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# The Value Relevance of Environmental Performance

LARS HASSEL*, HENRIK NILSSON** AND SIV NYQUIST†

**Åbo Akademi University, **Umeå School of Business and Economics and †Swedish University of Agricultural Sciences*

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ABSTRACT This paper provides insight into how environmental information is reflected in the market value of listed Swedish companies. Using the residual income valuation model, we express market value of equity as a function of book value of equity, accounting earnings, and environmental performance, where the last variable is used as a proxy for other value-relevant information. Our research is motivated by the recommendation of the Swedish Society of Financial Analysts regarding environmental reporting. This recommendation assumes that environmental information has value relevance, since it is likely to affect the expected future earnings of listed companies. We contribute empirical findings to current debate on the relationship between environmental performance and shareholder value. The cost-concerned school argues that environmental investments represent only increased costs, resulting in decreased earnings and lower market values. The value creation school regards environmental efforts as a way to increase competitive advantage and improve financial returns to the investors. The current research finds support for the cost-concerned school, because the results indicate that environmental performance has a negative influence on the market value of firms.

## 1. Introduction

The purpose of this study is to investigate the value relevance of environmental performance ratings for the market values of firms listed on Stockholm stock exchange (Stockholmsbörsen). The study proposes that the market value of

*Correspondence Address:* Henrik Nilsson, Umeå School of Business and Economics, Umeå University, SE-901 87 Umeå, Sweden. E-mail: henrik.nilsson@fek.umu.se

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firms will reflect both their financial and environmental performance. According to our research model, financial performance does not alone explain market values of firms, but the value relevance of financial statement information can be increased if it is combined with environmental information that has been compiled into performance ratings. In this respect, the study is related to research on value relevance of non-financial information in other contexts. Such extensions of purely financial models include the Amir and Lev (1996) study of the wireless communications industry, the Deng *et al.* (1999) study of high-tech firms, and the studies by Trueman *et al.* (2000) and Rajgopal *et al.* (2003) of the valuation of internet stocks. There is also a stream of value relevance studies of intangible assets, such as brand assets, that are not disclosed in financial statements (Kallapur and Kwan, 2004).

Accounting research on the financial outcomes of environmental efforts consists of two main streams. The financial benefits of environmentally friendly practices are searched for in pollution level studies. Event studies are used to demonstrate financial gains or returns from 'greening'. Proponents of 'it pays to be green' say that there is a causal link between environmental and financial performance. Pollution reduction is said to produce future cost savings and minimize future environmental liabilities (Porter and van der Linde, 1995; Reinhardt, 1999). An early pollution control related study was the Belkaoui (1976) study of the relationship between market reaction and disclosed pollution control expenditures. Spicer (1978) found that expenditures for pollution control were associated with financial performance among pulp and paper firms. Freedman and Jaggi (1986) searched for the relationship between market value and pollution disclosures, and Cormier *et al.* (1993) and Bath (1999) for the relationship between financial variables, market values, and pollution levels. Hart and Ahuja (1996) investigated the relationship between emission reductions and both return on assets and return on sales. They showed that changes in pollution predate changes in financial performance. King and Lennox (2001) had difficulties interpreting the Hart and Ahuja study because of difficulties linking environmental performance improvements to future financial gain. Attempts to isolate the effects of pollution control on future net cash flows and to account for firm differences beyond environmental efforts have proven to be a challenge for accounting research.

Environmental event type studies attempt to demonstrate that 'greening' results in financial gains. Such studies look at changes in stock prices or market values following some environmental event. Hart (1997) has proposed that excess financial returns result from the relative environmental capabilities of firms. When isolating an environmental event within a narrow window, important firm differences can be controlled for; the events under study, however, are only partially environmental and their dynamics are unknown. Shane and Spicer (1983) investigated the relationship between security price movements and disclosed studies of social performance. Research inspired by environmental regulations includes Maloney and McCormick (1982),

Blacconiere and Patten (1994), and Dowell *et al.* (2000), the latter of which examined the relationship between market values and adoption of stringent global environmental standards. Klassen and McLaughlin (1996) and Feldman *et al.* (1997) studied the effects of published events on firm value, and found that both positive and negative events were related to firm value. Freedman and Jaggi (1986) could not, however, relate firm value to environmental management. Milne and Chane (1999) conducted an experimental study of the relationship between narrative social disclosures and investment decisions. They found that only a small minority of respondents altered their investment decisions because of social disclosures. Based on prior literature, Cormier and Magnan (1997) suggested a study on the relationship between environmental stewardship and firm value. Subsequent research has produced mixed findings, and has not explicitly focused on the value relevance of environmental performance in complementing traditional accounting numbers. This paper contributes to filling that gap, by considering how the stock market reflects environmental performance over and above traditional financial statement information.

This paper uses an accounting-based valuation model developed by Ohlson (1995), in which the market value of equity is considered as a function of book value, accounting earnings, and environmental performance. The environmental performance variable is used as a proxy for other value-relevant information in the model. Ilinitch *et al.* (1998) have presented both a theoretical and empirical approach to an enhanced measurement of environmental performance. In this paper we use a special performance index, or an environmental rating of companies, developed for institutional investors in the Swedish stock market. Because the performance rating is disclosed for financial market purposes, the index is *a priori* expected to be a potential driver of future earnings of a company with value relevance on the Stockholm stock exchange.

