

*Research article*

## **Green finance engagement: An empirical study of listed companies on Chinese main board**

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**Abstract:** Using textual analysis, this paper divides green finance into green initiatives and green business activities. The former discusses whether environmental initiatives shall be signed, while the latter explores whether various emerging green commodities and services are provided. This paper investigates the influence of corporate size, the degree of internationalization, profits and competitiveness on the engagement degree of green finance, according to data collected from 410 Chinese listed companies on the Shanghai Stock Exchange. The results show that corporate size exerts a positive influence on green initiatives, and that the degree of internationalization, profits and corporate competitiveness of an enterprise each have a significant effect on green business activities. In addition, profits have a negative influence on green business activities. This paper provides insights and suggestions for developing green business activities in China.

**Keywords:** green finance; green initiatives; green business activities; listed companies; main board

**JEL Codes:** G30, M14, O16, Q56

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### **1. Introduction**

Environmental issues such as climate change, loss of biodiversity and land deterioration are attracting worldwide attention (Bhattacharyya, 2022). Being aware of the criticalness of the issues, international organizations, government authorities, industries and academia have spent much effort

on developing and implementing sustainable business practices (Zhang et al., 2019; Bhatnagar et al., 2022). A prominent progress in this regard is the establishment of the *Sustainability Reporting Guidelines* produced by the Global Reporting Initiative (GRI). Currently, the GRI's *Sustainability Reporting Guidelines* is widely accepted by the industry to disclose firms' sustainable business practices and analyze such practices' impact on the environmental, social and governance (ESG) issues (Ali and Atan, 2013; Bhattacharyya, 2022). Since the adoption of GRI's *Sustainability Reporting Guidelines* in the industry, several studies have examined the impact of firm characteristics on corporate social responsibility (CSR)/ESG disclosure<sup>1</sup>. However, little is known about the impact of firm characteristics on firms' engagement in CSR/ESG practices. This study aims to fill this gap by investigating how firms' characteristics affect their engagement in green finance.

This study focuses on Chinese public firms listed on the Shanghai Stock Exchange. With its commitment to climate change, the Chinese government has been building up a strong, coordinated green finance development momentum (Lee et al., 2020). For example, China has the largest market of green bonds in the world, which accounts for one-fifth of the international green bond market by volume. On the other hand, China differs from developed economies in terms of economic progress, environmental pressure and the development of a financial system. Therefore, an empirical study on Chinese firms would be complementary to extant literature that focuses on developed markets and provide insight into how to improve the green finance engagement in other emerging economies.

Our empirical analysis investigates the degree of green finance engagement by 410 Chinese firms listed on the Shanghai Stock Exchange from 2014 to 2017. The challenge in estimating the degree of green finance engagement is that we cannot directly observe and measure it because of the limited information available in corporate financial reports or CSR reports. To overcome this challenge, we employed the textual analysis method to count the number of appearances of green finance-related words in firms' annual reports. Moreover, we innovatively divided the green finance-related words into two categories, i.e., green initiatives and green business activities. Green initiatives represent a firm's commitment to engage in green finance activities. However, initiatives are not bonding contracts that necessarily lead to actual engagement in such activities. On the other hand, green business activities represent the actions that a firm has taken to realize its green commitments. Therefore, it is necessary to divide the green finance engagement into green initiatives and green business activities. The division allows us to examine how the factors affect a firm's commitment (what the firm says) to and actions taken toward (what the firm does) green finance. We conjecture that there is variation in the impact on the firm characteristics across different types of green finance engagement.

Based on the measured degree of green finance engagement, we have used the ordinary least squares (OLS) regression method to examine how the firm characteristics affect the firms' engagement in green finance. We show that firm size positively affects firms' engagement in green initiatives, which is consistent with the extant studies that have found that large firms strategically engage in CSR/ESG initiatives (Adams and Hardwick, 1998; Cormier and Morgan, 2004; Suttipun and Stanton, 2011; Akrout and Othman, 2013). However, we have not found evidence on the effect of size on firms'

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<sup>1</sup> For example, see Akrout and Othman (2013), Ali and Atan (2013), Erlandsson and Tillman (2009), Juhmani (2014) and Liu and Anbumozhi (2009), among others.

engagement in green business activities. This may imply that large firms tend to use green initiatives to feign greenness while their actual business activities depend on other factors. In addition, we have found that globalization has a positive impact on firms' engagement in green business activities, but it has no effect on their engagement in green initiatives. The result is consistent with the regulatory impact on CSR (Bolivar and Garcia, 2004; Chapple and Moon, 2005; Manuel and Lucia, 2008), as multinational firms face higher regulatory compliance burden when they enter markets that have greater emphasis on CSR/ESG issues. Moreover, we document a negative relationship between competition and green finance engagement. This finding is consistent with that of Demirguc-Kunt et al. (2003), who reported that competition restricts firms' engagement in innovation because firms are forced to focus on their core products and services for survival.

To the best of our knowledge, this paper is the first to divide the green finance into green initiatives and green business activities. By distinguishing what firms "say green" and what firms "do green", we show that their determinants vary significantly. This classification is expected to provide a new methodology for future research on green finance.

