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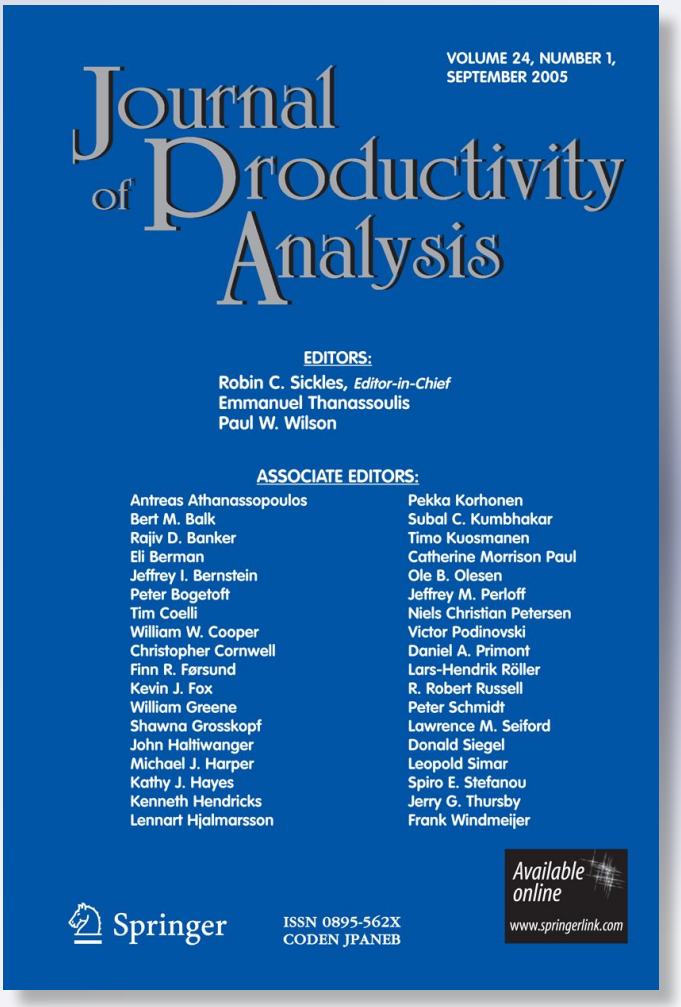
**Journal of Productivity Analysis**

ISSN 0895-562X
Volume 36
Number 3

J Prod Anal (2011) 36:231-246
DOI 10.1007/s11123-011-0207-5




Springer

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# Corporate social responsibility and firm efficiency: a latent class stochastic frontier analysis

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Published online: 3 February 2011


**Abstract** The nexus between corporate social responsibility and corporate performance is of fundamental importance to understand if the former can be a sustainable strategy in the competitive race. In this paper we test this relationship on a sample of firms observed in a 13-year interval by focusing on a performance indicator (productive efficiency) seldom explored in this literature with a novel approach (latent class stochastic frontiers). Our empirical findings show that firms included in the Domini 400 index (a CSR stock market index) do not appear to be more distant from the production frontier than firms in the control sample after controlling for the heterogeneity of production structure.

**Keywords** Stochastic frontier · Mixture models · Corporate social responsibility

**JEL Classification** M14 · L21

## 1 Introduction

According to a standard definition (Paul and Siegel 2006) corporate social responsibility (hereafter also CSR) defines a set of corporate practices which improve upon social and environmental regulatory standards of the markets in which such corporations operate and, de facto, (when they are not merely declared) shift corporate goals from the maximisation of shareholders value to the satisfaction of a broader multistakeholder target.

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Corporate social responsibility is becoming an increasingly relevant feature in the modern corporate environment. The KPMG International Survey on CSR reporting (KPMG 2008) documents that corporate responsibility information is released (in stand alone reports or integrated with annual financial reports) by 80% of the constituents of the Global Fortune 250, up from 50% in 2005. A likely rationale for the diffusion of this phenomenon is that social responsibility emerged in the globalisation era as an "endogenous reaction" of the socioeconomic environment to the lack of global governance and to the fall of the old system of checks and balances through which corporations, domestic trade unions and domestic institutions ensured the joint pursuit of economic development and social cohesion. In this new scenario of globally integrated real and financial markets with missing or weak global governance and institutions, CSR emergence is therefore prompted by consumers and investors who started asking corporations to take care of the social and environmental consequences of their actions.

As already mentioned, corporate social responsibility involves, by definition, a shift of focus from the maximization of shareholders wealth to that of a multistakeholder welfare function. The crucial question is whether this change of focus is compatible with firm survival and growth in a highly competitive environment. In other terms, borrowing an example from biology, we wonder whether this new species of socially responsible corporations is going to coexist or be eliminated by traditional corporations in the "Darwinian selection" of market competition.

A privileged field of inquiry which can provide elements for the solution of this puzzle is the analysis of the nexus between corporate social responsibility and corporate performance. Recently in this literature, this nexus has been

analysed in depth leading to the formulation of the so called "strategic CSR" hypothesis. The latter argues that the CSR decisions are not in contrast with profit maximization since costs of CSR adoption are outweighted by benefits (McWilliams et al. 2006).

The empirical literature in this field testing such hypothesis and, more in general, the CSR-profitability relationship has so far identified some preliminary and non conclusive results on specific performance indicators such as return on equity, market value, net sales or value added (Becchetti et al. 2007a, 2007b; Pava and Krausz 1996; Preston and O'Bannon 1997; Stanwick and Stanwick, 1998; Verschoor 1998). This lack of consensus on the sign of the relationship is confirmed by Margolis and Walsh (2001) who report that: "When treated as an independent variable, corporate social performance is found to have a positive relationship to financial performance in 42 studies (53%), no relationship in 19 studies (24%), a negative relationship in 4 studies (5%), and a mixed relationship in 15 studies (19%)."This literature suffers from several methodological weaknesses and has, in many cases, not fully taken into account the most recent statistical and econometric advances.

Following the suggestion of Paul and Siegel (2006) we argue that an important direction in which the CSR/corporate performance nexus needs to be explored is the relationship between CSR and productive efficiency. We believe so because productivity is a crucial measure of performance which is independent from how the value created by a given corporation is attributed to the different production inputs. In other terms, since the move toward social responsibility implies a change in the criteria for the division of the "value cake" (from the straightforward maximisation of the shareholders' size to that of the material and non material benefits accruing to different stakeholders), we are primarily interested to evaluate CSR performance on an indicator which measures the size of the cake itself, scaled for the number of employees, independently from the way it is divided among different stakeholders.

The few existing contributions on the specific effects of CSR on productivity find mixed results. On the one hand, Shadbegian and Gray (2006) estimate a stochastic frontier function with establishment level data. The authors find that implementation of environmental friendly techniques translates into substantial deviations from the efficient frontier, especially for older establishments. On the other hand, Vitaliano and Stella (2006) with a data envelope cost minimization approach show that banks with higher CSR ratings do not experience significant differences in productivity with respect to a control sample.

Our contribution to this literature is the application of a new technique to a different set of data. To this purpose we test the relationship between CSR and productive efficiency on a sample of 1085 corporations subject to a CSR screening and observed in a 15-year interval with a latent class stochastic frontier approach. With this approach we aim to overcome a traditional weakness of stochastic frontier models represented by the need to identify a priori groups of firms with homogenous production functions and/or rely on standard industry classifications, which are almost more problematic given the rhythm of changes in the product mix on contemporary corporate environment. If the above mentioned heterogeneity is not correctly taken into account, the model is misspecified and may lead to biased estimates, possibly overstating or understating the magnitude of the technological efficiency (Greene 2005a, b, 2008). Moreover, as it is well known, CSR is not easily measurable as it affects both cost and product functions in the firm profit maximization process. This is the reason why we use a semiparametric mixture model for estimating stochastic frontiers (Orea and Kunbhakar 2004). Our approach, described more in detail in the empirical section, has the advantage of introducing a random distribution of parameters for CSR, which generates a more flexible "ex-post" measure for the effects of CSR on firm profitability.

