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The Environmental Performance, Corporate Social Responsibility, and Food Safety of Food Companies from the Perspective of Green Finance

Xiang DENG[1], Junyu LU[2]

Abstract

In recent years, there have been frequent instances of environmental pollution in the Chinese food industry, and food safety incidents have aroused widespread concern. However, few empirical studies on the relationship among corporate environmental performance, corporate social responsibility, and food safety have been conducted. There is also a lack of targeted and effective interventions and solutions. To develop ways to resolve food safety issues, using the data from 77 listed food firms in China's Shanghai and Shenzhen A-share exchange market during 2006 to 2016, the relationships among the environmental performance of food firms, corporate social responsibility, and food safety were empirically analyzed, and the ameliorating effects of green finance acting as the intervention variable on corporate social responsibility and food safety for food firms were explored. Results show that the better the environmental performance of the food firm, the stronger the corporate social responsibility; furthermore, the stronger the corporate social responsibility and the better the environmental performance of the given firm, the less food safety incidents occur. Additionally, there is a correlation between the environmental performance of food firms and food safety. This indicates that strengthening supervision of the environmental performance of food firms may reduce the frequency of food safety issues. The implementation of green finance policy can also directly enhance the food safety by improving the environmental performance of food firms, and directly improve the food safety situation by raising corporate social responsibility. This study provides a significantly reference for decision-making with respect to strengthening internal controls on food safety in the food industry and to developing regulatory methods by food regulating authorities.

Keywords: environmental performance, corporate social responsibility, food safety, green finance.

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Introduction

In recent years, food safety issues in the Chinese food industry have been exposed frequently. With the "tainted Chinese milk powder scandal" (Xinhua, 2008), the "problematic yogurt incident" (China.com, 2011), the "toxic rice affair" (Nanfang Daily, 2013) and the "sea cucumbers raised on antibiotics incident" (Xi'an Evening News, 2014). Ever-increasing instances of dangerous food safety issues indicated the grim situation that Chinese food safety faces and have led to public reflection on the causes behind food safety issues. Many people are of the opinion that it related to food safety regulations, suggesting that if there are gaps in the regulatory system (Zhang & Sun, 2008), if implementation and accountability are lax (Wu, 2012), and the ability to enforce regulation is insufficient (Wang & Gu, 2014, 2014), there may be blind spots in food safety regulation. They recommended strengthening regulation as a means of resolving food safety issues. To address this situation, the Chinese government has adopted a series of food safety guarantees and regulatory actions, such as the *Food Safety Law* issued in 2009; the National Security Council Food Safety Committee was formed in 2010, the National Food Safety Risk Assessment Center was established in 2011, and the National Food and Pharmaceutical General Regulatory Administration was established in 2013. Although the food safety situation has seen substantial improvements, there are still several problems with food safety. The causes of food safety issues were analyzed by most scholars focused on the perspective of corporate social responsibility (Wang, 2009; Hua & Zhang, 2014). They recommend boosting corporate social responsibility and using ethical constraints as an approach to resolving food safety issues. However, these studies are mostly focused on theoretical discussion. The corresponding research arguments are not supported by empirical evidence, and the effectiveness of the solutions has not been verified. Therefore, we cannot help but reflect: The Chinese food industry is currently in the process of moving from guaranteeing food supply to guaranteeing food safety, so both the source of food safety issues and a solid resolution must be established.

The public, companies, and the government are the agents of social behavior; each behavioral agent is driven by the demands of its own interests, and as far as food safety issues, nevertheless, the environmental performance is the most difficult thing to be discovered and easiest to be neglected by regulators. In recent years, incidents of environmental contamination have been frequent in the food industry. Several food safety issues were due to the poor environmental performance of food firms themselves, which caused safety issues affecting food consumption (Economic Information Daily, 2015). There is an intimate relationship between the environmental performance of food firms and food safety. However, there is very little study addressing this issue, and current scientific results are mostly based on theoretical deduction (Lu *et al.*, 2015), and are not

supported by empirical testing targeted and effective interventions and solutions are also unclear. This study established the relationship between the environmental performance of food firms, corporate social responsibility, and food safety, and addressed the following questions: (1) Does the environmental performance of food firms and food safety reflect the level of corporate social responsibility and does social responsibility of food firms affect the environmental performance and food safety? (2) Is there a corresponding relationship between the environmental performance of food firms and food safety, and can strengthening the supervision of a company's environment activity increase food safety effectively? In addressing these two questions, this study took the food safety of food firms as the research objective. The linear regression analysis was used to build models of the relationship among corporate social responsibility, environmental performance, and food safety and attempted to clarify the mechanisms behind the effect of environmental performance on food safety. Furthermore, by considering the intervention variable of green finance policy, we used the corresponding conclusions to provide a reference point for decision-making via strengthening environmental regulation and improving the level of corporate social responsibility.

