Economic Society and Humanities Vol. 1 No. 11, 2024

Ecological Civilization and Corporate Sustainability-Evidence from the Natural Experiment of Environmental Regulation "*the Opinion*"

Yin Yang[1,*], Bin Liu[2]
[1]*Business School, Southwest University of Political Science and Law, Chongqing, China*
[2]*School of Economics and Business Administration, Chongqing University, Chongqing, China*
**Corresponding Author.*

Abstract: **Taking advantage of the promulgation of environmental regulation "the *Opinion on accelerating the construction of ecological civilization*" (referred as the *Opinion*) in China in 2015, this paper conducts a difference-in-differences method to investigate the effectiveness of the environmental regulation on firm's sustainable growth by comparing Chinese pollution-intensive companies and other non-pollution-intensive ones. Our results show that the promulgation of the *Opinion* decreases the deviation degree of pollution-intensive companies' actual growth rate from its sustainable growth rate, compared to the control group. In another words, the *Opinion* promotes the firm behavior shift towards sustainable development, especially for pollution-intensive companies. In addition, after considering the regional differences in China, the positive effects of the *Opinion* on sustainable growth of pollution-intensive companies are only effective in regions with higher degree of ecological civilization and ones with relatively low GDP growth pressure.**

Keywords: Environmental Regulation; Sustainable Growth; China

1. Introduction

China has implemented an economic reform and opening up policy from 1978. Over the 40 years, China achieved great accomplishments in economy, which has turned the country into the world's second-largest economy. China's economy capacity was only 367.9 billion in yuan in 1978. Until 2017, the gross domestic product has reached 82.71 trillion in yuan. The annual average growth rate is 9.5 percent over the 40 years. What's more, the proportion of China's economy contributes to the global economy significantly increases from 1.8 percent in 1978 to 16% in 2017. China's economic miracle benefits from the 40-years reform and opening up policy. However, the outstanding achievements in the economic developments cannot cover up the serious environment deteriorations, which are typical during the rapid economic growth. According to the data released by the National Bureau of Statistics, the total amount of Chinese energy consumption has increased from 571.44 million to 4.49 billion tons measured by standard coal from 1978 to 2017. Excessive energy consumption brought great pressure on ecological environment, such as the increasingly tightening constraints of natural resource and increasing serious pollution problems, such as air pollution, depletion of fuels, energy crisis, and emission threats [1]. China gradually realized that environmental degradation would impose serious constraints on economic developments, especially the sustainable developments of the economy. In response, China issued a series of environmental regulations to address the guidelines about the environmental protections. Especially, in 2015, China documented a regulation on ecological civilization construction, which is referred to as the *Opinion on accelerating the construction of ecological civilization* (hereinafter as the *Opinion*). Unlike other environmental regulations, the *Opinion* has mapped out the detailed strategies about how to improve Chinese ecological civilization and how to integrate the construction of ecological civilization into all aspects of economic, political, cultural and social constructions. It sets high-priority, quantitative targets on

ecological civilization. More specifically, the *Opinion* aims at clarifying the government's supervisory functions and responsibilities, and urging enterprises to achieve the transition of production modes towards green and sustainable development. So, is the promulgation of the *Opinion* is a boost or suppression to the sustainable development of the enterprise? Furthermore, how does the *Opinion* affect enterprises when they located in places which have different levels of ecological civilization and economic development? This paper will take the advantage of the promulgation of the *Opinion* to investigate these questions.

With growing concerns about environmental threats on economic developments, an increasing number of researches have conducted to analyze the effects of environmental regulations on the macro-economy [2], local governments [3.4], and micro-enterprises. Considering the prominent role of enterprises in economic actives, recent studies focus on analyzing the effectiveness of environmental regulations from the perspectives of corporate competitiveness [5], technological innovations [6], firm exports [7], and so on. However, there are limited studies have examined the effect of environmental regulations on corporate performance especially from the view of a firm's sustainability. Olson and Pagano (2005) [8] defined the sustainable growth as the growth of the firm can achieve given existing financial and operating constraints. Thus, the firm's sustainable growth rate can be used to assess the firm's future development capability. Moreover, as a comprehensive evaluation of all aspects of the whole company, the firm's sustainable growth rate is helpful for the security analysis and valuation [9].

As mentioned earlier, the *Opinion* presents a framework of institutions to promote ecological civilization in China. In specific, it proposes the overall requirements, targets and expectations of ecological civilization. It emphasizes the important responsibilities of central and local governments and the role of enterprise in the process of achieving the ecological civilization, especially for the energy companies. Moreover, the ecological civilization plays a key role in achieving the sustainability for the whole country. Therefore, the *Opinion* might have greater influence on companies in pollution-intensive industries. Accordingly, the promulgation of the *Opinion* provides us a great research background to apply the difference-in-differences method(DID) to identify the impact of government policy on corporate long-term financial performance. In another words, we compare the changes of firms' sustainable growth before and after the promulgation of the *Opinion*, especially for companies in pollution-intensive industries, as these kinds of companies are most affected by the environmental regulations. In order to investigate our research questions, we set Chinese listed companies in pollution-intensive industries as the treatment group, and the ones in other industries as the controlled group. Based on the sample of Chinese listed companies during the periods from 2012 to 2017, we reach the following findings. First, compared to the periods before the promulgation of the *Opinion*, the deviation degree of actual sales growth rate from its sustainable growth rate for pollution-intensive firms is more likely to be reduced than the ones in non-pollution-intensive industries. The deviation degree measures the sustainability of the companies' firm. The larger the value, the lower of sustainable growth rate. In addition, we find that the institution effect of the *Opinion* on the corporate sustainable growth is more obvious in pollution-intensive companies located in provinces with higher degree of ecological civilization. Furthermore, we also find a reduced probability of pollution-intensive companies to response the call of the *Opinion* towards sustainable developments when the companies located in provinces with higher GDP growth pressure.

