

Green Finance Pilot Zones and Corporate ESG Performance in China: A City-Level DID Analysis

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Abstract. This study examines the impact of China's Green Finance Reform and Innovation Pilot Zones (GFRIPZ) on business ESG performance. This article conducts an empirical analysis utilising standardised panel data from China's A-share non-financial listed companies sourced via LSEG Workspace. It employs a difference-in-differences methodology at the city level and integrates fixed effects for companies and years to assess the influence of policies on the overall ESG score and its three components: environment, society, and governance. The results provide little evidence of a broad policy effect. Overall, ESG performance does not improve significantly after the introduction of the pilot policy. At the pillar level, neither the environmental nor the governance score shows a significant response. The social pillar is positively associated with the policy in a parsimonious specification; however, the effect disappears once firm-level controls are added. One and two-year lag tests lead to the same conclusion. The research findings indicate that the influence of green finance reform on rating-based sustainability performance is less significant than anticipated. It may exhibit reduced speed, accompanied by considerable latency.

Keywords: Green finance, Corporate ESG performance, Pilot zone policy, Difference-in-differences

1. Introduction

Green finance is gaining increasing popularity as society places greater emphasis on sustainable development. In China, this became more visible in 2017, when the Green Finance Reform and Innovation Pilot Zones (GFRIPZ) were introduced to explore greener credit allocation, better disclosure, and stronger environmental risk management [1]. An important question for companies is if these reforms do improve ESG corporate performance? The evidence currently available on this subject is mixed overall. Some research has found that China's green finance reforms have been associated with better ESG (or related) sustainability practices, but the extent of the reported effects has varied according to sample, treatment definition and model specification [2,3]. ESG measurement makes the issue even less straightforward. Because providers rely on different indicators, weighting schemes, and processing rules, ratings often diverge, and genuine behavioral change may not be fully captured by any single score [4].

In this context, this article employs a city-level difference-in-differences methodology to analyse the impact of GFRIPZ on Chinese A-share non-financial publicly traded companies. By examining the comprehensive ESG score with the Environmental, Social, and Governance pillars, it provides micro-level data about the impact of green financing initiatives on visible changes in publicly traded companies [5].

2. Green finance and corporate ESG performance

2.1. Mechanisms and theory

Green finance aims to guide businesses toward activities that bring environmental and social benefits. However, policy incentives are sometimes not well reflected in ESG scores. This depends on two preconditions. First, there must be actual changes in companies' behaviour. Secondly, these shifts must be detected by ESG rating models.

Financing is one potential channel alone. With the expansion of green credit from banks and investors, corporations may incur lower financing costs. This can be done by backing investment in energy efficiency, pollution control, and workplace safety. Such investment, over time, may enhance environmental performance. In some cases, social performance may also be enhanced. Yet companies do not react equally. Larger organizations frequently enjoys superior reporting systems with easier ways to obtain funds through a bank or other financial institution. Consequently, their ability to respond is enhanced. Conversely, smaller enterprises may encounter greater difficulty qualifying for the necessary project funding or taking on an up-front cost; however, larger firms have an advantage in identifying potential projects and obtaining finance for those projects.

A second mechanism is through disclosure and monitoring. Green finance reforms often place increased demands on companies to enhance sustainability reporting, risk assessment, and verification. This matters because ESG scores rely heavily on what is disclosed. Companies that enhance their disclosures may receive better scores. According to the LSEG framework, firms' disclosures are used to generate pillar scores and a holistic ESG score. Consequently, the scores may improve before the full effect of adjusting [6].

The third channel is corporate governance. When green finance policies are established, companies will pay closer attention to them and may develop long-term strategies to promote green and sustainable development. These may be reflected in higher corporate governance ratings. However, such strategies often require a long period to implement and may not be immediately apparent.

Overall, green finance has the potential to improve ESG scores. However, its impact may vary from company to company and may be limited in the short term.

2.2. What the literature finds

The investigation into the Chinese sustainable finance reforms and the ESG performance of companies affected by these regulations has expanded significantly. The 2017 Green Finance Reform and Innovation Pilot Zones (GFRIPZ) present a distinctly defined policy shock. Numerous research indicate beneficial outcomes. Companies in pilot zones frequently exhibit elevated ESG scores or increased sustainability-related initiatives [2,3].

However, the literature also shows why the results do not always match. One reason is the measurement of ESG. ESG ratings can differ across providers because they use different scopes and

weighting systems [4]. If a policy mainly affects aspects that are harder to observe or less emphasized in a specific rating model, the estimated effect may appear limited.

