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The Impact of Corporate Environmental Performance on Market Risk: The Australian Industry Case

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Abstract Prior research suggests that Corporate Environmental Performance (CEP) enables businesses to build strong corporate image and reputation, thus leading to improved firm financial performance. However, studies relating to the relationship between CEP and firm risk are scarce. This research intends to bridge the gap in the literature by examining whether CEP helps firms to reduce their financial risk. Results of the Ordinary Least Squares regression with fixed effects provide strong evidence that environmental performance is negatively associated with firm volatility and firm downside risk. The results are robust after controlling for moderating effects such as financial, institutional and environmental management.

Keywords Corporate Environmental Performance · Market risk · Downside risk

Introduction

Debates continue to rage about firm engagement in environmental responsible behaviour. A review of literature by Horváthová (2010) shows that 55 % of the studies find a positive relationship, 30 % find a negative and 15 % find no association between Corporate Environmental Performance (CEP) and Corporate Financial Performance (CFP). Meta-analysis undertaken by several researchers (e.g. see Dixon-Fowler et al. 2013; Endrikat et al. 2014) shows similar results. A common feature in prior studies relating to the CEP–CFP nexus is that they all have used either accounting measures (based on profitability) or market measures (based on stock returns) as proxies for financial performance. However, firm risk is mainly used as a moderating factor only. There are conflicting findings in prior studies, for example, some studies claim that improved environmental performance creates competitive advantage which enables firms to enhance wealth creation objectives (Clarkson et al. 2011; Hart and Ahuja 1996; King and Lenox 2001; Konar and Cohen 1997; Russo and Fouts 1997). On the other hand, some studies argue that CEP does not enhance company value and is a burden on the shareholders (Cordeiro and Sarkis 1997; Hassel et al. 2005; Morris 1997).

The literature reviews (e.g. Endrikat et al. 2014; Orlitzky and Benjamin 2001; Orlitzky et al. 2003) show that there are few studies on the impact of CEP and financial risk. However, there is evidence that poor CEP poses risk for wealth creation. The risk arises from many sources, such as bad reputation leading to lower goodwill and revenue; legal violations leading to significant fines and clean-up costs (Capelle-Blancard and Laguna 2010; Lee and Garza-Gomez 2012); potential law suits from third parties affected by companies' operations, loss of environmental sensitive customer base; dissatisfaction in employee expectations leading to brain-drain from the company (Dögl and Holtbrügge 2013) and weak supply chain relationships. The findings of behavioural finance research show that investors are risk averse (Jianakoplos and Bernasek 1998), thus indicating that investors at a minimum level want to protect their investment. Therefore, environmental responsiveness is viewed by investors as providing an insurance-like effect on companies (Godfrey 2005). For example, a company with a positive environmental sustainability perception indicates to its investors

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that there will be a lower risk premium on their invested capital. Companies may also be able to increase their financial leverage (acquire higher levels of debt financing) without paying higher premium (Sharfman and Fernando 2008). Based on the above, it is assumed that improved environmental performance has the potential to enhance the financial market's expectations about the risk profile of the firm.

To study the wealth protection characteristic of CEP, we use the following proxies for market risk: firm volatility, systematic financial risk and downside risk. Utilising different measures of market risk is important because financial risk and return on investment are the essential factors from the company and financial market's standpoint. If the financial market recognises enhancement in resource consumption but did not see any difference in riskiness, the cost of financing for an investment would not change (Sharfman and Fernando 2008). Alternatively, if a change in observed riskiness leads to a decrease in cost of financing, companies would experience a decline in overall costs, thus leading to enhanced turnover and profitability.

Salama et al. (2011) argue that understanding the impact corporate environmental performance has on risk reduction is significantly important for advancing theories regarding the social aspect of corporate strategy and for providing practical implications for firm management. First, CEP represents a special type of firm expenditure that potentially appeals to a broader range of stakeholders and thus provides a multi-faceted protection mechanism to shield firms from potential risks. Extending this protection to volatility, systematic risk and downside risk illustrates the breadth of potential benefits from CEP. Second, unlike other pure profit-oriented investments, CEP has a distinctive "attribution" characteristic that enables stakeholders such as consumers, employees and shareholders to build stronger relationships with the firm. Third, extant research emphasises examining CEP's impact on a firm's immediate performance such as consumer metric benefits. Those benefits, although important, cannot reflect the fundamental health of the firm. For example, corporate environmental performance increases financial benefits but at the same time consumes a significant amount of financial and human capital. Volatility, systematic risk and downside risk represent an essential indicator of a combination of gains and costs of firm investment. Thus, linking corporate environmental performance and volatility, systematic risk and downside risk is a more reliable way to demonstrate corporate environmental performance's actual contribution. Fourth, volatility, systematic risk and downside risk represent a forward-looking performance indicator of a firm. Confirming CEP link to these proxies of risks further extends the understanding of its long-term nature and helps the firm's planning process.

In the next section, we position the research relative to relevant earlier work. A description of the data and method is provided in "Data and Method" section. Results are presented in "Results" section followed by discussion in "Discussion" section. The final section concludes the study.

Background and Hypothesis Development

The relationship between CEP and firm financial performance is a matter of ethical concern. This concern derives from four factors. Firstly, the negative impact of technology is one of the greatest challenges of this time. Agazzi (2004) highlights the place of responsibility in systems. Secondly, the need for solutions to environmental problems is urgent; hence a crucial element of environmental political philosophy is determining what constitutes effective action (Loukola and Gasparski 2012). Thirdly, environmental policy does not always achieve the outcomes expected. Fourthly, the ethical literature has long debated the role of individuals, governments and other institutions in achieving appropriate outcomes.

Addressing the above concerns involves consideration of political economy.[1] Political economy offers a descriptive, interpretive and critical approach to understand the implied motivations of corporate environmental performance from social perspective. This view acknowledges the presence of several stakeholders as opposed to the view that the sole responsibility of business is as agents are to just one stakeholder. Corporations' financial and economic activities cannot occur in isolation. Political economy considerations address the functioning of the market and political process and the interaction between the two that determines the impact on society (Preston and Post 1975).

Political economy theory sits alongside neo-classical marginalist theory that has dominated economics for years. According to Tinker (1980, pp. 147–148), "the neo-classical marginalist economics explanation concentrates on what are called the forces of production. They include the technological aspects of the input and output quantities and their transformation of coefficients. In contrast, political economy relies on the social relations of production: an analysis of the division of power between interest groups in a society and institutional processes through which interests may be advanced". Thus, classical economics emphasises price and production, whereas political economy stresses social interactions that make up the economy. In other words, markets are not "free" but are structured by

[1] Political economy refers to the social, political and economic framework within which business activities are produced (Hillman and Hitt 1999).

social relations in society. These are the relationships between stakeholders.

