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'Does Community and Environmental ResponsibilityAffect Firm Risk? Evidence from UK Panel Data 1994-2006'

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DOES COMMUNITY AND ENVIRONMENTAL RESPONSIBILITY AFFECT FIRM RISK? EVIDENCE FROM UK PANEL DATA 1994-2006

ABSTRACT

The question of how an individual firm's environmental performance impacts its firm risk has not been examined in any empirical UK research. Does a company that strives to attain good environmental performance decreases its market risk or is environmental performance just a disadvantageous cost that increases such risk levels for these firms? Answers to this question have important implications for the management of companies and the investment decisions of individuals and institutions. The purpose of this paper is to examine the relationship between corporate environmental performance and firm risk in the British context. Using the largest dataset so far assembled, with Community and Environmental Responsibility (CER) rankings for all rated UK companies between 1994 and 2006, we show that a company's environmental performance is inversely related to its systematic financial risk. However, an increase of 1.0 in the CER score is associated with only a 0.02 reduction in firm's risk and cost of capital.

INTRODUCTION

Recent conclusions on the effects of human activity on the earth's climate (Stern, 2006, IPCC, 2007) have pushed the community and environmental responsibility (CER) of corporations up the policy agenda. As a consequence, the issue of economic performance and its association with investment in CER, has become more urgent. Comprehensive literature reviews, for example, Pava and Krausz, 1996; Margolis and Walsh, 2001; Orlitzky, Schmidt, and Rynes 2003, suggest that CER is supportive of competitive advantage, and that therefore corporate managements at least are likely to be increasingly supportive of such investments.

As far as shareholder returns are concerned, there is no consensus as to whether such investments have a favourable or detrimental impact on returns (Brammer, Brooks and Pavelin, 2006, p.97). Indeed recent evidence suggests that corporate social responsibility is expected to be costly to shareholders, (Surroca and Tribo, 2008), and that investors show weaker preferences for attributes such as social performance than for shorter term operational efficiency attributes (Cox et al, 2007).

Although such investigations have been and remain important, it is also of value to consider an alternative but complementary avenue of research. Rather than representing cost and revenue trade-offs, investments in CER may also represent risk reduction opportunities or greater risk exposures. In particular, it is possible that firms that have made such investments might be more or less vulnerable to adverse shocks that systematically affect firms and that should accordingly be priced in a financial market. Examples might include firms that have invested in clean technology, insulation etc being less vulnerable to price increases in energy inputs, or conversely firms that have invested in premium priced products and processes, such as organic food and drink, being more vulnerable in a general economic downturn. These issues raise the question as to whether such risks are priced by stock markets and if so what is their net effect. The magnitude of these effects will potentially impact the overall level of utility in terms of the risk and return trade off for the average investor. True economic performance, as Orlitzky and Benjamin (2001, p.369) point out, manifests itself in both high financial return and low financial risk. Moreover, as far as portfolio investors are concerned, differential risk effects may compound or attenuate the negative effects of screening that otherwise follow from research evidence suggesting neutrality in terms of return differentials (Brammer et al, 2006).

A number of prior studies have attempted to quantify the empirical relationship between CER and market risk (beta). These are summarized in Orlitzky and Benjamin's (2001, p.385) meta-analysis, which finds an overall negative correlation. These studies utilise data from the US and cover papers published in the period 1978-1995. Many of these studies relied on small samples and all had fewer than 200 observations. To measure CER several of the studies use CEP data, and are thereby concerned only with pollution (Chen & Metcalf, 1980, Spicer, 1978, Pava & Krausz, 1995) or disclosure Trotman & Bradley (1981) Roberts (1992). Others used subjective indices for example a concern for society index Aupperle, Carroll, & Hatfield (1985), O'Neill Saunders, & McCarthy (1989). Other sundry measures are also used (Alexander & Buchholz, 1978; Baldwin et al. (1986), Fombrun & Shanley (1990). Only one, McGuire, Sundgren, & Schneeweis, 1988, used *Fortune's* responsibility to the community and environment ratings. The latter is a broad based and repeated measure, creating the possibility of a large sample panel survey. McGuire et al, whose research was conducted only shortly after the inception of the *Fortune* ranking could of necessity only access three years of data.