## 2. Literature review and hypothesis development

### 2.1. *Green finance*

Green finance, according to Asia-Pacific Economic Cooperation (APEC, 2010), is the provision of financial support for environmentally friendly growth. The main duty of businesses is to promote green growth and environmental benefits. The term "green growth" refers to a method of economic growth that is environmentally friendly and may address the three crises that the modern world is currently experiencing: climate change, resource scarcity and financial problems. Höhne et al. (2012) provide illustrations of various green finance initiatives. For instance, funds are invested in environmentally friendly programs and projects, the promotion of environmentally friendly goods and more environmentally friendly economic policies, including climate finance and other pertinent environmentally friendly financing. According to Zadek and Flynn (2013), green finance and green investment overlap, but green finance encompasses a broader range. More importantly, green finance covers the operational costs, planning and preparation expenditures, and land purchase prices of green investments. According to Lindenberg (2014), there are two reasons that there is no precise definition of green finance that is universally recognized: 1) very few literary works attempt to describe it; and 2) even when they do, meanings vary from one work to another.

Based on the definition provided by Höhne et al. (2012), this study expands it to state that "green finance" is a core activity promoting low-carbon green growth, and it may connect and enhance all industries while also enhancing environmental quality on a global scale. According to Hong (2010), the most essential financial activity that fosters green growth and development is labeled as "green finance" (Jin, 2010; Mackenzie and Rees, 2011). In order to promote sustainable development, businesses should avoid activities that could endanger ecological systems and cause environmental pollution. Green finance coordinates businesses' interaction with the environment by treating environmental protection as the baseline, taking into account the potential environmental effects in the investment decision-making process and involving relevant risks and costs in the assessment.

The extant literature mostly centers on the operational logic and functional description of green finance, but it pays insufficient attention to the role of the market and the government in the establishment and growth of green finance (Rahman et al., 2022). Green economic development serves as the cornerstone for the development of green finance, which is a crucial assurance for changing the mode of economic development. The growth of China's green economy from the standpoint of green finance has not been extensively studied (Lv et al., 2021). The present literature provides a thorough analysis of the impact of green finance's mechanism on industrial transformation from a theoretical standpoint. Although some scholars generally concur that green finance development has been effective in encouraging the green transformation of industry, there are still disagreements on the usefulness of green finance in the sectors of the modern real economy.

The predominant "culprit" of pollution is industrial, as it is the largest source of pollution emissions. It is now dealing with significant issues, including resource and environmental limitations and limited production constraints. There is still a paucity of actual data showing whether green financing can support the green growth of the real economy while overcoming the challenges posed by industrial transformation. The empirical studies on the growth of green finance emphasize the use of quantitative information on the fund supply side to assess the degree of green finance development in a nation or a region. It must be stressed that the mix between green credit and green bonds and the hazy nature of the money flow are caused by institutional factors, including incentive distortion and technical issues. As a result, using the quantitative supply-side indicators alone to determine the extent of green finance development is challenging. A more precise and useful alternative green finance measuring index has not yet been discovered by relevant scholars.

This study classifies green financing into two categories: related efforts and green business activities, based on the steps taken by businesses to address environmental deterioration and climate changes. When faced with the challenges of sustainable development imposed by global warming and climate change, businesses need to refrain from ecologically harmful practices. These measures are known as green initiatives. A substantial number of climate change initiatives have been complied in the United Nations Principles of Responsible Investing (UNPRI) (Labatt and Rodney, 2007). When businesses are faced with climate change and global warming, they will proactively address issues, develop new goods and open up new economic prospects (Liu and Anbumozhi, 2009).

## 2.2. Hypothesis development

Some businesses have gradually become aware of and involved in green finance in an effort to mitigate global climate change as the severity and impact of global warming and environmental degradation increase in strength. As mentioned, enterprise size, level of internationalization and earnings all have an impact on the engagement of organizations in pertinent industries. The three aforementioned elements' effects on Chinese listed businesses' involvement in green finance are examined in the sections that follow.

### 2.2.1. Size and engagement in green finance

A listed company attracts greater attention and releases more public information that tend to be directly proportionally with their size (Arif and Tuhin, 2013). Asymmetric information and agent costs may decrease (Jensen and Meckling, 1976; Niléhn and Thoresson, 2014), or political costs may increase with size (Watts and Zimmerman, 1986). Corporate size is a substitute variable for public visibility as a result (Manuel and Lucia, 2008).

Additionally, listed companies will highlight their social responsibility initiatives to draw in potential investors or rivals (Erlandsson and Tillman, 2009). Interested parties will study firms more closely in order to spot their deliberate behavior and prevent it. Investors will offer favorable compensation if businesses aggressively carry out their social obligations to foster relationships with various interest groups (McWilliams and Siegel, 2001). A part of CSR is green finance. Investors will assume that a company solely cares about its earnings if it fails to mitigate its negative environmental consequences over a period of years while also making no contribution to environmental protections.

