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Working Paper

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Nota di Lavoro, No. 104.2002

Provided in Cooperation with:
Fondazione Eni Enrico Mattei (FEEM)

Fondazione Eni Enrico Mattei

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NOTA DI LAVORO 104.2002

NOVEMBER 2002

ETA – Economic Theory and Applications

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Summary

This paper provides empirical evidence on the relation between the identity of ultimate owners and technical (in)efficiency by estimating stochastic production frontiers on Italian firm level panel data for twelve manufacturing industries over the 1978-93 period. Privately-owned independent firms are used as reference group and their efficiency is assessed against three alternative forms of ownership: subsidiaries of (privately owned) national business groups, subsidiaries of foreign multinationals, and state owned firms. Even if cross-industry differences obviously exist a common pattern can however be identified. Overall, subsidiaries of foreign multinationals (state owned firms) are found to be more (less) efficient than the reference group. On the contrary, no systematic difference is found between independent firms and subsidiaries of national business groups.

Keywords: Efficiency, type of ownership, panel data

JEL: C33, D23, D24

We wish to thank Luigi Benfratello, Almas Heshmati and the participants at the EARIE conference in Lausanne for helpful comments on a previous draft.

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1 Introduction

The main purpose of this paper is to provide empirical evidence on the relation between corporate ownership and firms' productive efficiency. The key question in this area of research has traditionally been whether firms with concentrated ownership are more productive than firms with dispersed ownership. On the one hand, concentrated shareholdings can mitigate free rider problems of corporate control (see Shleifer and Vishny, 1986). On the other hand, concentrated ownership might also lead to the extraction of inefficient private benefits by controlling shareholders at the expense of minority shareholders (see Shleifer and Vishny, 1997).[1] A related and less investigated issue is whether the identity of block-holders matters in explaining firms' performance in a corporate governance system characterized by a highly concentrated ownership structure. As documented among others by Shleifer and Vishny (1997), this feature is common in most developed as well as developing countries outside the Anglo-Saxon influence.

In this perspective, Italy is a very interesting case study. In fact, not only concentration of direct ownership is high but a substantial degree of variability in the identity of block-holders is observed. In fact, independent companies directly owned and managed by families coexist with firms belonging to large organizations - usually structured as pyramidal business groups - and therefore directly owned by other companies (Bianco and Casavola, 1999). In turn, these large organizations are led at the top by families (or coalitions of families), or multinational corporations or the State[2]. Contrary to independent companies where top managerial

[1] In his survey of the literature, Gugler (2001) points out that empirical results are mixed even if the majority of existing studies suggests a profitability-enhancing role of owner control. On a more theoretical basis, it has been also argued that there should be no systematic relation between ownership structure and firm performance to the extent that the market for corporate control responds to forces which create suitable ownership structures for firms (see the discussion in Demsetz and Villalonga, 2001).

[2] A related question is whether the ownership structure of multinational corporations affects the performance of their foreign subsidiaries. Unfortunately, due to data limitations we are not able to provide empirical evidence on this additional issue.

positions are usually held by family members, these large organizations are characterized - to different degrees - by the presence of externally appointed professional top managers. In these large organizations, the standard agency problem between block-holders and senior management is therefore expected to emerge and the incentive to monitor the management effectively may in turn depend on the identity of the blockholder. Given these institutional features two relevant issues have to be addressed: i) whether independent firms are more or less efficient than firms which are members of larger organizations; ii) whether in large organizations the identity of ultimate ownership affects firms' performance.

To investigate these issues we apply stochastic production frontier techniques to a large panel of Italian manufacturing firms for which qualitative information on firms' form of ownership is available. Using the approach developed by Battese and Coelli (1995), we allow the inefficiency component of the production function to depend on observables including size and a set of dummy variables proxying for the identity of ultimate ownership. The remainder of the paper is organized as follows. Section 2 motivates the paper by relating some institutional characteristics of Italian corporate governance with the received theoretical literature. Section 3 describes the data set - additional information is provided in the data appendix - and summarizes the relevant descriptive statistics. In section 4 the empirical model is discussed whereas section 5 comments upon the main empirical results. Section 6 concludes.

2 Institutional Framework and Relevant Issues

As noted by Nickell (1997), most of the recent empirical literature which analyses the impact of external factors on firms' efficiency is grounded on the idea that efficiency is basically driven by managerial effort. Indeed, the main task of corporate governance is to align managers' objectives to shareholders' goals. In order to achieve this result, the main mechanisms are perceived to be internal control and management compensation. In turn, the incentive to incur the cost of setting effective governance mechanisms is likely to depend on factors like the degree of ownership concentration and firm's capital structure. For this reason, variables proxying for the degree of shareholder control are usually included in regressions aimed at explaining productivity differentials together with measures of financial pressure. In addition to this, the stance of product market competition may also act as a complementary disciplinary device.[3]

As already mentioned in the introduction, Italian companies are characterized by a high level of ownership concentration. According to Bianchi et al (1997), in 1992 the largest shareholder of manufacturing companies owned on average approximately 66% of a company and the three largest shareholders owned more than 90%. Another relevant feature of Italian corporate governance is that neither financial institutions nor the stock market play a major role in monitoring firms' behavior. In fact, contrary to other bank-based systems, the role of banks and other financial institutions in equity financing is very limited and it is unusual for bankers to sit on the boards of directors of manufacturing firms. Furthermore, the market for corporate control does not play an important role and the number of firms which could be a target for hostile takeovers is fairly small. This is partly a consequence of the limited number of companies listed on the Milan stock exchange. In addition, it depends on the high degree of ownership concentration also among listed companies as well as on the diffusion of cross-ownership and board interlocks.[4] Taken all these

[3]Note however that the results of the theoretical literature are mixed in the sense that the relation between market competition and the amount of managerial slack is found not to be robust to different assumptions on owners' and managers' preference structures. See, among others, Hart (1983), Nalebuff and Stiglitz (1983), Willig (1987), Scharfstein (1988) and Vickers (1995).

[4]Furthermore, the Italian legal framework is widely perceived to guarantee a limited degree of protection to minority shareholders. In turn, this allows majority block-holders to expropriate rents at the expenses of minority shareholders and other stakeholders (See Zingales, 1994 and Nicodano and Sembenelli, 2000).

facts together, majority block-holders seem to be the natural candidates to behave as main active monitors in companies.