Prior research shows that different stakeholders (shareholders, government regulators, consumers, employees and the general public) are increasingly interested in corporations' environmental performance (Dixon-Fowler et al. 2013; Dobler et al. 2014; Endrikat et al. 2014). Part of this interest is motivated by the positive relationship between CEP and CFP. For example, CEP promotes innovation and operational efficiency (Aguilera-Caracuel and Ortiz-de-Mandojana 2013; Porter and van der Linde 1995); improves firm competitive advantage (Hart 1995; Russo an Fouts 1997); increases company environmental reputation and in turn employee commitment (Dögl and Holtbrügge 2013); enhances firm legitimacy (Hart 1995) and reflects strong organisational and management capabilities (Aragón-Correa 1998). All or some of the factors stated above also have potential to reduce firm financial risk and therefore, provide protection to the firm wealth (Godfrey 2005).

According to Sarkis (2006), companies (either through different regulatory requirements or internally motivated proactive strategic benefits) have started to address sustainability and environmental issues as a critical management challenge. Companies' environmental management practices will continue to evolve as the specification of environmental cost and liability is established (Karpoff et al. 2005). Capelle-Blancard and Laguna (2010) reported a drop of 1.3 % in market value of firms after environmental incidents. They further state that this loss is substantially related to the seriousness of the accident as measured by the number of casualties and by chemical pollution. For example, each casualty relates to a loss of $164 million in firm market value, whereas a toxic release relates to a loss of $1 billion in firm value. Similar results are also evident in the case of 2010 Deepwater Horizon oil spill. According to Lee and Garza-Gomez (2012, p. 73), the total cost[2] of the 2010 Deepwater Horizon oil spill was estimated to be approximately $251.9 billion[3] as of September 19, 2010 when the well was permanently sealed. Therefore, an impact of an unanticipated event in a competitive marketplace could force a company to substantially lose its market share and/or liquidate.

The Deepwater oil spill event of 2010 is a reflection and reminder for businesses to be adept at addressing issues that protect natural resources and implement strategies that focus on balancing economics, environmental, political and social constraints. In the contemporary world, it is expected that environmental concerns will be key issues affecting business deals and transactions (Cuddihy, 2000). Large, unforeseen environmental liabilities could be a significant competitive disadvantage. Therefore, the benefits from sustainable practices could lead to the creation of new opportunities and at the same time avoid liabilities that could lead to their competitive disadvantage in the market. Cuddihy (2000) argues that companies continually need to balance social needs with that of the pursuit of financial survival, profitability and growth.

In order to implement the concept of sustainable development, environmental accountability must be incorporated into policies, procedures and key commercial practices. Businesses can enhance environmental protection by tackling the environmental drivers in their operations through risk management. This will allow companies to deal with the social and environmental risk in their operations, but more importantly, companies will be able to translate these liabilities into monetary terms so that they can be more easily integrated into financial transactions. Furthermore, improvements in environmental risk management will offer complementary advantages. It will create conditions that help companies anticipate and/or avoid incidental expenditures caused by environmental damages and minimise the cost of compliance with regulation in the future (Karpoff et al. 2005; Sarkis et al. 2010). Based on the above, we propose that companies that have lower levels of toxic substance release would face lower risk of violating environmental regulations. Investment in CEP has a tendency to protect firms from unexpected events such as environmental incidents and law suits. Therefore, such CEP activities provide legitimacy in terms of decreasing regulatory violations and also minimises the chance of being sued by different stakeholders. CEP usually emphasises downside risk as opposed to upside opportunities. Based on the above, we propose the following hypotheses:

H_{1a} There is negative relationship between environmental performance and firm financial risk (volatility)

H_{1b} There is negative relationship between environmental performance and firm systematic financial risk

H_2 There is negative relationship between environmental performance and downside financial risk

Data and Method

The sample for this study consists of ASX-listed companies that filed both toxic release data to the Australian National

[2] Based on a market-based measure, the change (or loss) in market capitalization (Lee and Garza-Gomez 2012).

[3] It consists of $68.2 billion to British Petroleum, $23.8 billion to eight partners and $183.7 billion to other firms in the oil and gas industry. Big companies like BP could withstand the effect of this loss. Most firms do not have the same financial strength and market share like BP, and then it becomes more difficult to cope with unforeseen events.

Table 1 Industry break up of sample

Code	Industry name	Sub sector	Sub total	Total
1	Basic Materials	Industrial metals and mining	7	
		Mining	32	
		Chemicals	4	43
2	Consumer goods and services	Food producers	4	
		Beverages	3	
		Travel and leisure	1	
		General retailers	1	9
3	Health Care	Pharmaceuticals and biotechnology	1	
		Health care equipment and services	2	3
4	Industrials	Construction and materials	6	
		General industrials	1	
		Industrial engineering	2	
		Industrial transportation	1	
		Support services	1	11
5	Oil and gas	Oil and gas producers	7	
		Oil equipment and services	1	8
6	Utilities	Gas, water and multi-utilities	2	2
		Total number of companies		76

Pollutant Inventory and annual reports to SEC for the period 2001–2010. After excluding financial services sector, transport sectors and companies that do not report for more than 3 years, our final sample contains 76 firms. The distribution across industry and sector is given in Table 1.

Independent, Dependent and Control Variables

Independent Variable

Prior management literature on CEP uses company-level measures of environmental sustainability performance based on Pollutant Release and Transfer Registers (PRTRs). For example, Horváthová (2012) examined environmental performance effects on financial performance using the Czech PRTR. A number of studies have also used the United States' PRTR data to analyse environmental performance and its impact on financial performance (Cohen et al. 1997; Connors et al. 2013; Gerde and Logsdon 2001; Hart and Ahuja 1996; Khanna et al. 1998; King and Lenox 2002; Ragothaman and Carr 2008). The majority of these studies have used gross weights of chemical emissions as a proxy for environmental sustainability performance.

According to Toffel and Marshall (2004), summing annual chemical emission of all substances for a company in a given year is a poor proxy for environmental performance as the potential harm caused by a specific substance depends on different number of factors. For example, shareholders' understanding of the toxicity of different materials and their potential impact on environment and public health is equally important. If shareholders believe their actions will improve the surrounding environment and their health, this may be enough of an incentive to act (Stephan 2002). Furthermore, very few authors have considered the relative risk of chemicals as assessed in USEtox[4] in their studies (Bosworth and Clemens 2011) or used a ratio that divides the total emitted amount by the reporting threshold, if emissions are higher than the threshold (Horváthová 2012).