Several robustness checks are conducted to justify the findings. First, we apply the propensity matching score (PSM) method to establish pair companies between pollution-intensive and non-pollution companies in a 1:1 ratio. Then, considering the potential cross effect of other environmental regulations on corporate's sustainable growth, we resample the treatment group with companies that are resources utilizing but not polluted. Our results are still robust. After eliminating the year of 2015 when the Opinion is issued and the year 2014 to balance the research periods, our findings hold consistent.

This paper contributes to the existing

literatures in following ways. First, this paper sets out in a background of the promulgation of the environmental policy "the Opinion on accelerating the construction of ecological civilization", which enables us to apply the natural experiments method to analyze the effect of government policy on corporate performance. Our findings present empirical evidences about a positive effect of ecological civilization policy on corporate sustainable developments, which provide support for China to persist in system construction of ecological civilization.

Second, our study extends the recent literature about the effects of environmental regulations. Most of current studies which examine the effects of Chinese environmental regulations are focus on the corporate innovation, competitiveness, foreign direct investments, exports and so on. This paper puts forward a new perspective by combining the environment policy with corporate long-term growth, which suggests that environmental policies are an important driver to promote corporate towards sustainable developments.

Third, this study uses the deviation degree of a firm's actual growth rate from its sustainable growth rate as a depended variable to measure the corporate's sustainable development. This indicator significantly shows the firm's self-development ability, which is helpful for decision-making of stakeholders. Recently, most studies mainly focus on investigating the factors that could affect the corporate sustainability from the internal aspects. Our study sheds new lights on examining the possible exogenous impacts to corporate sustainable growth.

Last but not least, our paper also considers the regional differences which can influence the institutional impacts of environmental policy. Our findings suggest that regional differences in the levels of ecological civilization and GDP growth pressure do have significant impacts on the institutional effects of environmental policy to sustainable developments. Therefore, policy setters should pay more attention on the regional factors during the process of policy setting.

2. Literature Review and Research Hypothesis

2.1 Literature Review

Severe environmental problems threaten ecosystems and further restrict economic developments. In response, the government has constructed an environmental regulation framework in the expectations of reducing pollutions and improving environments. However, the effectiveness of environmental regulations has always caused debates between academics and policymakers, as the effectiveness depends on a variety of factors, such as the implementation of policies, the enterprise, the ecological awareness of society and so on. Recent studies have found the effects of environmental regulations on firms' strategy, production decisions, technological innovations, competitiveness and exports. Henriques and Sadorsky (1996) [10] found that regulations played important roles to push firms in Canada to elaborate a strategy of environmentally friendly development. Porter and Linde (1995) suggested that strict environmental regulations can improve production efficiency by promoting innovation, which won't harm economic performance, but also bring economic benefits [11]. Moreover, they argued that properly designed environment standards could improve competitiveness through "innovation offsets". In another words, firms can offset the part or more than full of compliance cost of meeting environmental regulations. Based on the samples from the oil refineries of the Los Angeles Air Basin, Berman and Bui (2001) found that the effect of air quality regulation had positive effect on promoting innovation [12].

However, some studies proposed different opinions. For example, Gray (1987) [13] found a negative relationship between regulation and productivity growth. He found that the effect of regulation on the productivity slowdown was larger than previous studies, the possible explanation was due to the relatively high regulation faced by manufacturing companies. Hatakeda et al. (2012) [14] analyzed the relationship between the greenhouse gas emission and a firm's profitability in Japanese manufacturing industries. They found that the adoption of environmental regulation ISO 14001 in Japan didn't sufficiently trigger firms to reduce emissions.

The reasons for inconsistent conclusions were due to the different innovations abilities and

different types of environmental regulations [6]. Bynde (2004) [15] found a reduced efficiency of environmental regulation in the agriculture and agro-processing sector but improved efficiency in the manufacturing sector. Milliman and Prince (1989) [16] divided the environmental regulations into five categories: direct controls, emission subsidies, emission taxes, free marketable permits, and auctioned marketable permits. They concluded that emission taxes and auctioned permits provided the highest firm incentives to promote innovation, while direct controls provided the lowest relative firm incentives to promote technological change. Williams (2012) [17] classified environmental regulations into two types, command-and-control regulation and incentive-based regulation (voluntary norms regulation or economic instruments and soft instruments). Zhao et al. (2015) [5] divided Chinese environmental regulations into command and control regulation and market-based regulation, which found that both types of regulations promoted firm's green transition, and improve firm competitiveness. However, different types of regulations showed different impacts on firm specific behaviors. Shi and Xu (2018) [18] took advantage of China's eleventh Five-Year plan to investigate the effect of environmental regulation on exports for Chinese listed companies. They found that companies in more pollution-intensive industries, or faced stricter environmental regulation would reduce the probability to export and the volume of exports. Yuan and Xiang (2018) [19] provided evidence that environmental regulations in China have promoted the improvements of labor productivity, energy efficiency and environmental efficiency in manufacturing in the short term. However, in the long term, the regulations only have impacts on energy efficiency.