However, whether concentrated ownership leads to effective cost reducing monitoring practices is an unsolved issue both theoretically and empirically. In fact, when ownership is concentrated what becomes crucial is the objective function of the majority blockholder which might deviate from the standard shareholders' value maximization assumption. For instance, managers in state owned firms may have incentives not always consistent with cost minimization practices (e.g. employment expansion). Analogously, in privately held companies managers may act in the private interest of majority blockholders and therefore be associated in inefficient rent extraction (e.g. hiring a lazy relative or purchasing a loss-maker soccer club).

Given this institutional framework two relevant questions have to be answered. Firstly, evidence has to be provided on whether externally appointed professional managers (in large organizations) are more likely to deviate from cost minimization rules than owners-managers (in independent companies). To isolate this effect, the most promising empirical strategy is to compare independent firms only with those firms belonging to business groups whose ultimate owner is a family (or a coalition of families). Secondly, a related but separate issue is whether in large organizations (national privately owned business groups, state owned business groups, multinational corporations) the identity of ultimate ownership matters in explaining efficiency differentials. This in turn has two competing explanations: on the one hand efficiency differentials might depend on the fact that different types of owners may be characterized by different objective functions. On the other hand, even if the pursuit of efficiency is a common objective for all types of owners, they might differ in the ability to provide effective monitoring and incentive schemes to the top management.[5]

[5] Another candidate explanation is grounded on the idea that it is performance that affects

3 Data and Descriptive Statistics

In this section we provide both a brief description of the unbalanced panel of Italian firms used in this study and some summary statistics on the variables which enter our econometric model. Our panel is extracted from a wider data-set constructed by Ceris-Cnr by merging balance sheet data collected by Mediobanca, a large investment bank, with industry level data provided by ISTAT, the Italian Central Statistical Office.[6] For our analysis we have extracted observations relative to manufacturing firms with no less than 4 consecutive observations over the 1978-93 period, thus obtaining an initial sample of 9816 firm-year observations relative to 1306 companies. Each company has been allocated to its primary industry following an adjusted two-digit NACE-CLIO classification. Since our empirical model is estimated at the industry level, industries with a small number of firms have been discarded, thus leaving us with a final sample of 1272 firms corresponding to 9549 firm-year observations.[7]

In each year (and therefore allowing for transition) firms are allocated to one out of four categories: members of large private national business groups (labelled as Group Firms in all tables), members of state owned national business groups (State Owned Firms), foreign subsidiaries (Multinationals), or other national firms (Independent Firms). Firms are classified as affiliates to large private national business groups if they are members of one of the following eighteen business groups: Agnelli-Fiat, De Benedetti-Cir, Ferruzzi-Montedison, Fininvest-Mondadori, Pesenti-Immobiliare, Pirelli, Barilla, Benetton, Cartiere Burgo, Falck, Ferrero, Gft,

(changes in) ownership structure trough the functioning of a competitive process which selects the most appropriate type of ultimate owner for each firm. However, this "reverse causality" explanation seems unconvincing in the Italian context given the ineffectiveness of external market mechanisms, including the market for corporate control, driving the selection process.

[6] More detailed information on the data-set can be found in the appendix or, for those familiar with the Italian language, in Margon et al. (1995).

[7] A threshold of 15 firms has been used. Eliminated industries are Artificial Fibres (Nace 26), Wooden Products (Nace 46) and Miscellaneous industries (Nace 49).

Lucchini, Marzotto, Merloni, Miroglio, Parmalat and Smi.[8] In these groups control is exercised by families, or at least by coalitions of shareholders where families play a major role, often through complex organizational pyramidal structures. However, given the size and the complexity of these organizations, externally appointed professional managers often held senior positions in operational companies. As already mentioned in the previous section, this feature makes it possible to test whether concentrated ownership is an efficient disciplinary mechanism by comparing the economic performance of these firms with the economic performance of independent firms where most if not all senior positions are usually filled by family members and therefore where the agency problem between shareholders and managers is not expected to emerge. Firms are classified as affiliates of state owned national business groups if they are controlled, directly or indirectly, by one of the following three state controlled financial holdings: Iri, Eni and Efim. Firms are classified as foreign subsidiaries if the parent company is foreign and as other national firms when they do not satisfy the requirements to be included in the first three categories. This category includes mainly independent companies, but firms affiliated to smaller and younger private national business groups can be also found. We have grouped these two types of firms together since the smaller groups are more similar to the independent firms in our sample than to the large business groups in terms of size and diversification and, as a consequence, in the likely role played by externally appointed senior managers.

Table 1 reports, separately for each industry, the sample mean and the standard deviation of the variables which enter the empirical model presented in section 4. Output is measured by sales deflated with the appropriate three-digit production price index. Materials are computed as the deflated difference between sales and

[8] These groups represented the core of the private national industrial sector in the eighties and most of them have been ranked in the top positions in terms of consolidated sales since the first incomplete list of groups was published by Mediobanca in 1983. In addition, these are the only private groups with a consolidated turnover larger than 1000 billion Lira in 1990.

value added and the capital stock is constructed by applying the standard perpetual inventory technique to available accounting data. All these variables are expressed in 1980 billion lira. Finally, employment is defined as the number of employees at the end of fiscal year. Table 2 reports the descriptive statistics (sample mean and standard deviation) on employment disaggregated not only by industry but also by type of ownership. Two comments are worth making at this stage. Firstly, the average size (measured as number of employees) of independent firms is much lower than the average size of affiliated firms. This can be easily seen by comparing the first column (Independent) with each of the next three columns (State Owned Firms, Group Firms, Multinationals). Furthermore, this difference cannot be exclusively attributed to a composition effect since it holds across most industries. Secondly, even if there is no systematic ranking among our three types of affiliated firms, on average subsidiaries of foreign multinationals tend to be smaller than affiliates both to privately and to state owned national groups. This descriptive evidence suggests that the type of ownership is not independently distributed from firm size. This will be accounted for in the specification of the inefficiency part of the model where size variables are included alongside ownership dummies in order to avoid potential biases due to the omission of relevant variables.

4 Methodological Issues

To test whether a statistical relation exists between firms' technical inefficiency and the identity of ultimate ownership we apply stochastic production frontier techniques to our sample of firms.[9] This approach, originally proposed by Aigner, Lovell and Smith (1977) and Meeusen and van den Broeck (1977), is motivated by the idea that deviations from the production frontier defined by the "best practice"

[9] For an introduction to efficiency and productivity analysis see, among others, Coelli, Rao and Battese (1998).

technology might not be entirely under the control of the firm being studied and might be due to measurement errors and other noise upon the frontier. The original specification and early empirical applications were usually based on cross-sectional data. The collection of longitudinal data on firms or plants has encouraged the development and use of stochastic frontier models suitable for panel data. In fact panel data techniques allow both to avoid many of the difficulties arising in a cross-sectional setting (Schmidt and Sickles, 1984) and to estimate the rate and direction of technical change. Greene (1997) and Kumbhakar and Lovell (2000) discuss and review both the theoretical and the empirical literature on stochastic production frontiers.