The structure of the study is arranged as follows: In Part 2, by reviewing existing literature, we propose the theoretical hypotheses for the relationships between corporate social responsibility and environmental performance, corporate social responsibility and food safety, environmental performance and food safety, and the implementation of green finance policies and food safety. In Part 3, we collect the relevant data, choose substitution variables for the research question, and construct relevant linear regression equations. Part 4 analyzes the empirical results of the linear regression equation and tests the research hypotheses. Part 5 addresses the test results from the perspective of green finance, the company's environmental performance, and interventions into food safety issues. In Part 6 the research conclusions and future directions are speculated.

Literature Review and Research Hypothesis

Relationship between the food industry's environmental impact and corporate social responsibility

The concept of corporate social responsibility has stirred controversy in academia since Sheldon (1923) first proposed in 1923. Carroll (1999) defined a given firm's social responsibility as the sum of society's expectations with respect to the organization's economic output, compliance with the law, ethical conduct, and philanthropy. In this study, a social enterprise is defined as a company that not only considers profits, stakeholders, and employees but also the customers, the

community, and the environment. Unlike the traditional principle by which the company only maximizes the own profits, social responsibility calls for the consideration of humanity in business and asks the company contribute to society and respect the environment and consumers (Lange, 2012; Whelan & Glen, 2012; Ait Sidhoum & Serra, 2017). In this way, the environmental impact of a company is an important factor in evaluation of a given corporate's level of social responsibility. Nonetheless, there are few researches about the corporate environment performance impact on the level of corporate social responsibility. By studying two incidents of environmental pollution, Xu, Lv & Wei (2013) found that deficiency in public awareness of the importance of the environment to be the main causes of the low corporate social responsibility among businesses. The operating model of multilayer corporate responsibility designed by Orr & Aviad (2016) treated a given firm's environmental performance as a very important factor to measure the level of corporate social responsibility. There is no doubt that a firm's environmental performance makes up a great deal of the corporate social responsibility. Especially poor environmental performance may damage a corporate's social responsibility level. Accordingly, the following hypotheses are put forward:

Hypothesis 1a: The environmental performance of a food firm exerts influence on the corporate social responsibility.

Conversely, is it possible for the company to continue the destructive behavior to the environment by improving the corporate social responsibility? There are few studies related to this topic, but there are studies focusing on the effect of corporate social responsibility on other factors. For example, some scholars have studied the impact of a corporate's social responsibility on employee job satisfaction (Liu, He & Zhang, 2013). Wang & Ni (2016) discovered corporate governance to have a significantly positive influence on the transparency of a given organization with respect to disclosing environmental information. Zhao, Song & Chen (2016) analyzed the operating conditions of listed companies in China's Shanghai and Shenzhen A-share markets from 2007 to 2009 and found that a company can lower the operating risk considerably by improving the ability to keep its promises to society. It is worthwhile to establish whether a company's environmental performance could be improved after the firm makes improvements to the corporate social responsibility. In this regard, we propose the following hypotheses:

Hypothesis 1b: Environmental performance can be positively affected by a given company's corporate social responsibility.

Relationship between food safety and corporate social responsibility

The companies in the food industry are not only responsible for the environment but also for the consumer health of the products. As a consequence, for food firms, the environmental performance and food quality are two factors that

illustrate the corporate social responsibility. The disclosure of food quality issues raises concerns about the company and products and can cause panic. Kong (2012) argued that consumers' concerns for corporate social responsibility in the food industry could be significantly influenced by the mounting attention given to corporate social responsibility-related events, and the food firms can reap long-term benefits by performing actions that strengthen the corporate social responsibility Zhao & Wang (2013) found that most consumers focus on company's food security issues, which is one important aspect of corporate social responsibility in the food industry, but the consumers do not pay attention to the level of corporate social responsibility of the given food firm. Food safety has a considerable influence on the corporate social responsibility of the food firm. When the incidence is disclosed, the rating of a corporate' social responsibility decreases. Accordingly, we propose the following hypotheses:

Hypothesis 2a: Food safety issues affect the corporate social responsibility level.

Some scholars have analyzed the food insecurity issue from the perspective of corporate social responsibility. Zhai (2013) argued that the insufficiency of the moral education leads to the food firms' ignorance with respect to public health and that the incompleteness of the credit system for food safety causes the high frequency of food quality problems. Zhang, Gao & Morse (2015) analyzed 161 food firms in the Henan Province and Wuhan City in China from the perspective of corporate social responsibility and risk management and found that companies with better corporate social responsibility performance experienced less risk than those with poor performance. As a result, the risk to food safety can be reduced when the company complies strictly with the corporate social responsibility. The following hypotheses are proposed:

Hypothesis 2b: The corporate social responsibility level of a food firm influences the food safety.

Relationship between food safety and the environmental performance of food firms

Environmental performance and product security are the main components of the social morality of a company, especially for the companies in the food industry. The food production process generates waste. Meanwhile, the raw material used in the production is likely to be affected directly by the polluted environment. Based on the information gathered by net crawler technology and sorted manually, *Table 1* summarizes the environmental performance and food security issues of 75 listed food firms in the Shanghai and Shenzhen A-share exchange market in China.

