor productivity, as a measure of firm performance, across different categories. We notice that the stand-alone ones have a much lower labor productivity than the other categories. Among the purely domestic groups, the *up-domestic* firms are slightly more productive than the stand-alone ones, but far less productive than the ones controlling at least one firm. The MNEs have

[5]See details in for Economic Co-operation and Development (2009)

Table 1: log *LaborProductivity* by Different Categories of Firms

category	expression	category	expression	Freq.	Mean	Std. Dev.
stand-alone	c_0	stand-alone	$c_{0,0}$	449,618	3.191	1.094
domestic group		up-domestic	$c_{1,0}$	78,783	3.268	1.128
		down-domestic	$c_{0,1}$	8,079	4.091	1.115
		up-domestic-down-domestic	$c_{1,1}$	2,008	4.068	1.246
domestic group	c_1			87,653	3.343	1.143
MNE		up-foreign	$c_{2,0}$	6,222	4.254	1.329
		up-foreign-down-domestic	$c_{2,1}$	513	4.501	1.171
		down-foreign	$c_{0,2}$	2,485	4.279	0.928
		up-domestic-down-foreign	$c_{1,2}$	744	4.353	0.951
		up-foreign-down-foreign	$c_{2,2}$	268	4.473	0.950
MNE	c_2			11,449	4.320	1.247
overall				548,720	3.239	1.118

on average a much larger labor productivity than the domestic firms. To test whether the difference among categories is statistically significant, we perform econometric models in the following analysis.

Table 2 presents some descriptive statistics of the variables in our data set. The dependent variable in the econometric specification is the logarithm form of labor productivity. We use several different centrality measures as control variables, such as degree centrality, closeness centrality and eigenvector. Other control variables include the number of employees, capital intensity, integration level and age, which are commonly used in literature.

Results and Discussion

When performing the regression, we exclude the observations in the one percent tails for the variables used in the model. We first compare the performance of all the nine categories of firms. We exclude the dummies of sectors or regions in different specifications as a

Table 2: Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	N	mean	sd	min	p25	p50	p75	max
labor productivity	548,720	56.36	617.9	0.0102	14.43	28	48	197,033
closeness centrality	99,102	7.53e-05	0.000437	5.08e-08	5.08e-08	5.08e-08	6.77e-08	0.00371
degree centrality	99,102	6.15e-08	1.09e-07	5.08e-08	5.08e-08	5.08e-08	5.08e-08	0.000013
eigenvector	99,102	1.73e-05	0.00028	0	0	0	0	.01636
numper of employees	548,720	15.18	236.1	1	2	4	10	138,001
fixed assets	548,720	1,508	69,874	1	11	57	393	3.513e+07
value added	548,720	889.8	20,527	1	37	118	368	9.145e+06
capital intensity	548,720	348.3	5,005	0.000359	2.667	10.58	68	1.618e+06
integration level	548,545	0.344	1.740	-44.25	0.160	0.299	0.477	1,196
age	548,720	14.63	13.93	0	4	10	21	929

robustness check. As Table 3 shows, most coefficients of the categories are significant and positive except the *up-domestic* firms, which implies that the firms involved in corporate groups are on average more productive than the stand-alone firms. What's more, most coefficients of the five categories of MNEs are larger than the ones of the domestic groups, which means that the MNEs are on average more productive than the domestic groups. In addition, the coefficients of *up-domestic* are close to 0 and not significant in the last column in Table 3, implying that they have almost the same level of productivity as the stand-alone ones.

Then we use the second specification to compare the performance of the eight categories of firms, including the three categories of domestic groups and the five categories of MNEs. Table 4 presents the estimation results of the three specifications using different centrality measures. We notice that all the categories of firms have significant and positive coefficients in all the three specifications, implying that they have a larger labor productivity with respect to the benchmark group, the *up-domestic* ones. We also make a robustness check by merging the three types of domestic groups as the benchmark. Similarly we use different