In this paper, we are using Australian PRTR data[5] as a proxy for CEP. Unlike the majority of the extant literature, we do not aggregate different chemicals without considering their toxicity. We use the toxic weighting scores presented in Muhammad et al. (2014). It is a composite toxicity measure that not only accounts for chemical toxicity to the environment but also for effects on human health and the consequences of large-scale population exposure to the substances. According to Muhammad et al. (2014), the Toxicity Risk Score (TRS)[6] of a given substance is multiplied to the emission level (E) in kg in order to get a Weighted Average Risk (WAR) for a chemical. This process is repeated for all chemicals to calculate WAR at facility level and finally a company level WAR is estimated by adding all facilities in a given company.

$$\mathrm{WAR}_{\mathrm{facility}} = \sum_{i=1}^{93} (\mathrm{TRS}_i * E_i).$$

This kind of toxicity score is important because there is evidence that despite reducing the mass of chemical emissions to air and water, toxicity from chemical emissions may have increased through waste transfers (Harrison and Antweiler 2003; Muhammad et al. 2014). This has important implications for commerce, governments and other stakeholders. The use of a toxicity weighting score has far reaching advantages over the use of mass emissions to express environmental information because it reduces

[4] USEtox characterisation factors are consensus based, include more chemicals and account for the exposure pathways: air, water and ground (Bosworth and Clemens 2011).

[5] Australian PRTR keep record of 93 different chemicals for over 4000 facilities (NPI 2013).

[6] Toxicity Risk Score = (Human Health Hazard + Environmental Hazard) X Exposure (Muhammad et al. 2014).

the cost of information acquisition and increases participation by all stakeholders affected by emission outputs (Muhammad et al. 2014). To normalise the weighted average risk of company, we followed the Stanwick and Stanwick (2013) method and divided WAR by total assets of the company and are using it as a proxy for CEP.

Dependent Variables

According to Oikonomou et al. (2012), choosing a single variable that measures market risk for a firm is not straight forward. Prior researchers have used a number of different methods to understand and define the notion of risk. Some have defined risk on the basis of probability, chances of occurrences or projected future values. Others define it on the basis of undesirable events or danger. Some viewed risk as being subjective and epistemic, dependent on the available knowledge, whereas others grant risk an ontological status independent of the assessors (Aven 2012). We consider risk in a similar light to prior researchers and use firm market risk or volatility (measured by standard deviation), systematic risk (measured by beta) (Salama et al. 2011) and downside risk (Bawa and Lindenberg 1977; Harlow and Rao 1989; Oikonomou et al. 2012) as dependent variables.

CEP influences investors' risk perceptions regarding firms which may negatively affect stock prices. Higher stock price volatility is considered as risk and is not good for a company's risk profile because investors will demand a higher return on their investment irrespective of the level of the firm's revenue. This will cause cost of capital to rise and consequently negatively affect projects which otherwise would have been profitable for the company. This will also limit company competitiveness and profit-making opportunities. The variation in stock return is market risk and is measured by its standard deviation (SD). SD is determined as follows:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(R_i - \bar{R})^2}{n-1}},$$

where R_i is the actual return and $\bar{R}$ is the expected return of investor.

Many studies use the relative volatility of a given firm to the market returns or to the broad market changes as a measure systemic risk which is represented by the beta coefficient (β). The beta coefficient is a significant determinant of the firms' discount rate in several valuation models. Despite some critiques (e.g. Ang et al. 2006; Goyal et al. 2003), it is still the most widely used measure of systematic risk due to its simplicity and validity. Following Oikonomou et al. (2012) and Salama et al. (2011), we also employ the Sharpe's (1964) Capital Asset Pricing Model.

$$\beta_{im}^{\mathrm{CAPM}} = \frac{E[(R_{it} - \mu)(R_{mt} - \mu_m)]}{E[(R_{mt} - \mu_m)]^2},$$

where β_{im} is the firm i beta when the market proxy is m, μ_i is the average value of return of firm i, R_m is the observed return of market proxy at time t and μ_m is the average value of those returns.

We also used downside risk for our study. Traditional risk measures like beta and standard deviation assume the distribution of asset returns is symmetric and in such cases traditional risk measures and downside risk measures will produce the same results. However, several studies (e.g. Deakin 1976; Ezzamel and Mar-Molinero 1990; Ezzamel e al. 1987) have refuted the symmetrical or normal distribution assumption of the stock returns. Oikonomou et al. (2012) argue that distribution of asset returns is not symmetrical and therefore, the downside risk measures can capture the market sensitivity more than traditional risk measures like SD and beta. Such a predicament is not new to the economic and finance literature, for example, Kahneman and Tversky (1979) state that market participants give significant weights on losses relative to their gains in expected utility function. Similarly, Roy (1952) suggests that a rational investor would certainly try to minimise downside risk and a safety first principle will prevail. Echoing this Godfrey (2005) argued that corporate social performance will have an insurance-like effect on firms. Therefore, Oikonomou et al. (2012) argue that financial risk should be described as the probability of a downward adjustment in the stock prices of socially and environmental negligent firms instead of an overall uncertainty and fluctuation of those prices.

There is no agreement in finance studies about what are the most suitable definition and ways of estimating the downside risk. The core challenge in this debate is the minimum benchmark or return that investors should use to assess the performance of their investment. Risk will then be characterised by the downside deviation from set target. Following Oikonomou et al. (2012), this study uses two types of downside risk measures. First, similar to Bawa and Lindenberg (1977) we use the risk-free rate for the target return. Second, similar to Harlow and Rao (1989), we use mean market return as a cut-off point.

$$\beta_{im}^{\mathrm{BL}} = \frac{E[(R_i - R_f)\min(\mathrm{R_m} - \mathrm{R_f}, 0)]}{E[\min(R_m - R_f, 0)]^2}$$

$$\beta_{im}^{\mathrm{HR}} = \frac{E[(R_i - R_f)\min(\mathrm{R_m} - \mu_\mathrm{m}, 0)]}{E[\min(R_m - \mu_m, 0)]^2},$$

where R_i and R_m are the returns on security i and market portfolio, respectively, and μ_i and μ_m are the mean returns of security and market portfolio, respectively. R_f is the risk-free rate (Government T-bills rate).

