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## **The Profitable Correlation Between Environmental and Financial Performance: A Review of the Research**

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*Research conducted over the last decade increasingly shows that there is a clear correlation between environmental performance and corporate profitability. Specifically, empirical studies have found that companies that score well according to objective environmental criteria realize stronger financial returns than the overall market (S&P 500), and companies that score poorly have weaker returns.*

*Furthermore, studies that have analyzed companies' adherence to environmental regulations have concluded that companies that go beyond legal compliance realize stronger stock price gains and market value growth than the S&P 500. In contrast, laggard companies that are threatened by actual or impending environmental laws have been shown to experience weaker returns.*

*Corporate investment in innovative pollution prevention technology has been found to be associated with positive stock returns, as has favorable media coverage for company environmental achievements according to the research; while Superfund-site responsibility, chemical leaks, and oil spills have been found to be among the environmental negatives associated with stock price declines.*

*Financial accounting measures, such as return on equity (ROE) and return on assets (ROA), have been shown to improve with improved environmental performance, while the inadequate disclosure of environmental liabilities has been found to have a compounding negative effect on the financial results of poor environmental performers.*

*Progressive environmental management strategies, including environmental auditing programs and corporate governance programs that seek to engage external stakeholders in company environmental programs, have been evaluated in various analytical papers and have also been found to be associated with strong financial performance.*

*Moreover, the performance of investment funds comprised of companies with superior environmental profiles has been analyzed in recent reports and has been shown to be more profitable than the S&P 500, plainly dispelling the presumption that environmental filtering invariably lowers the financial returns of investment portfolios.*

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## **I. Introduction**

Over the last decade, numerous quantitative studies and qualitative papers have examined the conventional notion that progressive environmental management is inevitably a ‘cost’ to the corporate ‘bottom-line.’ This environmental ‘cost’ assumption has been tested against a wide range of financial measures in an impressive body of research. The findings of this research increasingly indicate that the conventional ‘cost’ view is, at best, outdated. Rather, recent empirical and analytical research shows that there is a clear correlation between environmental performance and corporate profitability.

This paper summarizes twenty of the leading empirical studies on the environmental /financial performance correlation that have been conducted during the past ten years with the intention of demonstrating that quantitative research shows that environmental management impacts corporate profitability. In addition, the wide variety of environmental criteria and financial measures tested indicates that no single environmental criterion or type of criteria, and no single financial measure or type of measure, can be isolated as sole indicators of the environment/finance relationship.

All studies summarized in this paper evaluate the impact corporate environmental performance and environmental actions have on the ‘bottom-line’ of actual companies. Moreover, all studies employ environmental criteria generated by government or independent (that is, non-industry) sources and test for verifiable, commonly-reported financial measures.

Each study’s primary ‘conclusive’ findings are featured, although additional findings and author’s disclaimers are also indicated to the extent they impact reported findings. In order to keep study results relatively comparable, each study focuses (all but exclusively) on the environmental and financial performance of companies traded on U.S. exchanges

Attention is given to describing each empirical study’s methodology (for the purpose of communicating the thoroughness of each study’s approach) as well as to detailing the environmental performance criteria employed and the financial performance measure evaluated. Critiquing study methodology and data quality, however, is not within the scope of this paper.

As a supplement to the empirical studies, twenty non-quantitative papers are also reviewed for the purpose of presenting a sample of recent theoretical work that has been done on the environmental/financial relationship. Reviews of recent reports on the performance of investment funds that filter for corporate environmental performance are included, as well.

This paper does not purport to be an exhaustive compilation of the environmental management/ corporate profitability research; it is, rather, a highly representative sampling of recent studies that have been published in ‘peer review’ journals or are currently available in online libraries. In this sense, peer-reviewed publication is intended as a proxy for the quality of the research.

Considered collectively, this research provides a solid basis for concluding that there is, in fact, a profitable correlation between superior environmental stewardship and strong financial performance.

## II. Empirical studies that analyze the impact of environmental performance on financial performance

### a) studies which analyze companies across a spectrum of industries

**Konar and Cohen (2001)** found environmental performance to be correlated with the intangible asset value of S&P 500 firms, and reductions in toxic chemical releases to be associated with greater firm market value. The study evaluates the relationship between corporate environmental performance and the 'intangible assets' (defined as "factors of production or specialized resources that allow a firm to earn profits over and above the return on its tangible assets") of 321 S&P 500 manufacturing firms. Two environmental performance measures were employed: Toxic Release Inventory (TRI) emissions levels; and pending environment-related litigation. Changes in intangible asset values were estimated by observing changes in firm market value (that is, 'firm market value per dollar of replacement costs of tangible assets,' or Tobin's  $q$ ), and controlling for a range of variables that could potentially distort market value, such as 'sales growth.' Comparing 1989 data, the authors estimate the average intangible asset 'liability' associated with inferior environmental performance to be \$380 million, or 9% of the replacement value of a firm's tangible assets. 'Liability' percentages varied by industry, with large 'liability' in the chemical (31.2%), primary metals (27.7%) and paper (21.1%) industries. The primary 'liability' component for most industries proved to be toxic emissions levels (litigation loss was insignificant for many industries.) Evaluating the effects of changes in emissions levels on average firm market value, the study finds that a 10% lower TRI emissions level correlates with a \$34 million larger intangible asset value.