Our results indicate that environmental performance ratings complement accounting information, and consequently, that environmental performance has value relevance in the Swedish stock market. Specifically, we find a significant negative relationship between the market value of listed Swedish companies and their environmental performance ratings as measured by an environmental performance index. The results also indicate that the negative relationship is more pronounced in the latter portion of the study period, after environmental accounting regulations was changed. The results also apply universally across all industry groups.

The rest of the paper is organized as follows. The next section discusses the value relevance of environmental performance in the Swedish context. The following section presents the theoretical model that has been used and related regression equations developed to link financial and environmental performance to the market value of firms. The data, sample, and results are presented before the conclusions of the paper.

## 2. The Relevance of Environmental Performance

There is a general belief that various stakeholders require information from companies regarding their environmental performance. According to Deegan and Rankin (1997), annual report users have been found to believe that environmental information is important for their decision making and that they seek such information in annual reports. However, Deegan and Rankin (1997) also claim that the quality of environmental performance disclosures by companies themselves is low and biased. This section will briefly highlight the developments of environmental disclosures in Sweden and the need for and foundations of the environmental performance rating that is used in the empirical section of the study.

The importance to the investor of information on a company's environmental concerns and performance has recently been highlighted by the Swedish Society of Financial Analysts (SFF). Their recommendation, *Environmental Information for Financial Analysts*, states: 'For an increasing number of firms a positive environmental profile has become an important element in their marketing strategy, and a lack of such a profile constitutes a risk factor' (SFF, 2000, p. 58; author's translation). More importantly for this study, they suggest that: 'environmental factors will increasingly influence the future cash flows of firms in both a positive and negative way. Equity valuation, credit analysis, and other economic decisions that involve financial analyses are based on forecasts of future earnings or cash flows. These forecasts are influenced by or complemented with sensitivity analysis and risk estimation. The opinion of the Society is that such estimation will be increasingly determined by environmental factors' (SFF, 2000, p. 58; author's translation).

Swedish companies voluntarily disclose environmental information. However, from January, 1999, environmental information is also required by the accounting legislation. Companies that have a license to operate, according to the Environmental Code, must disclose information in their administrative reports as to how their operations directly influence the external environment (SFS, 1995: 1554). The increased focus on environmental reporting is not unique to Sweden. Bebbington (1999) says that Danish companies are mandated to publish environmental information as 'green accounts'. In June 2001, the European Commission adopted a recommendation on the recognition, measurement, and disclosure of environmental issues in annual accounts and annual reports. This recommendation applies to all companies covered by the EU fourth and seventh Company Law Directives (78/660/EEC and 83/349/EEC), and was to be applied to all accounting periods starting within 12 months of the date of adoption. The recommendation aims to improve the quality, transparency, and comparability of the environmental information that companies present in their annual reports (European Commission, 2001).

An evaluation of the environmental performance must, however, go beyond mere financial statement disclosures of environmental liabilities (Ilinitch *et al.*, 1998). Gauging environmental performance requires the measurement of

non-financial dimensions of performance. Systematic attempts have been made to describe good environmental performance, and Epstein (1996) has outlined the components of corporate environmental scorecards. Lober (1996) suggested that organizations consider four dimensions of environmental effectiveness. He suggests an output-based approach to how well firms meet stated goals, a system resource-based approach to how firms capture resources in order to be competitive, an internal process-based approach to information flows and employee communication, and, finally, a strategic constituency-based approach to how well stakeholders' needs are met. Ilinitch *et al.* (1998) have integrated the process, outcome, internal, and external components of environmental performance criteria into a framework useful to various stakeholder groups, such as investors. This theoretical framework provides the foundation of the environmental performance ratings used in this study, as it meets the need for a practice- and organizational effectiveness-oriented measurement.

This paper makes use of accounting-based valuation theory developed by Ohlson (1995) to model the relationship between market value and environmental performance. Following recent studies in market-based accounting research (e.g. Trueman *et al.*, 2000; Ali and Hwang, 2000), we define value relevance as the ability of accounting or non-accounting measures to capture or summarize information that affects equity value. The model expresses the market value of equity as a function of a firm's book value, earnings, and other value-relevant non-financial information. An index attempting to mirror the environmental performance of Swedish listed firms was provided for this study by the Swedish firm, CaringCompany (CC) Research, AB. We use the index as a proxy for environmental performance.

Current debate on how environmental performance impacts the market value of firms is basically divided into two schools (The Assabet Group, 2000). The cost-concerned school argues that environmental investments and high environmental performance represent only increased costs, resulting in decreased earnings and lower market values. Consequently, the relationship between environmental performance and market value of a firm is expected to be negative (e.g. Jaggi and Freedman 1992; Walley and Whitehead, 1994). The value creation school regards environmental efforts as a way to increase competitive advantage and improve financial returns to the investors. The relationship between environmental performance and market value is expected to be positive according to this view (e.g. Konar and Cohen 2000; Dowell *et al.*, 2000).

