An Evaluation of GFRIP (Green Financial Reform and Innovation Pilot Policy) on Real Estate Business in China

중국 부동산업에 대한 GFRIP(녹색금융개혁 및 혁신 시범 정책)의 평가

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Abstract

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In China, recently, green finance has become a hot social issue that people need to pay more attention to with the promotion of China's carbon neutrality and carbon peaking targets. As a carbon intensive industry, how to realize green transformation is a problem for real estate industry. In 2017, China proposed green financial reform and innovation pilot cities in five provinces, and with the implementation of this policy, some measures were taken by real estate enterprises in order to reduce financing costs. This paper studies whether green finance can promote real estate enterprises to realize green development by combining qualitative and quantitative methods. Using the panel data from 92 China A-share listed real estate

enterprises between 2014 and 2020, and a difference-in-difference model to evaluate the influence of GFRIP on real estate business in China through researching on the changing trend of overall ESG performance of real estate enterprises during the seven years, and to explore the heterogeneity of the impact when the ownership of enterprises are different. This results show that the GFRIP significantly improves the ESG scores of real estate enterprises and enhances the real estate business green development as well. This paper also analyzed the green development of a certain real estate enterprise, China Vanke, in pilot zone, Guangdong, and finds that green finance has improved the green development through increasing environmental, social and governance benefits. Based on the research results, the positive effect of GFRIP should be further enhanced in the future.

Keyword : GFRIP; green development; ESG performance; real estate business

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Chapter 1. Introduction

1.1. Basic Background

In recent years, environmental issues have become an tough challenge for all over the world. In order to achieve sustainable green development, the world has started to study on how to mitigate environmental changes and reduce carbon emissions, and has gradually implemented various environmental policies. According to the related statistics from "Global Carbon Budget report 2022", the global carbon emission is 40.5 billion tons. Driven by the global energy transition, the past decade has seen a gradual shift from traditional fossil energy sources such as coal and oil to natural gas, and clean energy sources such as wind, solar and hydrogen have been developed rapidly. In addition, the slowdown of global economic growth has also reduced the growth of carbon emissions. However, total global carbon emissions are still increasing and are far from meeting the climate targets set by the Paris Agreement. China remains one of the largest carbon emitters in the world, so the pressure of reducing carbon emission is certainly large.

Currently, the concept of green development has run through every stage of economic and social development in China, especially the new plan has been put forward that China will strengthen the ecological civilization construction and accelerate low-carbon emission reduction projects with the increasing requirement for sustainable and healthy development. In September 2020, China clearly proposed the goals of carbon peaking by 2030 and carbon neutrality by 2060, which is to

strive to reach the peak of carbon dioxide emissions by 2030 and then enter a phase of gradual decline, and to reach the goal of zero carbon emission by 2060. In order to achieve such policy targets, the government started to accelerate the construction of green financial system, encourage financial institutions to introduce social capital into energy conservation and clean production and other green industries through green credit, green bonds, green ABS, and green private equity funds. Among them, green bonds have become the main component of green finance, which refer to the use of funds raised specifically to support green industries, green projects or green economic activities that meet the prescribed conditions. These bonds have low interest rates, but have high fundamental requirements for real estate enterprises. Under the framework of the Green Financial reform and innovation pilot policy (GFRIP), ESG (environment, society, governance) has become one of the most important indicators to assess the performance of real estate enterprises in the field of green finance. While promoting the development of green finance, governments and financial institutions need to consider ESG factors of enterprises to ensure that investment funds are used to support sustainable projects and entities.

1.2. Arguments

Although there has been a lot of previous researches exploring the impact of GFRIP, most of the studies have only been conducted at the environmental level, while few have been conducted deeper into economic impact at industry level, especially focusing on real estate

industry. Only a few scholars conducted researches on GFRIP and ESG performance, however, they did not focus on real estate business.

Therefore, this paper aims to explore the influence of GFRIP on China's real estate enterprises and to analyze its contribution to the sustainable development of the overall real estate business. By evaluating the current status and effects of the policy implementation, some useful reference are provided for the sustainable development of real estate business. Based on the basic background, this paper proposed two arguments:

1. Does GFRIP significantly improve the green transformation of real estate business?

2. How does GFRIP improve green transformation of real estate business?

Chapter 2. GFRIP and Real Estate Business

2.1. Challenges to Real Estate Business

As a big part of carbon emission industry, people have paid more attention on how real estate industry realize low-carbon transition successfully with current about 45% of total energy consumption and 50% of China's total emissions. In a general sense, the real estate industry accounts for about half of the carbon emissions of a society. On the one hand, it is the raw materials used in the process of construction, especially steel and cement. On the other hand, the carbon emissions from electricity, natural gas and other energy sources used after putting houses into use.

Under the policy regulation of real estate financing such as "three red lines", the traditional financing channels of the real estate industry have become narrower, the growth rate of investment has slowed down, and the loan scale of the real estate industry has been strictly restricted. Real estate enterprises are facing certain financing difficulties in the process of development. In addition to the current slowdown of the real estate industry, exploring new high-quality development strategies has become a consensus, and real estate corporates are paying more and more attention to the construction of ESG systems, in order to explore new financing channels.

Therefore, the real estate green financing market is starting to gain attention. The first green bonds issued by real estate enterprises in China were issued in 2017, when a subsidiary of Longfor Group issued a total of 4.04 billion yuan of green bonds. However, according to the

report "China Real Estate Industry 2021 Performance Overview and ESG Development Opportunities" released by Ernst & Young in 2022, more than 600 billion yuan green bonds were issued in 2021, and among real estate companies, a total of 30 real estate companies, including CIFI Group, China Greentown, Longfor Group and Zhongliang Holding Group, have issued green bonds of more than 200 million yuan.

Basically, there are certainly a lot of advantages for real estate enterprises green financing under the green financial policies proposed by the government. For example, the entry conditions for green bonds are much lower for real estate enterprises. The ratio of funds raised from the issuance of green bonds to the total investment of the project is relaxed to 80%, and green financing provides a certain guarantee for the stability of the enterprise's capital chain. In addition, Green bonds help optimize corporate debt structure. The issuance of green bonds allows enterprises to use no more than 50% of the bond proceeds to repay bank loans and working capital supplement. At the same time, green bonds have longer financing terms and lower issuance rates than general bonds. Moreover, green bonds also have a shorter audit time. On the basis of perfect and complete qualification, procedures and debt service guarantee measures, green bonds are issued under the accelerated and simplified audit process, which is more efficient and beneficial for real estate enterprises to achieve efficient financing.

However, currently, the scale of green bonds issued by real estate enterprises is still relatively small and the number of issuing enterprises is still inadequate. The reason may be that the green building certification standards are high, and not many real estate

enterprises meet the requirements; the use of funds raised by green bonds is not flexible enough to mobilize the enthusiasm of real estate enterprises, for example, green bonds also taking up the debt issuance quota of ordinary bonds; the financing cost advantage of green bonds is not obvious because real estate enterprises need to pay not only explicit costs but also implicit costs, including the cost of evaluation and certification by third-party institutions and the cost of project maintenance; The market is lack of mature green investors in China and sufficient green institutional investors considering that investors have been exposed to the green investment concept for a short period of time and not have a strong preference for green bonds.

2.2. Implementation of GFRIP

Based on green finance reform and innovation pilot policy (GFRIP), the government decided to set several pilot zones, and each pilot zone has its own specific green finance programs to explore replicable experience. In general, five main tasks, including supporting financial institutions to set up green financial business units or green branches, to encourage the development of green credit, to explore the establishment of a market for trading environmental rights and interests and the establishment of green industries, to establish a government service channel for green industry projects on a priority basis, to establish green financial ethos, risk prevention mechanism, etc., were proposed for the construction of all pilot zones, with specific requirements at the level of financial institutions, financial instruments, financial service platforms, government support and risk prevention.

To sum up, GFRIP is a driving force in promoting structure industrial upgrading and optimization of energy, guiding more social capital and resources into low-carbon, efficient clean energy technology, equipment and infrastructure construction, etc., ensuring the construction and operation of green projects and the production and development of green real estate enterprises through financial means to promote capital financing and industrial integration.