Table 3: Regression Results

	(1)	(2)	(3)
VARIABLES	log LP	log LP	log LP
updome	0.0158***	0.0125***	0.00475
	(0.00356)	(0.00351)	(0.00349)
downdome	0.295***	0.265***	0.251***
	(0.0110)	(0.0111)	(0.0111)
updomedowndome	0.277***	0.256***	0.236***
	(0.0245)	(0.0245)	(0.0244)
upfore	0.554***	0.565***	0.491***
	(0.0137)	(0.0133)	(0.0132)
upforedowndome	0.491***	0.461***	0.401***
	(0.0557)	(0.0574)	(0.0569)
downfore	0.279***	0.257***	0.216***
	(0.0183)	(0.0185)	(0.0183)
updomedownfore	0.344***	0.333***	0.285***
	(0.0376)	(0.0382)	(0.0376)
upforedownfore	0.420***	0.402***	0.344***
	(0.0833)	(0.0839)	(0.0830)
log size	0.242***	0.254***	0.251***
	(0.00125)	(0.00159)	(0.00161)
log capital intensity	0.156***	0.164***	0.163***
	(0.000848)	(0.000773)	(0.000777)
integration level	0.118***	0.123***	0.127***
	(0.0309)	(0.0329)	(0.0341)
age	0.00417***	0.00487***	0.00371***
	(0.000115)	(0.000113)	(0.000113)
regions	Yes		Yes
sectors		Yes	Yes
Constant	2.493***	2.398***	2.561***
	(0.00924)	(0.00582)	(0.00599)
Observations	509,749	508,797	508,764
R-squared	0.221	0.239	0.252

Robust standard errors in parentheses

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

centrality measures in different specifications (see Table A1). We find that most of the coefficients of the five categories of MNEs are significant and positive, which indicates that MNEs are on average more productive than the domestic groups. In particular, the coefficients of *up-foreign* and *up-foreign-down-domestic* are higher than other categories in most of the specifications. Since these two types are both controlled by foreign companies but not controlling any foreign company, we conjecture that the Italian MNEs with inward FDI have better performance than the ones with outward FDI.

We make a further analysis to explore the reason why foreign-owned Italian firms outperform the Italian domestic-owned MNEs by considering the location of their upstream controlling firms and downstream controlled firms. Table 5 presents the estimation results. We notice that a majority of the interaction terms are significant and positive but the five categories except the *down-foreign* are no longer significant or not robust. The results indicate that MNEs' higher productivity are more due to that their controlling or controlled firms are situated in more developed countries rather than just be MNEs. What's more, the coefficients of the interaction terms of *up-foreign* and *up-foreign-down-domestic* are larger than the others in most specifications, implying that having controlling firms in more advanced countries has a larger effect on firm performance than having controlled firms in more advanced countries. In addition, the coefficients of *down-foreign* are significant and positive in all the specifications, which means that an ultimate owner of a MNE has on average a better performance than the domestic groups. We also make a robustness check by considering only the direction of FDI and merge the five categories of MNEs into three. As TableA2 shows, the interaction terms and the category *outward-fdi* are significant and positive. Hence, the results are consistent with the previous analysis.

Furthermore, we find that in all the specifications, the coefficients of the centrality measures are significant and positive, which implies that firms in a more central position have a better

Table 4: Regression Results

	(1)	(2)	(3)
VARIABLES	log LP	log LP	log LP
upfore	0.368***	0.472***	0.466***
	(0.0137)	(0.0132)	(0.0132)
upforedowndome	0.215***	0.319***	0.387***
	(0.0526)	(0.0551)	(0.0524)
downfore	0.241***	0.199***	0.241***
	(0.0223)	(0.0237)	(0.0223)
updomedownfore	0.229***	0.217***	0.297***
	(0.0446)	(0.0479)	(0.0447)
upforedownfore	0.153*	0.231***	0.320***
	(0.0842)	(0.0876)	(0.0843)
downdome	0.281***	0.251***	0.265***
	(0.0118)	(0.0121)	(0.0118)
updomedowndome	0.204***	0.179***	0.248***
	(0.0223)	(0.0264)	(0.0223)
log closeness	0.0554***		
	(0.00204)		
log degree		0.0871***	
		(0.0177)	
log eigenvector			0.0192***
			(0.00249)
log size	0.229***	0.242***	0.241***
	(0.00297)	(0.00295)	(0.00295)
log capital intensity	0.154***	0.155***	0.155***
	(0.00153)	(0.00154)	(0.00154)
integration level	0.256***	0.257***	0.257***
	(0.00599)	(0.00602)	(0.00601)
age	0.00348***	0.00372***	0.00370***
	(0.000280)	(0.000281)	(0.000281)
sectors	Yes	Yes	Yes
regions	Yes	Yes	Yes
Constant	3.505***	4.031***	3.054***
	(0.0360)	(0.298)	(0.0642)
Observations	91,725	91,725	91,725
R-squared	0.284	0.278	0.278