Firm heterogeneity is another important factor. Larger firms often receive higher ESG scores because they usually have more formalized disclosure systems [7]. Moreover, there is a chance that green finance can alter how companies report on their activities even if they do not produce different results. Moreover, some Pilot Zones might be able to help decrease the amount of "greenwashing" that happens in terms of ESG [8]. Thus, an aggregate ESG impact of zero does not imply that the policy has failed but rather that it may be due to differences in timing among firms, differences in response among firms, or differences in how ESG ratings reflect the variations associated with these issues.

3. Green finance and green innovation

Green innovation is frequently perceived as a mechanism via which green funding influences companies. Financial institutions that are incentivized or motivated to back eco-friendly initiatives may provide less resistance for companies in order to obtain funding for clean technologies; energy-efficiency equipment; and low-carbon production. Therefore, green innovation connects financial policies with positive ESG outcomes. Sustainability advancements require more than just improved reporting; they also require actual technological and operational advancements.

Numerous studies back this notion. Green credit policies can alter firms' financing terms and influence their environmental investment choices [9]. Research on China's green finance reforms also provides consistent evidence. Policy support may stimulate firms to undertake green projects and make environmentally friendly adjustments to their activities [2,3]. But that often takes time. Finance first influences investment. ESG ratings could respond later.

Green innovation is not equivalent to ESG performance. The company may prioritize green R&D and still not advance each ESG pillar at the same pace. However, higher-quality ESG disclosure is not always associated with greater innovation. Therefore, this study focuses on ESG performance. Green innovation is considered a relevant channel rather than an independent dependent variable. More detailed patent- or innovation-based measures would require additional classification and matching beyond the existing dataset.

4. Data, model, and empirical results

4.1. Data and sample

The firm-level panel data on listed companies in the Chinese A-share market are employed in the empirical analysis. LSEG Workspace uses ESG ratings. The total ESG score and the scores for the Environmental, Social, and Governance pillars are presented here. The financial information, encompassing total assets, liabilities, net income, and revenue, is sourced from the same database. This upholds similar standards for later company identification and reporting [6].

To make firms more comparable, we restrict the sample to non-financial firms. Excluding financial firms, as their balance sheets and regulatory environments differ from those of other listed firms. The data are then organized as a firm-year panel, with annual observations.

The policy examined is China's Green Finance Reform and Innovation Pilot Zone policy, introduced in 2017. Since the policy was implemented only in selected areas, treatment is identified at the city level based on firms' headquarters locations. The treated cities in this study are Huzhou, Quzhou, Guangzhou, and Changji. Other pilot areas are excluded because comparable city-level

data on listed companies are unavailable. Firms in these pilot cities form the treatment group, while firms from other cities serve as the control group.

The resulting dataset is an unbalanced panel. This is primarily because ESG disclosure was scant in earlier years. This is ubiquitous in ESG studies and has been interpreted as progressive coverage of sustainability reporting, rather than as errors in data processing [4,6].

4.2. Variables

The comprehensive ESG score from LSEG Workspace functions as the principal dependent variable in this research. The analysis additionally employs the scores from the environmental, social, and governance pillars. This demonstrates whether the policy impacts various components of ESG differently. All scores span from 0 to 100. Elevated ratings indicate superior achievement.

The primary explanatory variable is DID_city. It encapsulates the impact of the Green Finance Reform and Innovation Pilot Zone policy. This variable is derived from the interaction between a treatment indicator and a post-policy indicator. The treatment indicator is set to 1 if a firm is based in a recognisable pilot city. Conversely, it is equivalent to 0. The post-policy indicator is assigned a value of 1 for the year 2017 and subsequent years.

The baseline model incorporates two firm-level control variables. Size2 is quantified as the natural logarithm of total assets, denoting business size. Lev3 is calculated by dividing total liabilities by total assets and is utilised to assess leverage. To mitigate the impact of outliers, the leverage ratio is constrained to the interval between 0 and 1 in the final sample.

4.3. Empirical model

This study used a difference-in-differences (DID) model to analyse the impact of the Green Finance Reform and Innovation Pilot Zone policy on business ESG performance. The model incorporates firm fixed effects and year fixed effects. This methodology is extensively employed in policy evaluation research [5,10]. The baseline model is delineated as follows:

$$ESG_{it} = \alpha + \beta DID_City_{it} + \gamma Controls_{it} + u_i + \lambda t + \varepsilon_{it} \quad (1)$$

In firms model, ESG_{it} is the ESG score of firms i in year t . DID_City_{it} is the policy variable. It equals the interaction between the treatment indicator and the post-policy indicator. $Controls_{it}$ includes two firm-level control variables, Size2 and Lev3. u_i is the firm fixed effect. λt is the year fixed effect. ε_{it} is the error term.

The DID model compares firms in pilot cities with firms in non-pilot cities. It looks at how their ESG scores change before and after the policy. The coefficient β indicates whether firms in pilot cities experienced different ESG changes after the policy.