The difficulty of linking environmental reporting to financial outcomes has been brought up by Bebbington (1999). Danish companies have since 1996 been mandated to publish environmental information in the form of a 'green account'. Bebbington (1999) reviews an governmental report on environmental reporting outcomes of legislation in Denmark, and concludes that it appears to have had no significant adverse effects. One finding of the review was that about 50% of the firms complying with the environmental reporting legislation reported having achieved financial benefits exceeding the costs involved. The

estimated costs of the environmental reports were difficult to measure, but he concluded that the distribution of costs and benefits was probably uneven. Case studies conducted by Repetto and Duncan (1999) revealed that companies operating in the pulp and paper industry face different levels of exposure to and associated financial risks from environmental issues. In some cases, environmental issues had little impact on financial performance and could be a source of increased value. In other cases, environmental issues could involve costs exceeding 10% of their current stock market values and materially affect their competitive positions. Also, King and Lenox (2001) found evidence of an association between pollution reduction and financial performance, but were unable to prove the direction of causality (p. 113). Even though firms in cleaner industries had a higher Tobin's $q$, the confounding effects of fixed firm attributes could not be ruled out. Based on the accounting standard adopted in 1990 in Canada, Li and McConomy (1999) have suggested that the disclosure of provisions for future removal and site restoration costs is relevant for firm value, as it may enable capital markets to proxy for the liabilities involved. The evidence was, however, inconclusive and the environmental proxy was more limited than that used in this study.

The research evidence mentioned above suggests that environmental efforts could lead to different financial outcomes, as future earnings could be influenced both positively and negatively. Environmental information disclosed as performance ratings for the investor community is in this study expected to be value relevant and to complement financial information in the valuation process. Value relevance is determined by analyzing how environmental performance is reflected in the current expectations of future earnings that determine market values. If a relationship can be established, the finding would be consistent with investors' employing environmental performance information when setting prices, and the metric used to gauge environmental performance would be regarded as capturing the environmental information used by market participants in valuing firms.

## 3. The Valuation and Regression Models

*Linking Environmental Performance to the Market Value of the Firm*

The valuation model developed by Ohlson (1995)[1] is based on three main assumptions. First, the value of equity equals the present value of all future dividends. Second, the accounting system satisfies a clean surplus relationship. Finally, abnormal earnings evolve as a modified first-order, auto-regressive process and other information, $v_t$, as a simple first-order, auto-regressive process. Based on these assumptions, Ohlson (1995) derives the following valuation model:

$$MV_t = BV_t + \alpha_1 AE_t + \alpha_2 v_t, \tag{1}$$

where $MV_t$ is market value of equity at time $t$, $BV_t$ equals book value of equity at the end of the year $t$, $AE_t$ is equal to abnormal earnings (defined as the difference between net income and opening book value of equity multiplied by the required rate of return) for period $t$, and $v_t$ is other non-accounting value-relevant information. Some of this non-accounting information consists of information regarding companies' environmental performance. In the sequel our concern is limited to information regarding companies' environmental performance. The model emphasizes the use of both accounting and non-accounting information in the valuation process. Furthermore, the valuation framework allows the environmental performance, *EP*, of the firm to be explicitly added in a regression model through the $v_t$ term. Hence, we model environmental performance as a proxy for other information in the framework.

Estimating (1) requires an estimate of the required rate of return in order to calculate abnormal earnings. Because of data constraints, no generally accepted method for estimating the required rate of return applies here. Therefore, following Collins *et al.* (1999) and Lin and Walker (2000), we instead restate (1) in terms of cum-dividend market value, opening book value, earnings, and other information (see Appendix for a derivation), and present the following empirical analogue of the Ohlson model:[2]

$$MV_t + DI_t = \beta_0 + \beta_1 BV_{t-1} + \beta_2 NI_t + \beta_3 v_t + \varepsilon_t \tag{2}$$

where $DI_t$ is the dividend, $MV_t + DI_t$ is the cum-dividend adjusted market value, $BV_{t-1}$ equals opening book value, and $NI_t$ is current period net income. Equation (2) constitutes the empirical model foundation for this study, where the value relevance of environmental performance will be empirically investigated through the other information variable, $v_t$. The next section presents the estimated regressions based on equation (2).

### *The Regression Models and Research Design Issues*

We start by first investigating the value relevance of accounting information solely by estimating the following regression of cum-dividend market value on net income:

$$\frac{MV_{i,t} + DI_{i,t}}{BV_{i,t-1}} = \beta_0 \frac{1}{BV_{i,t-1}} + \beta_1 + \beta_2 \frac{NI_{i,t}}{BV_{i,t-1}} + e_{i,t}, \tag{3}$$

where $MV_{i,t}$ is the market value of firm $i$, $BV_{i,t-1}$ is firm $i$'s closing book value of equity available at quarter $t-1$ and $NI_{i,t}$ is the net income for quarter $t$. $MV_{i,t}$ is measured 10 days after the end of quarter $t$, since it is published by CC at that time point.

Compared to equation (2), this model is deflated by $BV_{i,t-1}$ to control for size differences. The constant term, $\beta_1$, which corresponds to the coefficient of

book value in equation (2), is expected to be positive. The coefficient of deflated net income, $\beta_2$, is expected to be positive as well.

