



ENVIRONMENTAL INFORMATION DISCLOSURE AND THE INVESTMENT-CASH FLOW SENSITIVITY

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Sheng Yao¹, Yuan Hong², Chen-Miao Lin³

¹Shanghai University, Department of Accounting, School of Management, Shanghai, China.

Kj9704@126.com, ORCID: 0000-0002-8927-7983

²China University of Mining and Technology, School of Management, China.

1013514920@qq.com, ORCID: 0000-0003-2399-4178

³Clayton State University, Accounting, Economics, and Finance, Morrow, GA, USA.

Chen-MiaoLin@clayton.edu, ORCID: 0000-0002-4525-4405

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ABSTRACT

Purpose- In 2008 China issued the Measures for the Disclosure of Environmental Information. Using the introduction of this environmental policy, this paper examines how the environmental information disclosure quality affects a firm's access to capital markets. In particular, the relationship is investigated between the environmental disclosure quality and the investment-cash flow sensitivity, a measure of a firm's financial constraints, before and after the implementation of the policy.

Methodology- The content analysis is used to construct the measure of environmental disclosure quality. First of all, the contents of both qualitative and quantitative environmental disclosures are analyzed with respect to the following ten areas reported in firms' annual reports: (1) corporate investment in environmental protection, (2) government financial support related to environmental control, (3) tax reductions related to environmental programs, (4) lawsuits, settlements, penalties, and rewards related to environmental protection, (5) emissions and pollution reduction implementation, (6) certifications of environmental programs, (7) firm environmental protection missions and goals, (8) firm environmental protection plans and strategies, (9) bank loans related to environmental protection, and (10) other environmental-related information. And then, different points are assigned based on the disclosure quality for each of the ten disclosure areas and aggregated to obtain an overall disclosure score. Univariate and regression tests are used to examine the relationship between environmental information disclosures and investment-cash flow sensitivity.

Findings- A negative association is found between a firm's environmental disclosure quality and the investment-cash flow sensitivity after the policy was implemented, while no such association is found before the policy implementation. Furthermore, the observed reduction in investment-cash flow sensitivity tends to be stronger for firms in high-polluting industries.

Conclusion- Given the environmental policies in emerging markets are often viewed with great doubts, our findings suggest that government environmental policy plays an important role in firm's access to capital markets.

Keywords: Environmental information disclosure, investment-cash flow sensitivity, government policy, asymmetric information, financial constraints

JEL Codes: G18, G30, G32

1. INTRODUCTION

In 2008 the Ministry of Environmental Protection of the People's Republic of China issued the Measures for the Disclosure of Environmental Information (hereafter MDEI). Prior to the implementation of this policy, firms were encouraged to voluntarily disclose their environmental exposures to the public, but no mandatory public disclosure was required. The MDEI required mandatory disclosure for firms operating in the following sixteen high-polluting industries: thermal power, steel, cement, electrolytic aluminum, coal, metallurgy, chemistry, petrochemical, building materials, paper making, brewing, pharmaceuticals, fermentation, textiles, leather, and mining. The MDEI detailed the scope of disclosure requirements for pollutant discharges,

environmental emergency plans, environmental protection facilities and etc. as well as the methods of procedures. Although firms in low-polluting industries were not required to provide environmental disclosure, they were strongly encouraged to do so.

The introduction of MDEI allows us to examine how the environmental information disclosure quality affects a firm's access to capital markets. Particularly, what investigated is the investment-cash flow sensitivity, a measure of financial constraints, before and after the implementation of MDEI. Fazzari et al. (1988) argue that asymmetric information between the corporations and external fund providers makes it very costly or impossible for firms to have access to the capital markets. Accordingly, firms must finance their investment opportunities through their internal funds, and thus a greater investment-cash flow sensitivity for financial constrained firms. Empirically, they find a positive relation between investment and internal cash flows.