The purpose of this paper is to conduct a new empirical investigation of the CER and market risk relationship using a longer run data set. In doing so it aims to present evidence for the UK, based on a large panel data set. It uses a measure equivalent to the *Fortune* rankings as a proxy for CER and measures its impact on risk using a twelve year panel data set. Our research is also important since we use the largest dataset so far used, which has Community and Environmental Responsibility (CER) rankings for all rated UK companies between 1995 and 2006. In brief, the results indicate that a company's environmental performance is associated with lower systematic risk. Specifically, an increase of 1.0 in the CER score is associated with only a 0.028 reduction in the firm's beta factor. The remainder of the paper is organised as follows. Section 2 reviews prior research in order to evaluate the appropriate proxies for empirical testing and other variables of interest. Section 3 describes the research design and the empirical predictions. The main findings are then discussed in section 4. In the final section conclusions are drawn.

I THEORETICAL PERSPECTIVES

Two main theoretical arguments have been used to examine the economic and risk consequences of corporate environmental responsibility (e.g. McGuire *et al*. 1988; Klassen and McLaughlin, 1996; McWilliams and Siegel, 2001). The first is the strict constructionism school which argues that high environmental responsibility results in additional operating costs and potential sacrifices (e.g. via promoting community development plans, establishing environmental protection procedures, and dropping certain product lines). Therefore, those firms that improve their environmental performance are at economic and, therefore, risk disadvantage.

The second is the environmental responsibility school which argues that despite the potential significant costs of improving environmental performance, other costs are reduced or revenues are increased. On the cost side, companies who minimize the negative environmental impacts of their products and processes, recycle post-consumer waste, and establish environmental management systems reduce costs from materials waste, energy consumption and inefficient processes and prevent environmental spills, crises, liabilities, penalties and management time directed at clean-up and remediation. On the revenue side, the environmentally oriented companies are posited to attract customers and expand their markets or displace competitors that fail to promote strong environmental performance (Klassen and McLaughlin, 1996). From this perspective, it can be argued that if a firm acts in an environmentally responsible manner, then this firm will decrease its market risk. This low risk makes projections of a firm's future cash flows more certain and reliable (Orlitzky and Benjamin, 2001).

Supporting this argument is the stakeholder theory which contends that every modern corporation has explicit and implicit relationships (contracts) with a variety of primary and secondary stakeholders who have the power and/or an interest (stake) in its actions and outputs and, therefore, they are a critical factor in determining its success or failure (e.g. Jensen and Meckling, 1976; Freeman, 1984; Cornell and Shapiro, 1987; Jones, 1995; Wijnberg, 2000). Consequently, managers, as agents monitored by multiple stakeholders, have a duty of balancing their stakeholders' claims to safeguard the welfare of the corporation (Evan and Freeman, 1993).

This paper analyses the CER-market risk relation by relating it to the instrumental approach of stakeholder theory which establishes a general relation between proposed behaviour and expected outcome (Jones, 1995). As Donaldson and Preston (1995) explained, "If you want to achieve (avoid) results X, Y, or Z, then adopt (don't adopt) principles and practices A, B, or C." (p. 72). Theoretically, if a firm does not act in an environmentally responsible manner and, therefore, fails to meet the claims of implicit stakeholders, investors may consider it as a risky investment because they may anticipate costly explicit claims (e.g. regulatory intervention, governmental fines and lawsuits) to force the firm to consider these claims. Also, investors may regard this as an evidence of poor management skills which may result in restricted ability to obtain capital at consistent rates (McGuire *et al*. 1988).