More specifically, we explain how the latent class stochastic frontier approach jointly deals with three problems: inter and intra industry technological heterogeneity, non-linearities in production functions and misspecification due to omitted variable or measurement error (on this last point see, Aitkin and Rocci 2002; Rabe-Hesketh et al. 2003). It does so by estimating homogeneous production functions conditional to firm specific technological characteristics. Such characteristics lead to the identifications of clusters of firms which are homogeneous in terms of production technology, conditional to unobservable latent variables. The paper is divided into five sections (introduction and conclusions included). In Sect. 2 we provide a brief survey on the state of art of the literature on the effects of CSR on corporate performance. In Sect. 3 we outline the latent class stochastic frontier approach used to test the relationship between CSR and productive efficiency. In Sect. 4 we present and discuss our econometric findings. Section 6 concludes.

## 2 CSR and corporate performance: the state of art

A common misconception on CSR is that it just involves some forms of cost enhancing philanthropic activities and that, for this reason, it should be negatively related with corporate performance. If we just extract a definition of CSR from the screening criteria adopted by the most important social rating agencies we find that this is definitely not the case. By taking as a benchmark the

classification performed by KLD (which will be used in this paper to discriminate between CSR firms and the control sample—see "Appendix"), we find that such classification is based on eight broad criteria (community, environment, relationship with employees, workforce diversity, human rights, corporate governance, product quality, controversial industries) which confirm that CSR is not merely identifiable in corporate charitable contributions as it involves the satisfaction of a more complex multistakeholder welfare target where involved stakeholders include workers, local communities, subcontractors, future generations and, obviously, consumers. A cursory evaluation of the areas of engagement in which CSR is declined would suggest that the likelihood of observing a negative relationship between CSR and corporate performance is much higher when we consider equity value and not productive efficiency. While in fact the shift of focus clearly implies that the shareholder's slice of the cake is no more the primary goal of the CSR firm, it is uncertain whether the attention to the satisfaction of the wider set of stakeholders should determine a reduction or an increase in firm productivity. It is in fact possible that the reaction of some of these crucial stakeholders to the enhanced care of CSR firms (i.e. consumers more satisfied by product quality or social characteristics, more motivated workers) could indeed have positive effects on corporate performance.

### 2.1 The four potential value increasing effects of CSR

More in detail, the state of art of the CSR literature leads us to identify at least four potential positive effects of CSR on output per worker. A first one is related to the "concerned consumer" demand effect. Recent evidence shows that, due to the increased perception of global interdependencies, the willingness to pay for socially and environmentally responsible characteristics of products is growing. Such evidence does not seem to be contradicted by actual consumer choices. The European Fair Trade Association 2005 Report documents that European net sales of fair trade products, one of the most well known and established kinds of socially responsible products, grew by 20% per year in the last five years. FT products have achieved significant market shares in specific segments such as the banana market in Switzerland (47%) and the ground coffee market in the UK (20%).[1]

A second potential positive effect of CSR adoption, again related to consumer demand, hinges on the perceived link between CSR and product quality. On the one side, consumers are among stakeholders to which CSR firms address their concerns, and product quality is explicitly one of the main domains of CSR, as shown by the taxonomy of KLD criteria. On the other side, even abstracting from direct engagement in product quality, consumers may be inclined to believe that firms taking care of social and environmental consequences of their actions are less likely to "cheat" consumers on the quality of their products.[2] Interesting evidence consistent with this value increasing argument of CSR is provided by Siegel and Vitaliano (2007) who argue that the informative role of the CSR signal is more important for consumers in presence of experience and not of search goods since, in the first case, it is not possible to verify product quality before use. Their empirical findings support this hypothesis.

A third potential positive effect concerns the reaction of workers to the higher attention of CSR firms to their monetary and nonmonetary satisfaction. Standard efficiency wage rationales tell us that, when the value of the job place is higher to workers, the latter are more reluctant to shirk (Yellen 1984; Shapiro and Stiglitz 1984). Turnover (Salop 1979) and gift exchange (Akerlof 1982) models also provide rationales in support of the positive relationship among monetary compensations, firm loyalty and productivity. Furthermore, the importance of intrinsic motivations in productivity, and the availability of workers to accept lower wages when intrinsic motivations[3] are strong, suggests that the latter are partial substitutes of pecuniary transfers. This is even more confirmed if we consider the extreme case of voluntary work where individuals are willing to "work for nothing" (Freeman 1997). Intrinsic motivations are therefore a channel through which

[1] An enquiry on a representative sample of the population in Italy (Demos & Pi / Coop 2004), emphasizes that 40% of respondents purchased at least once in a year FT products and 20% of them had more frequent purchasing habits of these products. Based on their survey data, Bird and Hughes (1997) classify in the UK consumers as ethical (23%), semi-ethical (56%) and selfish (17%). In the same survey 18% of the surveyed consumers declare to be willing to pay a premium for SR products. This share falls to 10% in the case of

Footnote 1 continued
Belgium according to a research of De Pelsmacker et al. (2003) on fair trade coffee. A similar survey for German, run by the market research company TNS Emnid in Germany in February 2004, documents that 2.9% of the German population buy Fair Trade products regularly, 19% rarely, and 6% almost never, while 35% of respondents said they support the idea, but do not buy.

[2] Consider that the "game of quality" between sellers and consumers is not just played on verifiable dimensions for which simple reputation concerns induce firms to choose high quality levels. Many dimensions of product quality are not immediately verifiable (i.e. medium term health effects) and therefore CSR adoption may signal to consumers that CSR firms have a higher propensity not to exploit these dimensions to their profit advantage against consumers, even though their action is not verifiable.

[3] On the relationship between workers' intrinsic motivation and productivity see Deci and Ryan (1991), Frey and Oberholzer-Gee (1997) and Kreps (1997).

corporate social responsibility, by fostering alignment between corporate goals and workers' motivations, may reduce costs and increase productivity.

Finally, according to the well known Freeman (1984) argument, SR may be a good instrument to minimise frictions with stakeholders and reduce the risk of legal action from consumers. The adoption of socially responsible practices should therefore mitigate this important source of corporate risk, with positive effects on economic performance. A relevant argument in this domain is that it may be convenient to engage in CSR, even when it does not add to profits, since the latter may act as a reputation insurance mechanism. The validity of this argument is supported by Minor and Morgan (2010) who measures the effects of product recalls on abnormal returns by considering 184 events. The author finds that firms with better KLD CSR ratings earn a 3% abnormal return with respect to other firms in the sample. Such gain amounts to 600 million for the sample median (market) value of 23 billion.

To sum up, the superior costs of CSR firms, generated by the need to comply with the CSR-related multistakeholder welfare targets, may be compensated by four potential positive effects which affect either product demand or workers productivity, thereby rising net sales per worker. This is the hypothesis we are going to test in our empirical analysis.

## 3 The model

Stochastic frontiers are probably one of the most widely adopted parametric approaches used to evaluate corporate efficiency in the empirical literature (see, among others, the seminal paper of Aigner et al. (1977) and those of Kumbhakar 1990; Battese and Coelli 1992 and 1995 or Greene 1997). A fundamental assumption of this approach is the homogeneity of the observed units' production functions. Strictly speaking, stochastic frontier models in a longitudinal design can be represented by $y_{it} = x_{it}^T\beta + \epsilon_{it}$; where $y_{it}$ represents the output (or cost) of units $i$ in time $t, x_{it}^T$ is the vector of inputs (or outputs) and the term $\epsilon_{it}$ is the composite error $\epsilon_{it} = \varepsilon_{it} + u_{it}$. It is possible to discriminate efficiency by simple noise only if the residual part $\varepsilon_{it} = N(0, \sigma_\varepsilon)$ follows a normal distribution while $u_{it}$ follows some other one-sided distributions[4]. By construction, the inefficiency has been represented by the "residual" term $u_{it}$, which captures the departure of the firm's specific function from the estimated frontier ($x_{it}^T\beta$).