Firm fixed effects are employed to account for firm attributes that exhibit minimal variation over time, such as corporate culture or market position. Year fixed effects are included to account for any year-specific influences on all firms in the sample, related to, amongst other things, macroeconomic conditions, policy changes, and broad trends in ESG. Standard errors are clustered by firm. This controls for serial correlation within firms over time.

The same model is also used for the E, S, and G pillar scores. This allows the analysis to test whether the policy effect differs across ESG dimensions.

4.4. Descriptive statistics

Descriptive statistics of the main variables are reported in Table 1. The average ESG score is 37.33, with a standard deviation of 17.54, suggesting considerable divergence in sustainability performance among firms. Of the three pillars, G has the highest average score (48.20), while S has the lowest (30.77). This pattern suggests that governance structures might be relatively more standardized, and that E and S advances might involve relatively more firm-level efforts.

The mean value of DID_city is 0.03, which means that only a small proportion of firm-year observations are pilot-city firms in the post-policy period. This reflects the fact that the policy covered only a few cities. The control variables exhibit a couple of decent variations themselves; the mean of Size2 is 20.34, and the mean of Lev3 is 0.22.

Table 1. Descriptive statistics

Variable	Mean	standard deviation	Min	Median	Max
ESG	37.33	17.54	0.73	35.52	91.47
E	35.04	24.35	0.00	32.84	97.08
S	30.77	20.80	0.56	21.50	95.71
G	48.20	21.06	0.49	47.70	97.01
DID_City	0.03	0.16	0.00	0.00	1.00
Size2	20.34	1.96	12.68	20.37	29.53
Lev3	0.22	0.22	0.00	0.13	1.00

Note: ESG, E, S, and G refer to the overall ESG score and its environmental, social, and governance pillar scores, respectively. DID_city equals 1 for firms located in pilot cities in the post-2017 period, and 0 otherwise. Size2 is measured as the natural logarithm of total assets, and Lev3 is measured as total liabilities divided by total assets.

4.5. Baseline regression results

Tables 2 and 3 present the baseline regression results, with and without firm-level controls, respectively. For the overall ESG score, the DID_city coefficient is not statistically significant in both regressions. In other words, the green finance pilot policy does not appear to have significantly improved firms' overall ESG performance during the sample period.

The pillar-level results tell a similar, but not identical, story. For the environmental pillar, the policy coefficient is not statistically significant in either model. The social pillar appears different at first glance: the estimate is positive and significant in the simpler model in Table 2; yet it becomes insignificant after controlling for firm size and leverage in Table 3, indicating that the initial finding is not robust. In contrast, the governance pillar remains insignificant throughout.

Most of the control variables in Table 3 are consistent with our expectations. Firm size has a positive association with ESG performance in all but one model, but leverage does not appear to have a consistent association with ESG results. Overall, the baseline regressions provide scant evidence for the notion that the pilot policy led to an across-the-board improvement in ESG performance for listed firms.

Table 2. Baseline regression results without firm-level controls

Variables	ESG	E	S	G
DID_City	3.508 (4.329)	2.593 (5.110)	4.162** (1.791)	6.706 (11.082)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	5,983	5,983	5,983	5,983
R-squared	0.493	0.553	0.436	0.096

Note: Robust standard errors clustered at the firm level are reported in parentheses. ***p < 0.01, ** p < 0.05, * p < 0.10.

Table 3. Baseline regression results with firm-level controls

Variables	ESG	E	S	G
DID_City	-0.073 (3.503)	1.296 (5.618)	2.728 (2.434)	-2.007 (11.961)
Size2	4.219*** (0.598)	6.048*** (0.798)	4.551*** (0.726)	2.497*** (0.861)
Lev3	2.424** (1.079)	4.284*** (1.450)	4.036*** (1.354)	-0.395 (1.557)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observations	4,790	4,790	4,790	4,790
R-squared	0.516	0.568	0.457	0.113

Note: Robust standard errors clustered at the firm level are reported in parentheses. ***p < 0.01, ** p < 0.05, * p < 0.10.

4.6. Robustness and discussion

Table 4 reports the results of the lagged specifications. To test whether the policy effect appears with a short delay, the baseline treatment variable is replaced with one-year and two-year lagged terms. The coefficients remain statistically insignificant in all models. This is true both with and without firm-level controls. These results suggest that advancing the treatment window by 1 or 2 years does not alter the main finding. The green financing pilot strategy has yet to demonstrate a significant impact on enterprises' ESG performance during the sample period.

The lack of significance in the short-lag models does not mean that the policy has no long-term effect. Green finance reforms may take longer to affect firms' financing choices, investment behaviour, and sustainability practices. These modifications may require time to manifest in ESG ratings. Related studies indicate that the impacts of green finance pilot zones may evolve progressively rather than instantaneously [11].