A company's social responsibility activities increase with an increase in scale, and vice versa (Adams and Hardwick, 1998; McElroy and Siegfred, 1985). Additionally, a growing number of environmental problems will be publicly disclosed (Cormier and Morgan, 2004; Suttipun and Stanton, 2011; Akrout and Othman, 2013; Juhmani, 2014). Company size presents a positive correlation with the reasons for their involvement because green finance is a part of CSR and environmental challenges. The greater the scale of a company, the larger the number of staff members. A company's diverse workforce makes it simple to come to an agreement against environmental deterioration. The corporation will be more pro-active in its involvement in green finance as a result of internal voices urging the company to participate in green finance more. Therefore, the following hypothesis is put out in this paper:

*H1: Corporate size has a positive effect on engagement in green finance.*

### 2.2.2. Scope and engagement in green finance

Many businesses have opened offices outside of their home countries as a result of globalization to expand their reach and gain experience. The degree of adopting CSR is increased if operational modes are adaptable to various national contexts (Bolivar and Garcia, 2004; Manuel and Lucia, 2008). According to Chapple and Moon (2005), the internationalization and globalization of businesses will have a favorable impact on the implementation of CSR. They used an example of 50 top-ranking corporations in seven Asian countries. Furthermore, there are differences in the level of environmental awareness about global warming between nations, and these differences are reflected in the environmental management policies that various governments have established. Along with varying laws, rules, national conditions and operational experience, various businesses must strengthen their capacity to deal with pertinent regulations and reveal pertinent product information. However, businesses with comparatively lower levels of internationalization lack obsessive demands and, for the most part, adhere to internal rules. Companies with a comparatively higher degree of internationalization will exhibit a substantially higher level of disclosure and engagement in green

finance as compared to those with a relatively lower degree of internationalization. Therefore, this paper puts forward a hypothesis as follows:

*H2: The higher the internationalization degree, the higher the degree of engagement in green finance.*

#### 2.2.3. Profit and engagement in green finance

It has been contested for a very long time whether profitability has an impact on how much information businesses disclose about the environment. ESGs are not the only way that businesses may communicate a high-quality return on assets (ROA), according to Clarkson et al. (2008); however, Wallace and Naser (1995) believe that environmental disclosure has costs. More environmental disclosures are made when profitability is low, which results in reduced earnings, while other academics believe that there is a positive association between both (Liu and Anbumozhi, 2009). This study makes the following claim based on prior literature: when corporate earnings meet the needs of shareholders and management, the incentive for more profits will decline. The ongoing maximization of earnings or further profit growth through other channels are the objectives of businesses. Demands in this sector cannot be met by enterprises operating merely to meet their own needs; hence, performance improvements are needed for emerging businesses. Global businesses are now giving green finance a lot of thought. In the period between 2008 and 2013, 10 significant clean energy projects saw better earnings. It demonstrates that more annual reports and CSR reports will lead to more active participation of corporations in green finance. To sustain or boost revenues, all interested parties' attention is drawn to the situation. As a result, this paper advances the following claim:

*H3: The larger corporate profits, the higher the degree of corporate engagement in green finance.*

#### 2.2.4. Competition intensity in green finance

According to Smirlock (1985) and Roman and Dănuțeiu (2013), corporate profits increase as asset concentration increases. The Herfindahl-Hirschman Index was used by Athanasoglou, Delis and Staikouras (2006) to analyze corporate practices in eastern European nations. They discovered that the degree of market concentration shows a positive link with ROA. In the context of a globally oriented competitive environment, businesses face greater rivalry, resources and obstacles from competitors in their own home nations than from operational networks abroad, which is growing more significant. If a company with a lesser market share faces intense horizontal competition in its industry, it should focus on strengthening its competitiveness in core activities rather than developing products and services. If not, the company risks losing its drive for innovation. Demirguc-Kunt et al. (2003) noted that, when a market is perfectly competitive, its product variety falls owing to the decline in total profits and bears no particular innovations; if domestic rivalry is not very intense, the market is oligopolistic. According to Acs and Audretsch (1987), large-scale businesses have a considerably higher capability of developing new products in an oligopolistic market if the industry is one that requires a lot of capital investment. Enterprises will actively participate in the most cutting-edge financial service, known as green finance, in order to consistently set themselves apart from rivals. Therefore, this article asserts that businesses will be motivated to engage in green finance in order to increase their level of competitiveness and enter an oligopolistic market. When faced with intense

competition, businesses will pay less attention to green finance, but when there is not intense competition, they will aggressively engage in green finance. Therefore, this paper proposes the following idea:

*H4: The fiercer the corporate competition of the firm's industry, the lower the degree of corporate engagement of the firm in green finance.*

### 3. Methodology

#### 3.1. Samples

Our initial sample included 1,338 companies listed on the Shanghai Stock Exchange. However, between 2014 and 2017, 796 businesses failed to issue (both) a CSR report and an annual report. This study disregarded the information gathered from the 796 businesses due to data unavailability. There were 132 companies that were insolvent or merging while the research was being done (Data Source: CCER Database). Our final sample was left with 410 companies, including 161 software service companies, 93 electrical equipment companies, 41 real estate companies, 38 auto parts companies, 27 medical care companies, 19 special-purpose machinery companies, 13 chemical raw material companies, 10 construction companies and eight businesses (from other industries).

#### 3.2. Keyword sampling

Following identifying a definition of “green finance” we used textual analysis to monitor and investigate the level of disclosure of green finance in publicly traded corporations. We then chose keywords to determine the word count. This paper provides a list of keywords in two categories—green initiatives and green business activities—based on the definition of green finance provided above.

