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Sustainable Debt, Sustainable Returns? The Impact of Green Bonds on Firm Performance in China

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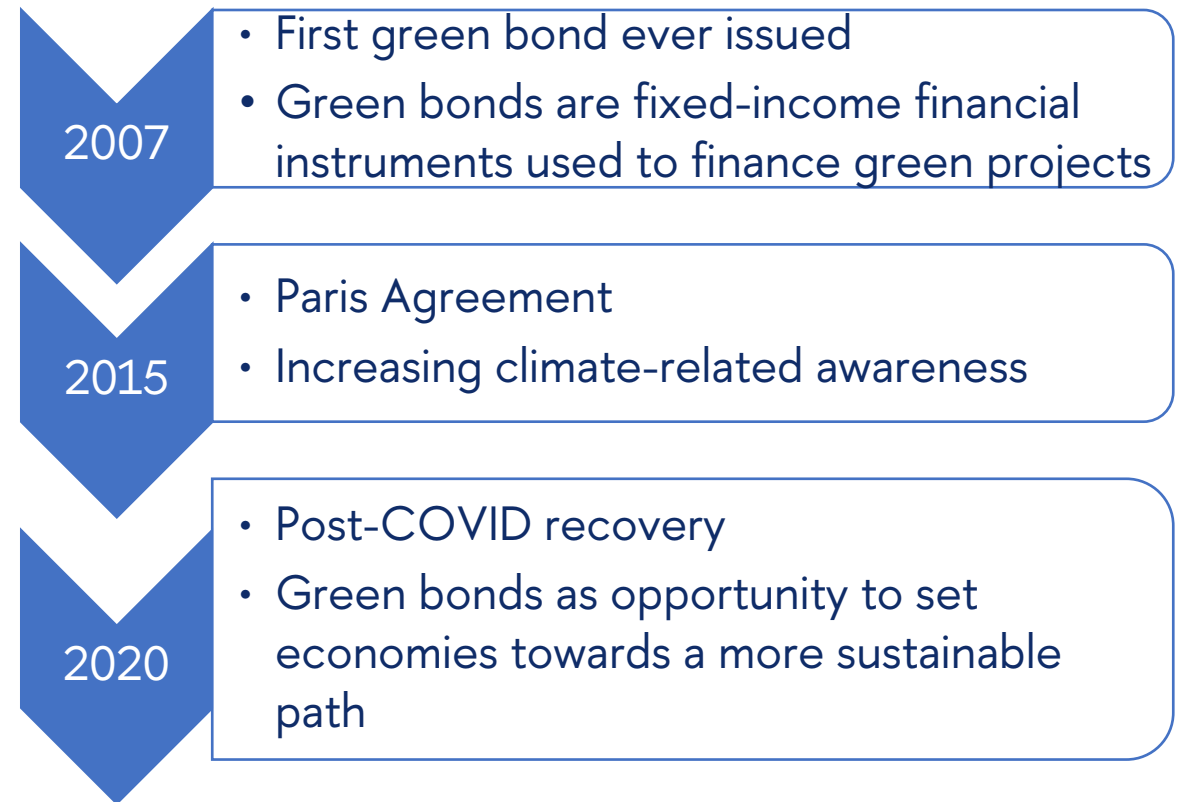


Introduction

In 2023, China was the world's largest green bond issuer for the second year running (USD 131 billion).

Research Gap

- Mixed and inconclusive evidence on whether green bond issuance improves firm profitability.
- China's market is large and unique, yet most firm-level studies focus on listed issuers; non-listed corporate bond issuers are underexplored.
- Prior work often uses short post-issuance windows and do not always address selection bias robustly.



RQ: "How the green bond issuance is related to the firm financial performance in China?"