Table 1. Environmental performance and food safety of food industry from 2006 to 2016

Year	No. of firms	No. of firms with food safety scandals	No. of food safety scandals	No. of firms with environmental pollution	No. of environmental pollution events
2006	75	5	6	11	19
2007	75	3	3	12	21
2008	75	4	4	8	11
2009	75	7	9	8	13
2010	75	11	15	17	34
2011	75	14	26	11	28
2012	75	27	64	11	23
2013	75	22	39	17	31
2014	75	13	15	14	49
2015	75	19	24	15	98
2016	75	17	26	7	34

As shown in *Table 1*, the number of incidences of environmental pollution and the number of food safety issues have increased and these two have certain synergistic effects on one other. Liu (2006) pointed out that if the environment is sufficiently polluted, it becomes inevitable that some poisonous substance will enter the food product. Wang, Li, Li & Wu (2015) took the case of the food-originated disease outbreaks and the incidence of emergent pollution as indicators of food safety and environment pollution, respectively. They argued that these two indicators have an internal connection with each other. Székács, Wilkinson & Appel (2017) discussed the possibility of chemical and biological pollution in the cultivation of spices and herbs. They proved that environment pollution can poison our food, which increases the likelihood of disease. Thus, if the food safety issue originates from polluted environment, it can become necessary to resolve the pollution problems before improving food quality. So, can the disclosure of the environment pollution information and the environment detection solve the food safety problem to some degree? Accordingly, we put forward the following hypotheses:

Hypothesis 3: Environmental pollution by a given food firm and food safety are related, so reinforcing the environmental regulation can resolve food safety issues.

Effects of the implementation of green finance policy on corporate social responsibility

Corporate social responsibility is more of moral requirement than a matter of strict compliance law. It encourages the company to develop sustainably and show responsibility for protecting the environment. Most studies about improving a corporate's social responsibility come from the perspective of corporate

governance (Chen & Xu, 2011; Ruangviset, Jiraporn & Kim, 2014; Wanvik, 2016). Some researchers believed that corporate management (Jo, Song & Tsang, 2016) and equity structure (Esa & Zahari, 2016) affect the corporate social responsibility level. However, these are internal factors, and influence each other internally, so relying on a company's own management structure is not enough. The green credit standards of China's banking regulations committee specifically state that banks must offer smaller loans to companies with low corporate social responsibility and require higher interest rates for companies in the specific categories of severe pollution and high energy consumption. In doing so, the regulatory agency hopes that corporate will become more socially responsible. The green finance policy is here considered a government intervention strategy to study the effectiveness in raising company awareness of the importance of corporate social responsibility. After researching 10,803 companies across 25 countries, Feng, Wang & Huang (2015) found that companies scoring high in corporate social responsibility often receive low-costs in equity financing. This suggests that firms may perform better to acquire low-cost funding sources, which means this type of selective funding can give companies incentives to become more socially responsible. Wang (2016) reported that the implementation of green finance policy has reduced the extent to which the financial industry has invested in companies generating huge pollution since 2007 in China. The external financing activity of overproduction industries was found to continue after the policy was implemented. The following hypotheses are proposed:

Hypothesis 4: The implementation of green finance policy has positive effects on improving corporate social responsibility.

Influence of green finance policy on the food safety

The world has come to a mutual agreement regarding the benefits of green finance policy, and professionals in this field have accumulated years of experience. Most of the research focuses on the impact of green finance policy on the financial industry. Chami, Cosimano & Fullenkamp (2002) hypothesized that promoting the green finance policy not only improves the institution's reputation and satisfies the stakeholders but also helps companies better control the operating risk and make strategic decisions regarding development. Scholtens & Dam (2007) drew a comparison between financial institutions that adopted the equator principle and those that did not. They found that those who adopted the principle had a higher sense of corporate social responsibility and enjoyed a better reputation. Xiang (2016) researched the impact of the green finance policy on the external financing of the chemical industry in China. One of the contributions of the study is that it introduces green finance policy as the intervening strategy to empirically analyze the effect of the green finance policy as a way of improving food safety. To allow the activities of other departments to constrain the behaviors that lead to

food insecurity, the Chinese government published *2014 Food Safety Priority Work Arrangements* in 2014, which clearly linked food safety rating and credit financing and taxation to dishonest behavior and the associated constraints on food insecurity. Green finance policy is a precise example of how the financial industry can take food safety into consideration before making decisions on funding. The implementation of green finance policy can have a positive effect on the environmental performance of food firms. For some companies, improvement to the environment also promotes improvement in food safety and mitigates negative effects on food safety caused by the pollution of raw materials used in food production. Accordingly, this study makes the following hypothesis:

Hypothesis 5: Implementing green finance policy has a positive effect on food safety.

Data, Variables, and Methodology

Methodology

Based on previous assumptions and related research, the influence of green finance policy on corporate social responsibility (*CSR*) was assessed by using the variables of corporate food safety (*Foods*), corporate environmental performance (*Eper*), and green finance policy (*GF*). This was used to validate Hypotheses 1a, 2a, and 4. The model is defined as follows:

$$CRS = \alpha + \beta_1 Foods + \beta_2 Eper + \beta_3 GF + \beta_4 Contr + \mu_i \quad (1)$$

Where *Contr* is the control variables that is related to the operation variables of food firms, such as return on equity (*ROE*), asset-liability ratio (*Lev*), corporate equity structure (*CES*), and total assets (*Size*).