People's Bank of China together with other departments issued a general plan for building GFRIP zones. In the pilot zones, government provides some preferential measures for enterprises to expand their financing channels. For construction projects, there are several ways to get lower interest rate, such as green credit bonds, green development loans, green supply chain ABS, green insurance, green private equity funds and so forth; for sale projects, green mortgages and green provident fund loans are provided with lower interest rate; and for holding projects, Green CMBS (commercial mortgage-backed securities) financing and green REITS (Real Estate Investment Trust) are the main channels. The reform programs of all pilot areas have required a rapid growth of green financing in the pilot area and a year-on-year decrease in the scale of financing for non-green projects through the efforts of about five years, and the non-performing green loan ratio should be lower than the average non-performing loans for small and micro enterprises.

In terms of the selection of pilot areas, the State Council considered different types of areas, which include ecological resource reserves, heavy industrial areas, places with better economic growth but also

facing the upgrading of traditional industries, and places with remote locations and more backward economic development, so that China can get the experience and lessons from the development of pilot zones applicable to different types of areas around China, which will be convenient and easy for other regions to learn and study in the future. The executive meeting of the State Council in 2017, chaired by Premier Li, finally decided to establish pilot zones for green financial reform and innovation in some areas of five provinces, which were Zhejiang Province (Huzhou and Quzhou City), Guangdong Province (Guangzhou City), Guizhou Province (Gui'an New Area, consisting of parts of Guiyang and Anshun City), Jiangxi Province (Ganjiang New Area, consisting of parts of Nanchang and Jiujiang City), and Xinjiang Province (consisting of Hami, Changji Hui Autonomous Prefecture, and Karamay City). GFRIP zone of Lanzhou New Area in Gansu Province was set up in 2019 as the ninth pilot zone. In August, 2022, the People's Bank of China and six other departments released the "Overall Plan for Building GFRIP zone in Chongqing", marking the official launch of Chongqing GFRIP zone, which will accumulate experience of Chongqing for the construction of China's green financial system. As shown in the Figure 1, the yellow areas are the first group of pilot zones, including five provinces, and the orange area is the second group of pilot zone, including one province, and the grey area is the third group of pilot zone, including one province.

Figure 1. Location of pilot zones
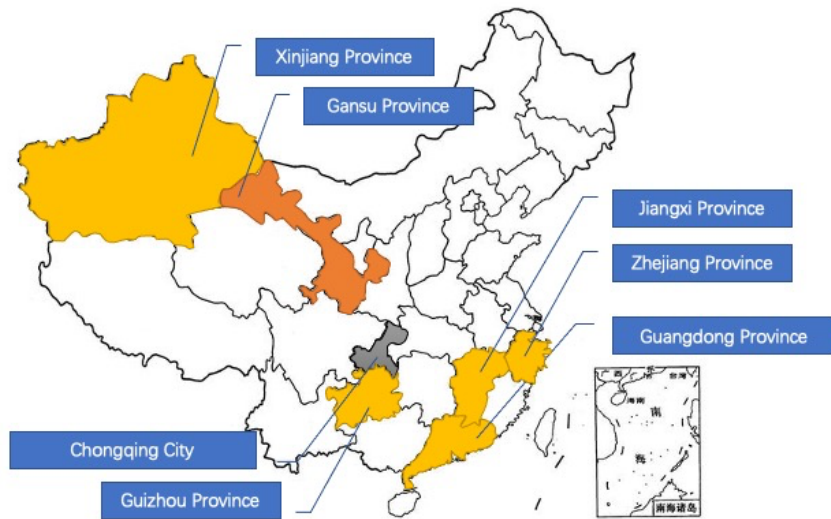
Over the past six years, the valuable green financial reform experience has not only supported the development of local green industries and economic transformation and upgrading, but also enhanced the green financial business level of institutions, driving the rapid development of the national green financial market. Public data show that the balance of green loans in the pilot zones reached 1.1 trillion yuan by the end of June 2022, representing 11.7% of the total loan balance, and green bond balance was 238.8 billion yuan, up 41.18% year-on-year. Through the GFRIP, the cost of using funds for enterprises in need of low-carbon transformation or green financial support can be effectively addressed. Green credit, green bonds and other flexible and innovative financial tools can substantially reduce the financing costs of enterprises and help their future transformation and development a lot.

2.3. Literature Review and Analytical Framework

Currently, there are few researches regarding the relationship between environmental policies and real estate business. However, as for the theories of environmental regulation, there have already exist two kinds of opinions towards the impact on enterprises brought by the environmental policies. Environmental policy is seen as a special tool for environmental regulation by the government (Frondel et al., 2007). Some scholars believed in "Environmental Cost Theory", which indicates that green financial policies lead to additional costs (environmental costs) for firms in order to meet the policy requirements. For certain industries with relatively high environmental investment or complex environmental processes, some strict environmental regulations and targets may be too burdensome for those enterprises. If the environmental policy restricts the economic development of enterprises, they will focus more on their financial performance rather than ESG performance. Moreover, some strict environmental policies may also have a negative impact on society and the governance chain, due to lack of confidence by society when enterprises do not achieve their expected environmental benefits or goals (Yonggang Jang, 2022).

Contrary to the "Environmental Cost Theory", the "Porter Effect" argues that under green financial policies, the costs of government environmental regulation can be partially or fully offset by the "innovation compensation" of increased production efficiency. The proper policy pressure can stimulate firms to innovate and to increase

the productivity of all elements, thereby offsetting the higher costs of protecting the environment (Porter and Van de Linde, 1995), which in turn improves the enterprises' future profitability, reduces the cost of debt financing, and increases the financing scale. Whether the intensity of the policy is within the appropriate interval may have an important impact on total factor productivity growth (Jingye Lv and Linhui Zhang, 2021). The study results of green credit policy show that the policy has significantly increased the capital investment in green technology innovation and the local marketization has also had a positive impact on enterprises. Some studies also show that the intensity of the green financial policy on the enterprises has a significant impact on their overall competitiveness. In other words, when the policy intensity is at a moderate level, enterprises will be encouraged to innovate green without affecting the increase of total factor production, and the policy impact will change from "offset effect" to "compensatory effect" (Cheng Zhang, 2011; Fuxin Jiang, 2013). According to the study results on the impact of environmental regulation on technological innovation in heavily polluting listed companies in China, environmental regulation will enable firms to adjust their production structure, and increase their debt financing capacity, and reduce external financing costs (Yijun Yuan and Ronghui Xie, 2014).

Nowadays, as the world increasingly focus on the sustainable and green development, green finance is helping individuals and enterprises make responsible investment decisions and can be seen as a bridge which connects economy and nature (Zhang, Q., Wong, J.B., 2020). Although the first GFRIP implementation just started in 2017

and related research was insufficient, there have been several studies on the impact of other green finance policy as a kind of environmental policy. In a study from the perspective of policy effects, it was found that developing green credit system effectively promoted the green sustainable development of enterprises by comparing the green debt and total financing cost among green enterprises(Lili Lian, 2017). There were also study results showed that green financial policies would reduce funding constraints, and the reduction of funding constraints of green enterprises would promote the development of green enterprises (Caggese A, Cunat V, 2013).

Fundamentally, the studies investigated green financial policy differences in environmental impacts. Corresponding research findings suggest that GFRIP can significantly reduce environmental pollution, as well as being conductive to environmental improvement. Conclusively, GFRIP plays a more significant role in heavy polluting areas and thus it can better improve the eastern region's environmental pollution in China (Haifeng Huang and Jing Zhang, 2021). Some studies focused on urban green development to evaluate the effect of GFRIP on GTFP. The results showed that GFRIP has promoted the GTFP by improvements in urban green innovation, and reductions in urban energy intensity. To be more specific, influence on China's big cities and resource-based cites is more obvious compared to medium and small cities (Hongfeng Zhang et al., 2022). Green finance significantly influences those heavy-polluting industries, listed companies in eastern areas and large state-owned companies. From the perspective of industries, green finance influences manufacturing, energy,

processing and engineering industry while service industry seems to be less influenced. Evidence showed that the effect was driven by a reduction of financing cost and increase of long-term debt ratio (Zhao Dong et al., 2022). In general, GFRIP can significantly improve green technology innovation capabilities of pilot zones, but such extent is different because of different resources, environment, and economic development levels. The policy are more obviously affected the regions with high economic development level, while influences the low developed areas less or even have restraining effect. Furthermore, although GFRIP improved pilot zone green technology innovation capability, the implementation effect remains unstable, with a better effect in the early stage and a downward trend after two years (Xueyang Wang et al., 2022).

