PATTERNS OF CORPORATE GOVERNANCE AND TECHNICAL EFFICIENCY IN ITALIAN MANUFACTURING.

Sergio Destefanis
CELPE
University of Salerno, Italy

Vania Sena*
LUBS
University of Leeds, UK

Abstract

The purpose of this paper is to analyse the relationship between the corporate governance system and technical efficiency in Italian manufacturing. We use a non-parametric frontier technique (DEA) to derive technical efficiency measures for a sample of Italian firms taken from 9 manufacturing industries. These measures are then related to the characteristics of the corporate governance system. Two of these characteristics turn out to have a positive impact on technical efficiency: the percentage of the company shares owned by the largest shareholder and the fact that a firm belongs to a pyramidal group. Interestingly, a trade-off emerges between these influences, in the sense that one is stronger in industries where the other is weaker.

*Corresponding author. Address: LUBS, Clarendon Road, The University of Leeds, LS2 9JT, Leeds, United Kingdom. E-mail: vs@lubs.leeds.ac.uk .

1. Introduction

The purpose of this paper is to analyse the relationship between the corporate governance system and productive (technical) efficiency in Italian manufacturing. The Italian corporate governance system has some distinctive features that make it quite different from the Anglo-Saxon system. It is characterised by a high degree of direct ownership concentration, both for listed and unlisted companies; owners are mainly physical persons, often linked by family relationships to other investors in the firms, with a very limited involvement of financial intermediaries. Besides, more than 50% of Italian industrial companies belong to a pyramidal group[1] where "upstream" firms along the chain of control directly own majority stakes in "downstream" firms. This structure has allowed stable control to be exerted over both small and large Italian companies in an environment where hostile take-overs as a disciplinary device play no role (Bianchi *et al.*, 1997; Visintin, 1999).

These features of the corporate governance system are regarded by the corporate finance literature as an optimal response to the asymmetric information problem arising from the separation between ownership and control in institutional settings where there is scant protection of minority shareholders. Indeed, in countries (like Italy) with poor protection of minority shareholders,[2] losing control involuntarily and thus becoming a minority shareholder may be so costly a proposition in terms of relinquished private benefits that the controlling shareholders do everything to keep control, keeping their voting rights to themselves and having little interest in selling shares in the market.

The impact of a corporate governance system of this kind upon firm performance is ambiguous: clearly, concentration of shareholdings has the advantage of aligning cash flow

[1] Here we use the definition of 'pyramidal group' provided by Gugler (2001): a pyramidal group is a business entity where legally independent firms are controlled by the same family or institution through a chain of unidirectional ownership relations.

[2] According to Bianchi *et al.* (1997), examples of the fact that minority shareholders are poorly protected are the following: fiduciary duties of company directors are difficult to enforce; proxy fights are discouraged by a very strict regime for proxies, and take-over rules are inefficient.

and the control rights of outside investors. Large shareholders address the agency problem in that they have both a general interest in profit maximisation and enough control over the assets of the firm for their interests to be respected. Performance is therefore expected to improve with large shareholder ownership. However, as ownership concentration grows to very large proportions, owners gain nearly full control and may be wealthy enough to prefer to use the firm to generate private benefits of control that are not shared by minority shareholders, with detrimental effects on performance. The impact of ownership concentration on performance is also ambiguous in economic environments where pyramidal groups are very widespread. Indeed, in this case the situation is even less straightforward. Even if no shareholder directly owns a large amount of shares, there is still a large blockholder (either a family or an institutional investor) that ultimately controls the whole group, possibly severing the link between ownership concentration and firm performance and not necessarily acting in the interests of the minority shareholders. On the other hand, belonging to a group may entail more stringent monitoring of firm performance, as well as several types of external economies.

These issues have already been analysed in several empirical studies, briefly surveyed in Section 2, which focus on the link between corporate governance and some measure of profitability (such as Tobin's Q or the ratio of net income to total assets). Some studies have also considered the impact of the Italian corporate governance system on managerial incentives and firm performance. Bianco and Signorini (1996) and Bianco and Casavola (1999) examine the links between types of control, ownership concentration and firm performance, and are in this sense the closest predecessors of the present paper.

Our paper differs from earlier contributions by measuring firm performance through technical efficiency, as defined by the ability to minimise inputs for given outputs or to maximise outputs for given inputs (Farrell, 1957). In our view, financial measures of firms'

performance based on balance sheets are likely to be affected by a host of (fiscal, speculative, short-term) factors not related to the fundamentals of firm performance: they therefore potentially obscure the impact on the latter of the corporate governance system. Relying on technical efficiency has the additional advantage of placing our paper within the very large literature on the frontier analysis of production.[3] This has advantages inasmuch as it provides us with a well defined benchmark. Frontier techniques have been extensively used, also within Italian manufacturing, and various explanations have been provided for the determination of efficiency across firms. Hence derives the interest of gauging the additional explanatory power of the characteristics of the corporate governance system within this field, as we know of no previous attempt to relate efficiency scores to these factors.[4] More precisely, we focus on the relationship between technical efficiency and three features of the corporate governance system: the percentage of firm' s shares owned by the largest shareholder, the possibility that a firm belongs to a pyramidal group, and the institutional characteristics of the main shareholder.

Measuring technical efficiency also required us to conduct the empirical analysis on firms from 9 manufacturing industries, analysing each industry on its own. The data were drawn from the *Mediocredito Centrale* surveys and covered years 1994 and 1997. We adopted a two-stage approach (Lovell, 1993). First, technical efficiency was measured using a non-parametric frontier technique (DEA). The efficiency scores were then related to the characteristics of the corporate governance system and to some other controls through OLS and Logit regression models.

The rest of the paper is organised as follows. Section 2 presents a brief summary of the literature on the relationship between corporate governance and firm performance. Section 3

[3] Fried *et al*. (1993) still provide a very valuable introduction to this literature.
[4] Obviously, there has been a longstanding interest in frontier analysis about the impact of types of ownership on productive efficiency. Our analysis can be seen as a new example of this kind of interest.

describes in some detail the data-set and the empirical procedures; Section 4 presents the results, while Section 5 makes some concluding remarks.

2. The background literature

The relationship between corporate governance features and firm performance has been the object of a large body of analysis both theoretical and empirical. Interest in these issues is prompted by the fact that corporate governance mechanisms are supposedly able to solve the basic agency problem existing within the firm due to the separation between ownership and control (Jensen and Meckling, 1976; Fama and Jensen, 1983; Shleifer and Vishny, 1997). The essence of this agency problem concerns the difficulties faced by financiers in ensuring that their funds are not expropriated or wasted on unattractive projects which prove detrimental to firm performance.