This mathematical representation for inefficiency holds if all sample firms use the same technology facing the same long-run profit (or cost) function. In such case, any deviation from the technological frontier may be attributed to the inefficiency score, once conditioned to the noise term. However, when the observation unit is at firm level, it is unreasonable to figure out a common productive technology, given the widely observed heterogeneity of product, market and industry mix. A commonly adopted choice is therefore that of inserting in the profit (cost) function a set of dummies representing sectors or industries. The problem with this approach is that not all technological heterogeneity can be captured simply by sector or industry dummies. Firms which we conventionally classify into the same industry may have different technologies simply because they sell on different markets to consumers with heterogeneous tastes requiring different customized products. An alternative strategy to deal with this issue separates exogenously firms into groups according to thresholds based on some 'stratification" variables (i.e. variables measuring financial or commercial integration among markets, market types, political differences among countries and markets, kind of goods supplied by firms, industries, etc.) and then estimates standard parametric stochastic frontiers for each identified group or cluster (Grifell and Lovell 1997; Kolari and Zardkoohi 1995; Polachek and Yoon 1987, 1996). Two problems are related with this choice. First, the exogenous classification could produce clusters with an insufficient number of observations. In that case it could not be easy to understand how to aggregate such observations with other clusters. In addition to it, even when the number of units in each clusters is adequate, the estimated class-specific efficiency frontier may be biased since it does not consider the information provided by the other classes (Greene 2001, 2005a; Orea and Kumbakhar 2004). A second problem, after technological heterogeneity is accounted for, is that parametric models could be misspecified due to the coincidence between variables describing the firm's profit (or cost) function and those describing heterogeneity (for example the variety of goods supplied by firms helps us to discriminate between types of firms but is also part of the firm outputs used to build the profit (or cost) function).

Consider as well that, by using a time invariant variable, we have the model $\ln y_{it} = \alpha_0 + \beta^T x_{it} + \varepsilon_{it} - [max_j(a_j) - a_i]$ in which the time invariant inefficiency has to be captured by the estimated "residual" term $u_i = [max_j(a_j) - a_i]$. As specified by Greene (2004a, b) there is no space for the unobserved heterogeneity if the time invariant term captures entirely the time invariant efficiency. This is because the intercept value $a_j$ "*ab originae*" measures all the heterogeneity (industry effects

[4] Leaving out of the discussion the time invariant or time varying inefficiencies estimations, the commonly considered distributions are: half-normal, truncated normal, gamma, exponential.

for example) and not only that directly related to the firm specific efficiency[5]. The problem related to standard parametric stochastic frontier estimation is therefore the assumption that the underlying production technology is common to all producers, but firms may use different technologies also in the same industry. In such a case estimating a common and unique frontier function for all units in the sample could not capture the effective and ‚representative" underlying technology. If this is the case, we could obtain biased estimate of the underlying technological parameter.

As a consequence in what follows, since our observations are at firm level and since firms can belong to different industries, countries or markets, it is reasonable to assume heterogeneity in the allocating process both within and between sectors arising from three potential sources: varying parameters across industries, omitted variables and nonlinearity in the production function, see for example the discussion on unobserved sources of heterogeneity in Alfó and Trovato (2004), Becchetti et al. (2007a, 2007b), and Alfó et al. (2008).

Whilst heteroscedasticity can be corrected through traditional parametric applications, a more complex model needs to be designed to detect heterogeneity (see, for example, Kunbhakar and Lovell, 2000; Kunbhakar and Orea 2004; Caudill 2003 and Greene 2005a). As it is well known, fixed and random effects cannot distinguish between inefficiency and any time invariant firm specific heterogeneity (Greene 2005a). Potentially, the extension of random effects to random parameter models allows us to detect unobserved heterogeneity. However, since the density of the compound disturbance in this model estimation has not closed form, we need to integrate the common term out of the likelihood function and the integration can be done by quadrature or simulation[6] An important disadvantage of this approach lies in the required computational effort, which is exponentially increasing in the dimension of the random parameter vector[7]. As stressed above, it would be preferable to select groups of firms with homogeneous production functions by some techniques such as cluster analysis or local regressions in order to simplify the approach. Only after this step standard parametric stochastic frontiers should be applied on each cluster (Grifell and Lovell 1997; Kolari and Zardkoohi 1995; Polachek and Yoon 1987). The problem is that, in this case, the production frontier of a particular class is estimated without correlation to the information from the other classes (Caudill 2003; Greene 2002; Orea and Kumbakhar 2004). To avoid this problem it is necessary to assume that unobserved heterogeneity can be detected by the observation units' endogenous clustering process into $k = 1, \ldots, K$ classes, each of them depending from some latent variables (Green 2001, 2005a; Caudill 2003; Orea and Kumbakhar 2004). We follow this approach by assuming that firms do not share the same parametric technology in each period and adopt a latent class model estimated via EM algorithm (Caudill 2003). The model can be specified as

$$y_{it|k} = \beta_k^T x_{it} + \varepsilon_{it} - u_i \tag{1}$$

where $y_{it}$ represents net sales per worker of the $i$-th firm ($i = 1, \ldots, n$) at time $t$ ($t = 1, \ldots, T$) and $k$ ($k = 1, \ldots, K$) are the unknown classes in which firms share the same homogeneous technology. This implies that $k = 1, \ldots, K$ different frontier functions exist, with the associated probability $\pi_k = 1, \ldots, \pi_K$, and $\sum_{1-k}^{K} \pi_k = 1$. In the following, given an apriori clustering process, which represents the effects of unobserved sources of heterogeneity, the individual $y_{it}$ observations are assumed to be conditionally independent variates, drawn from a normal density. This means that the vector of $p_t$ covariates, $\mathbf{x}_{it}^T = \left(x_{i1}^T, \ldots, x_{ip_T}^T\right)$, has been recorded for each firm. As a consequence, the $y_{it}$ represent *conditionally* independent realizations of the potential output $(Y)_{it}$, given an endogenous clustering process due to unobserved heterogeneity. More formally, the values of the frontier production function can be modelled as

$$\mathbf{y}^* = (\mathbf{y}^T, \mathbf{z}^T)^T \tag{2}$$

where $\mathbf{y}^T$ is the vector of the realized values of $\mathbf{y}^*$ and $z_{ik} = 1$ iff the observed output of firm $i$ in time $t$ derives from the specific cluster $k$ with probability $\pi_k$, $(\pi_1, \ldots, \pi_K)$ and $\mathbf{z} = (\mathbf{z}_1^T, \ldots, \mathbf{z}_n^T)^T$. As a consequence, the complete-data log-likelihood is given by

$$\ell(\cdot) = \sum_{k-1}^{K} \sum_{i-1}^{n} z_{ik} \{ log\pi_k + logf_k(y_{it}, \boldsymbol{\eta_k}) \} \tag{3}$$

where $f_k(y_{it}, \boldsymbol{\eta_k})$ is the conditional density of the frontier in the k-th cluster conditioned to the set of *complete* parameter vectors $(\boldsymbol{\eta_k})$.

[5] The identification problem still arises if we consider the "true" fixed (or random) effect model (Greene 2004a, 2008), in this case the inefficiency is free to vary over time and all time invariant effects are measured by unobserved heterogeneity, but we need some additional assumptions (out of sample) on the parametric distribution of $a_j$ and then on $u_{it}$, see Kotzian (2009), for a fully parametric specification of the models above.