Literature Review

Table 1. Effects of green bond issuance on corporate performance

Study Name	Methodology	Market	Time period	Result
Tang & Zhang (2018)	Event study	Global	2007–2017	Positive abnormal returns at announcement
Zhou & Cui (2019)	PSM +DiD	China	2016–2019	↑ ROA, gross profit margin, R&D expenses; limited short-term ROIC gains
Flammer (2020)	Event study	Global	2007–2018	Immediate positive market reaction; long-term gains in ROA & ROE
Agliardi & Chechulin (2020)	OLS	U.S. & Europe	2000–2017	↑ ROE, negative but not significant for ROA
Lebelle et al. (2020)	Event study	Global	2009–2018	Negative stock-market reaction at announcement
Yeow & Ng (2021)	PSM + DiD	Global	2015–2019	↑ Environmental performance; negative but not significant for ROA
Tan et al. (2022)	DiD	China	2010–2020	↑ ROE, green patents, social reputation
Khurram et al. (2023)	DiD	China	2016–2020	↑ Innovation performance, Tobin's Q
Wicaksono (2024)	DiD	Asia	2015–2020	↑ ESG scores; no significant effect on ROA and ROE

Source: Compiled by the authors



Hypotheses Developed

H1: Green bond issuance is positively related to the firm's financial performance.

H2: Firm size is positively related to firm's financial performance.

H3: Leverage is negatively related to firm's financial performance.



Data & Methodology (1)

Data: Panel

Time period (issuance): 2016-2019, annual

Time period (performance): 2012-2024, annual

Country: China

Source: Wind Database

Method: Propensity score matching, Difference-in-Difference

Table 2. Variables Used for Propensity Score Matching

Variable	Description
Size	Firm's size measured as the natural log of total assets for the year prior to bond issuance
Year of issuance	Year of bond issuance
Industry	A set of industry dummies based on Wind Database Classification
Province	A set of regional dummies according to the province where the firm is registered
ROE	Firm's return on equity for the year prior to bond issuance
ROA	Firm's return on assets for the year prior to bond issuance

Source: Compiled by the authors



Result: 6 802 observations of 799 issuers



Data & Methodology (2)

Empirical model:

$$ROA_{it}/ROE_{it} = \alpha + \beta_1 Treated_i + \beta_2 Post_i + \beta_3 (Treated_i \times Post_i) + \beta_4 Debt - to - assets_{it} + \beta_5 Firm\ size_{it} + \beta_6 Tangibility_{it} + \beta_7 Quick\ ratio_{it} + \beta_8 Interest\ coverage\ ratio_{it} + \beta_9 Firm\ age_{it} + \beta_{10} \sum Year_{it} + \beta_{11} \sum Ind_{it} + \beta_{10} \sum Prov_{it} + \epsilon_{it}$$

Table 3. Variables Description

Variable type	Variable name	Description
Dependent	ROA	Return on assets, percent
	ROE	Return on equity, percent
Independent	Debt-to-Assets	Debt-to-assets ratio
	Firm size	Natural log of total assets
	Tangibility	Assets tangibility
	Quick Ratio	Quick ratio
	Interest Coverage ratio	Interest Coverage Ratio
	Firm age	Firm's age, years
	Industry	Industry dummy according to Wind database (2025) classification
	Year	Year dummy
	Province	Province dummy

Source: Compiled by the authors



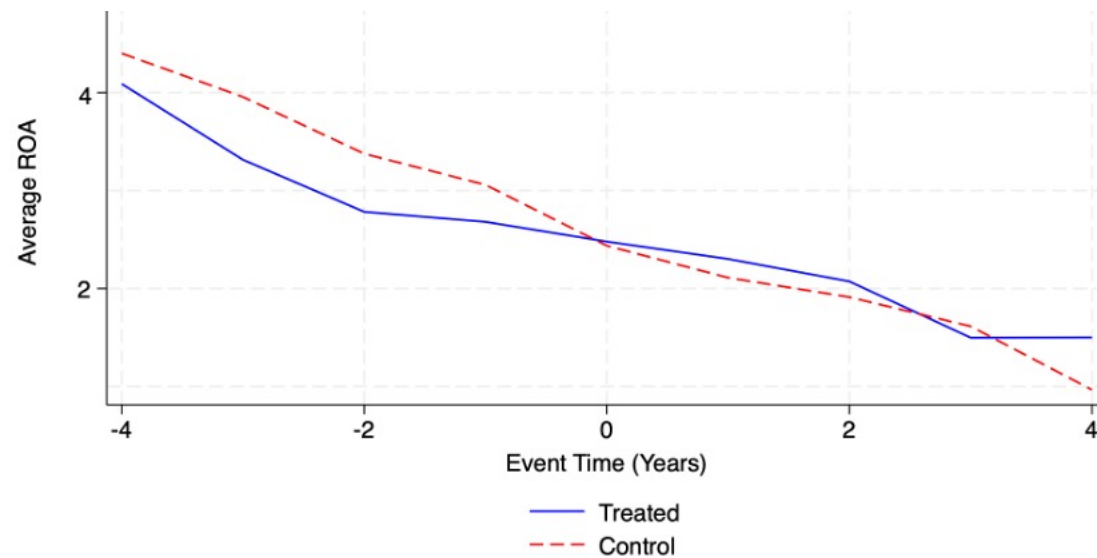
Results (1)