Control Variables

We included several sustainability and financial-related variables in our estimated model. The description of the control variables used in this study is given below:

Sustainability-Related Control Variables ISO-14000 Certification: ISO certification represents both an internal management tool and a way of advertising an organisation's legitimacy among stakeholders (Boiral 2007). Sometimes it is used as marketing tool for international audience. These management system standards, also called meta-standards, (Heras-Saizarbitoria and Boiral 2013) do not guarantee a specific level of improvement in environmental performance as the requirements for obtaining ISO 14001 certification basically refer to the process and not to the outcome (Cañón-de-Francia and Garcés-Ayerbe 2009). Also, this certification is awarded to the individual plants. It may not represent the overall company process and therefore we control for ISO 14000 certificates in our estimated model. If the company claims to have an ISO 14000 certification then it is equal to "1" otherwise "0".

Crisis Management System (*CMS*) Companies exposed to greater public scrutiny are more likely to incur political costs associated with poor environmental performance (Al-Tuwaijri et al. 2004). Consequently, companies use public relation activity and hire lobbyist for greenwashing instead investing in improving environmental performance. Therefore, we control for CMS. If the company report on crisis management systems or reputation disaster recovery plans to reduce or minimise the effects of reputation disasters then it is equal to "1" otherwise "0".

Environmental Supply Chain Management (*ESCM*) ESCM can have significant implications for a firm's corporate reputation by shielding the firm from negative media attention and consumer boycotts (Hoejmose et al. 2013). To focus on the impact of CEP on financial risk, we are trying to control for potential factors that may affect this relationship. This notion aligns with Ullmann (1985) conceptual emphasis on including management strategy in models examining firm social responsibility. ESCM is "1" if the company uses environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners otherwise "0".

Environmental Training (*ETR*) As discussed earlier, Ullmann (1985) emphasised the inclusion of management strategy in models for analysing company social responsibility. Similarly, Telle (2006) claim that the companies that have reported positive environmental performance could be the result of omitted variable bias. To be consistent with earlier work, we operationalise and control for ETR. The ETR is equal to "1" if the company trains its employees on environmental issues, otherwise "0".

Regulatory Quality (*RQ*) Corporate environmental performance is influenced by institutional role. Institutional economists argue that institutions are fundamental to the effective functioning of market-based economies. Further, institutions can contribute to growth as well as environmental sustainability. Evidence shows that countries with strong regulations in place can control and minimise the harmful impact of toxic substances. For example, Gani (2013) find that regulatory quality is negatively and statistically significantly correlated with the emission levels. Thus, this study controls for Regulatory Quality (RQ) in the estimated models. Regulatory quality is the perception of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

Rule of Law (*RoL*) Firms working in governance regimes where there is high level rule of law spends more to mitigate the detrimental effects of their activities like pollution and toxic substances emission. The fear of being monitored and accountable for deed makes an important link between industrial production and environmental damage and impacts the political, social and economic relationship of a society (Gani 2013). Rule of law reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and, in particular, the quality of contract enforcement, property rights, the police and the courts as well as the likelihood of crime and violence.

Size Literature shows that firm size is negatively related to the financial risk of the company. Larger firms tend to be more risk aversive as compared to smaller companies (Alexander and Thistle 1999). Another line of argument is that larger firms' chances of default are lower than smaller firms because larger firms have more potential to sustain adverse economic shocks than smaller firms (Oikonomou et al. 2012). Following the norm in extant literature, we also use log of total assets as measure of size.

Financial-Related Control Variables Market to Book (M2B) ratio Fama and French (1992) studied the cross sections of expected stock returns and argued that the reciprocal of the market to book value captures risk which is associated with the distress factor of Chan and Chen (1991). Particularly, companies having weak projections are indicated by lower share values and better book-to-market ratios (lower M2B ratios) than companies with sound projections (p. 428). Similarly, sound and stronger projection may lead to better flexibility in profitability and financial market performance. This "growth versus value" segregation of companies may describe why experts often

Table 2 Explanatory variables and Datastream code

Variables	Measurement technique	Datastream code
ISO	Does the company claim to have an ISO 14000 certification?	(ENERDP073)
Crisis Management System (CMS)	Does the company report on crisis management systems or reputation disaster recovery plans to reduce or minimise the effects of reputation disasters?	(SOCODP053)
Environmental Supply Chain Management (ESCM)	Does the company use environmental criteria (ISO 14000, energy consumption, etc.) in the selection process of its suppliers or sourcing partners?	(ENRRDP058)
Environmental Management Training (ETraining)	Does the company train its employees on environmental issues?	(ENRRDP008)
Regulatory quality (RQ)	Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development	The Worldwide Governance Indicators (WGI) Database
Rule of law (RoL)	Reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and, in particular, the quality of contract enforcement, property rights, the police and the courts as well as the likelihood of crime and violence	The Worldwide Governance Indicators (WGI) Database
Market to book ratio (M2B)	This is defined as the market value of the ordinary (common) equity divided by the balance sheet value of the ordinary (common) equity in the company	(MTBV)
Dividend yield (DY)	Expresses the dividend per share as a percentage of the share price	(DY)
Current ratio (CR)	Total current assets/total current liabilities	(WC08106)
Debt to equity (D2E)	Total debt/total liabilities	
Size	Log of total asset; total asset represents the sum of total current assets, long-term receivables, investment in unconsolidated subsidiaries, other investments, netproperty plant and equipment and other assets	(WC02999)

believe the stock of a firm with low M2B to be a less risky investment, with book value seen as the minimum threshold of firm equity (Oikonomou et al. 2012).

Debt to equity (D2E) ratio D2E measures firm leverage. A very high D2E ratio shows significant indebtedness which may challenge firm's ability to pay its creditors and as such, increases its viability. Following Oikonomou et al. (2012), we also control D2E ratio in our study.

Dividend Yield (*DY*) DY is calculated as dividend on company per share divided by the price per share. There is argument suggesting that stocks paying higher dividend yields are considered to be risky than stocks paying no or low dividends (Blume 1980). Dividend yield has signalling effect regarding managements' perception and company prospects. Arguably, the management of a constantly high dividend paying company have no opportunities to reinvest their earnings. Contrarily, Beaver et al. (1970) state that lower dividend paying companies are more risky than the higher dividend yield companies because management has less uncertainty about future earnings.

Current Ratio (*CR*) CR measures firm liquidity. The current ratio is calculated by dividing a firm's book value of current assets by its current liabilities. It shows a firm's ability to pay its creditors and remain solvent in the short run. This ratio is widely used to assess a firm's liquidity risk. Table 2 lists all control variables along with sources.