Corporate governance structures are therefore basic mechanisms with which to solve this asymmetric information problem.[5] Among possible alternatives, the high concentration of control rights in the hands of investors with a collectively large cash-flow stake is a solution typically adopted in institutional frameworks where there is no legal protection of minority shareholders.[6] In the absence of real disciplinary devices, managers have considerable discretion and power to pursue their own objectives, which may not necessarily coincide with those of the shareholders (Roe, 1994). In this case, the problem of management control can be overcome by concentrating both ownership and voting power in the hands of large shareholders. The latter have a strong incentive to monitor managers closely, since a large fraction of the benefits of monitoring can be appropriated. Also, concentrated voting rights equip shareholders with the necessary power to influence the decision-making process. In

[5] Zingales (1997) defines a corporate governance system as "a complex set of constraints that shape the *ex post* bargaining over the quasi rents generated in the course of a relationship".
[6] See Schleifer and Vishny (1997) for a survey of the different institutional solutions to the problem of separation between ownership and control.

many countries, large shareholdings in some form are the norm. La Porta *et al.* (1997, 1999) point out that ownership of large companies in rich economies is typically concentrated among controlling shareholders, most of which are families often actively involved in company management. In Germany, large commercial banks control over a quarter of the votes in major companies (through proxy voting arrangements); in France, cross-ownership and so-called core investors are common; in Italy, as well as in Finland and Sweden, corporations typically have controlling owners who are often the founders or their off-spring.[7]

Of course, this solution to the agency problem may entail some costs. Large investors represent their own interests, which may not coincide with those of other investors in the firm or of other stakeholders. In using their control rights to maximise their own welfare, large investors may collude with managers and other large shareholders, thus expropriating minority shareholders and using the firm to generate private benefits of control, with potentially detrimental effects on firm performance (Burkart *et al*., 1997; Pagano and Roell, 1998). In addition, ownership concentration in the hands of large shareholders may reduce market liquidity and restrict possibilities for diversification.

The benefits from large shareholder control and the costs of the potential expropriation of minority shareholders on firm performance have already been subject to empirical scrutiny. Morck *et al*. (1988) present evidence on the relationship between cash-flow, managerial ownership (percentage of shares owned by the board of directors) and Tobin's Q for a sample of large US firms. They find a positive relationship between managerial ownership and Tobin's Q in the range of ownership between 0% and 5%, a negative relationship between 5% and 25%, and again a positive relationship beyond the 25% level. One interpretation of this result is that, consistently with the role of incentives in reducing agency costs, performance at first improves with higher managerial ownership (*convergence of interests*). However, as large owners gain further control, they are wealthy enough to prefer to use firms to generate

[7]See also Bebchuck and Roe (1999) on this.

private benefits not shared by minority shareholders (*entrenchment*). In a refinement, the authors find that among older firms, the presence of the founding family on the board reduces Tobin's Q on average, whereas among younger firms, the presence of the founding family raises the Q. This suggests that the founders (or their off-spring) in old firms are too entrenched to be removed.

Further evidence on the US, corroborating the above results, is provided by Wruck (1989), McConnell and Servaes (1990) and Kole (1995). The analysis in Kole (1995) suggests that the positive relationship between firms' performance and ownership is sustained at higher levels of ownership for small firms than it is for large firms. Investigation of the impact of ownership concentration on firms' performance in European countries has focused mostly on the role played in this respect by pyramidal groups. Indeed, in European countries (with the notable exception of UK) concentrated holdings of voting blocks are very common, which implies that the main conflict of interest is likely to arise between the ultimate owner of the company and minority shareholders. Large blockholders (controlling whole groups) may try to expropriate minority shareholders also in the absence of a large shareholder. On the other hand, belonging to a group may entail more stringent monitoring of firm performance, as well as several types of external economies (greater specialisation, closer control over sale and purchase channels, reduction of risk and of credit constraints and so on). In the absence of pyramidal groups, a relationship between ownership concentration and firm performance should reappear, possibly along the non-monotonic lines described above for the US. The studies cited in Gugler (2001) analyse the links between corporate governance and firms' performance in Continental European countries. None of these studies establishes a consistent link between ownership concentration and firm performance. No consistent relationship is found either between firm performance and the nature of the main shareholder (family groups, corporate groups, individuals). Most of these studies, however, do not take simultaneous account of ownership concentration and the nature of the main shareholder. Some empirical

studies have also been carried out on Italian firms. Caprio and Floreani (1994) test for the possibility of rent extraction from large shareholders by analysing the effects of control transfers on stock market prices. Brunello *et al*. (2001) analyse the implications of the Italian corporate governance system for the determination of executive pay levels. Bianco and Signorini (1996) compare the growth in various indicators (sales, investments, labour productivity) across different control models (absolute control, family control, coalition control and group control) in a sample of Italian manufacturing firms organised into the four Pavitt sectors. They do not find very significant relationships between performance and control models. Bianco and Casavola (1999), using a different sample of Italian manufacturing firms, find that ROI, ROS and a proxy for managerial ability are lower for firms belonging to pyramidal groups. The profitability measures are also related to ownership concentration in a non-monotonic fashion. The lowest ROI and ROS are achieved where the largest shareholder owns more than 66% of the voting capital, whereas the highest ones are attained at an intermediate level where the largest shareholder holds between 50% and 66% of the equity. The explanation offered for these results is that both high ownership concentration and pyramidal groups make control insufficiently contestable, which hampers the efficient selection of controlling agents.

As this short survey has made clear, there is still considerable uncertainty about the nature of the relationships between corporate governance system and technical efficiency, particularly in countries where pyramidal groups are very common. The aim of our analysis was to provide new and more robust evidence in this regard by relying on technical efficiency as a measure of performance, and by simultaneously controlling for three sets of potentially relevant corporate governance variables: ownership concentration, nature of the main shareholder, presence of pyramidal groups. This enabled us to assess the probable interactions among these factors.

3. The data-set and the empirical framework

a) The data-set

The empirical analysis was carried out on a sample of Italian manufacturing firms taken from the 6th and 7th *Mediocredito Centrale* surveys for years 1994 and 1997. The *Mediocredito Centrale* survey (henceforth the Survey) is one of the most complete sources of information about Italian manufacturing. It is conducted on firms (not plants or establishments) with more than 10 employees. The procedures for data collection are mixed: sampling is adopted for firms with 11 to 500 employees, the sample being a stratified one with random extraction. For firms with more than 500 employees, the Survey covers the entire population. The sampling strata are singled out on the basis of the number of employees and of the class of activity. The sample dimension for each stratum is determined according to Neyman's formula, in a manner such that it is representative of the population at the level of each administrative region.

We had balance-sheet data from 1992 to 1997, as well as qualitative and quantitative data on the structural characteristics of the sampled firms, regarding the legal and organisational structure of the firm, its investment and financial policy, the quality of its human capital and its R&D investment. However, most of these structural data, including those relating to the corporate governance system, were only available for 1994 and 1997. We consequently concerned ourselves with those two years only.

