

A study of the relationships among environmental performance, environmental disclosure, and financial performance

Relationships
among EP, ED,
and FP

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Abstract

Purpose – The purpose of this paper is to study the relationships among environmental performance (EP), environmental disclosure (ED), and financial performance (FP) (three corporate constructs) using data from Newsweek's green rankings.

Design/methodology/approach – Previous studies document mixed results about the relations among the three constructs. A firm's overall management strategy may affect the three constructs simultaneously; therefore, the interrelationships among EP, ED, and FP were jointly examined. A simultaneous equations approach was used to test the hypothesis.

Findings – The three-stage least square (3SLS) estimation results show a negative relationship between EP and FP and a positive relationship between EP and ED, suggesting that financially successful firms are less likely good environmental performers but green firms are more likely to disclose their EP.

Research limitations/implications – Since the sample firms examined in this study are US large-size companies, the results found in this paper may not apply to small- and/or medium-size firms or to companies in other countries.

Practical implications – Three corporate constructs are jointly correlated with each one. A firm's overall strategic plan on environmental engagement is likely reflected in how it engages in each of the constructs that affect costs and benefits. Sustainable efforts, in short term, may put firms at risk. Companies may need to take a long-term perspective when cutting costs is curtailed.

Originality/value – The research contributes to the ED and EP literature by using a 3SLS simultaneous equation method and analyzing a more recent and comprehensive multi-industry data. By controlling industry effect, the research investigates the interrelationships among three corporate constructs and finds interesting results. An interpretation and discussion are provided.

Keywords Financial performance, Environmental performance, Environmental disclosure, Simultaneous equation models Newsweek's green rankings

Paper type Research paper

1. Introduction

The environmental issues of today have become global hot topics. Compared to a decade ago, environmental issues bring more and more discussion among corporations and regulators. As most large corporations compete in a global economy, environmental sustainability practices become a competitive strategy for a company's success. How does environmental performance (EP) impact environmental disclosure (ED) and further impact a



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corporation's profitability or equity value? Does EP affects financial performance (FP)? Is there any relationship between ED and FP? To answer these questions, this paper studies the relationships among the three corporate constructs: EP, ED, and FFP jointly, using more current and comprehensive data obtained from *Newsweek's* green rankings. The new data are more rigorous and reliable than data used in previous studies. In addition, the overall green score is *z*-standardized, making intra- and inter-industry comparison possible and meaningful.

Prior research has largely examined the three constructs either by using data from a single industry that is too old or a sample size that is relatively small. For example, Al-Tuwaijri *et al.* (2004) studied 198 firms using one-year data which are the Investor Responsibility Research Center's 1994 Environmental Profiles Directory data. Clarkson *et al.* (2011) examined the relationship between EP and economic performance of 191 firms using data from 1990 to 2003. However, the research on environmental studies has changed significantly in the past decade. These changes include measurement of EP, requirements/standards of ED, data variability, and research methodology (Patten, 2002). For example, large corporations are now required to make more mandatory disclosures of their EP. In addition, recent studies in this area call for a comprehensive study using more current data and different environmental measures (Al-Tuwaijri *et al.*, 2004). In this study, we reexamine the interrelationships among the three constructs using more current comprehensive data.

Previous studies document mixed results about the relationships among the three constructs. For example, Jaggi and Freedman (1992), Blacconiere and Patten (1994), and McPeak *et al.* (2010) found a negative relationship exists between EP and FP; a positive association has been documented by Hart and Ahuja (1996), Sroufe (2003), Al-Tuwaijri *et al.* (2004), Clarkson *et al.* (2011), and Davis *et al.* (2016); and no relationship was found by Yu *et al.* (2009). As for the relationship between EP and ED, a positive relationship has been documented by Al-Tuwaijri *et al.* (2004), Clarkson *et al.* (2011), and Gelb and Strawser (2001); a negative relationship has been observed by Patten (2002) and Cho and Roberts (2010); and a no relationship was found by Wiseman (1982). Ullmann (1985) explored the interrelationships among social performance, social disclosure, and economic performance, and suggested that an unobservable variable – management overall strategy – may jointly affect the relationships among the three constructs. A firm's FP may depend on EP, ED, and other control variables. Similarly, EP is affected by FP, and EP reflects the disclosure of its performance. The error term in each function is correlated; therefore, the interrelationships among EP, ED, and FP were jointly examined. A simultaneous equations approach was used to test the hypothesis.

We investigate the interrelationships among EP, ED, and FP using a simultaneous equations system (SEM) and explored more current third-party provided data: 2012 Green Rankings for the top 500 largest US companies provided by *Newsweek* magazine. These companies were chosen to be included in the green ranking based on their size: market capitalization, employee numbers, and revenue. Individual companies themselves had no option to be included or excluded from the green ranking list, thus reducing the problem of selection bias. The green ranking report assigns rankings for each firm based on overall green scores. The green scores are calculated and compiled by two leading environmental research institutes, Truecost and Sustainalytics[1] who analyzed more than 700 environmental impact variable metrics, environmental policies and programs, and degree of transparency reporting. Due to the nature of rigorous and data-driven ranking procedures, the environmental data released by *Newsweek* are more comprehensive and objective. We observe a positive relationship between EP and ED, but a negative relationship between FP and EP in the three-stage least squares (3SLS) model specifications.

The system used in this study consists of three equations: the first one for FP proxied by firm value (Tobin's *Q*); the second one for EP (revised green scores and revised ranks); and the

third one for ED (disclosure scores). In total, a system of three equations has to be estimated. There are three endogenous variables. The three endogenous variables are the variables of interest. They are dependent variables in the three equations – EP, ED, and FP. FP and EP are also independent variables in EP-FP and FP-EP equations. A more in-depth discussion of the above variables is presented in Section 3.

This study finds a significantly positive relationship between EP and ED, a significantly negative relationship between EP and FP. In addition, the results of the study show that firm size is positively correlated to ED. This suggests that bigger firms are more likely to disclose their EP. Industry rank (INDRANK) is negatively correlated to EP, suggesting that industry green leaders are more likely leaders in EP.

In the additional tests section, an identification test was conducted on the system equations, and all three equations passed the identification test. To test the sensitivity of the model, revised ranks were used as an alternative measure of EP. The results are consistent with the main findings in which revised green score are used.

Information on EP and ED is important to stakeholders (shareholders, consumers, suppliers, employees, government regulators, and the general public). Without reliable, consistent, and accurate information for comparing companies, it is difficult for stakeholders to make informed strategic decisions. Thus, it is important to have a standardized measurement of EP and ED. Green scores are z-standardized measures, making intra- and inter-industry comparisons possible and meaningful. The empirical findings and analysis have important implications to both internal stakeholders, for example, employees and shareholders, and external stakeholders, such as customers and environmental regulators.

The remainder of the paper is organized as follows: Section 2 reviews the related literature and develops hypotheses; Section 3 provides research models and variable measurements; Section 4 describes data and sample selection; Section 5 discusses empirical results; Section 6 contains additional econometric tests and sensitivity analysis; and Section 7 concludes the paper, discusses its limitations, and provides suggestions for future research.

2. Theories, literature review, and hypotheses development

2.1 EP and FP

There are two views about EP and FP: the “traditionalist” view and the “revisionist” view. The former is rooted in neo-classical theory, which posits that pollution abatement measures are predicted to increase production costs and are assumed to have increasing marginal costs (Patten, 2002). The latter, also called the Porter theory, was initiated and developed mainly by Porter who theorized that pollution reduction provides future cost savings by increasing efficiency, reducing compliance costs, and minimizing future liabilities (Porter and van der Linde, 1995), thus increasing firm value.

The relationship between financial and EP has been investigated and debated for several decades. Under neo-classical theory, researchers have found that FP is negatively associated with EP (Lorraine *et al.*, 2004; Murray *et al.*, 2006; Blacconiere and Patten, 1994; Cordeiro and Sarkis, 1997; Jaggi and Freedman, 1992; McPeak *et al.*, 2010). Scholars under this stream of EP studies argue that there is a conflict between the competitiveness of firms and their EP (Walley and Whitehead, 1994). Their discussion posits that firms in industries with higher environmental compliance costs (such as paper and pulp manufacturing industry) face a competitive disadvantage, because compliance costs of production activities outweigh the value added to the firm. Thus, high EP corresponds to low economic performance and vice versa.