**Green initiatives:** In response to climatic change concerns, businesses will take part in a variety of agreements or conventions that will enable them to reject transactions that harm the environment and implement the sustainable development selection process (Williamson et al., 2006). In order to determine if a company has taken part in numerous initiatives that enable its transactions to address the challenges faced by sustainable development, we chose the Principles for Sustainable Insurance (PSI) and the UNPRI, two highly regarded initiative groups on a global scale.

**Green business activities:** When faced with the difficulties posed by climate changes around the world, businesses must take the initiative to produce new goods, create profitable business prospects, make green investments and even formally establish an environmental department. For the purpose of reducing or resolving issues related to the natural environment, all businesses are obliged to actively accept the challenges provided by sustainable development. Investment plans, specifically the use of proprietary funds to make investments, are the key component of green business activities. The selection process must follow ESG guidelines (Udayasankar, 2008). This study solely applied the environment for pertinent investigations, including climate financing and sustainable responsible investment (SRI). Plans to lessen the effects of climate change are referred to as climate financing. Enterprises are encouraged to provide general clients with a variety of green investment funds or products by using green finance goods and services.

Above is a demonstration of the range of linked efforts and green business activities. The broad range of green finance activities, however, makes it difficult to give information through all keywords. The occurrence of all keywords does not imply that one company is discussing topics connected to green finance. As a result, when choosing keywords, we shall adhere to the definition of green finance. Table 1 provides a list of keywords.

**Table 1.** Summary of keywords required by textual analysis.

Green initiatives	UNPRI, PSI
Green business activities	Investment Plan
	Climate Finance
	Green Product & Service

Source: Summarized by the authors

### 3.3. Data collection

By using auxiliary keywords, this study performs a regression analysis on the sum of paragraphs and words that fit the concept of “green finance” in the CSR report or annual report, in accordance with the textual analysis.

The sample here involves a total of 410 companies. We used the year in which the reports were issued as the time when green finance engagement was measured. We chose to ignore the time range stated in the reports. The following are the criteria for the number of words selected from the CSR or annual report:

1. If there is only a CSR report, the number of words in the CSR report is calculated. If there is not, the number of words in the annual report is calculated. If green finance is mentioned in the CSR report and described by the annual report, the number of words in the annual report is also calculated.

2. Some CSR reports may be published every two or three years; this paper only includes statistics for the year within the reporting date. For example, for the CSR report for FOUNDER TECHNOLOGY from 2013 to 2015, we only calculated the number of words in 2014. If the year was overlapping, the second reporting guideline was used for calculations. Consider the example of the CSR report for Shanghai HUI TONG Energy Co., Ltd. from 2006 to 2009, from 2009 to 2011 and from 2011 to 2013; the number of words from 2006 to 2008 was calculated according to the reporting guidelines from 2006 to 2009, the number of words from 2009 to 2010 was calculated according to the reporting guidelines from 2009 to 2011 and the number of words from 2011 to 2013 was calculated according to the reporting guidelines from 2011 to 2013.

3. If some keywords are similar and overlapping, the principle adopted for this study to calculate the number of words is as follows: 1) graphic words are excluded unless one article describes one issue in the form of graphic words; 2) foundation affairs are excluded because profit creation is not the target;

3) if the same paragraph and sentence simultaneously describing green initiatives or green business activities satisfy two conventions, the number of words and details will be simultaneously calculated on the sentence or paragraph.

In order to verify the hypotheses, we selected a total of three variables, including size, scope and profit. As an endogenous relationship is possibly established between an independent variable and a dependent variable, we made the time lag for one year and selected the data of the previous year as the independent variable. Therefore, the year of the dependent variable refers to 2014 and 2017 and the year of the independent variable refers to 2013 and 2016.

#### 4. Regression equation and independent variables

##### 4.1. Regression equation

In order to test the hypotheses, we established a regression model as follows:

$$Y_{i,t} = \beta_0 + \beta_1 \text{Size}_{i,t-1} + \beta_2 \text{Scope}_{i,t-1} + \beta_3 \text{Profit}_{i,t-1} + \beta_4 \text{Competition}_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

In Equation (1),  $t$  (=2014, 2017) refers to the year of observation,  $i$  (=1, 2, ..., 410) refers to the  $i$ -th firm in our sample and  $Y_{i,t}$  refers to the measure of green finance engagement. The explanatory variables are explained in the rest of this section.

##### 4.2. $\text{Size}_{i,t-1}$

We selected the number of employees as the measurement variable of size (Udayasankar, 2008). Currently, measurement indicators on size include market values, total assets and the number of employees. The entry-level engagement in green finance is relatively higher and the market values of the companies selected are larger. At the same time, this work holds that interested parties will influence corporate engagement in green finance. However, the scope of interested parties is extensive, and includes employees. Therefore, we thought it to be more suitable to select the number of employees as a measurement indicator, as compared to market values or total assets. This variable refers to the size of the  $i$ th company in the  $t-1$  year. The number of global employees was calculated among the 410 sample enterprises. The number of employees or the average number of employees by the end of this year provided by the annual report or CSR reporting guidelines was selected as the materials. The number of employees at the end of the year was selected as a priority.

##### 4.3. $\text{Scope}_{i,t-1}$

This variable refers to the operational scope of the  $i$ th company in the  $t-1$  year. The number of countries where it develops its sales networks was calculated according to the annual report or CSR reporting guidelines in order to observe its business scope in the world. It was selected as the measurement indicator of the company's internationalization degree (Bancel and Mittoo, 2001).