It is a well known tenet of efficiency analysis that, in order to get meaningful frontier estimates, one should consider firms characterised by a similar technology. In the present context, this means that the empirical analysis should have been carried out at a level of aggregation low enough for the above condition to obtain. This implied disaggregating the manufacturing sector into different industries, bearing in mind that the samples obtained should be reasonably large. Indeed, recent studies (Kneip *et al*., 1998; Gijbels *et al*., 1999)

have shown that a major problem of small-sample bias arises when non-parametric frontier approaches are used. We therefore carried out the empirical analysis for the manufacturing industries listed in Table 1 (whose names follow the NACE Rev. 1 classification).We did not consider other industries because the samples constructed for them were substantially smaller (from 100 to 150 observations: according to the evidence reported in Kittelsen, 1999, DEA begins to be characterised by substantial small-sample bias around these values). Also to be noted is that our samples pooled 1994 and 1997 together. In order to obtain larger samples, we did not estimate separate frontiers for these two years, which are close enough to lend credibility to the assumption of a common technology.

b) The empirical procedure

The format of our empirical analysis is straightforward enough. First we applied a non-parametric frontier technique, DEA-VRS (Banker *et al.*, 1984), to a conventional production set in order to measure technical efficiency across firms (computing the so-called efficiency scores). Then we adopted techniques also well established in the literature to assess the relationship between the efficiency scores and a set of explanatory variables. These variables included a dummy for the observations belonging to 1997, some factors widely believed in the international and Italian literature to be closely associated with technical efficiency (basically dimensional and territorial dummies), and three sets of characteristics of the corporate governance system. We took various functions of the percentage of shares owned by the largest shareholder, a binary variable equal to one if a firm belonged to a pyramidal group, and two binary variables equal to one if the main shareholder was, respectively, a foreign resident or a physical person.

It is well known that DEA-VRS can be input-oriented if the linear program minimises inputs for given outputs, output-oriented if the linear program maximises outputs for given

inputs, and non-oriented if the linear program simultaneously maximises outputs and minimises inputs. The latter choice seemed to be particularly desirable in our case, where no assumptions could be made with any confidence about the exogeneity of either inputs or outputs (unless we were prepared to assume perfect competition throughout all firms and industries). The technical efficiency scores were obtained from:

$$\max \{ \theta \mid [(1 - \theta) X^k , (1 + \theta) Y^k] \in T \}$$

where X^k and Y^k are the inputs and outputs of any given observation k, and T denotes the technology.[8]

A further advantage of DEA is, of course, that no assumption is required concerning the functional form of the production frontier. On the other hand, DEA does not allow for the presence of stochastic noise in the data generation process. Moreover, relying on a non-parametric technique makes the above described two-stage procedure unavoidable, because the usual regularity assumptions underlying DEA can only be made with sufficient confidence for a restricted set of conventional inputs and outputs. In particular, the relationship between output and the characteristics of the corporate governance system, for given values of the other inputs, can in principle be either positive or negative and can only be assessed through regression analysis.

c) The variables

As already said, we followed the existing literature on efficiency measurement as closely as possible. Starting with the DEA production set, *value added* was chosen as the (only) measure of output; while the *gross book value of depreciable assets* and the *number of employees* were used as measures of the capital and labour inputs respectively. Moreover, the

[8] Calculations were performed using the *EMS* package kindly made available by Holger Scheel, Universität Dortmunds, Germany. Further details on the algorithms can be found in Scheel (2000).

literature on Italian manufacturing[9] suggests that the labour input can be measured much better if employees are split into *blue and white collars*. We included two more variables in this production set: *the degree of educational attainment*, as measured by the weighted average of the years spent in education by the employees, and a binary variable controlling for the *research and development* (R&D) *activities* within the firm.

Once DEA had been applied to the above production set, the efficiency scores obtained were regressed on their potential determinants. Ownership concentration was measured by the percentage of company shares owned by the largest shareholder and by various functions of this variable. Following most of the literature, we allowed for a non-monotonic relationship between ownership concentration and firm performance. More specifically we constructed five binary variables taking the value of 1 when the percentage of shares held by the main shareholder was between the ranges specified below and 0 otherwise.[10] The ranges considered were: a) between 50% and 66%, b) between 66% and 99%, c) between 50% and 99%, d) above 66%, e) above 99%. The choice of the cut-off points was suggested by a variety of considerations. The 66% level was chosen because, under Italian company law, it enables the main shareholder to carry out important transactions without any other shareholder being able to intervene. The choice of 99% was prompted by the desire to ascertain whether absolute control has some particular impact on efficiency, as suggested by the literature on Italian capitalism (Bianco and Signorini, 1996).

We then checked whether the firm belonged to a pyramidal group or not. As already said, the existence of pyramidal groups is a distinctive feature of Italian capitalism. According to Bianco and Casavola (1999), pyramidal groups make control insufficiently contestable, hampering the efficient selection of controlling agents. On the other hand, belonging to a group may entail more stringent monitoring of firm performance, as well as several types of

[9] See for instance Balloni (1984), Prosperetti and Varetto (1991), Ofria (1997), who all carry out their empirical analyses on previous issues of the Survey.

external economies. Finally, we included among the corporate governance variables two dummies accounting for the characteristics of the main shareholder. Following Bianco and Casavola (1999), we focused on two possible types: a foreign resident, or a physical person residing in Italy. In the first case a favourable impact was expected on performance, given that foreign residents should monitor firms more stringently. On the contrary, in the second case the company was supposed to be run with less emphasis on monitoring.

As for the other potential determinants of efficiency, it is a well established in the Italian literature that location matters for productive efficiency. This can probably be ascribed to the operation of local factors such as infrastructure endowment, external economies linked to technological potential and level of industrialisation, the presence of organised crime, and so on. We controlled for these factors in our analysis by using four *territorial dummies* (following common practice, we divided Italy in North-West, North-East, Centre and South). Another factor widely believed to have an impact on efficiency is size. We controlled for this by sorting out the firms into five size categories (which again were derived from common practice): a) from 11 to 20 employees, b) from 21 to 50 employees, c) from 51 to 250 employees, d) from 251 to 500 employees, e) more than 500 employees. Five *dimensional dummies* were then constructed from this classification.[11]

4. The results

We first describe the main results, then assess their robustness, and finally provide a first attempt at their interpretation.

a) The main results

[10] Squared and cubic functions of the percentage of shares owned by the largest shareholder were also used, but they never proved significant and are not reported in the results.

[11] Obviously, in regression analysis one of the territorial dummies and one of the dimensional dummies were left out to avoid the so-called multicollinearity trap.

Table 2 shows some descriptive statistics of the DEA non-oriented technical efficiency scores for each industry. To repeat, in this case we computed the efficiency scores from a production set including value added as output, while the inputs were the stock of capital, blue-collar employees, white-collar employees, educational attainment and an R&D dummy.

The efficiency scores generally have pretty high mean values (with the exception perhaps of Non-electrical machinery). Also, their standard deviations are reasonably low. These descriptive statistics suggest that the production sets were sufficiently well specified and yielded reliable technical efficiency scores.