As a newly introduced policy, GFRIP is bound to have an impact on China's enterprises, which may change their business behaviors to some extent. Some studies researched on the impact of GFRIP on green innovation and the research findings showed that the policy has an effective impact on improving company's green innovation. The analysis of the influence of GFRIP on different kind of enterprises showed that the GFRIP on green innovation only worked significantly on enterprises which were large size, heavy-polluting, and located in areas where the marketization is relatively low. GFRIP considers to improve green innovation of enterprises through alleviating debt financing restriction (Shuyu Han, Zuoqian Zhang, and Siying Yang, 2022). The conclusion of some papers is confirmed that the GFRIP promotes enterprise green technology innovation mainly through

application of green invention patents, promoting social financing, government financial support and talent support. However, there was more obvious influence on high tech certified and large enterprises (Xinyu Sun, Aili Zhang and Mengze Zhu, 2023). Further research showed that the GFRIP stimulated reputation insurance effect through signal transmission instead of innovation compensation effect raised by Porter Hypothesis mentioned above (Jinyan Shi et al., 2022). From the perspective of patent types, the policy works better on the green utility model patents rather that green innovation patents; from the perspective of enterprise ownership, the policy works better on non-state enterprises (Fei Lan and Shuang Yu, 2022). Generally speaking, GFRIP would also affect different sectors and enterprises because regulations have the function of constraining organization behavior. Since the first GFRIP implementation just started in 2017, even less empirical research has been done so far, especially around GFRIP and real estate business.

According to the "Green Finance Guidelines for the Banking and Insurance Industry", ESG is a key concept in the green finance sector, and also an important pillar for the development of green finance in China. ESG system should be integrated into the internal business processes and comprehensive risk control systems of enterprises to promote green development and the green transformation of society. By analyzing the need to pay attention to green finance, the study results show that green finance contributes to corporate ESG performance (Yongjie Zhu and Dongmei Li, 2023). An empirical study also researched on GFRIP and ESG scores of enterprises, but the

enterprises were seen as a whole without classification in different industries. The results showed that ESG performance could be improved through GFRIP and the main driving force could be social responsibility (Xiao Chen, 2022). Moreover, for large enterprises from pilot zones, the effects have stronger influence. In addition, GFRIP not only improve ESG performance, but also their financial performance (Chen et al., 2022). ESG will promote more financial institutions to apply ESG investment strategies and identify long-term investment value targets. ESG can be regarded as an important factor in judging enterprises on non-financial metrics (Yao Wang, 2023). Based on the literature on ESG and green finance, ESG can be used as a proper variable in analyzing the policy effect.

Previous studies also focus on a certain real estate enterprise, and analyze the influence of green finance. Based on analysis of the impact of "Longfor Green bonds" on Longfor Group green transformation, the study results indicate that the green bond issued by Longfor Group promotes enterprise green transformation through four main paths including improving the debt structure, enhancing the green reputation, improving resource utilization rate and reducing waste emissions, and enhancing the green brand image as well as strengthening the competitiveness of Longfor Group. The issuance of Longfor Group's green bonds also broadens the financing channels and helps to alleviate its short-term debt servicing pressure (Fukao Yu, 2022). When analyzing CIFI Group in China, the results show that the regional policies and company strategy have greatly promoted the issuance of green bonds by CIFI Group and the green bonds issued have obvious

financing cost advantages, which can also generate benefits such as improving financial indicators, reducing financial expenses and improving the company's reputation (Yue Li, 2021). In the case study of Modern Land, in terms of financial performance, it has reduced the cost of corporate financing and in terms of social effect, it has had an environmental effect of energy saving and carbon reduction, enhancing the brand image of "green technology real estate". However, the frequent issuance of green bonds by Modern Land since 2016 has put pressure on the company's debt service and increased its financial risk (Yixin Wang, 2022).

ESG scores including environmental, social and governance aspects are usually used to see the green development situation of the whole market for the following reasons. First, as for environmental performance, a real estate enterprise's environmental rating reflects its level of impact and commitment to the environment. Environmental regulations and social concerns are increasing, leading to increasing popularity of environmental-friendly buildings and communities. Therefore, real estate enterprises with high environmental score may be more likely to better comply with environmental regulations, which is expected to drive the overall real estate business in an environmental-friendly direction. Second, from social performance perspective, it reflects the commitment to social responsibility, including concern for employees, customers, suppliers and local communities. Real estate enterprises with high social score may be more likely to adopt sustainability strategies, such as providing more housing and employment opportunities and contributing to local

communities, which may also drive the overall real estate business in a sustainable direction. Finally, in terms of governance performance, it reflects the health and transparency of its governance structure. Real estate enterprises with high governance score are more likely to have better ability of management and risk control, which can help enhance their ability to grow soundly over time. Across the real estate business, more enterprises with high governance score are likely to drive the overall market toward greater transparency and robustness. Therefore, the ESG score of real estate enterprises can reflect their performance and commitment to sustainability and governance, which may have an impact on the direction and dynamics of the overall real estate business.

Real estate enterprises often encounter capital bottlenecks in the process of green transformation, and urgently need to seek new financing methods to solve the financing problem and to maximize the conservation of resources. Green finance is born under such circumstances referring to real estate industry. The issuance of green bonds by real estate enterprises is in line with the national concept of ecological environmental protection and sustainable development, and the green bonds are mainly invested in green construction projects. Green construction projects with green building certification can reduce waste emissions in four aspects: energy saving, water saving, land saving and material saving, and improve the resource utilization rate of the whole industrial chain of the enterprises, which can basically generate great environmental benefits.

To make sure whether the funds are invested properly, investors

often set higher standard for information disclosure of the enterprise, investigate or study on the enterprises strictly, and analyze their evaluation reports, audit reports and sustainable development reports to acquire more information besides their financial performance. Though increasing opportunity for investors to know about enterprises comprehensively, green finance has a more positive impact on the green reputation of the enterprises and increases investors' confidence in investment, increasing both social benefits and governance benefits. In addition, the successful issuance of green bonds not only demonstrates the enterprise strength, but also enhances the capital market recognition, which in turn enhances the company's reputation in the capital market and helps real estate enterprises to increase social benefits.

Figure 2. Analytical Framework
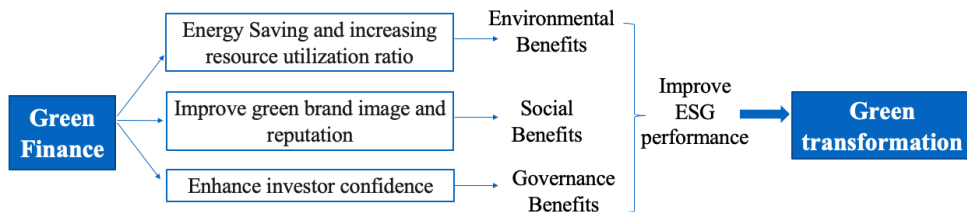
The increase in environmental, social and governance benefits improves overall ESG performance for real estate enterprises, and thus helps real estate enterprises to achieve green transformation.