#### 4.4. $Profit_{i,t-1}$

Cohen et al. (1997) selected the ROA as a measurement indicator for profitability. This variable refers to the return on Stocks of the  $i$ th company in the  $t-1$  year. After studying 391 companies from 51 industries located in 59 countries, Ortas et al. (2014) reflected the relationship between corporate profits and environmental information disclosure via the ROA; similar to this study, Juhmani (2014) also adopted the use of textual analysis to analyze the social and environmental information disclosed by Balin Company on its website by focusing on the ROA (profitability indicator). We think that the return on equity can only show the shareholders' reactions to green finance, while the ROA can indicate all interested parties' reactions to green finance. It was more significant to select ROA as a measurement indicator.

#### 4.5. $Competition_{i,t-1}$

By referring to the research conducted by Roman and Dănușteiu (2013), we selected asset concentration degrees of the top five enterprises from all industries as a measurement indicator and observed the competition degree of the  $i$ th company in its industry in the  $t-1$  year. The calculated value was divided by 100 and adjusted to act as the ratio. A bigger ratio means a higher degree of industry concentration. This means that enterprises will be more willing to participate in green finance.

#### 4.6 Descriptive statistics

Table 2 presents the descriptive statistics for the variables used in this paper. It shows that, on average, the firms in our sample have more green initiatives than green business activities. This is consistent with the general progress in green finance that show that firms engage in green finance first by joining in related initiatives and then taking actions as necessary.

**Table 2.** Descriptive statistics.

	Number of observations	Mean	Standard deviation
Green initiatives	410	48.78	13.67
UNPRI	410	25.07	10.74
PSI	410	23.62	10.89
Green business activities	410	38.87	11.44
Investment plan	410	5.72	2.43
Climate finance	410	6.15	2.60
Product & service	410	27.20	8.22
Profit	410	5.17%	1.37%
Scope	410	12.81	8.02
Size	410	8554.25	4975.96

This table reports the descriptive statistics of our analysis in the form of the mean, standard deviation and number of observations of data.

## 5. Regression results

### 5.1. Correlation coefficient matrix

The correlation coefficient matrix among variables is listed in Table 3. According to Table 3, the correlation coefficients among variables were between  $-0.057$  and  $0.317$ , and a pairwise correlation was observed among many variables.

**Table 3.** Correlation coefficient matrix.

Variable	1	2	3	4	5	6	7	8
1 Size	1							
2 Scope	0.181	1						
3 Profit	0.204*	0.076	1					
4 UNPRI	0.307**	0.117*	0.314***	1				
5 PSI	0.104	0.094	0.193*	-0.071	1			
6 Investment Plan	0.198*	0.112*	0.301***	0.138*	-0.057	1		
7 Climate Finance	-0.111	0.274**	0.133*	0.271**	0.105*	0.235**	1	
8 Product & Service	0.254**	0.170*	0.219**	0.317***	0.257**	0.143*	0.216**	1
9 Competition	-0.101	0.177*	0.174*	0.039	0.119	0.251**	0.183*	0.172*

This table reports the matrix of correlation coefficients for our analysis, including the key dependent and independent variables of our analysis. In the table, \*, \*\* and \*\*\* indicate that the P-values are smaller than 10%, 5% and 1%, respectively.

**Table 4.** Multiple regression analysis results.

Variable	Green Initiatives	UNPRI	PSI	Green Business Service	Investment Plan	Climate Finance	Product & Service	Total
Intercept	-139.242**	-120.001*	-68.701	401.381***	58.112	91.337***	155.001	813.371
Size	0.071*	0.021*	0.000	-0.008	0.000	0.000	0.000	0.000
Scope	2.012	0.112	-0.520	3.093*	2.583	5.697*	2.833	11.237**
Profit	-23.918	36.173	-56.771	-389.537*	-118.305	-182.931	-187.009*	-394.618*
Competition	-309.107**	-129.331*	32.510	-237.058***	-64.108*	-197.336	38.546	81.773
$R^2$	0.132	0.125	0.098	0.127	0.097	0.121	0.139	0.088
Adj. $R^2$	0.116	0.104	0.077	0.106	0.079	0.100	0.118	0.063

This table reports the results of our multiple regression analysis. We divided our results into three groups. The first group contained the results of *Green Initiatives*, and we divided it into *UNPRI* and *PSI*. The second group contained the results of *Green Business Service*, and we divided it into *Investment Plan*, *Climate Finance* and *Product & Service*. The third group is the result of *Total*, where it includes the total statistics of *Green Initiatives* and *Green Business Service*. In the table, \*, \*\* and \*\*\* indicate that the P-values are smaller than 10%, 5% and 1%, respectively.