Tables 3 and 4 set out the main results obtained from regressing the DEA scores on the set of explanatory variables illustrated in the previous section. In order to allow for sectoral heterogeneity, we ran a different regression for each industry. Two types of regression models were used: OLS and Logit (the Eviews 3.1 package was used in both cases). As efficiency scores are variables bounded between zero and one, OLS were applied on the transformation of the efficiency scores suggested in Kalirajan and Shand (1988) which allows them to vary between $-\infty$ and $+\infty$. The Logit exploits the distribution of scores between zero and one in a different way. If we construct a dependent variable taking the value of 1 if the firm has an efficiency score of 1 (is efficient) and 0 otherwise, the Logit can be used to determine whether the corporate governance pattern helps in predicting the probability that a firm will be on the frontier. For OLS, we relied on White heteroskedasticity-consistent variance-covariance matrices to compute the standard errors.

Different specifications were estimated for each of these regression models. The baseline specification only included the 1997 dummy, the territorial and dimensional dummies, plus the dummies for the type of the main shareholder (denoted TYPE1 and TYPE2) and the pyramidal group dummy (denoted GROUP). This specification was augmented in several ways. First, we introduced PRC, the percentage of shares owned by the largest shareholder.

Then, we allowed for a non-monotonic relationship between ownership concentration and technical efficiency, through dummies controlling for different ranges of ownership concentration. We simultaneously controlled for the following ranges: a) between 50% and 66% and above 66% (dummies SH1A and SH2); b) between 50% and 99% and above 99% (dummies SH1B and SH3); c) between 66% and 99% and above 99% (dummies SH1C and SH3).The results obtained suggested two additional specifications which controlled *only* for ranges between, respectively, 50% and 99% (through dummy SH1B), and 60% and 99% (through dummy SH1C).

In order to present the results more compactly, we report the t-ratios for GROUP, TYPE1 and TYPE2 from the baseline specification only, as well as the t-ratios for the ownership concentration proxies from their respective equations. From the baseline specification we also report R^2 and F-statistic for the OLS, and Mc Fadden R^2 and LR-statistic for the Logit. We focus on the t-ratios because we are mainly interested in the significance and sign of corporate governance variables. The other diagnostics for the baseline equation are indicative of the explanatory power of our estimates.

There is broad consistency between the OLS and Logit results. The fit is not very close, but the R^2's are perfectly comparable to those obtained in the literature. Moreover, the control variables included in the baseline specification are always very comfortably jointly significant. In Table 3, at least one of the ownership concentration variables is positive and significant (at the 10% level) in four industries (Apparel; Food, beverages and tobacco; Non-electrical machinery; Rubber and plastic products); it is negative and significant for Fabricated metal products. In Apparel and Non-electrical machinery we find a linear relationship between ownership concentration and technical efficiency, while in the other industries the relationship appears to be non-monotonic. The pyramidal group dummy is positive and significant in five industries (Food, beverages and tobacco; Chemicals; Fabricated metal products; Non-electrical machinery; Non-metallic mineral products). In

accordance with a priori expectations, a trade-off emerges between the effects of the two sets of variables. This is made clearer by Table 5, which contrasts the t-ratio for GROUP with the highest t-ratio for one of the ownership concentration variables.A clear negative correlation appears between the two sets of variables. The Spearman rank correlation coefficient between these values is –0.50. Much less of a pattern is apparent for the TYPE1 and TYPE2 dummies: TYPE1 is significant in two industries only and with an a priori unexpected (negative) sign, TYPE2 is marginally significant in one industry only.

Very similar considerations apply to the Logit results presented in Table 4. At least one of the ownership concentration variables is positive and significant in four industries (Apparel; Chemicals; Non-electrical machinery; Rubber and plastic products); it is negative and significant for Fabricated metal products. Once again there is a linear relationship between Apparel and Non-electrical machinery and a non-monotonic relationship among the other industries. The pyramidal group dummy is positive and significant in four industries (Food, beverages and tobacco; Chemicals; Fabricated metal products; Non-metallic mineral products). A trade-off emerges between the effects of the two sets of variables in this case too. Consider Table 6, which is the analogue of Table 5.The Spearman rank correlation coefficient between these values is –0.31. Note that most of the t-ratios are higher than the OLS ones. A possible explanation is that the OLS standard errors are biased because the efficiency scores are not independently distributed (there is correlation between the scores of firms dominated by the same facet of the production frontier). Finally, TYPE1 and TYPE2 are never significant.

b) Assessing robustness

As far as the OLS regressions are concerned, the most likely source of bias in the results is the presence of outliers among the efficiency scores. As already said, DEA cannot allow for stochastic noise in the production set. Hence, very low scores (say below 0.15-0.20) may

simply reflect the occurrence of some exceptional circumstances. These outliers may bias at least the standard errors for our OLS estimates (possibly the coefficients too if they are correlated with the regressors). In an attempt to protect our estimates against these potential biases, we applied OLS to a sample from which we excluded the lower 5% of the efficiency scores. The results, given in Table 7, show much the same patterns as in Table 3. T-ratios generally increase and now also approach significance for the ownership concentration variable in Electrical machinery and apparatus. More importantly, there is always a trade-off between the impacts of group and ownership concentration.

Modifying the sample would be of very little relevance for the Logit. However, the robustness of these results could be assessed by computing GLM standard errors, which are robust to general misspecification of the conditional distribution of the dependent variable, as well as to heteroskedasticity (see for instance Fahrmeir and Tutz, 1994). As can be seen from Table 8, the t-ratios obtained with these standard errors are very similar to the previous ones, which is evidence in favour of the soundness of the Logit estimates.

c) A first attempt at interpretation

We now attempt to provide some explanation for the sectoral characteristics of our results. Our main points of interest are (a) why pyramidal groups are significant in some particular industries and ownership concentration is significant in some others; (b) why there is a linear relationship between ownership concentration and technical efficiency in some industries (Apparel, Non-electrical machinery), whereas in other industries (Chemicals, Electrical machinery, Food and, to some extent, Rubber) the relationship appears to be non-monotonic.

Considering the univariate distributions of corporate governance variables (within and between industries) proves to be of little help in answering these questions. On the other hand,

one may usefully start from the suggestion in Kole (1995) to the effect that firm size matters in determining the relationships between firms' performance and corporate governance variables. Tables 9-10 consider the distribution across size classes of the share of firms belonging to a pyramidal group and of the percentage of shares held by the main shareholder. We provide cell means for three classes: a) *small*, from 11 to 50 employees, b) *medium*, from 51 to 250 employees, c) *large*, more than 250 employees. To facilitate interpretation, we rank industries according to the significance of the GROUP variable (we take the mean of the t-ratios from Tables 3 and 4). It turns out from Table 9 that industries where GROUP is more significant are characterised by a larger share of small firms belonging to a pyramidal group, while the share of medium or large firms belonging to a pyramidal group is immaterial in this respect. Given our priori belief that a positive relationship between GROUP and technical efficiency reflects the operation of external factors, it seems plausible to conclude that this relationship is mostly dictated by what happens to small firms: larger firms are more likely to internalise these factors without belonging to a pyramidal group. Naturally, this raises a further question: why are some industries characterised by a larger share of small firms belonging to a pyramidal group? We cannot provide an answer: considering some customary classifications (like capital intensity or Pavitt classification) is of very little help. Yet, even our descriptive finding is of some interest, as we shall see below.

