Green Bonds and Corporate ESG Performance

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Abstract: This paper investigates the effect of green bond policy on corporate ESG performance using the promulgation of the "Green Bond Guidelines"(2015 Guidelines) policy in China as aquasi-natural experiment. By constructing a unique penal of data spanning from 2009 to 2021, we draw several findings. We collected data from all 785 companies listed on the Kuala Lumpur Stock Exchange. Our final sample consisted of 91 companies that have an ESG disclosure score. The high cost of common bonds and the crowding-out effect of green bonds on common bonds seek more to ease financing constraints, and enterprises that have not issued bonds are more likely to issue green bonds for the reason of building green projects. China's green bond regime has continued to evolve, from the head office announcing at the end of 2015 that enterprises could issue green bonds with project credit, to the Development and Reform Commission proposing a maximum gearing limit for enterprises to issue green bonds in order to alleviate corporate financing constraints, to the Securities Regulatory Commission clarifying the investment of funds raised by green bonds, which in principle does not support highly polluting and energy-consuming industries, to the explicit removal of the coal and fuel categories from the support act in 2021, which has fully aligned with international practice.

***Keywords*:** green bonds, ESG performance, common bonds

1. Introduction

The global surface temperature has risen more than 1℃ in the past 140 years, which is over the scope of natural climate fluctuations[1]. One of the main reasons is the excessive emissions of Greenhouse gasses that could potentially erase 18% of the GDP in the world if the global temperature rises by 3.2℃ by 2050[2]. To relieve the global warming issues, parties reached the Paris Agreement at COP 21 to intensify the necessary actions and investments for a sustainable future, which includes promoting finance flows in line with low GHG emissions and climate-resilient pathways (UNFCCC). More specifically, it requires a reformed technology framework and reinforced capacity-building to be facilitated by appropriate mobilisation and provisions of financial resources (UNFCCC).

Therefore, ESG is acknowledged as a win-win method to improve brand reputation and market value, as well as fulfil green production and social sustainability[3]. Companies that overlook ESG may be rendered inferior in the marketplace and lose the role of game-players in more stringent ESG environments, such as the USA and EU[4]. As Chen et al. (2023) suggested that resource availability has a positive relation with ESG development, sufficient financial resources are indispensable for ESG investments to make economic and environmental profits[5]. Green bonds, defined as debt financing issued by corporations and organisations to support green capital projects, are recognised as the key to achieving the Paris Agreement[6]. Besides, green bond issuance (GBI) is not only a financing action but also a reaction to external pressure for environmental protection[6]. GBI has been acknowledged as a reliable signal regarding sustainable development for both corporates and investors, through which for companies, issuing green bonds can effectively reduce greenhouse gasses emissions and increase their environmental ratings, while investors are able to foresee profits, as GBI would be interpreted as the signal of the change of the ESG profile[7]. However, as Miles (1993)[8] noticed, the market value of a company tends to be decided upon expected incomes in the short term. Therefore, there is a tension between the prioritisation of market pricing and ESG performance, in other words, a balance between long-term and short-term goals. Managerial myopia may consider excessive highlight on ESG as a distraction to the growth, market share, and short-term incomes of the company[9] and thus prioritise short-term earnings at the expense of sustainable development and long-term value brought by ESG[10].

Previous studies have shown that green bonds can bring positive impacts on all three components of ESG[6]. Furthermore, green bonds have a positive effect on a company's reputation that in turn promotes a corporation's CSR and ESG performance[11]. However, little research has been obtained regarding the relationship between firm-level factors and successful GBI. Besides, most of the studies nowadays only focus on the relationship between GBI and corporate ESG performance but overlook that through which mechanism two elements interact with each other[12]. Another point is that green bonds have gained great popularity in the market to combat climate change. However, future success in the sustainable

marketplace relies on its pricing and financial performance[6]. That is to say – there lacks a systematic comparison between the effect of green-labelled bonds and non-green-labelled bonds on corporate ESG performance. Therefore, this paper aims to fill the gap by exploring the mechanisms that GBI employed to influence corporate ESG performance and conducting a comparative study between green bonds and traditional bonds to probe into their roles in ESG respectively.