II PRIOR RESEARCH ON THE EFFECTS OF CER FOR INVESTORS

Shareholders, government regulators, consumers, employees, and the general public are becoming increasingly interested in companies' environmental activities (Ilinitch *et al*. 1998). Part of this interest is motivated by the possibility of a positive relationship between CER and financial performance. For most, if not all of these stakeholders it is also likely to be motivated by some perception of risk. In the case of shareholders, financial risk is likely to be the relevant aspect. Accordingly, firms with stable stakeholder group relations will probably encounter fewer difficulties attracting new equity investment to the firm (Waddock and Graves, 1997).

In general this view is borne out by prior empirical studies. Orlitzky and Benjamin find an overall negative correlation of 0.0965 in their meta-survey of 1968-1985.[1] Even so, there is some variation in individual studies. Aupperle et al (1985, table 3, p.459) found a negative (-0.08) but insignificant (p=0.25) association between market-based risk and concern for society, as measured by a forced choice survey instrument administered to corporate executives. Whilst risk adjusted return measures are helpful, they do not allow the separate interpretation of risk. As Orlitzky and Benjamin (2001, p.370) point out, '…risk must be considered in and of itself and not only as an adjustment factor.' McGuire et al (1988, table 3, p.864) find a weakly significant relationship (p<0.1) between beta and CER when CER data is averaged over the three years (1983-85) of their sample and a stronger relationship in one of the years (1983). In this study the beta is a lagged independent variable, so that low financial risk is theorised to create the planning certainty that facilitates investment in CER. A similar hypothesis, this time related to general reputation, is tested by Fombrun and Shanley (1990, p.237), suggesting that high performance and low risk send positive signals to market constituents, predisposing them to make favourable assessments of their managerial reputations. They found a significant and negative correlation (-0.28) between the overall 1985 *Fortune* ranking (which includes CER among a total of ten variables) and systematic risk measured by beta (Fombrun and Shanley, 1990, table 1, p.248), although in general beta was insignificant when regressed as an independent variable in conjunction with others, including size, book to market, dividend yield and risk measured by variability in accounting returns (table 3, p.250).

[1] The publication dates range from 1978-1995, but the earliest data included in the meta-analysis dates to 1968 (Spicer, 1978a).

Other studies have examined the impact of systematic risk on CER disclosures and found weak negative associations (Roberts, 1992, table 4, p.608) for US data and highly significant negative association for UK data (Toms, 2002, Hasseldine, Salama and Toms, 2005). These studies follow the approach of McGuire et al 1988, suggesting that systematic risk is a determinant of CER since managers in lower risk companies have access to more stable cash flows allowing them to make such investments (Roberts, 1992, p.604, Hasseldine et al, 2005, p.238).

In addition to these hypothesised cause and effect relations, there may be other reasons for an association between CER and systematic risk. Alexander and Buchholz (1978) suggest that investors may consider less socially responsible firms to be riskier investments because they see management skills at the firm as low. Spicer (1978, pp.96-97) suggests that firms with good pollution control records are less vulnerable to costly sanctions and therefore might enjoy lower risk and capital costs. These hypotheses are tested by examining the statistical association between the CER measure and systematic risk, and also imply that lower systematic risk might be an outcome of better CER management. Alexander and Buchholz (1978) also found no significant relationship between stock market returns and corporate social performance, in this case using betas to compute risk adjusted returns. Spicer (1978, tables 4&6, pp.107-108) finds a negative and significant relationship between systematic risk and pollution control performance, but the association does not persist through time. Reviewing these results, Chen and Metcalf (1980, table 2, p.176), show that the relationship between CER and systematic risk is impacted by firm size, and although negative is not significant.