**Dowell et al. (2000)** found that firms which adopt global environmental standards that go beyond legal requirements have higher market values than firms which adopt standards at or below the legal mandate. The study examines U.S. 500 (S&P 500) corporations with manufacturing or mining operations in developing countries (i.e., countries with per capita GDP below \$8,000) – a total of 89 firms. This sample was then categorized into three 'environmental' classifications according to Investor Responsibility Research Center (IRRC) data: (1) firms which adhere to local environmental standards when operating in developing countries (30% of sample firms); (2) firms which apply U.S. standards when operating in developing countries (10% of sample firms); and (3) firms which apply internal standards which surpass U.S. requirements when operating abroad (60% of sample firms.) Results indicate that firms in category (3), those applying the most stringent standard, have significantly higher market values (as defined as 'firm market value per dollar of replacement costs of tangible assets,' or Tobin's  $q$ ) than firms in category (2) -- that is, higher by a factor of 1.1, or on-average \$8.4 billion to \$10.6 billion in market value depending on measuring methodology. Furthermore, category (2) firms ('U.S. standards') proved to have only insignificantly higher market values than category (1) firms ('local standards').

**Gottzman and Kessler (1998)** determined that portfolios of 'good' environmental performers return more than the S&P 500, and that portfolios of 'poor' environmental performers return less than the S&P 500. The study classifies S&P 500 firms according to four revenue-normalized environmental performance measures (Investor Responsibility Research Center data): (1) emissions efficiency; (2) compliance; (3) spill frequency; (4) waste generation rates. The firms were scored in each category and then compared to the median scorer in their industry to determine their environmental status: firms scoring above the median were labeled 'good' environmental performers; firms scoring below were deemed 'poor' performers. Three portfolios of 'good' performers were constructed according to score, with the highest performers comprising the 'top' portfolio; and three reverse portfolios were constructed of 'poor' environmental performers. Over a 5-year observation period (1992-97) each of the three 'good' performer portfolios out-gained the S&P 500 (on-average, annualized returns 154 basis points higher than the S&P 500) and significantly out-gained the 'poor' performer portfolios (on-average, annualized returns 307 basis points higher.) Moreover, the portfolio of top environmental performers achieved the highest total return, while the portfolio of the worst performers earned the lowest return. The authors, however, point out that if firms for which "no environmental data are expected" (roughly 28% of the S&P 500 companies -- largely the financial services industry) are excluded from the analysis, the divergence in returns is much smaller.

**Stanwick and Stanwick (1998)** determined that a significant correlation existed between low emissions levels and high profitability for firms with excellent reputations for social responsibility. The

study examines companies listed on *Fortune* magazine's Corporate Reputation Index (CRI) that also had a complete set of Toxic Release Inventory (TRI) data for any year in a five-year investigation period (1987-92.) Sample sets thus varied in size from 102 to 125 companies depending on the availability of complete TRI data for each observed year. Firm 'profitability' was measured by yearly profits and controlled for firm size by dividing profit numbers by the firm's annual sales. Firm 'pollution' level was measured as total toxic emissions, and again divided by annual sales to offset variances in firm size. The study tests the correlations between firms' rankings on the CRI (termed as a 'proxy' for 'corporate social responsibility') and their profitability and emissions levels, as well as the correlation between firms' profitability and emissions. A significant positive relationship existed for all three variables in 2 of the 6 years tested; moreover, a significant positive correlation between high annual profits and low pollution emissions existed for 5 of the 6 years tested. The authors caution that, due to the environmental and financial measures employed, the study is biased toward large "heavy manufacturing" firms.

**Feldman et al. (1997)** found that firms which improve their environmental performance by adopting environmental management systems which go 'beyond compliance' (exceed legal requirements), and by lowering their toxic emissions levels, realize lower capital costs. The study examines the 'systemic risk' (as measured by *beta*) of 330 S&P 500 companies over two distinct time periods: (1) before the firms adopted progressive environmental management systems (1980-87); and (2) after (1988-94.) Conceptually, the authors hypothesize that firms which adopt advanced environmental management systems (such as systems that incorporate environmental considerations in all phases of design and production) and experience, as a result, improved environmental performance (such as a reduction in average annual emissions as measured by Toxic Release Inventory criteria) effectively signal to capital markets that their 'systemic risk' has been lowered. This, in turn, produces a reduced cost of financial capital. The findings suggest that stock volatility, or *beta*, can be reduced by either an improvement in environmental management or an improvement in environmental performance results; and, moreover, that a 50% improvement in both can reduce *beta* by a significant amount, about 13%. The resulting reduction firm cost of capital was found to be roughly equivalent. A 13% reduction in cost of capital could produce, according to the authors' estimates, an on-average increase of better than 5% in the firm's market value.

**Russo and Fouts (1997)** determined that a firm's return on assets (ROA) improves as a firm's environmental performance improves. The study analyzes 243 firms that had been rated for environmental compliance by Franklin Research and Development Corporation (FRDC) over a two-year period (1991-92.) The sample set excluded utilities (with ROA's established by law), firms lacking complete environmental data, and firms that had undergone a major restructuring during the observation period. Environmental 'scoring' was based on FRDC criteria (including information on compliance records, waste reduction, environmental management expenditures and environmental protection initiatives) that were transformed into a ranking scheme that divided companies into quintiles. Firm financial data, taken from Compustat, were controlled for firm size and growth rate, among other factors. Collectively, firms increasing their quintile rankings (i.e., improved their environmental performance) over the observation period also experienced statistically positive increases in ROA. Moreover, firms in 'growing industries' (i.e., industries which incurred a greater than -3.14 % increase in annual sales) experienced significant increases in ROA (the authors note that virtually all the industries sectors assessed in their study experienced greater than -3.14% growth.)