Both theory and empirical findings suggest that disclosure can increase a company's access to capital markets or lower the investment-cash flow sensitivity. Disclosure can enhance a firm's access to capital markets by reducing the "lemons market" problem in valuation discount (Myers and Majluf, 1984; Sanders and Boivie, 2004; Greenwald et al., 1984), and/or by reducing non-diversifiable estimation risk (Brown, 1979; Barry and Brown, 1984 and 1985; Coles and Loewenstein, 1988; Handa and Linn, 1993; Clarkson et al., 1996; Coles et al., 1995; Lambert et al., 2007). This reduction in information costs in turn leads to an increase in the liquidity of the company's securities and a reduction in the cost of raising outside capital (Botosan, 1997; Easley, Hvidkjaer and O'Hara, 2002; Bhattacharya, Daouk and Welker, 2003; Botosan and Plumlee, 2002; Francis et al., 2004; Botosan, Plumlee and Xie, 2004; Easley and O'Hara, 2004; Gietzmann and Ireland, 2005; Hughes et al., 2007; Sengupta, 1998; Baber and Gore, 2008; Hope et al., 2009).

In this study, no association is found between the disclosure quality and cash flow sensitivity of investment before MDEI was implemented for a sample of publicly traded companies in China. However, a negative relationship is found between environmental disclosure and the sensitivity of investment-cash flow after the issuance of MDEI. The results indicate that the environmental information disclosure quality has been increasing since MDEI was implemented and suggest that disclosures, by reducing the asymmetric information, increase a firm's access to the capital markets. Along this line, Surma (1992) states that "environmental issues can dramatically impact a company's short-term financial position and its chances for long-term success." Our finding is consistent with the notion that firm's superior corporate social responsibility performance is negatively associated with capital constraints as shown in several studies, for example, Cheng et al. (2014). Furthermore, the negative relation between the disclosure quality and investment-cash flow sensitivities is only significant for firms in high-polluting industries. This latter finding is consistent with the argument that since high-polluting firms face greater environmental issues and concerns, they are more inclined to provide more extensive disclosures to ease investors' concerns (Cho and Patten, 2007). Also, since the disclosure is mandatory for firms in high-polluting industries and voluntary for firms in low-polluting industries, our result suggest that the compulsory disclosure has a more pronounced impact on a firm's investment-cash flow sensitivities. Our results are robust to alternative measures of disclosure quality.

2. LITERATURE REVIEW

Literature has documented that environmental disclosure has an impact on firm value by either increasing a firm's future expected cash flows, or reducing its discount rate, or both. Richardson et al. (1999) argue that the disclosure quality affects firm value through the cash flow effects. Since the negligence of environmental issues possibly leads to regulatory interventions, fines, and penalties, the disclosure of company environmental risks and policies in annual reports provides important information for investors and other interested parties to estimate the impacts of regularly sanctions on future cash flows. Many empirical studies find evidence that environmental disclosure quality is positively associated with firm value (Hughes, 2000; Al-Tuwaijri et al., 2004; Rikhardsson and Holm, 2008; Ragothaman and Carr, 2008; Blacconiere and Patten, 1994; Iatridis, 2013, Clarkson et al., 2013; Plumlee et al., 2015). Plumlee et al. (2015) find that environmental disclosure increases firm value through the expected cash flow effects. Aerts et al. (2008) and Cormier and Magnan (2013) find supporting evidence showing that corporate environmental disclosure improves analysts' forecasts accuracy.

Richardson et al. (1999) also argue that the disclosure quality affects firm value through the discount rate effect or the cost of capital, which may in turn mitigate the firm's financial constraints. Lamont et al. (2001, page 529) define financial constraints as "this inability to obtain finance may be due to credit constraints or inability to borrow, inability to issue equity, dependence on bank loans, or illiquidity of assets". The issue of financial constraints arises as it has been well documented in the literature that capital markets are not perfect. One of the market frictionless that causes financial constraints is asymmetric information. The asymmetric information between insiders and outsiders causes financing costs to rise (Myers, 1984; Myers and Majluf, 1984; Sanders and Boivie, 2004) and investment opportunities may be constrained by the limited internal funds.

