Do investors value environmental capital spending? Evidence from the electric utility sector

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ABSTRACT

This study shows that investors attribute a positive value to environmental capital expenditures by firms with lower rates of carbon emissions, but attribute a negative value for firms with higher rates of carbon emissions. The results support the arguments of existing environmental accounting literature that predict that environmental capital spending by firms with poor environmental performance is related to regulatory compliance, while superior environmental performers intentionally over-comply. While voluntarily environmental capital spending is associated with positive NPV projects designed to control and decrease emissions, environmental capital spending related to compliance with regulatory requirements imposes a cost on investors.

Keywords: environmental capital expenditures, firm value, corporate environmental performance

INTRODUCTION

Environmental capital spending by companies may relate to compliance with federal and state regulations, or may result from over-compliance (Johnston, 2005). Companies may intentionally over-comply to obtain a strategic competitive advantage in anticipation of future regulations or legislation. Companies that over-comply benefit from the flexibility inherent to voluntary environmental initiatives, as they have more time to invest in innovative pollution technologies and process improvements without the threat of non-compliance penalties (Boyd, 1998; Khanna and Damon, 1999). In addition, firms may pursue a pollution reduction strategy to benefit from green consumerism, reduce the risk of future environmental liabilities and lawsuits, and increase productivity and efficiency in production (Porter and van der Linde, 1995; Epstein, 1996; Reinhart, 1999). Therefore, over-compliance may create economic benefits and "green goodwill" for the company (Arora and Gangopadhyay, 1995; Clarkson et al, 2004).

Conversely, regulatory environmental capital expenditures (ECE) may have to follow processes specified in regulations and, therefore, lack the flexibility to promote innovation (Boyd and McClelland, 1999; Johnston, 2005). Consequently, regulatory ECE may have no incremental return and represent a cost that is imposed on investors.

This study investigates the value relevance of environmental capital spending to investors in a sample of electric companies. The Ohlson (1995) valuation equation is estimated to address the impact of ECE on the market value of companies. The results show that ECE has a positive impact on the market value of companies with superior environmental performance, but has a negative impact on the market value of poorer environmental performers.

The period considered in this study includes the years of 2005 to 2007. Several developments concerning control and regulation of greenhouse gas emissions took place during this time period, and it was expected that future developments would require companies to further reduce emissions. For example, in 2005 the Environmental Protection Agency (EPA) introduced the Clean Air Interstate Rule (CAIR), designed to limit emissions of sulfur dioxide (SO2) and nitrogen oxides (NOx). The EPA proposed a two-phased emission reduction program, with Phase 1 beginning in 2009 for NOx and 2010 for SO2, and Phase 2 beginning in 2015. Also in 2005, the EPA issued the Clean Air Mercury Rule (CAMR), which established mercury emissions standards. The CAMR set caps on mercury emissions to be implemented in two phases, in 2010 and 2018, and provided for an emission allowance trading market. The House of Representatives approved the American Clean Energy and Security Act in 2009, with the purpose of implementing mechanisms to limit and reduce greenhouse gas emissions. A similar bill introduced in the Senate in the Fall of 2009 was not approved. It is still not clear to what extent companies will have to reduce their greenhouse gases emissions, and how much companies will be required to invest in emissions reduction and control. These developments introduce additional uncertainty and risk in the valuation of companies. Furthermore, the impact of this risk on value is likely conditional on the firm's current environmental performance.

A study by Clarkson et al. (2004) found, for a sample of companies in the pulp and paper industry, that there are incremental economic benefits for capital expenditures by low-polluting firms, but the results were not statistically significant for high-polluting firms. This study finds a statistically significant positive association between ECE and market value for low-polluting firms, and a statistically significant negative association for high-polluting firms. The difference in results may be related to considering different industries, different measures of pollution emissions, and a different time period. This study uses carbon emissions, while Clarkson et al.

(2004) use Toxics Release Inventory (TRI) emissions. This study also considers a more recent time period, when federal and state regulations in the U.S. regarding the control of pollution emissions by companies became more stringent, and the expectation for further developments is higher.

PREVIOUS LITERATURE AND HYPOTHESES DEVELOPMENT

Several studies provide evidence that environmental performance is valued by investors by testing the association between environmental performance and either market price abnormal returns or Tobin's Q (e.g., Hamilton, 1995; Konar and Cohen, 2001; King and Lenox, 2002). Given the lack of availability of data on carbon emissions, most of these studies use TRI as a measure of environmental performance.