Under the Porter theory, the high EP of firms would increase firms' FP. This stream of research has documented that high EP is associated with increased FP (Davis *et al.*, 2016; Lu and Taylor, 2016; Al-Tuwaijri *et al.*, 2004; Clarkson *et al.*, 2011; King and Lenox, 2001;

Hart and Ahuja, 1996; Judge and Douglas, 1998; Montabon *et al.*, 2007; Orlitzky *et al.*, 2003; Russo and Fouts, 1997; Sroufe, 2003). King and Lenox (2001) found an association between reduced environmental emissions and increased financial profits. Scholars under this stream of environmental studies argue that the improved EP is a potential source for competitive advantage as it can lead to more efficient processes, improvements in productivity, lower costs of compliance, and new market opportunities (Porter, 1991; Porter and van der Linde, 1995; Schmidheiny, 1992). Thus, a positive relationship is expected to exist between EP and FP. Recent studies from Dhaliwal *et al.* (2011) and Lev *et al.* (2010) documented that firms with higher level of CSR have lower cost of capital and higher revenue growth, respectively. de Villiers *et al.* (2011) suggested that there is a positive relationship between strong EP and shareholder wealth. A most recent research study conducted by Davis *et al.* (2016) looked at a company's corporate social responsibility (CSR) activity and tax avoidance practice and found socially responsible firms pay less tax. Reduced tax payment results in increased profit, thus increasing a firm's FP. The findings of Davis *et al.* (2016) implicitly indicate a positive relationship between EP and FP. Lu and Taylor (2016) found a positive relationship between EP and FP using meta-analysis method. Another small group of researchers found no significant relationship between FP and EP (Yu *et al.*, 2009).

2.2 EP and ED

There are two major theories on ED: legitimacy theory and stakeholder theory (Chan *et al.*, 2014; Freedman and Jaggi, 2010). Legitimacy theory posits that firms, in order to legally exist, try to operate within the norms and expectations of the society within which they operate. Stakeholder theory posits that a company should be accountable to various stakeholders and thus a company's ED is reflective to stakeholders' demand.

In the USA, most EDs are made voluntarily. Companies have many channels to disclose their EP, for example, company website, annual report, or standalone non-financial report. Prior research documents that firms tend to disclose more environmental information on companies' website when they face environmental crisis and more on annual report when they had environmental reputation (de Villiers and van Staden, 2011). Firms with good EP and a high level of ED are sending signals to the public that they take credit for their actions, and that the good EP is not to the detriment of stakeholders. Similarly, poor environmental performers tend to disclose less of their environmental activities. Guthrie and Parker (1990) suggested that even with regulation, poor performers may not be willing to disclose. They argued that "Corporations appear to respond to government or public pressure for information about their environmental impact but may choose to disclose such information only to the minimum degree required."

The literature provides explanations about why companies would voluntarily disclose environmental information. Most researchers refer to legitimacy theory. Legitimacy theory posits that to achieve legitimacy firms should operate within the norms and expectations of the society within which they operate (Cong and Freedman, 2011; Deegan, 2002; de Villiers and van Staden, 2006; Dowling and Pfeffer, 1975; O'Donovan, 2002; van Staden and Hooks, 2007). Previous empirical evidence provides mixed results on the relationship between EP and the level of EDs. Some studies found a significant positive ED-EP relationship (Al-Tuwaijri *et al.*, 2004; Clarkson *et al.*, 2008, 2011; Gelb and Strawser, 2001; van Staden and Hooks, 2007), suggesting that EDs reflect EP. Al-Tuwaijri *et al.* (2004) found a positive relationship between EP and ED only after controlling for the endogeneity of EP. Their ED measure is based on information reported on the form 10 K and focused on pollution-related information in four areas: the total amount of toxic waste generated and transferred or recycled; financial penalties resulting from violations of federal environmental laws; potential responsible party for the cleanup of hazardous-waste sites;

and the occurrence of reported oil and chemical spills. The authors used a content analysis method and self-assigned ED scores ranging from 0 to +3. Some studies (i.e. Patten, 2002; Cho and Patten, 2007; Cho and Roberts, 2010; Ingram and Frazier, 1980; Cho and Roberts, 2010) found that poor environmental performers make more disclosures than good performers to legitimize their environmental activities (Patten, 2002; Lindblom, 1994). Lindblom (1994) suggested that a corporation may use disclosure as a legitimizing device to change public perceptions or expectations about company's performance, to distract public attentions from the company's poor performance in environment by highlighting other accomplishments related to the environmental issue.

Stakeholder theory holds that EDs are made because they are demanded by the stakeholders. Managers provide environmental information that they believe is really what the stakeholders want. If a firm's long-term survival and success depends on the resources provided by its external stakeholders, then a firm "requires the support of all its stakeholders" (van der Laan Smith *et al.*, 2005) and the stakeholder demands will be addressed by management through performing and disclosing environmental strategies and activities. Environmental improvement programs can bring benefits and reputation to the business. It is reasonable to expect a positive relationship between EP and ED. In addition, as an increase in the global economy, companies are becoming more international. It is likely that those international companies have a growing impact on the social and ecological environment of both local and international communities, and therefore a growing expectation that companies should be accountable to various stakeholder groups for all such impacts is resulted (Chan *et al.*, 2014).

According to Clarkson *et al.* (2008), firms with favorable EP voluntarily convey information to the stakeholders, while those with poor environmental records withhold information to avoid negative exposure. Further, Aerts and Cormier (2009) argued that "environmental legitimacy is significantly and positively affected by the extent and quality of annual report EDs." Better environmental performers make more disclosures about positive environmental activities and the disclosures reflect a form of legitimacy; however, if poor performers make more statements about positive environmental activities, the disclosures reflect legitimization (Freedman and Wasley, 1990; Gray *et al.*, 1995). Others (Freedman and Jaggi, 1982; Wiseman, 1982) found no significant relationship between performance and disclosure.

The reasons for an inconclusive result on the relationship between EP and ED can be many. Patten (2002) suggested several reasons for this, mainly that the samples were too small and that the studies did not control for extraneous variables that could influence the relationship.

Given the competing theories and conflicting results found about the relationships among EP, ED, and FP, we state our hypothesis in a null form as below:

There is no significant relationship between any two of the three corporate constructs: environmental performance, environmental disclosure, and financial performance.

3. Research models and variable measurements

3.1 Research models

The interrelationships among EP, FP, and ED can be jointly determined. Ullmann (1985) examined the interrelationships among social performance, social disclosure, and economic performance. Ullmann (1985) suggested that an unobservable variable, management overall strategy, may jointly affect the relationships among the three constructs. Thus, following the notion of Ullmann (1985) and the research conducted by Al-Tuwaijri *et al.* (2004), the following functions are established to test the null hypothesis that no relationship exists between any two of EP, ED, and FP:

$$\text{Financial performance} = f(\text{Environmental performance} + \text{Control variables}) \quad (1)$$

$$\text{Environmental performance} = f(\text{Financial performance} + \text{Control variables}) \quad (2)$$

$$\text{Environmental disclosure} = f(\text{Environmental performance} + \text{Control variables}) \quad (3)$$

The above functions imply that a firm's FP depends on EP and other control variables. Similarly, EP is affected by FP, and EP reflects the disclosure of its performance. The empirical models, specifically, are shown below in a system of simultaneous equations:

$$FP_t = \omega_0 + \omega_1 EP_{t+1} + \omega_2 ED_t + \omega_3 SALESG_t + \omega_4 SIZE_t + \omega_5 ROA_t + \omega_6 CFO_t + \omega_7 INSTOWN_t + \omega_8 INDRANK_t + \omega_{9-27} \sum INDUSTRY + \mu_1 \quad (4)$$

$$EP_{t+1} = \gamma_0 + \gamma_1 FP_t + \gamma_2 ED_t + \gamma_3 LEV_t + \gamma_4 INSTOWN_t + \gamma_5 CONCERN_t + \gamma_6 CAPINTENS_t + \gamma_7 INDRANK_t + \gamma_{8-26} \sum INDUSTRY + \mu_2 \quad (5)$$

$$ED_{t+1} = \theta_0 + \theta_1 + EP_{t+1} + \theta_2 SIZE_t + \theta_3 CONCERN_t + \theta_4 CAPINTENS_t + \theta_5 AGE_t + \theta_{6-24} \sum INDUSTRY + \mu_3 \quad (6)$$

In which, t = year of 2011.