To address the research gap, we will first argue that issuing general bonds is detrimental to GBI thus deprives the corporate ESG performance from the managerial aspect. Green bonds are of a category of knowledge-based financial innovation that requires substantial long-term resource investment, which in turn takes a considerable duration to yield noticeable benefits, such as performance enhancement. Therefore, from the perspective of contractual obligations, the issuer would be inclined to low-risk ventures to secure punctual bond payments and short-term financial boosts. Moreover, because of the necessity for bond collateral, knowledge-based R&D instruments tend to restrict cash flow more easily than collateralised fixed assets. For this reason, issuers would be compelled to forgo high investment and risk-return green innovation. On the other hand, issuing debts can trigger managerial rent-seeking that shifts the risks to creditors and is detrimental to corporate ESG performance.

We posit that green bonds enhance corporate ESG performance via tripartite mechanisms — environmental stewardship through earmarked investments, governance refinement via transparency-enforced accountability, and social value creation through resource-efficient branding — while conventional bonds erode governance quality and overall ESG outcomes. The environmental mechanism operates through project-specific capital allocation that incentivizes green transition, coupled with supervisory cost asymmetry wherein fund misuse penalties exceed financing costs. Governance efficacy stems from mandatory disclosure requirements that mitigate agency conflicts by aligning managerial conduct with creditor oversight. Socially, this ecological commitment generates reputational capital and operational efficiencies that fulfill CSR mandates. Conversely, ordinary bonds' undifferentiated financial rigidity fosters short-termism and exacerbates governance risks through opaque capital management.

This paper will adopt a quasi-natural experimental method to construct a multi-temporal double difference model to bond's impact on corporate ESG performance to address this research gap. The data in this paper are extracted from A-share listed companies from 2009-2021. Based on the findings in this study, we propose that not only companies but also investors should raise awareness of environmental protection through green bonds, acting as an external force to corporates for sustainable development. Moreover, in order to have green bonds act effectively, regulators should clarify the criteria of GBI that corporates with an asset-liability ratio higher than 75% should not be given to issue green bonds, and companies in heavy pollution industries should not be supported to issue green bonds.

2. Review of the literature

This section establishes an analytical framework bridging Environmental, Social, and Governance (ESG) performance with Green Bond Issuance (GBI) mechanisms, contextualized within the historical evolution from Corporate Social Responsibility (CSR) to contemporary ESG paradigms. Originating as corporate-initiated socio-environmental commitments[13], CSR demonstrates measurable impacts on market valuation enhancement and capital acquisition efficiency. However, its reliance on self-regulated governance structures has precipitated systemic challenges, including disclosure authenticity disputes and institutional complexity amplification[14]. The transition to ESG frameworks addresses these limitations through standardized quantitative metrics, particularly through Key Performance Indicators (KPIs) that enable cross-institutional sustainability benchmarking for external stakeholders[15]. Empirical observations reveal a paradoxical adoption pattern: while financial markets exhibit rapid ESG integration through algorithmic portfolio adjustments, corporate operational implementation frequently encounters strategic gridlock due to conflicting stakeholder priorities and data integrity challenges[16]. The Nordic model offers critical insights, demonstrating that successful ESG institutionalization requires three-tiered data infrastructure: 1) real-time environmental impact monitoring, 2) third-party verified social metrics, and 3) machine-readable governance disclosures[17].

The conceptual architecture of this study positions green innovation as a dual-externality generator, combining knowledge spillover effects (through cross-industry technology diffusion) with environmental externalities (via emission reduction multipliers). This theoretical construct informs our analysis of Green Bonds (GB), first conceptualized by the World Bank in 2010 as climate finance instruments. Effective GB implementation necessitates advanced evaluation frameworks, particularly the TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) method, which enables multidimensional assessment of energy-environment-economic tradeoffs while designing market-based compensation mechanisms for ecological externalities.

Current research establishes three critical pathways through ESG disclosure mechanisms: 1) environmental

performance optimization through regulatory anticipation[18], 2) operational risk mitigation via early-warning systems[19], and 3) capital cost reduction through information asymmetry alleviation[20]. However, the emerging phenomenon of ESG rating divergence—manifested through 43% variance in cross-agency evaluations[21]—introduces capital market distortions by creating conflicting future earnings projections[22]. This diagnostic inconsistency underscores the imperative for unified ESG assessment protocols[23]. Of particular concern is the observed decoupling between ESG scoring mechanisms and substantive environmental performance: while scoring algorithms disproportionately weight voluntary disclosure volume[24], they systematically underweight verified pollution metrics, creating perverse incentives for "greenwashing" strategies. Such strategic disclosure manipulation enables firms to engineer synthetic ESG profiles through selective information release while maintaining high-emission operations[25]. When ESG compliance degenerates into symbolic signaling without operational internalization, it fundamentally undermines the sustainability transition mechanisms that these frameworks were designed to catalyze[26].