Turning now to the relationship between ownership concentration and technical efficiency, we find indirect support for the suggestion that the positive relationship between firms' performance and ownership is sustained at higher levels of ownership for small firms than it is for large firms (Kole, 1995). Table 10 clearly shows that larger firms are characterised by a higher percentage of shares held by the main shareholder, with the exception of firms in the Apparel industry. Since the latter is one of the industries characterised by a linear relationship between ownership concentration and technical

efficiency, we may conjecture that industries where this relationship is non-monotonic are also industries where the variation of ownership concentration between size classes is a large proportion of the total variation of ownership concentration: a rise in ownership concentration largely coincides with passage to a higher size class, where entrenchment is more likely. To provide evidence on this, we calculated for each industry the coefficient of variation between size groups and the total coefficient of variation of PRC. The last column of Table 10 reports the ratio between these two coefficients, providing sufficient support for our conjecture. The variation of ownership concentration between size classes is a relatively small proportion of the total variation of ownership concentration in the industries characterised by a linear relationship (Apparel, Non-electrical machinery), while the opposite is for the case of most of the industries characterised by a non-monotonic relationship (Chemicals, Electrical machinery and apparatus, Rubber), although not of Food.

It is fair to point out that the above considerations do not explain either the lack of significance of the share variables in Textiles (while the lack of significance of GROUP in this industry can be explained by the low share of small firms belonging to a pyramidal group), or why there is a significantly negative relationship between ownership concentration and technical efficiency for Fabricated metal products. Indeed, the latter industry is an outlier also because GROUP is highly significant even if pyramidal groups are not very frequent among small firms.

All this descriptive evidence helps shed some light on the implicit assumption of our analysis, and of much of the related literature, to the effect that corporate governance patterns determine performance, not the other way around. In principle, causality could well run in the other direction: successful firms provide incentives to shareholders to increase their stakes (similarly, successful firms are more likely to become part of pyramidal groups).

Recall however that a higher significance of GROUP is associated with a larger share of *small* firms belonging to a pyramidal group, while the correlation between significance of GROUP and share of *large* firms belonging to a pyramidal group is small or even negative. Furthermore, note from Table 9 that the share of firms belonging to a pyramidal group is always larger for large firms. Thus, whatever the factors dictating adhesion to a group may be, they do not seem to be related to the factors determining the significance of GROUP. On the other hand, as already said, if one believes that GROUP is significant because of the operation of external factors, it makes sense to maintain that the significance of GROUP is determined by the share of *small* firms belonging to a pyramidal group.

The "reverse causality" argument would also find it difficult to explain the non-monotonic relationship between ownership concentration and technical efficiency clearly apparent for all industries except Apparel and Non-electrical machinery. While it is widely believed that entrenchment is more likely to occur in large firms and/or at high levels of ownership concentration (the evidence presented here favours the former alternative), it is not easy to understand why shareholders should fight shy of absolute control in successful firms.

5. Concluding remarks

This paper has empirically analysed the relationship between corporate governance patterns and technical efficiency in Italian manufacturing. Unlike the Anglo-Saxon system, the Italian corporate governance system is characterised by a high degree of direct ownership concentration. This kind of corporate governance system is considered to be an optimal response to the existence of asymmetric information in countries where minority shareholders have scant protection. Yet the impact of such a corporate governance system upon firms'

productive performance is ambiguous. On the one hand, large shareholders both have a general interest in profit maximisation and exert enough control over the assets of the firm to have their interests respected. On the other hand, as ownership concentration increases, large owners gain nearly full control, and they may be wealthy enough to prefer to use firms to generate private benefits of control that are not shared by minority shareholders, with detrimental effects on firms' performance. The presence of pyramidal groups may complicate things even further. In this case, large blockholders may try to expropriate minority shareholders in order to pursue their own private interests even in the absence of a direct large shareholder. Also, pyramidal groups may have an – a priori ambiguous - influence of their own on firms' performance.

Very few empirical studies have analysed the impact of this corporate governance system on firms' performance in the Italian institutional setting. This paper differs from earlier contributions mainly because of its focus on technical efficiency and on the interactions among the corporate governance variables influencing performance. Hopefully, our evidence may prove relevant to other countries whose corporate governance systems are characterised, like Italy's, by the presence of both large shareholders and pyramidal groups. The impact of various indicators of corporate governance on technical efficiency has been assessed in a sample of firms from Italian manufacturing using a two-stage approach. First, efficiency scores were calculated using the non-parametric DEA technique, and then the link between these scores and corporate governance was appraised by means of regression analysis.

The results suggest that two corporate governance variables have a positive impact on technical efficiency: the percentage of firm' s shares owned by the largest shareholder and the fact that a firm belongs to a pyramidal group. In accordance with a priori expectations, a trade-off emerges between these influences: ownership concentration has a stronger impact on

technical efficiency in industries where the impact of the pyramidal group is weaker. Across industries, a higher significance of GROUP is associated with a larger share of small firms belonging to a pyramidal group. This makes sense if one believes that GROUP is significant because of the operation of external factors: larger firms are more likely to internalise these factors without belonging to a pyramidal group.

Furthermore, in industries where the influence of GROUP is relatively weak, the profit-maximising incentive for large shareholders to promote the technical efficiency of their firms outweighs any inducement to gain private benefits of control with detrimental effects on performance. This is especially true of small firms. For large firms the two effects are broadly of the same strength, and ownership concentration appears to have no significant impact on technical efficiency.

TABLE 1 – The Industry Samples

Industries	**Number of observations**
Apparel	260
Chemicals	241
Electrical machinery and apparatus	400
Fabricated metal products	524
Food, beverages and tobacco	344
Non-electrical machinery	865
Non-metallic mineral products	306
Rubber and plastic products	292
Textiles	496

TABLE 2 – The DEA Efficiency Scores: Some Descriptive Statistics

Industries	Efficiency scores **Mean**	Efficiency scores **Standard deviation**	Efficient DMU's **Number and percent**
Apparel	0.77	0.19	54 (20.8 %)
Chemicals	0.77	0.19	53 (22.0 %)
Electrical machinery and apparatus	0.76	0.17	67 (16.8 %)
Fabricated metal products	0.73	0.16	58 (11.1 %)
Food, beverages and tobacco	0.75	0.18	53 (15.4 %)
Non-electrical machinery	0.61	0.19	68 (7.9 %)
Non-metallic mineral products	0.74	0.18	49 (16.0 %)
Rubber and plastic products	0.74	0.17	50 (17.1 %)
Textiles	0.72	0.18	64 (12.9 %)