Next, in order to study the incremental value relevance of environmental information, we extend model (3) to include a measure of environmental performance, *EP*:

$$\frac{MV_{i,t} + DI_{i,t}}{BV_{i,t-1}} = \beta_0 \frac{1}{BV_{i,t-1}} + \beta_1 + \beta_2 \frac{NI_{i,t}}{BV_{i,t-1}} + \beta_3 EP_{i,t} + e_{i,t}. \tag{4}$$

*EP* is our proxy for $v_t$ in equation (2). Note that *EP* is not deflated since our measure of environmental performance is assumed to be independent of company size. Based primarily on anecdotal evidence, high environmental performance is expected to increase the demand for a company's products and services while at the same time increasing the cost of operations. *A priori*, *EP* has an impact on both revenues and expenses and the future benefits can either be positive or negative. Since no theoretical or empirical guidelines exist to suggest whether high environmental performance increases or decreases future net income, its effect on market value is *a priori* unknown. Therefore, *EP* is expected to be value relevant, i.e., $\beta_3$ will be significantly different from zero, but the sign will be an open empirical question.

Both equations (3) and (4) are estimated on the full sample. Two extensions of equation (4) regarding the value relevance of environmental performance are made. First, we investigate the possibility of environmental performance having different degrees of value relevance in two different industries, service and manufacturing. Second, we investigate a possible structural change in the value relevance of environmental information. In 1999 the accounting legislation for environmental reporting was changed in Sweden. Therefore it is of interest to see whether this legislation change had an impact on the value relevance. To test for differences between industries and differences caused by the change in legislation, we introduce two indicator (dummy) variables. The dummies are type of industry, *I*, and time period, *T*, whose coefficients will reflect possible unknown systematic differences between industries and time periods. In addition we also introduce their interactions with the environmental performance measure. Equation (5) serves as the model for these tests:

$$\begin{aligned}\frac{MV_{i,t} + DI_{i,t}}{BV_{i,t-1}} = {} & \beta_0 \frac{1}{BV_{i,t-1}} + \beta_1 + \beta_{1,I} I_{i,t} + \beta_{1,T} T_{i,t} + \beta_2 \frac{NI_{i,t}}{BV_{i,t-1}} \\ & + \beta_3 EP_{i,t} \quad + \beta_4 (I_{i,t} EP_{i,t}) + \beta_5 (T_{i,t} EP_{i,t}) + e_{i,t}\end{aligned} \tag{5}$$

where all variables are as before. The variable, *I*, is equal to zero for manufacturing companies and equal to one for service companies. Similarly, variable *T* is equal to zero for the time period before the change in accounting law, and equal to one for the time period after the change.

Deegan and Rankin (1997) say that environmental reports often lack comparability and may often be positively biased. This is not a severe problem in this study. As will be discussed in the next section, the environmental performance measure used in this study not only relies on the firms' own environmental disclosures, but also contains both private and other public information concerning environmental issues. The advantage of this is that the measure contains more information than would be voluntarily disclosed and may therefore presumably also contain more 'negative' information. The disadvantage is that to some extent parts of the market might be unaware of the information in CC's environmental performance measure. This was especially the case before the change in Swedish accounting legislation on January 1, 1999. After that date, Swedish companies were required to disclose environmental information in their administrative reports. Consequently, the market's familiarity with the information in the environmental performance measure might differ before and after the change in legislation. To account for this possibility, the indicator variable, $T$, is included to facilitate investigation of the usefulness of environmental performance information (in addition to accounting information) before and after the change in accounting regulations. It is believed that the impact of environmental information on the market value of firms is increasing over time. An argument against a slow or limited dissemination of the performance rating information among investors is that the environmental performance rating might be value relevant because it captures a widespread general opinion regarding the environmental reputation of individual listed companies in Sweden, a matter that the performance index confirms.

Inclusion of the industry dummy, $I$, lets us study a possible difference in the impact of environmental performance information between the service and manufacturing industries. Our hypothesis is that high environmental performance is likely to be more costly for manufacturing firms because they normally operate in environmentally sensitive sectors. To investigate this hypothesis, the firms in our sample are first classified according to the Global Industry Classification Standard (GICS) used by the Stockholm stock exchange, Stockholmsbörsen. Based on the GICS standard, the companies are then classified into 8 different industry groups (see Table 1 for a list of the sample firms). Finally, industry groups 1–4 are classified as manufacturing firms, while groups 5-8 are classified as service firms. Unfortunately, the limited sample size does not allow us to examine more than two industry groups in this study.

Equations (3–5) are estimated by pooling observations cross-sectionally and over time. Furthermore, the coefficients in the equations are estimated using the ordinary least squares technique. Heteroscedasticity-consistent standard errors using White's procedure are estimated to allow for any non-constant residual variance (White, 1980). The next section presents data sources and the final sample of the study.