Econometric Model

To study the relationship between company financial risk and environmental performance, the following generic regression model is used:

$$\mathrm{FR}_{i,t} = \alpha_i + \beta_1 \mathrm{EP}_{i,t-1} + \beta_2 x_{i,t-1} + \varepsilon_{i,t},$$

where $\mathrm{FR}_{i,t}$ represents the measure of financial risk [SD (standard deviation), CAPM beta (systematic risk), BL beta (Bawa and Lindenberg), HR beta (Harlow and Rao)] and

$EP_{i,t}$ represents the measure of environmental performance. $x_{i,t}$ represents control variables and $\varepsilon_{i,t}$ is the error term.

To control for the noise effect due to the outliers in the dataset, all the financial risk measures and financial control variables are winsorized at the 1 % level (Oikonomou et al. 2012). To account for any missing values, we used linear interpolation. Outliers and missing values treatment is important because (i) we are using firm-year observations and (ii) very high variations in observation and missing values have potential to sway the adjusted R^2 (goodness of fit) of the estimated models towards their direction (Baltagi 2005).

Selecting the most suitable panel data regression model is vital in empirical studies. The effectiveness and reliability of the predicted constant and beta coefficients are characterised on the selection of the proper and suitable estimator, each having characteristic properties (Baltagi 2005). It is to be noted that more than 50 % of our sample companies are from the mining sector and this may bias our results towards large capital intensive Australian publicly traded companies. According to Baltagi (2005), "the fixed effects model is an appropriate specification if we are focussing on a specific set of N firms… and our inference is restricted to the behaviour of this set of firms" (p. 12). On the other hand, the random effects estimation model is suitable when the companies in a sample are supposed to represent random draws from universe or a larger population (Baltagi 2005, p. 14). The Hausman test strongly suggested the use of fixed effects model in our estimation.

In the above equation, we have used α_i as intercept notation depicting that intercept varies in cross section (firms) but is invariant in time series. It is important to note is that we have not explicitly used a set of industry dummy variables in our estimated equation because this part of cross-sectional heterogeneity is constant over time[7] and is thus embedded in the intercepts. The estimation of robust standard errors is another important issue in panel data estimation. If the residuals of the estimated model for a given company are correlated across years (time-series dependence) or the residuals for a given year are correlated across companies (cross-sectional dependence), then the standard errors of the estimated coefficients will be upward or downward biased (Baltagi 2005; Brooks 2002). In the latter case, the statistical significance of the results of the study will be overestimated and the conclusions drawn may be spurious (Petersen 2009). There is reason to expect that time-series dependence may arise in the residuals of the estimated models since CEP is generally quite constant for the same company and environmental/social dimensions across time. Persistence and resolve in the application of CEP principles seems the most rational way to ensure the accruement of its long-run valuable economic impacts. The presence of fixed effects (dummy variables) in the specified models deals with this issue and leads to unbiased standard errors, as long as this time-series dependence is fixed and not time-decreasing (Petersen 2009, p. 464). Contrarily, there are no particular grounds to anticipate that cross-sectional dependence will arise in the residuals of the fixed effects model. Moreover, the detection of such dependence is not an easy process considering both the two-dimensional nature of the residuals and the fact that cross sections are randomly (alphabetically) stacked (Oikonomou et al. 2012; Petersen 2009). Therefore, the robust function in STATA is used to estimate robust standard errors. To avoid simultaneity bias due to contemporaneous bi-directional causality among environmental performance and risk that will result in endogeneity problems, we used a 1-year lag for environmental performance and all control variables in our estimated fixed effects (Brooks 2002; Oikonomou et al. 2012).

[7] We are assuming that a company does not significantly alter its business orientation during the study period.

Results

Table 3 reports the basic descriptive statistics for the dependent and independent variables used in this study.

Table 3 Descriptive statistics for the dependent and control variables

	COUNT	MEAN	MEDIAN	MIN	MAX
SD	760	0.872	0.345	0	23.01
HR	760	0.57	0.30	−7.93	21.2
BL	760	0.77	0.70	−6.1	3.9
CAPM	760	1.17	0.98	−5.81	10.6
ENVPER	758	−1.23	−0.008	−153.9	0
ISO	760	0.49	0.42	0	1
CMS	760	0.21	0	0	1
ESCM	760	0.22	0	0	1
ETR	760	0.50	0.50	0	1
ROL	760	1.76	1.75	1.70	1.84
RQ	760	1.64	1.63	1.44	1.77
M2B	760	2.21	1.61	−2.7	5.5
DY	760	2.01	1.10	0	16.4
CR	760	3.82	1.54	0	62.4
D2E	760	0.50	0.40	−7.64	11.0
SIZE	759	13.0	13.4	2.30	18.7

Table contains variable count, mean, median, minimum and maximum values for all variables. SD is the Standard Deviation of market value of share price, HR and BL refer to the Harlow-Rao and Bawa and Lindenberg betas, ENVPER refers to the weighted average toxic substance per unit of assets

ISO ISO-14000 certificates, *CMS* Crisis Management System, *ESCM* Environmental Supply Chain Management, *ETRAINING* Environmental Training, *ROL* rule of law, *RQ* regulatory quality, *M2B* market to book ratio, *DY* dividend yield, *CR* current ratio, *D2E* debt to equity ratio, *Size* log of total assets

Table 4 Correlation coefficients

	SD	HR	BL	CAPM	CEP	ISO	CMS	ESCM	ETR	ROL	RQ	M2B	DY	CR	D2B	SIZE
SD	1															
HR	0.027	1														
BL	0.035	0.239***	1													
CAPM	−0.050	0.76***	0.232***	1												
CEP	0.0394	−0.0877**	−0.222***	−0.043*	1											
ISO	0.0731**	0.0437	0.0542	−0.00555	−0.0783**	1										
CMS	0.0210	0.0392	0.0126	0.00195	−0.00941	0.257***	1									
ESCM	0.127***	0.0570	−0.0677*	0.0248	0.0285	0.315***	0.389***	1								
ETR	0.0832**	0.0437	−0.0233	0.0214	0.0510	0.254***	0.150***	0.232***	1							
ROL	−0.0503	−0.0472	0.00308	0.0339	−0.0634*	−0.0478	−0.0239	0.00615	−0.0646*	1						
RQ	0.114***	0.112***	0.00360	0.0342	0.0727**	0.150***	0.112***	0.101***	0.161***	0.0836**	1					
M2B	0.0664*	0.0710*	0.0540	0.110***	0.0125	−0.0284	0.0731**	−0.0163	0.0687*	0.000662	0.00963	1				
DY	0.0681*	−0.109***	0.0259	−0.0752**	0.0967***	0.0702*	−0.0542	0.0556	0.0945***	−0.0318	0.0823**	−0.0923**	1			
CR	−0.111***	0.0530	0.124***	0.0748**	−0.116***	0.0495	0.00672	−0.0888**	−0.0790**	0.0308	−0.0423	−0.0569	−0.242***	1		
D2B	0.0329	−0.0160	0.000912	0.0360	0.0815**	−0.0151	−0.00997	0.0180	0.0800**	−0.00897	0.00766	0.513***	0.135***	−0.140***	1	
SIZE	0.353***	−0.117***	0.0463	−0.0841**	0.271***	0.0918**	−0.0147	0.139***	0.109***	−0.0238	0.0780**	0.0621*	0.453***	−0.356***	0.273***	1