3. Theoretical analysis and research hypothesis

First, bond issuance undermines ESG performance through dual contractual mechanisms rigid repayment obligations compress managerial risk appetite, forcing prioritization of low-risk conventional projects over innovation investments (contractual theory perspective); Second, collateral requirements induce a cash flow crowding-out effect, diverting resources to fixed assets rather than knowledge-intensive R&D—particularly crowding out long-term green innovation initiatives. Given green technologies' inherent characteristics of capital intensity, extended return cycles, and lagged environmental benefits, debt-induced myopic decision-making systematically erodes corporate sustainable development capacity.

Under dual pressures of bond regulation and capital markets, management may manipulate financial leverage for regulatory arbitrage (agency theory framework); The structural separation of cash flow rights from control rights incentivizes ultimate shareholders to engage in risk shifting by externalizing private gains through high-risk investments; Severe information asymmetry in China's capital markets weakens creditor monitoring efficacy, while expanded cash flow control from debt financing creates operational space for managerial self-interest behaviors (e.g., executive compensation inflation). The interplay of these tripartite agency conflicts ultimately dissipates corporate governance efficacy and degrades ESG value.

In summary, this paper proposes hypothesis:

H1: common bonds reduce corporate ESG performance.

First, signalling theory posits that firms issue green bonds to demonstrate environmental commitment. The primary purpose is to channel raised capital into eco-friendly projects, thereby increasing environmental investments. Post-issuance, enterprises actively pursue green transformation through targeted allocations (signalling intent to stakeholders). Concurrently, institutional theory highlights green bonds' earmarked-fund characteristic: violations of fund usage incur external penalties exceeding financing costs, creating binding incentives for compliance (enforcement mechanism).

Second, principal-agent theory identifies governance complexities arising from ownership-management separation. Green bonds mitigate managers' short-term opportunism through dual constraints: Strict covenants on capital deployment and cash flow repayment timelines. Superior disclosure requirements compared to conventional bonds (creditor oversight intensification). These mechanisms collectively curb managerial power abuse (agency cost reduction).

Third, the resource compensation effect emphasizes innovation's dependence on sustained capital/talent investment. As government-backed instruments, green bonds offer accelerated financing and lower costs versus traditional debt. Neoclassical analysis confirms that policy-supported resource compensation alleviates financial burdens crowding out green R&D: Government subsidies reduce innovation costs (funding source diversification). Risk uncertainty mitigation incentivizes managerial commitment to sustainable innovation. Thus, green bonds' cost-efficiency compensates environmental resource gaps, driving technological upgrades and ESG improvement (policy-institution synergy).

Fourth, green bonds activate dual social accountability channels:

Issuance boosts corporate image via consistency theory, fostering broader CSR engagement (employee welfare, product quality, community impact). Reduced capital costs and optimized resource allocation enable socially responsible product/service provision (stakeholder theory operationalization)In summary, this paper proposes hypothesis :

H2: Green bonds improve corporate ESG performance compared to no bond issuance and common bond issuance.

4. Study design

4.1 Regression model design

In December 2015, the National Development and Reform Commission issued the Guidelines on Green Bond Issuance to encourage enterprises to issue green bonds, and 2016 opened the first year of green bond issuance in China., under the

guidance of the policy, if an enterprise issues green bonds for the first time, it can be regarded as an exogenous shock event independent of the enterprise's decision, providing a quasi-natural experimental setting for this paper's research.