**Table 1.** The sampled firms. The Global Industry Classification Standard is the basis of the classification made in this study. Materials = 1; industrials = 2; consumers discretionary = 3; consumer staples = 4; health care = 5; financials = 6; information technology = 7; telecommunication services = 8; utilities = 9

| | Clas. | Firm name | | Clas. | Firm name | | Clas. | Firm name |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | ABB | 26 | 1 | Gränges AB | 51 | 6 | PriFast AB |
| 2 | 7 | Adera AB | 27 | 2 | Haldex Group | 52 | 2 | Proffice AB |
| 3 | 5* | Aerocrine AB | 28 | 6 | Handelsbanken Svenska AB | 53 | 7 | RKS Data AB |
| 4 | 2* | AGA | 29 | 3 | Hennes&Mauritz | 54 | 1 | Rottneros AB |
| 5 | 7 | Allgon AB | 30 | 1 | Holmen AB | 55 | 2 | Sandvik AB |
| 6 | 1 | AssiDomän AB | 31 | 1 | Höganäs AB | 56 | 1 | Sapa AB |
| 7 | 5 | Astra | 32 | 7 | Icon Medialab AB | 57 | 1 | SCA |
| 8 | 5 | AstraZeneca PLC | 33 | 2 | JM AB | 58 | 2 | Scania |
| 9 | 2 | Atlas Copco | 34 | 2* | Kalmar Industries AB | 59 | 6 | SEB |
| 10 | 3 | Autoliv Inc. | 35 | 4 | Karlshamns AB | 60 | 6 | Skandia |
| 11 | 1* | Avesta Sheffield AB | 36 | 2 | Lindab | 61 | 2 | Skanska |
| 12 | 3 | Bilia AB | 37 | 3 | Lindex AB | 62 | 2 | SKF AB |
| 13 | 2 | Cardo AB | 38 | 6 | Lundbergföretagen AB | 63 | 1 | SSAB |
| 14 | 6 | Castellum AB | 39 | 6 | Mandamus Fastigheter AB | 64 | 1 | StoraEnso |
| 15 | 7 | Digital Vision AB | 40 | 7* | Mandator AB | 65 | 2 | Svedala AB |
| 16 | 6* | Diligentia AB | 41 | 5 | MediTeam Dental AB | 66 | 8 | Telia |
| 17 | 6* | Diös AB | 42 | 3 | Mekonomen AB | 67 | 6 | Tornet Fastighets AB |
| 18 | 6 | Drott AB | 43 | 6 | MeritaNordbanken AB | 68 | 2 | Trelleborg AB |
| 19 | 3 | Electrolux AB | 44 | 7 | Micronic Laser Systems AB | 69 | 6 | Wihlborgs Fastigheter AB |
| 20 | 7 | Ericsson | 45 | 2 | Munters AB | 70 | 7 | WM Data AB |
| 21 | 8 | Europolitan AB | 46 | 8 | NetCom AB | 71 | 2 | Volvo AB |
| 22 | 2 | Finnveden AB | 47 | 6 | Norrporten AB | | | |
| 23 | 7 | Framfab | 48 | 6 | Om Gruppen AB | | | |
| 24 | 6 | Förenings-Sparbanken AB | 49 | 5 | Pharmacia&Upjohn | | | |
| 25 | 9 | Graningeverkens AB | 50 | 5 | Pharmacia Corporation | | | |

*Our classification. The firm was not listed on the Stockholmsbörsen at the time for classification.

## 4. Data

The data used in this study were collected from three different main sources. Stock prices and the number of shares were obtained from the Trust Database of Bonnier-Findata, Sweden. Accounting information, i.e., book value of equity and net income, were manually collected from the companies' financial statements (interim reports).[3] Finally, the environmental performance information used in this study was not collected directly from the financial reports. Instead, we obtained environmental performance measures from CaringCompany (CC) Research, AB. While there are several indices useful in assessing a company's environmental performance, for instance the Dow Jones Sustainability Group Index, we chose the index provided by CC for three reasons. First, the model captures the theoretical foundations suggested by Ilinitch *et al.* (1998) for an organizational effectiveness and stakeholder-oriented measure. Second, data at an individual level is a necessity for the model, and CC kindly provided us with their environmental performance ratings for Swedish firms. Finally, the number of Swedish firms included in the Dow index is very limited.

CC is a member of an international network that provides information on the ethical and environmental responsibility of firms. Their clients are leading investment companies, banks, and insurance companies in Sweden. Their proprietary performance-rating model is built on 23 criteria and aggregated into five categories. The categories on which firms are evaluated are as follow: (I) environmental objectives and strategy, includes environmental reporting (five criteria); (II) implementation of environmental processes (five criteria); (III) production-related environmental issues (five criteria); (IV) product-related environmental issues (five criteria); and (V) service company-related issues (three criteria). Evaluation is done using information obtained from official documents, such as annual and interim reports, and also by directly contacting the companies, for example, by surveys or visits. Information is also collected from authorities and to some extent from newspaper reports. A firm that is rated receives points according to how well it meets the various criteria. The resulting environmental index is an equally weighted average of the points from the different criteria. The index can range from 0 to 3, with a high score indicating high environmental performance. According to CC, their index not only summarizes the environmental information contained in financial reports, but also other public and private information. The criteria used in each category and the requirements for the scores cannot be disclosed, since they comprise a proprietary model developed by CC. Hence, it is outside our ability fully to assess the reliability and validity of the index as a proxy for environmental performance. According to CC, however, the index is widely used among large institutional investors and should have high face validity.

CC has been evaluating environmental performance on a quarterly basis since June 30, 1998. This limits the research period of this paper to the nine quarters from June 30, 1998 to September 30, 2000. The total number of rated Swedish

firms listed on the Stockholmsbörsen was 71, and the total number of quarterly ratings in the database was 384 (see Table 1). Ten firms lack one or more values in the quarterly rating series, so for these cases we calculated an average between the two nearest available adjacent observations. This procedure increases the number of available quarterly ratings to 407.