Newsweek, working with two research providers – Truecost and Sustainalytics – spent over a year to compile the green rankings, thus in the above models, to match the actual EP, the 2011 financial data for each company are used in the estimation. In Equation (4), ED_t represents 2011 ED score, we call it *lagED* (relative to 2012 ED score) in the data analysis and discussion sections.

It normally takes a year to compile green rankings report, so when 2012 green ranking was issued; it corresponds to the fiscal year of 2011 financial data. Therefore, all control variables and FP are measured with one-year lag.

In this system, FP, EP, and ED are the endogenous variables as well as dependent variables, and the rest of the variables are control variables.

The variables included in the equations consider prior studies and model identification in a SEM. Al-Tuwaijri *et al.* (2004) argued that prior period ED may affect FP and EP, thus prior year disclosure score (ED_t or *lagED*) was added to the FP and the EP equations. Clarkson *et al.* (2011) posited that sales growth and enterprise value (Tobin's Q) are evidence of the proactive investment strategy in intangibles and thus used them as proxies for unobservable management talent or capability. In this paper, we use sales growth (*SALESG*), capital intensity (*CAPINTENS*), and firm value (*FP* calculated as Tobin's Q) to proxy for management ability and thus overall management strategy (Al-Tuwaijri *et al.*, 2004; Clarkson *et al.*, 2011; Lyon and Shimshack, 2015; Porter and van der Linde, 1995). Industry rank (*INDRANK*) is used to proxy for environmental exposure within the industry. Prior studies tend to use SIC code as a proxy for environmental exposure (Al-Tuwaijri *et al.*, 2004; Deegan and Gordon, 1996; Wiseman, 1982). In addition, the relationships among EP, ED, and FP are likely affected by industries that firms belong to[2], therefore, our models control for industry effect by adding industry dummy variables. There are 19 industries included in the models (one industry sector is dropped when the models are run, since the dropped industry is served as a control industry. Table III in Section 4.2 presents a whole list of industry sectors found in the final sample.

The data in this paper are initially from 2012 *Newsweek's* green ranking[3], which reports EP and ED for 500 largest US publicly traded firms. These companies were chosen to be included in the green ranking based on their size. EP is measured by revised green scores and revised green rank scores obtained from *Newsweek's* (2012) green rankings.

3.2 Measurement of variables

3.2.1 Dependent variables. Following Clarkson *et al.* (2011), FP is measured as market capitalization plus debt and preferred shares divided by beginning of period total assets. It measures the firm value and proxies for intangible assets associated with innovation (Al-Tuwaijri *et al.*, 2004; Lyon and Shimshack, 2015; Porter and van der Linde, 1995). The measurement for EP is the revised green score: 50 percent of impact score plus 50 percent of management score on Newsweek's (2012) green rankings. A revised green score is used because the original green score provided by *Newsweek* is a weighted score of three components: environmental impact score (45 percent), environmental management score (45 percent), and disclosure score (10 percent). The disclosure score is a measure of the ED, thus it is necessary to adjust the green score so that it would not be contaminated by disclosure score. The additional analysis shows that even using the original green score, the main results of this study do not change. The measurement for ED is the disclosure score obtained from Newsweek's (2012) green rankings. The lagged ED score was obtained from Newsweek's (2011) green rankings.

3.2.2 Control variables. Prior research shows that *SIZE*, *LEV*, *ROA*, *CFO*, sales growth (*SALESG*), equipment age, and capital intensity are determinants of FP and EP (Al-Tuwaijri *et al.*, 2004; Clarkson *et al.*, 2008, 2011). *INDRANK* is a company's rank within industry, obtained from Newsweek's (2012) green rankings. Other control variables include institutional ownership (*INSTOWN*) (Graves and Waddock, 1994) and environmental concern score (*CONCERN*) (Al-Tuwaijri *et al.*, 2004). *INSTOWN* was hand collected from MSN money website. *CONCERN* was calculated as the difference between environmental concern score and environmental strength score from Kinder, Lydenberg, and Domini (KLD).

AGE is the age of equipment, measured by net property, plant and equipment divided by annual depreciation, which assumes all firms use straight line depreciation. *CAPINTENS* is capital intensity, measured as capital expenditures divided by beginning of period total assets. *SIZE* is firm size, measured as natural logarithm of total assets (\$ millions). *ROA* is return on assets, measured as net operating income divided by beginning period total assets. *LEV* is leverage ratio, measured as total debt divided by total assets (Clarkson *et al.*, 2011). *SALESG* is sales growth, measured by change in sales divided by beginning of period sales. *CFO* is the cash flow from operations, measured for liquidity, calculated as net cash flow from operating activities divided by beginning of period total assets. *INDRANK* (*instry_rank*) represents a company's rank number within its industry. It is obtained from 2012 Newsweek's green rankings. It is used to proxy for environmental exposure. For example, Dell Company is ranked No. 2 in the industry of Technology Equipment, but ranked No. 4 on the overall green ranking list. *INDRANK* captures its EP within its industry. In addition, industry control variables (*INDUSTRY*) were added to the models to control for industry effect, since industries may have different life cycles and business models and thus may have different environmental policies.

4. Data and sample selection

4.1 Sample selection

We obtained a list of green firms from Newsweek's (2012) green rankings. The ranking report releases EP for the US largest 500 public companies. *Newsweek* did not issue green rankings in 2013[4]. Due to a change in research partners and research methodology in 2014, the most recent two years of green rankings, i.e. 2014 and 2015, would not provide meaningful comparisons. Thus, to be included in the sample, a firm has to satisfy the following four criteria:

- (1) Be listed in the Newsweek's green rankings for year 2011 and 2012[5].
- (2) Has complete financial data reported in COMPUSTAT for year 2011 and 2010[6].

- (3) Has an environmental concern score from KLD.
- (4) Has institutional ownership data available.

The final sample includes 450 firms. The sample selection procedure is shown in Table I.

4.2 Sample firms

The sample firms used in this study are from Newsweek’s (2012) green rankings of the 500 largest US companies. For the fourth year in a row, *Newsweek* analyzed data on the largest 500 US companies, comparing their environmental footprint, corporate management, and transparency. Since the Newsweek (2012) changed its research providers and research methodology in 2011, only green rankings 2011 and 2012 can provide meaningful comparisons to academic researchers and interested investors. A truncated 2012 green rankings report can be found in Table II.

The top three most green companies in America are IBM, Hewlett-Packard, and Sprint Nextel on 2012 green rankings. The sample firms cover 20 industry sectors, among which, financial, healthcare, industrial goods, and technology equipment are the most represented. Real estate and telecommunications are the least represented. More green companies are dominated by financial-services and tech companies such as HP, Dell, American Express, and CitiGroup. Less green companies are represented by companies in energy, materials, and food and beverage industry, such as Apha Natural Resources, Monsanto, and Tyson. The distribution of sample firms by industry is illustrated in Table III.

4.3 Research providers

To prepare the 2012 green rankings, *Newsweek* partnered with two leading environmental research organizations, Trucost, and Sustainalytics, to evaluate each company’s environmental footprint, management of that footprint, and transparency. Trucost “specializes in quantitative measurements of EP and holds the most extensive data available on corporate environmental impacts”[7]. Sustainalytics is “known for its credible and independent environmental analysis as well as its vast research coverage”[8]. An independent Green Ranking Advisory Panel of five corporate sustainability experts was set up for reviewing and advising about the rankings methodology and other-related matters. Newsweek’s green rankings reports are essential reading for everyone in CSR management, consultancy, marketing, communications, operations, investor relations, and more (*Newsweek*, 2012).