After reviewing above literatures, we find there are few studies explore the relationships between environmental policies and corporate performance, especially about a firm's sustainable growth. Sustainable growth refers to the highest growth the company can achieve without issuing new shares or changing existing financial policies [20]. If the sales growth is inconsistent with the established financial objectives, it may lead to the detriment of the firm's financial soundness or make the firm to change its operations.

2.2 Hypothesis Development

As mentioned earlier, the *Opinion* displays the importance of carrying out ecological civilization in China. It proposes the instructions on the property right system for the natural resources, ecological compensation system and ecological evaluation system. It also clarifies the overall requirements, objectives, visions and tasks on the ecological civilization constructions to achieve the sustainable developments in the economy and the whole society. To achieve the goals stated in the *Opinion*, enterprises play an important role as the main participants.

According to legtimacy theory, firms have implicit social contracts with the societies in which they operate [21]. A company can sustain its operations by adhering to social constraints and norms and meeting societal expectations. Meanwhile, stakeholder theory holds that companies bear economic, social and environmental responsibilities. The company is urged to meet the expectations from the society and take the social responsibilities. With the promulgation of the *Opinion*, Chinese companies would take their social responsibilities for ecological civilization construction and build a business system that is consistent with the value system of ecological civilization construction, in further to achieve the goal of continuous operations. Moreover, for the companies that solely pursue the maximization of shareholders' interests, the *Opinion* would increase the social responsibilities of enterprises to other stakeholders, and further mitigate the problems of overinvestment or underinvestment happened during the process.

Therefore, this paper emphasis on investigating whether there exists significant effect of promulgation of the *Opinion* on Chinese companies, whether the regulation promotes sustainable developments of the companies. We will conduct empirical analyses to examine the effects of the environmental regulation on the sustainable growth of the companies. In the next section, we will propose our research design.

3. Research Design

3.1 Variables Definition

3.1.1 Sustainable Growth Rate (SGR) and depended variable

Higgins (1977) [20] introduced a sustainable growth model assuming that one company can use its retained earnings and debt financing to meet its growing demand without issuing new equity. Without raising any new shares of common stock, the company prefers to maintain a target capital structure and dividend policy. This can be rational that firms are reluctant to issue new equity to support its growth because of high transaction costs, dilution of ownership control and initial negative stock price effects [22]. Therefore, Higgins (1977) [20] develop a sustainable growth rate in sales with the company's indicated combination of profit margin, asset-to-sales ratio, leverage ratio and payout ratio obtained from financial statements. Consequently, the sustainable growth model is stated as follows:

$$SGR = \frac{m(1-d)(1+\frac{D}{E})}{\frac{A}{S} - m(1-d)(1+\frac{D}{E})}$$

However, since $1+\frac{\mathrm{D}}{\mathrm{E}}=\frac{\mathrm{E}}{\mathrm{E}}+\frac{\mathrm{D}}{\mathrm{E}}=\frac{\mathrm{A}}{\mathrm{E}}$

The sustainable growth model can be simplified as:

$$SGR = \frac{m(1-d)\frac{A}{E}}{\frac{A}{S} - m(1-d)\frac{A}{E}}$$

Where

m=net profit/sales revenue

d=total dividends /net profits

D= total liabilities

E= total shareholders' equity

A=total assets

S=total sales revenue

SGR represents the estimated company's sustainable growth rate with its indicated historical financial ratios. If the company's actual growth rate (AGR) differs from the estimated sustainable growth rate (SGR), one or more financial ratios should be adjusted. For example, if AGR is larger than SGR, the company needs to improve the efficiency of assets or alter its financial policies [9]. Therefore, the difference between estimated sustainable growth rate and the actual growth rate captures the sustainability of the company, the larger the value, the worse the sustainability of the company. Following by the measurement methods applied in Cao et al. (2018) [23], we construct an index Deviation as the measure of difference between AGR and SGR. Deviation is our depended variable.

3.1.2 Independent variable

To examine whether the regulation Opinion influences companies' sustainable growth, we apply a difference-in-differences (DID) research design. Thus, we first establish a treatment and control group to execute the DID design. The treatment group includes companies in pollution-intensive industries those are most affected by the regulation, such as from mining, beverage manufacturing, textile, foodstuff manufacturing, manufacturers of clothes and other fiber products, manufacturing of leather, fur, and other products, paper making and paper products, printing, oil processing and refining, chemical material and products manufacturing, medicine manufacturing, chemical fibres manufacturing, rubber and plastic manufacturing, non-mental mineral products, ferrous metal foundries and presses, non-ferrous metal foundries and presses, metal products, and waste resources comprehensive utilization, electric power, steam and hot water production and supply. The control group includes companies those are excluding from above industries and the financial industry. We construct the variable Pollution to indicate the impact of the Opinion on pollution-intensive industries. If the company belongs to treatment group, Pollution equals to one, otherwise equals to zero. The Opinion was first introduced in 2015. Then, we define the variable Post equals to one if the firm is in 2015 and subsequent years, and 0 otherwise.