Prior studies (for example, Copeland and Galai, 1983; Demsetz, 1968; Amihud and Mendelson, 1986; Glosten and Milgrom, 1985) argue that extensive information disclosure can potentially reduce asymmetric information and in turn increase a firm's access to capital markets (or reduce financial constraints) by lowering the transaction costs or bid-ask spread. Another channel through which disclosure is able to reduce asymmetric information is through reducing the non-diversifiable estimation risk (Coles and Loewenstein, 1988; Barry and Brown, 1985), and/or through increasing a company's trading liquidity (Diamond and Verrecchia, 1991). Several empirical studies report a negative association between corporate social responsibility and/or environmental disclosure and the cost of equity (Dhaliwal et al., 2011; Cormier and Magnan, 2007; Plumlee et al., 2015), while Richardson and Welker (2001) and Clarkson et al. (2013) fail to find the same relation. Transparent environmental information can also result in a reduction in the cost of debt by reducing monitoring and bonding costs and providing more flexible financing (Jones, 2010; Karolyi, 2012; Goss and Roberts, 2011).

Bewley and Li (2000) and Li et al. (1997) also argue that disclosing more environmental information can increase firm value by distinguishing good environmental performers from poor environmental performers. Since disclosures cannot be easily mimicked by poor environmental performers, by disclosing more information, good environmental performers signal their performance type, so they can potentially increase their firm value as investors infer expected environmental liabilities are lower for them.

In this study, it is focused on the discount rate effect and hypothesized that firms with greater disclosure quality, by reducing asymmetric information, will face lower financial constraints, measured by investment-cash flow sensitivity.

3. DATA AND METHODOLOGY

3.1. Data Description

Our sample covers publicly traded companies in the Chinese stock exchanges between 2004 and 2011. Since MDEI was implemented in 2008, information between 2004 and 2006 is defined as pre-MDEI time period and information between 2009 and 2011 is defined as post-MDEI time period. Observations are excluded for firms in the finance industry and for firms with missing financial data. Our final sample consists of 1,733 firm-year observations for the pre-MDEI period and 3,046 firm-year observations for the post-MDEI period.

3.2. Methodology

To examine the relationship between the environmental information disclosure quality and the investment-cash flow sensitivity, first of all, a firm's environmental information disclosure level is measured by using content analyses. Secondly, regression models are used to test our hypothesis. Finally, to ensure our results are robust, regression analysis is repeated by using alternative measure of environmental information disclosure quality. The details are provided in the following sections.

3.2.1. Measure of Environmental Information Disclosure Level

Following the approach in Wiseman (1982) and Al-Tuwaijri et al. (2004), the environmental information disclosure quality (hereafter EID) is constructed using content analysis. Environmental disclosures are usually found in company annual reports. Companies provide both qualitative and quantitative information about their environmental risks. The contents of corporate environmental disclosures are analyzed with respect to the following ten areas: (1) corporate investment in environmental protection, (2) government financial support related to environmental control, (3) tax reductions related to environmental programs, (4) lawsuits, settlements, penalties, and rewards related to environmental protection, (5) emissions and pollution reduction implementation, (6) certifications of environmental programs, (7) firm environmental protection missions and goals, (8) firm environmental protection plans and strategies, (9) bank loans related to environmental protection, and (10) other environmental-related information.

Following prior studies (Patten, 1992; Wiseman, 1982), different points are assigned for disclosure level. For a typical environmental risk, if company annual report provides specific information and monetary impact of environmental risk it will score 3; if the report provides specific information about environmental risk but no monetary information provided it will score 2, if the disclosure is a generic statement of company's environmental exposure it will score 1, and if the report contains no discussion on environmental disclosure it will score 0. This is done for each of the ten disclosure areas and then aggregated to obtain an overall EID score.

3.2.2. Multivariate Framework

Investment to cash flow sensitivity equation is specified as follows:

$$Investment = \beta_0 + \beta_1 CF * EID + \beta_2 CF + \beta_3 EID + \sum \beta_i Controls \quad (1)$$

Investment is change in the ratio of investment in plant and equipment to total assets. Cash flow (CF) is the ratio of earnings before extraordinary items and depreciation to total assets. β_1 is expected to be negative if EID lowers the sensitivity of investment-cash flow and β_2 is expected to be positive, indicating a positive cash flow sensitivity of investment.