**Cohen et al. (1995)** found that "industry-balanced" portfolios of "low pollution" S&P 500 companies earned greater stock returns than portfolios of "high pollution" companies, and that "low pollution" portfolios earned larger 'accounting returns' as well. S&P 500 companies were separated by industry sector (a total of 85 industries) and then divided into "low pollution" or "high pollution" portfolios according to their performance relative to nine Investor Responsibility Research Center environmental criteria (including toxic emissions, Superfund sites, environmental litigation, accident frequency, and regulatory compliance record.) Adjusting the data for firm size, six "industry-balanced" portfolios of low and high polluting companies were constructed, and then tested for financial performance (stock return, risk-adjusted stock return, Return on Equity and Return on Assets measures were evaluated.) A total of 90 comparisons were made over three time frames (1987-91, 1990, and 1991) for each of the five financial performance measures. In more than 80% of the portfolio comparisons (73 of 90) the "low pollution" portfolio outperformed the "high pollution" portfolio according to the financial performance measures.

Moreover, of the 18 comparisons made of risk-adjusted stock returns, roughly 75% of the “low pollution” portfolios outperformed the “high pollution” portfolios (with the underperformance largely restricted to one environmental criterion – ‘environmental litigation.’) The authors suggest that environmental management may provide insight into managerial capacity, and may be indicative of future financial performance.

**White I (1995)** determined that a portfolio of firms with good environmental reputations earned significantly greater returns than both a portfolio of firms with neutral environmental reputations and a portfolio of firms with bad reputations. The study bases ‘environmental reputation’ on Council of Economic Priorities (CEP) ratings. The CEP scale included three reputation categories: 1) good environmental reputation firms – firms that have “substantial positive” environmental programs, including recycling, alternative energy and waste reduction programs, along with generally positive environmental compliance records; 2) neutral environmental reputation firms – those firms that have “nothing outstanding” in terms of programs, including a lack of proactive programs; and 3) bad reputation firms – those firms that have a “poor record” or major accidents and compliance violations, or have lobbied against progressive environmental standards. Over a three-year observation period (January 1989-December 1992), the good reputation portfolios significantly outperformed the neutral and bad reputation portfolios. The study also tests the market reaction to corporate commitments to externally-developed environmental management principles: it found that, on-average, the shares of six ‘environmentally-committed’ firms showed a 1.05% increase in their value on the day after the firm signed on to a recognized code of environmental conduct (the Coalition for Environmentally Responsible Economics (CERES) principles.)

**Hart and Ahuja (1994)** found that pollution prevention and emissions reduction initiatives have positive impacts on a firm’s return on assets (ROA), return on sales (ROS) and return on equity (ROE) within two years, and that firms with the highest initial emissions levels show the largest ‘bottom-line’ gains. S&P 500 manufacturing, mining, and production firms constituted the sample set (excluding firms that did not have at least three additional firms in its industry sector from which a “reliable” industry sample group could be assembled.) The 127 firms in the observation set were then aggregated according to their performance on the ‘emissions reduction’ component of their Investor Responsibility Research Center profile, and then analyzed according to their operating and financial performance data. Results of this analysis showed that operating performance (ROA and ROS) was significantly enhanced one year after large emissions reductions occurred, and that those performance gains were even more pronounced the following year, before dwindling in year-three. Significant gains were also made in financial performance (ROE), although those gains appeared in year-two, before tapering off in year-three. The authors suggest that the lag in ROE gains may reflect the expected time it takes operating efficiencies and reputational improvements to affect the “capital structure” of firms; however, eventual ROE gains were the most significant for a subset of 52 firms identified as being “highly polluting” in year-one, and those gains stayed strong through year-three.

**Barth and McNichols (1994)** determined that the market assessed Superfund liability in excess of that reported (recognized) by firms in their financial disclosure statements – and thus imposed a penalty on those companies for their ‘unrealized’ environmental liability. The study estimates the remediation costs of 1,156 Superfund sites based on publicly-available data on each site’s EPA ‘hazard score,’ remediation technology required, volume of contaminated soil, and other operating and monitoring costs. For each Superfund site, all Potentially Responsible Parties (PRP’s) – a total of 1,496 companies – were identified and then evaluated over a ten-year period (1982-91) under several scenarios – most notably under scenarios in which each PRP is held responsible for only its ‘share’ of site remediation costs, and scenarios under which each is held fully responsible for all site remediation costs (Superfund provides for ‘joint and several’ liability; that is, up-to full liability for any responsible party in the event that other responsible parties avoid or escape liability.) For each company, each scenario was tested for its association with the firm’s market value of equity (measured as total assets plus total liabilities, and controlled for errors in calculating environmental liabilities and other factors.) All scenarios proved to be significantly negatively related to share price. Moreover, under the ‘full’ responsibility scenarios, the market assessment of firms’ unrecognized Superfund liability proved to be, on-average, 28.6% of the firm’s market value of equity. In 3.5% of observations that assessment exceeded the firm’s market value of equity.

**Table 1: environmental performance criteria employed/ financial performance measures evaluated**  
(studies cross-categorized in italics)