In Table 4, we tested our research hypotheses by using the OLS regression specified by Equation (1). According to Table 4, corporate size bears a significantly positive correlation with green initiatives, which mainly originates from the influences exerted by the size and the participation of enterprises in the UNPRI. It further verifies that, only when enterprises advocate relevant rules by the UNPRI can

the size encourage enterprises to emphasize green finance. Therefore, Hypothesis 1 is partially supported. The corporate size failed to significantly influence green business activities. On the contrary, there was no obvious relationship between the internationalization degree and green initiatives. Green business activities, especially climate finance, were greatly influenced by the internationalization degree. Therefore, Hypothesis 2 is also partially supported. Corporate profits also exerted no significant influences on green initiatives, but significantly influenced green business activities. However, the hypothesis is totally contrary, as it says that corporate profits exert a negative influence on green products and services. In other words, the larger the profits of the previous year, the more there will be corporate disclosures of issues on green finance in the next year. Therefore, Hypothesis 3 received no support. According to the regression results for competitive environments and green finance, competition exerts a significant positive influence on green initiatives and green business activities, but a negative influence on green initiatives. In other words, if the horizontal competition in the motherland is fiercer, it is more impossible for enterprises to put forward green initiatives. On the contrary, enterprises will focus on competition; competition also exerts a negative influence on green business activities, which is possibly incurred by negative influences of competitive environments on investment plans. Therefore, Hypothesis 4 is supported. In terms of the unclassified green finance engagement (represented by *Total* in Table 4), both the internationalization degree and corporate profits exert obvious influences on both green initiatives and green business activities, while the corporate size exerts no significant influence on either green initiatives or green business activities.

## 5.2. Robustness test

This work also included two categorical variables: enterprise category and industry category. The former includes private enterprises, state-owned enterprises and joint ventures. The latter involves the software service industry, the electrical equipment industry, the regional real estate industry, the auto spare parts industry, the medical care industry, the special-purpose machinery industry, the chemical raw material industry and the construction industry. According to the results of analysis, the size and profits of a joint venture exerted obvious effects on the green initiatives, UNPRI, green business activities, investment plans and climate finances; and, the enterprise internationalization degree has an apparent effect on green business activities, climate finance and green products and services. All results further explain this work's multiple regression consequences. The sizes of the state-owned and private enterprises exerted obvious influences on the green initiatives, UNPRI and green business activities; the influential results are consistent with the overall regression results; additionally, profits exerted an obviously negative influence on green business activities and the internationalization degree was only related to climate finance. From the perspective of the industry category, profits of only the regional real estate industry, the auto spare parts industry and the chemical raw materials industry bear a negative correlation with green business activities and climate finance, whereas the other relationships were not significant. The statistical results of private companies and joint ventures in the competitive industrial environment at respective motherlands conformed to the overall regression results. However, the statistical results of state-owned enterprises demonstrated conformity to the regression results, which further shows that state-owned enterprises pay less attention to green finance, and they also reflect the deficiencies of state-owned enterprises in the area of enterprise social responsibility. The

statistics and analysis results of the software service industry, the electrical equipment industry and the auto spare parts industry basically conformed to the overall regression results, while the statistics and analysis results of other industries demonstrated no significant relationships.

## 6. Conclusions

The level of emphasis placed on green finance differs among businesses. The pertinent literature on green finance, however, is inadequate. The purpose of this research was to examine potential business activities in the event of climate change, as based on past responses to environmental challenges, by putting up three hypotheses based on environmental literature. The variables were therefore split into two divisions and five classes in this study in order to validate the pertinent assumptions. Results for the hypotheses exhibited a range of major repercussions in diverse data sets and did not follow any logical pattern. It also demonstrates that a company's individual pieces of information supplied are related to the particular attribute of that company.

This study concludes from empirical research that the PSI and investment plans are not evident in the information released in 2014 and 2017, whereas five residual classifications exhibited outcomes. However, the degree of variety was greater; some businesses failed to fully disclose any information, and some, like SAIC Motor, used more than 8,000 words to describe their information disclosures. It demonstrates that even some very large, well-known listed businesses fail to fully emphasize the need for green finance, and that Chinese businesses likewise give the issue less weight. Corporate scale, in general, has a substantial impact on linked efforts and specifics. The degree of corporate internationalization, competitive industrial settings abroad and earnings have comparatively greater impacts on green business activities and specifics. The disclosure of the entire green finance is mostly impacted by the corporation size and its level of internationalization; profitability and competitive settings also have a negative impact on green business activities and details.

The major contribution of this paper is that, while earlier studies primarily examined disclosures of environmental issues, this study goes further and evaluated green finance (the most significant element among environmental issues) in an effort to learn more about how businesses disclose information about climate change. Despite several novel study viewpoints and methodologies, there are still a lot of aspects that could be improved. The following are some aspects of this study that could be strengthened, as well as some recommendations for upcoming researchers:

First, scholarly literature on green finance lacks a clear definition. This paper provides a definition of green finance based on a variety of sources of literature and reporting rules, as well as individual interpretations of green finance. It remains to be further investigated whether this definition is appropriate in all situations.

Second, the keywords chosen here are hypothesized based on the definition of green finance. It needs to be further checked whether the keyword selection used in this case is also appropriate, even if the future verification turns out to be absolutely accurate.

This study, which employs a quantitative approach, looks at whether a corporation uses pertinent language in its sustainability reporting guidelines as a foundation for revealing green finance. It is unclear whether a business genuinely engages in the practice or merely seeks to get people's attention.

Therefore, a more qualitative approach is needed in the future to assess if a company actually implements the aforementioned green finance contents.