To be included in the sample, we require that a firm be rated in the CC database. In addition, net income, $NI_t$, and opening book value, $BV_{t-1}$, must be available in the firm's quarterly report.[4] Finally, the stock price and the total number of issued shares have to be available in the Trust Database. After excluding firms that lacked sufficient accounting or market value data for the period, 337 valid firm quarter observations remained.[5] As is evident, the limited time series of the performance index results in a somewhat limited sample size. Also, note that the number of observations reported in the empirical analysis in the next section may not equal 337. To ensure that the regression results are not unduly sensitive to outliers, we excluded observations with absolute values of Studentized residuals greater than 3. This approach is in line with those of other value relevance studies, such as Rajgopal *et al.* (2003).

## 5. Results of the Study

*Descriptive Statistics and Correlations*

Panel A in Table 2 provides descriptive statistics on the dependent and independent variables in the study (before deleting outliers). All of these variables, except environmental performance, are deflated by book value. For the sample firms, market value is on average 4.60 times higher than the book value. The high level of this ratio reflects the somewhat extreme market conditions prevalent during the research period. However, there are some firms whose market value is lower than the book value (minimum 0.37), and others with extremely high market values, especially among the 'new economy firms' (maximum 48.15 times higher market than book value). The median deflated market value of the sample is about half of the mean (1.90) because of outliers at the higher end and the concentration of the sample at the lower end of the distribution. Hence, the distribution of this variable is positively skewed. The deflated net income variable, $NI_{i,t}/BV_{i,t-1}$, indicates that the mean return on equity in the sample is 4% on a quarterly basis. The median return is 4% as well. This suggests that the yearly profitability on average equals 16% for the sample firms. Nevertheless, some sample firms show extreme levels of profitability. Extreme negative profitability is found among a few consulting firms, and extreme positive profitability is found among a very few companies with large capital gains. The environmental performance variable, $EP_{i,t}$, has a mean of 1.44 and a slightly higher median of 1.55. The actual performance scores range from 0.18 to 2.19 on a theoretical performance scale ranging from 0 to 3. Hence, the sample consists of both high and low environmental performers.

**Table 2.** Descriptive statistics. The table reports the descriptive statistics of the sample. The sample consists of 71 firms listed on the stock exchange in Sweden, Stockholmsbörsen. The research period is June 30, 1998 to September 30, 2000, and nine environmental performance rating periods are used. The statistics are presented for 337 firm quarter observations. Market value, $MV_{i,t}$, is the market value of firms 10 days after the end of the quarter, the same day that the environmental performance report is released. Book value, $BV_{i,t-1}$, is the firms' opening book value of equity for the quarter and $NI_{i,t}$ is the net income for the same quarter. $EP_{i,t}$ is the environmental performance rating for the quarter. Panel B provides Pearson correlation coefficients between the explanatory variables in the model ($P$ values in parentheses)

| Variables | Mean | Median | Std. deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Panel A. All companies before deleting outliers (337 observations) | | | | | |
| $MV_{i,t}/BV_{i,t-1}$ | 4.60 | 2.01 | 6.53 | 0.37 | 48.15 |
| $NI_{i,t}/BV_{i,t-1}$ | 0.04 | 0.04 | 0.09 | −0.52 | 0.93 |
| $EP_{i,t}$ | 1.44 | 1.55 | 0.43 | 0.18 | 2.19 |
| Panel B. Pearson Correlation Coefficients (337 observations) | | | | | |
| Variables | $1/BV_{i,t-1}$ | $NI_{i,t}/BV_{i,t-1}$ | $EP_{i,t}$ | | |
| $1/BV_{i,t-1}$ | 1.00 | | | | |
| $NI_{i,t}/BV_{i,t-1}$ | −0.49 (0.00) | 1.00 | | | |
| $EP_{i,t}$ | −0.26 (0.00) | 0.12 (0.03) | 1.00 | | |

Panel B in Table 2 provides the correlation coefficients between the explanatory variables in the model (before deleting outliers). The statistics show that the inverse of the book value, $1/BV_{i,t-1}$, is negatively related ($-.49$) to net income, $NI_{i,t}/BV_{i,t-1}$. Not surprisingly, in practice this means that there is a positive association between book value of equity and net income. Environmental performance is positively associated with both book value as well as with net income, and both correlation coefficients are significant. However, the correlation matrix does not suggest the presence of any serious multicollinearity problems. In addition, unreported calculations of VIF statistics support this finding. Next, we explore whether the variation in market values is associated with variation in environmental performance, after controlling for financial information.

*Regression Analysis*

Recall that the study proposes that market value should reflect both the financial and environmental performance of the companies. The financial statement information, in this study book value of equity, *BV*, and net income, *NI*, are expected to be positively related to the cum-dividend market value of equity, $MV + D$. No elaborate theoretical work exists to guide us as to whether environmental performance has a positive or negative effect on market values. However, we propose that financial performance alone cannot explain market values, because many stock market participants today carefully screen potential investments both on financial and environmental performance criteria. The empirical question is whether the relationship between environmental performance and market value is positive or negative. Table 3 provides the results of regression models based on equations (3)–(5).