Table 5. Parallel trend test for ROA

Test	Statistic	p-value
Chi-square	16.80	0.157

Source: Own Estimations

Figure 1. Parallel trend test for ROA



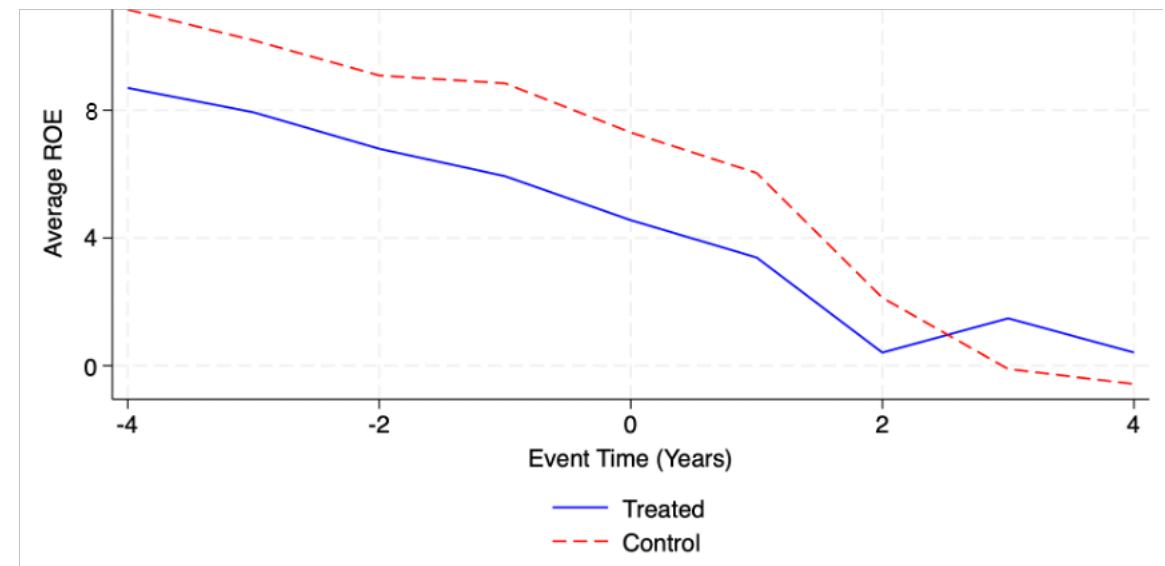
Source: Compiled by the authors

Table 6. Parallel trend test for ROE

Test	Statistic	p-value
Chi-square	16.78	0.158

Source: Own Estimations

Figure 2. Parallel trend test for ROE



Source: Compiled by the authors



Results (2)

Table 4. Difference-in-difference results for ROA

Variables	Coefficient	Std. Err.	z	P > z
DebtAssets	-0.515	0.213	-2.420	0.015
Size	-0.033	0.027	-1.220	0.224
Quick ratio	0.000	0.003	-0.040	0.970
Tangibility	0.338	0.196	1.720	0.085
Age	0.008	0.004	2.250	0.025
Interest Coverage	0.000	0.000	0.370	0.715

Period	Group	Mean	Std. Err.	t	P > t
Before	Control	1.514			
	Treated	1.470			
	Diff (T-C)	-0.045	0.029	1.560	0.118
After	Control	1.041			
	Treated	0.987			
	Diff (T-C)	-0.053	0.073	0.730	0.465
Diff-in-Diff		0.353	0.110	3.200	0.001***
Number of Obs	1 418				
R ²	0.17				