Fourth, the study's focus is on a particular aspect of the situation in the country. All information was gathered from Shanghai's main board for Chinese-listed companies. It is difficult to give specific references for other businesses' involvement in green finance. To further confirm the involvement of other businesses in green finance, more research is still required.

The 2014 Flood Wall Street protest indicated that businesses around the world are still not giving green development enough attention. This paper confirms that improvements were made by Chinese businesses between 2014 and 2017, although those advances fell short of environmentalists' expectations. Though profits are typically prioritized by businesses, it is envisaged that all businesses worldwide would place a high priority on environmental degradation and global warming, abandon the notion of short-term profit and handle issues relating to green finance from the viewpoint of the scientific standpoint on sustainable development.

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## Conflict of interest

The authors declare no conflict of interest.

## References

Acs ZJ, Audretsch DB (1987) Innovation, market structure, and firm size. *Rev Econ Stati* 567–574. <http://dx.doi.org/10.2307/1935950>

Adams M, Hardwick P (1998) An Analysis of Corporate Donations: United Kingdom Evidence. *J Manage Stud* 35: 641–654. <https://doi.org/10.1111/1467-6486.00113>

Akrout MM, Othman HB (2013) A Study of Corporate Environmental Disclosure in MENA Emerging Markets. *J Rev Global Econ* 2: 46–59. <https://doi.org/10.6000/1929-7092.2013.02.5>

Ali MAM, Atan RH (2013) The Relationship Between Corporate Social Responsibility Disclosure: A Case of High Malaysian Sustainability Companies. *South East Asia J Contemporary Bus Econ Law* 3. <https://doi.org/10.1007/s11356-020-11247-4>

Allet M (2014) Why Do Microfinance Institutions Go Green? An Exploratory Study. *J Bus Ethics* 122: 405–424. <https://doi.org/10.1007/s10551-013-1767-2>

Arif HM, Tuhin MH (2013) Disclosure of Non-Financial Information Voluntarily in the Annual Report of Financial Institutions: A Study on Listed Banks of Bangladesh. *Eur J Bus Econ* 8: 37–44. <https://doi.org/10.12955/ejbe.v8i2.397>

Athanasoglou PP, Delis M, Staikouras C (2006) Determinants of bank profitability in the South Eastern European region. Available at SSRN. <https://ssrn.com/abstract=1146385>

Asia-Pacific Economic Cooperation (APEC) (2010) Green Finance for Green Growth, 17<sup>th</sup> Finance Ministers' Meeting, Japan.

Bancel F, Mittoo C (2001) European Managerial Perceptions of the Net Benefits of Foreign Stock Listings. *Eur Financ Manage* 7: 213–236. <https://doi.org/10.1111/1468-036X.00153>

Bansal P, Roth K (2000) Why Companies Go Green: A Model of Ecological Responsiveness. *Acad Manage J* 43: 717–736. <https://doi.org/10.2307/1556363>

Bhatnagar M, Taneja S, Özen E, et al. (2022) A wave of green start-ups in India—The study of green finance as a support system for sustainable entrepreneurship. *Green Financ* 4: 253–273. <https://doi.org/10.3934/GF.2022012>

Bhattacharyya R (2022) Green finance for energy transition, climate action and sustainable development: Overview of concepts, applications, implementation and challenges. *Green Financ* 4: 1–35. <https://doi.org/10.3934/GF.2022001>

Bolivar M, Garcia B (2004) The Corporate Environmental Disclosures on the Internet: The Case of IBEX 35 Spanish. *Int J Account Auditing and Perform Eval* 1: 215–266. <https://doi.org/10.1504/IJAAPE.2004.004766>

CCER data. <http://new.ccerdata.cn/>

Chapple W, Moon J (2005) Corporate Social Responsibility (CSR) in Asia: A Seven Country Study of CSR Website Reporting. *Bus Soc* 44: 415–441. <https://doi.org/10.1177/0007650305281658>

Clarkson P, Li Y, Richardson GD, et al. (2008) Revisiting the Relation between Environmental Performance and Environmental Disclosure: An Empirical Analysis. *Account Orga Soc* 33: 303–327. <http://dx.doi.org/10.1016/j-aos.2007.05.003>

Cohen S, Doyle WJ, Skoner DP, et al. (1997) Social Ties and Susceptibility to the Common Cold. *J Am Med Assoc* 277: 1940–1944. <https://doi:10.1001/jama.1997.03540480040036U>

Cormier D, Morgan M (2004) The Impact of the Web on Information and Communication Modes: The Case of Corporate Environmental disclosure. *Int J Technol Manage* 27: 393–416. <http://dx.doi.org/10.1504/ijtm.2004.004278>

Demirguc-Kunt A, Laeven L, Levine R (2003) The Impact of Bank Regulations, Concentration, and Institutions on Bank Margins. World Bank Policy Research Working Paper 3030: 1–25. <http://dx.doi.org/10.3386/w9890>

Erlandsson J, Tillman A (2009) Analyzing Influencing Factors of Corporate Environmental Information Collection, Management and Communication. *J Clean Prod* 17: 800–810. <https://doi.org/10.1016/j.jclepro.2008.11.021>

Höhne N, Khosla S, Fekete H, et al. (2012) Mapping of Green Finance Delivered by IDFC Members in 2011. *Ecofys*.

Hong JH (2010) Green financing needs the approach based on profit. *LG Bus Insight Weekly Focus* 22–28.