Control variables in equations (1) are described as follows. Size is measured as the natural log of total assets. Current ratio is computed as current assets over current liabilities. ROA is net income over total assets. Net cash flow from investing activities is net cash flow from investing activities scaled by total assets. Administration is assigned to a value of 1 for a company under the central administration of the Central People's Government, or a value of 2 for a stated-owned but not under the central administration company, or 3 for a non-state-owned company. Operation is a measure of the firm's operating environment which ranges from 1 to 5 with 1 poor and 5 the best. Interest coverage ratio is earnings before interest and taxes divided by interest expenses. Year dummies are also included to control for year effects. As shown in the descriptive statistics presented in Table 1, EID ranges from 0 to 18. EID has mean values of 2.32 for the pre-MDEI period and 5.04 for the post-MDEI period, while the median values are 1 and 4 for the pre-MDEI period and the post-MDEI period, respectively. Our results suggest an increase in environmental disclosure after the implementation of MDEI.

Table 1: Summary Statistics of Variables

	Variable	Mean	Median	Std Dev	Minimum	Maximum
Pre-MDEI	Investment	0.05	0.04	0.09	-0.16	0.24
	EID	2.32	1	2.69	0	18
	Cash Flow	0.06	0.06	0.06	-0.05	0.17
	Size	0.02	0.02	0	0.02	0.03
	Current Ratio	1.47	1.22	0.83	0.58	3.85
	ROA	0.03	0.03	0.07	-0.53	0.56
	Net Cash Flow from Investing Activities	-0.07	-0.06	0.06	-0.21	0.02
	Administration	2.08	2	0.72	1	3
	Operation	2.91	2.93	0.22	0	3.16
	Interest Coverage Ratio	0.01	0	0.01	-0.03	0.05
Post-MDEI	Investment	0.03	0.03	0.09	-0.24	0.19
	EID	5.04	4	4.24	0	18
	Cash Flow	0.04	0.04	0.07	-0.08	0.17
	Size	0.02	0.02	0	0.02	0.03
	Current Ratio	2.95	1.7	2.96	0.68	11.81
	ROA	0.07	0.07	0.04	0.01	0.17
	Net Cash Flow from Investing Activities	-0.07	-0.06	0.06	-0.23	0.02
	Administration	2.31	2	0.77	1	3
	Operation	3.1	3.09	0.2	0	3.38
	Interest Coverage Ratio	0.01	0.01	0.03	-0.02	0.11

Note: The sample consists of 1,733 firm-year observations for the pre-MDEI period and 3,046 firm-year observations for the post-MDEI period.

3.2.3 Alternative Measure of Environmental Information Disclosure

To ensure our environmental information disclosure measure is robust, the environmental information disclosure horizons (EID time) is used as an alternative measure (Darrell and Schwartz (1997)). If the disclosure reports only the present information, it receives 1 point; if its information is about the future environmental risk, it receives 2 points; if it compares the future and present environmental risk, it receives 3 points. The scores for all environmental disclosure are then aggregated to obtain a disclosure horizon score for each company.

4. FINDINGS AND DISCUSSIONS

Table 2 reports the regression results of investment-cash flow sensitivities before and after MDEI was implemented. As presented in table 2, the coefficient on EID*cash flow is insignificant in the pre-MDEI period. The findings suggest that before MDEI was implemented, disclosures about the environmental risks may be insufficient and unreliable and thus had no impact on the sensitivity of investment-cash flow. Next, the impact is examined of EID on investment-cash flow sensitivity in the post-MDEI period. As shown in Table 2, the coefficient on EID*CF is -0.0132 and is statistically significant at the 5% level. Our results suggest that after MDEI was implemented, environmental disclosure lowers the sensitivity of investment to cash flows. Furthermore, the coefficient on cash flow is positive and significant at 1% level for the post-MDEI, which is consistent with evidence presented in Fazzari et al. (1988).