Second, we constructed formula (2) to examine Hypothesis 1b: whether corporate social responsibility (*CSR*) has an impact on the environmental performance (*Eper*) of the company. We constructed formula (3) to examine Hypothesis 2b to determine whether corporate social responsibility (*CSR*) has an impact on food safety (*Foods*).

$$Eper = \alpha + \beta_1 CRS + \beta_2 SDR + \beta_3 Contr + \mu_i \quad (2)$$

$$Foods = \alpha + \beta_1 CRS + \beta_2 SDR + \beta_3 Contr + \mu_i \quad (3)$$

Where *SDR*, a dummy variable, represents whether the corporate annual report disclosure according to *Sustainability Reporting Guidelines* issued by the Global Reporting Initiative.

Finally, we further discussed the factors affecting the safety of food firms by using the variables of environmental performance (*Eper*) and green finance policy (*GF*) to verify Hypotheses 3 and 5. The model is as follows:

$$Foods = \alpha + \beta_1 Eper + \beta_2 SDR + \beta_3 ESD + \beta_4 GF + \beta_5 Contr + \mu_i \quad (4)$$

Where *ESD*, a dummy variable, represents whether the corporate annual report disclosure is consistent with the *Environment and Sustainable Development Guidelines*.

Variable selection and measure

Corporate Social Responsibility Index. There are many methods of calculating the corporate social responsibility index, such as reputation evaluation index, quantitative analysis index, and questionnaire investigation. Sonnenfeld (1982) investigated corporate stakeholders to analyze corporate social responsibility awareness in forestry industry. Zhao, Sun & Zhao (2012) by setting industry employees as the main factor to calculate the corporate social responsibility index in the coal industry, uncovered a new direction for the comprehensive evaluation of corporate social responsibility. Businesses in different industries differ in corporate social responsibility measurement systems because of the particular characteristics of the specific industries, and a unified measurement index system has not yet been formed. In this study, we referenced the research of Qi (2013), which set the index system for food industry using five aspects-financial responsibility, legal liability, food safety, environmental responsibility, and charitable responsibility. These can be used to comprehensively evaluate corporate social responsibility in food firms. All variables and the index are shown in *Table 2*.

The index system includes 5 first-level indicators, 10 second-level indicators, 37 third-level indicators, 19 quantitative indicators, and 18 qualitative indicators. According to the Carroll corporate social responsibility pyramid model, we evaluated the characteristics of the food industry and constructed an analytic hierarchy process to calculate comprehensive corporate social responsibility scores. The main steps included establishing a hierarchical structure, analyzing each other indicators' relationships at different levels, and calculating the characteristic roots and vectors of the matrix.

Table 2. Food firm CSR index and weight

First-level indicators	Second-level indicators	Third-level indicators	Second-level indicators	Third-level indicators
Financial responsibility (0.3114)	Shareholder responsibility (0.1048)	Return on equity (0.0232)	Government responsibility (0.739)	Return on sale (0.0106)
		Dividends per share (0.0198)		Tax increase rate (0.0119)
		Dividend payout ratio (0.0272)		Rate of tax payment (0.0158)
		Profit growth rate (0.0156)		Government income rate (0.0276)
		Rate of capital accumulation (0.0190)		Tax rate of asset (0.0080)
	Creditor responsibility (0.0901)	Cash flow ratio (0.0143)	Employee Responsibility (0.0426)	Employee wage growth rate (0.0151)
		Asset-liability ratio (0.0318)		Employee income rate (0.0275)
		Interest coverage ratio (0.0166)		
		Current ratio (0.0274)		
Legal liability (0.2655)	Responsibility for rules and regulations (0.1066)	Observation of the employment injury insurance ordinance (0.0445)	Legal responsibility (0.1589)	Compliance with the Universal Declaration of Human Rights (0.0226)
		Establish a law-abiding compliance system (0.0141)		Compliance with the Labor Law of the People's Republic of China (0.0614)
		Tendency to conduct compliance training (0.0210)		Compliance with the People's Republic of China Consumer Protection Law (0.0749)
		Disclosure of negative information about compliance (0.0270)		

First-level indicators	Second-level indicators	Third-level indicators	Second-level indicators	Third-level indicators
Food safety responsibility (0.2173)	Institutional responsibility (0.0979)	Pass ISO9000 certification (0.0272)	Operating responsibility (0.1194)	Advertising compliance (0.0370)
		Pass HACCP management system certification (0.0295)		Safety and health control of raw materials (0.0824)
		Establishment of food safety accident emergency system (0.0079)		
		Attention paid to the nutrition of special needs consumers (0.0127)		
		Food health and nutrition balanced system (0.0206)		
Charity responsibility (0.0768)	Commonwealth responsibility (0.0460)	Public service activities (0.0207)	Donated responsibility (0.0308)	Donation ratio (0.0109)
		CSR project construction (0.0253)		Ratio of welfare employee (0.0199)
Environmental responsibility (0.1292)	Technology of reducing greenhouse gas emission (0.0342)			
	Carbon dioxide information disclosure system (0.0188)			
	Pass ISO9000 certification (0.0762)			