| <i>measures</i>                         | stock returns<br>(comparison<br>of firms) | stock returns<br>(vs. history/<br>the market) | ROE/ profit<br>growth (per<br>firm) | capital costs/<br>cost savings<br>(per firm) | market value<br>(per firm, on-<br>average) |
|-----------------------------------------|-------------------------------------------|-----------------------------------------------|-------------------------------------|----------------------------------------------|--------------------------------------------|
| <i>criteria</i>                         |                                           |                                               |                                     |                                              |                                            |
| <b>IRRC* corporate profiles</b>         | <i>Cohen et al.</i>                       | <i>Gottzman and Kessler</i>                   | <i>Hart and Ahuja</i>               |                                              |                                            |
| <b>TRI* emissions data</b>              |                                           |                                               | <i>Stanwick and Stanwick</i>        | <i>Feldman et al.</i>                        | <i>Konar and Cohen</i>                     |
| <b>CEP* company classifications</b>     | <i>White I</i>                            |                                               |                                     |                                              |                                            |
| <b>FRDC* company ratings</b>            |                                           |                                               | <i>Russo and Fouts</i>              |                                              |                                            |
| <b>media reports on the environment</b> |                                           | <i>Hamilton</i>                               |                                     |                                              | <i>Klassen McLaughlin</i>                  |
| <b>legislation/ regulations</b>         |                                           | <i>Blaconiere and Northcut</i>                |                                     |                                              | <i>Repetto and Austin</i>                  |
| <b>oil spills; chemical leaks</b>       | <i>White II</i>                           | <i>Blaconiere and Patten</i>                  |                                     |                                              |                                            |
| <b>internal operating standards</b>     |                                           |                                               |                                     |                                              | <i>Dowell et al.</i>                       |
| <b>EPA enforcement actions</b>          |                                           | <i>Bosch et al.</i>                           |                                     |                                              |                                            |
| <b>use of innovative technology</b>     |                                           |                                               | <i>Nehrt</i>                        | <i>Christmann</i>                            |                                            |
| <b>Superfund liabilities</b>            |                                           |                                               |                                     | <i>Garber and Hammitt</i>                    | <i>Barth and McNichols</i>                 |

\*IRRC: Investor Research Responsibility Center; TRI: Toxic Release Inventory;  
CEP: Council on Economic Priorities; FRDC: Franklin Research and Development Center

**b) studies which analyze a specific company/industry or event(s)**

**Repetto and Austin (2001)** found that pulp and paper firms likely to be most impacted by proposed environmental regulations can be expected to experience significant market value declines if the regulations are implemented. The study assesses the vulnerability of 13 large pulp and paper companies to potential regulatory changes under various environmental laws (such as the Clean Water Act and the Endangered Species Act.) Vulnerability was largely determined by estimating the level of each firm's operational activities along water systems protected under the various legislative acts (some firms had all their operations on affected water systems, others less than 20%.) Potential financial impact was estimated by examining firm revenues, production costs, investment spending, and asset values. Two distinct regulatory scenarios were tested: one in which the new regulations are imposed in a traditional 'command-and-control' manner ("high-cost" scenario), and another in which an emissions trading system is available ("low-cost" scenario.) When the potential financial impacts of all regulatory changes were considered together, and under both scenarios, the well-positioned companies experienced insignificant changes in share value, while 'vulnerable' companies showed significant declines in value. Thus, firms whose operations were not, or generally not, located on impaired water systems become "net gainers" in share price relative to the vulnerable companies as a result of regulatory tightening. The authors note that under the "low-cost" scenario, all sample firms incurred collectively lower market value declines.

**Christmann (2000)** found that chemical companies which employed innovative, proprietary pollution prevention technologies realized significant cost savings, and that those savings were greatly enhanced for firms that had pre-existing capacities to innovate. Surveys focusing on both pollution prevention and cost management were mailed to 512 business units of chemical companies operating in the U.S., and 88 units (a total of 70 companies) were deemed to have 'complete' data sets. Cost management data were compared to Compustat share price and dividend data to ensure that, as a measure, it accurately reflected firm financial performance. Those business units which employed industry 'best practices' pollution prevention technology (as reported in survey responses) revealed no statistically significant cost savings, while an analysis of business units which employed innovative proprietary pollution prevention technology revealed a positive and significant correlation with the cost savings data. Moreover, an analysis of units with a history of technological innovation and implementation (termed 'complementary assets') revealed a positive correlation with cost savings for both those units employing 'best practices' technology and those employing innovative proprietary technologies, the latter correlation significantly higher than the former. Finally, units employing innovative proprietary technologies realized the strongest cost savings when they acted early; that is, before their competitors.

**Garber and Hammitt (1998)** determined that as Superfund liability rose for a set of chemical companies, the cost of capital for the "large" firms in the set rose as well. The EPA database of Superfund Potentially Responsible Parties (PRP's) was examined for chemical company listings over a 12-year observation period (1981-92.) A total of 73 publicly-traded companies were identified as PRP's, of which 23 were categorized as "large" (market equity in excess of \$1 billion) and 54 "small" (market equity below \$500 million for at least a 2-year period during the observation.) The observation period itself was split to reflect the effect that an influential May 1988 *Wall Street Journal* article on Superfund liability had on investor expectations. The monthly stock returns of each company were tested immediately after each was named a PRP. Observing the increased volatility of "large" firm share returns, the authors conclude that firm systemic risk and cost of equity capital also increased. Moreover, the observed effect doubled after May 1988, indicating a substantial increase in investor sophistication. The authors estimate that being named a PRP at 10 additional Superfund sites would raise the real cost of equity capital by .01 to .02 per month during the observation period. For the 23 companies in the sample set, overall costs of capital rose between .006 and .019% per month over the 12-year period, and jumped to a significant increase of between .25 and .40% on a yearly basis for the 1988-92 period.

**Blaconiere and Northcut (1997)** determined that chemical companies which were likely to be impacted by adverse environmental legislation suffered collectively negative stock price returns while the legislation was being debated and enacted, and that firms with the largest potential liabilities suffered the greatest share price declines. The study analyzes the stock prices of 72 chemical companies over an eight-month period during which the amending and re-authorizing of Superfund (SARA) took place. Each firm's

public financial statements (10-K reports) were examined for environmental disclosures, as well as for EPA Superfund data (such as Notice Letters and Records of Decision) and firm-specific environmental liabilities. A total of 26 news events regarding the SARA process (as reported by the *Wall Street Journal*) were tested for stock price reaction over three-day 'event windows' (no two events overlapped), along with a more-focused set of 17 news events involving specific legislative actions. Stock price reactions to SARA news events were measured against overall market reaction to the SARA events. Variances between firm-specific returns and overall market return were insignificant for the set of 26 events – however, variances between firm and market returns were significant when the 17 “legislative action” events model was run. Moreover, when a subset of firms with “high” Superfund liability (as measured by total number of Notice Letters and total ‘costs’ reported in Records of Decisions) were tested against the 17 events model, larger negative share price returns were realized, and firms with the largest ‘costs’ incurred the sharpest declines.