Table 4. Robustness test: lagged policy effects

Variables	t+1 ESG (No controls)	t+1 ESG (With controls)	t+2 ESG (No controls)	t+2 ESG (With controls)
DID (t+1)	3.306 (5.918)	0.223 (5.239)		
DID (t+2)			0.298 (5.908)	-1.371 (5.080)
Size2		4.218*** (0.598)		4.220*** (0.598)
Lev3		2.422** (1.079)		2.430** (1.078)
Firm FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Observation	5,983	4,790	5,983	4,790
R-squared	0.493	0.516	0.492	0.516

Note: Robust standard errors clustered at the firm level are reported in parentheses. DID (t+1) and DID (t+2) denote one-year and two-year lagged policy variables, respectively. Firm FE and Year FE denote firm and year fixed effects. Controls refer to firm-level controls, including Size2 and Lev3. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

5. Conclusion

This study examines the impact of China's Green Finance Reform and Innovation Pilot Zone policy on the ESG performance of A-share non-financial listed companies. A city-level Difference-in-Differences model incorporating firm and year fixed effects is employed. The data do not indicate a definitive rise in total ESG scores during the sample period. Incorporating firm-level controls does not alter this outcome.

The pillar results are similar. No significant effect is found for the environmental score or the governance score. The social score is positive only in the simpler model. After controls are added, it is no longer significant. The one-year and two-year lag results are also insignificant.

These results do not mean that the policy had no role. Green finance may still affect firms in some ways. It may change financing conditions. It may also affect disclosure and governance. But these changes may not appear quickly in ESG ratings.

This paper investigates non-financial listed companies, and the treatment is defined at the city level. Yet some limitations remain. The panel is not balanced. The treated group is small. The analysis also relies on a single ESG data source. Further research could employ a larger sample, contrast different ESG ratings, and incorporate measures of green innovation.

References

- [1] State Council of the People's Republic of China. (2017). China to set up pilot zones for green finance, cut red tape for industries. https://english.www.gov.cn/premier/news/2017/06/15/content_281475686634782.htm
- [2] Chen, Z., Hu, L., He, X., Liu, Z., Chen, D., & Wang, W. (2022). Green financial reform and corporate ESG performance in China: Empirical evidence from the green financial reform and innovation pilot zone. *International Journal of Environmental Research and Public Health*, 19(22), 14981. <https://doi.org/10.3390/ijerph192214981>
- [3] Sun, X., Zhou, C., & Gan, Z. (2023). Green finance policy and ESG performance: Evidence from Chinese manufacturing firms. *Sustainability*, 15(8), 6781. <https://doi.org/10.3390/su15086781>
- [4] Berg, F., Kölbels, J. F., and Rigobon, R. (2022). Aggregate confusion: The divergence of ESG ratings. *Review of Finance*, 26(6), 1315–1344. <https://doi.org/10.1093/rof/rfac033>

- [5] Callaway, B., & Sant'Anna, P. H. C. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2), 200–230. <https://doi.org/10.1016/j.jeconom.2020.12.001>
- [6] London Stock Exchange Group (LSEG) Data & Analytics. (2024). Environmental, Social, and Governance scores from LSEG: ESG scores methodology. https://www.lseg.com/content/dam/data-analytics/en_us/documents/methodology/lseg-esg-scores-methodology.pdf
- [7] Drempetic, S., Klein, C., & Zwergel, B. (2020). The influence of firm size on the ESG score: Corporate sustainability ratings under review. *Journal of Business Ethics*, 167(2), 333–360. <https://doi.org/10.1007/s10551-019-04164-1>
- [8] Tong, Y., Lau, C. K. M., & Ngalim, S. M. B. (2024). Do pilot zones for green finance reform and innovation avoid ESG greenwashing? Evidence from China. *Heliyon*, 10(13), e33710. <https://doi.org/10.1016/j.heliyon.2024.e33710>
- [9] Zhang, B., Yang, Y., & Bi, J. (2011). Tracking the implementation of green credit policy in China: Top-down perspective and bottom-up reform. *Journal of Environmental Management*, 92(4), 1321–1327. <https://doi.org/10.1016/j.jenvman.2010.12.019>
- [10] Goodman-Bacon, A. (2021). Difference-in-differences with variation in treatment timing. *Journal of Econometrics*, 225(2), 254–277. <https://doi.org/10.1016/j.jeconom.2021.03.014>
- [11] Lin, G., Lam, J. F. I., Shi, Y., Chen, H., & Chen, H. (2023). Revisiting the linkage between green finance and China's sustainable development: Evidence from the pilot zones for green finance reform innovations. *Frontiers in Ecology and Evolution*, 11, 1264434. <https://doi.org/10.3389/fevo.2023.1264434>