Source: Own Estimations

Table 5. Difference-in-difference results for ROE

Variables	Coefficient	Std. Err.	z	P > z
DebtAssets	-0.524	0.212	-2.470	0.013
Size	-0.032	0.027	-1.180	0.238
Quick ratio	-0.0002	0.0032	-0.050	0.958
Tangibility	0.332	0.196	1.700	0.089
Age	0.008	0.004	2.310	0.021
Interest Coverage	0.000	0.000	0.350	0.725

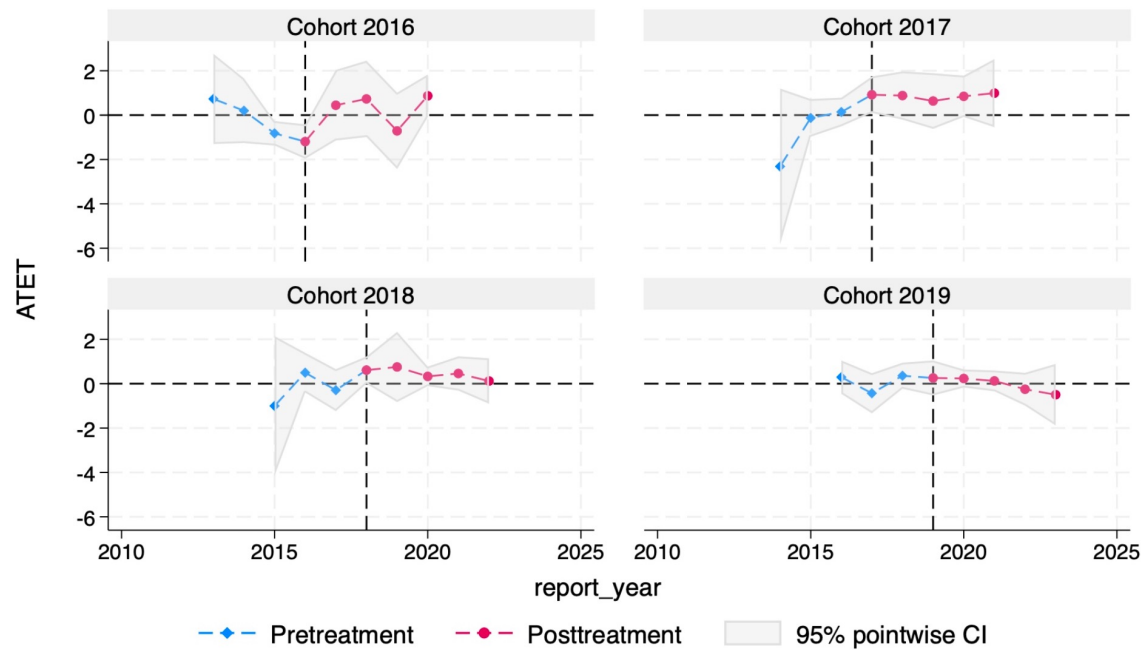
Period	Group	Mean	Std. Err.	t	P > t
Before	Control	2.835			
	Treated	2.712			
	Diff (T-C)	-0.123	0.081	-1.52	0.129
After	Control	1.582			
	Treated	1.724			
	Diff (T-C)	0.141	0.076	1.86	0.062*
Diff-in-Diff		0.265	0.111	2.38	0.017**
Number of Obs	1 418				
R ²	0.12				