3.2 Models Design and Sample Selection

3.2.1 Difference-in-differences regression model

To estimate the impact of the environmental regulation on firm's sustainable growth, we establish the following regression model, modified by a difference-in-differences methodology:

$$Deviation = \alpha_0 + \alpha_1 Pollution + \alpha_2 Post + \alpha_3 Pollution * Post + \alpha_4 Size + \alpha_5 Lev + \alpha_6 Roa + \alpha_7 Cfo + \alpha_8 Age + \varepsilon_{it} \quad (1)$$

In the model, *Deviation* is the proxy refers to the deviation degree of companies' actual growth rate from its sustainable growth rate. Greater values indicate the less sustainability of the company. *Pollution* is a dummy

variable equal to one for firms that belong to pollution-intensive industries. Post is a dummy variable equal to one after the *Opinion* is employed. The intersection variable *Pollution*Post* measures the institutional effect of the *Opinion* on a particular measure of sustainable growth by comparing the treated companies with control ones before and after the regulation is promulgated. Following priors studies, we apply several variables to control for the firm-level characteristics, such as firm size (*Size*), financial leverage (*Lev*), profitability (*Roa*), operating cash flows (*Cfo*) and firm age (*Age*). All definitions and calculations are illustrated in Table 1.

Table 1. Summary of Variable Definitions

Category:	Variables:	Definitions:	Calculations:
	SGR	Sustainable growth rate	=[m*(1-d) * A/E]/[A/S-m * (1-d) * A/E]
	AGR	Actual growth rate	= (sales revenue at current year – sales revenue at previous year)/ sales revenue at previous year
Depended variables	*Deviation*	Deviation of actual sales growth from sustainable growth	$= \frac{\lvert AGR_{t,t} + SGR_{t,t-1} \rvert}{\lvert AGR_{t,t} \rvert + \lvert SGR_{t,t-1} \rvert}$
Independent variable	*Pollution*	Effect of Chinese environmental regulation on firm	An indicator variable that takes one if the firm belongs to the treatment group
	Post	Time effect of environmental regulation	An indicator variable that takes 1 if all firm-year observations that occur during and after 2015
Control variables	*Size*	Firm size	Ln (total assets)
	Lev	Financial leverage	Total liabilities/ total assets
	Roa	Return on assets	Net profits/ total assets
	Cfo	Net cash flows from operating activities	Operating net cash flows/total assets
	Age	Firm age	Ln (year-IPO_year)

To identify the institutional effect of the Opinion on sustainable developments of companies, we focus on the coefficient α3 in model (1). A significantly positive coefficient of α3 is expected, which suggests after the promulgation of the Opinion, deviation degree of pollution-intensive companies between actual sales growth and estimated sales growth is decreased. That is to say, the Opinion promotes the sustainable development of pollution-intensive companies.

3.2.2 Sample selection

The initial sample was comprised by all Chinese A-share listed firms in nonfinancial industries from the fiscal year of 2012 to 2017. The *Opinion on accelerating the construction of ecological civilization* was issued in 2015. In order to explore the institutional effects of this environment regulation, we use difference-in-differences model based on panel data starting from 2012. We divide the initial samples into treatment and control groups according to industry classifications defined by the 2012 edition of China Securities Regulatory Commission (CSRC) industry code. Manufacturing companies were further classified based on the secondary industry code. Next, we exclude observations with missing data and ST/PT tags. Finally, we get 13320 firm-year observations. There are 4900 observations in treatment group and 8420 observations in control groups. The sample distribution is shown in Table 2. As is shown in Table 2, approximately 69.26% of samples belong to coal mining and dressing, manufacturing and energy industries. Moreover, considering the firm-level characteristics between treatment and control samples may influence the validity of DID estimation, we reconstruct the research samples by using propensity score matching (PSM) method depending on firm size. We get 9732 firm-year observations in PSM samples, and report our research results with PSM samples in the robust analysis. All necessary data come from China Stock Market & Accounting Research (CSMAR) database and Wind database. Eliminating the effect of extreme values, we winsorize all continuous variable at 1 percent and 99 percent levels. We

use STATA analysis software to process data and test our hypothesis.

