

The Impact of Academic Independent Directors of Bond Issuers on Bond Rating Quality

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ABSTRACT

This study empirically examines the impact of academic independent directors on bond rating quality, measured by bond credit spreads, using a sample of Chinese A-share listed companies from 2010 to 2023. The empirical results demonstrate that the presence of academic independent directors significantly reduces bond credit spreads, indicating a substantial improvement in bond rating quality. This finding remains robust after a series of robustness tests, including excluding the COVID-19 pandemic period, adopting alternative measure of the dependent variable, adding additional governance control variables, and addressing endogeneity concerns through lagged explanatory variables and two-stage least squares (2SLS) estimation. Mechanism analyses reveal that academic independent directors enhance bond rating quality by boosting corporate innovation, improving social responsibility disclosure quality, and increasing information transparency. Heterogeneity analyses further show that this positive effect is more pronounced in non-state-owned enterprises, firms with higher board meeting frequency, and those with a lower proportion of academic independent directors. Our analysis moves beyond surface-level associations to offer three distinct contributions. We transplant the academic-director literature into the bond pricing domain, decode the operational channels from director presence to rating assignments, and distill practical takeaways for issuers, rating firms, and policy makers operating within fixed-income markets.

Keywords: Academic Independent Directors, Bond Rating Quality, Corporate Innovation, CSR Disclosure Quality, Information Transparency

1. Introduction

The bond market plays an indispensable role in the funding landscape of China's publicly traded companies. Meanwhile, bond credit ratings function as pivotal signals of creditworthiness, forming a foundational input for investment evaluation and risk assessment by market participants. However,

the long-standing “issuer-pays” model in China’s rating industry has given rise to persistent concerns over rating inflation, insufficient independence, and weak credibility. In 2021, Chinese regulatory authorities issued the Notice on Promoting the Healthy Development of the Credit Rating Industry in the Bond Market, with the goal of rectifying existing structural flaws and boosting the informational utility of credit ratings. Despite these regulatory efforts, rating inflation, information opacity, and rating divergence continue to impede the improvement of bond rating quality. Thus, the question of what internal oversight mechanisms can most robustly support credit rating performance has grown into a priority issue, bridging applied corporate practice and fundamental research agendas.

As a crucial institutional arrangement of corporate governance, independent directors are expected to perform both supervisory and advisory functions, thereby reducing agency costs and mitigating information asymmetry between managers and external stakeholders. Among various categories of independent directors, those with academic backgrounds—defined as independent directors engaged in research and teaching at universities or research institutions—have attracted growing scholarly attention[1-3]. Academic independent directors bring distinctive attributes to the boardroom: rigorous academic training, deep domain expertise, strong professional independence, and a long-term orientation shaped by academic career incentives. A growing corpus of research indicates that academic independent directors exert a multifaceted positive influence on corporate behavior: they enhance investment efficiency, curb earnings manipulation, stimulate R&D expenditure, and uplift the standard of information disclosure. However, existing research has predominantly focused on internal governance and operational outcomes, paying relatively little attention to the capital market consequences of academic independent directors—particularly their impact on bond credit risk and rating quality.

The determinants of bond rating quality have been extensively examined from both macroeconomic and microeconomic perspectives. Macro-level factors such as economic policy uncertainty, and micro-level determinants including firm-specific fundamentals, financial reporting quality, and corporate governance characteristics, have all been documented as significant predictors of credit risk assessments[4-7]. More recent studies have highlighted the role of information transparency and ESG performance in shaping credit spreads[8, 9]. Despite extensive research on related topics, the distinct impact of academic directors on corporate bond ratings has not been adequately addressed, representing a noticeable gap in the governance-ratings nexus. While Papadimitri et al. (2020) provide cross-country evidence that better-educated boards receive more favorable credit ratings, the channels through which academic directors influence bond market outcomes in China’s unique institutional environment lack systematic empirical verification[10].

Against this background, this paper takes Chinese A-share listed companies from 2010 to 2023 as the research sample, uses bond credit spread as a market-based measure of bond rating quality, and empirically tests the impact of academic independent directors on bond rating quality. We further identify three transmission mechanisms through which academic directors exert their influence: corporate innovation, corporate social responsibility (CSR) disclosure quality, and corporate information transparency. Our findings indicate that the presence of academic independent directors

significantly reduces credit spreads, and this effect operates through the three identified channels. The results remain robust after excluding the COVID-19 pandemic period, employing alternative measures of the dependent variable, controlling for additional governance characteristics, and addressing endogeneity concerns through lagged explanatory variables and two-stage least squares (2SLS) estimation. Heterogeneity analyses reveal that the effect is more pronounced in non-state-owned enterprises, firms with more active boards, and those where the proportion of academic directors has not yet reached saturation.