Table 2: Sensitivity of Investment to Cash Flow before and after the Implementation of MDEI

Independent Variables	Pre-MDEI	Post-MDEI
	Investment	Investment
EID*Cash Flow	-0.0200 (-1.60)	-0.0132** (-2.36)
Cash Flow	0.0617 (1.37)	0.1660*** (4.39)
EID	0.0018* (1.69)	0.0014*** (3.13)
Size	11.0900*** (5.35)	10.6900*** (7.02)
Current Ratio	-0.0259*** (-10.50)	-0.0081*** (-14.28)
ROA	0.0790** (2.25)	-0.0109 (-0.26)
Net Cash Flow from Investing Activities	-0.3660*** (-11.57)	-0.3270*** (-13.74)
Administration	-0.0050* (-1.89)	-0.0016 (-0.78)
Operation	0.0023 (0.28)	0.0044 (0.57)
Interest Coverage Ratio	0.0883 (0.65)	-0.2680*** (-4.82)
Intercept	-0.1790*** (-3.62)	-0.2100*** (-5.14)
Year Dummies	Yes	Yes
Number of Observations	1,733	3,046
Adj R ²	0.2034	0.1885
F-value	41.18	65.23

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

The impact is further examined of EID on investment-cash flow sensitivity after the implementation of MDEI for firms in low-polluting and high-polluting industries. The regression analysis is repeated by breaking down our sample firms into high-polluting and low-polluting based on the CSRC (China Securities Regulatory Commission) industry classification and report our finding in Table 3.

Table 3 shows that the coefficient on EID*Cash Flow is -0.0075 and is insignificant for firms in low-polluting industries, while the coefficient on EID*Cash Flow is -0.0188 and is significant at the 1% level for firms in high-polluting industries. The findings suggest that only firms in high-polluting industries experience a decline in investment-cash flow sensitivity after the Implementation of MDEI. Also, the coefficients on cash flow are all positive and significant at 1% level for firms in the low-polluting and high-polluting industries. The results indicate greater sensitivities of investment-cash flow for firms in the high-polluting industries than for firms in low-polluting industries.

Table 3: Sensitivity of Investment to Cash Flow for Firms in Low-Polluting and High-polluting Industries after the Implementation of MDEI

Independent Variables	Low-Polluting	High-Polluting
	Investment	Investment
EID*Cash Flow	-0.0075 (-0.76)	-0.0188*** (-2.57)
Cash Flow	0.1380*** (2.58)	0.2070*** (3.75)
EID	0.0009 (1.24)	0.0016** (2.53)
Size	10.0700*** (4.60)	11.4100*** (5.29)
Current Ratio	-0.0080*** (-9.52)	-0.0083*** (-10.75)
ROA	-0.0658 (-0.98)	0.0165 (0.30)
Net Cash Flow from Investing Activities	-0.3570*** (-9.57)	-0.3010*** (-9.67)
Administration	-0.0048 (-1.57)	0.0013 (0.43)
Operation	-0.0035 (-0.20)	0.0081 (0.96)
Interest Coverage Ratio	-0.2680*** (-3.26)	-0.2590*** (-3.41)
Intercept	-0.1580** (-2.13)	-0.2500*** (-4.68)
Year Dummies	Yes	Yes
Number of Observations	1,380	1,666
Adj R ²	0.1740	0.1900
F-value	27.41	36.50

*, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4 reports the results of using EID_time as an alternative measure of environmental information disclosure quality. As shown in table 4, the coefficient on EID_time*Cash Flow is -0.0202 and is statistically significant at the 5% level in the post-MDEI period, which is consistent with the finding reported in Table 2. However, the coefficient on EID_time*Cash Flow is insignificant in the pre-MDEI period. The coefficient on cash flow is positive and significant in the post-MDEI period but not in the pre-MDEI period.