In summary there are several important features of the above literature. First and most importantly, more attention is given to CER as a dependent variable where systematic risk is an independent variable, sometimes lagged and often argued to be a causal factor. Conversely, only an association with CER is asserted where systematic risk is the dependent variable. A large panel data set provides the opportunity to examine these relationships in more detail. Second, where systematic risk has been the explained variable, relatively few control variables such as size and industry grouping have been used. New tests, using a large dataset potentially overcomes problems associated with interpreting key co-efficients in the absence of such control variables without compromising required degrees of freedom. Third, the datasets upon which the literature is based is somewhat dated and typically considers relatively short windows. Again a longer run panel data set overcomes these limitations and allows some investigation of the extent to which the increasing policy importance of environmental reputation is impacting on firm risk. Long run tests have been conducted on the impact of CER on financial returns, for example, Antunovich and Laster (2000) employ data for the 1983-1996 period, and a complementary study of its impact on risk is therefore of potential value. Fourth, there was no consistent, comprehensive and objective standard for the measurement of CER. These have varied from self-generated measures, for example accounting disclosures, are difficult to objectively identify (Aupperle *et al*, 1985) are inevitably propagandist and part of the image creation process (Cochran and Wood, 1984). Alternatively, measures generated by external agencies, for example pollution control indices is potentially equally biased, for example by dealing with only one particular aspect of CER such as pollution (Bragdon and Marlin, 1972) or being likely to reflect opinion without reference to the technical aspects of the particular industry (Cochran and Wood, 1984). A useful compromise comes from surveys from objective observers conversant with the industry, based on the views of large numbers of managers and investors. These 'Most Admired Companies' surveys have been published annually in *Fortune* since 1982 and in *Management Today* since 1994 for the US and the UK respectively and have been utilised in some of the prior studies referred to above (McGuire et al, 1998, Fombrun and Shanley, 1990, Antunovich and Laster, 2000, Toms, 2002, Hasseldine, Salama and Toms, 2005)

As the above review of evidence has suggested, if a firm proactively engages in environmentally responsible actions, stakeholders will be satisfied. Supporting this view, Orlitzky and Benjamin (2001) summarising many of the prior studies, concluded that firms with better reputations for corporate social performance are less risky. Based on this framework, we derive our main theoretical argument; if a firm acts (does not act) in an environmentally responsible manner, then this firm will decrease (increase) its market risk. This leads to our hypothesis that *firm risk is negatively related to corporate environmental performance.*

III. RESEARCH DESIGN AND HYPOTHESES

A. Reputation data

Reputation data for CER was obtained from the *Management Today* magazine survey for several reasons. First, it provides comparable data for the whole period of the study, 19940-2006. Second, the number of respondents provides a sufficient year by year sample size. Third, respondents, who consist of both managers and investment analysts specialising in that sector, rate only firms in an industry with which they are familiar. The sample population chosen for this study included all firms covered by the *Management Today* 'Britain's Most Admired Companies (MAC)' 1994-2006 survey in terms of 'Community and Environmental Responsibility'.[2] Each annual survey contains all the FTSE100 British companies and, on average, 90% of the top 200 companies by market capitalisation. The sample companies are the largest by market capitalisation from each of 26 sectors. Each year Britain's MAC survey asks senior executives from 260 British companies and senior specialist business analysts to give a rating of the performance of each company, other than their own in the case of executives, within their industrial sector. They provide a score of 0 (= poor) to 10 (= excellent) for each of nine characteristics that impact on the major stakeholders.[3] A total of

[2] Data are available from 1992-2006, but there is no data for 1993, so we started our panel dataset in 1994. Collection of results starts in April each year, and they are finalised in September and published in December, so we assume that the CER rankings are available from October each year. Tests of leads/lags (not reported) showed that our original assumption gave the strongest predictor for beta.

[3] These include quality of management, financial soundness, quality of service/products, quality of marketing, ability to attract & retain top talent, long-term investment value, capacity to innovate, use of corporate assets, and community and environmental responsibility.

3153 firm-years were listed in these surveys, with 567 individual firms represented over the years. The sample was reduced further due to missing accounting and return data. This leaves 1625 usable observations which appeared in the MAC published survey of Community and Environmental Responsibility from 1994 and 2006 (inclusive), and for which all appropriate data were available.