[6] More specifically, the Gaussian quadrature is satisfactory if the distribution of the compound error is Gaussian and sufficient quadrature points are used. Furthermore, the approximation is more accurate if locations are defined in regions where the function is non zero, and if the integral function is a smooth one.

[7] Other alternatives are based on series expansions of the random effects distribution (Gurmu and Elder 2000).

The maximum likelihood estimates of model parameters are computed by using an EM algorithm (Dempster et al. 1977).[8]

The algorithm is based on the maximization of the complete likelihood in Eq. (3) where $z_{ik}$ is 1, if the observation $y_{it}$ has been sampled from the $k$th component of the mixture, and 0 otherwise. The $z$'s are not directly observed and are therefore treated as missing data, i.e. they are estimated on the basis of their expectations

$$\hat{z}_{ik} = \frac{\pi_k f(y_{it}|\boldsymbol{\eta_k})}{\sum_{k=1}^{K} \pi_k f(y_{it}|\boldsymbol{\eta_k})} \tag{4}$$

The algorithm simply maximizes the complete likelihood (step M) given a set of $z$'s estimates (step M) and then recalculates by 4 the $z$'s estimates (step E). It can be shown that, at each E or M-step, the likelihood in 3 increases. The algorithm starts from initial estimates of the parameters, iterates the two steps and stops when the likelihood increment between two iterations is less than a given threshold.

In our approach the M-step is partitioned into three sub-steps where the complete likelihood is maximized with respect to a sub-set of parameters given the current values of the others. The three sub-steps can be described as follows.

In the first sub-step the log of the complete likelihood

$$\ell_c(\boldsymbol{\vartheta}|\mathbf{y}) = \sum_{i=1}^{n}\sum_{k=1}^{K} \hat{z}_{ik}\left(\log(\boldsymbol{\pi_k}) + \sum_{i,t}\log(\boldsymbol{f}(\boldsymbol{y_{it}}|\boldsymbol{\eta_k}))\right) \tag{5}$$

is maximized with respect to the $\pi$'s. It is simple to show that, by rewriting 5 as

$$\ell_c(\boldsymbol{\vartheta}|\mathbf{y}) = \sum_{ik} \hat{z}_{ik}\log(\boldsymbol{\pi_k}) + \boldsymbol{c} \tag{6}$$

where $c$ is a constant term independent from the parameters of interest, the log-complete likelihood attains a maximum when

$$\pi_k = \frac{1}{n}\sum_i \hat{z}_{ik} \tag{7}$$

In the second sub-step we maximize 5 with respect to the variances of two-sided and one-sided error components, while, in the last sub-step, the log-complete likelihood 5 is maximized with respect to the regression coefficients. The E and M-steps are alternated repeatedly until the following relative difference:

$$\frac{|\ell^{(r+1)} - \ell^{(r)}|}{|\ell^{(r)}|} < \epsilon, \qquad \epsilon > 0 \tag{8}$$

changes by an arbitrarily small amount if the adopted criterium is based on the sequence of likelihood values $\ell^{(r)}$, $r = 1, \ldots$. Since $\ell^{(r+1)} \geq \ell^{(r)}$, convergence is obtained with a sequence of likelihood values which are bounded above.

We note that the algorithm corresponds to the solution of $K$ independent maximization problems, one for each parameter. Moreover, $\hat{z}_{ik}$ represents the posterior probability that the $i$—th unit comes from the $k$—th component of the mixture. Equating the derivatives to zero yields corresponding likelihood equations which are weighted sums of those from an ordinary weighted regression with weights $z_{ik}$. Solving these equations for a given set of weights, and updating the weights from the current parameter estimates, defines an EM algorithm.[9] We use penalized criteria as BIC to choice the exact number of $k$ points.

Summing up, the latent class stochastic frontier approach presented above allows to verify statistically the link between CSR and performance under the assumption that firm heterogeneity affects parameters estimation. Heterogeneity has been handled by allowing parameters to vary across firm and industries. In the model, mixture components have firm varying variances. This enables us to handle missspecification due to unobserved variables or measurement error (MacLachlan and Peel 2000).

## 4 Data and results

Our discriminating criterion for creating the CSR group and the control sample is based on the screening of Kinder, Lydenberg and Domini Research & Analytics, Inc. (KLD), the leading research group in providing ratings of corporate social performance to investors. KLD screens around 3,000 firms accounting for 98% of total market value of US public equities. The screening approach is in two steps. In the first step a group of firms is excluded from the CSR sample if their activity is for a significant share in controversial industries (alcohol, tobacco, or gambling; companies that derive more than 2% of gross revenues from the production of military weapons; and electric utilities that own interests in nuclear power plants or derive electricity from nuclear power plants in which they have an interest). From the remaining group of firms a subset of SR firms is selected according to a series of qualitative indicators (community relations, product quality, workforce diversity, employee relations, environment, human rights, non-US operations, and product safety and use). Full description of KLD criteria is provided in the "Appendix". The definition of the Domini CSR criteria is obviously questionable and open to debate. At the moment Domini information

[8] For a detailed survey on the topic see McLachlan and Krishnan (1997).

[9] For the literature on the computational perspective in stochastic frontier approach see Caudill (2003), Orea and Kumbhakar (2004) and Green (2005a).

represents one of the most reliable and detailed sources of CSR classification and is therefore the reference for our econometric analysis.

Our unbalanced panel includes 16,245 firm-year observations recorded in the 1990–2004 time interval for the 1,085 corporations for which we have information available (and the relative CSR screen). Balance sheet data for firms in the sample are taken from Datastream. The control group is made by firms having non positive scores for any of the Domini criteria and not just by firms not affiliated to the Domini 400 index. The rationale of this choice is that the index has a fixed number of constituents. Entries are therefore possible only when one of the constituents looses its SR characteristics. This implies that firms outside the index may have some positive SR features or, in other terms, could be SR firms queueing for admission to the Domini 400 index. Industry and CSR breakdown of our sample is described in Tables 1 and 2. Table 1 shows that the largest share of our sample firms belongs to the Financial and Miscellaneous Industrial sectors (around 20%). This is an additional motivation for our decision to use latent class approach and not the official industry classification to create clusters of firms with homogeneous technology.

In Table 2 we observe that two industries (consumer cyclical and non cyclical) have a share of CSR firms above 50% while all others are far below.

This finding has an intuitive explanation. If an important part of the potential benefits depends on consumers' action and beliefs, it is highly likely that the convenience to adopt CSR will be higher in more consumer oriented industries.

The econometric part of our paper consists in the application of the methodology described in Sect. 4 to the following translog production function

**Table 1** Industry breakdown of the sample

| Sectors | Freq. | Percent | Cum. |
|---|---|---|---|
| Basic materials | 585 | 3.6 | 3.6 |
| Consumer cyclical | 2,895 | 17.82 | 21.42 |
| Consumer noncyclical | 1,110 | 6.83 | 28.25 |
| Energy | 810 | 4.99 | 33.24 |
| Financial | 3,240 | 19.94 | 53.19 |
| Healthcare | 1,485 | 9.14 | 62.33 |
| Industrial | 2,415 | 14.87 | 77.19 |
| Technology | 1,905 | 11.73 | 88.92 |
| Telecommunications | 255 | 1.57 | 90.49 |
| Utilities | 840 | 5.17 | 95.66 |
| Not available | 705 | 4.34 | 100 |
| Total | 16,245 | 100.00 | |