Table 2. Sample Composition by Industry

	Industry	Treatment Samples	Control Samples	Percentage
A	Agriculture	0	207	1.55%
B	Coal mining and dressing	354	0	2.66%
C1	Manufacturing	726	192	6.89%
C2	Manufacturing	2298	133	18.25%
C3	Manufacturing	1038	3782	36.19%
C4	Manufacturing	0	219	1.64%
D	Electric power, steam and hot water production and supply	484	0	3.63%
E	Construction	0	371	2.79%
F	Wholesale & Retail	0	833	6.25%
G	Transport, warehousing and postal service	0	471	3.54%
H	Hotel and catering industry	0	55	0.41%
I	Information transmission, software and information technology services	0	740	5.56%
K	Real estate	0	725	5.44%
L	Commerce service	0	154	1.16%
M	Scientific research and technology services	0	78	0.59%
N	Ecological protection, environment and public facilities management	0	145	1.09%
P	Education	0	6	0.05%
Q	Hygienism	0	27	0.2%
R	Culture, sports and Entertainment	0	168	1.26%
S	Comprehensive	0	114	0.86%

4. Descriptive Analysis and Regression Results

4.1 Descriptive Statistics

The results of descriptive analysis and unvariate analysis were displayed in Table 3. As is shown in Panel A of Table 3, we find that the minimum amount of Deviation is 0.02 both in treatment and control samples, and the maximum amount is 1. Thus, it shows great differences in the deviation of sustainable developments among listed companies in treatment group and control group. We also find that the means of firm-level factors show little differences between treatment group and control group during the selected sample periods. In addition, an unvariate analysis is undertaken to test whether the means of *Deviation* in the DID sample are significantly different. In Panel B of Table 3, the mean of Deviation for the treatment group during the post-issuance period is significantly larger than that in the pre-issuance period (the t-value is 1.89 with 10 percent significant level). However, there are no significant differences between the means of *Deviation* for the control sample during the two periods. Therefore, our preliminary results show that the *Opinion* does have significant effects on companies' sustainable development, especially for pollution-intensive companies.

Table 3. Descriptive Statistics and Unvirate Analysis Results

Panel A: Descriptive Statistics by treatment and control group							
	Variables:	Obs	Mean	St.Dev.	Min	Median	Max
Treatment	*Deviation*	4900	0.690	0.320	0.0200	0.800	1
	Size	4900	22.26	1.250	19.12	22.07	25.69
	Lev	4900	0.430	0.210	0.0500	0.420	1.060
	Roa	4900	0.0400	0.0500	-0.220	0.0300	0.200
	Cfo	4900	0.0600	0.0700	-0.200	0.0500	0.260
	Age	4900	2.210	0.710	0.690	2.400	3.140
Control	*Deviation*	8420	0.680	0.320	0.0200	0.770	1

	Size	8420	22.22	1.270	19.12	22.08	25.69
	Lev	8420	0.450	0.210	0.0500	0.440	1.060
	Roa	8420	0.0300	0.0500	-0.220	0.0300	0.200
	Cfo	8420	0.0300	0.0700	-0.200	0.0300	0.260
	Age	8420	2.120	0.760	0.690	2.200	3.140
Panel B: Unvariate Analyis							
		Means				Test of Difference	
		Pre		Post			
Deviation	*Treatment*	0.694		0.677		0.0170 (1.89*)	
	Control	0.672		0.673		-.0011 (-0.166)	

4.2 Regression Results

Table 4 presents the regression results for answering our question about the institutional effectiveness of the Opinion. The coefficient of variable Pollution is significantly positive (the coefficient is 0.026, t-value is 2.68), suggesting that pollution-intensive companies are more inclined to deviate from sustainable growth than non pollution-intensive companies before the issuance of the Opinion. However, with the promulgation of Opinion, pollution-intensive companies experience a significant decrease in the deviation degree of sustainable growth, relative to the non-pollution-intensive companies. The coefficient of Pollution*Post is -0.019 (t-value is -1.68), which is significantly negative at 10 percent level. Based on above results, we find that the Opinion brings positive effects on the sustainable development for pollution-intensive companies, which supports our expectation.

Table 4. Environmental Regulation and Corporate Sustainable Developments

Variables	Depended Variable: *Deviation*	
	Coefficients	t-value
Pollution	0.026***	(2.68)
Post	0.011	(1.53)
*Pollution*Post*	-0.019*	(-1.68)
Size	-0.018***	(-5.44)
Lev	-0.148***	(-7.61)
Roa	-1.663***	(-18.04)
Cfo	-0.310***	(-6.77)
Age	0.019***	(4.83)
constant	1.175***	(17.50)
N	13320	
adj. R^2	0.082	

Note: This table reports the empirical results with the difference-in-differences model. Robust t-statistics clustered by firms are reported in parentheses. ***, **, *show the significance at 1 percent, 5 percent and 10 percent level. See Table 1 for variable definitions.

4.3 Additional Analyses

4.3.1 Comparison of regional differences in ecological civilization constructions

The degrees of economic, cultural and environmental developments in regions of China are discrepant. Thus, we conduct a further test to analyze whether the effects of the *Opinion* on company's sustainable growth for pollution-intensive companies are different among regions across China. To investigate the impacts of the *Opinion* on companies' sustainable growth in regions with different levels of ecological civilization constructions, we designate a group test. Specifically, based on the regional green development index rankings published in *Bulletin on Annual Evaluation of Ecological Civilization Constructions*, we divided our original samples into two groups that represent companies located in regions with high degree of ecological civilization constructions and low degree of ecological civilization constructions, respectively. Companies located in the top 10 of rankings will belong to the subgroup of high degree of ecological civilization constructions. The top 10 regions are Beijing, Fujian, Zhejiang, Shanghai,

Chongqing, Hainan, Hubei, Hunan, Jiangsu and Yunnan. Companies in the rest regions are subject to low degree of ecological civilization constructions. To test this group analysis, we focus on comparing the regression results of model (1) between the two subgroups. The Column (1) and Column (2) of Table 5 reports the results. The coefficient of variable *Pollution*Post* in Column (1) of Table 5 is significantly negative at 10 percent significance level. On contrast, the coefficient of *Pollution*Post* in Column (2) is proved to be not statistically significant. The results of Table 5 show that the positively institutional effects of the *Opinion* on sustainable development of pollution-intensive companies are only effective in regions with higher degree of ecological civilization constructions after the promulgation of the *Opinion*.