4.4 Environmental measures

Companies are ranked by their overall green score which is made up of three components – environmental impact score (*IMPACT*), environmental management score (*MGMT*), and ED score. The advisory panel determines the weight of each score.

Environmental impact score (0-100 points): Trucost prepares the environmental impact score of each company, which is a comprehensive, quantitative, and standardized measurement of the overall environmental impact of a company’s global impacts (*Newsweek*, 2012).

Table I.
Sample selection
procedure

Newsweek’s green ranking firms 2012	500
Less green firms not on 2011 green ranking list	(20)
Less firms with missing institutional ownership	(2)
Less firms with missing COMPUSTAT firm specifics	(22)
Less firms with missing environmental concern score	(6)
Total sample green firms	450

RANK 2012	COMPANY	INDUSTRY/SECTOR	INSTRY_RANK	IMPACT	MANAGEMENT DISCLOSURE	2011 GREENSCORE	2012 GREENSCORE	RANK CHANGE	RANK 2011
1	IBM	Information Technology and Services	1	78.9	87	82.9	82.9	0	1
2	Hewlett-Packard	Technology Equipment	1	67.2	91.9	68.7	78.5	0	2
3	Sprint Nextel	Telecommunications	1	72.4	84.3	70.2	77.5	0	3
4	Dell	Technology Equipment	2	67.4	89.6	64.4	77.1	1	5
5	CA Technologies	Information Technology and Services	2	79.9	80.6	48.1	77.1	4	9
6	Nvidia	Technology Equipment	3	77.2	76.3	72.3	76.3	4	10
...
495	Invesco	Financials	51	6.2	47.6	16.7	25.9	2	497
496	Monsanto	Materials	33	11.3	28.6	73.5	25.3	2	498
497	T. Rowe Price Group	Financials	52	0	45.5	47.8	25	3	500
498	CF Industries Holdings	Materials	34	32.7	21.3	0.5	24.3	na	na
499	Alpha Natural Resources	Energy	31	8.4	34.3	42.2	23.5	NA	NA
500	Black Rock	Financials	53	0	46.7	4.2	21.4	-1	499

Notes: This is the truncated 2012 green rankings obtained from *Newsweek* magazine listing top 6 and bottom 6 green companies per the overall green score. Both 2011 and 2012 green scores for US 500 largest companies are listed. Companies included in the green rankings are largest US companies based on companies' market capitalization. Companies themselves do not have options to be included or excluded from the report

Table II.
Top 6 and bottom 6
green companies from
2012 green rankings

ARA
26,1

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Industry sector	Frequency	%	Cum. %
Aerospace and defense	11	2.44	2.44
Consumer goods	16	3.56	6.00
Energy	27	6.00	12.00
Financials	34	7.56	19.56
Food, beverage and tobacco	25	5.56	25.11
Healthcare	49	10.89	36.00
Hotels and restaurants	13	2.89	38.89
Industrial goods	40	8.89	47.78
Information technology and services	25	5.56	53.33
Materials	30	6.67	60.00
Media and publishing	18	4.00	64.00
Professional services	9	2.00	66.00
Real estate	2	0.44	66.44
Retailers	41	9.11	75.56
Technology Equipment	34	7.56	83.11
Telecommunications	8	1.78	84.89
Textiles, apparel, and luxury goods	13	2.89	87.78
Transportation and logistics	17	3.78	91.56
Utilities	27	6.00	97.56
Vehicles and components	11	2.44	100.00
Total	450	100.00	

Table III.
Frequency of
industry sectors

Notes: The sample firms cover 20 industry sectors, among which, financial, healthcare, industrial goods, and technology equipment are the most represented. Real estate and telecommunications are the least represented

Trucost takes into account more than 700 metrics including emissions of nine key greenhouse gas emissions, water use, solid waste disposal, and emissions that contribute to acid rain and smog. Environmental impact score accounts for 45 percent of each company's green score. In this study, environmental impact score accounts for 50 percent of the revised green score.

Environmental management score (0-100 points): Sustainalytics compiles the environmental management score and this assesses how a company manages its EP through environmental policies, programs, targets, certifications, etc., on the basis of company operations, suppliers, and contractors, as well as products and services (*Newsweek*, 2012). Environmental management score accounts for 45 percent of each company's green score. However, environmental management score accounts for 50 percent of the revised green score.

ED score (0-100 points): this component was introduced in 2011. Prepared by Trucost and Sustainalytics, this score evaluates the quality of company sustainability reporting and involvement in key transparency initiatives such as the global reporting initiative (GRI) and Carbon Disclosure Project (CDP). To receive full points, a company must have released a corporate sustainability report in the most recent accounting year which is both in line with GRI Level-A criteria and is externally verified, in full, to a global standard. In addition, the company must have publicly responded to the 2012 CDP survey (*Newsweek*, 2012). A company will receive a disclosure score of 0 if it fails to publish a CSR report and/or data relating to environmental impact, programs, or policies. On the green ranking report, the ED score accounts for 10 percent of each company's green score. Since ED score, aligning with the revised green score, is used to measure one of the three dependent variables in this study, this disclosure score is excluded from the calculation of green score which is used as a measure for EP.

Green score (0-100 points): it is an aggregated score. The above three components are z-standardized and converted to a 100-point scale by using different weightings of three components: environmental impact score (45 percent), environmental management score (45 percent), and ED score (10 percent), respectively. The highest green score in 2012 is 82.9 obtained by IBM.

Rank (1-500): ranking numbers are inversely related to green scores. A low rank represents a high overall green score and vice versa. For example, IBM is ranked number 1 with a green score of 82.9, followed by Hewlett-Packard with a green score of 78.5.

To sum up, we examine the interrelationships among three corporate constructs: EP, ED, and FP. While the Newsweek's green score includes three components (*IMPACT*, *MGMT*, *DISCLOSURE*) with a 45-45-10 weighting scale, our revised green score is calculated on a 50-50 scale which includes only environmental impact score and environmental management score. The ED score is used to measure how much a firm discloses its EP. Since the environmental impact score and environmental management score present a firm's environmental footprint, they are better served to measure EP. The disclosure score on the green rankings captures a company's CDP disclosure, thus disclosure scores are used to measure the ED in this paper. Green scores are more related to environmental reporting and transparency, thus a more reflection of a company's environment disclosure. The *DISCLOSURE* component is excluded from the calculation of revised green score which is the EP measure.

5. Empirical results

Table IV presents descriptive statistics of all variables used in the system of simultaneous equations.

Variable	<i>n</i>	Mean	SD	Min.	Quantiles			
					25%	Median	75%	Max.
<i>FP</i>	450	1.48	1.21	0.06	0.77	1.13	1.80	9.41
<i>EP</i>	450	55.08	10.97	19.95	48.55	54.77	62.80	82.95
<i>ED</i>	450	38.73	30.99	0.00	4.20	39.55	65.90	100.00
<i>Rank</i>	450	248.15	144.77	1.00	122.00	248.50	374.00	500.00
<i>lagED</i>	450	29.07	27.68	0.00	2.80	20.80	54.40	99.60
<i>SIZE</i>	450	9.67	1.23	7.02	8.77	9.47	10.41	14.63
<i>ROA</i>	450	0.07	0.07	-0.26	0.03	0.06	0.11	0.36
<i>CFO</i>	450	0.12	0.07	-0.07	0.07	0.11	0.15	0.50
<i>SALESG</i>	450	0.10	0.16	-1.05	0.02	0.07	0.15	1.16
<i>LEV</i>	450	0.27	0.20	0.00	0.13	0.24	0.38	1.57
<i>CONCERN</i>	450	-1.42	1.46	-5.00	-2.00	-1.00	0.00	3.00
<i>INSTOWN</i>	450	78.47	14.69	17.03	70.30	80.62	88.00	131.65
<i>AGE</i>	450	7.41	5.98	0.40	3.59	5.62	8.72	34.43
<i>CAPINTENS</i>	450	0.05	0.05	0.00	0.02	0.04	0.06	0.56
<i>INDRANK</i>	450	16.45	12.15	1.00	7.00	13.50	24.00	53.00