Corporate environmental performance. There is a lack of a standard definition and scoring criteria for the evaluation of corporate environmental performance, and few studies have been performed on this matter either in China or abroad. Lyv (2012) used excessive emissions of pollutants from specific businesses to assess the environmental performance. The commonly used Wiseman Index has several shortcomings, such as the oversimplified classification of environmental information, which can lead to inaccuracies in calculation, and the overemphasis on quantitative data and neglect of qualitative information. For this reason, according to the *National Standard of the People's Republic of China: Environmental Management, Environmental Performance Evaluation Guidelines (GB/T24031-2001)*,

we have defined corporate environmental performance as whether a given company discloses information relevant to pollution information, so the more pollution information a company discloses, the worse the environmental performance. We also introduced SDR, the factor addressing whether the corporate annual report is consistent with the *Sustainable Development Report and Guidelines* issued by Global Reporting Initiative, and ESD, the factor addressing whether the corporate annual report is consistent with the *Environment and Sustainable Development Guidelines*, as additional variables to evaluate corporate environmental performance.

Food safety. Food safety usually refers to whether foods are non-toxic, harmless, meet specific nutritional requirements, and do not cause any acute, subacute, or chronic harm to human health. In the process of collecting and processing the data, we found a specific phenomenon: Many food companies have food safety problems not only through the quality of the actual food quality, but also with packaging. Consumer injuries can be caused by food packaging problems, such as glass-bottled beer's bottle blast. For this reason, we defined food safety here as accordance with national compulsory standards and requirements covering planting, breeding, processing, packaging, storage, transportation, marketing, and consumption. The entire food supply process must be free of any possible poisonous or harmful material threatening human health that can lead to death or pose hidden dangers to consumers or the offspring.

In this study, we selected food security hidden dangers, food insecurity, substandard food quality, and disclosure of potentially scandalous information as substituted variables for food safety. Because there is no complete and accurate database of food safety information available for use, we used web crawler technology and manual collection from the news media reports and food safety supervision departments to identify research samples suitable for evaluation of Chinese food firms. Additionally, the frequency of food safety scandal disclosure was considered as the variable to measure the food safety of the food firms.

Green finance

In China, green finance related practices and policies started late. On July 30, 2007, to curb the high-energy consumption and pollution of the industrial sector, the Environmental Protection Administration, People's Bank, and China Banking Regulatory Commission jointly proposed a new credit policy regulations on implementation of environmental protection policies and credit risk prevention (hereinafter referred to as Regulations). Regulations provides credit limitations for companies and projects that do not comply with industrial policy and with environmental regulations and requires commercial banks to consider corporate environmental compliance as a prerequisite for approval of loans. To further promote the implementation of China's green finance policy, in 2011, the National

Development and Reform Commission issued the *Notice on Carbon Emissions Trading Pilot*. In 2013, Shanghai, Beijing, Guangdong, Shenzhen, Tianjin, Hubei, and Chongqing officially launched a carbon trading pilot program, the programs provide support and protection for green financial markets in China. For this reason, we selected 2007 and 2013, two milestone years in the development of green finance in China, to discuss the effects of green finance policy. Because of the lag between the announcement of a policy and enforcement, we selected 2008 and 2014 as the sample periods for time dummy variables indicating the effects of the green finance policy.

The features of management, operating capacity and other factors may lead to differences between food firms, so we introduced the firms' return on equity (ROE), asset-liability ratio (Lev), corporate equity structure (CES) and total assets (Size) as the control variables. All of these variables are illustrated in *Table 3*.

Table 3. Definition of the variables

Variables		Variable definition
Dependent variables	CSR	*CSR* score is calculated by using the corporate social responsibility index system of food firms in Table 2.
	Foods	Food safety is represented by the number of food safety issues disclosed per company, which indicates how many times it has been exposed to the public for food safety incidents in that year.
Independent variables	Eper	Environmental performance is represented by the number environmental disclosures per company, which indicates how many times it has been exposed to the public for environmental violation in that year.
	ESD	If the corporate annual report disclosure is consistent with *Environment and Sustainable Development Guidelines*, then the number is 1; otherwise, it is 0.
	SDR	If the corporate annual report disclosure is consistent with *Sustainable Development Report and Guidelines*, then the number is 1; otherwise, it is 0.
	GF	*GF* is represented by the green finance policy implementation years, which is divided into two periods, 2008 and 2014. Thus, *Y2008* means before 2008 the number is 0; otherwise, it is 1; *Y2014* means before 2014 the number is 0; otherwise, it is 1.
Control variables	Size	*Size* is the natural logarithm of the total assets of the company.
	CES	Equity nature of an enterprise, scored according to the nature of enterprise equity
	ROE	*Return on equity* is equal to a fiscal year net income divided by total equity.
	Lev	*Lev* is the leverage ratio, which is equal to total debt divided by the total equity.