During the eighties research efforts shifted towards the analysis of the determinants of efficiency differentials. Initially, this task was tackled with the adoption of a two stage approach: after estimating inefficiency with a frontier technique, inefficiency scores were regressed on various explanatory variables using OLS.[10] The drawback of this procedure is that it contradicts the identical distribution assumption of the first stage. Recently, several authors have proposed different models for inefficiency effects in stochastic frontier production functions.[11] In this study we adopt the approach suggested by Battese and Coelli (1995) who developed a stochastic production frontier approach suitable for panel data where inefficiency is modeled as an explicit function of a vector of firm-specific variables and a random error.

We assume that for each industry technology is represented by the following flexible translogarithmic production function:

$$y_{it} = \beta_0 + \sum_j \beta_j x_{jit} + \sum_j \sum_k \beta_{jk} x_{jit} x_{kit} + (v_{it} - u_{it}) \tag{1}$$

[10] See, among others, Pitt and Lee (1982), and Kalirajan and Shand (1986).

[11] See Kumbhakar, Ghosh and McGuckin (1991), Reifschneider and Stevenson (1991), and Huang and Liu (1994).

where y_{it} denotes (the logarithm of) production for firm i at time t, $j = k = M, L, K, T$ is a vector including (the logarithms of) the material (M), labor (L) and capital (K) inputs together with a linear time trend (T). v_{it} are random variables which are assumed to be $IIN \sim (0, \sigma_v^2)$ and independent of the u_{it} which are non-negative random variables assumed to be independently distributed as truncations at zero of the $N \sim (m_{it}, \sigma^2)$ distribution. The v_{it} component of the error term captures measurement errors and production function misspecification effects, while the u_{it} is related to technical inefficiency.

For our purposes we have parameterized m_{it} as a linear function of size and ownership variables - including their interactions - which in our framework are expected to affect firms' efficiency:

$$
\begin{aligned}
m_{it} &= \delta_0 + \delta_S S_{it} + \delta_G G_{it} + \delta_M M_{it} + \delta_T T + \delta_L x_{Lit} \qquad (2)\\
&\quad \delta_{SL} S_{it} x_{Lit} + \delta_{GL} G_{it} x_{Lit} + \delta_{ML} M_{it} x_{Lit}
\end{aligned}
$$

where x_{Lit} is our size measure for firm i at time t, M_{it}, G_{it}, and S_{it} are three dummy variables which are respectively equal to 1 (and 0 otherwise) if at time t firm i is a subsidiary of a foreign Multinational, a member of a domestic private business Group or a State-owned firm. T is a linear time trend which accounts for time varying efficiency effects.

Given the specification of the inefficiency model (2), independent firms act as reference group and coefficients related to ownership dummies, together with their interactions with the size variable, show efficiency differentials with respect to independent firms. The inefficiency model (2) allows us to test whether the identity of ultimate owners matters in explaining efficiency differentials. The size variables has been included in order to account for apparent size differentials observed in the sample and discussed in Section 3. Size is measured as the log number of employees.

When, as in our specification, inputs are also involved as explanatory variables for the inefficiency effects, the stochastic frontier model is called a non-neutral model, as proposed by Huang and Liu (1994) and further considered by Battese and Broca (1997). This model has important bearing upon the estimation of the elasticity of mean output with respect to the input variable included as explanatory variable in the inefficiency model.[12]

In the stochastic model defined by (1) and (2) technical efficiency for firm i at time t is defined as:

$$TE_{it} = \exp(-u_{it}) \tag{3}$$

which takes a value lower than one unless a firm is fully efficient. Technical efficiencies are predicted using the conditional expectations of $\exp(-u_{it})$ given the composed error term of the stochastic frontier (Battese and Coelli, 1988).

Maximum likelihood method allows to simultaneously estimate the coefficients of the stochastic frontier production function (1) as well as of the inefficiency model (2). In addition, variances parameters can be recovered on the basis of the following parameterization suggested by Battese and Coelli (1992):

$$\gamma = \frac{\sigma^2}{\sigma^2 + \sigma_v^2} \text{ and } \sigma_s^2 = \sigma + \sigma_v^2 \tag{4}$$

Finally, restrictions on parameters of the stochastic frontier function and of the inefficiency model can be tested using the following generalized likelihood ratio test statistic which has approximately a chi-squared distribution with degrees of freedom equal to the number of parameters involved in the restriction :

[12] In their 1997 paper, Battese and Broca derive the expression for the mean output elasticity with respect to input variable k for firm i at time t as: $\frac{\partial \ln[E(Y_{it})]}{\partial x_k} = (\beta_k + 2\beta_{kk} x_{kit} + \sum_{j \neq k}^{4} \beta_{kj} x_{jit}) - C_{it}(\frac{\partial m_{it}}{\partial x_k})$ where $C_{it} = 1 - \frac{1}{\sigma}[\frac{\phi(\frac{m_{it}}{\sigma} - \sigma)}{\Phi(\frac{m_{it}}{\sigma} - \sigma)} - \frac{\phi(\frac{m_{it}}{\sigma})}{\Phi(\frac{m_{it}}{\sigma})}$, ϕ and Φ are the density and the cumulative density functions of the standard normal variable. The first part of the above expression is referred as elasticity of frontier output and the second part as elasticity of technical efficiency.

$$\lambda = -2[l(H_0) - l(H_1)] \quad (5)$$

where $l(H_0)$ is the log-likelihood value of the restricted frontier model. Estimates are performed using the FRONTIER 4.1 software developed by Coelli (1996).

5 Empirical results

In this section separate maximum likelihood estimates of the model defined in equations (1) and (2) are presented for twelve two-digit manufacturing industries. Providing a comprehensive analysis at the industry level is indeed one of the novelties of this paper. Among other things, it allows us to assess whether a common pattern in the ownership-efficiency relation exists across a broad spectrum of industries which differ with respect to several other characteristics including the speed of technological innovation and the stance of competition in the product market.