Column A of Table 3 reports the results for the earnings regression. Consistent with theory, the coefficient for net income is significant with the expected sign ($\beta_2 = 18.22$, $t$-value $= 3.84$). Also, note that the intercept term, which corresponds to the coefficient for book value, is significant with the expected sign. The adjusted $R^2$ equals 0.22 and the $F$-statistic is significant. This result corroborates prior findings of Marton (1998) and Runsten (1998) concerning the value relevance of earnings and book value in the Swedish market. Adding the environmental performance variable (column B) increases the adjusted $R^2$ to 0.30, and all coefficient estimates are statistically significant. The finding indicates that the environmental performance measure contains information that is value-relevant to investors. More importantly, the sign of the coefficient for environmental performance is negative. A negative coefficient is consistent with the view of the cost-concerned school. That is, high levels of environmental performance are costly and will have a negative impact on the expected earnings and market values. Column C further investigates this possible explanation.

Column C reports the results of the dummy variable approach. Two dummy variables, one for industry and one for time period, and their interactions with EP are added. When including the control variables in the model, the adjusted

**Table 3.** Regression results. The table reports the results of regressing market value on financial measures and environmental performance (all financial measures scaled by opening book value). Column A presents the results of regressing market value on net income (*NI*). Column B shows the results when environmental performance (*EP*) is added to the regression. Finally, Column C presents the results when two indicator variables and their interactions with *EP* are added to the model as independent variables. The indicator variable, *I*, equals zero if the company is classified as a manufacturing firm and one if it is classified as a service firm. Similarly, variable *T* equals zero to indicate the period before the change in accounting law, and equals one to indicate the period after the change.

| | A | B | C |
|---|---|---|---|
| Intercept ($\alpha 0$) | 2.54 (8.60)*** | 8.96 (6.63)*** | 4.04 (2.28)** |
| $1/BV_{i,t-1}$ | 420.13 (8.69)*** | 312.65 (6.45)*** | 298.75 (6.54)*** |
| $NI_{i,t}/BV_{i,t-1}$ | 18.22 (3.84)*** | 12.36 (2.90)*** | 11.64 (3.13)*** |
| $EP_{i,t}$ | | −4.12 (−7.73)*** | −1.62 (−1.59) |
| $I_{i,t}$ | | | −0.45 (−0.17) |
| $I_{i,t}EP_{I,t}$ | | | 1.14 (0.53) |
| $T_{i,t}$ | | | 6.51 (3.04)*** |
| $T_{i,t}EP_{i,t}$ | | | −3.34 (−2.62)*** |
| Adj. $R^2$ | 0.22 | 0.30 | 0.35 |
| $F$ value | 48.39 ($p < 0.01$) | 48.68 ($p < 0.01$) | 25.7 ($p < 0.01$) |
| Num. obs. | 329 | 329 | 329 |

** and *** indicate significance at the 1% and 5% levels, respectively. The *t*-statistics are one-tailed where the sign is predicted, two-tailed otherwise. All *t*-statistics are estimated using White's (1980) standard error.

$R^2$ increases marginally to 0.35. The coefficient for industry, *I*, is not significant, indicating that there are no unknown systematic unexplained differences between the two industries. Somewhat surprising the coefficient for interaction, $I_{i,t}EP_{i,t}$, is positive, but insignificant at a 5% level of significance. One would expect investments in high environmental performance to be less costly for service than for manufacturing companies. These findings rule out high environmental performance as a strong marketing tool. Of course, our industry classification is crude and the number of observations included in the study is limited; consequently, the results should be interpreted with care. Further research into the value relevance of environmental performance in various industries is needed.[6]

The coefficient for time period, *T*, is statistically significant and indicates that there are systematic differences in time periods indicating that the change in legislation is of significant importance. The coefficient of interaction between time period and environmental performance, $T_{i,t}EP_{i,t}$, is also significant. This finding implies a structural shift in the relationship between cum-dividend market values and environmental performance. The negative relationship has strengthened over time, suggesting that market participants have increased their focus on environmental performance information and increasingly penalized high performance.

Based on the statistical tests we conclude that environmental performance seems to have incremental value relevance for the market value of Swedish listed companies. According to the results, the relationship between market values and environmental performance is negative. Moreover, the negative relationship seems to have increased over time. Overall, the results of our study differ from those of most prior studies, which show a positive relationship between environmental performance and market value. This study, however, controls for financial variables when estimating the relevance of environmental information.

## 6. Conclusions

This study is among the first to investigate the relationship between market value and overall environmental performance in conjunction with financial statement information. We find that in the quarterly financial statements of Swedish listed companies, both book value of equity and net income provide value-relevant information to investors. Environmental performance has an incremental explanatory power, as suggested. The negative relationship between environmental performance and the market value of equity indicates that firms rated highly in terms of environmental performance are not, *ceteris paribus*, highly valued by investors. The argument of the cost-concerned school is that high environmental performance is costly and thus has a negative impact on expected earnings and market values.

Considering that our sample size is small, the environmental performance measure is novel, and the time period studied is relatively short, the results of this study have to be interpreted with caution. Nevertheless, we provide the following suggestions for the negative relationship between environmental performance and market value: (1) investors perceive that environmental performance is used for the window dressing of book values and financial performance; (2) investors perceive that environmental responsibility activities are made at the expense of increased profits, and rational investors react negatively because of expected reductions in profitability with no corresponding reduction in risk (Holman *et al.*, 1985); and (3) the market is short-term oriented, and investors do not consider longer-term environmental information when making investment decisions. Hence, investors do not reward companies that are rated highly in terms of environmental performance. The amount of money invested in environmental and ethical funds does not seem to be large enough to reward high environmental performance. Of course, even for these funds environmental performance might be a subordinate investment criterion.