Standard errors in parentheses

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

Table 5: Regression Results

VARIABLES	(1) log LP	(2) log LP	(3) log LP	(4) log LP	(5) log LP	(6) log LP
upfore	-0.0224	0.164***	-0.0162	0.199***	-0.0203	0.194***
	(0.0320)	(0.0227)	(0.0321)	(0.0227)	(0.0321)	(0.0227)
oecd*upfore	0.409***		0.517***		0.516***	
	(0.0149)		(0.0141)		(0.0142)	
adv*upfore		0.420***		0.540***		0.540***
		(0.0163)		(0.0155)		(0.0156)
upforedowndome	-0.366**	0.128	-0.458**	0.0428	-0.323*	0.207**
	(0.179)	(0.0972)	(0.180)	(0.0984)	(0.180)	(0.0975)
oecd*upforedowndome	0.228***		0.241***		0.398***	
	(0.0551)		(0.0564)		(0.0548)	
adv*upforedowndome		0.194***		0.241***		0.389***
		(0.0624)		(0.0634)		(0.0620)
downfore	0.167***	0.148***	0.128***	0.0999***	0.159***	0.141***
	(0.0415)	(0.0344)	(0.0417)	(0.0346)	(0.0416)	(0.0345)
oecd*downfore	0.189***		0.103***		0.194***	
	(0.0257)		(0.0267)		(0.0258)	
adv*downfore		0.204***		0.117***		0.212***
		(0.0282)		(0.0293)		(0.0282)
updomedownfore	0.113	0.121*	0.0544	0.0501	0.183**	0.185***
	(0.0860)	(0.0711)	(0.0869)	(0.0722)	(0.0862)	(0.0713)
oecd*updomedownfore	0.210***		0.0922*		0.271***	
	(0.0519)		(0.0540)		(0.0520)	
adv*updomedownfore		0.222***		0.106*		0.287***
		(0.0569)		(0.0589)		(0.0570)
upforedownfore	0.138	-0.0188	-0.134	-0.0955	0.207	0.118
	(0.878)	(0.278)	(0.881)	(0.279)	(0.881)	(0.279)
oecd*upforedownfore	0.113		0.0565		0.271***	
	(0.0848)		(0.0868)		(0.0848)	
adv*upforedownfore		0.124		0.0730		0.285***
		(0.0885)		(0.0906)		(0.0886)
log closeness	0.0503***	0.0509***				
	(0.00205)	(0.00206)				
log degree			0.185***	0.182***		
			(0.0149)	(0.0150)		
log eigenvector					0.0159***	0.0157***
					(0.00250)	(0.00251)
log size	0.242***	0.242***	0.249***	0.249***	0.252***	0.253***
	(0.00293)	(0.00293)	(0.00292)	(0.00293)	(0.00291)	(0.00291)
log capital intensity	0.160***	0.161***	0.160***	0.160***	0.161***	0.161***
	(0.00152)	(0.00152)	(0.00152)	(0.00153)	(0.00152)	(0.00152)
integration level	0.253***	0.253***	0.254***	0.254***	0.254***	0.254***
	(0.00601)	(0.00601)	(0.00602)	(0.00602)	(0.00603)	(0.00603)
age	0.00433***	0.00435***	0.00435***	0.00438***	0.00447***	0.00449***
	(0.000278)	(0.000278)	(0.000279)	(0.000279)	(0.000279)	(0.000279)
sectors	Yes	Yes	Yes	Yes	Yes	Yes
regions	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.396***	3.405***	5.654***	5.609***	2.950***	2.943***
	(0.0363)	(0.0364)	(0.252)	(0.252)	(0.0643)	(0.0645)
Observations	91,725	91,725	91,725	91,725	91,725	91,725
R-squared	0.280	0.280	0.277	0.276	0.276	0.275

Standard errors in parentheses

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

performance than the others.

Conclusion

In this paper, we provide a comprehensive categorization of firms based on whether they have upstream controlling companies, whether they have downstream controlled companies and whether foreign companies are involved. We investigate the relationship between the categories and firm performance using the data of Italian firms. We find that on average the domestic groups are more productive than the stand-alone ones and MNEs have a better performance than the domestic ones. What's more, among the MNEs, the foreign-owned Italian firms have a higher labor productivity than the Italian domestic-owned MNEs. We find that this is due to that having controlling firms in more advanced countries has a larger effect on firm performance than having controlled firms in more advanced countries. In addition, we find a positive relation between a firm's centrality in the network and its performance.