Simultaneous econometric estimates for the parameters of the frontier function and of the inefficiency model are reported in Table 3. As it is well known, the parameters in the translog production function have no immediate economic interpretation. For this reason output elasticities with respect to materials, capital, labor and time have been computed at mean values of each variable and reported in Table 4 together with estimated standard errors. Rather comfortingly, most of estimated elasticities look economically sensible. In particular, material elasticity ranges from 0.659 ("Office Machinery") to 0.842 ("Food and Drink"). Capital (0.028-0.119) and labor (0.106-0.512) elasticities differ considerably across industries, this in turn reflecting substantial technological idiosyncracies. Among other things, this result casts more than a passing doubt on the methodological soundness of the common practice of estimating production functions on panels of firms operating in different industries. "Office Machinery" and "Textile and Clothing" exhibit substantial increasing returns to scale, whereas returns to scale turn out to be decreasing in "Rubber and Plastics". In all remaining industries returns to scale are close to unity. Finally, estimated elasticities of mean output with respect to time show the presence of moderate technical progress (0.001-0.013) in all industries but "Mechanical Engineering" where it is negative even if not significantly different from zero at conventional statistical levels.

As it can be seen in the upper part of Table 5, the translog functional form with non-neutral technical progress seems an adequate representation of the technology. In fact, reported generalized likelihood ratio tests strongly reject the restrictions imposed by the Cobb Douglas specification ($\beta_{jk} = 0$ for $j, k = M, K, L, T$ and $j \neq k$) for all industries, thus confirming that a flexible functional form, which let input and substitution elasticities depend on the data, provides a more appropriate description of the production process. Furthermore, the null hypotheses of no technical change ($\beta_T = \beta_{jT} = 0$ for $j = M, K, L, T$) as well as of neutral technical change ($\beta_{MT} = \beta_{KT} = \beta_{LT} = 0$) are both rejected in all industries. Therefore, not only the estimated frontier functions shift over time but also the marginal rates of technical substitution are found to depend on time.

In the lower part of Table 5 are reported generalized likelihood ratio tests concerning restrictions imposed on the inefficiency model defined in equation (2). The null hypothesis that each firm is operating on the technical efficiency frontier (no inefficiency effects) is strongly rejected in all industries. Therefore the traditional average response function is not an adequate representation of the data (Battese and Coelli (1995)). Moreover, estimates of the variance parameter γ reported at the bottom of Table 3 range between 0.41 to 0.94 and are all statistically different from zero. Hence the random component of the inefficiency effects is significant. In turn this implies that deviations from the best practice frontier are not entirely due to noise and that stochastic inefficiency is present.

We now turn to the issue of whether observed inefficiency is a linear function of the explanatory variables included in the inefficiency model of equation (2). As already mentioned, independent firms are used as benchmark group. As a consequence, estimated coefficients on dummy variables - and their interactions with size - have to be interpreted as efficiency differentials with respect to independent firms. The joint test of no ownership effects, which involves restrictions on all ownership dummies and their interactions with size, is strongly rejected in all industries. This implies that, even after controlling for a common size effect, membership to larger organizations has a widespread effect on firms' efficiency. To provide additional evidence on this issue, the same test is also applied separately to each sub-sample. The null hypothesis of no State owned differential ($\delta_S = \delta_{SL} = 0$) is always rejected at the 5% significance level except for "Office Machinery". Analogously, affiliation to a national privately owned business group ($\delta_G = \delta_{GL} = 0$) significantly affects efficiency differentials with respect to independent firms in all industries but "Metals", "Office Machinery" and "Transport Equipment". Finally, the null hypothesis of no foreign subsidiaries differentials ($\delta_M = \delta_{ML} = 0$) is also rejected in most industries. Exceptions are "Metals", "Transport Equipment" and "Textiles and Clothing".[13]

While informative, all tests presented so far suffer from a major shortcoming since they do not allow us to identify the direction of efficiency differentials. Additional evidence can therefore be provided by directly computing the efficiency differentials from the benchmark of independent firms. As robustness check, differentials have been evaluated both at the mean and at the median firm size in each industry. Estimates and related standard errors are reported in Table 6. Overall results can be summarized as follow. Firstly, if one focuses on punctual estimates state owned firms turn out to be less efficient than their independent counterparts

[13] For "Mineral Products", "Metal Products" and "Food and Drink" the null hypothesis $\delta_M = \delta_{ML} = 0$ is rejected only at the 10% significance level.

in all industries but "Rubber and Plastics". Furthermore, this exception is unlikely to be very reliable because of the small number of observations on state owned firms in this industry (see the data appendix). Secondly, there is evidence that subsidiaries of foreign firms tend to be more efficient than independent firms. In fact, not only punctual estimates are negative - and therefore suggesting a positive differential - in 7 out of 12 industries ("Mineral Products", "Chemicals", "Metal Products", "Mechanical Engineering", "Office Machinery", "Food and Drink", Paper and Printing") but these negative estimates are all significant at the 10% level independently on whether size is evaluated at the mean or at the median. On the contrary, when punctual estimates are positive, they are statistically significant only for "Electrical Engineering". Thirdly, there is no systematic evidence for firms affiliated to national business groups. In fact, when size is evaluated at median values, punctual estimates point out that affiliated firms are more efficient than independent firms exactly in 6 out of 12 industries. In addition, if one focuses only on industries where differentials are significantly different from zero, estimates are positive in "Metal products", "Mechanical Engineering" and "Rubber and Plastics" and negative in "Food and Drink", "Textiles and Clothing" and "Paper and Printing", thus confirming the overall balance.

To provide a quantitative assessment of the differentials analyzed so far, mean technical efficiency scores are reported in Tables 7 and 8. In particular Table 7 summarizes the results by type of ownership and industry, whereas in Table 8 scores are cross-tabulated by type of ownership and size. Aggregate results confirm that subsidiaries of foreign multinationals (mean efficiency across industries 0.959) are more efficient than national firms even if the differential is not very large. Among national firms, independent firms (0.924) and affiliates to private business groups (0.920) show very similar results whereas scores for state owned firms are lower on the aggregate (0.894) and in most industries. Finally, results in Table 8 allow to enrich the overall picture. In fact, subsidiaries of multinational firms are found to be the most efficient group of firms in all size classes. Furthermore, even if it is true that efficiency is a negative function of size in all groups, this function turns out to be flatter for the sub-sample of foreign subsidiaries. The bottom line is that differentials between foreign subsidiaries and national firms are more pronounced when the analysis is restricted to medium-large firms.

6 Conclusions

In the introduction we posed ourselves two questions to be addressed empirically. Firstly, whether externally appointed managers are more likely to deviate from cost minimization rules than owners-managers in a country where direct ownership is concentrated. Secondly, whether the identity of ultimate owner matters in large organizations. To isolate the first issue, we proposed to compare independent firms with firms affiliated to private national business groups, that is to organizations where the ultimate owner is still a family or a coalition where families play a relevant role. Our answer to the first question is that there is no systematic evidence supporting the existence of additional agency problems due to the presence of externally appointed top managers, when firms directly managed by owners are used as benchmark.