* denotes significance at 10 % ($p < 0.10$)

** denotes significance at 5 % ($p < 0.05$)

*** denotes significance at 1 % ($p < 0.01$)

Table 5 Fixed effect regressions using Standard Deviation and CAPM as dependent variables

	SD			CAPM		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
ENVPER	−0.7569***	−1.3770***	−1.3752***	−0.0063	−0.0031	−0.0034
	[−3.21]	[−3.44]	[−3.94]	[−1.57]	[−0.56]	[−0.65]
ISO			−1.9517			−0.0604
			[−0.18]			[−0.55]
CMS			−16.0682			−0.1285
			[−0.80]			[−0.88]
ESCM			36.4736			0.2031
			[1.64]			[1.51]
ETRAINING			8.0768			0.0535
			[0.85]			[0.46]
ROL		−257.0295*	−257.0469*		1.1988	1.1539
		[−1.96]	[−1.87]		[0.89]	[0.85]
RQ		193.3381***	181.8646***		0.5788	0.5666
		[3.36]	[3.30]		[1.14]	[1.08]
M2B		4.6911	4.9061		0.0451***	0.0466***
		[1.33]	[1.36]		[2.66]	[2.76]
DY		−8.3975***	−8.4452***		−0.0181	−0.0185
		[−2.70]	[−2.68]		[−0.76]	[−0.78]
CR		0.2514	0.3765		0.0102	0.0113
		[0.37]	[0.55]		[1.37]	[1.53]
D2E		−22.9090***	−23.2896***		0.0065	0.0025
		[−2.72]	[−2.74]		[0.14]	[0.05]
SIZE		30.8174***	30.0504***		−0.0298	−0.0327
		[6.79]	[7.39]		[−1.24]	[−1.37]
CONSTANT	88.3748***	−163.7661	−143.4601	1.1689***	−1.6011	−1.4851
	[13.00]	[−0.59]	[−0.51]	[22.74]	[−0.61]	[−0.57]
N	682	682	682	682	682	682
R^2	0.16	0.1621	0.168	0.18	0.264	0.297

* denotes significance at 10 % ($p < 0.10$)

*** denotes significance at 1 % ($p < 0.01$)

The mean (median) of SD is 0.87 (0.35), suggesting that on an average basis, companies have 0.87 standard deviation. However, the median of SD is 0.35 which suggests that more than half of the companies in the sample have lower risk. The mean (median) of CAPM beta is 1.17 (0.98), suggesting that sample companies are more risky than the market. However, median 0.98 suggests that more than half of the companies are slightly less risky or equal to the aggregated market. When we compared mean (median) of the CAPM beta with the BL beta 0.77 (0.70) and HR beta 0.57 (0.30), the results indicate that the sample companies on an average basis are less risky than the market.

The average firm-year values of sustainability-related variables are as follows: ISO (0.49), CMS (0.21), ESCM (0.22) and ETR (0.50). Median value of CMS and ESCM is zero suggesting that more than half of the companies have not adopted CMS and ESCM practices. The median value of ISO is 0.42 and the median value of ETR is 0.50, thus indicating that nearly half of the sample companies have ISO-14001 certifications and are providing environmental related trainings to their employees.

The average value of EP is −1.23, thus suggests that on average basis, 1.23 units of toxic chemicals are released for every one unit of total assets by large companies. Since the median of EP −0.008, this suggests that environmental performance varies considerably from firm to firm. The average of size is 13.0, leverage ratio is 0.5, current ratio is 3.82, dividend yield is 2.01 and market to book ratio is 2.21.

Table 4 reports the pairwise correlation coefficients of the independent and dependent variables used in this study. Overall, CEP is negatively related to different measures of risk. It supports the main hypothesis of our study that CEP and financial risk have a negative relationship. An interesting observation is that ISO and CMS are negatively

Table 6 Downside risk using BL beta

	BL			HR		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
ENVPER	−0.9972*	−1.1252*	−1.1122*	−0.0198**	−0.0167**	−0.0163*
	[−1.68]	[−1.93]	[−1.90]	[−2.42]	[−1.98]	[−1.92]
ISO			2.8145			0.0372
			[0.79]			[0.21]
CMS			3.914			−0.1134
			[0.88]			[−0.50]
ESCM			−10.0225**			0.3578
			[−2.55]			[1.61]
ETRAINING			−1.6678			0.0939
			[−0.52]			[0.54]
ROL		−15.6057*	−13.5167*		−3.5850*	−3.5136*
		[−1.74]	[−1.69]		[−1.83]	[−1.79]
RQ		6.6101*	7.7468*		3.1005***	2.9100***
		[1.62]	[1.69]		[3.70]	[3.40]
M2B		1.0522***	0.9988***		0.0517*	0.0533*
		[2.75]	[2.63]		[1.91]	[1.95]
DY		0.431	0.4239		−0.0617*	−0.0622*
		[1.18]	[1.09]		[−1.72]	[−1.73]
CR		1.0146***	0.9654***		0.0036	0.0044
		[2.84]	[2.70]		[0.29]	[0.36]
D2E		−2.2881*	−2.1645*		−0.0562	−0.0582
		[−1.89]	[−1.76]		[−0.54]	[−0.56]
SIZE		2.7308***	2.8742***		−0.0568	−0.0662*
		[3.20]	[3.18]		[−1.57]	[−1.81]
CONSTANT	−0.4447	−25.4811	−31.7333	0.5464***	2.523	2.7064
	[−0.30]	[−0.27]	[−0.35]	[6.88]	[0.70]	[0.75]
N	682	682	682	682	682	682
R^2	0.3492	0.3884	0.2958	0.2717	0.2468	0.2516

* denotes significance at 10 % ($p < 0.10$)