**Table 2** CSR breakdown within industries in the sample

| Sectors | Domini Index | | |
|---|---|---|---|
| | 0 = Non Domini | 1 = Domini | Total |
| Basic materials | 366 | 219 | 585 |
| Consumer cyclical | 1,798 | 1,097 | 2,895 |
| Consumer noncyclical | 579 | 531 | 1,110 |
| Energy | 654 | 156 | 810 |
| Financial | 2,684 | 556 | 3,240 |
| Healthcare | 1,184 | 301 | 1,485 |
| Industrial | 1,660 | 755 | 2,415 |
| Technology | 1,434 | 471 | 1,905 |
| Telecommunications | 161 | 94 | 255 |
| Utilities | 658 | 182 | 840 |
| Not available | 611 | 94 | 705 |
| Total | 11,789 | 4,456 | 16,245 |

$$E(y_{it}|x_{it}, u_i) = \alpha_i + \beta_{1i}\mathcal{K}_{it} + \beta_{2i}\mathcal{K}_{it}^2 + \beta_{3i}\mathcal{K}D_{it} + \beta_{4i}\mathcal{K}D_{it}^2 + \beta_{5i}D_{it} \quad (9)$$

where $y_{it}$ is net sales per worker, $\mathcal{K}_{it}$ is the capital-labour ratio and $D_{it}$ is the dummy variable which takes the value of one if the firm $i$ is a constituent of the Domini 400 Index in time $t$ and zero otherwise. As explained above, our production function varies across firm-years and the specific intercepts and slopes are able to capture the $k$'s ($K < n$) technologies and efficiencies. The model has been estimated via EM in a pooled-cross section regression and in a parametric frontier approach. Findings for both methods are reported in Table 3.

As it is immediately evident, the parametric approach is constrained in that it can capture heterogeneity only in the intercept and not in the slope of the production function. This explains the extreme difference in intercept values between Domini and non Domini firms. On the other hand, with the mixture model, heterogeneity can be distributed on more parameters. Within this approach our estimate highlights that the clustering process identifies two different classes, while the specification estimated with more than two support points does not achieve convergence.

Within such classes we observe that CSR firms in the first cluster have a significantly higher intercept (the effect is therefore unequivocally positive) while, in the second cluster, CSR produces a more complex effect (an upward shift of the intercept, larger in magnitude than in the first cluster, together with a negative effect in the linear component and a positive effect on the squared component of the capital/labour ratio). In order to check the robustness of our findings to different ways of measuring CSR we propose two additional measures of CSR based on KLD ratings. Following Siegel and Vitaliano (2007) we use as a first measure the sum of strengths minus the sum of weaknesses in the eight KLD

**Table 3** Latent class stochastic frontier

| lny | Param. frontier | | Latent class frontier | | | |
|---|---|---|---|---|---|---|
| | | | First group | | Second group | |
| | Coeff. | SE | Coeff. | SE | Coeff. | SE |
| *Cons* | 1.4476** | 0.0409 | 0.7598 | 7.8490 | 0.9748 | 0.1200 |
| $\mathcal{K}$ | 0.8889** | 0.0131 | 0.8652** | 0.0239 | 1.1005** | 0.0357 |
| $\mathcal{K}^2$ | 0.0003 | 0.0011 | 0.0082** | 0.0017 | −0.0301** | 0.0032 |
| $D$ | 0.5444* | 0.1111 | 0.4251** | 0.1426 | 1.1054** | 0.2261 |
| $\mathcal{K}D$ | −0.0567 | 0.0388 | −0.0131 | 0.0483 | −0.2982** | 0.0777 |
| $\mathcal{K}D^2$ | 0.0030 | 0.0032 | −0.0069† | 0.0039 | 0.0355** | 0.0065 |
| $\sigma^2$ | 1.26** | 0.038 | | | | |
| $\lambda$ | 1.85** | 0.008 | | | | |
| $\pi_k$ | | | 0.425** | 0.033 | 0.575** | 0.033 |
| $\sigma_{u_k}$ | | | 2.2E-04 | | 1.137 | |
| $\sigma_{\varepsilon_k}$ | | | 0.573 | | 0.789 | |
| $\sigma_k$ | | | 0.573** | 0.013 | 1.384** | .0298 |
| $\lambda_k$ | | | 3.8E-04 | 10.22 | 1.44** | 0.100 |
| $\ell$ | −8857.27 | | −6418.744 | | | |
| $\mathcal{N}$ | 16245 | | | | | |
| $\mathcal{T}$ | 15 | | | | | |

Stochastic frontier (half normal). Models fit with more that 2 latent classes do not achieved convergence

Significance levels : † 10%, * 5% ** 1%

**Table 4** Latent class stochastic frontier

| lny | First group | | Second group | |
|---|---|---|---|---|
| | Coeff. | SE | Coeff. | SE |
| CSR3 indicator | | | | |
| *Cons* | 1.7439** | 0.1050 | 1.2927** | 0.2031 |
| $\mathcal{K}$ | 0.7414** | 0.029 | 1.0431** | 0.0613 |
| $\mathcal{K}^2$ | 0.0132** | 0.0021 | −0.0200** | 0.0047 |
| *CSR*3 | 0.2457 | 0.3400 | −0.1027 | 0.7288 |
| $\mathcal{K}D$ | −0.0650 | 0.1190 | 0.0742 | 0.2461 |
| $\mathcal{K}D^2$ | 0.0059 | 0.0100 | −0.0020 | 0.020 |
| $\pi_k$ | 0.58** | | 0.42** | |
| $\sigma_k$ | 0.69** | | 1.37** | |
| $\lambda_k$ | 1.12** | | 1.29** | |
| Strength–weak indicator | | | | |
| *Cons* | 0.8172 | 9.491 | 0.9481** | 0.1084 |
| $\mathcal{K}$ | 0.8716** | 0.0184 | 1.139** | 0.0327 |
| $\mathcal{K}^2$ | 0.0060** | 0.0010 | −0.0330** | 0.0028 |
| *DIF* | 0.582** | 0.1867 | 0.5603* | 0.3175 |
| $\mathcal{K}DIF$ | −0.1232* | 0.0614 | −0.0823 | 0.1150 |
| $\mathcal{K}DIF^2$ | 0.0051 | 0.0046 | 0.0098 | 0.0101 |
| $\ell$ | −8857.27 | | −6418.744 | |
| $\mathcal{N}$ | 16245 | | | |
| $\mathcal{T}$ | 14 | | | |
| $\pi_k$ | 0.57** | | 0.43** | |
| $\sigma_k$ | 0.60** | | 1.45** | |
| $\lambda_k$ | 0.00005 | | 1.43** | |

Stochastic frontier (half normal).Models fit with more that 2 latent classes do not achieved convergence

- *CSR*3 is a dummy variable taking value one if the the difference between the sum of strengths and weaknesses on the 8 CSR domains (community, environment, employees, human rights, corporate governance, product quality, controversial industries)is positive and zero otherwise
- a dummy which takes value one if the sum of strengths on community relations, diversity, employee relations, environmental performance, and international social practices, is greater than the sum the weaknesses in the same CSR domains

Significance levels : † 10%, * 5% ** 1%

domains (corporate governance, community relations, diversity, employee relations,environment, human rights, product quality (innovation/R&D), alcohol, gambling, military contracting, nuclear power and tobacco). The second measure is the CSR3 indicator of "public" CSR used in the same paper, which looks only at four KLD CSR domains: community relations, diversity, environment, and the international human rights practices of non-US operations of multinational firms. The CSR3 is built as a dummy variable, which takes value of 1 if a firm has more CSR strengths than weaknesses in community relations, diversity, environment, and international human rights practices of non-US operations; 0 otherwise. The rationale is to check whether the positive effect on corporate performance is produced by the more visible component of the CSR. The underlying assumption is that most of the potential value increasing effects of CSR (the demand from consumers sensitive to the issue, the signal of product quality and the minimisation of transaction costs with stakeholders) materialise to the extent that CSR is perceived at the exterior. In Table 4 we show the results.