**Bosch et al. (1997)** found that firms targeted by the EPA for pollution-control enforcement actions suffered stock price declines when their violations were announced, and that firms which lost enforcement challenges incurred significant negative returns. News references regarding EPA enforcement actions were gleaned from the *Wall Street Journal* news index over a twenty-year observation period (1970-1989.) A sample set of 171 cases involving 77 firms were classified according to the maturity of the enforcement action (i.e., from initial announcement to final resolution.) References in each category were then analyzed for their effect on firm stock price: abnormal returns relative to the market were calculated for the ten days surrounding the news reference and also for the event day itself (defined as the event day and the day before.) References regarding initial enforcement announcements (a total of 38, involving 31 firms) resulted in significant negative cumulative abnormal returns for the ‘event window’ (more than 70% of the cases showed negative returns.) References regarding challenges to enforcement actions (19 cases) and references to firms ‘winning’ enforcement actions (30 cases) showed no significant effect on returns. However, news references to firms ‘losing’ enforcement actions (84 cases involving 42 firms) produced significant negative abnormal returns (a greater than 1% loss in total value.) Cases involving ‘settlement’ agreements also showed negative returns, but with a 40% smaller loss in total share value.

**Klassen and McLaughlin (1996)** determined that firms receiving environmental achievement awards realized subsequent increases in market value, while negative publicity was followed by decreases in market value. The Nexis database was searched for environmental awards and for environmental crises that occurred over a seven-year period (1985-91.) A total of 140 award announcements (pertaining to 96 NYSE and AMEX companies) and 22 crises stories – including oil spills, gas/chemical leaks and explosions – about 16 companies were identified. The financial impact of the award or crises event was measured by comparing the change in a firm’s market valuation relative to its baseline valuation (baselines were calculated using a 200-day period prior to the event, not including the ten days immediately before an award.) The event period included the three days following the event to allow for market reaction. Overall market gains and losses were factored out using a weighted index of all NYSE and AMEX stocks. Results showed a positive cumulative abnormal return (0.63%) for award winners, and a negative return for crises (-0.82%.) Moreover, when an additional screen was applied that eliminated events that were potentially contaminated by contemporaneous news events involving the same firm, the results were more significant: 110 award events produced an even larger positive return differential (0.82%), which translated to an on-average award gain of \$80.5 million per firm. For crises, the negative return differential also rose (-1.50%) which translated to an on-average loss in market valuation of \$390.47 million per firm.

**White II (1996)** found that the Exxon Valdez oil spill had an immediate and lasting negative effect on Exxon shares, and that companies with good environmental reputations earned abnormally strong returns during the aftermath of the crisis. Investor response to the Valdez spill was evaluated by comparing the daily values of Exxon shares over a 120-day post incident investigation period (March 27, 1989 – September 14, 1989) to a 225-day pre-event model of Exxon share activity. The same comparison was carried out for the share values of five additional sample groups: the members of the Alyeska Alaska oil pipeline consortium; Exxon’s ten largest oil-industry competitors; non-oil companies with good environmental reputations (as determined by Council on Economic Priorities ratings); companies with neutral environmental reputations; and companies with bad environmental reputations. Of the shares of the six sample groups, Exxon shares experienced the largest abnormal negative returns, as measured on a day-to-day basis over the observation period. Neither Alyeska group shares nor the shares of Exxon’s major

competitors showed significant abnormal returns – which the author speculates to be the result of the “canceling-out” effect of impending Exxon-related liability and the expectation of windfall profits at Exxon’s expense. In contrast, the good environmental reputation sample group did show significantly positive cumulative abnormal returns over the investigation period, while the neutral and bad reputation firms showed zero or weakly negative returns (although the author expresses uncertainty about causality.)

**Nehrt (1995)** determined that paper pulp manufacturers which invested early in pollution-reducing technologies realized positive abnormal profit growth. Fifty chemical bleach paper pulp manufacturers in eight countries were analyzed for the timing and intensity of their investments in pollution-reducing technologies (investment data came primarily from a 1992 *Pulp & Paper International* survey of “elemental and totally chlorine-free mills”) and for the percentage growth in their ‘real local currency’ net income from the mean period 1983-85 to 1989-91. The initial period was selected because it coincides with the development of important new chlorine-reducing technology. Because the sample set included foreign firms, ‘profit growth’ rates were controlled for both percentage growth in home country GDP and for real wage increases. ‘Profit growth’ rates were further controlled for firm initial net income, and for percentage growth in firm sales. Results indicate that the full set of firms which invested in the new technologies realized positive, significant growth (average growth of 513%) and, moreover, that firms which invested during the first few years of the technology’s availability out-performed those which invested during the last few years of the observation period (a 756% growth rate to a 207% growth rate.) Investment intensity, however, proved not to play a statistically significant role in ‘profit growth’ rates.

**Hamilton (1995)** found that firms which experienced negative news coverage regarding their Toxic Release Inventory (TRI) emissions levels incurred subsequent stock declines. A total of 450 NYSE and AMEX companies were identified as owning facilities reporting 1987 TRI data and having “complete” historical stock return data (Center for Research in Security Prices.) Of those companies, 58 received news coverage (which was universally negative) of their TRI emissions levels on the day the data was made public by the EPA, and did not receive other, potentially contaminating, news coverage of their financial performance around the TRI release date (June 19, 1989.) Examining the returns of those companies, the study found significantly negative on-average abnormal returns (compared to historical performance) on the release date. In addition, a larger set of 134 companies that received TRI news coverage at points later in 1989 also incurred significantly negative returns. The author estimates that the abnormal negative returns would translate into an on-average loss of \$4.1 million in market value for companies that received coverage on the data release date, and \$6.2 million for companies that were eventually reported on during 1989. In addition, the study found that while companies with previously-released information regarding their Superfund liability (and thus already-negative environmental reputations) also suffered negative returns when their TRI releases were reported, those returns were slightly less negative than the returns of the complete sample group.