As to the second issue, there is very strong evidence that in large organizations the identity of the ultimate owner matters. In fact, subsidiaries of multinational firms are found to be the most efficient group in most industries whereas state owned firms show systematic lower efficiency levels. It has to be pointed out that these results hold across a broad range of industries which differ in the speed of technological innovation as well as in the likely stance of product competition. This is an important result which makes the standard managerial effort explanation for efficiency differentials much more convincing.

Which lessons can be drawn from these results? It would be tempting to conclude that privatizations are likely to bring efficiency gains. However, two caveats have to be borne in mind. Firstly, the methodology used in this paper assumes that the type of ownership is exogenous. This identification assumption might be too restrictive and therefore one must be cautios in giving our estimates a causal (or structural) interepretation. Secondly, the size of these gains should not be over-emphasized. On average our estimates suggest that in the sample period under study differentials amount at -3.04% and -6.78% respectively, depending on whether national private firms or subsidiaries of foreign multinationals are used as comparison.

Another important finding of this paper is that private national firms (both independent and affiliates to business groups) seem less successful than their foreign counterparts in designing appropriate incentive schemes and in implementing adequate monitoring devices. Also, this problem turns out to be more severe in large firms. In turn, even if additional work in this area is obviously needed, these findings seem to suggest that a gap in managerial culture still exists in Italy and that multinational corporations are a potential vehicle for the diffusion of "best practices".

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Table 1: Descriptive Statistics on Output and Input Factors

	Output	Materials	Capital	Labour
Metals	1428.397	1059.019	995.779	1396.303
	3329.054	2355.291	3289.679	4765.181
Mineral Products	557.377	328.093	507.727	678.896
	474.214	313.108	515.628	629.731
Chemicals	878.538	626.596	334.187	644.983
	820.353	626.869	371.413	665.490
Metal Products	487.901	342.064	218.746	520.520
	725.594	503.854	397.590	797.267
Mechanical Engineering	861.807	586.799	350.935	970.357
	1255.659	917.181	778.375	1278.100
Office Machinery	3295.316	1786.479	1247.636	2294.580
	9924.241	5769.080	3541.036	4414.521
Electrical Engineering	972.456	638.932	327.067	1154.892
	1105.681	779.676	484.777	1601.574
Transport Equipment	2157.151	1446.841	1083.467	2875.392
	9058.815	6321.078	4610.521	10631.186
Food and Drink	936.888	727.492	299.872	563.089
	1291.413	955.577	488.522	1025.566
Textiles andClothing	442.543	312.023	196.222	566.398
	459.516	357.652	202.050	654.339
Paper and Printing.	664.886	452.355	347.135	631.782
	856.076	602.900	597.990	755.788
Rubber and Plastics	881.131	550.723	508.955	1235.828
	1643.761	942.085	1095.146	2738.796
Total	952.802	651.440	433.338	959.251
	3044.447	2041.796	1607.315	3224.567

Table 2: Descriptive Statistics on Employment by Type of Ownership

	Independent	State Owned Firms	Group Firms	Multinationals	Total
Metals	339.484	3810.433	1372.075	535.754	1396.303
	200.488	9015.125	2476.540	326.035	4765.181
Mineral Products	600.118	1368.945	571.245	691.015	678.896
	535.097	1025.683	344.998	653.670	629.731
Chemicals	527.268	702.537	1311.205	617.842	644.983
	459.483	416.723	1683.406	512.201	665.490
Metal Products	427.931	546.626	1340.373	284.514	520.520
	341.947	319.148	2278.680	166.799	797.267
Mechanical Engineering	551.974	2063.342	1609.684	822.452	970.357
	554.937	2035.052	1509.876	1065.940	1278.100
Office Machinery	529.400	971.632	4353.727	2199.076	2294.580
	355.767	327.445	7204.697	3714.529	4414.521
Electrical Engineering	654.396	1591.453	1293.063	1387.817	1154.892
	1303.002	1759.103	1873.443	1562.417	1601.574
Transport Equipment	841.320	2683.016	8295.320	516.451	2875.392
	654.358	4376.816	22056.032	256.513	10631.186
Food and Drink	338.296	1260.282	1178.536	874.181	563.089
	452.037	1399.412	1731.825	1536.080	1025.566
Textiles andClothing	461.670	1447.455	1001.933	784.153	566.398
	320.052	1108.756	1497.910	749.687	654.339
Paper and Printing.	447.309	879.943	921.704	546.103	631.782
	336.130	569.252	1219.932	291.106	755.788
Rubber and Plastics	343.863	857.556	1633.319	2181.883	1235.828
	240.092	292.860	2708.607	4011.041	2738.796
Total	482.600	1772.695	1973.601	936.546	959.251
	566.791	3881.951	7420.566	1590.952	3224.567

Note to tables: a) All data are expressed in 1980 billion Lira with the exception of employment which refers to the number of employees at the end of fiscal year; b) Standard deviations in small characters.

Table 3: Maximum likelihood Estimates for the Parameters of the Stochastic Frontier with Time Varying Inefficiency