4.3.2 Comparison of regional differences in GDP growth pressure

Economy developments, especially local economic performances, have significant impacts on environmental constructions. On the other hand, political incentives of local officials also influence local economic growth. Chinese provincial official's promotion is correlated with its provincial economic ranking. Better economic performance would increase the likelihood of the provincial leaders' promotion and decrease the likelihood of their termination [24]. China has imposed the "Championship system" of GDP for a long time, which taking GDP growth as an important indicator to assess the performance of local officials. Under this circumstance, when local governments suffer great pressure on improving GDP growth, local officials may have greater incentives to urge companies to increase sales to boost local economic performance, even though at the cost of environment. Therefore, we take an additional group test to examine whether the effects of the *Opinion* on sustainable developments of pollution-intensive companies will be different when companies located in regions with relatively high or low GDP growth. Following the measurement developed by Tang et al. (2010) [25], we first calculate the changing value of regional GDP growth using the data at the previous year and the year before. Then, we compare the regional changing value with the national average changing value of GPD growth rate. When the regional changing value of GDP growth is smaller than the national average changing value, the relative performance of this region is regarded as poor at the previous year. Consequently, it would place greater pressure on GDP growth at the current year. Based on the above measurement, we divide our samples into two groups, representing companies in regions with relatively high or relatively low GDP growth pressure. The regression results of group analysis are reported in Column (3) and Column (4) of Table 5. The coefficient of variable *Pollution*Post* in relatively low GDP growth pressure group is -0.032 and significant at 10 percent level. However, the coefficient of *Pollution*Post* in the relatively high group is not statistically significant. In another words, the institutional effects of the *Opinion* on decreasing the deviation degree of sustainable developments are only effective in pollution-intensive companies that located in regions when suffering relatively low GDP growth pressure.

Table 5. Tests of Regional Differences

	(1)	(2)	(3)	(4)
	Degree of Ecological Civilization		Relative GDP Growth Pressure	
	High	Low	High	Low
Pollution	0.031**	0.018	0.018*	0.033***
	(2.26)	(1.36)	(1.68)	(2.66)
Post	0.011	0.010	-0.001	0.041***
	(1.13)	(1.00)	(-0.11)	(3.27)
*Pollution*Post*	-0.029*	-0.012	-0.014	-0.032*
	(-1.77)	(-0.75)	(-1.01)	(-1.65)
Size	-0.023***	-0.013***	-0.023***	-0.011***
	(-4.55)	(-2.95)	(-7.22)	(-2.62)
Lev	-0.159***	-0.137***	-0.140***	-0.154***
	(-5.76)	(-4.90)	(-6.92)	(-5.40)
Roa	-1.747***	-1.595***	-1.810***	-1.382***
	(-12.65)	(-12.76)	(-23.16)	(-12.61)
Cfo	-0.313***	-0.312***	-0.290***	-0.339***
	(-4.72)	(-4.85)	(-5.88)	(-5.07)
Age	0.020***	0.018***	0.020***	0.018***

	(3.59)	(3.14)	(5.01)	(3.04)
Constant	1.281***	1.067***	1.276***	1.016***
	(12.73)	(11.72)	(20.12)	(11.54)
N	6689	6544	8687	4603
adj. R^2	0.091	0.074	0.096	0.061

Note: This table presents the regression results of how the degree of regional ecological civilization and regional GDP growth pressure influence the institutional effect of environment regulation on companies' sustainable development. Robust t-statistics clustered by firms are reported in parentheses. ***, **, * show the significance at 1 percent, 5 percent and 10 percent level. See Table 1 for variable definitions.

4.4 Robust Checks

4.4.1 Propensity matching sample (PSM)

In the earlier analysis, for each of the treated companies, we just select control companies that are not belong to pollution-intensive industries. To further mitigate the difference between the treated and control groups, we employ a matched sample estimation approach to identify the institutional effect of the *Opinion* on the sustainable developments of pollution-intensive companies. Specifically, we use propensity score matching method to make sure that the conclusions are robust. Following the propensity score matching method, each treated company is matched with the non-pollution-intensive companies that have the closest score given by the firm size and year. Then, we redo the regression analysis conducted earlier. The result with matched sample is presented in Table 6. As we have seen, the coefficient of variable *Pollution*Post* still shows significantly negative at the 10% significance level.