B. Other variables

The dependent variable for empirical analysis is systematic risk. This is captured by estimating a firm's beta risk (BETA). In this paper, a company's beta factor has been estimated from regressing monthly log stock return on the monthly log market return of the FTSE-350 over the last five years.

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_i \quad (1)$$

where:

R_{it} = the return on security *i* for month *t*

α_i = the intercept term

β_i = the systematic risk of security *i (BETA)*

R_{mt} = the return on the market for month *t*

e_i = an error term

The beta has only been calculated if twenty-four or more company monthly returns were available over that period.

The explanatory variables used in the regression analysis include the corporate environmental performance. This has been measured by Community and Environmental Responsibility (CER) rankings, as published in *Management Today*'s MAC survey in December each year. The CER variable is the average score derived from the individual ratings of executives and analysts combined.

In addition, following the literature (see for instance the seminal work of Beaver *et al*. 1970), we include a number of underlying firm characteristics (i.e. accounting variables) that can affect individual firms' risk and which need to be controlled for in the estimations. In particular, the prior empirical studies suggest that large firms are presumed to be less risky and find negative association between firm size and systematic risk (e.g. Alexander and Thistle, 1999; Lord and Beranek, 1999). Therefore, we control for corporate size (SIZE) as measured by the log of the number of employees. Additionally, it is often asserted that firms with low payout ratios are more risky (Beaver *et al*. 1970) and, therefore, many studies examine the dividend payout ratio as a determinant of systematic risk and find a significant negative association with systematic risk (e.g. Bowman, 1979). Hence, we control for the dividend payout (POUT), calculated by dividing dividends per share by the adjusted net earnings per share for the last reporting period.

Another variable that has been frequently used in the tests of association and prediction of systematic risk is corporate liquidity (e.g. Ferris *et al*. 1990). The current ratio is widely interpreted as a measure of liquidity (Abdelghany, 2005). Therefore, we control for liquidity (LIQU) using current ratio (*Datastream Worldscope* item 08106), as measured by total current assets / total current liabilities.

Gearing is another determinant of risk. The larger the debt in the firm's capital structure, the higher is the risk of default, and the lower is the valuation of its equity (see for example, Baxter, 1967; Bierman, 1968; Ben-Zion and Balch, 1973; Hamada, 1972; Ben-Zion and Shalit, 1975). Therefore, we control for capital gearing (GEAR) (*Datastream Worldscope* item 08221), as measured by total debt as a percentage of total capital. Further, empirical studies examining the determinants of systematic risk have generally hypothesized and observed positive association between risk and asset growth (e.g. Bowman, 1979). Therefore, we control for asset growth (GROW), as measured by TA_t / TA_{t-1} where TA is the book value of total assets. We also control for firm profitability, as measured by Return on Capital Employed (ROCE) (*Datastream*

Worldscope item 08376, Return on Invested Capital). We group our companies by industry using the Datastream INDC2 indicator, thereby breaking the sample into 11 high-level groups.[4]

C. Model specification

The model is designed to investigate whether the CER rankings add extra information to models of the determinants of a company's beta (e.g. Beaver *et al*. 1970; Bowman, 1979; Ferris *et al*. 1990; Alexander and Thistle, 1999; Lord and Beranek, 1999; Abdelghany, 2005).[5] To do so, the following model was estimated using random and fixed-effects regression models:[6,7]

$$BETA_{it} = \beta_1 CER_{it} + \beta_2 SIZE_{it} + \beta_3 POUT_{it} + \beta_4 LIQU_{it} + \beta_5 GEAR_{it} + \beta_6 GROW_{it} + \beta_7 ROCE_{it} + \beta_8 IND_{it} + \mu_{it} \quad (2)$$