The second indicator (the sum of strengths minus the sum of weaknesses) produces results which are slightly different from those found in Table 3 when we use admission to the Domini 400 index as classification criterion. We have a first cluster (see the second panel of Table 4) in which CSR produces again a positive shift in the intercept (very similar in magnitude to that of the first cluster in Table 3) and a weakly significant negative effect on the linear component of the capital/labour ratio, and a second cluster where only the first effect is produced (even though its magnitude is half of that observed in the second cluster with the Domini classification criteria). Results with the third indicator are not significant for both clusters of firms.

To understand better our results we plot predicted efficiency frontiers for CSR and non CSR firms under the Domini and "strengths minus weaknesses" classifications

(Fig. 1) and observe that CSR tend to outperform non CSR firms under the Domini criteria while this is not the case with the "strengths minus weaknesses" classification. We have at least four rationales which may explain this difference. First, the Domini classification corresponds to something visible for investors and consumers. Second, it is not an automatic or blind taxonomy since inclusion in the Index requires a more in depth evaluation of the CSR stance of the firm than just the algebraic difference of strengths and weaknesses. Third, the quality threshold for admission in the index is higher than the above mentioned mere automatic criterion. Fourth, an objective and symbolic event such as inclusion in the Domini 400 index may be more easily sold in corporate marketing policies.

Our robustness check therefore confirms that visibility and quality of CSR stance are crucial to produce the potential positive effects on productive efficiency and performance, consistently with the fact that an important part of these effects is related to the perception of CSR itself by consumers and stakeholders.

In order to identify factors affecting class membership we perform a logit model where the response is the probability of being classified in group one and the covariates are firm specific or industry characteristics (Table 5).

Looking at the table we observe that years of permanence in the Domini index and strengths in product quality are factors affecting the probability of being in the first Domini cluster, that is, the cluster in which effects of CSR are unequivocally positive.

## 5 Conclusions

When something is socially valuable, and also personally non detrimental, its chances of success and development are much higher than when the same social value is associated to a personal disadvantage. This is all the more so in the case of the nexus between corporate social responsibility and industrial performance, since in the competitive race such disadvantage may endanger firm survival. This argument helps us to understand one of the main reasons why the issue of the effects of CSR at firm level is becoming of increasing interest in the most recent years.

Within this field we present a contribution which introduces a new methodological approach and looks at a measure of performance (productivity measured in terms of distance from the efficient frontier) which has been only partially explored by the previous literature. The choice of the productivity (and not the profit) dimension helps us to focus directly on the cake of the economic value created by the firm before considering the distribution of it among stakeholders.

Within the stochastic frontier approach the specificity of our methodology is in the application of mixture models which allow for the endogenous identification of subsample models before the estimation of the stochastic frontier from which inefficiency measures are extracted. Our results do not reject the hypothesis that adoption of CSR practices does not significantly reduce firm efficiency, thereby being not in contrast with the "strategic CSR" hypothesis as far as productive efficiency is concerned a and if the efficiency

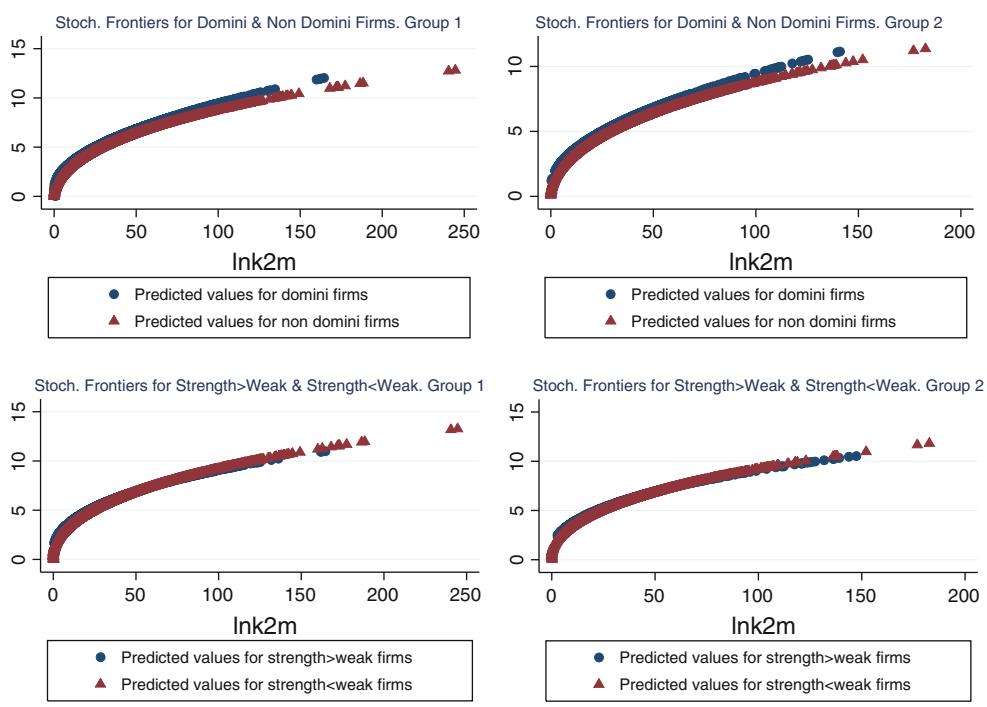


**Fig. 1** Estimated production frontiers for CSR and non CSR firms under different estimates

**Table 5** Logit model for estimated groups from latent SFMs

| | Domini index latent SFM | |
|---|---|---|
| | Dept. variable group | |
| | OR | (SE) |
| Community | 0.71* | 0.10 |
| Diversity | 1.19 | 0.19 |
| Environment | 0.85 | 0.18 |
| Product | 0.19** | 0.03 |
| Permanence | 0.98** | 0.01 |
| BasicMaterial | 0.06** | 0.03 |
| ConsumerCycle | 0.45** | 0.07 |
| Energy | 0.58† | 0.18 |
| Financial | 4.70** | 0.72 |
| HealthCare | 0.72* | 0.11 |
| Industrial | 0.10** | 0.03 |
| Technology | 0.92 | 0.12 |
| Telecom | 1.73* | 0.38 |
| Utilities | 0.56† | 0.18 |
| Banks | 0.80 | 0.12 |
| Chemical | 0.22* | 0.15 |
| Construction | 1.35 | 0.54 |
| FoodBeveverage | 0.07** | 0.03 |
| Insurance | 0.16** | 0.03 |
| Media | 4.11** | 0.77 |
| Retail | 4.26** | 0.70 |
| SmallCap | 0.93 | 0.08 |
| Industry | 3.28** | 0.90 |
| YeryLarge | 1.07 | 0.07 |
| Intercept | 1.71* | 0.38 |
| N | 6591 | |
| Log-likelihood | −3292.997 | |
| $\chi^2_{(24)}$ | 825.863 | |

Permanence: number of years of permanence in Domini 400 Index; Community, diversity, environment and product quality: dummies taking value of one if the firm has a strength in these CSR domains according to the KLD classification (see "Appendix"); Smallcap and Verylarge are capitalization measured as firm's equity values as reported in Datastream (the average of equity per share is: 795, 207.2*M*. $ for small cap. firms 5, 913, 623*M*. $ for large cap. firms and 1, 289, 851 $ for very large cap. firms, the others variables are industry dummies

*OR* odd ratio;

Significance levels : † 10%, * 5% ** 1%

result is paralleled by a similar result on corporate profits. More specifically, we observe that the admission to the Domini 400 index criterion is more effective in identifying the positive CSR effect on productive efficiency than the "blind" difference between CSR strengths and weaknesses according to the KLD database.

Such findings may obviously be affected by the quality of data, the specificity of the considered sample period and the characteristics of the CSR measure adopted. They are however consistent, in more general terms, with theoretical approaches postulating that the increase in costs generated by a corporate attitude which is more favorable to stakeholders may be counterbalanced by some potential positive effects. Effectiveness of CSR as a product quality signal, higher "efficiency wages", minimisation of transaction costs with stakeholders, a closer link to workers' intrinsic motivation and higher support from concerned consumers may all contribute to increase the output sold per worker, thereby offsetting CSR costs and making the CSR choices sustainable in the competitive arena.