Table 6. Robust Test with PSM Sample

Variables	Depended Variable: *Deviation*	
	coefficients	t-value
Pollution	0.027**	(2.54)
Post	0.014	(1.58)
*Pollution*Post*	-0.023*	(-1.79)
Size	-0.014***	(-3.81)
Lev	-0.128***	(-5.72)
Roa	-1.615***	(-15.38)
Cfo	-0.290***	(-15.38)
Age	0.017***	(3.59)
constant	1.085***	(14.14)
N	9733	
adj. R^2	0.075	

Note: This table reports the robust result with the established PSM sample. Robust t-statistics clustered by firms are reported in parentheses. ***, **, * show the significance at 1 percent, 5 percent and 10 percent level.

4.4.2 Eliminating effects of other environment regulations

As mentioned earlier, China's safeguarding of the environment still lags behind its economic status, with prominent problems such as limited resources and severe pollution. China gradually realizes the importance of ecological environment protection. As the result, a series of legislative and administrative regulations have been released. For example, China issued the *Air Pollution Control Action Plan* (referred as the *Plan*) in 2013, which proposed the improvement of national air quality through five years' efforts. In addition, the *Environmental Protection Law* (revised) was introduced in 2014 and implemented in 2015, which is regarded as the strictest environment protection laws than ever, as it stipulated toughened penalties for pollutions and emphasized the role of public scrutiny and rights to sue liable parties. In 2015, the *Opinion* was also published, which emphasize on accelerating constructions of ecological environment, especially increasing utilization efficiency of natural resource and promoting high-quality economic developments. By comparing the above environmental regulations, the new *Environmental Protection Law* shows substantial effect on pollution relevant activities. However, the *Opinion* puts

more emphasize on improving utilization efficiency of natural resource and developing green economy. Therefore, the institutional effect of the *Opinion* would cover not only pollution companies but also other resource-utilization companies that may not pollute the environment. In order to mitigate the possible cross effects of environment regulations, we reconstruct the research sample through choosing companies whose main businesses are resource-relevant but do not belong to pollution-industries. We manually collect the data and finally get 330 firms which are fit for the criteria. Then, we follow propensity score matching (PSM) method and establish the matched treatment and control groups. Finally, there are 629 firm-year observations effective in the regression analysis. Similar to above analysis, our dependent variable is the deviation degree of company's actual growth from its sustainable growth. However, we add new variables (*Source* and *Source*Post*) in this analysis. *Source* is defined as one if the company belongs to resource-utilization one but is not part of pollution companies. *Source* Post* evaluates the institutional effect of the *Opinion* on the deviation of sustainable growth for resource-utilization companies after the issuance of the *Opinion*, which avoids the effects of other environment regulations. We expect a negative relationship between the *Opinion* and the deviation of sustainable growth. Table 7 presents the regression results. As is shown in the Table, the coefficient of *Source* is not statistically significant. On contrary, the coefficient of Source*Post is proved to be significantly negative at 5 percent level (value is -0.105 and t-value is -2.02). Taken them together, the results suggest that the *Opinion* do has institutional effect on companies' sustainable growth, especially for resource-utilization companies.

Table 7. Eliminating Effects of other Environment Regulation

	PSM Sample	
Variables	Coefficients	t-value
Source	0.054	(1.31)
post	0.035	(0.95)
*Source*Post*	-0.105**	(-2.02)
Size	-0.027**	(-2.09)
Lev	-0.188**	(-2.32)
Roa	-1.507***	(-3.78)
Cfo	-0.358*	(-1.83)
Age	0.039**	(2.00)
constant	1.321***	(4.87)
N	629	
adj. R^2	0.072	

4.4.3 Other robust tests

Considering that the institutional effect of the *Opinion* may be biased during the periods when the regulation is first implemented, we first delete observations happened in 2015. Then, we exclude observations that are in 2014 as to keep the balance of the data. In the end, the periods from 2012 to 2013 are defined as the pre-issuance periods and years from 2016 to 2017 belong to post-issuance periods. Our main results remain
robust after we redo the regression analysis. There are no obvious changes.

5. Conclusion and Policy Implications

This study investigates the effects of domestic environmental regulations on the firm's sustainable growth by taking advantage of China's promulgation of "the *Opinion on accelerating the construction of ecological civilization*". As a special deployment on the ecological civilization constructions, the *Opinion* is expected to boost the ecological civilization for the business groups and the society, and further improve the green developments of the economy. After applying a difference-in-differences (DID) method, we find that the promulgation of the *Opinion* decreases the deviation degree of the actual sales growth rate from the sustainable growth rate for the pollution-intensive companies. In another words, the *Opinion* promotes the sustainable developments of the companies. Considering the regional differences in

ecological civilization resulted from different capacity of natural resources and economic development, we conduct additional analysis and find that the positive impact of the *Opinion* on sustainable development is more efficient for pollution-intensive companies located in provinces with higher level of ecological civilization. Moreover, GDP growth is a substantial driver to influence the effectiveness of environmental regulations. In addition, we divide our original research samples into two sub-groups of relatively high and low GDP growth pressure. We find that the institutional effects of the *Opinion* are more obvious where the provinces that pollution-intensive companies located facing relatively low GDP growth pressure. We also take several robust tests to check our findings. We use a propensity matching scores method (PSM) to establish a one-by-one matched research sample between the treatment and controlled group. We find that there are no obvious changes in these robustness tests. Finally, in order to eliminating the possible cross-effect of other environmental regulations, we rebuild our research samples and redo the regression analysis. As expected, our results hold still and support our previous conclusions. In response, China should continue to promote the construction of ecological civilization, and guide corporations to establish a greener and more environmentally-friendly economic mode to achieve sustainable growth. In addition, the policymakers should pay more attention on the areas with relatively low level of ecological civilizations, strength the supervision for these areas, and promote the coordinated development of ecological civilization construction throughout the whole country. Furthermore, in order to increase the cooperation and efficiency of local governments to strength ecological civilization, environmental cadre evaluation can be introduced.