To control for the endogeneity of the relationship between green bonds issuance and corporate ESG performence in this study, the green bonds issuance event of the announcement by the National Development and Reform Commission in 2015 was chosen to conduct a quasi-natural experiment using the difference-in-differences method to carry out testing. As the DID model is considered the best method to evaluate the effevt of quasi-natural experimental policies[xxx], a heterogeneous timing DID model with two-way fixed effects (FE) is constructed as follows:

The DID approach is often used in event studies, where listed companies issue green bonds at different points in time, similar to the batching and gradual advancement of policy pilots, drawing on scholarly research (Purnanandam & Weagley, 2016), this paper examines the effect of green bonds on corporate ESG performance by constructing a multi-temporal double difference model to bond's impact on corporate ESG performance.

$$ESG_{i,t} = \alpha_0 + \alpha_1 Bond_{i,t} \times Post_{i,t} + \alpha_2 Control_{i,t} + \sum Year + \sum stock + \varepsilon \quad (1)$$

$$ESG_{i,t} = \alpha_0 + \alpha_1 Green_{i,t} \times Post_{i,t} + \alpha_2 Control_{i,t} + \sum Year + \sum stock + \varepsilon \quad (2)$$

$$ESG_{i,t} = \alpha_0 + \alpha_1 Green_{i,t} \times Post_{i,t} + \alpha_2 Control_{i,t} + \sum Year + \sum stock + \varepsilon \quad (3)$$

The theoretical analysis in this paper concludes that the issuance of green bonds by enterprises will enhance their ESG performance, at which point the coefficient in model (1) α_1 is significantly greater than zero.

Model 1 examines ESG performance enhancement by common bonds, with bond of 1 indicating firms that issued common bonds, this paper examines the bond of 0 selecting 1:2 matching firms that did not issue common bonds, post of 0 for before issuing common bonds and post of 1 for after issuing common bonds.

Model 2 examines the improvement in ESG performance of green bonds compared to no bonds, with a green of 1 indicating companies that issued green bonds and a green of 0 indicating companies that did not issue any bonds. a post of 1 indicates after the issuance of green bonds and a post of 0 indicates before the issuance.

Model 3 tests that green bonds promote ESG performance more than regular bonds, with the experimental group being firms issuing green bonds, 1:2 matching firms issuing regular bonds only, green being 1 for firms issuing green bonds and green being 0 for firms not issuing green bonds, post being 1 for after issuing green bonds and post being 0 for before issuing.

Table 1. Variable definition table

Variables	Before and after matching	Average value		P-value
		Experimental group	Control group	
Size	Before matching	0.3776	0.3747	0.000
	After matching	0.3776	0.3776	0.874
ATO	Before matching	0.3377	0.3634	0.000
	After matching	0.3377	0.3382	0.559
Growth	Before matching	0.1027	0.1241	0.987
	After matching	0.1027	0.1036	0.913
Indep	Before matching	2.9818	2.8393	0.000
	After matching	2.9818	2.9714	0.069
Balance2	Before matching	-0.0598	.74934	0.000
	After matching	-0.0598	.58384	0.294

4.2 Definition of key variables

4.2.1 Explanatory variables

The core explanatory variables of the model are the interaction term between Green bonds (Green) and the time variable (Post) (Green × Post) and the interaction term between common bonds (Bond) and the time variable (Post) (Bond × Post).

4.2.2 Explained variables

The explanatory variables are corporate ESG performance and ESG data using the latest version of 2022 ESG evaluation of Huazheng which is online in both the Flush database and WIND database. Based on China's ESG information disclosure system and with reference to the mainstream ESG framework in foreign countries, Huazheng uses environment,

social and corporate governance as the 3 pillars, internal management system, business objectives, green products, external certification, and violations in environmental aspects, institutional system, business activities, social contribution, and external certification in social aspects, and institutional system, governance structure, business activities, operational risks, and external risks in corporate governance The top-down three-tier index system is constructed by combining quarterly evaluation and dynamic tracking. Based on the index scores at all levels and the industry weighting matrix, a nine-grade "AAA-C" rating is calculated. ESG rating. In addition, as the time of the ESG data of China Securities is 31 January, 30 April, 31 July and 31 October respectively, which is different from the regular quarterly reporting time, in order to facilitate the empirical study, the average of the four quarterly scores is taken as the ESG performance of the enterprises in that year, and so on.

4.2.3 Control variables

Drawing on existing studies, the model's control variables include, among others, firm size (Size), total asset turnover (ATO), cashflow ratio (Cashflow), inventory share (INV), growth rate of operating income (Growth), proportion of independent directors (Indep), equity checks and balances (Balance2), years on the market (ListAge), dual employment (Dual), with year and individual fixed effects also added. See Table 2 for specific definitions and measures.