**Aknowledgments** The authors thank M. Alfó, S. Kumbhakar, R. Sickles and two anonymous referees for their useful comments and suggestions. The usual disclaimer applies.

## Appendix: Criteria of KLD social ratings

Social issue ratings community

*Strengths*

*Charitable giving* The company has consistently given over 1.5% of trailing three-year net earnings before taxes (NEBT) to charity, or has otherwise been notably generous in its giving.

*Innovative giving* The company has a notably innovative giving program that supports nonprofit organizations, particularly those promoting self-sufficiency among the economically disadvantaged. Companies that permit nontraditional federated charitable giving drives in the workplace are often noted in this section as well.

*Non-US charitable giving* The company has made a substantial effort to make charitable contributions abroad, as well as in the US To qualify, a company must make at least 20% of its giving, or have taken notably innovative initiatives in its giving program, outside the US Support for Housing. The company is a prominent participant in public/private partnerships that support housing initiatives for the economically disadvantaged, e.g., the National Equity Fund or the Enterprise Foundation.

*Support for education* The company has either been notably innovative in its support for primary or secondary school education, particularly for those programs that benefit the economically disadvantaged, or the company has prominently supported job-training programs for youth. Other Strength. The company has either an exceptionally strong volunteer program, in-kind giving program, or engages in other notably positive community activities.

*Concerns*

*Investment controversies* The company is a financial institution whose lending or investment practices have led to controversies, particularly ones related to the Community Reinvestment Act.
*Negative economic impact* The company's actions have resulted in major controversies concerning its economic impact on the community. These controversies can include issues related to environmental contamination, water rights disputes, plant closings, "put-or-pay" contracts with trash incinerators, or other company actions that adversely affect the quality of life, tax base, or property values in the community.
*Other concern* The company is involved with a controversy that has mobilized community opposition, or is engaged in other noteworthy community controversies.

Corporate Governance

*Strengths*

*Limited compensation* The company has recently awarded notably low levels of compensation to its top management or its board members. The limit for a rating is total compensation of less than 500,000 per year for a CEO or 30,000 per year for outside directors.
*Ownership strength* The company owns between 20% and 50% of another company KLD has cited as having an area of social strength, or is more than 20% owned by a firm that KLD has rated as having social strengths. When a company owns more than 50% of another firm, it has a controlling interest, and KLD treats the second firm as if it is a division of the first.
*Other strength* The company has an innovative compensation plan for its board or executives, a unique and positive corporate culture, or some other initiative not covered by other KLD ratings.

*Concerns*

*High compensation* The company has recently awarded notably high levels of compensation to its top management or its board members. The limit for a rating is total compensation of more than 10 million per year for a CEO or 100,000 per year for outside directors.
*Tax disputes* The company has recently been involved in major tax disputes involving more than 100 million with the Federal, state, or local authorities.
*Ownership concern* The company owns between 20% and 50% of a company KLD has cited as having an area of social concern, or is more than 20% owned by a firm KLD has rated as having areas of concern. When a company owns more than 50% of another firm, it has a controlling interest, and KLD treats the second firm as if it is a division of the first.
*Other concern* The company restated its earnings over an accounting controversy, has other accounting problems, or is involved with some other controversy not covered by other KLD ratings.

Diversity

*Strengths*

*CEO* The company's chief executive officer is a woman or a member of a minority group.
*Promotion* The company has made notable progress in the promotion of women and minorities, particularly to line positions with profit-and-loss responsibilities in the corporation.
*Board of directors* Women, minorities, and/or the disabled hold four seats or more (with no double counting) on the board of directors, or one-third or more of the board seats if the board numbers less than 12.
*Work/life benefits* The company has outstanding employee benefits or other programs addressing work/life concerns, e.g., childcare, elder care, or flextime.
*Women and minority contracting* The company does at least 5% of its subcontracting, or otherwise has a demonstrably strong record on purchasing or contracting, with women- and/or minority-owned businesses.
*Employment of the disabled*. The company has implemented innovative hiring programs, other innovative human resource programs for the disabled, or otherwise has a superior reputation as an employer of the disabled.
*Gay and lesbian policies* The company has implemented notably progressive policies toward its gay and lesbian employees. In particular, it provides benefits to the domestic partners of its employees. Other Strength. The company has made a notable commitment to diversity that is not covered by other KLD ratings.

*Concerns*

*Controversies* The company has either paid substantial fines or civil penalties as a result of affirmative action controversies, or has otherwise been involved in major controversies related to affirmative action issues.
*Non-representation* The company has no women on its board of directors or among its senior line managers.
*Other concern* The company is involved in diversity controversies not covered by other KLD ratings.

Employee relations

*Strengths*

*Cash profit sharing* The company has a cash profit-sharing program through which it has recently made distributions to a majority of its workforce.
*Employee involvement* The company strongly encourages worker involvement and/or ownership through stock options available to a majority of its employees, gain sharing, stock ownership, sharing of financial information, or participation in management decision-making.
*Health and safety strength* The company is noted by the US Occupational Health and Safety Administration for its safety programs.
*Retirement benefits strength* The company has a notably strong retirement benefits program.
*Union relations* The company has a history of notably strong union relations.
*Other strength* The company has strong employee relations initiatives not covered by other KLD ratings.

*Concern*

*Union relations* The company has a history of notably poor union relations.
*Health and safety concern* The company recently has either paid substantial fines or civil penalties for willful violations of employee health and safety standards, or has been otherwise involved in major health and safety controversies.
*Workforce reductions* The company has reduced its workforce by 15% in the most recent year or by 25% during the past two years, or it has announced plans for such reductions.
*Retirement benefits concern* The company has either a substantially underfunded defined benefit pension plan, or an inadequate retirement benefits program.
*Other concern* The company is involved in an employee relations controversy that is not covered by other KLD ratings.

Environment

*Strengths*

*Beneficial products and services* The company derives substantial revenues from innovative remediation products, environmental services, or products that promote the efficient use of energy [costa], or it has developed innovative products with environmental benefits. (The term "environmental service" does not include services with questionable environmental effects, such as landfills, incinerators, waste-to-energy plants, and deep injection wells.)
*Clean energy* The company has taken significant measures to reduce its impact on climate change and air pollution through use of renewable energy and clean fuels or through energy efficiency. The company has demonstrated a commitment to promoting climate-friendly policies and practices outside its own operations.
*Communications* The company is a signatory to the CERES Principles, publishes a notably substantive environmental report, or has notably effective internal communications systems in place for environmental best practices.
*Pollution prevention* The company has notably strong pollution prevention programs including both emissions reductions and toxic-use reduction programs.
*Recycling* The company either is a substantial user of recycled materials as raw materials in its manufacturing processes, or a major factor in the recycling industry.
*Other strength*. The company has demonstrated a superior commitment to management systems, voluntary programs, or other environmentally proactive activities.

*Concerns*

*Hazardous waste* The company's liabilities for hazardous waste sites exceed 50 million, or the company has recently paid substantial fines or civil penalties for waste management violations.
*Regulatory problems* The company has recently paid substantial fines or civil penalties for violations of air, water, or other environmental regulations, or it has a pattern of regulatory controversies under the Clean Air Act, Clean Water Act or other major environmental regulations.
*Ozone depleting chemicals* The company is among the top manufacturers of ozone depleting chemicals such as HCFCs, methyl chloroform, methylene chloride, or bromines.
*Substantial emissions* The company's legal emissions of toxic chemicals (as defined by and reported to the EPA) from individual plants into the air and water are among the highest of the companies followed by KLD. Agricultural Chemicals. The company is a substantial producer of agricultural chemicals, i.e., pesticides or chemical fertilizers.
*Climate change* The company derives substantial revenues from the sale of coal or oil and its derivative fuel products, or the company derives substantial revenues indirectly from the combustion of coal or oil and its

derivative fuel products. Such companies include electric utilities, transportation companies with fleets of vehicles, auto and truck manufacturers, and other transportation equipment companies.
*Other concern*. The company has been involved in an environmental controversy that is not covered by other KLD ratings.