TABLE 3. – OLS, complete sample, White heteroskedasticity-consistent standard errors

	Apparel	***Chem***	***Electr***	***Met***	***Food***	***Mach***	***NonMet***	***Rubber***	***Textile***
GROUP	**+0.29**	**+1.76**	**+1.61**	**+2.29**	**+2.00**	**+1.76**	**+2.14**	**+1.52**	**+1.13**
TYPE1	**-3.53**	**-1.23**	**+0.55**	**-1.21**	**-0.92**	**+0.52**	**-5.54**	**-0.36**	**-0.06**
TYPE2	**-1.26**	**-0.37**	**-0.60**	**-0.23**	**+0.08**	**-0.06**	**+0.25**	**+0.49**	**-1.63**
PRC	**+1.88**	**+0.35**	**+1.18**	**-2.56**	**+0.84**	**+1.88**	**-0.21**	**+1.58**	**-0.53**
SH1A	**+0.18**	**+0.71**	**+1.26**	**-0.42**	**-0.38**	**+0.31**	**-0.20**	**+1.03**	**-0.41**
SH2	**+1.43**	**+0.26**	**+1.35**	**-2.02**	**+1.37**	**+1.54**	**-0.17**	**+1.60**	**-0.56**
SH1B	**+0.97**	**+0.78**	**+1.59**	**-1.09**	**+0.92**	**+0.79**	**-0.50**	**+1.67**	**-1.04**
SH3	**+1.24**	**-0.25**	**+0.76**	**-2.45**	**+0.42**	**+1.66**	**+0.51**	**+0.95**	**+0.46**
SH1C	**+1.16**	**+0.28**	**+0.76**	**-1.14**	**+1.71**	**+0.80**	**-0.56**	**+1.24**	**-1.03**

SH3	**+1.27**	**-0.63**	**+0.23**	**-2.46**	**+0.63**	**+1.63**	**+0.60**	**+0.59**	**+0.61**
SH1B	**+0.39**	**+1.06**	**+1.28**	**-0.04**	**+0.81**	**-0.20**	**-0.84**	**+1.30**	**-1.46**
SH1C	**+0.75**	**+0.58**	**+0.71**	**-0.40**	**+1.58**	**+0.08**	**-0.80**	**+1.07**	**-1.39**
Adj. R^2	*0.17*	*0.27*	*0.15*	*0.15*	*0.19*	*0.16*	*0.23*	*0.19*	*0.18*
F-st.	*5.84*	*8.97*	*7.24*	*9.14*	*8.22*	*16.40*	*9.46*	*7.34*	*10.65*

TABLE 4. – Logit, complete sample

	Apparel	***Chem***	***Electr***	***Met***	***Food***	***Mach***	***NonMet***	***Rubber***	***Textile***
GROUP	**+0.15**	**+2.19**	**+1.59**	**+1.79**	**+2.33**	**+0.85**	**+2.14**	**+1.25**	**+0.17**
TYPE1	**--**	**-0.48**	**+0.70**	**-0.40**	**-0.18**	**-0.40**	**-0.00**	**+0.40**	**-0.24**
TYPE2	**-1.40**	**+0.61**	**-0.22**	**-0.51**	**+1.25**	**-0.33**	**+0.97**	**+1.17**	**-0.86**
PRC	**+2.02**	**+0.32**	**+0.15**	**-1.69**	**+0.63**	**+2.46**	**+0.26**	**+1.81**	**-0.18**
SH1A	**+1.55**	**+1.06**	**+0.86**	**-0.42**	**+0.09**	**+0.45**	**+0.02**	**+1.31**	**-0.20**
SH2	**+2.06**	**+0.57**	**+0.61**	**-1.19**	**+0.85**	**+1.74**	**+0.45**	**+2.18**	**-0.62**
SH1B	**+1.96**	**+1.27**	**+0.95**	**-0.40**	**+0.55**	**+0.95**	**-0.05**	**+2.06**	**-0.97**
SH3	**+1.88**	**-0.22**	**+0.05**	**-2.01**	**+0.71**	**+2.07**	**+1.04**	**+1.73**	**+0.25**
SH1C	**+1.32**	**+0.72**	**+0.48**	**-0.14**	**+0.72**	**+0.97**	**-0.12**	**+1.72**	**-1.20**
SH3	**+1.39**	**-0.73**	**-0.37**	**-1.97**	**+0.74**	**+2.11**	**+1.12**	**+1.36**	**+0.34**
SH1B	**+1.15**	**+1.74**	**+1.15**	**+0.74**	**+0.27**	**-0.23**	**-0.71**	**+1.44**	**-1.32**
SH1C	**+0.81**	**+1.21**	**+0.71**	**+0.68**	**+0.49**	**+0.12**	**-0.60**	**+1.32**	**-1.47**
McFadden R^2	*0.11*	*0.16*	*0.10*	*0.10*	*0.13*	*0.09*	*0.16*	*0.11*	*0.12*
LR-stat.	*29.10*	*40.15*	*34.69*	*37.12*	*38.91*	*43.69*	*43.16*	*28.92*	*44.89*

TABLE 5. – The OLS Impact of Pyramidal Groups and Ownership Concentration

Industries	Pyramidal group **T-ratio**	Ownership concentration **T-ratio**
Apparel	+0.29	+1.88
Chemicals	+1.76	+1.06
Electrical machinery and apparatus	+1.61	+1.59
Fabricated metal products	+2.29	-0.04
Food, beverages and tobacco	+2.00	+1.71
Non-electrical machinery	+1.76	+1.88
Non-metallic mineral products	+2.14	+0.60
Rubber and plastic products	+1.52	+1.67
Textiles	+1.13	+0.61

TABLE 6. The Logit Impact of Pyramidal Groups and Ownership Concentration

Industries	Pyramidal group **T-ratio**	Ownership concentration **T-ratio**
Apparel	+0.15	+2.06
Chemicals	+2.19	+1.74
Electrical machinery and apparatus	+1.59	+1.15
Fabricated metal products	+1.79	+0.74
Food, beverages and tobacco	+2.33	+0.85
Non-electrical machinery	+0.85	+2.46
Non-metallic mineral products	+2.14	+1.12
Rubber and plastic products	+1.25	+2.06
Textiles	+0.17	+0.34

TABLE 7. – OLS, 5% trimmed sample, White heteroskedasticity-consistent standard errors