** denotes significance at 5 % ($p < 0.05$)

*** denotes significance at 1 % ($p < 0.01$)

correlated to CEP. Several studies (e.g. Boiral 2007; Cañón-de-Francia and Garcés-Ayerbe 2009; Paulraj and Jong 2011) have used ISO-14001 certification as a proxy for CEP. The negative correlation between CEP and ISO suggests that ISO-14001 certification should not be taken as similar to toxic substance release. The results show that the correlation between leverage ratio and market to book is high. Although, the correlation coefficient is 0.513, it is less than the rule of thumb level of 0.80 (Gujarati 2004). Therefore, this relationship will not potentially affect our estimated model. Other pairwise correlation coefficients reported in Table 4 are low and there are no obvious concerns or anomalies in the data. Furthermore, we conducted multi-collinearity diagnostic (unreported) for variables in the model by using variance inflation factors (VIFs). The results show that the highest VIF is 1.57 and the average of VIFs is 1.26, suggesting that multi-collinearity may not be the problem in this study. The estimated value of the averaged fixed effects and slope coefficients are provided in Table 5 and 6. Each dependent variable (SD, CAPM, BL and HR) is estimated using three models: Model one is estimated without control variables; Model two is estimated using winsorized financial control variables and Model three is estimated with all financial control variables and firm sustainability-related variables (ISO, CMS, ESCM and ETR). Columns two, three and four in Table 5 represent models where standard deviation is dependent variable and columns five, six and seven represent models where CAPM beta is the dependent variable. Similarly, columns two, three and four in Table 6 represent models where BL beta is the dependent variable and columns five, six and seven represent models where HR beta is the dependent variable.

In Table 5, overall, there appears to be a negative and statistically significant relationship between CEP and standard deviation (volatility). This provides support to our main Hypothesis-1a. The results are robust after adding financial control variables (M2B, DY, CR, D2E and Size) and sustainability-related variables (ISO, CMS, ESCM and ETR) in columns 4 and 5, respectively.

The results reported in the last three columns of Table 5 show that the relationship between CEP and CAPM beta is negative but statistically insignificant in all three models. It suggests that there is no relationship between CAPM beta and CEP.

Table 6 reports the results for Bawa and Lindenberg (1977) (BL) beta and Harlow and Rao (1989) (HR) beta. Overall, our results show that there is a negative and statistically significant relationship between corporate environmental performance and BL beta. The results are consistent when financial control and firm sustainability-related variables are used in model two and three, respectively. The results reported in the last three columns of Table 6 show that the relationship between HR beta and CEP. It shows that CEP is negative and statistically significant in all three models meaning that downside risk metrics have a negative relationship with CEP.

Discussion

Overall, there appears to be a negative and statistically significant relationship between CEP and different measures of firm risk (SD, BL and HR). This provides support to our main Hypothesis-1a and Hypothesis-2. We do not find support for Hypothesis-1b. According to Orlitzky and Benjamin (2001), high firm risk that has arguably been caused by low CEP not only increases probability of civil or/and criminal legal proceedings but may also increase chances of state regulatory actions against the polluters. This means that being a good corporate citizen tends to reduce firm risk. Similarly, Godfrey (2005) argues that CEP does not represent an oxymoron but can contribute towards the positive moral capital among a broad base stakeholders. CEP not only enhances shareholder wealth but also improves risk management and provides protection of wealth. The findings are consistent with those reported by prior studies with similar data sets but different methodologies and a very general purpose[8] such as Horváthová (2012); Khanna et al. (1998); King and Lenox (2001) and (King and Lenox, 2002), but contrasts with the findings of Connors et al. (2013) and Telle (2006). Such mixed results suggest that further exploration is necessary. Telle (2006) argues that the mixed results reported in the literature may be because of a number of reasons including omitted variable bias, the difference in measurement of economic and environmental variables, difference in the characteristics of sectors and the sample firms, and difference in regulations and regulatory quality of the countries. We control for firm heterogeneity in our Model one but to control for other financial variables, rule of law (ROL) and regulatory quality (RQ), we estimated Model two. The results reported in Model two remain robust. Al-Tuwaijri et al. (2004) and Ullmann (1985) suggested that while investigating the CEP–CFP nexus, researchers should include variables such as management strategy in their estimated models. Consistent with this line of argument, we included several environmental sustainability-related variables such as ISO, CMS, ESCM and ETR and reported results in Model three. The results remain robust after firm sustainability-related variables. None of the coefficients of ISO, CMS, ESCM and ETR has t-statistics value greater than 1.65 in any of the estimated models (except ESCM in BL beta model). It suggests that overall there is no relationship between firm risk and other sustainability factors (ISO, CMS, ESCM and ETR). This may be because such factors are not visible and not adequately communicated to investors (Orlitzky & Benjamin, 2001).

To account for the potential existence of contemporaneous, reverse association between CEP and firm risk, we followed Oikonomou et al. (2012) and used lagged independent variables in our estimated models. Telle (2006) criticised extant literature empirical methods for incapability of illuminating the casual links between CEP and economic performance that may cause the issue of endogeneity. Therefore, these study results are robust. As mentioned earlier, our results provide support for hypotheses 1a and 2. Also, results show that firm total volatility (SD) and downside beta measures (BL and HR) are statistically significant. These results suggest that downside risk measures are better at capturing firm risks that arise from CEP compared to mean-variant risk measures like CAPM.

It is interesting to note that the goodness-of-fit statistics for our study is very much similar to the Corporate Socially Responsible (CSR) studies undertaken by Oikonomou et al. (2012); McGuire, Sundgren, and Schneeweis (1988) and Salama et al. (2011). For example, the adjusted R^2 of the models using BL and HR beta are in the range of 24.68–38.84 % which is very close to the results reported by Oikonomou et al. (2012), that is, adjusted R^2 in the range of 27–35 %. The adjusted R^2 in the study using systematic risk is in the range of 18–29.70 % which is comparable to the results reported by Salama et al. (2011), that is, 11.3 % using fixed effects model and 24.30 % using random effects model. Our results are also comparable to the results reported by McGuire et al. (1988). The R^2 when systematic risk is used in our study is 13.1 % and the

[8] The prime focus of these studies are “Does it pays to be green?”.

adjusted R^2 when firm total risk is used is in the range of 16–16.8 %. These results are comparable to McGuire et al. (1988) R^2 of 17.5 %.