Chapter 3. Analysis of GFRIP on Real Estate Enterprises

3.1. Quantitative Analysis

3.1.1. Data Source and Model

In this paper, using data from China A-share listed real estate enterprises between 2014 and 2020, the influence of GFRIP on ESG scores of China's real estate enterprises with a DID model as a quasi-natural experiment is analyzed. The contributions of this study are listed below. The existing studies do not reach a consensus on how environment regulations affect the real estate business. Moreover, the relationship between GFRIP and real estate business has not been well studied yet. This study researches on the relationship between GFRIP and real estate business in China to well explain the mechanisms of this impact. Moreover, the research findings will help to understand the mechanisms by which environmental policies affect the real estate business as a whole, and can provide a valuable reference for developing countries to accelerate green development. Second, green finance may have endogenous problems in previous studies. Using GFRIP to design a quasi-natural experiment can overcome such problems to a certain extent and enrich the research at the firm level. If the results of the study show that GFRIP can stimulate real estate enterprises to improve their ESG performance, they can prove that GFRIP has a positive effect on promoting the green and low-carbon transformation in real estate industry.

This paper aims to evaluate the influence of GFRIP on real estate enterprises, therefore, the data of ESG scores are selected as the explanatory variables. The reasons are as follows: (1) As more and more people focus on the environmental data of real estate enterprises when making investment decisions, the evaluation on performance of a certain company used ESG scores as a measure, which has a research basis; (2) with the enterprises' awareness of sustainable development and the improvement of China's ESG evaluation system, ESG scores can better reflect their green development according to previous literature review.

The ESG scores of listed real estate enterprises are extracted from Bloomberg. The core of ESG is the evaluation system and evaluation method, although there is no international unified standard specification yet. The strength of the Bloomberg ESG Rating System is that it provides a comprehensive approach to assessing the ESG performance of enterprises, using a large amount of data and professional judgment to evaluate the ESG performance. The results also include a rating report that can help investors better understand their ESG performance. Generally, in terms of environment (E), ESG evaluation focuses on topics such as climate change, carbon emission, pollution emission, energy and water conservation, resource saving, recycling and disposal, green products and technologies. When evaluating society (S) aspect, ESG focuses on corporate culture, consumer relations, supplier relations, community relations, employee relations and so on. As for governance (G), ESG focuses on whether corporate management and the board of directors operate the company

effectively, whether corporate incentive mechanism is reasonable, whether the mode of management is diversified.

In this paper, the data of economic characteristics at enterprise level were obtained from CSMAR database. Several data processes were conducted in order to ensure the comparability of the study results: (1) the samples of ST, *ST and S*ST were excluded; (2) the samples of companies listed after 2014 were excluded; (3) the samples of companies with incomplete financial data or ESG data were excluded; (4) the samples of real estate companies in Chongqing and Gansu were seen as control group, because the implementation of GFRIP in both areas just started, and the effect may not be reflected through this experiment. The final sample consists of 644 observations in 20 provinces. The final sample of experimental group consists of 231 observations (33 companies) in four provinces, including Guangzhou, Zhejiang, Guizhou, Jiangxi province, because there is no real estate enterprise in Xinjiang province with complete data, and the rest 413 observations (59 companies) are in control group. In order to reduce the effect of extreme values, the continuous variables are scaled down at the 1% and 99% levels. The statistical analysis software used in this paper is Stata. 16.

Taking into account previous studies and the availability of data, following variables are chosen as control variables. Firm size (SIZE) represents the total assets, which has been shown to be an important factor affecting companies' green innovation of economic sustainable development and social responsibility. The larger the size of the firm, the more attention given to ESG performance and the more stable in

investment on green development, such as using green materials in building process. Asset-liability ratio (LEV), which is expressed as the ratio of total liabilities to total assets at the end of the period, can be used to assess financing risk and reflect the green transformation capability of a real estate enterprise because of representing business ability. Age (AGE), expressed as the listed year of the company, represents its maturity of the real estate company, and the more mature a company is, the stronger environmental awareness contains. Tobin Q value (TOBINQ), expressed as the ratio of its market value divided by its total assets at the end of the period, reflects its ability to create social value, and when a real estate enterprise has a higher Tobin Q value, it chooses to convert financial capital to industrial capital and has a stronger incentive on green development. Female board members (FEMALE), expressed as the number of female directors. Related research has shown that women's participation on corporate boards can improve the quality of corporate governance and operating performance, which affects ESG performance of a real estate company. According to Jones Lang LaSalle's research, in terms of board structure diversity, the ratio of men to women on boards of real estate enterprises is uneven, with women generally accounting for less than 30% of the MSCI standard. Return on assets (ROA) is the ratio of corporate profit to total assets which can reflect the ability of a real estate enterprise to use its assets to make profit. As a source of surplus funds, most studies have shown that profitable enterprises are more willing to invest in R&D, which can improve environmental development.

The difference-in-difference (DID) model is mostly used to assess the policy effects. The GFRIP was implemented selectively, with starting in five provinces in 2017, and implemented in Gansu in 2019, as well as in Chongqing in 2022, so it is appropriate to use the DID model to assess the impact. This paper compares the differences in ESG performance between pilot and non-pilot regions before and after implementation year. Therefore, The following DID model is developed:

$$ESG_{it} = \alpha + \beta 1 Treat_i \times Post_t + \beta 2 \sum Control_{it} + \gamma_i + \varepsilon_{it}$$

In the model, ESG_{it} is the independent variable, which indicates the environmental performance of real estate enterprise i in year t. $Treat_i$ is a dummy variable of the pilot province, which is assigned as "1" if the enterprise i is located in the pilot province, and "0" otherwise. $Post_t$ is a dummy variable of the policy time, which is assigned as "1" if the time is after 2017, and "0" otherwise. $Treat_i \times Post_t$ is the interaction term between $Treat_i$ and $Post_t$, and its coefficient is the core estimation parameter. $Control_{it}$ is a series of control variables, including age, Tobin Q value, female director number, return on assets, and so on. γ represents the fixed effect. ε_{it} represents the random disturbance term.

The experimental group is the sample subject to the policy impact. $Treat_i$ equals 1 and $Post_t$ equals 0 prior to policy implementation year, and the interaction term $Treat_i \times Post_t$ equals 0; $Treat_i$ equals 1 and $Post_t$ equals 1 after the policy implementation year, so $Treat_i \times Post_t$ also equals 1. Similarly, the control group includes provinces without

policy implementation effect. $Treat_i$ equals 0 and $Post_t$ equals 0 before the policy implementation, so the interaction term $Treat_i \times Post_t$ is equal to 0; $Treat_i$ equals 0 and $Post_t$ equals 1, so $Treat_i \times Post_t$ also equals 0 after the policy implementation.

The descriptive statistics of the main variables in this paper are shown in the Table 1. The mean ESG score is about 21.62 and the median score is 20.2479, showing that the median ESG score is a little smaller than the mean, which indicates that the ESG performance need to be improved among real estate enterprises. The standard deviation of ESG scores is 6.482, with the minimum value being 8.678 and the maximum value being 46.694, indicating that the ESG scores vary very widely.

Other variables are all control variables in this paper. The average age of enterprises is about 23 year, with the minimum value being 8 and maximum value being 41, affirming that the sample real estate enterprises in this paper are all listed before 2014.

Table 1. Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max	Median
ESG	644	21.62	6.482	8.678	46.694	20.2479
AGE	644	23.533	4.719	8	41	24
SIZE	644	23.851	1.473	19.26	28.257	23.6654
LEV	644	.657	.182	.096	1.347	.696427

9

FEMALE	644	3.668	1.911	0	10	4
ROA	644	.024	.041	−.431	.297	.020159
TOBINQ	644	1.328	.861	.717	14.84	1.09096
						6

3.1.2.   Empirical Results

Table 2 shows the regression results, indicating the impact from GFRIP on ESG performance of real estate enterprises. The first three columns do not take into account the influence of other factors, and the last three columns take into account the control variables including firm size, Tobin Q's value, firm age, asset-liability ratio, return on assets, female director number. This study also controlled time fixed effect and province fixed effect: (1) and (4) is the simple regressions without controlling fixed effects, and the regression coefficients of Treat×Post are 2.104 and 1.484, significant at the 1% and 5% level respectively; (2) and (5) controlled province effect only, and the regression coefficients of Treat×Post are 2.866 and 2.433, which are both significant at the 1% level; (3) and (6) controlled time effect only, and the regression coefficients of Treat×Post are 0.889 and 0.533, with both insignificance. The above results indicate that the GFRIP significantly promoted the ESG performance for real estate enterprises.