Notes: *FP*, firm value, measured as market capitalization plus debt and preferred shares, divided by beginning of period total assets; *EP*, environmental performance, revised green score measured as the sum of 50 percent of environmental impact score and environmental management score from 2012 green rankings; *ED*, environmental disclosure score, is the disclosure score from 2012 green rankings; *RANK*, green ranking. It ranges from 1 to 500, calculated based on overall green scores. It is reported on 2012 green rankings; *LagED*, prior year's ED, i.e. environmental disclosure score of 2011, obtained from 2011 green rankings; *SIZE*, firm size, measured as natural logarithm of total assets (\$ millions); *ROA*, return on assets, measured as net operating income divided by beginning period total assets; *CFO*, cash flow from operations, measured as liquidity, measured as net cash flow from operating activities divided by beginning of period total assets; *SALESG*, sales growth, measured by change in sales divided by beginning of period sales; *LEV*, leverage ratio, measured as total debt divided by total assets (Clarkson *et al.*, 2011); *CONCERN*, environmental concern score, calculated as the difference between environmental total concern score and environmental total strength score from *KLD*; *INSTOWN*, institutional ownership, retrieved from MSN money website; *AGE*, equipment age is net property, plant, and equipment divided by annual depreciation, which assumes all firms use straight line depreciation; *CAPINTENS*, capital intensity, measured as capital expenditures divided by beginning of period total assets; *INDRANK*, industry rank, obtained from 2012 Newsweek's green rankings

Table IV.
Descriptive statistics
for all variables

Table IV shows the mean scores of the revised green score (EP) and disclosure score (ED) are 55 and 39, respectively. The average rank is 248. The sample firms are likely big, profitable, and growth firms. The mean of *SIZE* and Tobin's *Q* (FP) is 9.67 and 1.48, respectively. For every dollar of common stock and total debt, the market perceives a value of 1.48 dollars for the firm on average.

The correlation coefficients matrix of environmental variables and all variables is presented in Table V (Panel A and Panel B), respectively.

Panel A of Table V is the correlation matrix for environmental variables. Rank is significantly negatively related to the overall green score and other three components. This makes sense, since firms with high green scores are assigned a low number. For example, IBM is the greenest company (Rank No. 1) on the list with a highest green score of 82.9. The green score is significantly positively related to impact score (*IMPACT*), management score (*MGMT*), and disclosure score (*ED*).

Panel B of Table V presents the correlation coefficients of all variables, including endogenous and control variables. Firm size is positively correlated to EP and ED, suggesting that big firms are likely good environmental performers and would likely to disclose their EP. Industry rank (*INDRANK*) is negatively related to financial, environmental, and disclosure, suggesting that industry green leaders are likely leaders in the financial and environmental activities, and likely to make more disclosure.

The main purpose of this paper is to examine the interrelationships among EP, ED, and FP. Table VI shows the main results of this study.

We conduct ordinary least squares (OLS), two-stage least squares (2SLS), and 3SLS estimates. The estimates of OLS are not consistent for simultaneous equations. The 2SLS results are different from OLS results because 2SLS takes the endogeneity problem into account. But 2SLS is not as efficient as 3SLS because 2SLS does not take the correlated error terms into consideration[9]. 3SLS is the combination of 2SLS and seemingly unrelated regressions (*SURE*). It is used in a system of equations which are endogenous, i.e. in each equation there are endogenous variables on both the left and right hand sides of the equation which applies to the models of this paper. Because the error terms in each equation are correlated, it is appropriate to use 3SLS to overcome the inconsistency presented in OLS and inefficiency shown in 2SLS. Due to correlated errors and endogeneity issues, we believe 3SLS estimation results are more reliable and thus reported in the main body of the paper as shown in Table VI. A comparison of estimation results of OLS, 2SLS, and 3SLS is reported in Table AI. In 3SLS, the coefficient of EP in Equation (4) is -0.00295 , and the coefficient of FP in Equation (5) is -0.505 (significant at the 5 percent level). It implies that good financial performers are less likely to be good environmental performers, and vice versa, consistent with the traditionalist view and neo-classical theory. In addition, the coefficient of EP in Equation (6) is 1.225, significant at the 1 percent level. The positive relationship between ED and EP suggests that good EP firms tend to disclose more of their performance, consistent with findings of Clarkson *et al.* (2008), supporting the legitimacy view and stockholder theory. In Table AI, the OLS results in Columns 2-4 show that the relationship of FP-EP and ED-EP is not significant at any conventional level; the relationship EP-FP is negatively correlated and significant at the 1 percent level. However, the estimation results from 3SLS show that the relationship of EP-FP is negatively correlated and the relationship of ED-EP is positively correlated, significant at the 5 and 1 percent levels, respectively. The OLS results reconcile the prior literature by showing no significant relationship exists between FP and EP or ED and EP, consistent with the findings of Yu *et al.* (2009) and Wiseman (1982), respectively. Our results from 3SLS are different from Al-Tuwaijri *et al.* (2004) and Davis *et al.* (2016) who found a positive relationship between FP and EP.

Panel A: correlation matrix of environmental variables

	RANK	EP	ED	IMPACT	MGMT	GREENSCORE
RANK	1.00000					
EP	-0.9246* (0.0000)	1.0000				
ED	-0.3095* (0.0000)	0.0064 (0.8920)	1.0000			
IMPACT	-0.5866* (0.0000)	0.7809* (0.0000)	-0.4149* (0.0000)	1.0000		
MGMT	-0.6938* (0.0000)	0.5555* (0.0000)	0.5626* (0.0000)	-0.0857 (0.0694)	1.0000	
GREEN SCORE	-0.9730* (0.0000)	0.9542* (0.0000)	0.3052* (0.0000)	0.6196* (0.0000)	0.6972* (0.0000)	1.0000

Panel B: correlation matrix of all variables

	1	2	3	4	5	6	7
FP	1						
EP	0.0365 (0.4397)	1.0000					
ED	-0.1388* (0.0032)	0.0064 (0.8920)	1.0000				
lagED	-0.1092* (0.0205)	0.1060* (0.0245)	0.8478* (0.0000)	1.0000			
SIZE	-0.3665* (0.0000)	0.0587 (0.2142)	0.3985* (0.0000)	0.3765* (0.0000)	1.0000		
ROA	0.7258* (0.0000)	0.0744 (0.1148)	-0.0958* (0.0422)	-0.0561 (0.2353)	-0.2422* (0.0000)	1.0000	
CFO	0.7405* (0.0000)	0.1072* (0.0230)	-0.0907 (0.0546)	-0.0581 (0.2185)	-0.2625* (0.0000)	0.7605* (0.0000)	1.0000
SALESFSG	0.2949* (0.0000)	-0.0529 (0.2624)	-0.1429* (0.0024)	-0.1888* (0.0001)	-0.1360* (0.0038)	0.2884* (0.0000)	0.2330* (0.0000)
LEV	0.0323 (0.4946)	-0.1544* (0.0010)	0.0455 (0.3351)	-0.0019 (0.9687)	-0.0213 (0.6522)	-0.1051* (0.0257)	-0.0119 (0.8007)
CONCERN	-0.0097 (0.8373)	-0.3773* (0.0000)	-0.4311* (0.0000)	-0.4093* (0.0000)	-0.1466* (0.0018)	-0.0036 (0.9388)	-0.0013 (0.9777)
INSTOWN	0.0694 (0.1416)	0.0363 (0.4418)	-0.2681* (0.0000)	-0.2641* (0.0000)	-0.3289* (0.0000)	0.0164 (0.7294)	0.0552 (0.2422)
AGE	-0.1038* (0.0277)	-0.4604* (0.0000)	0.3160* (0.0000)	0.1828* (0.0001)	0.1348* (0.0042)	-0.1044* (0.0268)	-0.0961* (0.0417)
CAPITENS	0.0984* (0.0368)	-0.1618* (0.0006)	0.0852 (0.0711)	0.0402 (0.3954)	-0.0603 (0.2015)	0.0526 (0.2658)	0.3107* (0.0000)
INDRANK	-0.0482 (0.3072)	-0.5011* (0.0000)	-0.4631* (0.0000)	-0.4387* (0.0000)	-0.0928* (0.0492)	-0.0334 (0.4802)	-0.0759 (0.1081)