Table 2. Variable definition table

Variable type	Variables	Meaning of variables and their calculation
Explained variables	ESG	ESG performance of companies, using the CSI ESG Rating Index
Explanatory variables	Green	The dummy variable, if the firm issued green bonds during the sample period, its observation in all years is assigned a value of 1 and enters the experimental group, otherwise it takes the value of 0 and enters the control group.
	Post	The dummy variables are assigned a value of 1 for the experimental group if the firm issued green bonds in the year of issuance and subsequent years, and 0 otherwise; for firms in the control group that did not issue green bonds, all are assigned a value of 0.
Control variables	Size	Company size, equal to the natural logarithm of total assets
	ATO	Total asset turnover ratio, equal to operating income/average total assets
	Cashflow	Cash flow ratio, equal to net cash flow from operating activities divided by total assets
	INV	Inventory as a percentage, equal to the ratio of net inventory to total assets
	Growth	Operating income growth rate, equal to current year's operating income / previous year's operating income - 1
	Indep	Percentage of independent directors, equal to independent directors divided by the number of directors
	Balance2	The degree of balance of power, which is equal to the sum of the shareholdings of the second to fifth largest shareholders divided by the shareholding of the first largest shareholder
	ListAge	Years on market, equal to ln(current year - year on market + 1)
	Dual	Two positions in one, equal to the same chairman and general manager as l, otherwise 0
	Year	Year, dummy variable
	Stock	Individuals, dummy variables

4.3 Sample selection and data sources

In this paper, A-share listed companies from 2009-2021 were used, and data on repeated green bond issues were removed to eliminate the effect of the number of issues, and finally the observations of companies that issued green bonds for the first time were used as the initial research sample. The samples were removed according to the following principles: (1) exclude ST* and ST companies; (2) exclude samples with missing data and outliers; (3) exclude financial listed companies. The data on green bonds in this paper are sourced from the WIND database, and the data on corporate financial and governance characteristics are sourced from the Guotaian and WIND databases. In order to control the effect of extreme values, all continuous variables in this paper were subjected to tail-shrinking at 1% and below. The experimental group is companies issuing green bonds and the control group is companies in the industry of the company issuing green bonds that have not issued green bonds.

5. Empirical results and analysis

5.1 Descriptive statistics

Table 3 reports the results of descriptive statistics for the variable green bonds compared to no bond issuance. The minimum and maximum values of the quarterly ESG mean among the list companies are 1 and 6 respectively, indicating

significant differences in ESG ratings among different companies with a trend towards polarization and the mean value of ESG_Score is 4.42, which means that the average level of ESG scores is between the B+ and B levels and overall ESG level is low.The minimum and maximum values of DID are respectively 1 and 0, the mean valueis 0.1 and the median value is 0 showing a general lack of green bonds in listed companies compared to more mature capital markets. In terms of control variables, the values of Size, ATO, and ListAge with the reality of listed companies and are consistent with the existing literature's statistical results.

Table 3. Descriptive statistics of variables

variable	N	mean	sd	min	p50	max
ESG_Score	2702	4.420	1.020	1	4.500	6
did	2702	0.100	0.300	0	0	1
Size	2702	23.83	1.340	19.84	23.94	26.14
ATO	2702	0.570	0.410	0.0500	0.470	2.590
Cashflow	2702	0.0500	0.0700	-0.400	0.0500	0.350
INV	2702	0.130	0.150	0	0.0900	0.880
Growth	2702	0.190	0.450	-0.620	0.110	3.190
Indep	2702	0.380	0.0600	0.330	0.360	0.570
Balance2	2702	0.640	0.580	0	0.450	4
ListAge	2702	2.440	0.740	0	2.640	3.430
Dual	2702	0.170	0.370	0	0	1

5.2 Analysis of regression results

The regression results for model (1) are shown in Table 4. Column (1) presents the regression results for the effect of common bonds issuance on ESG performance compared with not issuing bonds with a regression coefficient of -0.0721, which is significantly negative at the 10% level. Columns (2) to (4) report the regression results for the impact of corporate issuance of common bonds on environmental (E), social(S) and corporate governance (G). The regression coefficients for E, S and G are -0.0516, -0.0592 and -0.105 respectively, with the governance dimension significant at the 10% level, indicating that common bonds have a negative impact on the corporate governance dimension, and verifiedhypothesis 1 that issuance of common bonds reduce corporate ESG performance and specifically reduce the governance dimension.