Data and summary statistics

*Data sources.*This study evaluated publicly listed food firms in the Shanghai and Shenzhen A-share exchange market in China, many of which were involved in environmental regulation violations and food scandals from January 1, 2006 to December 31, 2016. In the research period, 77 companies were selected. From the net crawler technology and text analysis, 42 companies were identified as involved in environmental scandals, and 48 companies were identified as involved in food insecurity. The stock trading data, financial reports, announcement information, and stock market data were collected from the Institution of Public and Environmental Affairs, Resset Database, and GTA Database. STATA/SE 14.0 was used for data processing and empirical analysis.

Summary statistics. Table 4 reports the descriptive statistics of the variables in the multiple regression model from 2006 to 2016.

Table 4. Summary statistics of the variables

Variable	Mean	S.D.	Min	Median	Max	Obs.
CSR	32.4163	16.4980	0.55	29.45	91.72	576
Foods	0.3667	0.9899	0	0	12	630
Eper	0.6042	2.3464	0	0	31	614
SDR	0.2970	0.1699	0	0	1	606
ESD	0.2294	0.4208	0	0	1	606
Y2008	0.1327	0.9771	0	1	1	605
Y2016	0.3700	0.1948	0	0	1	605
ROE	21.7274	1.0898	-1.47	0.08	23.77	606
lev	2.0897	1.4108	0.02	0.35	1.28	591
Lnsize	0.7273	0.4456	19.24	21.57	25.45	825
CES	0.1818	0.3859	1	1	6	825

Table 4 shows that the *CSR* variance of food companies is 16.4980, indicating a large difference in corporate social responsibility among food firms. An average of about a third of food firms experienced food safety events, with the highest one having disclosed 12 times food safety scandals (*Foods*) in one year. Meanwhile, nearly two-thirds of food firms disclosed environmental pollution events (*Eper*), the greatest number being 31 events in a single year. It is easy to find environmental pollution events associated with food firms. People usually pay more attention to food safety issues than the environmental violation events of food firms, which is also the expressed purpose of this study, to guide people's concerns about the relationship between food safety and environmental performance. The mean of *SDR* was 0.2970, which indicates that nearly one-third of the financial reports of information disclosure by food firms were consistent with *SDR*. The mean of *ESD* was 0.2294, which means that nearly a quarter of the financial information disclosed by food firms was consistent with *ESD*.

Result and Analysis

Corporate social responsibility is defined as a dependent variable and used to discuss the degree of the role of corporate environmental performance, disclosure of food safety issues, and green finance policy intervention, respectively, on the overall sample and the problem sample companies, which here refers to the set of companies that have either environmental information disclosure records or disclosed food safety issues. *Table 5* summarizes the empirical results.

Table 5. Impact factor analysis of CSR

	Whole sample		Problem sample		Problem sample	
	Coef.	P > t	Coef.	P > t	Coef.	P > t
Foods	-1.3173	0.104	-1.2249	0.156	-1.1310	0.176
Eper	-0.2747	0.036	-0.7797	0.034	-0.7891	0.028
Y2008	-5.5143	0.022	-11.4788	0.012	-11.6468	0.009
Y2014	-0.4185	0.823	-0.2692	0.928		
ROE	0.9020	0.175	-0.6797	0.952		
lev	2.1620	0.604	2.2511	0.761		
CES	-0.2747	0.617	0.2277	0.801		
Lnsize	-2.6528	0.000	-2.0968	0.119	-3.2827	0.002
_cons	93.6062	0.000	85.7916	0.004	113.3022	0.000
No. Of obs	436		144		151	
R^2	0.0887		0.1479		0.1812	
Prob > F	0.0000		0.0048		0.0000	

Table 5 shows that both the whole sample model and the problem sample model pass the *F*-test (*Prob> F*= 0.0000), indicating that the model is reasonable. The explanatory variables of the problem sample model can better explain the explained variables (R^2 = 0.1479) than the whole sample, indicating that the problem sample *CSR* is more deeply affected by the explanatory variables than by explained variables. The regression results show that food safety events have a significant negative effect on *CSR*, especially in the whole sample model, the *CSR* of food insecurity firms is significantly lower than that of food safety firms. The number of environmental pollution disclosures (*Eper*) has a significant negative effect on the *CSR* of the companies, that is, the more environmental pollution information disclosure, the lower the *CSR* (*Eper*= -0.2747), and corporate environmental performance's negative impact on *CSR* was more significant (*Eper*= -0.7797). In the overall sample model, the coefficient of *Y2008* is significantly negative (-5.5143), indicating that with the implementation of green finance intervention strategy, environmental protection departments strictly investigate the corporate environmental pollution and improve pollution information disclosure, so the company's *CSR* index showed a significant decline. The *CSR* of the problem companies was especially pronounced (-11.4788). The

implementation of the green finance policy in 2014 also had a negative effect on the CSR index, but the estimated coefficient was not significant. This may be due to the insufficient size of the sample and implementation time of the policy. This matter is not discussed further in this work.