Where:

i	=	1, …, N;
t	=	1994,…,2006;
BETA	=	Systematic risk as measured by the company's beta factor;
CER	=	Community and Environmental Responsibility rankings, as published in *Management Today*'s MAC survey in December each year;
SIZE	=	Log of number of employees;
POUT	=	Dividend payout;
LIQU	=	Current ratio;
GEAR	=	Log of equity gearing;
GROW	=	Log of asset growth;
ROCE	=	Return on Capital Employed;
IND	=	Industry grouping variable

It should be noted that most of our variables are company accounts variables which are announced once a year. However, beta varies continuously. This mismatch means that we have to make a

[4] The groups are: basic materials (BMATR), consumer goods (CNSMG), consumer services (CNSMS), finance (FINAN), healthcare (HLTHC), industrials (INDUS), technology (TECNO), telecommunications (TELECOM), unclassified (UNCLS), unquoted equities (not an ICP-covered sector) (UQEQS) and utilities (UTILS).

[5] We also test the impact of CER growth on beta growth.

[6] Fixed-effects modelling should be used when the data represents a self-selected group. However, if the data represents a random draw from the population, then the researcher should use the random-effects modelling. Furthermore, random-effects should be used if one or more of the key independent variables are fixed within firms over time (Black *et al*. 1997).

[7] In unreported tests we checked the CER could predict total risk (i.e. variance of returns) or firm-specific risk (i.e. the risk of (firm returns minus FTSE350 returns)) instead of beta, but found no significant predictive power.

decision on the frequency of our data to be used in the regressions. We decide that, since most of our variables changed only annually, if we use monthly data in the regressions, we might get highly significant results but would be in danger of creating twelve times as much data as there really was.

Instead, we request monthly data from *Datastream*, and thus the accounts data came in runs of twelve months, but then filter it so as only to include data when the accounts variables changed from the previous run of twelve months. Using this method, each data item was "fresh", at the cost of losing some information on the monthly variation in betas and market values.[8] All accounting data are assumed to be available at a lag of four months, since UK Listing Authority rules state that preliminary results must be released within 120 days of the company year-end. Thus, data on beta for e.g. April are paired with accounts data for companies with year-ends in December.

IV. RESULTS AND DISCUSSION

Descriptive statistics of the primary variables of interest are provided in Tables 1 to 4. Table 1 (overleaf) presents descriptive statistics for each series at the company/month level (1,600 data items). BETA, Systematic risk as measured by the company's beta factor; CER, Community and Environmental Responsibility rankings, as published in *Management Today*'s MAC survey in December each year; SIZE, Natural logarithm of number of employees; POUT, Dividend payout; LIQU, Current ratio; GEAR, capital gearing; GROW, Natural logarithm of asset growth; ROCE, Return on Capital Employed. Natural logarithms are calculated for variables with large positive skewness (SIZE and GROW). Even so, several variables demonstrate the trappings of non-normality, mainly due to the presence of outliers, indicated by the maximum and minimum observed values. The dependent variable, beta, is however close to normal. These data characteristics do not necessarily have further implications for model specification in a panel data context at this stage.

[8] We also tried using data every December, so that the CER data was fresh but the accounting data was up to 11 months old, but arrived at very similar results.

Table 1

Descriptive statistics

	BETA	CER	SIZE	POUT	LIQU	GEAR	GROW	ROCE
Mean	0.924	5.532	9.399	47.68	1.339	35.92	0.067	12.33
Median	0.916	5.500	9.505	45.64	1.160	35.85	0.050	11.19
Std.Dev.	0.473	0.844	1.391	22.44	0.877	19.64	0.241	16.02
Min	-0.800	2.700	1.792	0	0.150	0	-1.197	-128.7
Max	3.775	8.500	12.93	100.0	11.25	99.67	3.738	135.5
< 0	23	0	0	0	0	25	532	126
= 0	0	0	0	66	0	0	0	0

Table 2 (below) presents the correlations between the dependent variable and the main explanatory and control variables. Table 2 shows that none of the variables suffered from multicollinearity. In fact, the correlations are remarkably low between all our variables. Table 2 also shows that the highest figure is a correlation of 0.32 between CER and size. This confirms that large firms invest more in reputation as evidenced by the positive significant association between corporate size and CER, a finding which is consistent with prior studies (e.g. Chen and Metcalf, 1980, Toms, 2002; Hasseldine *et al*. 2005). There is only a -0.09 direct correlation between CER and beta.