(continued)

Relationships among EP, ED, and FP

Table V. Correlation coefficients

Variables	Equation (4) <i>FP</i>	Equation (5) <i>EP</i>	Equation (6) <i>ED</i>
<i>EP</i>	-0.00295 (0.00445)		1.225*** (0.213)
<i>lagED</i>	-0.000756 (0.00153)	0.0407*** (0.0104)	
<i>SALESG</i>	0.545** (0.222)		
<i>SIZE</i>	-0.168*** (0.0326)		7.150*** (1.057)
<i>ROA</i>	6.474*** (0.811)		
<i>CFO</i>	6.688*** (0.714)		
<i>INSTOWN</i>	-0.000987 (0.00253)	0.0138 (0.0162)	
<i>INDRANK</i>	-0.00359 (0.00390)	-0.523*** (0.0266)	
<i>FP</i>		-0.505** (0.250)	
<i>LEV</i>		-1.731 (1.212)	
<i>CAPINTENS</i>		-0.844 (5.772)	9.616 (25.77)
<i>CONCERN</i>		-0.312 (0.208)	-6.108*** (0.956)
<i>AGE</i>			1.216*** (0.255)
<i>INDUSTRY</i>	Included	Included	Included
Constant	2.074*** (0.470)	52.15*** (1.933)	-96.86*** (13.72)
Observations	450	450	450
R^2	0.644	0.753	0.423

Notes: *EP*, environmental performance, revised green score measured as the sum of 50 percent of environmental impact score and environmental management score from 2012 green rankings; *LagED*, prior year's environmental disclosure score, i.e. environmental disclosure score of 2011 obtained from 2011 green rankings; *SALESG*, sales growth, measured by change in sales divided by beginning of period sales; *SIZE* = firm size, measured as natural logarithm of total assets (\$ millions); *ROA*, return on assets, measured as net operating income divided by beginning of period total assets; *CFO*, cash flow from operations, measured as liquidity, measured as net cash flow from operating activities divided by beginning of period total assets; *INSTOWN*, institutional ownership, retrieved from MSN money website; *INDRANK*, industry rank, obtained from 2012 Newsweek's green rankings; *FP*, firm value, measured as market capitalization plus debt and preferred shares, divided by beginning of period total assets; *LEV*, leverage ratio, measured as total debt divided by total assets (Clarkson *et al.*, 2011); *CAPINTENS*, capital intensity, measured as capital expenditures divided by beginning of period total assets; *CONCERN*, environmental concern score, calculated as the difference between environmental total concern score and environmental total strength score from *KLD*; *AGE*, equipment age is net property, plant, and equipment divided by annual depreciation, which assumes all firms use straight line depreciation; *INDUSTRY*, dummy variables, used to control for industry fixed effect. In total, 19 industries (see Table III) are included in the model with one industry dropped as a control group. Standard errors are in parentheses. ** $p < 0.05$; *** $p < 0.01$

Table VI.
Estimation results of
3SLS (environment
performance =
revised green score)

6. Additional tests

6.1 The identification check

An important issue for the estimation of a simultaneous equation system is that the equations must be identified. In order for an equation to be identified, it is vital to use exclusive restrictions, known as "order condition." The order condition states that for an equation to be identified, the number of control variables excluded from the equation must be at least as large as the number of endogenous variables included in the equation minus one (Wooldridge, 2006). In this study, the system has three ($G = 3$) endogenous variables (*FP*, *EP*, and *ED*), thus, to be identified there must be at least 2 ($k = G - 1 = 3 - 1$) control variables excluded from each equation. If there are exactly two control variables excluded from each equation, then the equation is "just identified"; on the other hand, if there are more than two control variables excluded from each equation, then the equation is "over-identified." A just-identified equation will produce a unique estimate for each structural parameter, while an over-identified equation will produce more than one set of estimates for each parameter if using the OLS method. A just-identified model is preferred to an over-identified model because it provides more efficient and consistent estimates of parameters. If an equation is

over-identified, using 2SLS or 3SLS can overcome the problem of an oversupply of instruments by using combinations of the control variables to create a new instrument. Both a lagged endogenous variable in an SEM (as long as it is not included in the same equation with endogenous variable) and control variables can serve as instruments (Wooldridge, 2006). We conducted the identification check and all three equations in the system passed the identification test.

6.2 The sensitivity test

Instead of using revised green scores as a measure of EP, revised *RANK* was used as alternative measure of EP. Revised ranks are rank numbers of each company’s EP based on revised green scores. We repeat the procedures to run OLS, 2SLS, and 3SLS. Similarly, we report the 3SLS results in Table VII and report the comparison of estimation results of OLS, 2SLS, and 3SLS in Table AII.

Revised rank numbers are inversely related to revised green scores. A low *RANK* represents a high overall green score and vice versa. Thus, the signs of coefficients of FP-EP, EP-FP, and ED-FP are flipped over. In 3SLS, the coefficient of EP (Rank) in Equation (4)

Variables	Equation (4) <i>FP</i>	Equation (5) <i>RANK</i>	Equation (6) <i>ED</i>
<i>RANK</i>	0.000142 (0.000370)		-0.130*** (0.0126)
<i>lagED</i>	0.000357 (0.00151)	-1.324*** (0.130)	
<i>SALESG</i>	0.532** (0.222)		
<i>SIZE</i>	-0.174*** (0.0329)		5.149*** (1.017)
<i>ROA</i>	6.473*** (0.809)		
<i>CFO</i>	6.640*** (0.712)		
<i>INSTOWN</i>	-0.00122 (0.00253)	-0.104 (0.203)	
<i>INDRANK</i>	-0.00290 (0.00408)	7.005*** (0.318)	
<i>FP</i>		10.87*** (3.118)	
<i>LEV</i>		14.35 (15.12)	
<i>CAPINTENS</i>		-52.35 (69.55)	1.491 (23.28)
<i>CONCERN</i>		8.209*** (2.519)	-3.693*** (0.898)
<i>AGE</i>			1.384*** (0.233)
<i>INDUSTRY</i>	Included	Included	Included
Constant	1.943*** (0.449)	297.7*** (23.70)	25.85* (13.93)
Observations	450	450	450
<i>R</i> ²	0.644	0.799	0.533

Notes: Revised *RANK*, revised green ranking. It ranges from 1 to 500, calculated based on overall revised green scores; *LagED*, prior year’s environmental disclosure score, i.e. environmental disclosure score of 2011 obtained from 2011 green rankings; *SALESG*, sales growth, measured by change in sales divided by beginning of period sales; *SIZE*, firm size, measured as natural logarithm of total assets (\$ millions); *ROA*, return on assets, measured as net operating income divided by beginning period total assets; *CFO*, cash flow from operations, measured as liquidity, measured as net cash flow from operating activities divided by beginning of period total assets; *INSTOWN*, institutional ownership, retrieved from MSN money website; *INDRANK*, industry rank, obtained from 2012 Newsweek’s green rankings; *FP*, firm value, measured as market capitalization plus debt and preferred shares, divided by beginning of period total assets; *LEV*, leverage ratio, measured as total debt divided by total assets (Clarkson *et al.*, 2011); *CAPINTENS*, capital intensity, measured as capital expenditures divided by beginning of period total assets; *CONCERN*, environmental concern score, calculated as the difference between environmental total concern score and environmental total strength score from *KLD*; *AGE*, equipment age is net property, plant and equipment divided by annual depreciation, which assumes all firms use straight line depreciation; *INDUSTRY*, dummy variables, used to control for industry fixed effect. Nineteen industries (see Table III) are included in the model with one industry dropped as a control group. Standard errors are in parentheses. **p* < 0.1; ***p* < 0.05; ****p* < 0.01

Table VII.
Estimation results of
3SLS (environment
performance =
revised *RANK*)

is 0.000142; the coefficient of FP in Equation (5) is 10.87 (significant at the 1 percent level); the coefficient of EP in Equation (6) is -0.130 (significant at the 1 percent level). The overall results in Table VII are consistent with Table VI.