		Metals	Min.Prod.	Chemicals	Met. Prod.	Mec. Eng.	Off.Mac.
β_0	Constant	0.696	0.153	0.593	0.849	1.346	-1.523
		0.235	0.372	0.134	0.290	0.215	0.986
β_M	Materials	0.640	0.875	0.840	0.710	0.776	0.961
		0.070	0.094	0.038	0.081	0.040	0.183
β_K	Capital	0.213	0.303	0.103	0.162	0.165	-0.911
		0.078	0.065	0.027	0.077	0.049	0.277
β_L	Labour	0.028	-0.071	0.002	-0.049	-0.167	0.975
		0.074	0.113	0.048	0.103	0.079	0.461
β_T	Year	-0.001	0.020	-0.015	0.013	-0.022	0.147
		0.011	0.012	0.005	0.014	0.010	0.042
β_{MM}	$(\text{Materials})^2$	0.088	0.051	0.045	0.073	0.081	0.056
		0.006	0.014	0.003	0.007	0.005	0.009
β_{KK}	$(\text{Capital})^2$	0.009	0.019	0.000	0.006	0.015	-0.036
		0.005	0.007	0.000	0.002	0.003	0.016
β_{LL}	$(\text{Labour})^2$	0.030	0.069	0.062	0.065	0.087	-0.067
		0.010	0.012	0.005	0.010	0.008	0.061
β_{TT}	$(\text{Year})^2$	0.000	-0.001	0.000	0.000	0.000	-0.002
		0.000	0.000	0.000	0.000	0.000	0.001
β_{MK}	(Materials)(Capital)	-0.077	-0.033	-0.009	-0.034	-0.030	-0.079
		0.012	0.017	0.004	0.013	0.008	0.027
β_{ML}	(Materials)(Labour)	-0.075	-0.076	-0.093	-0.098	-0.129	-0.089
		0.013	0.019	0.005	0.011	0.013	0.044
β_{MT}	(Materials)(Year)	-0.008	-0.009	-0.002	-0.006	-0.001	0.008
		0.002	0.003	0.001	0.002	0.001	0.004
β_{KL}	(Capital)(Labour)	0.034	-0.041	-0.003	0.001	-0.010	0.239
		0.014	0.012	0.004	0.006	0.007	0.065
β_{KT}	(Capital)(Year)	0.002	0.003	0.000	0.000	-0.004	0.020
		0.002	0.002	0.000	0.000	0.002	0.006
β_{LT}	(Labour)(Year)	0.007	0.005	0.004	0.006	0.006	-0.037
		0.002	0.002	0.001	0.003	0.002	0.011
δ_0	Constant	-3.464	-1.382	-0.754	-0.593	0.900	-0.187
		0.535	0.743	0.141	0.338	0.160	0.424
δ_S	Dummy State	2.337	4.150	0.212	-1.831	0.073	0.199
		0.358	1.176	0.306	0.666	0.143	0.659
δ_G	Dummy Group	1.337	2.802	-0.323	-0.620	0.386	-1.097
		0.220	1.254	0.222	0.298	0.159	0.543
δ_M	Dummy Multinat.	0.041	1.564	0.032	-2.798	-0.187	-1.053
		0.350	1.077	0.149	1.145	0.187	0.647
δ_T	Year	0.025	0.000	0.000	-0.012	-0.026	-0.015
		0.007	0.000	0.000	0.008	0.003	0.006
δ_L	Size	0.444	0.042	0.084	-0.005	-0.123	0.072
		0.048	0.082	0.027	0.046	0.026	0.065
δ_{SL}	(Size)(D.State)	-0.318	-0.532	-0.001	0.362	0.002	-0.022
		0.045	0.174	0.033	0.131	0.023	0.097
δ_{GL}	(Size)(D.Group)	-0.213	-0.428	0.041	0.131	-0.046	0.167
		0.034	0.200	0.036	0.053	0.023	0.084
δ_{ML}	(Size)(D.Multinat)	0.001	-0.376	-0.085	0.455	-0.040	0.112
		0.063	0.200	0.026	0.187	0.035	0.093
	σ^2_S	0.030	0.099	0.015	0.070	0.021	0.011
		0.010	0.019	0.001	0.025	0.002	0.002
	γ	0.929	0.929	0.531	0.945	0.671	0.411
		0.025	0.013	0.014	0.021	0.043	0.199
	Log-likelihood	692.501	531.772	1353.510	579.404	996.173	232.309

Table 3 (continued): Maximum likelihood Estimates for the Parameters of the Stochastic Frontier Production Functions with Time Varying Inefficiency

		Elec.Eng.	Transp.Eq.	Food Dr.	Text.Cloth.	Paper Pr.	Rubb.Pl.
β_0	Constant	0.200	0.196	0.672	1.145	0.563	2.328
		0.199	0.290	0.083	0.360	0.170	0.355
β_M	Materials	0.935	0.887	0.798	0.739	0.935	0.714
		0.047	0.068	0.032	0.055	0.061	0.075
β_K	Capital	0.036	0.302	0.176	0.063	0.073	0.162
		0.045	0.091	0.030	0.054	0.055	0.085
β_L	Labour	0.042	-0.123	-0.041	-0.315	-0.034	-0.380
		0.074	0.120	0.031	0.106	0.063	0.112
β_T	Year	0.017	0.019	-0.024	0.019	-0.020	-0.013
		0.009	0.017	0.005	0.013	0.009	0.012
β_{MM}	$(\text{Materials})^2$	0.067	0.078	0.031	0.091	0.079	0.031
		0.006	0.006	0.004	0.004	0.008	0.012
β_{KK}	$(\text{Capital})^2$	0.018	0.052	0.008	0.036	0.021	0.027
		0.005	0.010	0.003	0.006	0.006	0.010
β_{LL}	$(\text{Labour})^2$	0.082	0.131	0.024	0.092	0.104	0.096
		0.010	0.015	0.004	0.009	0.008	0.018
β_{TT}	$(\text{Year})^2$	0.000	-0.001	0.000	0.000	0.000	0.001
		0.000	0.001	0.000	0.000	0.000	0.000
β_{MK}	(Materials)(Capital)	-0.015	-0.018	-0.036	-0.075	-0.029	0.025
		0.009	0.017	0.006	0.009	0.013	0.016
β_{ML}	(Materials)(Labour)	-0.138	-0.152	-0.033	-0.095	-0.163	-0.072
		0.013	0.019	0.006	0.009	0.011	0.017
β_{MT}	(Materials)(Year)	-0.005	0.000	0.004	-0.003	0.003	0.000
		0.002	0.000	0.001	0.001	0.001	0.002
β_{KL}	(Capital)(Labour)	-0.013	-0.096	0.009	0.017	-0.014	-0.075
		0.012	0.021	0.006	0.008	0.012	0.030
β_{KT}	(Capital)(Year)	-0.002	-0.008	-0.003	-0.002	0.001	-0.009
		0.002	0.003	0.001	0.001	0.001	0.003
β_{LT}	(Labour)(Year)	0.006	0.006	0.003	0.004	0.000	0.009
		0.003	0.003	0.001	0.002	0.000	0.004
δ_0	Constant	-2.286	-1.633	-0.003	-1.781	-0.626	1.014
		0.425	0.600	0.092	0.188	0.249	0.172
δ_S	Dummy State	-0.065	1.349	0.153	0.212	-0.839	-2.092
		0.546	0.515	0.098	0.177	0.275	0.662
δ_G	Dummy Group	0.994	2.650	-1.014	-0.634	1.437	-0.203
		0.554	0.999	0.121	0.175	0.373	0.119
δ_M	Dummy Multinat.	1.494	-2.696	-1.006	0.062	2.418	-0.267
		0.340	0.434	0.125	0.132	0.429	0.112
δ_T	Year	-0.004	0.026	0.012	0.009	0.035	0.011
		0.008	0.006	0.002	0.004	0.008	0.006
δ_L	Size	0.275	0.116	-0.088	0.312	0.004	-0.173
		0.044	0.059	0.20	0.031	0.030	0.024
δ_{SL}	(Size)(D.State)	0.030	-0.140	0.076	-0.015	0.155	0.320
		0.071	0.066	0.20	0.026	0.044	0.100
δ_{GL}	(Size)(D.Group)	-0.130	-0.396	0.151	0.097	-0.261	0.048
		0.072	0.148	0.021	0.027	0.068	0.021
δ_{ML}	(Size)(D.Multinat)	-0.203	0.395	0.172	-0.006	-0.442	0.050
		0.051	0.075	0.022	0.023	0.080	0.020
	σ^2_S	0.031	0.074	0.014	0.010	0.031	0.005
		0.007	0.020	0.001	0.001	0.006	0.000
	γ	0.683	0.915	0.528	0.718	0.892	0.585
		0.077	0.025	0.056	0.050	0.025	0.108
	Log-likelihood	930.388	463.750	1354.086	1084.410	769.623	471.880