Two previous papers study the valuation relevance of ECE. Clarkson et al. (2004) show, in a sample of 39 companies in the pulp and paper industry, that the market values ECE for low-polluting firms, but not for high-polluting firms. Their sample includes the period from 1989-2000, and their measure of pollution is based on the TRI. They explain these results based on the economic benefits generated by over-compliance, the creation of "green goodwill", and incentives to innovate created by greater flexibility. Instead, high polluting firms are more likely to be complying with regulatory requirements, with no incremental returns.

Another study, by Johnston (2005), finds a significant negative relationship between regulatory ECE and future abnormal earnings, and a positive relation between voluntary ECE and future abnormal earnings. Johnston (2005) also shows that regulatory capital expenditures are negatively associated with stock prices and stock returns, but the results are insignificant for voluntary ECE. He argues that regulatory capital expenditures, made to comply with environmental regulations, may not result in innovation and efficiency in the production processes.

This study investigates the relationship between ECE and market value for a more recent period. Given recent regulatory and legislative developments, it is expected that the value of ECE has a significant impact on market value. However, this impact may be conditional on the firm's environmental performance. Following the arguments used by Clarkson et al. (2004), ECE by companies with superior environmental performance are likely to represent over-compliance investments, while ECE by companies with poor environmental performance are related to compliance with the regulation requirements.

There are important advantages in investments in the reduction and control of emissions beyond what is required by existing regulation or legislation. Over-compliance by stronger performers may set higher standards and show regulators that those standards are economically achievable (Salop and Scheffman, 1987). There are also advantages from having a longer time for compliance in anticipation of future regulations and allowing managers flexibility to make cost-effective emission reductions without the threat of non-compliance fines and penalties (Boyd, 1998; Khanna and Damon, 1999).

Conversely, regulatory capital expenditures follow environmental regulations that in the U.S. are "command-and-control" in nature, and define both the goals of the legislation as well as the processes for attaining those goals (Johnston, 1995). Consequently, these investments may not promote innovation and efficient. [1]

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[1] Several companies acknowledge in the 10-k reports the negative impact of regulatory environmental capital expenditures on earnings. For example, Alabama Power Company states in the 2007 10-k report that "new or

This study tests the relationship between ECE and market value, conditional on environmental performance. Carbon emissions rates are used as a measure of environmental performance. Formally, the hypotheses tested are the following:

H1: There is a positive relationship between ECE and market value for companies with low carbon emissions rates.

H2: There is a negative relationship between ECE and market value for companies with high carbon emissions rates.

EMPIRICAL DESIGN

The following Ohlson (1995) valuation equation is estimated to address the valuation relevance of environmental capital expenditures:

$$P_{i,t} = \beta_0 + \beta_1 BVNCAPX_{i,t} + \beta_2 AE_{i,t} + \beta_3 CAPXNECE_{i,t} + \beta_4 ECE_{i,t} + \beta_5 CEMISS_{i,t} + \varepsilon_{i,t} \qquad (1)$$

where:
P = stock price at the end of the fiscal year;
BVNCAPX = book value minus current period total capital expenditures, divided by the number of shares outstanding;
AE = abnormal earnings per share defined as earnings before extraordinary items less the cost of equity capital estimated based on the CAPM times the beginning of the period book value of equity, divided by the number of shares outstanding;
CAPXNECE = total capital expenditures minus environmental capital expenditures, divided by the number of shares outstanding;
ECE = environmental capital expenditures divided by the number of shares outstanding;
CEMISS = carbon emissions output rate, defined as carbon emissions in tons divided by generation in MWh.

Following Clarkson et al. (2004), an interaction variable between ECE and CEMISS is introduced in the equation, to test if investors value environmental capital spending conditional on environmental performance. The following model is estimated:

$$P_{i,t} = \beta_0 + \beta_1 BVNCAPX_{i,t} + \beta_2 AE_{i,t} + \beta_3 CAPXNECE_{i,t} + \beta_4 ECE_{i,t} + \beta_5 CEMISSP_{i,t} + \beta_6 ECE_{i,t} * CEMISSP_{i,t}\ \varepsilon_{i,t} \qquad (2)$$

where:
CEMISSP= an indicator variable assuming the value of 1for firms in the defined percentile of carbon emissions output rate.

The signal of the coefficient β_4 is predicted to be positive for low percentiles of carbon emissions rates and negative for high percentiles. Similarly, the coefficient β_5 is expected to be

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revised laws and regulations or new interpretations of existing laws and regulations, such as those related to climate change, could affect unit retirement and replacement decisions and/or result in significant additional expense and operating restrictions on the facilities of the traditional operating companies or Southern Power or increased compliance costs which may not be fully recoverable from customers and would therefore reduce the net income."

positive when the indicator variable CEMISSP is defined for low percentiles, and negative for high percentiles.