In this study, we used revised green scores which include 50 percent of environmental impact score and 50 percent of ED score to measure EP and ED scores to measure ED. Some may argue how the Newsweek's green scores are associated with ED and FP. To address this concern, we reran the system of simultaneous equations using Newsweek's raw green scores as a measure of EP. In 3SLS, the coefficient of EP in Equation (4) is -0.00316 ; the coefficient of FP in Equation (5) is -0.632 (significant at the 1 percent level); the coefficient of EP in Equation (6) is 1.918 (significant at the 1 percent level). The overall results are consistent with Table VI with significant level increased. For brevity, the results are not tabulated.

7. Discussion and conclusions

EP and ED become increasingly important factors in the competitive success of companies. Legitimacy theory implies that in order to exist, a corporation is required to be accountable for people, planet, and profit: triple bottom line reporting, or CSR reporting. Environmental accountability includes increasing public scrutiny of both a company's EP and its disclosure of that performance. This study uses a system of simultaneous equations (SEM) to explore the interrelationships among the three constructs. The results of the study show that firms with higher EP have higher ED. Firms with higher EP are not those with higher economic performance. This is central to the conclusion reached by Al-Tuwaijri *et al.* (2004) where there was a positive relationship between all the constructs.

What would be a plausible explanation? A recent article in *The Economist*, "A new green wave" (*The Economist*, 2014), may shed some light on this. The paper posits that many corporate sustainability goals have focused on "saving on energy, cutting waste and streamline logistics." This would explain why the "early wave" of sustainability efforts reduced costs by increasing efficiency and thereby improved profit for many companies.

However, with the "second wave" of sustainability efforts it may be more difficult for companies to keep cutting costs, and may actually raise costs and reduce profits, especially in the short run. Companies may need to take a long-term perspective. In the short term, this may put sustainable firms at risk. Firms that green wash with sustainability reports prepared by their public relations department, and which limit spending on sustainability issues, can have a short-term profit advantage. As *The Economist* (2014) puts it, going forward, sustainable companies may have to rely on "virtue being its own reward."

Compared to previous studies in environmental accounting, this study supplements the literature in the following aspects: first, we employ more current EP and ED data: the 2012 Newsweek's green rankings. The new data are more rigorous and reliable. The *z*-standardized green data make intra- and inter-industry comparison possible and meaningful. Second, many prior studies are limited to one or several measures of pollution emission indicators, such as the US Environmental Protection Agency's Toxics Release Inventory. Green scores compiled by Truecost and Sustainalytics and issued by Newsweek's green rankings are calculated from more than 700 environmental impact variable matrices, environmental policies and programs, and degree of transparency reporting. Third, this study has a larger sample size than prior studies. The final sample size is 450 firms, compared to a sample size of 198 firms examined in Al-Tuwaijri *et al.* (2004) and 191 firms in Clarkson *et al.* (2011). The large sample size in this study makes the results more robust and generalizable. In total, 20 industries are included ranging from more pollution-related industries, such as utilities, to more environmentally friendly industries, such as financial service and high-tech industries. The large sample

used in this study makes empirical analysis more persuasive and the results more generalizable. Fourth, the research on environmental studies has changed significantly. These changes include measurement of EP, requirements/standards of ED, data variability, and research methodology. All of these changes suggest that a more accurate assessment of EP is likely to be beneficial to the environmental literature (Al-Tuwaijri *et al.*, 2004). The 2012 green rankings were calculated using the same methodology as 2011, making meaningful year-to-year comparisons possible (*Newsweek*, 2012). Fifth, most prior pairwise studies examine the relationship between any of the three corporate constructs: EP, ED, and FP. However, a firm's overall management strategy may affect the three constructs simultaneously. By analyzing the data using 3SLS models, we are able to address the endogeneity problem identified in the prior literature (Patten, 2002).

This paper, as most of the papers in the empirical research studies, has limitations. The sample firms examined in this study are US large-size companies. The results found in this paper may not apply to small- and/or medium-size firms or companies in other countries. Future studies may explore the interrelationships among three corporate constructs in these areas.

The findings of this paper have social and practical implications. A negative relationship between EP and FP, and a positive relationship between EP and ED were observed in 450 of the largest US companies. An environmentally responsible firm may result in a lower firm value because the immediate benefit from its increased engagement in environmental activities may not be seen until five or ten years later. At the same time, an environmentally responsible firm may be more likely to disclose its EP to signal the public, through more transparent reporting of its environmental footprint, that it really cares about the society and community. For large US companies, FP, EP, and ED are jointly correlated, indicating that a firm's overall strategic plan on environmental engagement is likely reflected in how it engages in each of the constructs that affect costs and benefits. An environmentally responsible firm may be more likely to disclose its environmental practices but doing so may not necessarily increase its firm value.

Disclosure requirements for large corporations have increased as companies voluntarily disclose and regulators mandate expanded disclosure (e.g. the SEC and EU). Therefore, a current study of the relationships among FP, EP, and ED can provide useful information to companies and the government as they contemplate further disclosure requirements, and will make a contribution to the literature in this field.

Notes

1. The *Newsweek's* green rankings compares the actual environmental footprints, management (policies, programs, initiatives, controversies), and reporting practices of big companies. *Newsweek* collaborated with leading environmental research providers, Trucost and Sustainalytics, to assess each company's environmental footprint, management of that footprint, and transparency to create the most comprehensive rankings available. Trucost is a leading research company "specializes in quantitative measurements of environmental performance and holds the most extensive data available on corporate environmental impacts." More details can be found at the company's website: www.trucost.com. Sustainalytics is an organization dedicated to providing ESG research and services for a variety of clients with broad academic and work experience. More details can be found at the company's website: www.sustainalytics.com
2. Given that industries have different life cycles and business models, they may have different environmental policies. We added industry dummy variables to control for industry effect.
3. *Newsweek* magazine launched the first green ranking report in 2009, providing green scores for a list of top 500 largest US companies as measured by revenue, market capitalization, and number

of employees. 2010s green rankings include top 500 US companies. Both 2009 and 2010 green rankings provide only green score but not disclosure score for each US company on the list. *Newsweek* also changed its partners in 2011. Due to lack of disclosure score reported on these two earlier years' green rankings and change of methodology, it is not appropriate to use these two years' green data. *Newsweek* did not issue green rankings in 2013. *Newsweek* changed its research partners when it collaborated the 2014 and 2015 green rankings. Due to the change of research partners, the methodologies used for computing green scores and disclosure scores are quite different from green rankings released in previous years, thus the comparison between 2012 and years beyond becomes meaningless. The environmental data are limited to only two years: 2011 and 2012 green rankings from *Newsweek*.

4. *Newsweek* changed its research partners in 2014, as well as research methodology. Thus, the most recent two years of green rankings, i.e. 2014 and 2015, would not be appropriate to be included in this study.
5. In our simultaneous equation model, only environmental disclosure (ED) measure used two years of data: 2011 and 2012. Environmental performance (EP) used the 2012 green scores.
6. The green ranking report is normally issued with a one-year lag, so the financial performance and other control variables are measured using 2011 data.
7. Available at: www.trucost.com (accessed July 2, 2014).
8. Available at: www.sustainalytics.com (accessed July 2, 2014).
9. Because error terms in three equations are correlated with each other, 3SLS overcomes the inconsistency presented in OLS and inefficiency shown in 2SLS, thus more accurate results are expected from the 3SLS model (Wooldridge, 2006).