**Blaconiere and Patten (1994)** determined that, in the aftermath of the Union Carbide Bhopal chemical leak, companies dependent on their chemical business for a large part of their annual revenues experienced significant negative share price returns, although firms with more extensive publicly-filed environmental disclosures showed a less negative reaction. The study assessed a sample of 47 companies that gained at least 10% of their annual revenues from chemical activities and whose financial performance during the five-day post-leak investigation period was not affected by concurrent “confounding events.” The 10-K reports of these firms were examined for the presence or absence of statements regarding actual or potential environmental expenditures, liabilities, litigation and compliance concerns. Firms were broken into five categories according to the extent of their disclosures. In addition, companies were categorized according to the percentage of their annual revenue derived from chemical activities. The study’s results indicate that the portfolio of firms heavily-dependent on their chemical revenues (in excess of 75% of annual revenue) experienced significantly negative cumulative abnormal returns relative to a 200-day pre-event model of the portfolio, while the portfolio of firms which depended least on their chemical activities (less than 18% of annual revenue) showed expected returns. Furthermore, the portfolio of firms rated highest for the extent of their disclosures showed expected returns, while the portfolio of firms with the least disclosures experienced significantly negative cumulative abnormal returns.

**Table 2: empirical environmental performance studies and their profitability-related findings**  
(financial result highlighted)

|                          |                                                                                                                                                                                |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>study</i>             | <i>findings indicating (primarily) that positive environmental performance is linked to positive financial results</i>                                                         |
| Christmann               | * chemical companies with pre-existing capacities to innovate and that employed innovative pollution prevention technologies realized <b>significant cost savings</b>          |
| Cohen et al.             | * 'industry-balanced' portfolios of " <b>low pollution</b> " S&P 500 companies earned <b>greater stock returns</b> than portfolios of "high pollution" companies               |
| Dowell et al.            | * firms with international environmental standards more stringent than local law had <b>higher market values</b> than firms with standards at or below the legal mandate       |
| Feldman et al.           | * firms that improved their environmental performance by adopting 'beyond compliance' environmental management systems realized <b>lower capital costs</b>                     |
| Gottzman and Kessler     | * portfolios of 'good' environmental performers <b>returned more than the S&amp;P 500</b> , and portfolios of 'bad' performers returned less than the S&P 500                  |
| Hart and Ahuja           | * pollution prevention and emissions reduction initiatives led to <b>positive improvements in firms' ROE, ROA and ROS ratios</b>                                               |
| Klassen and McLaughlin   | * firms receiving environmental achievement awards realized subsequent <b>increases in market value</b> , while negative publicity was followed by market value decreases      |
| Konar and Cohen          | * environmental performance correlated with intangible asset value, and reductions in toxic chemical releases resulted in <b>increases in firm market value</b>                |
| Nehrt                    | * paper pulp manufacturers that invested early in pollution-reducing technologies realized <b>positive abnormal profit growth</b>                                              |
| Russo and Fouts          | * firms' <b>ROA ratios improved</b> as their environmental performance improved, with the effect the strongest in 'growth' industry sectors                                    |
| Stanwick and Stanwick    | * firms with excellent reputations for social responsibility and with low pollution emissions levels <b>experienced greater profits</b> than high emissions firms              |
| White I                  | * portfolios of firms with <b>good environmental reputations earned greater returns</b> than portfolios of firms with neutral or bad reputations                               |
| <i>study</i>             | <i>findings indicating (primarily) that negative environmental performance is linked to negative financial results</i>                                                         |
| Barth and McNichols      | * the <b>market assessed Superfund liability in excess of that reported</b> (was recognized) by firms in financial disclosure statements – thus imposing a penalty             |
| Blacconiere and Northcut | * chemical companies likely to be impacted by adverse environmental legislation suffered <b>negative stock price returns</b> as the legislation was being debated              |
| Blacconiere and Patten   | * after the Union Carbide Bhopal chemical leak, companies dependent on their chemical business experienced <b>significant negative share price returns</b>                     |
| Bosch et al.             | * firms targeted by the EPA for pollution-control enforcement actions <b>suffered stock price declines</b> when their violations were announced                                |
| Garber and Hammitt       | * as Superfund liability rose for a set of chemical companies, the <b>cost of capital for the "large" firms in the set rose as well</b>                                        |
| Hamilton                 | * firms which experienced negative news coverage regarding their Toxic Release Inventory (TRI) emissions levels incurred subsequent <b>stock declines</b>                      |
| Repetto and Austin       | * pulp and paper firms likely to be impacted by possible environmental regulations are likely to experience <b>market value declines</b> if the governmental actions are taken |
| White II                 | * the Exxon Valdez oil spill had an <b>immediate and lasting negative effect</b> on the value of Exxon shares                                                                  |

### III. Qualitative reports and papers on the environmental/financial performance relationship and environmental investment fund performance

#### a) environmental management as competitive advantage

'Seminal' works on 'environmental management as competitive advantage,' include *A Natural Resource-Based View of the Firm* [Hart (1995)] which theorizes that the basis for competitive advantage between companies will increasingly be rooted in their differing environmental management capabilities. Three interconnected management strategies – pollution prevention, product stewardship, sustainable development – are seen as the basis for competition, and firm capabilities in each strategic area are postulated as being determinative of competitive advantage.