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Appendix

Table A1: Regression Results

VARIABLES	(1) log LP	(2) log LP	(3) log LP
upfore	0.335***	0.434***	0.431***
	(0.0136)	(0.0131)	(0.0132)
upforedowndome	0.161***	0.169***	0.329***
	(0.0527)	(0.0542)	(0.0525)
downfore	0.178***	0.101***	0.179***
	(0.0222)	(0.0230)	(0.0223)
updomedownfore	0.175***	0.0696	0.242***
	(0.0447)	(0.0468)	(0.0447)
upforedownfore	0.0945	0.0369	0.259***
	(0.0845)	(0.0866)	(0.0845)
log closeness	0.0539***		
	(0.00204)		
log degree		0.193***	
		(0.0149)	
log eigenvector			0.0181***
			(0.00250)
log size	0.243***	0.251***	0.255***
	(0.00293)	(0.00293)	(0.00291)
log capital intensity	0.160***	0.160***	0.161***
	(0.00152)	(0.00153)	(0.00152)
integration level	0.254***	0.255***	0.255***
	(0.00601)	(0.00603)	(0.00603)
age	0.00443***	0.00449***	0.00460***
	(0.000278)	(0.000279)	(0.000279)
sectors	Yes	Yes	Yes
regions	Yes	Yes	Yes
Constant	3.457***	5.789***	3.005***
	(0.0360)	(0.251)	(0.0643)
Observations	91,725	91,725	91,725
R-squared	0.279	0.275	0.274

Standard errors in parentheses

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

Table A2: Regression Results

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	log LP	log LP	log LP	log LP	log LP	log LP
inward_fdi	-0.0329	0.163***	-0.0296	0.192***	-0.0296	0.195***
	(0.0315)	(0.0221)	(0.0316)	(0.0222)	(0.0316)	(0.0222)
oecd*inward_fdi	0.400***		0.504***		0.509***	
	(0.0146)		(0.0138)		(0.0139)	
adv*inward_fdi		0.409***		0.527***		0.532***
		(0.0161)		(0.0152)		(0.0153)
outward_fdi	0.157***	0.143***	0.120***	0.0972***	0.164***	0.150***
	(0.0375)	(0.0311)	(0.0378)	(0.0315)	(0.0376)	(0.0312)
oecd*outward_fdi	0.194***		0.113***		0.209***	
	(0.0233)		(0.0247)		(0.0233)	
adv*outward_fdi		0.209***		0.126***		0.227***
		(0.0255)		(0.0270)		(0.0255)
in_out_fdi	0.0151	-0.323	-0.188	-0.363	0.0729	-0.226
	(0.880)	(0.281)	(0.882)	(0.281)	(0.882)	(0.281)
oecd*in_out_fdi	-0.478***		-0.535***		-0.448***	
	(0.0881)		(0.0888)		(0.0884)	
adv*in_out_fdi		-0.492***		-0.556***		-0.473***
		(0.0925)		(0.0931)		(0.0928)
log closeness	0.0499***	0.0505***				
	(0.00205)	(0.00205)				
log degree			0.165***	0.165***		
			(0.0144)	(0.0144)		
log eigenvector					0.0159***	0.0157***
					(0.00250)	(0.00250)
log size	0.241***	0.242***	0.249***	0.249***	0.252***	0.252***
	(0.00293)	(0.00293)	(0.00292)	(0.00293)	(0.00290)	(0.00291)
log capital intensity	0.160***	0.161***	0.160***	0.160***	0.161***	0.161***
	(0.00152)	(0.00152)	(0.00152)	(0.00153)	(0.00152)	(0.00152)
integration level	0.253***	0.253***	0.254***	0.255***	0.254***	0.254***
	(0.00601)	(0.00601)	(0.00602)	(0.00603)	(0.00603)	(0.00603)
age	0.00432***	0.00434***	0.00435***	0.00437***	0.00445***	0.00447***
	(0.000278)	(0.000278)	(0.000279)	(0.000279)	(0.000279)	(0.000279)
sectors	Yes	Yes	Yes	Yes	Yes	Yes
regions	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.390***	3.399***	5.332***	5.319***	2.951***	2.942***
	(0.0362)	(0.0363)	(0.242)	(0.242)	(0.0643)	(0.0644)
Observations	91,725	91,725	91,725	91,725	91,725	91,725
R-squared	0.280	0.280	0.276	0.276	0.276	0.275

Standard errors in parentheses

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