Based on the regression results of the last three columns, which are related to control variables, Tobin Q's value significantly increases the ESG score, indicating that a real estate enterprise with high Tobin Q's value is good at creating social value and converting financial capital to industrial capital, thus increasing the ESG score.

2 5

Firm age also significantly increases the ESG score of real estate enterprises, indicating that maturity of the enterprise makes the effect of GFRIP more obviously, which is in line with the ideal expectation. Female director number also increases the ESG score, indicating that female directors can improve the corporate governance and operating performance in real estate industry. The coefficients of ROA, asset-liability ratio (leverage), and firm size in all tests are not significant, indicating that they are not the core factors affecting ESG performance.

Table 2. DID model regression results.

VARIABLES	(1) ESG	(2) ESG	(3) ESG	(4) ESG	(5) ESG	(6) ESG
did	2.104***	2.866***	0.889	1.484**	2.433***	0.533
	(0.704)	(0.795)	(0.802)	(0.724)	(0.819)	(0.817)
SIZE				0.269	0.195	0.182
				(0.249)	(0.252)	(0.251)
TOBINQ				0.868***	0.643**	1.108***
				(0.333)	(0.326)	(0.345)
AGE				0.208***	0.189***	0.147**
				(0.0557)	(0.0572)	(0.0590)
LEV				−0.518	−1.363	0.736
				(2.019)	(2.219)	(2.062)
ROA				−2.322	−6.811	1.100
				(7.013)	(6.904)	(7.212)
FEMALE				0.304**	0.321**	0.279**
				(0.132)	(0.131)	(0.132)
Constant	21.30***	21.18***	21.49***	8.212	11.18**	10.73**
	(0.276)	(0.265)	(0.281)	(5.356)	(5.390)	(5.443)
Time Control	NO	NO	YES	NO	NO	YES
Province Control	NO	YES	NO	NO	YES	NO
Observations	644	644	644	644	644	644
R-squared	0.014	0.176	0.038	0.053	0.204	0.069

Notes: The t-values are in parentheses, *, **, and *** indicate significance levels of 10%, 5%,

and 1% respectively.

3.2. Application to Vanke

3.2.1. Case Study Background

In December 2016, Guangdong Province issued the "Implementation Opinions on Strengthening the Integration of Environmental Protection and Finance to Promote Green Development", which can be seen as a starting point of the green financial development in Guangdong. Guangdong Province will build a comprehensive green financial service system, further encourage financial institutions to actively launch green credit products such as energy efficiency loans, carry out asset securitization on green credit and green bonds to accelerate the green development of industries. In June, 2017, the People's Bank and other ministries and commissions jointly issued the "Overall Plan for the Construction of Green Financial Reform and Innovation Pilot Zone in Guangdong Province", and Guangzhou, mainly in Huadu District, was included in the first group of GFRIP zone in China. As of the end of first quarter of 2022, the green loan balance of Guangzhou city was 647.152 billion yuan, ranking first among all the pilot cities.

Figure 3. Top 10 China Green Low-Carbon Real Estate Index in 2021.

Ranking	Firm Name	Green Low-Carbon Design Coefficient	Green Low-Carbon Operational Coefficient	Green Low-Carbon Incentive Coefficient	Fully Decorated Finished Apartment Coefficient	Prefabricated Building Coefficient	Carbon Emission Coefficient	Emission Factor of Polluting Gases	Emission Factor of Waste	Water Resource Consumption Coefficient	Environmental Information Disclosure Coefficient	Green Low-Carbon Index	Province
1	China Overseas Land & Investment Ltd.	8.7	6.4	-	21.0	3.0	4.0	4.3	4.9	3.7	4.6	60.5	Shanghai
2	China Vanke Co., Ltd.	7.5	5.4	-	15.0	7.5	8.0	4.9	3.9	3.3	4.1	59.6	Guangdong
3	Greentown China	6.8	3.5	6.0	24.9	-	7.0	2.4	2.4	3.5	2.7	59.2	Zhejiang
3	Beijing Capital Land Ltd.	7.0	7.8	-	27.5	-	-	4.9	4.5	3.3	4.3	59.2	Beijing
4	Contemporary Amperex Technology Co., Limited	6.9	8.8	-	24.5	-	-	3.6	4.2	4.8	4.2	57.0	Beijing
5	China Jinmao Holdings Group Limited	8.5	4.3	-	28.7	-	-	4.2	3.9	4.9	2.4	56.9	Beijing
6	Shimao Property Holdings Limited	5.5	2.7	8.0	23.1	9.0	3.0	-	-	2.0	3.5	56.8	Shanghai
6	Longfor Group Holdings Limited	9.3	5.2	-	19.4	2.9	4.0	4.1	3.9	1.7	3.9	56.8	Chongqing
7	China Jinke Limited	7.9	4.2	-	28.9	-	-	4.3	4.2	0.7	4.1	54.4	Chongqing
7	China Evergrande Group	8.1	5.9	4.7	9.0	6.6	4.0	4.2	4.3	3.3	4.3	54.4	Guangdong
8	Risesun Real Estate Development Co., Ltd.	6.0	2.9	-	26.9	-	-	3.9	4.3	3.3	3.8	51.0	Hebei
8	Jindi Group Co., Ltd.	6.1	3.5	-	28.6	-	-	4.4	4.2	1.0	3.1	51.0	Guangdong
9	Landsea Group	4.3	5.4	-	16.6	7.2	7.9	-	-	4.1	3.3	48.8	Jiangsu
10	Country Garden Holdings Company Limited	8.9	6.9	3.5	12.0	-	-	4.5	4.6	3.9	4.2	48.5	Guangdong
10	Powerlong Real Estate Holdings Limited	9.4	6.5	-	17.3	-	-	4.1	4.7	2.7	3.8	48.5	Shanghai

Figure 4. Top 10 China Green Low-Carbon Real Estate Index in 2022.

Ranking	Firm Name	Green Low-Carbon Design Coefficient	Green Low-Carbon Operational Coefficient	Green Low-Carbon Incentive Coefficient	Fully Decorated Finished Apartment Coefficient	Prefabricated Building Coefficient	Carbon Emission Coefficient	Emission Factor of Polluting Gases	Emission Factor of Waste	Water Resource Consumption Coefficient	Environmental Information Disclosure Coefficient	Green Low-Carbon Index	Province
1	Greentown China	9.2	6.2	2.8	3.7	3.9	28.5	2.8	9.3	9.0	4.0	79.5	Zhejiang
2	China Overseas Land & Investment Ltd.	8.3	7.1	1.6	4.9	3.7	21.4	-	5.5	6.0	4.5	63.1	Shanghai
3	Beijing Capital Land Ltd.	6.9	9.2	0.9	4.9	4.5	29.7	-	-	2.0	4.0	62.0	Beijing
3	China Jinmao Holdings Group Limited	7.4	3.6	2.1	2.3	3.0	26.4	-	8.0	7.2	2.0	62.0	Beijing
4	China Resources Land Limited	6.8	5.6	0.9	5.0	3.8	23.8	-	4.3	5.9	4.5	60.6	Hong Kong
5	China Vanke Co., ltd.	9.8	8.6	2.1	4.2	4.9	15.2	-	4.4	6.2	4.5	59.9	Guangdong
6	Longfor Group Holdings Limited	7.4	5.8	3.2	5.0	3.6	20.8	-	4.6	5.4	4.0	59.8	Beijing
7	CIFI Holdings (Group) Co. Ltd.	8.1	2.2	1.9	4.4	1.2	25.9	-	5.9	6.6	3.0	59.2	Shanghai
8	China SCE Group Holdings Limited	6.0	0.4	0.4	-	1.2	28.4	4.8	7.2	6.8	3.2	58.3	Shanghai
8	Yuexiu Property Company Limited	5.8	3.6	0.1	-	-	29.4	-	8.1	7.4	4.0	58.3	Guangdong
9	Zhongnan construction co., ltd.	6.6	1.6	0.4	1.1	0.9	27.9	-	9.4	6.5	3.5	57.8	Jiangsu
10	Hengtong Group Co., Ltd.	9.6	8.7	2.8	2.0	3.3	13.3	2.7	7.3	6.5	1.3	57.5	Guangdong