Table 2

Correlation analysis

	BETA	CER	SIZE	POUT	LIQU	GEAR	GROW	ROCE
BETA	1.00	-0.09	0.03	-0.12	0.21	-0.07	0.00	-0.11
CER		1.00	0.32	0.13	-0.11	0.06	0.00	0.02
SIZE			1.00	0.10	-0.20	0.21	0.09	0.15
POUT				1.00	-0.19	0.16	-0.01	-0.06
LIQU					1.00	-0.30	-0.03	-0.01
GEAR						1.00	0.00	-0.02
GROW							1.00	0.02
ROCE								1.00

How the mean betas and CERs vary by industry can be seen in Table 3 below. As one would expect, the Technology sector has very high betas and the Utilities sector very low betas. Mean CERS do not however vary a great deal by sector.

Table 3

Mean betas and CERs by industry

	No. of company / year data items	Mean beta	Mean CER
Basic materials	147	1.02	5.65
Consumer goods	279	0.80	5.51
Consumer services	466	0.88	5.26
Finance	15	0.62	4.53
Healthcare	54	0.72	6.12
Industrials	421	1.07	5.60
Technology	45	1.63	5.48
Telecommunications	27	1.25	5.68
Unclassified	2	1.20	5.64
Unquoted equities	1	0.90	5.33
Utilities	118	0.56	5.86

The mean betas and CERs for each year are shown in Table 4 (overleaf). The mean beta is not exactly 1.00 each year, as which companies are included in the MAC survey and which companies satisfy all our data criteria vary year by year. The mean CER is however remarkably consistent over the years, even after we drop some companies due to the non-availability of data. Possibly the CER scores are standardised at 5.50 by Management Today before publication.

Table 4

Mean betas and CERs by year

	No. of company / year data items	Mean beta	Mean CER
1994	7	1.17	5.58
1995	159	1.05	5.48
1996	147	0.97	5.53
1997	148	0.93	5.58
1998	145	0.76	5.55
1999	131	0.94	5.75
2000	130	0.87	5.53
2001	128	0.80	5.54
2002	136	0.88	5.48
2003	143	1.02	5.54
2004	127	0.90	5.48
2005	127	0.89	5.41
2006	97	1.08	5.50

Table 5 (following) presents the regression results from the estimation of equation (1). Fixed effect and random effects are reported. The random effects model is preferred since beta varies significantly across most industry groups, from an average of 0.62 for finance to 1.63 for technology, and group membership is time invariant. Otherwise, it should be noted however that the Hausman test (p = 0.0238) favours the fixed effects model.

Using a two tailed test, CER is significantly and negatively associated with beta in the random effects model, and in the fixed effects the significance threshold is at 10% rather than 5%. Following the literature and hypothesis stated above, using a one tailed test the significance is at the 5% threshold for all models. If significance can be safely assumed, other things being equal, an improvement of 1.0 in a company's environmental performance is associated with a 0.028 drop in its beta.

Other variables are also important in the regressions. The random effects model reflects the fact that the technology sector in particular is characterised by high betas. The year dummies have typically negative signs indicating that the reference year of 2006 has untypically high betas. Size is only weakly significant in both models and takes an unexpected positive sigh in the random effects model. Payout and ROCE are consistently and negatively significant as expected in both models.

To address the issue of the attention given in the literature to CER as a dependent variable and the possibility of lagged effects, further models were tested. Tests of CER with beta as an independent variable did not produce a significant co-efficient for beta, nor did the use of lags on beta or CER as independent variables in either model. As these results are less significant than those reported in table 5, or altogether insignificant, they are not described further. Therefore it is concluded that the contemporaneous relationship between CER and risk is much closer than considering lags of either variable.