	Apparel	*Chem*	*Electr*	*Met*	*Food*	*Mach*	*NonMet*	*Rubber*	*Textile*
GROUP	**+0.12**	**+1.67**	**+1.51**	**+2.13**	**+1.83**	**+1.96**	**+2.90**	**+1.50**	**+0.83**
TYPE1	**-3.75**	**-0.92**	**+0.57**	**-1.69**	**-0.46**	**+0.39**	**-6.30**	**-0.44**	**-0.27**
TYPE2	**+1.19**	**-0.26**	**-0.10**	**-0.69**	**+0.29**	**-0.09**	**+0.62**	**+0.64**	**-1.63**
PRC	**+1.91**	**+0.35**	**+0.62**	**-2.27**	**+0.69**	**+2.48**	**-0.15**	**+1.66**	**-0.76**
SH1A SH2	**+0.24** **+1.31**	**+0.88** **+0.38**	**+1.62** **+0.98**	**+0.09** **-1.81**	**-0.08** **+1.41**	**+0.44** **+2.21**	**+0.12** **+0.03**	**+0.88** **+1.83**	**-0.31** **-0.57**
SH1B SH3	**+0.97** **+1.05**	**+0.94** **-0.16**	**+1.61** **+0.33**	**-0.61** **-2.43**	**+1.20** **+0.33**	**+1.45** **+1.88**	**-0.11** **+0.42**	**+1.74** **+1.12**	**-0.86** **+0.16**
SH1C SH3	**+1.13** **+1.04**	**+0.34** **-0.61**	**+0.38** **-0.37**	**-1.05** **-2.65**	**+1.76** **+0.45**	**+1.62** **+1.83**	**-0.31** **+0.39**	**+1.54** **+0.82**	**-0.89** **+0.27**
SH1B	**+0.49**	**+1.19**	**+1.56**	**-0.46**	**+1.13**	**+0.38**	**-0.35**	**+1.27**	**-1.08**
SH1C	**+0.77**	**+0.62**	**+0.54**	**-0.23**	**+1.70**	**+0.84**	**-0.47**	**+1.29**	**-1.09**
Adj. R^2	*0.16*	*0.23*	*0.13*	*0.15*	*0.16*	*0.16*	*0.22*	*0.18*	*0.17*
F-st.	*5.12*	*7.21*	*5.99*	*8.86*	*6.66*	*14.78*	*8.58*	*6.40*	*8.69*

TABLE 8. – Logit, complete sample, GLM standard errors

	Apparel	*Chem*	*Electr*	*Met*	*Food*	*Mach*	*NonMet*	*Rubber*	*Textile*
GROUP	**+0.15**	**+2.11**	**+1.59**	**+1.83**	**+2.40**	**+0.86**	**+2.11**	**+1.20**	**+0.20**
TYPE1	**--**	**-0.48**	**+0.70**	**-0.40**	**-0.18**	**-0.40**	**-0.00**	**+0.40**	**-0.24**
TYPE2	**-1.38**	**+0.68**	**-0.36**	**-0.44**	**+1.33**	**-0.27**	**+1.05**	**+1.10**	**-0.84**
PRC	**+1.96**	**+0.27**	**+0.15**	**-1.67**	**+0.64**	**+2.48**	**+0.17**	**+1.77**	**-0.18**
SH1A SH2	**+1.50** **+1.99**	**+1.02** **+0.50**	**+0.89** **+0.63**	**-0.41** **-1.18**	**+0.10** **+0.86**	**+0.49** **+1.76**	**+0.04** **+0.39**	**+1.29** **+2.13**	**-0.21** **-0.63**
SH1B SH3	**+1.90** **+1.81**	**+1.21** **-0.25**	**+1.00** **+0.03**	**-0.38** **-1.98**	**+0.58** **+0.71**	**+1.01** **+2.12**	**-0.06** **+0.94**	**+2.02** **+1.70**	**-0.98** **+0.26**
SH1C SH3	**+1.29** **+1.36**	**+0.66** **-0.76**	**+0.52** **-0.41**	**-0.12** **-1.95**	**+0.75** **+0.74**	**+0.97** **+2.11**	**-0.15** **+1.00**	**+1.66** **+1.36**	**-1.20** **+0.35**
SH1B	**+1.13**	**+1.68**	**+1.23**	**+0.76**	**+0.30**	**-0.20**	**-0.67**	**+1.41**	**-1.33**
SH1C	**+0.80**	**+1.14**	**+0.78**	**+0.71**	**+0.52**	**+0.13**	**-0.59**	**+1.28**	**-1.47**
McFadden R^2	*0.11*	*0.16*	*0.10*	*0.10*	*0.13*	*0.09*	*0.16*	*0.11*	*0.12*
LR-stat.	*29.10*	*40.15*	*34.69*	*37.12*	*38.91*	*43.69*	*43.16*	*28.92*	*44.89*

TABLE 9. – The Distribution of GROUP across Size Classes

Industries	**11-50 empl.**	**51-250 empl.**	**> 250 empl.**
Food	0.15	0.27	0.33
NonMet	0.17	0.34	0.74
Met	0.09	0.32	0.65
Chem	0.19	0.42	0.94
Electr	0.14	0.37	0.76
Rubber	0.14	0.32	0.93
Mach	0.11	0.35	0.77
Textile	0.07	0.31	0.78
Apparel	0.07	0.26	0.42

TABLE 10. – The Distribution of PRC across Size Classes

Industries	**11-50 empl.**	**51-250 empl.**	**> 250 empl.**	**CV ratio**
Food	0.61	0.64	0.75	*0.251*
NonMet	0.62	0.66	0.82	*0.400*
Met	0.64	0.68	0.83	*0.449*
Chem	0.65	0.75	0.85	*0.449*
Electr	0.61	0.69	0.81	*0.392*
Rubber	0.65	0.7	0.88	*0.484*
Mach	0.63	0.67	0.79	*0.335*
Textile	0.65	0.69	0.81	*0.317*
Apparel	0.68	0.71	0.68	*0.131*

LEGEND OF TABLES

In Tables 1-10 the industries are indicated by self-explanatory shortened names.
Tables 3-4 and 7-8 report the t-ratios for GROUP, TYPE1 and TYPE2 from the baseline specification, as well as the t-ratios for the ownership concentration proxies from their respective equations. From the baseline specification we also report *Adj.* R^2 (the coefficient of determination corrected for degrees of freedom) and *F-statistic* for the OLS, and *Mc Fadden* R^2 and *LR-statistic* for the Logit. The LR-statistic, which is asymptotically distributed as a χ^2 variable with (in our case) 11 degrees of freedom, tests the joint null hypothesis that all slope coefficients except the constant are zero. It is the analog of the F-statistic in linear regression models and tests the overall significance of the model. Mc Fadden R^2 is the analog to the R^2 in linear regression models and is computed from the log-likelihood ratio. The TYPE1 dummy cannot be included in the Logit estimates for Apparel because all the observations equal to 1 for this dummy are associated with inefficient firms, and conversely. Hence the LR-statistic is distributed with 10 degrees of freedom in the Apparel industry.
Table 10 reports the ratio between the coefficient of variation of PRC between size groups and the total coefficient of variation of PRC. The coefficient of variation between size groups is calculated on *five* dimensional groups (from 11 to 20 employees, from 21 to 50, from 51 to 250, from 251 to 500, more than 500 employees). The results are qualitatively unchanged if the three dimensional groups shown in Table 10 are considered instead.