Human rights

*Strengths*

*Indigenous peoples relations strength* The company has established relations with indigenous peoples near its proposed or current operations (either in or outside the US) that respect the sovereignty, land, culture, human rights, and intellectual property of the indigenous peoples.
*Labor rights strength* The company has outstanding transparency on overseas sourcing disclosure and monitoring, or has particularly good union relations outside the US
*Other strength* The company has undertaken exceptional human rights initiatives, including outstanding transparency or disclosure on human rights issues, or has otherwise shown industry leadership on human rights issues not covered by other KLD human rights ratings.
*Quality* The company has a long-term, well-developed, company-wide quality program, or it has a quality program recognized as exceptional in US industry.
*R&D/innovation* The company is a leader in its industry for research and development (R&D), particularly by bringing notably innovative products to market.
*Benefits to economically disadvantaged* The company has as part of its basic mission the provision of products or services for the economically disadvantaged. Other Strength. The company's products have notable social benefits that are highly unusual or unique for its industry.

*Concerns*

*Burma concern* The company has operations or investment in, or sourcing from, Burma.
*Labor rights concern* The company's operations outside the US have had major recent controversies related to employee relations and labor standards or its US operations have had major recent controversies involving sweatshop conditions or child labor.
*Indigenous peoples relations concern* The company has been involved in serious controversies with indigenous peoples (either in or outside the US) that indicate the company has not respected the sovereignty, land, culture, human rights, and intellectual property of indigenous peoples.
*Other concern* The company's operations outside the US have been the subject of major recent human rights controversies not covered by other KLD ratings.
*Product safety* The company has recently paid substantial fines or civil penalties, or is involved in major recent controversies or regulatory actions, relating to the safety of its products and services.
*Marketing/contracting controversy* The company has recently been involved in major marketing or contracting controversies, or has paid substantial fines or civil penalties relating to advertising practices, consumer fraud, or government contracting.
*Antitrust* The company has recently paid substantial fines or civil penalties for antitrust violations such as price fixing, collusion, or predatory pricing, or is involved in recent major controversies or regulatory actions relating to antitrust allegations.
*Other concern* The company has major controversies with its franchises, is an electric utility with nuclear safety problems, defective product issues, or is involved in other product-related controversies not covered by other KLD ratings.

Controversial business issues adult entertainment

1. *Distributors* The report includes publicly traded US companies that derive 15% or more of total revenues from the rental, sale, or distribution (wholesale or retail) of adult entertainment media products.
2. *Owners and operators* The report includes publicly traded US companies that own and/or operate adult entertainment establishment. Producers. The report includes publicly traded US companies that produce adult media products including movies, magazines, books, calendars, and websites.
3. *Providers* The report includes publicly traded US companies that offer pay-per-view adult entertainment.
4. *Ownership of an adult entertainment company* The company owns more than 20% of another company with adult entertainment involvement. (When a company owns more than 50% of company with adult entertainment involvement, KLD treats the adult entertainment company as a consolidated subsidiary.)
5. Ownership by an Adult Entertainment Company. The company is more than 50% owned by a company with adult entertainment involvement.

Alcohol

1. *Licensing* The company licenses its company or brand name to alcohol products.

2. *Manufacturers* Companies that are involved in the manufacture alcoholic beverages including beer, distilled spirits, or wine.
3. *Manufacturers of products necessary for production of alcoholic beverages* Companies that derive 15% or more of total revenues from the supply of raw materials and other products necessary for the production of alcoholic beverages.
4. *Retailers* Companies that derive 15% or more of total revenues from the distribution (wholesale or retail) of alcoholic beverages.
5. *Ownership of an alcohol company* The company owns more than 20% of another company with alcohol involvement. (When a company owns more than 50% of company with alcohol involvement, KLD treats the alcohol company as a consolidated subsidiary.)
6. O*wnership by an alcohol company* The company is more than 50% owned by a company with alcohol involvement.

Firearms

1. *Manufacturers* The company is engaged in the production of small arms ammunition or firearms, including, pistols, revolvers, rifles, shotguns, or submachine guns.
2. *Retailers* The company derives 15% or more of total revenues from the distribution (wholesale or retail) of firearms and small arms ammunition.
3. *Ownership of a firearms company* The company owns more than 20% of another company with firearms involvement. (When a company owns more than 50% of company with firearms involvement, KLD treats the firearms company as a consolidated subsidiary.)
4. *Ownership by a firearms company*. The company is more than 50% owned by a company with firearms involvement.

Gambling

1. *Licensing* The company licenses its company or brand name to gambling products.
2. *Manufacturers* Companies that produce goods used exclusively for gambling, such as slot machines, roulette wheels, or lottery terminals.
3. *Owners and operators* Companies that own and/or operate casinos, racetracks, bingo parlors, or other betting establishments, including casinos; horse, dog, or other race tracks that permit wagering; lottery operations; on-line gambling; pari-mutuel wagering facilities; bingo; Jai-alai; and other sporting events that permit wagering.
4. *Supporting products or services* Companies that provide services in casinos that are fundamental to gambling operations, such as credit lines, consulting services, or gambling technology and technology support.
5. *Ownership of a gambling company*. The company owns more than 20% of another company with gambling involvement. (When a company owns more than 50% of company with gambling involvement, KLD treats the gambling company as a consolidated subsidiary.)
6. *Ownership by a gambling company*. The company is more than 50% owned by a company with gambling involvement.

Military

1. *Manufacturers of weapons or weapons systems* Companies that derive more than 2% of revenues from the sale of conventional weapons or weapons systems, or earned 50 million or more from the sale of conventional weapons or weapons systems, or earned 10 million or more from the sale of nuclear weapons or weapons systems.
2. *Manufacturers of components for weapons or weapons systems* Companies that derive more than 2% of revenues from the sale of customized components for conventional weapons or weapons systems, or earned 50 million or more from the sale of customized components for conventional weapons or weapons systems, or earned 10 million or more from the sale of customized components for nuclear weapons or weapons systems.
3. *Ownership of a military company* The company owns more than 20% of another company with military involvement. (When a company owns more than 50% of company with military involvement, KLD treats the military company as a consolidated subsidiary.)
4. *Ownership by a military company* The company is more than 50% owned by a company with military involvement.

Nuclear power

1. *Ownership of nuclear power plants* Companies that own nuclear power plants. Ownership of a Nuclear Power Company. The company owns more than 20% of another company with nuclear power involvement. (When a company owns more than 50% of company with nuclear power involvement, KLD treats the nuclear power company as a consolidated subsidiary.)

2. *Ownership by a nuclear power company* The company is more than 50% owned by a company with nuclear power involvement.

Tobacco

1. *Licensing* The company licenses its company name or brand name to tobacco products.
2. *Manufacturers* The company produces tobacco products, including cigarettes, cigars, pipe tobacco, and smokeless tobacco products.
3. *Manufacturers of products necessary for production of tobacco products* The company derives 15% or more of total revenues from the production and supply of raw materials and other products necessary for the production of tobacco products.
4. *Retailers* The company derives 15% or more of total revenues from the distribution (wholesale or retail) of tobacco products.
5. *Ownership of a tobacco company* The company owns more than 20% of another company with tobacco involvement. (When a company owns more than 50% of company with tobacco involvement, KLD treats the tobacco company as a consolidated subsidiary.)
6. *Ownership by a tobacco company*. The company is more than 50% owned by a company with tobacco involvement.

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