Jensen MC, Meckling WH (1976) Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *J Financ Econ* 3: 303–360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X)

Jin NH (2010) Financial Strategy to Accelerate Innovation for Green Growth. *Korea Capital Market Institute*. 2–3.

Juhmani O (2014) Determinants of Corporate Social and Environmental Disclosure on Websites: the Case of Bahrain. *Univers J Account Financ* 2: 77–87. <https://doi.org/10.13189/ujaf.2014.020402>

Labatt S, White RR (2011) *Carbon Finance the Financial Implications of Climate Change*. Wiley Finance.

Lee CC, Wang CW, Ho SJ (2020) Financial innovation and bank growth: The role of institutional environments. *North Am J Econ Financ* 53: 101195. <https://doi.org/10.1016/j.najef.2020.101195>

Liu X, Anbumozhi V (2009) Determinant factors of corporate environmental information disclosure: An empirical study of Chinese listed companies. *J Clean Prod* 17: 593–600. <https://doi.org/10.1016/j.jclepro.2008.10.001>

Lindenberg N (2014) Definition of Green Finance, German Development Institute, Deutsches Institut für Entwicklungspolitik (DIE).

Lv C, Bian B, Lee CC, et al. (2021) Regional gap and the trend of green finance development in China. *Energy Econ* 102: 105476. <https://doi.org/10.1016/j.eneco.2021.105476>

McElroy KM, Siegfried JJ (1985) The Effect of Firm Size on Corporate Philanthropy. *Q Rev Econ Bus* 25: 18–26. <https://doi.org/10.1007/s10551-006-9167-5>

Mackenzie C, Rees B (2011) Corporate Social Responsibility and the Open Society. Available at SSRN. <https://ssrn.com/abstract=1966030>

McWilliams A, Siegel D (2001) Corporate Social Responsibility: A Theory of the Firm Perspective. *Acad Manage Rev* 26: 117–127. <https://doi.org/10.5465/AMR.2001.4011987>

Manuel CB, Lúcia LR (2008) Factors Influencing Social Responsibility Disclosure by Portuguese Companies. *J Bus Ethics* 83: 685–701. <https://doi.org/10.1007/s10551-007-9658-z>

Niléhn P, Thoresson A (2014) Determinants of Voluntary Disclosure in Swedish Corporate Annual Reports. Uppsala University Master Thesis, Supervisor: Sabine G. Persson.

Ortas E, Gallego-Alvarez I, Etxeberria IA (2014) Financial Factors Influencing the Quality of Corporate Social Responsibility and Environmental Management Disclosure: A Quantile Regression Approach. *Corp Soc Responsib Environ Manage*. <https://doi.org/10.1002/csr.1351>

Rahman S, Moral IH, Hassan M, et al. (2022) A systematic review of green finance in the banking industry: Perspectives from a developing country. *Green Financ* 4: 347–363. <https://doi.org/10.3934/GF.2022017>

Roman A, Dănuțiu AE (2013) An Empirical Analysis of the Determinants of Bank Profitability in Romania. *Ann Univ Apulensis Ser Oeconomica* 2: 580–593. <http://oeconomica.uab.ro/upload/lucrari/1520132/23.pdf>

Smirlock M (1985) Evidence on the (Non) Relationship between Concentration and Profitability in Banking. *J Money Credit Bank* 17: 69–83. <https://doi.org/10.2307/1992507>

Suttipun M, Stanton P (2012) The Differences in Corporate Environmental Disclosures on Websites and in Annual Reports: A Case Study of Companies Listed in Thailand. *Int J Bus Manage* 7: 18–31. <https://doi.org/10.5539/ijbm.v7n14p18>

Udayasankar K (2008) Corporate Social Responsibility and Firm Size. *J Bus Ethics* 83: 167–175. <https://doi.org/10.1007/s10551-007-9609-8>

Waddock S (2008) Building a New Institutional Infrastructure for Corporate Responsibility. *Acad Manage Perspect* 22: 87–108. <https://doi.org/10.5465/amp.2008.34587997>

Wallace R, Naser K (1995) Firm-Specific Determinants of the Comprehensiveness of Mandatory Disclosure in the Corporate Annual Reports of Firms Listed on the Stock Exchange of Hong Kong. *J Account Public Policy* 14: 311–368. [https://doi.org/10.1016/0278-4254\(95\)00042-9](https://doi.org/10.1016/0278-4254(95)00042-9)

Watts RL, Zimmerman JL (1986) *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall, 1986. Available at SSRN. [tps://ssrn.com/abstract=928677](https://ssrn.com/abstract=928677)

Williamson D, Lynch-Wood G, Ramsay J (2006) Drivers of Environmental Behaviour in Manufacturing SMEs and the Implications for CSR. *J Bus Ethics* 67: 317–330. <https://doi.org/10.1007/s10551-006-9187-1>

Zadek S, Flynn C (2013) South-Originating Green Finance: Exploring the Potential. The Geneva International Finance Dialogues, UNEP FI, SDC, and iisd.

Zhang D, Zhang Z, Managi S (2019) A bibliometric analysis on green finance: Current status, development, and future directions. *Financ Res Lett* 29: 425–430. <https://doi.org/10.1016/j.frl.2019.02.003>



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