DATA SAMPLE

The data relating to carbon emissions were obtained from EGRID 2006 and 2007, a database that provides emissions, generation resource mix and capacity, ownership and corporate affiliation for almost all U.S. electricity generating plants. EGRID collects information from three federal agencies: the EPA, the U.S. Energy Information Administration (EIA), and the Federal Energy Regulatory Commission (FERC). Emissions resulting from the generation of electricity are reported for carbon dioxide, methane, nitrous oxide, nitrogen oxides, sulfur dioxide and mercury.

For each of the U.S. parent companies in eGRID, 10-K reports were downloaded from the SEC's EDGAR database for the fiscal years of 2005, 2006 and 2007. The values of ECE were hand-collected. For the companies that disclosed ECE, the value was reported under the section ''Environmental Matters'' or in the section that discusses capital expenditures. A total of 23 companies disclosed amounts of ECE in 2005, 24 in 2006 and 25 in 2007, resulting in a sample size of 72 company/year observations. Data necessary to construct the control variables in the model were downloaded from the Compustat database.

Table 1 presents descriptive statistics for the sample. ECE represents between 0.42% and 68.81% of the total expenditures of the companies in the sample, and between 0.02% and 6.81% of the value of total assets. The average market value of the companies in the sample is $1.29 billion, and varies between as little as $0.7 and as much as $115.24 billion. The rate of tons of carbon emissions per MWh also varies widely, between a minimum of 12.83 and a maximum of 2,963.49.

RESULTS AND DISCUSSION

As show in Table 2, the correlation coefficient between the variable market price and CAPXNECE is +0.529 ($p<0.01$) and the correlation coefficient between price and CEMISS is -0.590 ($p<0.01$), suggesting a positive impact of capital expenditures and a negative impact of carbon emission on market value. The correlation coefficient for the variable ECE is statistically insignificant.

Table 3 shows the results for the multivariate regressions. As described in the previous section, the sample comprises observations from three years: 2005, 2006 and 2007. To preclude contemporaneous correlation in error terms and heteroscedasticity the models were estimated from pooled regressions, and t-statistics are based on firm cluster-adjusted robust standard errors. All variables are scaled by the number of shares outstanding.

Model 1 presents the results for the regression of market price on book value minus capital expenditures (BVENCAPX), abnormal returns (AE), non-environmental capital expenditures (CAPXNECE), and environmental capital expenditures (ECE). ECE does not significantly explain market value in this model (t-stat.=-1.387, $p>0.10$). Model 2 adds the variable CEMISS, as represented in equation (1) above. While the coefficient for CEMISS is significantly and negatively related to market value (t-stat.=-4.526, $p<0.01$), the coefficient of ECE is still statistically insignificant.

Models 3, 4, 5 and 6 include the interaction between the variables ECE and carbon emissions rates, to test if the market value impact of ECE is conditional on the level of carbon emissions. In these models, the variable that represents carbon emissions, CEMISSP, is an indicator variable that assumes the value one for the specified percentiles.

In Models 3 and 4 CEMISSP represents the observations in the lower percentiles of carbon emissions. In Model 3 CEMISSP is equal to one for observations bellow the 50^{th} percentile of carbon emissions rates. The coefficient of ECE is not significant in Model 3 (t-stat.=1.100, p>0.10). The coefficient of ECE is, however, positive and statistically significant at the 10% level in Model 4, where CEMISSP represents observations bellow the 25^{th} percentile of carbon emissions rates (t-stat.=1.802, p<0.10). This result suggests that ECE has a positive impact on the market price of firms with superior environmental performance, and supports H1.

Models 5 and 6 represent the models with CEMISSP defined for the highest percentiles of carbon emissions. In Model 5 CEMISSP is equal to one for observations above the 50^{th} percentile of carbon emissions and in Model 6 CEMISSP is equal to one for observations above the 75^{th} percentile. In both models, the coefficients of ECE are negative and significant at the 10% level, suggesting a negative impact of environmental spending on investors' value assessment of the companies. This result supports H2.

The results lead to the conclusion that ECE creates value for investors when companies have superior environmental performance, but represent a cost to investors for firms with poor environmental performance. One can argue that ECE by companies with superior environmental performance are likely to represent over-compliance investments, while ECE by companies with poor environmental performance are related to compliance with regulatory requirements. As discussed above, firms that over-comply benefit from flexibility in environmental investments and from first-movers advantages. However, environmental investments made in compliance with the requirements of regulations follow the processes defined in these regulations and do not promote innovation and efficiency. Therefore, voluntary environmental capital spending creates value for investors while regulatory environmental spending represents a cost to investors.