LIST OF CORPORATE GOVERNANCE VARIABLES:

GROUP = dummy variable taking the value of 1 if the firm belongs to a pyramidal group and 0 otherwise;
TYPE1 = dummy variable taking the value of 1 if the main shareholder is a foreign resident and 0 otherwise;
TYPE2 = dummy variable taking the value of 1 if the main shareholder is a physical person residing in Italy and 0 otherwise;

PRC = percentage of shares held by the main shareholder;
SH1A = dummy variable taking the value of 1 if the percentage of shares held by the main shareholder is between 50% and 66% and 0 otherwise;
SH1B = dummy variable taking the value of 1 if the percentage of shares held by the main shareholder is between 50% and 99% and 0 otherwise;
SH1C = dummy variable taking the value of 1 if the percentage of shares held by the main shareholder is between 66% and 99% and 0 otherwise;
SH2 = dummy variable taking the value of 1 if the percentage of shares held by the main shareholder is bigger than 66% and 0 otherwise;
SH3 = dummy variable taking the value of 1 if the percentage of shares held by the main shareholder is bigger than 99% and 0 otherwise.

References

BALLONI V. (1984), Misure e spiegazioni dell' efficienza del sistema industriale: considerazioni di carattere metodologico, in AA.VV., *Produttività e competitività nell' industriaitaliana*, il Mulino, Bologna.

BEBCHUCK, L.R., ROE, M.J., (1999), A Theory of Path Dependence in Corporate Ownership and Governance, *Stanford Law Review*, 52, 127-170.

BIANCHI, M., BIANCO, M., ENRIQUES L., (1997), Ownership, Pyramidal Groups and Separation between Ownership and Control in Italy, *European Corporate Governance Network*.

BIANCO M., SIGNORINI L. F. (1996), Modelli di controllo, riallocazione e performance: alcune evidenze per l'Italia, in S. BERETTA, P. BIANCHI (eds.), *Cambiamento delle istituzioni economiche e nuovo sviluppo in Italia e Europa*, il Mulino, Bologna.

BIANCO M., CASAVOLA P. (1999), Italian Corporate Governance: Effects on Financial Structure and Firm Performance, *European Economics Review*, 43, 1057-69.

BRUNELLO G., GRAZIANO C., PARIGI B. (2001), Executive Compensation and Firm Performance in Italy, *International Journal of Industrial Organisation*, 19 (1-2), 133-161.

BURKART M., GROMB D., PANUNZI F. (1997), Large Shareholders, Monitoring and the Value of the Firm, *Quarterly Journal of Economics*, 112, 693-728.

CAPRIO L., FLOREANI A. (1994), I Trasferimenti del Controllo di Società Quotate in Italia: un'Analisi Empirica dei Prezzi e dei Risultati per gli Azionisti di Minoranza, *Finanza Impresa e Mercati*, 6, 355-393.

BANKER R.D., CHARNES A., COOPER W., (1984), Some Models for Estimating Technical and Scale Efficiencies in Data Envelopment Analysis, *Management Science*, 30(9), 1078-92.

FAHRMEIR L., TUTZ G. (1994) *Multivariate Statistical Modelling Based on Generalized Linear Models*, Springer, Wiesbaden.

FAMA E., JENSEN M. (1983), Separation of Ownership and Control, *Journal of Law and Economics*, 26, 301-325.

FARRELL, M.J. (1957), The Measurement of Productive Efficiency, *Journal of the Royal Statistical Society,* series A 120 (3), 253-290.

FRIED, H., LOVELL, C.A.K., SCHMIDT, S. (1993), *The Measurement of Productive Efficiency*, Oxford University Press, Oxford.

GIJBELS I., MAMMEN E., PARK B.U., SIMAR L. (1999), On estimation of monotone and concave frontier functions, *Journal of the American Statistical Association*, 94, 220-228.

GUGLER, K. (ed.), (2001), *Corporate Governance and Economic Performance*, Oxford University Press, Oxford.

JENSEN M., MECKLING W. (1976), Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure*, Journal of Financial Economics*, 3, 305-360.

KALIRAJAN, K.P., SHAND, R.T. (1988), *Testing Causality Between Technical and Allocative Efficiencies*, W.P. 88/6, Research School of Pacific Studies, ANU, Canberra.

KITTELSEN S.A.C. (1999), *Monte Carlo simulations of DEA efficiency measures and hypothesis tests*, Memorandum N. 9, Department of Economics, University of Oslo.

KNEIP A., PARK B.U., SIMAR L. (1998), A note on the convergence of nonparametric DEA estimators for production efficiency scores, *Econometric Theory*, 14, 783-793.

KOLE, S. R., (1995), Measuring Managerial Equity Ownership: a Comparison of Sources of Ownership Data, *Journal of Corporate Finance: Contracting, Governance and Organisation*, 1(3-4), 413-35.

LA PORTA, R., LOPEZ-DE-SILANES, F., SHLEIFER, A., VISHNY, R.W., (1997), Legal Determinants of External Finance, *Journal of Finance*, 52, 1131-1150.

LA PORTA, R., LOPEZ-DE-SILANES, F., SHLEIFER, A., (1999), Corporate Ownership Around the World, *Journal of Finance*, 54, 471-517.

LOVELL C.A.K. (1993), 'Production Frontiers and Productive Efficiency', in H.O. FRIED, C.A.K. LOVELL, S.S. SCHMIDT (eds.), *The Measurement of Productive Efficiency: Techniques and Applications*, Oxford University Press, London.

McCONNELL J., SERVAES H. (1990), Additional Evidence on Equity Ownership and Corporate Value, *Journal of Financial Economics*, 27, 595-612.

MORCK R., SHLEIFER A., VISHNY R. (1990), Do Managerial Objectives Drive Bad Acquisitions?, *Journal of Finance*, 45, 31-48.

OFRIA F. (1997), *Divari regionali di produttività nell' industria manifatturiera italiana*, Franco Angeli, Milano.

PAGANO M., ROELL A. (1998), The Choice of Stock Ownership Structure: Agency Costs, Monitoring and the Decision to Go Public, *Quarterly Journal of Economics*, 187-225.

PROSPERETTI L., VARETTO F. (1991), *I differenziali di produttività Nord-Sud nel settore manifatturiero*, il Mulino, Bologna.

ROE M. (1994), *Strong Managers, Weak Owners: The Political Roots of American Corporate Finance*, Princeton: Princeton University Press.

SCHEEL H. (2000), *Effizienzmasse der Data Envelopment Analysis*, Gabler, Wiesbaden.

SHLEIFER A., VISHNY R. (1997), A Survey of Corporate Governance, *Journal of Finance*, 52(2), 737-783.

VISINTIN F. (1999), *Corporate Governance in Italy*, European Commission (DG XII) Report, Bruxelles.

WRUCK K. (1989), Equity Ownership Concentration and Firm Value, *Journal of Financial Economics*, 23, 3-28.

ZINGALES, L. (1998), *Corporate Governance*, in the New Palgrave Dictionary of Economics and the Law, Palgrave MacMillan, Basingstoke.