As shown in *Table 5*, the worse the environmental performance, the lower the corporate social responsibility score. The three regression models showed a negative correlation between food safety issues and the corporate social responsibility score, but these regression results did not show strong significance, indicating that the food safety disclosure of food firms in the index system of corporate social responsibility of the current food industry was not being taken seriously. A corporate social responsibility score could be low because of food safety or environmental issues or a combination of these, so the next step was finding a way to determine how to assess the score qualitatively. *Table 6* summarizes the empirical analysis of these results.

Table 6. Impact of CSR on food safety and environmental performance

	Foods		Eper	
	Coef.	P > t	Coef.	P > t
CSR	-.0046	0.096	-0.0140	0.020
SDR	0.8391	0.001	1.9915	0.000
Lnsize	0.1562	0.000	0.4371	0.000
_cons	-2.9267	0.002	-8.5722	0.000
No. of obs	448		448	
R^2	0.0959		0.1361	
Prob >F	0.0000		0.0000	

Table 6 shows that the level of corporate social responsibility has a significant negative effect on the food safety and environmental performance, indicating that the improvement of corporate social responsibility can reduce environmental pollution and food safety problems effectively, and the impact on corporate environmental performance is more pronounced. In addition, the *SDR* coefficients were significantly positive, indicating that the *Sustainable Development Report and Guidelines* can help companies improve food safety and environmental performance.

According to the regression analysis in *Tables 5* and *6*, environmental performance and corporate social responsibility are correlate to each other. Although corporate social responsibility has an impact on food safety, food safety's impact on corporate social responsibility is not very significant. We established which factors affect corporate food safety issues. *Table 7* shows the factors of food safety and the effect of green finance intervention on food safety.

Table 7. Impact factor analysis of food safety

	Whole sample		Problem sample		Problem sample	
	Coef.	P > t	Coef.	P > t	Coef.	P > t
Eper	-0.0060	0.737	-0.0895	0.003	-0.7756	0.006
ESD	0.1425	0.177	0.4864	0.067	0.5149	0.036
SDR	1.3584	0.00	1.7190	0.000	1.8276	0.000
Y2008	0.2415	0.018	0.7012	0.022	0.7033	0.017
Y2016	-0.0999	0.338	-0.2782	0.31	-0.2923	0.26
ROE	-0.2288	0.556	-1.7303	0.062	-1.3321	0.102
CES	-0.0085	0.762	-0.2257	0.777		
Lev	0.2792	0.173	0.2783	0.664		
Lnsize	0.1167	0.005	0.1160	0.336		
_cons	-2.5394	0.004	-2.0509	0.427	0.5182	0.05
No. of obs	591		185		193	
R^2	0.1319		0.2261		0.2091	
Prob > F	0.0000		0.0000		0.0000	

Table 7 shows that the regression models have all passed the *F*-test (*Prob>F*= 0.0000), indicating that these models are reasonable. However, the explanatory variables have a greater impact on the explained variable in the problem companies sample model than that in the overall sample model of corporate food safety (R^2 = 0.2261). *Eper* showed no significant effect on food scandals in the whole sample regression model, but in the problem sample regression model, *Eper* showed a significant negative effect on *Foods*. That is, the more environmental pollution information disclosed, the less likely there were to be problems with food safety. This indicates that strict monitoring of corporate environmental pollution is conducive to improving food safety and reducing the frequency of food safety incidents. *ESD* and *SDR* indicators are significantly positive, further verifying the conclusions drawn in Table 6. That is, concerns regarding corporate environmental information disclosure and sustainable development can help improve food safety. In addition, the coefficient of *Y2008* is significantly positive, which shows that the implementation of green finance policy and higher requirements on corporate environmental pollution information disclosure can bring more attention to food safety issues and disclose more food safety hazards. *Y2008* showed a profound impact on problem companies (0.7012). The coefficient of *Y2016* is negative, although not statistically significant, but reflects a trend which explains that with the implementation of the green finance policy, the frequency of food safety incidences associated with food companies has declined. This inference is verified in the problem sample regression model that eliminates the insignificant explanatory variables, see columns 6 and 7 in *Table 7*.

Discussion

Based on the analysis of the study above, all hypotheses except Hypothesis 2a are now supported by empirical analysis, which means that there is correlation between the environmental performance of food firms and corporate social responsibility with significant level. The level of corporate social responsibility can affect the food safety situation, and the environmental performance of businesses on food safety has a negative effect. The green finance intervention strategy can improve the environmental performance of businesses effectively, and enhance corporate social responsibility and food safety, but there is not a high degree of concern about the effect of food safety factors on food firms' corporate social responsibility.