The regression results of model (2) are shown in Table 5. Column (1) shows the regression results of green bonds issuance on ESG performance compared with not issuing bonds with a regression coefficient of 0.195 significantly positive at the 1% level, indicating that issuing green bonds enhances corporate ESG performance relative to not issuing bonds. Columns (2) to (4) report the regression results for the impact of issuing green bonds on environmental (E), social (S) and corporate governance (G) relative to not issuing bonds, with regression coefficients of 0.106, 0.578 and 0.121 for E, S and G respectively, which are significantly positive at the 10%, 1% and 10% levels respectively, which means green bonds have an enhanced impact on ESG performance compared to not issuing bondsand all three dimensions by an elevated impact.

The regression results for model (3) that are shown in Table 6. Column (1) shows the regression results of green bonds issuance on ESG performance compared with common bonds issuance with a regression coefficient of 0.478, which is significantly positive at the 1% level, indicating that issuing green bonds enhances corporate ESG performance compared to issuing common bonds. Columns (2) to (4) report the regression results for the effects of green bonds on environmental (E), social (S) and corporate governance (G) relative to the issuance of common bonds, with regression coefficients of 0.0908, 0.596 and 0.575 for E, S and G respectively, which are significantly positive at the 10%, 1% and 1% levels respectively, which means thatcompared to the issuance of common bonds, green bonds have an enhanced effect on ESG and all three dimensions of performance have an elevated impact.

The above results are statistically and economically significant and consistent with previous theoretical results stating that issuing common bonds will bring about a reduction the ESG performance of companies.

This further proves the effectiveness of green bonds: issued companies are more willing to pay attention on environment, social and corporate governance(ESG) performance and increase the quantity of ooo after obtaining ESG ratings comparing to no-bond issuance companies, thereby validating hypothesis H2.

Table 4. Regression results for common bonds and ESG performance

	(1)	(2)	(3)	(4)
VARIABLES	common bonds vs. no bonds issuance	E	S	G
did	-0.0721*	-0.0516	-0.0592	-0.105*
	(0.0408)	(0.0408)	(0.0627)	(0.0546)
Size	0.199***	0.00569	0.380***	0.114***
	(0.0210)	(0.0210)	(0.0323)	(0.0281)
ATO	0.106**	-0.0859*	0.178**	0.181***
	(0.0461)	(0.0460)	(0.0708)	(0.0616)
Cashflow	-0.153	0.101	0.133	-0.344*
	(0.153)	(0.153)	(0.235)	(0.205)
INV	0.0814	0.360***	0.276	-0.195
	(0.133)	(0.133)	(0.205)	(0.178)
Growth	-0.0594***	-0.0180	-0.113***	-0.0459*
	(0.0180)	(0.0179)	(0.0276)	(0.0240)
Indep	1.380***	0.228	-0.0230	3.160***
	(0.295)	(0.294)	(0.453)	(0.394)
Balance2	-0.120***	0.00755	-0.0466	-0.184***
	(0.0329)	(0.0328)	(0.0505)	(0.0440)
ListAge	-0.303***	0.0209	0.135**	-0.716***
	(0.0442)	(0.0441)	(0.0679)	(0.0591)
Dual	-0.0803**	0.0326	-0.0602	-0.0774
	(0.0359)	(0.0358)	(0.0551)	(0.0480)
Constant	-0.137	1.713***	-4.728***	3.358***
	(0.496)	(0.495)	(0.763)	(0.664)
F-value	17.05	1.55	17.22	24.88
Observations	6,118	6,118	6,118	6,118
R-squared	0.660	0.717	0.765	0.609

Table 5. Regression results of green bonds and ESG performance

	(1) Green bonds vs. no debt issuance	(2)	(3)	(4)
VARIABLES	ESG	E	S	G
did	0.195***	0.106*	0.578***	0.121*
	(0.0568)	(0.0645)	(0.0940)	(0.0713)
Size	0.203***	0.151***	0.448***	0.0282
	(0.0347)	(0.0409)	(0.0575)	(0.0474)
ATO	0.305***	0.358***	0.475***	0.0627
	(0.0763)	(0.0920)	(0.126)	(0.102)
Cashflow	0.0532	0.272	-0.398	0.305
	(0.276)	(0.322)	(0.457)	(0.350)
INV	0.287	-0.0389	0.713*	-0.220
	(0.259)	(0.294)	(0.430)	(0.327)
Growth	-0.0354	-0.0232	-0.113**	-0.0968**
	(0.0333)	(0.0380)	(0.0552)	(0.0417)
Indep	1.600***	0.710	1.547***	2.637***
	(0.360)	(0.449)	(0.597)	(0.474)
Balance2	-0.0308	0.0479	0.105	-0.288***
	(0.0537)	(0.0606)	(0.0890)	(0.0692)
ListAge	0.0806	0.275***	0.408***	-0.123