Table 4: Mean Estimates of Frontier Input Elasticities (M, K, L) and Technical Progress

	Materials	Capital	Labour	Technical Progress
Metals	0.799	0.049	0.169	0.009
	0.006	0.007	0.010	0.001
Mineral Products	0.691	0.119	0.171	0.006
	0.011	0.008	0.010	0.002
Chemicals	0.762	0.028	0.214	0.008
	0.003	0.003	0.004	0.001
Metal Products	0.707	0.054	0.239	0.008
	0.007	0.009	0.011	0.001
Mechanical Engineering	0.725	0.049	0.200	-0.002
	0.005	0.007	0.009	0.001
Office Machinery	0.659	0.027	0.512	0.006
	0.014	0.021	0.033	0.003
Electrical Engineering	0.709	0.030	0.274	0.013
	0.005	0.007	0.008	0.001
Transport Equipment	0.663	0.061	0.288	0.010
	0.007	0.013	0.016	0.002
Food and Drink	0.842	0.060	0.106	0.001
	0.003	0.004	0.005	0.001
Textiles andClothing	0.758	0.088	0.400	0.010
	0.005	0.005	0.024	0.003
Paper and Printing.	0.718	0.060	0.224	0.007
	0.007	0.006	0.008	0.001
Rubber and Plastics	0.765	0.045	0.086	0.011
	0.009	0.010	0.019	0.004

Table 5: Generalised Likelihood-ratio tests of Hypotheses for the Parameters of the Stochastic Frontier Production Functions

Null Hypothesis	Metals	Min.Prod	Chemical	Met. Prod.	Mec. Eng.	Off.Mac.	Crit. val. (5%)
Frontier Function							
$\beta_{jk}=0$ j,k=M,K,L,T (Cobb Douglas)	299.04	85.44	657.17	409.71	330.60	124.43	18.30
$\beta_{MT}=\beta_{KT}=\beta_{LT}=0$ (Neutral technical change)	51.25	11.98	55.54	20.74	45.78	67.92	7.81
$\beta_{T}=\beta_{jT}=0$ j=M,K,L,T (No technical change)	79.76	38.74	280.24	40.73	85.78	94.94	11.07
Inefficiency Model							
$\gamma=\delta_0=\delta_T=\delta_L=\delta_S=\delta_G=\delta_M=\delta_{SL}=\delta_{GL}=\delta_{ML}=0$ (No inefficiency effects)	162.53	101.64	286.06	132.24	140.09	110.81	17.67
$\delta_S=\delta_G=\delta_M=\delta_{SL}=\delta_{GL}=\delta_{ML}=0$ (No ownership effects)	40.11	50.50	259.61	30.09	100.85	76.75	14.44
$\delta_S=\delta_{SL}=0$ (No State owned differential)	36.29	41.79	92.14	16.52	28.73	2.50	5.99
$\delta_G=\delta_{GL}=0$ (No affiliated differential)	4.34	8.02	104.68	8.91	25.51	4.13	5.99
$\delta_M=\delta_{ML}=0$ (No for. Subs. differential)	0.41	5.39	80.66	5.70	48.49	14.07	5.99

Null Hypothesis	Elec.Eng.	Transp. Eq.	Food Dr.	Text. Cloth.	Paper Pr.	Rubb.Pl.	
Frontier Function							
$\beta_{jk}=0$ j,k=M,K,L,T (Cobb Douglas)	335.55	262.55	233.81	542.22	476.45	96.14	18.30
$\beta_{MT}=\beta_{KT}=\beta_{LT}=0$ (Neutral technical change)	8.40	8.55	32.24	12.69	29.41	6.70	7.81
$\beta_{T}=\beta j_{K}=0$ j=M,K,L,T (No technical change)	60.77	50.07	37.46	48.58	82.36	19.67	11.07
Inefficiency Model							
$\gamma=\delta_T=\delta_L=\delta_S=\delta_S=\delta_G=\delta_M=\delta_{SL}=\delta_{GL}=\delta_{ML}=0$ (No inefficiency effects)	87.61	117.90	148.87	115.15	158.09	55.14	17.67
$\delta_S=\delta_G=\delta_M=\delta_{SL}=\delta_{GL}=\delta_{ML}=0$ (No ownership effects)	33.17	37.11	130.74	42.16	38.80	43.15	14.44
$\delta_S=\delta_{SL}=0$ (No State owned differential)	11.96	19.49	128.08	26.33	7.42	15.64	5.99
$\delta_G=\delta_{GL}=0$ (No affiliated differential)	10.40	2.28	6.58	17.02	7.95	31.54	5.99
$\delta_M=\delta_{ML}=0$ (No for. subs. differential)	19.57	3.23	5.68	3.18	20.37	18.35	5.99

Table 6: Technical Efficiency Differentials with respect to Independent Firms

	State Owned Firms		Group Firms		Multinationals	
	Mean	Med.	Mean	Med.	Mean	Med.
Metals	0.388	0.425	0.028	0.053	0.046	0.046
	0.106	0.110	0.048	0.049	0.051	0.052
Mineral Products	0.870	0.904	0.161	0.188	-0.755	-0.731
	0.203	0.208	0.119	*0.121*	0.243	*0.235*
Chemicals	0.203	0.203	-0.072	-0.071	-0.490	-0.492
	0.046	0.046	0.044	0.044	0.024	0.025
Metal Products	0.291	0.284	0.151	0.149	-0.125	-0.133
	0.119	0.117	0.078	0.078	0.070	0.073
Mechanical Engineering	0.085	0.084	0.089	0.093	-0.445	-0.442
	0.023	0.024	0.023	0.024	0.078	0.076
Office Machinery	0.049	0.058	0.031	-0.035	-0.296	-0.340
	0.049	0.060	0.057	-0.048	0.063	0.079
Electrical Engineering	0.130	0.126	0.149	0.167	0.175	0.204
	0.113	0.121	0.115	0.122	0.058	0.059
Transport Equipment	0.386	0.408	-0.067	-0.004	0.018	-0.045
	0.115	0.120	0.065	0.062	0.107	0.098
Food and Drink	0.579	0.574	-0.162	-0.172	-0.038	-0.050
	0.063	0.062	0.023	0.023	0.019	0.019
Textiles andClothing	0.124	0.124	-0.049	-0.050	0.029	0.029
	0.030	0.030	0.021	0.021	0.017	0.017
Paper and Printing.	0.103	0.087	-0.149	-0.123	-0.266	-0.222
	0.042	0.042	0.052	0.046	0.076	0.070
Rubber and Plastics	-0.122	-0.384	0.091	0.052	0.037	-0.003
	0.062	0.133	0.017	0.014	0.018	0.014