*Green and Competitive: Ending the Stalemate* [Porter and van der Linde (1995)] makes the argument that environmental regulations do not erode competitiveness, but instead present opportunities for competition among firms, especially in regards to resource productivity and cost minimization. Comprehensive case studies are presented to illustrate instances in which strengthened environmental regulations have produced more profitable companies.

#### b) progressive environmental management practices and financial return

Waddock and Smith (2000) examine the financial implications of internal auditing programs: the paper focuses on 'responsibility audits,' defined as a "management tool" that can demonstrate the potential qualitative and financial benefits of a firm's environmental ethic and furthermore, create "new opportunities" within a firm to profit from progressive environmental management. A case study of a "leading multinational manufacturing firm that had won numerous environment awards" is presented, with a description of how an internal audit led to improved waste reduction practices, increased plant capacity, and significant cost savings.

Miles and Covin (2000) explores the relationship between environmental performance, reputation, and financial performance and concludes that "good environmental steward(ship) helps create a reputational advantage that leads to enhanced marketing and financial performance." Additionally, the paper suggests that progressive environmental management leads to opportunities for "pro-active" marketing, including opportunities to work with external environmental stakeholder groups, and to participate in high-profile government environmental management programs.

Petrick et al. (1999) compares and contrasts corporate leadership practices and concludes that some practices led to enlightened environmental management and, as a result, financial and reputational competitive advantages; while others led to "waste reputational capital." Four competitive advantage-enhancing practices are proposed involving, for example, oversight and auditing.

Naimon (1994) advances strategies for upgrading corporate environmental benchmarking programs – specifically, techniques for decomposing companies along business lines in order to compare particular industrial activities among companies, as well as techniques for measuring environment-related risk within business line categories. In addition, techniques are presented for normalizing risk indicators by revenue source (foreign or domestic.)

#### c) corporate governance and the environmental/financial performance link

Corporate governance (used here in the limited sense of 'senior management/board director responsiveness to external stakeholders') papers have also assessed the environmental/financial performance relationship. Descano and Gentry (1998) examine companies' processes for communicating environmental performance externally and concluded that internal teams developing environmental reports rarely interacted with teams developing financial reports, and as a result, correlations between environmental and financial results rarely came to light, and were rarely communicated externally. One critical external stakeholder audience – financial analysts – remained, therefore, unaware of the

“sustainability-profitability” link, as did, in many cases, a critical internal audience, senior company executives. The paper suggests that, when communicating environmental performance externally, companies should strive to make their messages relevant to the investor community, and to equip all senior managers with an understanding of the environmental/financial correlation, while also ensuring that information communicated is both operational and strategic and fully credible.

**Naimon et al. (1997)** evaluated a range of corporate governance, human resource and auditing policies within the context of the financial parameters of a set of S&P 500 companies and determined that certain policies are highly relevant to improving environmental performance. Among other findings, the paper shows that companies with strong internal policies exhibit better environmental performance than those merely adopting industry codes of conduct, and that firms with more ‘inside-the-company’ board directors performed better than firms with majority ‘outside’ director boards.

**Ilnitch et al. (1996)** argues that the accounting profession should establish policies for environmental performance reporting in order to diminish the complexity of evaluating management programs and increase the quality of publicly-available environmental data/indicators. Individual indicators proved, in general, to be “insufficient” to confidently evaluate firms’ performances and often failed to take into consideration industry-specific characteristics and firms’ foreign operations, while, in some cases, even penalized firms for disclosing more environment-related information than their counterparts.

**Barth et al. (1996)** examined the disclosure patterns of firms and concluded that large firms voluntarily disclosed more environment-related information than small firms, and that firms with historically positive environmental information to disclose, as well as firms that rely on capital markets for financing, are likely to frequently disclose environment-related information. A number of factors were found to influence firms’ voluntary disclosure patterns: litigation concerns, regulatory concerns, and the effect disclosure might have on access to capital.

#### **d) translating environmental performance into shareholder value**

**Figge and Schaltegger (1998)** demonstrate that progressive environmental management, by lowering resource consumption and other costs, can raise financial performance margins and increase long-term shareholder value. Noting that, in general, firm valuation is done by examining backward-looking accounting data, the authors propose using a ‘free cash flow’/“shareholder value” method (i.e., a comparison of future costs and future income) instead to evaluate firms – in order to take into account the financial benefits of operating in an environmentally efficient manner. The paper argues that financial analysts should, in the very least, examine firms’ environmental efficiency when evaluating ‘future costs.’ The report includes techniques for appraising environment-related value, and for estimating environment-related risk, and presents case studies that serve to illustrate the “shareholder value” approach.

**Reed (1998)** contains an assessment of the methodology employed by empirical researchers that have studied the environment/finance link, as well as an assessment of the performance of ‘green’ funds and recommends improvements in the quality of the environmental data used in research, and an increased emphasis on finding ‘causality’ between the data and financial return. Notably, the paper suggests that the current ‘fiduciary responsibility’ legal standard applicable to (U.S.) financial analysts and institutional investors could eventually be interpreted to extend beyond its traditional obligations and require ‘trustee’ investors to consider a company’s environmental performance when selecting investments (if the case is strong that environment and profitability are correlated.)

Those primarily responsible for growing shareholder wealth, corporate executives, have also weighed-in on the environment/shareholder value relationship. A United Nations Development Program report [**Gentry and Fernandez (1997)**] assessed the differing approaches Fortune 500 CFO’s and financial analysts take in evaluating environmental performance and concludes that environmental factors have had little impact in financial analysts’ decisions, even when evaluating pollution-intensive industry sectors, and that more often than not have served as a negative financial indicator to analysts.