Table 4: Alternative Environmental Disclosure Quality Measure on Investment-Cash Flow Sensitivity before and after the Implementation of MDEI

Independent Variables	Pre-MDEI	Post-MDEI
	Investment	Investment
EID_time*Cash Flow	-0.0058 (-0.39)	-0.0202** (-2.43)
Cash Flow	0.0273 (0.63)	0.1670*** (4.42)
EID_time	0.0006 (0.38)	0.0021*** (3.18)
Size	10.9700*** (5.28)	10.8900*** (7.24)
Current Ratio	-0.0260*** (-10.54)	-0.0081*** (-14.27)

ROA	0.0817** (2.33)	-0.0111 (-0.26)
Net Cash Flow from Investing Activities	-0.3660*** (-11.54)	-0.3290*** (-13.84)
Administration	-0.0052** (-1.96)	-0.0017 (-0.79)
Operation	0.0030 (0.35)	0.0042 (0.55)
Interest Coverage Ratio	0.0775 (0.57)	-0.2680*** (-4.83)
Intercept	-0.1750*** (-3.53)	-0.2150*** (-5.27)
Year Dummies	Yes	Yes
Number of Observations	1,733	3,046
Adj R ²	0.2020	0.1886
F-value	40.84	65.28

The regression analysis is repeated for firms in low-polluting and high-polluting industries by using EID_time as a measure of disclosure quality. Table 5 reports the results. As shown in Table 5, the coefficient on EID_time*Cash Flow is negative and statistically significant at the 5% level for only high-polluting firms, which is consistent with the finding reported in Table 3.

Table 5: Alternative Environmental Disclosure Quality Measure on Investment-Cash Flow Sensitivity for Firms in Low- Polluting and High-polluting Industries

Independent Variables	Low-Polluting	High-Polluting
	Investment	Investment
EID_time*Cash Flow	-0.0130 (-0.89)	-0.0271** (-2.54)
Cash Flow	0.1430*** (2.62)	0.2020*** (3.72)
EID_time	0.0015 (1.32)	0.0023*** (2.60)
Size	10.0400*** (4.59)	11.8300*** (5.64)
Current Ratio	-0.0081*** (-9.54)	-0.0082*** (-10.69)
ROA	-0.0656 (-0.98)	0.0156 (0.29)
Net Cash Flow from Investing Activities	-0.3570*** (-9.56)	-0.3040*** (-9.75)
Administration	-0.0048 (-1.55)	0.0012 (0.40)
Operation	-0.0032 (-0.18)	0.0077 (0.91)
Interest Coverage Ratio	-0.2680*** (-3.27)	-0.2560*** (-3.37)
Intercept	-0.1590** (-2.14)	-0.2580*** (-4.88)
Year Dummies	Yes	Yes
Number of Observations	1,380	1,666
Adj R ²	0.1741	0.1900
F-value	27.43	36.50

5. CONCLUSION

For many developing nations, like China, environmental protection and economic development are often conflicting goals. However, as economic continues to grow, environmental failure and ecological disaster start to catch the attention of the public and government. New environmental policies and regulations are issued to hope to improve corporate environmental disclosure and regulate polluting firms. As a result, nations in emerging markets start to put more effort enforcing environmental policies and put more resources in protecting natural resources. However, for developing nations, given that the tradeoff between economic growth and environmental protection seems to be inevitable, the effectiveness of environmental policies in emerging markets is often a question. It is, therefore, important for stakeholders to examine how companies react to the increasing disclosure requirement and its impact on a firm's access to capital markets.

As shown in this study, environmental regulation in emerging markets is not just a façade. Instead, it has increased the quantity and quality of environmental disclosure, resulting in a positive impact on firm's access to capital markets. In particular, a lower investment-cash flow sensitivity is found after the implementation of MDEI in China. Our results support the notion that the greater the level of environment disclosure, the lower is the level of asymmetric information, which leads to a reduction in a firm's financial constraints. Furthermore, high-polluting firms experience in the decline of investment-cash flow sensitivity more significantly than low-polluting firms in the post-MDEI period. Our findings support the notion of greater government regulation in emerging markets to improve environmental information disclosure.

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