	(0.0655)	(0.0747)	(0.109)	(0.0893)
Dual	-0.0740	-0.0840	0.0133	-0.0865
	(0.0557)	(0.0630)	(0.0923)	(0.0688)
Constant	-1.415*	-2.467**	-8.364***	3.763***
	(0.860)	(1.059)	(1.424)	(1.160)
F-value	9.21	4.41	15.52	11.55
Observations	2,702	2,702	2,702	2,702
R-squared	0.672	0.715	0.735	0.673

Table 6. Regression results of green bonds and ESG performance

	(1)	(2)	(3)	(4)
VARIABLES	ESG	E	S	G
did	0.383***	0.129*	0.615***	0.418***
	(0.0628)	(0.0717)	(0.100)	(0.0820)
Size	0.173***	0.0515	0.352***	0.0798**
	(0.0308)	(0.0352)	(0.0492)	(0.0403)
ATO	0.0959	0.0220	0.217**	0.145*
	(0.0630)	(0.0720)	(0.100)	(0.0823)
Cashflow	-0.0945	0.0178	0.422	-0.194
	(0.237)	(0.270)	(0.377)	(0.309)
INV	0.229	0.0820	0.453	0.192
	(0.196)	(0.224)	(0.313)	(0.256)
Growth	-0.0292	0.00292	-0.121**	-0.0189
	(0.0322)	(0.0367)	(0.0513)	(0.0420)
Indep	1.279***	0.313	0.534	2.988***
	(0.399)	(0.455)	(0.635)	(0.520)
Balance2	-0.167***	-0.00322	-0.101	-0.313***
	(0.0526)	(0.0601)	(0.0839)	(0.0687)
ListAge	-0.218***	0.0849	0.235**	-0.755***
	(0.0641)	(0.0732)	(0.102)	(0.0837)
Dual	-0.0837	-0.0862	-0.121	-0.0561
	(0.0538)	(0.0614)	(0.0857)	(0.0702)
Constant	0.411	0.532	-4.574***	4.441***
	(0.741)	(0.846)	(1.182)	(0.968)
F-value	10.81	1.04	11.65	16.82
Observations	2,422	2,422	2,422	2,422
R-squared	0.643	0.679	0.753	0.573

5.3 Robustness tests

5.3.1 Substitution of explanatory variables

Bloomberg Information has been collecting ESG information from listed companies since 2009 and provides information on the quality of corporate disclosure in the areas of environment, social responsibility and corporate governance respectively. The Bloomberg database provides data on the ESG index of Chinese listed companies, which contains the index values of the three primary indicators of corporate environmental disclosure, social responsibility disclosure and corporate governance disclosure, and is equally weighted to obtain the ESG practice index of Chinese listed companies. A number of scholars have used the Bloomberg database to conduct research on the influencing factors and policy consequences of ESG. To ensure the robustness of the results, this paper replaces the ESG performance measure with the Bloomberg database ESG ratings.

5.3.2 Change of year

Green policies may interfere with the impact of green bonds on corporate ESG. In August 2016, the People's Bank of China, the Ministry of Finance, the National Development and Reform Commission and seven other departments jointly

issued the Guidance on Building a Green Financial System, and on 25 December of the same year, the adoption of the Environmental Protection Tax Law of the People's Republic of China (Decree of the President of the People's Republic of China [2018 No. 61) made the corporate ESG performance more affected, therefore, after removing the sample from 2016, the empirical results are presented in the table.