The results of the study differ from most of the prior U.S. studies that used other measures of environmental performance, such as pollution control information, pollution levels, CEP reports, and adoption of stringent global environmental standards. The majority of these studies find a positive relationship between environmental information and market reactions/investment

return. Therefore, the value relevance of environmental information in combination with financial statement information is still an open question that needs to be further addressed. We believe that studying European data using different measures of environmental performance for cross-county comparisons and industry comparisons within the EU would be an interesting future research area. Such a study would put the results of the current study into a broader perspective. Although well accepted among accounting and finance researchers, the model used here to link environmental performance and market value is somewhat crude. Therefore we share the view of Feldman *et al.* (1997) that future research should focus on developing a theoretical model that explicitly relates environmental performance to a firm's sales, earnings, competitive position, and ultimately, market value.

We conjecture that the increased focus on environmental issues is here to stay, and that the future will bring more available data and improved measures of environmental performance. Prospective studies will address the question of value relevance in a more exhaustive way. The debate between the cost-concerned and the value creation school is far from over.

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## Notes

[1]See also Appendix.

[2]Also note that the intercept allows for the non-zero mean valuation effects of other valuation-relevant information, besides environmental performance which is picked up by the error term.

[3]Five of the companies studied did not use SEK as a reporting currency. For these companies, we translated the accounting numbers into SEK using the relevant exchange rate as of the last trading day of the quarter. The exchange rates were collected from the Trust Database.

[4]In a few cases *NI* was not available on a quarterly basis. To avoid a further reduction of the sample size, we used profit after financial items or operating profit adjusted for proxy tax for those firms.

[5]Forty-two firm quarters were deleted because no available stock prices and/or total number of stocks figure appeared in the Trust Database.

[6]As a robustness check, we reran all the tests deflating equations 3–5 by sales instead of opening book value. The results obtained were very similar to those reported in the paper.

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## Appendix

This appendix presents Ohlson's (1995) valuation framework and shows that his book value–abnormal earnings model can be re-expressed in terms of current period earnings and opening book value. Please note that this derivation draws heavily on the papers by Collins *et al.* (1999) and Lin and Walker (2000). Three main assumptions underlie the Ohlson (1995) valuation model. First, the value of a firm's equity, $MVE_t$, equals the discounted present value of expected dividends, $D_{t+\tau}$, at a constant discount rate, $r$:

$$MVE_t = \sum_{\tau=1}^{\infty} (1+r)^{-\tau} E_t[D_{t+\tau}] \tag{1}$$

Second, the clean surplus relation of accounting holds:

$$BV_t = BV_{t-1} + NI_t - D_t \tag{2}$$

The final assumption defines the time series process for abnormal earnings, $AE_t$, and other value-relevant non-accounting information, $v_t$, as a modified and standard first-order auto regressive process, respectively:

$$\begin{aligned} AE_{t+1} &= \omega AE_t + v_t + \varepsilon_{1,t+1} \\ v_{t+1} &= \gamma v_t + \varepsilon_{2,t+1} \end{aligned} \tag{3}$$

were $\omega$ and $\gamma$ are parameters, and $\varepsilon_{1,t}$ and $\varepsilon_{2,t}$ are unobserved random variables. Based on these three assumptions, Ohlson derives the following valuation model:

$$MV_t = BV_t + \alpha_1 AE_t + \alpha_2 v_t \tag{4}$$

where

$$\alpha_1 = \frac{\omega}{(1+r-\omega)},\ \alpha_2 = \frac{1+r}{(1+r-\omega)(1+r-\gamma)}$$

By using the definition of abnormal earnings, $AE_t$, in equation (1), market value can alternatively be expressed as a function of current net income, $NI_t$, closing book value, $BV_t$, opening book value, $BV_{t-1}$, and other information, $v_t$:

$$MV_t = BV_t + \alpha_1 NI_t - \alpha_1 r BV_{t-1} + \alpha_2 v_t \tag{5}$$

Furthermore, using the clean surplus relation and substituting the closing value of book value in (2) results in:

$$MV_t = BV_{t-1} + NI_t - D_t + \alpha_1 NI_t - \alpha_1 r BV_{t-1} + \alpha_2 v_t \tag{6}$$

Collecting terms generates a valuation function expressed in the form of cum-dividend market value, current period net income, opening book value, and other value-relevant non-accounting information:

$$MV_t + D_t = (1 + \alpha_1) NI_t + (1 - \alpha_1 r) BV_{t-1} + \alpha_2 v_t \tag{7}$$

Finally, the empirical analogy to equation (E4) is:

$$MV_t + D_t = \beta_0 + \beta_1 BV_{t-1} + \beta_2 NI_t + \beta_3 v_t + \varepsilon_t \tag{8}$$

which is the same as equation (2) in the paper. Note that the intercept allows for non-zero mean valuation effects of other valuation relevant information, besides environmental performance which is picked up by the error term.