Acknowledgments

This paper is supported by Chongqing Social Science Planning Project (No. 2019BS070).

References

[1] Liu Y L, Li Z H, Yin X M. Environmental regulation, technological innovation and energy consumption- a cross-region analysis in China. Journal of Cleaner Production, 2018, 203:885-897.

[2] Bowen W. M., Park S., Elvery J.A. Empirical Estimates of the Influence of Renewable Energy Portfolio Standards on the Green Economies of States. Economic Development Quarterly, 2013, 27(4):338-51.

[3] Konisky D. M. Regulator Attitudes and the Environmental Race to the Bottom Argument. Journal of Public Administration Research & Theory, 2008, 18(2):321-44.

[4] Whitford A. B. Information and Uncertainty in Policy Implementation. Journal of Public Administration Research & Theory, 2014, 24(2):267-88.

[5] Zhao X L, Zhao Y, Zeng S X, et al. Corporate behavior and competitiveness: impact of environmental regulation on Chinese firms. Journal of Cleaner Production, 2015, 86:311-322.

[6] Zhao X, Sun B W. The influence of Chinese environmental regulation on corporation innovation and competitiveness. Journal of Cleaner Production, 2015, 112(4), 1528-1536.

[7] Shi X Z, Xu Z F. Environmental regulation and firm exports: Evidence from the eleventh Five-Year Plan in China. Journal of Environmental Economics and Management, 2018, 89, 187-200.

[8] Olson G. T., Pagano M. S. A New Application of Sustainable Growth: A Multi-Dimensional Framework for Evaluating the Long Run Performance of Bank Mergers. Journal of Business Finance & Accounting, 2005, 32(9-10).

[9] Brick I. E., Chen H Y, Hsieh C H, et al. A comparison of alternative models for estimating firm's growth rate. Review of Quantitative Finance & Accounting, 2016, 47(2):369-393.

[10] Henriques I., Sadorsky P. The Determinants of an Environmentally Responsive Firm: An Empirical Approach. Journal of Environmental Economics and Management, 1996, 30(3):381-395.

[11] Porter E.M., Linde V.C., Toward a new conception of the environment competitiveness relationship. Econ. Perspect, 1995, 9 (4), 97-118.

[12] Berman E., Bui L. T. M. Environmental Regulation and Productivity: Evidence

from Oil Refineries. Review of Economics and Statistics, 2001, 83(3):498-510.
[13]Gray W. B. The Cost of Regulation: OSHA, EPA and the Productivity Slowdown. American Economic Review, 1987, 77(77):998-1006.
[14]Hatakeda T., Kokubu K., Kajiwara T., Nishitani K. Factors Influencing Corporate Environmental Protection Activities for Greenhouse Gas Emission Reductions: The Relationship Between Environmental and Financial Performance. Environmental & Resource Economics, 2012, 53(4):455-481.
[15]Bynde M. Estimating the effects of environmental regulations on firm's competitiveness. Social and economic studies, 2004, 53:125-157.
[16]Milliman S. R, Prince R. Firm incentives to promote technological change in pollution control: Reply. Journal of Environmental Economics and Management, 1992.
[17]Williams C.R. Growing state-federal conflicts in environmental policy: the role of market-based regulation. Journal of Public Economics. 2012, 96: 1092-1099.
[18]Shi X Z, Xu Z F. Environmental regulation and firm exports: Evidence from the eleventh Five-Year Plan in China. Journal of Environmental Economics and Management, 2018, 89:187-200.
[19]Yuan B L, Xiang Q L. Environmental regulation, industrial innovation and green development of Chinese manufacturing: Based on and extended CDM model. Journal of Cleaner Production. 2018, 176:895-208.
[20]Higgins R. C. How Much Grow Can a Firm Afford? Financial Management, 1997(8):186-198.
[21]Deegan C., Samkin G. New Zealand financial accounting. McGraw-Hill, 2009.
[22]Cai X Q, Lu Yi, Wu M Q, Yu L H. Do environmental regulations drive away inbound foreign direct investment? Evidence from a quasi-natural experiment in China. J. Dev. Econ., 2016, 123-73-85.
[23]Li H, Zhou L A. Political turnover and economic performance: the incentive role of personnel control in China. Journal of Public Economics, 2003, 89(9):1743-1762.
[24]Tang X S, Zhou X S, Ma R J. Government intervention, GDP growth and local government overinvestment. Finance Review. 2010, 8:33-47.