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Variables	OLS (Equation (4)) FP	OLS (Equation (5)) EP	OLS (Equation (6)) ED	2SLS (Equation (4)) FP	2SLS (Equation (5)) EP	2SLS (Equation (6)) ED	3SLS (Equation (4)) FP	3SLS (Equation (5)) EP	3SLS (Equation (6)) ED
EP	-0.00814 (0.00643)		0.229 (0.147)	-0.00292 (0.00449)		1.236*** (0.218)	-0.00295 (0.00445)		1.225*** (0.213)
LogED	-0.000776 (0.00162)	-0.0302** (0.0117)		-0.000254 (0.00155)	-0.0306*** (0.0118)		-0.000756 (0.00153)	0.0407*** (0.0104)	
SALESG	0.657*** (0.228)			0.554** (0.225)			0.545** (0.222)		
SIZE	-0.185*** (0.0380)		8.476*** (1.085)	-0.165*** (0.0330)		6.753*** (1.172)	-0.168*** (0.0326)		7.150*** (1.057)
ROA	6.011*** (0.840)			6.415*** (0.820)			6.474*** (0.811)		
CFO	7.358*** (0.749)			6.730*** (0.722)			6.688*** (0.714)		
INSTOWN	-0.000593 (0.00258)	-0.00208 (0.0184)		-0.00104 (0.00255)	-0.00196 (0.0184)		-0.000987 (0.00253)	0.0138 (0.0162)	
INDRANK	-0.00686* (0.00515)	-0.564*** (0.0273)		-0.000379 (0.00634)	-0.565*** (0.0273)		-0.000359 (0.00630)	-0.523*** (0.0266)	
FP		-0.599*** (0.223)			-0.675** (0.283)			-0.505** (0.250)	
LEV		-1.469 (1.385)			-1.468 (1.385)			-1.731 (1.212)	
CAPINTENS		-1.216 (5.887)	5.242 (24.96)		-0.979 (5.913)	3.854 (26.28)		-0.844 (5.772)	9.616 (25.77)
CONCERN		-0.736*** (0.215)	-8.484*** (0.863)		-0.737*** (0.215)	-6.194*** (0.973)		-0.312 (0.208)	-6.108*** (0.956)
AGE			1.393*** (0.271)			1.677*** (0.288)			1.216*** (0.255)
INDUSTRY	Included	Included	Included	Included	Included	Included	Included	Included	Included
Constant	2.162*** (0.599)	56.31*** (2.090)	-66.31*** (13.04)	2.060*** (0.475)	56.38*** (2.096)	-97.44*** (14.52)	2.074*** (0.470)	52.15*** (1.933)	-96.86*** (13.72)
Observations	450	450	450	450	450	450	450	450	450
R ²	0.661	0.773	0.481	0.644	0.772	0.425	0.644	0.753	0.423

Notes: EP, environmental performance, revised green score measured as the sum of 50 percent of environmental impact score and environmental management score from 2012 green rankings; *LogED*, prior year's environmental disclosure score, i.e. environmental disclosure score of 2011 obtained from 2011 green rankings; *SALESG*, sales growth, measured by change in sales divided by beginning of period sales; *SIZE*, firm size, measured as natural logarithm of total assets (\$ millions); *ROA*, return on assets, measured as net operating income divided by beginning period total assets; *CFO*, cash flow from operations, measured as liquidity, measured as net cash flow from operating activities divided by beginning of period total assets; *INSTOWN*, institutional ownership, retrieved from MSN money website; *INDRANK*, industry rank, obtained from 2012 Newsweek's green rankings; *FP*, firm value, measured as market capitalization plus debt and preferred shares, divided by beginning of period total assets; *LEV*, leverage ratio, measured as total debt divided by total assets (Clarkson *et al.*, 2011); *CAPINTENS*, capital intensity, measured as capital expenditures divided by beginning of period total assets; *CONCERN*, environmental concern score, calculated as the difference between environmental total concern score and environmental total strength score from *KLD*; *AGE*, equipment age is net property, plant and equipment divided by annual depreciation, which assumes all firms use straight line depreciation; *INDUSTRY*, dummy variables, used to control for industry fixed effect. The Table reports the OLS, 2SLS, and 3SLS estimation results as a comparison when EP is measured by revised green score. The 3SLS results enhance the OLS and 2SLS results because it provides more consistent and efficient estimation than OLS and 2SLS. More discussions can be found in Section 5. In total, 19 industries (see Table III) are included in the model with one industry dropped as a control group. Standard errors are in parentheses. *, **, *** $p < 0.05$, $p < 0.01$, $p < 0.001$.

Table A1.
Estimation results of
OLS, 2SLS, and
3SLS (EP = revised
green score)

Table All.
Estimation results of
OLS, 2SLS, and
3SLS (EP = revised
RANK)

Variables	OLS (Equation (4))		OLS (Equation (6))		2SLS (Equation (4))		2SLS (Equation (5))		2SLS (Equation (6))		3SLS (Equation (4))		3SLS (Equation (5))		3SLS (Equation (6))		
	FP	RANK	ED	RANK	FP	RANK	ED	RANK	ED	FP	RANK	ED	FP	RANK	ED	RANK	ED
RANK	0.000570 (0.000536)		-0.0855*** (0.00987)		0.000140 (0.000374)		-0.132*** (0.0129)		0.000142 (0.000370)		0.000142 (0.000370)		-0.130*** (0.0126)				
lagED	-0.000177 (0.00165)	-0.650*** (0.142)			-1.92e-05 (0.00153)												
SALES	0.660*** (0.228)				0.562** (0.225)												
SIZE	-0.183*** (0.0384)		5.884*** (1.037)		-0.165*** (0.0334)												
ROA	6.015*** (0.841)				6.408*** (0.821)												
CFO	7.341*** (0.749)				6.709*** (0.722)												
INSTOWN	-0.000669 (0.00258)	0.0462 (0.222)			-0.00115 (0.00256)	0.0411 (0.222)											
INDRANK	-0.000971* (0.000559)	7.808*** (0.330)			-0.000326 (0.00413)	7.819*** (0.330)											
LEV		9.512*** (2.684)				12.66*** (3.415)											
CAPINTENS		9.009 (16.70)				8.948 (16.73)											
INDUSTRY		-34.69 (71.00)				-44.49 (71.41)											
AGE		10.79*** (2.587)				10.83*** (2.591)											
CONCERN																	
Constant	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included	Included
Observations	1,543*** (0.561)	255.3*** (25.21)	1,527 (13.31)	1,527 (13.31)	1,865*** (0.455)	252.5*** (25.32)	1,865*** (0.455)	252.5*** (25.32)	34.81** (14.77)	1,943*** (0.449)	287.7*** (23.70)	1,943*** (0.449)	287.7*** (23.70)	25.85* (13.93)	25.85* (13.93)	25.85* (13.93)	25.85* (13.93)
R ²	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
	0.661	0.810	0.555	0.555	0.844	0.899	0.844	0.899	0.532	0.644	0.799	0.644	0.532	0.799	0.533	0.533	0.533

Notes: Revised RANK, revised green ranking. It ranges from 1 to 500, calculated based on revised overall green scores; LagED prior year's environmental disclosure score, i.e. environmental disclosure score of 2011 obtained from 2011 green rankings; SALES, sales growth, measured by change in sales divided by beginning of period sales; SIZE, firm size, measured as natural logarithm of total assets (\$ millions); ROA, return on assets, measured as net operating income divided by beginning period total assets; CFO, cash flow from operations, measured as liquidity, measured as net cash flow from operating activities divided by beginning of period total assets; INSTOWN, institutional ownership, retrieved from MSN money website; INDRANK, industry rank, obtained from 2012 Newsweek's green rankings; FP, firm value, measured as market capitalization plus debt and preferred shares, divided by beginning of period total assets; LEV, leverage ratio, measured as total debt divided by total assets (Clarkson *et al.*, 2011); CAPINTENS, capital intensity, measured as capital expenditures divided by beginning of period total assets; CONCERN, environmental concern score, calculated as the difference between environmental total concern score and environmental total strength score from KLD, AGE, equipment age is net property, plant and equipment divided by annual depreciation, which assumes all firms use straight line depreciation; INDUSTRY, dummy variables, used to control for industry fixed effect. The Table reports the OLS, 2SLS, and 3SLS estimation results as a comparison when EP is measured by revised ranks. The 3SLS results enhance the OLS and 2SLS results because it provides more consistent and efficient estimation than OLS and 2SLS. More discussions can be found in Section 5. In total, 19 industries (see Table III) are included in the model with one industry dropped as a control group. Standard errors are in parentheses. **p* < 0.1; ***p* < 0.05; ****p* < 0.01