Table 7: Mean Technical Efficiencies by Industry and Form of Ownership

	Independent Firms	State Owned Firms	Group Firms	Multinationals	Total
Metals	0.963	0.884	0.942	0.940	0.938
Mineral Products	0.932	0.881	0.923	0.956	0.931
Chemicals	0.974	0.937	0.970	0.990	0.980
Metal Products	0.914	0.922	0.920	0.919	0.918
Mechanical Engineering	0.927	0.924	0.924	0.978	0.942
Office Machinery	0.918	0.795	0.747	0.933	0.883
Electrical Engineering	0.969	0.926	0.953	0.953	0.955
Transport Equipment	0.921	0.877	0.932	0.938	0.913
Food and Drink	0.981	0.876	0.987	0.983	0.976
Textiles andClothing	0.827	0.583	0.762	0.748	0.808
Paper and Printing.	0.929	0.900	0.948	0.953	0.936
Rubber and Plastics	0.845	0.937	0.873	0.902	0.872
Total	0.924	0.894	0.920	0.959	0.930

Table 8: Mean Technical Efficiencies by Size and Form of Ownership

	Independent Firms	State Owned Firms	Group Firms	Multinationals	Total
Small	0.947	0.911	0.932	0.960	0.946
Medium	0.913	0.899	0.928	0.966	0.930
Large	0.895	0.888	0.909	0.951	0.913
Total	0.924	0.894	0.920	0.959	0.930

7 Data Appendix

The panel of firms used in this paper was constructed by using "Le Principali Società Italiane" directory, published yearly by Mediobanca Investment Bank. Each release of this directory includes balance sheet data for two consecutive years for a variable number of medium-large sized companies. Over the 1977-93 period the total number of firm-year observations amounts at 23761. Time series were obtained by merging data coming from several releases. The outcome of this operation is an unbalanced panel of 3982 firms with a minimum of 1 and a maximum of 17 observations.

From Mediobanca directories, information is available on the occurrence of extraordinary operations including major mergers, acquisitions or divestments. Since in these cases balance sheet data are unlikely to be comparable with data from either the previous or the following year, observations in years where an extraordinary operation occurred are excluded from the sample. For the purpose of the present paper firms outside manufacturing as well as manufacturing firms with less than 4 observations have also been excluded. At the end of this cleaning process we are left with an unbalanced panel of 1306 firms and 9816 firm-year observations. Table A.1 reports the number of firms and firm-year observations by industry and type of ownership.

Table A.1: Panel data Characteristics

Industry	Firms	Observations (Total)	Independent Firms	State Owned Firms	Group Firms	Multinationals
Metals	78	555	254	134	106	61
Mineral Products	89	654	363	55	102	134
Chemicals	171	1327	377	108	88	754
Artificial Fibres	8	65	16	16	33	0
Metal Products	81	638	303	171	59	105
Mechanical Engineering	140	1082	465	158	114	345
Office Machinery	26	224	30	19	44	131
Electrical Engineering	158	1144	371	117	192	464
Transport Equipment	76	612	197	188	125	102
Food and Drink	176	1288	859	78	97	254
Textiles andClothing	156	1074	864	33	105	72
Wooden Products	14	109	99	0	10	0
Paper and Printing.	90	706	350	53	206	97
Rubber and Plastics	43	338	146	9	72	111
Miscellaneous Industries	12	93	29	6	6	52
Total	1306	9816	4694	1139	1353	2630

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(xlii) This paper was presented at the International Workshop on "Climate Change and Mediterranean Coastal Systems: Regional Scenarios and Vulnerability Assessment" organised by the Fondazione Eni Enrico Mattei in co-operation with the Istituto Veneto di Scienze, Lettere ed Arti, Venice, December 9-10, 1999.
(xliii)This paper was presented at the International Workshop on "Voluntary Approaches, Competition and Competitiveness" organised by the Fondazione Eni Enrico Mattei within the research activities of the CAVA Network, Milan, May 25-26,2000.
(xliv) This paper was presented at the International Workshop on "Green National Accounting in Europe: Comparison of Methods and Experiences" organised by the Fondazione Eni Enrico Mattei within the Concerted Action of Environmental Valuation in Europe (EVE), Milan, March 4-7, 2000
(xlv) This paper was presented at the International Workshop on "New Ports and Urban and Regional Development. The Dynamics of Sustainability" organised by the Fondazione Eni Enrico Mattei, Venice, May 5-6, 2000.
(xlvi) This paper was presented at the Sixth Meeting of the Coalition Theory Network organised by the Fondazione Eni Enrico Mattei and the CORE, Université Catholique de Louvain, Louvain-la-Neuve, Belgium, January 26-27, 2001

(xlvii) This paper was presented at the RICAMARE Workshop “Socioeconomic Assessments of Climate Change in the Mediterranean: Impact, Adaptation and Mitigation Co-benefits”, organised by the Fondazione Eni Enrico Mattei, Milan, February 9-10, 2001
(xlviii) This paper was presented at the International Workshop “Trade and the Environment in the Perspective of the EU Enlargement ”, organised by the Fondazione Eni Enrico Mattei, Milan, May 17-18, 2001
(xlix) This paper was presented at the International Conference “Knowledge as an Economic Good”, organised by Fondazione Eni Enrico Mattei and The Beijer International Institute of Environmental Economics, Palermo, April 20-21, 2001
(l) This paper was presented at the Workshop “Growth, Environmental Policies and Sustainability” organised by the Fondazione Eni Enrico Mattei, Venice, June 1, 2001
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(lv) This paper was presented at the First Workshop of the Concerted Action on Tradable Emission Permits (CATEP) organised by the Fondazione Eni Enrico Mattei, Venice, Italy, December 3-4, 2001
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