According to Top 10 real estate enterprises based on China Green Low-carbon Real Estate Index in 2021 and 2022 respectively, real estate enterprises in Guangdong have the outstanding performance compared to those in other pilot areas, including Vanke, Yuexiu,

Hengtong, Evergrande, Gemdale, Country Garden. Among them, Vanke has ranked top in both two years. China Green Low-carbon Real Estate Index is released by China Green Low-carbon Alliance and China Academy of Land Sciences to evaluate the green low-carbon level of China's real estate business, which is an important evaluation standard in real estate industry, reflecting the environmental protection and sustainable development level of enterprise in China's real estate business. Currently, 13 of the Top 30 real estate enterprises have released ESG reports, and among them, Vanke Group has issued 14 consecutive CSR (corporation social responsibility) reports since 2007 and sustainability report based on the original CSR report since 2021. The reports systematically present Vanke's development and future goals in ESG management from 3 perspectives: management, environment and society. Moreover, the public data can be obtained from the sustainable reports, financial reports and announcements published by Vanke and the information disclosure is comprehensive, with some voluntary public data, such as the destination of each green bond financing disclosed in the annual report of China Vanke. Therefore, China Vanke is an appropriate case study objective since the case is representative and the case data is available.

3.2.2. Enterprise Profile

Founded in 1984, China Vanke is a large residential real estate developer in Guangdong, focusing its business on more than 60 mainland Chinese cities in the Pearl River Delta, Yangtze River Delta

and Bohai-Rim Region, with the provision of investment, trading, consultancy services and e-business. It also has expanded into Hong Kong, the United States, the United Kingdom, and Malaysia since 2012. Its largest shareholder is Shenzhen Metro. The company was ranked among the Fortune Global 500 for the first time in 2016, ranking 356th on the list, and in 2022, 178th.

In 2014, Vanke extended the company's position to "urban support service provider". In 2018, Vanke further upgraded this positioning to "city and town developer and living service provider" and has always focused on good products and services. Vanke always insists on providing good products and services for ordinary people, and through its own efforts, makes its contribution to meeting people's needs for a better life in all aspects within its capacity. So far, the ecosystem the company has built is beginning to take shape, and China Vanke has always adhered to green development.

Vanke has been ranked first for many years in exploring green development. Vanke City Phase Four in Shenzhen is the first company in China to be awarded the "3-star Green Building". China Vanke is the first company in the global real estate industry to join the World Wide Fund for the "Carbon Reduction Pioneer" program, and is one of the largest companies in the world.

3.2.3. Basic Information of Vanke Green finance

In 2022 sustainable report, Vanke added a new section for discussion on green finance, not only introducing the company's green finance framework, but also showing in detail the three green

medium-term notes. The general environment is affected in 2022 and the overall credit declines, real estate enterprises' financing difficulty has increased and the cost of bond issuance is higher. Therefore, green bonds have become one of the favored ways for Vanke to expand their financing channels.

In 2022, Vanke issued three tranches of medium term green notes with 7 billion yuan totally. The first issue amounted to 3 billion yuan, with a term of 3 years, and was all intended to be used for the construction of green building-related projects, and was invested in 6 projects in total. The second issue amounted to 2 billion yuan, and the initial issue size of Variety 1 is 1 billion yuan, with a term of 3 years, and the initial issue size of Variety 2 is 1 billion yuan, with a term of 5 years for the five projects. The third issue amounted to 2 billion yuan, with the initial issue size of Variety 1 being 1 billion yuan for the 3-year term, and 1 billion yuan for the 5-year term of Variety 2 with the initial issue size of 1 billion yuan for the eight projects.

Table 3. Vanke Green medium-term notes in 2022

Vanke green medium-term notes in 2022			
Name	22Vanke. GN001	22Vanke. GN002	22Vanke. GN003
Size (RMB100 million)	30	20	20
Issue Date	2022-07-19	2022-08-10	2022-09-19

Maturity Date	2025-07-21	2025-08-12	2025-09-21
Green Building Projects	6	5	8
Maturity (years)	3	3	3
Coupon Rate	3.00%	2.90%	3.20%
Interest Rate Type	Fixed Rate	Fixed Rate	Fixed Rate
Rating	AAA/AAA	AAA/AAA	AAA/AAA

The comprehensive financing cost of Vanke's new financing for 2022 was 3.88% and the comprehensive financing cost of the stock financing was 4.06%. From the perspective of Vanke's overall financing, the issuance cost of the three green medium-term notes is in the low range. In addition, Vanke promised in the prospectus of the three green medium-term notes that all the funds raised would be used for green projects, and even if the use of the funds changes during the life of the notes, they will only be used for green projects or repayment of green loans. In other words, the 7 billion yuan green medium-term notes issued by Vanke all correspond to green project construction, and cannot be compared with the interest rate of the outstanding notes, which is also in line with the gradual regulation of green financing nowadays.

Real estate companies in the past issued green bonds have been questioned the investment of fund-raising with a certain degree of

operability. By July last year, the Green Bond Standard Committee officially released the "China Green Bond Principles" to the market, further clarifying that 100% of the funds raised should be used for green projects and overall enhancing the purity of green bonds. Taking Vanke's third green medium-term note for 2022 as an example, the note issue amounted to 2 billion yuan, which is comparable to the total amount of funds to be raised for eight asset projects. Among them, the City Light West project in Yantai is expected to have a total investment amount of 835.2 million yuan, with 687.8 million already invested and 70 million to be used from the proceeds, while the remaining investment plan for the project in 2022 is 35 million yuan, with the remaining 15 million, 15 million and 5 million yuan to be invested in the subsequent three years respectively.

Table 4. Details of the use of funds raised by Vanke's third green medium-term notes for 2022

Project	City	Amount Expected investment (yuan)	Amount invested (yuan)	Proposed use funds (yuan)
City light West	Yantai	835200	687800	70000
Park Legend	Chengdu	4719120	3631950	623330
Vanke City	Xuzhou	4418270	4219660	98870
The New Metropolis	Xuzhou	2081620	1815180	149990
Starry Place	Wenzhou	3680000	3230000	365570
Vanke Runyuan	Chengdu	2460330	1964660	294610
Vanke Gaodi	Hefei	1757700	1462070	295630
Vanke City of	Dongguan	1433500	1142620	102000

Dongguan				
Total		21385740	18153940	2000000

3.2.4. Policy Effect Analysis

Under the Green Finance Framework, which has been developed in 2021, Vanke will issue green bonds and green loan financing instruments and use proceeds from green bonds and financing instruments issuance for financing and refinancing existing, future assets to improve Vanke's environmental business.

Besides the use of proceeds, another focus disclosed by the documents of green medium-term notes by Vanke is the environmental benefits of green buildings. Vanke's three green medium-term notes in 2022 measured the annual energy savings of the residential component of the offering projects to be 19,384,800 kWh, 35,832,100 kWh and 34,573,600 kWh respectively, for a total of 89,790,000 kWh. In addition, taking the third medium-term note as an example, according to the proportion of the proposed funds used for each fund-raising project to the total investment amount of each estimated project, it is expected to save 1054.10 tons of standard coal, 2473.89 tons of carbon dioxide, 0.15 tons of soot, 20.55 tons of SO and 0.61 tons of NOx per year after conversion. Currently, these quantitative indicators are used to measure the energy efficiency benefits from the green buildings where the bonds are invested in, however, in the long run, they may be relevant to future changes of the whole real estate industry.