Clarkson et al. (2004) found significant results for the value relevance of ECE only for low-polluting firms. Their measure of environmental performance is based on the TRI, while this study is based on carbon emissions. The reporting and regulation of toxic chemical releases and waste management has been effective for several years, whereas new developments related to disclosure and regulation of greenhouse gases are anticipated in the coming years. Therefore, a measure of environmental performance based on carbon emissions better reflects current environmental investment, and the uncertainty related to future regulatory requirements.

This study also considers a more recent period than the one under study by Clarkson et al. (2004). In recent years the House of Representatives and the Senate have contemplated legislation to limit and reduce greenhouse gas emissions and the implementation of a cap and trade system of allowances and credits. In addition, the EPA has been taking steps to regulate greenhouse gas emissions. Since January of 2010 the EPA requires large emitters of greenhouse gases to collect and report data with respect to greenhouse gas emissions. Other initiatives from the EPA include the CAIR and the CAMR, issued in 2005. These new developments may require companies to make future capital investments in emissions reduction and control. The uncertainty related to future requirements in emissions reduction and environmental capital investments is likely to have an impact on firm risk and value.

Furthermore, the Securities and Exchange Commission (SEC) recently released guidance concerning the discussion and disclosure of climate change matters, more precisely regarding the physical, legislative, regulatory, business and market impacts related to climate change that may have a material effect on a the company's business and operations. In particular, the SEC states that these matters "could have a significant effect on operating and financial decisions, including those involving capital expenditures to reduce emissions".[2] The guidance came as a response to several petitions by institutional investors and other investor groups, [3] and underlines the relevance of this information to investors.

Therefore, current regulatory requirements and expectations regarding future legislation and regulation are likely to have an impact on firms' environmental investment decisions and on investors' assessment of the value of these investments. Additionally, the value of environmental investments is conditional on the environmental performance of companies.

CONCLUSION

This study finds that equity markets attribute a positive value to environmental capital investments by companies with carbon emissions rates in the lower 25th percentile, but attribute a negative value to environmental capital spending by companies with carbon emissions above the 50th percentile. Investors' market value assessments suggest that environmental capital spending adds value to companies with superior environmental performance, but decreases value for companies with relatively poorer environmental performance.

Following the arguments from previous literature in environmental accounting, the results can be explained in different angles. Environmental capital spending by companies with good environmental performance is likely related to over-compliance, rather than compliance with requirements of current regulations. Previous studies discuss several benefits from over-compliance, from setting higher standards to competitors, to the flexibility related to introducing innovative technologies and processes that create efficiency in production, to having more time to comply with forthcoming regulatory requirements. Another benefit from over-compliance is a decrease in regulatory risk, as companies make investments in anticipation of future regulatory requirements. Therefore, these investments are susceptible of creating value for the company.

Conversely, environmental capital spending by companies with poor environmental performance is likely related to regulatory requirements, and follows the processes specified in regulations. Rather than creating value for the company, these investments lack the flexibility necessary to innovate and improve efficiency, and represent a cost to investors. Additionally, the risk associated with future regulations and legislation is amplified for these companies, as better environmental performers benefit from investment in anticipation to new regulatory requirements.

This study has important implications for investors, as they understand the mechanisms of value creation in environmental capital investments, for managers, as they make capital investment decisions, and regulators, as they understand the economic benefits for companies of regulations that require environmental capital spending. The results show that voluntary environmental investment creates value for the company and, therefore, should be an important component of the company's environmental and financial strategy.

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[2] http://www.sec.gov/rules/interp/2010/33-9106.pdf

[3] See, for example, http://www.incr.com/Page.aspx?pid=911

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Table 1: Descriptive Statistics

	Min:	Mean:	Median:	Max:	Std. Dev.:
MVE ($Millions)	702	14,614	10,454	115,239	17,363
Capital Expenditures ($Millions)	64	1,298	963	4,052	1,086
ECE ($Millions)	1	168	75	1,500	242
ECE / Total Assets	0.02%	0.94%	0.43%	6.81%	1.28%
ECE / Capital Expenditures	0.42%	13.27%	7.92%	68.81%	14.77%
Carbon Emissions Rate (tons / MWh)	12.83	1,470.20	1,566.42	2,963.49	658.78

Table 2: Correlation Coefficients

PRICE is the stock price at the end of the fiscal year; *BVNCAPX* is the book value of equity minus current period total capital expenditures, divided by the number of shares outstanding; *AE* is abnormal earnings per share defined as earnings before extraordinary items less the cost of equity capital estimated based on the CAPM times the beginning of the period book value of equity, divided by the number of shares outstanding; *CAPXNECE* is total capital expenditures minus environmental capital expenditures, divided by the number of shares outstanding; *ECE* is environmental capital expenditures divided by the number of shares outstanding; *CEMISS* is carbon emissions output rate, defined as carbon emissions in tons divided by generation in MWh; *CEMISSP* is an indicator variable assuming the value of 1 for firms in the defined percentile of carbon emissions output rate. p-values are reported below each coefficient in italic. The significance levels are given by: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.10$.