Source: Own Estimations



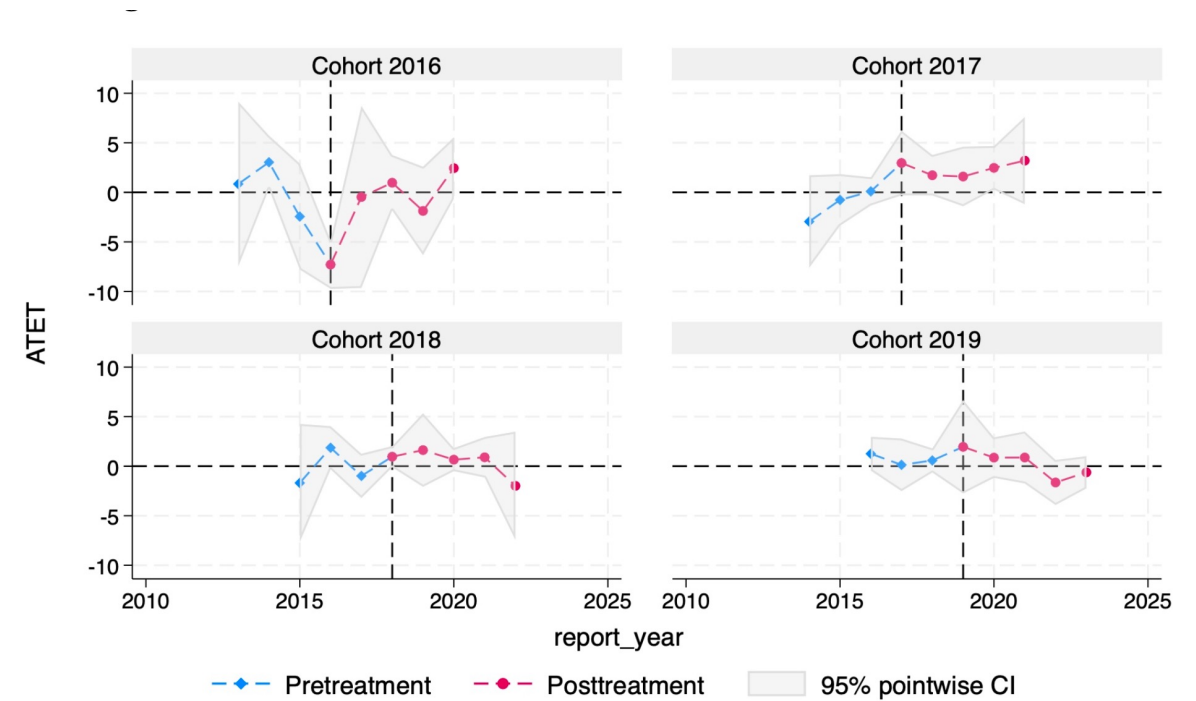
Results (2)

Picture 1. ATET Estimates for ROA Across Different Cohorts



Source: Own Estimations

Picture 2. ATET Estimates for ROE Across Different Cohorts



Source: Own Estimations



Conclusion

Hypotheses supported:

H1: Green bond issuance is positively related to the firm financial performance.

(aligns with Zhou and Cui, 2019, Tan et al., 2022, Flammer, 2020)

H3: Leverage is negatively related to firm's financial performance.

(aligns with Tan et al., 2022, Khurram et al., 2023, Zhou and Cui, 2019)

Hypothesis rejected:

H2: Firm size is not found to be positively related to firm's financial performance.

(aligns with Yeow and Ng, 2021, Wicaksono, 2024, Lebellet et al., 2020)

Further Research:

Unpack the transmission channels:

- Track green, R&D/sales; test mediation: Issue → Innovation → Performance (Innovation channel);
- Examine volatility of profits/sales, Z-score (risk reduction channel);
- Test whether Treat×Post → lower debt costs, higher liquidity (financial channel);
- Environmental impact.
- More?



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Joint Workshop

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THANK YOU!

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Appendix

Table 7. Treatment vs Control T-test

Variable	Group	Obs	Mean	Std. Err.	Std. Dev.	95% Conf. Interval
Panel A: Average ROE						
	Non-Green (0)	777	3.070	0.276	7.687	[2.528, 3.611]
	Green (1)	22	2.987	0.711	3.336	[1.508, 4.466]
Difference			0.083	1.644		[-3.145, 3.310]
t-statistic					0.0503	
p-value					0.9599	
Panel B: Average ROA						
	Non-Green (0)	777	1.485	0.098	2.726	[1.293, 1.677]
	Green (1)	22	1.340	0.307	1.439	[0.702, 1.979]
Difference			0.145	0.584		[-1.001, 1.290]
t-statistic					0.2477	
p-value					0.8045	
Panel C: Log of Total Assets (log(TA))						
	Non-Green (0)	777	23.905	0.036	1.278	[23.834, 23.975]
	Green (1)	22	24.187	0.172	1.216	[23.841, 24.533]
Difference			-0.282	0.184		[-0.643, 0.078]
t-statistic					-1.5358	
p-value					0.1248	

Source: author's work