Table 7. Regression results for common bonds and ESG performance

	(1) Green debt vs. no debt issuance	(2)common bonds vs. no debt issuance	(3) Green bonds vs. common bonds
VARIABLES	ESG1	ESG1	ESG1
did	1.180**	-0.590*	2.258***
	(0.491)	(0.322)	(0.513)
Size	1.138***	1.053***	0.601*
	(0.385)	(0.220)	(0.347)
ATO	0.839	-0.236	-0.657
	(0.727)	(0.400)	(0.550)
Cashflow	-6.797***	1.177	-5.668***
	(2.607)	(1.295)	(2.175)
INV	4.391*	5.414***	3.191
	(2.615)	(1.316)	(2.161)
Growth	0.374	-0.0612	0.210
	(0.313)	(0.157)	(0.285)
Indep	4.669	-1.060	3.088
	(3.046)	(2.216)	(3.266)
Balance2	-0.517	0.287	0.161
	(0.493)	(0.280)	(0.480)
ListAge	3.807***	0.184	1.971***
	(0.733)	(0.472)	(0.757)
Dual	0.700	-0.0966	-0.0565
	(0.520)	(0.294)	(0.457)
Constant	-16.14*	-4.486	0.864
	(9.637)	(5.266)	(8.522)
F	6.60	4.88	4.71
Observations	1,680	2,915	1,363
R-squared	0.823	0.796	0.785

	(1) Green debt vs. no debt issuance	(2) common bonds vs. no debt issuance	(3) Green bonds vs. common bonds
VARIABLES	ESG	ESG	ESG
did	0.188***	-0.0908**	0.400***
	(0.0587)	(0.0423)	(0.0652)
Size	0.187***	0.193***	0.166***
	(0.0356)	(0.0218)	(0.0318)
ATO	0.267***	0.0827*	0.0845
	(0.0789)	(0.0479)	(0.0651)
Cashflow	0.0712	-0.105	-0.131
	(0.290)	(0.160)	(0.251)
INV	0.404	0.111	0.235
	(0.270)	(0.140)	(0.205)
Growth	-0.0356	-0.0605***	-0.0469
	(0.0354)	(0.0193)	(0.0335)
Indep	1.633***	1.464***	1.202***
	(0.374)	(0.306)	(0.419)

	(1) Green debt vs. no debt issuance	(2) common bonds vs. no debt issuance	(3) Green bonds vs. common bonds
Balance2	-0.0288	-0.119***	-0.196***
	(0.0563)	(0.0343)	(0.0548)
ListAge	0.0827	-0.291***	-0.221***
	(0.0675)	(0.0457)	(0.0669)
Dual	-0.0849	-0.0882**	-0.0734
	(0.0581)	(0.0382)	(0.0572)
Constant	-1.047	-0.0286	0.637
	(0.883)	(0.515)	(0.765)
F	8.11	15.41	10.34
Observations	2,457	5,567	2,226
R-squared	0.673	0.662	0.647

6. Conclusions and recommendations

This paper investigates the impact of green bonds on corporate ESG performance and its underlying mechanism using a double difference model with a sample of A-share listed companies in Shanghai and Shenzhen from 2009 to 2021, using green bond issuance as a quasi-natural experiment. The study finds that: (1) green bonds enhance ESG performance and common bonds reduce ESG performance compared to common bonds and no bond issuance. (2) Green bonds enhance corporate ESG in terms of environmental mechanism, governance mechanism and social responsibility mechanism, and common bonds reduce governance performance and thus corporate ESG. (3) The asset-liability ratio and public environmental concern are selected from internal and external sources respectively, and it is found that asset-liability ratio has a suppressive effect on the effect between green bonds and ESG performance, and public environmental concern has a positive effect on green bond performance. Green bonds for heavy polluting industries do not enhance ESG performance. Based on the above findings, this paper makes the following policy recommendations:

6.1 Companies actively issue green bonds to enhance ESG performance and promote sustainable development

In order to achieve sustainable corporate development, companies should also focus on the quality of internal controls and on-the-job consumption. For common bonds, companies should focus on the quality of their internal controls, the level of green innovation as well as the level of agency costs and on-the-job consumption after issuance.

6.2 The regulator clarifies the criteria for issuance

When issuing green bonds for enterprises that only enhance green utility innovation should not be allowed to issue green bonds again, for enterprises with an asset-liability ratio higher than 75% should not be given to issue green bonds, and for enterprises in heavy pollution industries should not be supported to issue green bonds. At the same time, information disclosure of green bonds should be strengthened to improve the transparency of green bonds.

6.3 Investors should raise awareness of environmental concerns

Public environmental concern positively contributes to the ESG performance-enhancing effect of green bonds. The public's concern for environmental protection as an external watchdog will force companies to improve their ESG performance and promote sustainable social development.

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