Conclusion, Qualifications and Future Research

This study investigates the relationship between CEP and financial risk for Australian listed companies from 2001 to 2010. It addresses the negative impact of technology on the environment, highlights the place of responsibility in systems and facilitates the urgent search for solutions to environmental problems. It recognises that environmental policy does not always achieve the outcomes expected and considers the role of individuals, governments and other institutions in achieving appropriate outcomes. This study addresses the challenge of responsibility for technologies by examining the performance measures used by managers, markets and regulators in evaluating firm responsibility. It analyses the relationship between different measures used to assess firm performance. The data reveal the results of firm behaviour given the legal requirement of firms to report emissions. This provides a foundation for examining the behaviour of specific firms or industries and evaluating policy results.

Three financial risk measures including firm market risk, systematic risk and downside risk were used. The analytical procedure based on fixed effects estimation provides strong evidence that environmental performance is negatively and statistically associated with firm total volatility and to different measures of downside risk. Our results show that downside risk is a better measure of firm risk especially when investors are not showing linear sensitivity to changes in prices. Therefore, we conclude that environmental performance (reduction in toxic emissions) provides wealth protection or an insurance-like effect on the firm. The results are robust after controlling for several moderating effects including financial, institutional and environmental management.

The findings from this paper have several implications. This paper enriches existing literature by providing positive empirical evidence that corporate environmental performance reduces firm market risk. Our empirical results provide an alternative to the view that previously existed, that is emerging challenges of corporate environmental performance has potential to impose new constraints on firm performance. Our results show that there is market incentive for investment in environmental responsive practices. This has important implications for governments. It is important to note that conventional sustainability and environmental policy tools usually depend on rigid legislation and regulations, which must be observed irrespective of cost, and they need standard process implementation. The majority of standards are based on available technology when the policies and regulations were formulated. Since the dynamics of environmental liability and accountability are constantly changing, many regulatory solutions become outdated, and there is not a uniform interpretation of environmental legislation. In addition, it increases the costs of compliance without necessarily improving the environment (Cuddihy 2000). Considering the above argument, our results have implication for regulators and policy makers. As environmental performance has a negative impact on the firm financial risk, therefore, the benefits from market-based measure like firm risk and downside risk may be promulgated to the market participants so that they will adopt environmental responsive behaviour irrespective of legislation because it provides strategic advantages to firms. This will allow regulators to rely on a market-based enforcement mechanism that will be more efficient and encourage a greater degree of environmental improvement than through direct intervention by conventional laws and regulations (Salama et al. 2011).

As with any empirical research, there are limitations to this study. The primary limitation is that the use of pollution emissions reported in the Australian National Pollutant Inventory limits the data to the largest firms in Australia and is therefore not representative of small, medium, private or not for profit firms. The study is biased towards higher polluting industries such as manufacturing and mining and this limits the generalizability of the results. Given the large number of CEP measures and methods of measurement, our selection of toxic emissions and treatment for hazardousness by assigning risk factors may preclude generalisation to all measures of CEP and all assumptions underlying these measures. Our findings are conditioned by the toxic weighted index, and we do not assert that this hazardous weighting system is the only way to sum different toxic chemicals. Rather, we highlight this as an important issue among a number of factors that may influence firms' CEP.

While this study has provided useful insights into corporate environmental performance and financial risk in Australian companies, the findings are based on research in a single country. It is suggested that future research on corporate environmental performance extends beyond Australia. This study utilises data from the National Pollution Inventory (NPI) which has an objective that community/investor awareness will lead to pressure on polluters to reduce their emissions. The success of the NPI depends on the extent of engagement that the general population and investors have with the programme. Future studies could determine the extent of knowledge and use of the NPI in the community and investment circles and to identify whether barriers exist which indicate a need to restructure aspects of the programme to overcome these barriers. Further, the use of pollution emissions does not capture extraordinary environmental impacts, such as major oil spills and toxic gas releases. However, the goal of this study is to examine the consistency of the relationship presented over a 10-year time period. The objective of this study was not to examine the short term measurement of this relationship based on unique one time extraordinary circumstances.

The use of pollution emissions to measure environmental performance in firms of all sizes is challenging. We have addressed this issue by dividing the weighted average risk factor (chemical emission) by respective total assets. Future research may explore other avenues to address this issue. While empirical researchers continue in their search for the comprehensive database of corporate environmental performance, it is pertinent to note that much can be learned about environmental performance by conducting surveys, interviews and archival research.

This study has used data from operations within Australia and many (if not all) of the companies have subsidiaries or facilities abroad. There is evidence in the literature that some companies based in rich countries may be outsourcing pollution to developing or less developed countries (Pollution Haven Hypothesis). By way of contrast, there are companies that have only domestic manufacturing operations and pollute the domestic environment but part of their revenues are based on exports. Future research may address this issue by comparing pollution and revenue in the domestic market and control for foreign sales or subsidiaries.

Methodologically, the findings from this study may be biased because of endogeneity. To minimise the impact of endogeneity, one may use the Instrumental Variable (IV) approach in estimating models. Econometricians agree that finding a suitable instrument is a challenge and the only source for finding a good instrument is in the literature. Since the literature is so divided, almost every study has used a different set of independent variables. To minimise the potential impact of endogeneity, this study used lagged independent variables in estimated models. Future research may use different econometric techniques including Instrumental Variable (IV) approaches. Addressing causation over longer timeframes could certainly increase our understanding. To this end, the use of different assumptions and methodologies, such as a split time-series data set, or lagged or nested effects may be useful.

In short, this study suggests further academic research to explore the relationship between CEP and CFP. Future research could incorporate individual firm efforts at mitigating the detrimental effects of their activities on the environment. It could include consideration of investment in pollution efficient technologies; the performance of top management fiduciary responsibilities (compared to personal aspirations regarding the involvement in voluntary mitigation efforts) and cultural factors that shape how individual managers contribute to corporate environmental performance.

Theoretically, this study calls for further exploration of CEP and firm sustainability activities as long-run commitments. At a higher level, investors need to identify and recognise the dynamic relationships between CEP activities; corporate governance practices and the overall organisation model; other key stakeholder priorities; and business performances, as these factors mature and evolve in the longer run rather than quarter by quarter. At the micro level, the progress and evolution of attitudes and decisions regarding CEP policy calls for further study addressing managerial level decisions about investment in sustainability-related activities. Efforts made to further understand CEP as an internal firm process should help investors and assist firms trying to improve their standing in this critical area.

Finally, this study suggests future empirical research focus on a few, key CEP and CFP performance indicators in order to improve internal validity and reliability of performance measures rather than generalizability. Since the toxic weighted index appears to differentiate between high and low environmental performers, further research using this database is warranted. The NPI database could be analysed for any double counting due to inter- and intra-company transfers. On the financial side, consistency in measurement criteria would facilitate comparison across industries and firms.

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