Table 5

Regression output

Independent Variables	*Random-effects GLS regression*	*Fixed-effects (within) regression*
Intercept	0.940 (0.000)***	1.786 (0.000)***
CER	-0.028 (0.026)**	-0.024 (0.086)*
SIZE	0.031 (0.050)*	-0.053 (0.071)*
POUT	-0.002 (0.000)***	-0.002 (0.003)***
LIQU	0.043 (0.046)**	-0.004 (0.872)
GEAR	-0.000 (0.636)	-0.000 (0.995)
GROW	-0.072 (0.018)**	-0.072 (0.029)**
ROCE	-0.003 (0.000)***	-0.003 (0.000)***
Year: 1994	0.022 (0.863)	-0.043 (0.739)
Year: 1995	0.040 (0.432)	0.043 (0.450)
Year: 1996	-0.046 (0.361)	-0.033 (0.557)
Year: 1997	-0.079 (0.127)	-0.062 (0.271)
Year: 1998	-0.232 (0.000)***	-0.219 (0.000)***
Year: 1999	-0.078 (0.133)	-0.072 (0.208)
Year: 2000	-0.173 (0.001)***	-0.166 (0.003)***
Year: 2001	-0.265 (0.000)***	-0.266 (0.000)***
Year: 2002	-0.180 (0.000)***	-0.188 (0.001)***
Year: 2003	-0.093 (0.060)*	-0.108 (0.034)**
Year: 2004	-0.139 (0.006)***	-0.134 (0.010)**
Year: 2005	-0.113 (0.022)**	-0.107 (0.032)**
CNSMS	-0.022 (0.763)	
UTILS	-0.067 (0.560)	
BMATR	0.282 (0.002)***	
INDUS	0.152 (0.035)**	
TECNO	0.849 (0.000)***	
TELCM	0.370 (0.290)	
FINAN	-0.099 (0.377)	
HLTHC	-0.114 (0.366)	
UNCLS	0.209 (0.080)*	
UQEQS	0.134 (0.088)*	
R^2	0.243 (overall)	0.115 (within)
Sample size	1625	1625

*Not*es:

- Dependent variable, BETA. Numbers in parentheses are P-values computed using heteroscedasticity-consistent standard errors. Significance levels (one-tailed test except intercept terms): ***p <0.01, **p<0.05, *p<0.10. CER, corporate environmental reputation.

- Hausman Test: $P > \chi^2_{18} = 0.0239$

V. CONCLUSIONS

The paper has used the largest dataset yet assembled, with all the *Management Today* CER scores from 1994-2006, and a range of accounting variables found by previous authors to be significant explanatory factors for firm risk. It has found evidence of a negative relationship between CER and beta. As is therefore perhaps to be expected, developing a good environmental reputation also amounts to good risk management. However, the potential benefit, whether to corporate financial mangers or portfolio investors is quite small. Specifically, a 1.0 improvement in the CER score is associated with only a 0.02 decrease in a firm's beta, once the more frequently-used accounting statistics are included in the regression. There is accordingly a similar scale impact in typical cost of capital formulations such as the capital asset pricing model.

Although the apparent elasticity of the relationship is rather low, the findings are important for two specific reasons. First, they can be added to the literature that shows a positive relationship between CER and financial performance as a further dimension of the benefits of developing a reputation for environmental management. Second, as the required response to the challenge of climate change imposes new constraints on the corporate sector, the association is likely to become stronger and more elastic. At this stage, the existence of a relationship is suggestive of the possibility of market incentives for investment in environmental good practice which may substitute of complement regulatory alternatives.

Further research might examine whether this result applies in other countries (e.g. the US), particularly when using larger environmental performance databases. Further investigations could also look at individual industries: the CER-risk relationship could be much stronger for, e.g., oil companies than retailers. These will, however, be constrained by the limited amount of data yet available, since we found only 1600 useable data points across all industries.

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