Another example of application is called "Dameisha Vanke Center"

designed under the green financial framework, which is a carbon neutral demonstration project to address climate change problem in Shenzhen, Guangdong. Vanke has adopted zero-carbon emissions, zero-waste, biodiversity solutions to achieve the approach to society and nature, and built "carbon neutral" pilot zones. It promotes environmental protection in two main ways. On the one hand, the "net-zero carbon community" promotes energy saving through upgrading intelligent lighting systems, building high-efficiency air-conditioning rooms, establishing energy-efficiency management system to improve energy efficiency. On the other hand, it promotes energy open source through deploying photovoltaic (PV) power generation, distributed energy storage, and smart charging stations to increase green energy proportion. The energy saving rate of near-zero energy building reaches 25.08%, and comprehensive energy saving rate reaches 85.38%. In terms of carbon emission, compared to the base year, 752.2tCO2e has been reduced and the carbon reduction rate reaches 93.3%. In the future, Vanke aims to realize 85% renewable energy use, with 100% of the green power for operational process. All the measures taken by Vanke in such a "near-zero carbon community" have greatly increased environmental benefits.

In addition, Vanke has initiated many community activities. Vanke Public Welfare Foundation combined all kinds of social scenarios and explored to build a "near-zero carbon community". When people in the community truly understand the green development philosophy by Vanke, the "near-zero carbon community" will help Vanke to

build green brand, increase the green reputation, and green real estate index to enhance their brand competitiveness, and then increase consumer awareness. The social activities and governmental selected projects will help to promote and enhance the green brand image and green transformation further, and thus increase social benefits as well.

In 2022, Vanke established an ESG management system, setting up an ESG governance structure including the Board of Directors, the Working Committee, and the ESG Executive Team. Besides increasing environmental and social benefits through promoting environmental protection development, reducing pollution and resource waste to improve Vanke's image and reputation in society, Vanke ESG management system significantly increases its governance benefit. Vanke's establishment of ESG management system can improve governance benefits in the following ways. Firstly, improving the transparency and trust of the company. A well-developed ESG management system can help the company disclose information better, improve the transparency of the company, provide more information about their non-financial performance to investors and increase the trust of the market. Secondly, identifying and managing related governance risks to improve the return on investment. ESG management system can reduce unnecessary losses, and improve the company's operational efficiency and return on investment. According to previous studies, companies with good ESG performance are more likely to achieve better returns on their investments. Finally, Complying with relevant regulations. With the

increasingly serious environmental issues occurred in China, government has paid more attention on establishing relevant regulations and rules to regulate the non-financial performance of real estate enterprises, so establishing ESG management system can help Vanke comply with the requirements of these regulations.

To sum up, Green Financial Framework (GFF) created under the promotion of GFRIP promoted Vanke to achieve green building construction, design "near-zero carbon community" and establish its own ESG management system. The samples of Vanke all increase the environmental, social and governance benefits through energy saving, resource utilization ratio increasing, green brand image and reputation improvement, investor confidence enhancement and so on, which improve Vanke ESG performance and then achieve green transformation successfully.

Chapter 4.   Conclusion and Limitation

This paper conducts a quasi-natural experiment using the GFRIP approved by the State Council in 2017 to empirically test the impact of the policy on China's real estate business using difference-in-difference (DID) method, based on the ESG score data of A-share listed real estate enterprises from 2014 to 2020. The results of the study show that the GFRIP can improve ESG performance of real estate enterprises and induce green development of real estate business to a certain extent. After the research and analysis of green development in a specific real estate enterprise, China Vanke, in Guangdong, the results show that green development of real estate enterprise has been achieved through increasing the environmental, social and governance benefit to improve ESG performance.

There are still some limitations in this paper. Firstly, GFRIP was first introduced in 2017, and due to the short time of the policy impact on real estate business, the accuracy of research results may be influenced to some extent. Secondly, when analyzing the Vanke case, the study may have ignored the variability of impact in different regions, therefore, the conclusion may be limited and hard to generalize nationwide. Thirdly, ESG and GFRIP are not one to one match relationship. ESG indicates society and governance besides environment, whereas GFRIP mainly promotes environmental construction, so ESG is a limited indicator when analyzing GFRIP or other environmental problems.

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APPENDIX A: Tables

Table 1. Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max	Median
ESG	644	21.62	6.482	8.678	46.694	20.2479
AGE	644	23.533	4.719	8	41	24
SIZE	644	23.851	1.473	19.26	28.257	23.6654
LEV	644	.657	.182	.096	1.347	.6964279
FEMALE	644	3.668	1.911	0	10	4
ROA	644	.024	.041	−.431	.297	.020159
TOBINQ	644	1.328	.861	.717	14.84	1.090966

Table 2. DID model regression results.

VARIABLES	(1) ESG	(2) ESG	(3) ESG	(4) ESG	(5) ESG	(6) ESG
did	2.104***	2.866***	0.889	1.484**	2.433***	0.533
	(0.704)	(0.795)	(0.802)	(0.724)	(0.819)	(0.817)
SIZE				0.269	0.195	0.182
				(0.249)	(0.252)	(0.251)
TOBINQ				0.868***	0.643**	1.108***
				(0.333)	(0.326)	(0.345)
AGE				0.208***	0.189***	0.147**
				(0.0557)	(0.0572)	(0.0590)
LEV				−0.518	−1.363	0.736
				(2.019)	(2.219)	(2.062)
ROA				−2.322	−6.811	1.100
				(7.013)	(6.904)	(7.212)
FEMALE				0.304**	0.321**	0.279**
				(0.132)	(0.131)	(0.132)
Constant	21.30***	21.18***	21.49***	8.212	11.18**	10.73**
	(0.276)	(0.265)	(0.281)	(5.356)	(5.390)	(5.443)
Time Control	NO	NO	YES	NO	NO	YES
Province Control	NO	YES	NO	NO	YES	NO
Observations	644	644	644	644	644	644
R-squared	0.014	0.176	0.038	0.053	0.204	0.069

Table 3. Vanke Green medium-term notes in 2022

Vanke green medium-term notes in 2022			
Name	22Vanke. GN001	22Vanke. GN002	22Vanke. GN003
Size (RMB100 million)	30	20	20
Issue Date	2022-07-19	2022-08-10	2022-09-19
Maturity Date	2025-07-21	2025-08-12	2025-09-21
Green Building Projects	6	5	8
Maturity (years)	3	3	3
Coupon Rate	3.00%	2.90%	3.20%
Interest Rate Type	Fixed Rate	Fixed Rate	Fixed Rate
Rating	AAA/AAA	AAA/AAA	AAA/AAA

Table 4. Details of the use of funds raised by Vanke's third green medium-term notes for 2022

Project	City	Amount Expected investment (yuan)	Amount invested (yuan)	Proposed use funds (yuan)
City light West	Yantai	835200	687800	70000
Park Legend	Chengdu	4719120	3631950	623330
Vanke City	Xuzhou	4418270	4219660	98870
The New Metropolis	Xuzhou	2081620	1815180	149990
Starry Place	Wenzhou	3680000	3230000	365570
Vanke Runyuan	Chengdu	2460330	1964660	294610
Vanke Gaodi	Hefei	1757700	1462070	295630
Vanke City of Dongguan	Dongguan	1433500	1142620	102000
Total		21385740	18153940	2000000

Appendix B: Figures

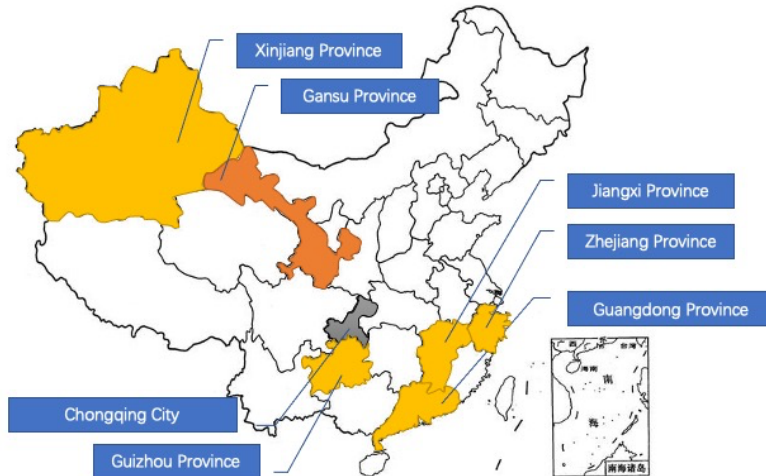Figure 1. Location of pilot zones
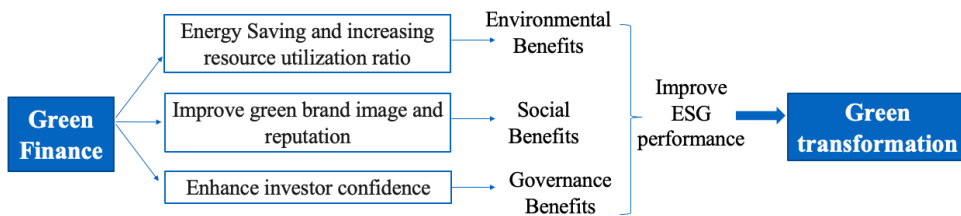