	PRICE	BVNCAPX	CAPXNECE	AE	ECE	CEMISS
PRICE	1					
BVNCAPX	0.343	1				
	*0.006****					
CAPXNECE	0.528	0.578	1			
	*0.000****	*0.000****				
AE	0.220	-0.318	0.050	1		
	*0.080**	*0.011***	*0.693*			
ECE	0.005	-0.017	0.026	0.006	1	
	0.967	*0.894*	*0.841*	*0.962*		
CEMISS	-0.590	-0.428	-0.284	-0.082	0.130	1
	*0.000****	*0.000****	*0.023***	*0.519*	*0.305*	
CEMISSP < 50th perc.	0.445	0.375	0.244	0.019	0.013	-0.862
	*0.000****	*0.002****	*0.052**	*0.880*	*0.922*	*0.000****
CEMISSP > 50th perc.	-0.445	-0.375	-0.244	-0.019	-0.013	0.862
	*0.000****	*0.002****	*0.052**	*0.880*	*0.922*	*0.000****
CEMISSP <25th perc.	0.689	0.443	0.344	0.015	-0.305	-0.749
	*0.000****	*0.000****	*0.005****	*0.906*	*0.014***	*0.000****
CEMISSP >75th perc.	-0.386	-0.388	-0.276	-0.125	0.131	0.802
	*0.002****	*0.002****	*0.028***	*0.326*	*0.304*	*0.000****

Table 3: Pooled Cross-Sectional Regressions

Dependent variable is the stock price at the end of the fiscal year; *BVNCAPX* is the book value of equity minus current period total capital expenditures, divided by the number of shares outstanding; *AE* is abnormal earnings per share defined as earnings before extraordinary items less the cost of equity capital estimated based on the CAPM times the beginning of the period book value of equity, divided by the number of shares outstanding; *CAPXNECE* is total capital expenditures minus environmental capital expenditures, divided by the number of shares outstanding; *ECE* is environmental capital expenditures divided by the number of shares outstanding; *CEMISS* is carbon emissions output rate, defined as carbon emissions in tons divided by generation in MWh; *CEMISSP* is an indicator variable assuming the value of 1for firms in the defined percentile of carbon emissions output rate. All models are estimated using pooled cross-sectional regressions with robust standard errors clustered at the firm level. t-statistics are reported below each coefficient in italic. The significance levels for the independent variables are given by: *** = $p < 0.01$, ** = $p < 0.05$, * = $p < 0.10$.

	Model 1	Model 2	Model 3 <50^{th}perc.	Model 4 <25^{th}perc.	Model 5 >50^{th}perc.	Model 6 >75^{th}perc.
INT	20.948	43.757	18.195	24.725	37.265	28.662
	2.960***	*5.439****	*2.765****	*4.548****	*4.736****	*3.773****
BVNCAPX	0.608	0.023	0.060	-0.128	0.060	0.273
	1.678*	*0.069*	*0.165*	*-0.437*	*0.165*	*0.735*
AE	4.999	3.187	3.307	3.243	3.307	2.916
	2.564**	*1.854**	*1.794**	*2.178****	*1.794**	*1.487*
CAPXNECE	2.991	3.242	3.855	2.620	3.855	4.148
	2.360**	*2.983****	*3.194****	*2.472***	*3.194****	*3.302****
ECE	-1.387	-0.123	4.265	4.486	-7.987	-6.920
	-0.446	*-0.046*	*1.100*	*1.802**	*-1.934**	*-1.823**
CEMISS		-28.820				
		-4.526***				
CEMISSP			19.070	28.694	-19.070	-18.297
			3.631***	*5.534****	*-3.631****	*-3.016****
ECE*CEMISSP			-12.252	-0.955	12.252	16.146
			-2.176**	*-0.066*	*2.176***	*2.613****
R^2	37.72%	55.13%	49.48%	66.53%	49.48%	46.76%
F-Stat.	5.632	10.35	6.732	13.67	6.732	6.038
N	72	72	72	72	72	72