A World Business Council for Sustainable Development (WBCSD) report [Blumberg et al. (1996)] lists a large number of environmental ‘drivers’ (such as concerns for air and water quality) that have led corporations to concentrate on lessening the environmental impacts of their activities and maintains that those ‘drivers’ represent opportunities for companies to gain advantages on their competitors. The report laments the insufficient “consideration” paid to environmental management by financial analysts and recommends that analysts develop techniques to integrate firms’ environmental ethic in their share value estimations.

#### **e) the role of market participants in the environment/profitability equation**

Heinkel et al. (2001) analyze the effect investing in environmentally-progressive companies might have on corporate behavior. A model is developed of a hypothetical world in which there are three categories of companies – firms “acceptable” to ‘green’ investors, firms that are not, and firms previously “unacceptable” that have “reformed” their ways – and in which no neutral (non-green) investor holds shares of “reformed” companies. The total number of ‘green’ investors is adjusted incrementally to determine the point at which “unacceptable” firms reform (that is, the model is constructed so that an increase in the number of ‘green’ investors leads to a larger number of “reformed” firms, along with an increase in the cost of capital for “unacceptable” firms. The hypothetical model shows that a greater than 20% concentration of ‘green’ investors in the market lowers the cost of capital enough to induce a reform-minded company to invest in pollution prevention technology.

Kasemir et al. (2001) advances the argument that pension fund managers have a unique opportunity to draw on existing investment and scientific research to form investment strategies that encourage environmentally sustainable business practices. The paper points out the lack of “in-house capacity” to develop satisfactory ‘sustainability’ screens among pension funds, and the increasing difficulty of identifying environmental leaders by simply examining corporate reports, and recommends establishing relationships between funds and the ‘green’ investment and ‘sustainability’ science communities in order to bring “sustainable investing” skills to fund managers.

The U.S. EPA Environmental Capital Markets Committee [Howes et al. (2000)] solicited the financial services industry and other equity investors for insights into the environmental/financial performance relationship, and for opinions on how environmental performance might be more fully incorporated into the investment selection process. The report finds that institutional investors do, in fact, recognize a positive correlation between environmental and financial performance, although “moderate,” but that a number of barriers inhibit the full incorporation of environmental factors in the investment selection process, including the absence of standardized benchmarks to measure environmental performance and the lack of technical skills among investors to understand how environmental strategies affect financial outcomes.

Soyka and Feldman (2000) surveyed institutional investors and fund managers to determine their opinions on the impact advancements in environmental (and health and safety) management have had on corporate financial performance. A number of conclusions are drawn from the survey results, including that money managers do recognize that environment (and health and safety) improvements can contribute to firm value, and that they are willing to pay a premium for the equity and debt of firms for which this value has been “convincingly demonstrated.”

#### **f) analysis of recent ‘green’ fund performance**

A number of recent reports have analyzed ‘green’ fund performance and have concluded that screening for the environment is becoming increasingly lucrative. Among the most comprehensive of these reports is the (year) “2000 Review of Eco-Efficiency Funds” [Buffington and Ganzi (2001)]. ‘Eco-efficiency’ funds -- defined in the report as those funds “that offer investment opportunities in leading environmental companies and seek superior financial returns” -- by all indications outperformed the market in 2000). According to the report, 19 of 26 companies that rated their funds’ performances relative to a market-based index for the year 2000 outperformed their benchmarks by an average of 7.1%.

“The Emerging Relationship Between Environmental Performance and Shareholder Wealth,” [Earle (2000)] also reviews ‘green’ fund performance and finds that a large body of research shows a “consistently positive relationship between environmental performance and financial returns,” and that “results from the historical studies are being replicated in the marketplace.” Of the ‘green funds’ analyzed, the report concludes that despite the “newness of the field” and the need for further data, “the direction of the information analyzed is clear: companies with superior environmental performance generally have greater shareholder returns.”

#### **IV. Conclusion**

Empirical research on the environmental/financial performance relationship has: 1) tested a wide variety of environmental performance indicators against a range of financial measures; and 2) found that positive environmental performance is linked with positive financial results, and that negative environmental performance leads to negative results.

Research conducted over the last decade increasingly shows that there is a clear correlation between environmental performance and corporate profitability. Specifically, empirical studies have found that companies that scored well according to independent environmental criteria have realized stronger stock price gains than the S&P 500 overall – and companies that scored poorly have had weaker returns.

Furthermore, empirical studies have analyzed companies’ adherence to environmental regulations and have concluded that those companies that went beyond legal compliance have realized stronger stock price gains and market value growth than the S&P 500 – while laggard companies that are threatened by actual or impending environmental laws have been shown to experience weaker returns.

Corporate investment in innovative pollution prevention technology has been found to be associated with positive stock returns – according to the research – as has favorable media coverage for company environmental achievements. In contrast, Superfund-site responsibility, chemical leaks, and oil spills have been found to be among the environmental negatives associated with stock price declines.

Financial accounting measures, such as return on equity (ROE) and return on assets (ROA), have been shown to improve with improved environmental performance, while the inadequate disclosure of environmental liabilities has been found to have a compounding negative effect on the financial results of poor environmental performers.

Progressive environmental management strategies, including environmental auditing programs and corporate governance programs which seek to engage external stakeholders in company environmental programs, have been evaluated in various analytical papers and have been found to be associated with strong financial performance.

Moreover, the performance of investment funds comprised of companies with superior environmental profiles has been analyzed in recent reports and has been shown to be more profitable than the S&P 500, plainly dispelling the presumption that environmental filtering invariably lowers the financial returns of investment portfolios.

Considered collectively, this research provides a solid basis for concluding that there is, in fact, a profitable correlation between superior environmental stewardship and strong financial performance.

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