Figure 2. Analytical Framework

Figure 3. Top 10 China Green Low-Carbon Real Estate Index in 2021

Ranking	Firm Name	Green Low-Carbon Design Coefficient	Green Low-Carbon Operational Coefficient	Green Low-Carbon Incentive Coefficient	Fully Decorated Finished Apartment Coefficient	Prefabricated Building Coefficient	Carbon Emission Coefficient	Emission Factor of Polluting Gases	Emission Factor of Waste	Water Resource Consumption Coefficient	Environmental Information Disclosure Coefficient	Green Low-Carbon Index	Province
1	China Overseas Land & Investment Ltd.	8.7	6.4	-	21.0	3.0	4.0	4.3	4.9	3.7	4.6	60.5	Shanghai
2	China Vanke Co., Ltd.	7.5	5.4	-	15.0	7.5	8.0	4.9	3.9	3.3	4.1	59.6	Guangdong
3	Greentown China	6.8	3.5	6.0	24.9	-	7.0	2.4	2.4	3.5	2.7	59.2	Zhejiang
3	Beijing Capital Land Ltd.	7.0	7.8	-	27.5	-	-	4.9	4.5	3.3	4.3	59.2	Beijing
4	Contemporary Amperex Technology Co., Limited	6.9	8.8	-	24.5	-	-	3.6	4.2	4.8	4.2	57.0	Beijing
5	China Jinmao Holdings Group Limited	8.5	4.3	-	28.7	-	-	4.2	3.9	4.9	2.4	56.9	Beijing
6	Shimao Property Holdings Limited	5.5	2.7	8.0	23.1	9.0	3.0	-	-	2.0	3.5	56.8	Shanghai
6	Longfor Group Holdings Limited	9.3	5.2	-	19.4	2.9	4.0	4.1	3.9	1.7	3.9	56.8	Chongqing
7	China Jinke Limited	7.9	4.2	-	28.9	-	-	4.3	4.2	0.7	4.1	54.4	Chongqing
7	China Evergrande Group	8.1	5.9	4.7	9.0	6.6	4.0	4.2	4.3	3.3	4.3	54.4	Guangdong
8	Risesun Real Estate Development Co., Ltd.	6.0	2.9	-	26.9	-	-	3.9	4.3	3.3	3.8	51.0	Hebei
8	Jindi Group Co., Ltd.	6.1	3.5	-	28.6	-	-	4.4	4.2	1.0	3.1	51.0	Guangdong
9	Landsea Group	4.3	5.4	-	16.6	7.2	7.9	-	-	4.1	3.3	48.8	Jiangsu
10	Country Garden Holdings Company Limited	8.9	6.9	3.5	12.0	-	-	4.5	4.6	3.9	4.2	48.5	Guangdong
10	Powerlong Real Estate Holdings Limited	9.4	6.5	-	17.3	-	-	4.1	4.7	2.7	3.8	48.5	Shanghai

Figure 4. Top 10 China Green Low-Carbon Real Estate Index in 2022

Ranking	Firm Name	Green Low-Carbon Design Coefficient	Green Low-Carbon Operational Coefficient	Green Low-Carbon Incentive Coefficient	Fully Decorated Finished Apartment Coefficient	Prefabricated Building Coefficient	Carbon Emission Coefficient	Emission Factor of Polluting Gases	Emission Factor of Waste	Water Resource Consumption Coefficient	Environmental Information Disclosure Coefficient	Green Low-Carbon Index	Province
1	Greentown China	9.2	6.2	2.8	3.7	3.9	28.5	2.8	9.3	9.0	4.0	79.5	Zhejiang
2	China Overseas Land & Investment Ltd.	8.3	7.1	1.6	4.9	3.7	21.4	-	5.5	6.0	4.5	63.1	Shanghai
3	Beijing Capital Land Ltd.	6.9	9.2	0.9	4.9	4.5	29.7	-	-	2.0	4.0	62.0	Beijing
3	China Jinmao Holdings Group Limited	7.4	3.6	2.1	2.3	3.0	26.4	-	8.0	7.2	2.0	62.0	Beijing
4	China Resources Land Limited	6.8	5.6	0.9	5.0	3.8	23.8	-	4.3	5.9	4.5	60.6	Hong Kong
5	China Vanke Co., ltd.	9.8	8.6	2.1	4.2	4.9	15.2	-	4.4	6.2	4.5	59.9	Guangdong
6	Longfor Group Holdings Limited	7.4	5.8	3.2	5.0	3.6	20.8	-	4.6	5.4	4.0	59.8	Beijing
7	CIFI Holdings (Group) Co. Ltd.	8.1	2.2	1.9	4.4	1.2	25.9	-	5.9	6.6	3.0	59.2	Shanghai
8	China SCE Group Holdings Limited	6.0	0.4	0.4	-	1.2	28.4	4.8	7.2	6.8	3.2	58.3	Shanghai
8	Yuexiu Property Company Limited	5.8	3.6	0.1	-	-	29.4	-	8.1	7.4	4.0	58.3	Guangdong
9	Zhongnan construction co., ltd.	6.6	1.6	0.4	1.1	0.9	27.9	-	9.4	6.5	3.5	57.8	Jiangsu
10	Hengtong Group Co., Ltd.	9.6	8.7	2.8	2.0	3.3	13.3	2.7	7.3	6.5	1.3	57.5	Guangdong

국문 초록

중국 부동산업에 대한 GFRIP(녹색금융개혁 및 혁신 시범 정책)의 평가

최근 중국에서는 녹색금융이 중국의 탄소 중립과 탄소 피크 목표치 추진과 함께 국민들이 더욱 주목해야 할 뜨거운 사회적 이슈가 되고 있다. 탄소 집약형 산업으로서 어떻게 녹색 전환을 실현할 것인가가 부동산 산업의 문제이다. 중국은 2017년 5개 성에서 녹색금융개혁과 혁신 시범 도시를 제안했고, 이 정책이 시행되면서 부동산 기업들이 자금조달 비용을 줄이기 위해 일부 조치를 취했다. 본 논문은 GFRIP가 부동산 사업이 녹색 개발을 실현하는데 도움이 될 수 있는지를 연구하기 위해 정성적 방법과 정량적 방법을 결합하여 사용한다. 2014~2020년 부동산업계 A 공유 상장기업 92개사를 대상으로 패널 자료와 7년간 부동산기업의 전반적인 ESG성과 변화추세에 대한 연구를 통해 GFRIP가 중국 부동산사업에 미치는 영향을 분석하기 위한 차이(DID)모형을 기반으로 하였다, 그리고 기업의 소유권이 다를 때 영향의 이질성을 탐구한다. 이 결과는 GFRIP가 부동산 기업의 ESG 점수를 크게 향상시키고 부동산 사업의 녹색 발전도 향상시킨다는 것을 보여준다. 추가적인 이질성 분석을 통해 GFRIP가 국유기업보다 비국유부동산기업의 녹색 개발에 더 유의한 영향을 미치는 것으로 나타났다. 본 논문은 또한 광둥성 시범지구에서 특정 부동산기업인 중국 방크의 녹색 개발을 분석한 결과 녹색금융이 환경적, 사회적, 지배구조적 편익 증대를 통해 녹색 개발을 개선한 것으로

나타났다. 연구결과를 바탕으로 향후 GFRIP의 긍정적 효과를 더욱 제고

해야 할 것이다.