Firstly, based on the empirical results shown in Table 5, the poorer the environmental performance of the food firms, the lower the corporate social responsibility score, indicating that if the firms place too much emphasis on short-term profitability and fail to pay attention to environmental performance, the CSR score may decrease. This verifies Hypothesis 1a, which is consistent with the conclusions drawn by Orr & Aviad (2016). The disclosure of food safety scandals in food firms does not have a significant impact on the corporate social responsibility score, which means that Hypothesis 2a is not validated. This empirical result shows that although consumers are very concerned with food safety issues (Zhao & Wang, 2013), the corporate social responsibility scoring system does not give the matter due consideration and attention. In Table 6, empirical results show that the food firms with strong corporate social responsibility in the daily operation and production process pay more attention to the environmental performance and food safety. In this way, improving the level of corporate social responsibility is an effective means of improving corporate food safety and the environmental performance of the firm. Hypothesis 1b and Hypothesis 2b are validated herein. Improving corporate environmental performance can improve corporate social responsibility, and improving corporate social responsibility can improve corporate environmental performance. The green finance policy of the implementation of this intervention strategy begins with environmental supervision of industry. This strengthens the supervision and management of environmental performance of firms and also guides businesses to pay attention to environmental protection and corporate social responsibility by restricting the external financing of those businesses. The effect of this intervention strategy, Hypothesis 4, is verified as shown in Table 5. It can be concluded that the green finance intervention strategy can improve the environmental performance of firms and improve the level of corporate social responsibility to promote food firms to improve food safety.

Secondly, Hypothesis 3 concerns the relationship between the environmental pollution by food firms and food safety. The empirical results shown in *Table 7*

demonstrate that the more environmental pollution information disclosed, the fewer food scandals are associated with the firm. In other words, more stringent monitoring of the existence of environmental pollution problems in food firms can enhance the quality of company effectively, thereby reducing the number of food insecurity events. This confirms the research reported by Liu (2006) and others that indicated that strengthening environmental supervision and improving the environmental performance of firms can improve food safety, reinforcing environmental regulation can solve food safety problems. The implementation of environmental-protection-related policies can fundamentally resolve some food safety issues caused by environmental pollution and damage. This idea has been validated in the implementation of the green finance intervention strategy (Hypothesis 5). That is, the green finance intervention strategy can be implemented by strengthening corporate environmental pollution supervision and disclosure of environmental information to advise government departments and consumers of food safety, to reduce the hidden dangers of food safety and to reduce the frequency of food safety accidents.

Thirdly, after confirming the relationship between the environmental performance of food firm, corporate social responsibility, and food safety, the green finance intervention strategy was introduced which based on the firms' environmental performance to regulate the access to external financing and encourage businesses to engage in environmental protection and improve environmental performance. This strategy reduces the pollution of raw materials that can cause food safety issues and also increase corporate social responsibility, which also urges firms to foster food quality and environmental performance under the more stringent control. In this way, the implementation of green finance policy has a positive role in promoting these three factors, and this confirmed the argument made by Labablt & White (2002) that green finance policy can improve the quality of the environment and shifting environmental risks.

In summary, the implementation of green finance policy can improve environmental performance and the corporate social responsibility of food firms effectively, which can fundamentally improve food safety. In this way, green finance policy intervention was shown to be an effective way to realize multi-stakeholders' win-win objectives, which can also facilitate sustainable development of both firms and society.

Conclusion

This study discussed the environment performance of food firms, corporate social responsibility and food safety issues by using data from 77 listed food firms in China's Shanghai and Shenzhen A-share exchange market from 2006 to 2016, and introduced green finance interventions. The study analyzed the mechanism by which the environmental performance of food firms affects food safety, and the following conclusions were drawn:

(1) The environmental performance of a food firm and corporate social responsibility affect each other mutually; thus, the worse a company's environmental performance, the lower corporate social responsibility rating. The worse a corporate's social responsibility, the worse the environmental performance; the stronger a corporate's sense of social responsibility, the safer the food it produces. However, the effect of food safety level on corporate social responsibility was not statistically significant. This shows that improving a company's environmental performance can raise the level of corporate social responsibility and improve the firm's food safety situation. (2) There is a negative correlation between the environmental performance of a firm and food safety, which indicates that strengthening supervision of a company's environmental performance can increase food safety effectively. (3) Green finance intervention strategies have a significant effect on the improvement of corporate social responsibility. (4) Green finance intervention strategies can also increase the food safety level of food firms. For this reason, we here propose that implementing green finance policy is an effective method of improving the environmental performance, corporate social responsibility, and food safety of food firms because the implementation of green finance policy can strengthen regulation of corporate environmental pollution, encourage companies to improve environmental performance by channeling the flow of funds, and reducing the rate of food safety incidents due to environmental contamination.

The conclusions here have important theoretical implications and practical value with respect to improving the environmental performance of food firms, increasing corporate social responsibility, and strengthening food safety. However, this study also has several limits. For example, because Chinese green finance policy has been in effect for only a short period, there has been relatively little disclosure of corporate environmental information and few observation data. With the disclosure of environmental information improves continually, sample sizes for future research may increasingly expand, and future studies could be conducted on the following two focal points: (1) the effect of increases in the corporate social responsibility of food firms on the financial performance can be further discussed. This would include the effects of corporate social responsibility on enterprise value, profitability, and financing. Moreover, whether the boosting effects of green finance intervention strategies on food firms can increase the

profitability of food firms is worth to evaluate in the future. (2) Because concrete information on the extent to which current green finance policy has been implemented is difficult to obtain, future studies of green finance policy should be more detailed. For example, the effect of green credit, green bonds, and other green financial tools that used in food firms can be evaluated in the future studies. At the same time, the efficiency of green funds can be assessed which may make the food safety issues of food firms solved out better.

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