This paper makes several marginal contributions to the existing literature. First, it extends the research scope of academic independent directors' economic consequences to the bond market, revealing the governance value of academic independent directors in reducing credit risk and improving bond rating quality. By doing so, it supplements the literature on both the determinants of bond rating quality and the capital market implications of board composition. Second, we identify and subject to empirical scrutiny three distinct mechanisms of influence, namely, corporate innovation, the caliber of CSR reporting, and information transparency. This approach sheds light on the internal conduits linking academic independent directors to bond rating outcomes. This mechanistic analysis responds to calls in the literature for a more nuanced understanding of how governance characteristics affect credit market outcomes. Third, the study provides practical implications for multiple stakeholders. For firms, our findings suggest that appointing academic independent directors can serve as an effective governance mechanism to reduce borrowing costs. For rating agencies, incorporating board governance characteristics—particularly the presence and proportion of academic directors—into rating frameworks may enhance the accuracy and credibility of credit assessments. For regulators, our results support policies that encourage the appointment of qualified academic independent directors, particularly in non-state-owned enterprises where their governance role appears most impactful.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature on the determinants of bond rating quality, the governance role of academic independent directors, and the potential mechanisms linking academic directors to bond market outcomes, culminating in the development of our core hypothesis. Section 3 describes the research design, including data sources, sample selection, variable definitions, and the empirical model specification. Section 4 reports the empirical results, including descriptive statistics, baseline regression findings, robustness checks addressing endogeneity concerns, mechanism analyses identifying transmission channels, and heterogeneity analyses exploring boundary conditions. Section 5 concludes the study with a summary of findings, policy implications, and limitations.

2. Literature Review and Hypothesis Development

2.1 Related Literature

2.1.1 Bond credit rating quality

Existing literature has extensively explored the factors influencing bond rating quality from both macro and micro perspectives. These factors include differences in credit rating agency

methodologies[11], financial reporting quality[6], corporate financial data[12], reputation[13], and issuer pay mode[14]. These studies, grounded in a micro-macro perspective, provide rich empirical evidence and theoretical insights that deepen our understanding of the determinants and mechanisms of bond rating quality.

Extensive research has examined how bond rating quality is measured. Several criteria are commonly used to assess rating quality. These include rating accuracy in both absolute and relative terms, such as the deviation between actual ratings and benchmark model outputs[11]; disagreement among rating analysts[15]; dynamic forecasts issued by government-related institutions; and market reactions[16]. While these criteria provide valuable insights, a growing literature adopts credit spread—the difference between a corporate bond’s yield and that of a risk-free government bond of the same maturity—as a market-based measure of bond rating quality[5]. Recent studies continue to validate this approach. Li, Huang and Oxman (2025)[17] show that inflated credit ratings from ratings shopping result in artificially compressed credit spreads, demonstrating that spreads capture the pricing consequences of rating quality distortions. Liu (2026)[18] finds that firms voluntarily retaining bond ratings exhibit 10.2 percent higher credit spreads than those that abandon issuance ratings, underscoring spreads’ sensitivity to rating policy regimes. Lu, Zhou and Feng (2025)[9] document that higher disclosure quality significantly narrows credit spreads, while economic policy uncertainty amplifies this effect. In the Chinese context, Gu, Zhao and Wang (2025)[8] find that ESG rating disagreement significantly increases credit spreads through financial risk and information asymmetry channels. Moreover, the rating difference between investor-paid and issuer-paid rating agencies has been shown to contain significant credit risk information that is priced into credit spreads[19]. Collectively, these recent studies reaffirm that credit spreads serve as a credible proxy for investors’ ex-post assessment of rating quality. Accordingly, this paper follows this approach and uses credit spread as the primary dependent variable.

2.1.2 Academic independent directors

As China’s financial markets mature, the independent director system has been gradually introduced to enhance corporate governance and effectively mitigate agency problems, thereby injecting new vitality and institutional safeguards into corporate development. Independent directors with different backgrounds exert varying effects on corporate management, with profound implications for strategic decision-making, risk control, and corporate social responsibility.

A growing body of literature has examined how the backgrounds of independent directors influence various corporate outcomes. Independent directors with government connections have been shown to enhance firm performance, particularly in privately controlled enterprises, by facilitating access to public resources[20]. Independent directors with banking experience play a critical role in corporate debt financing; Subsequent research finds that firms with independent directors for whom the board ranks among their most prestigious appointments obtain bank loans with lower spreads, longer maturities, fewer covenants, and higher bond ratings[21, 22]. Independent directors with tax expertise significantly influence corporate tax policies; lead independent directors have been found to promote more conservative tax policies, resulting in lower tax risk and a reduced likelihood of

engaging in tax shelters[23]. Leveraging their profound expertise, scholarly independent directors occupy an important position in corporate governance structures and contribute to long-term corporate development. Such directors typically possess backgrounds in universities or academic institutions, demonstrating high competence in academic research, theoretical knowledge, and practical application. In their seminal study, Francis et al. investigate the effect of professors as independent directors on firm innovation and find that academic directors provide valuable expertise and that their presence is associated with higher innovation outputs[2]. Similarly, Pang et al. find that stock prices drop significantly following the unexpected resignations of academic independent directors, indicating that markets positively value their monitoring and advising contributions[24]. Furthermore, board members' educational attainment has been shown to positively influence firms' credit ratings; Papadimitri et al. document, using a data set of 1,618 firms from 39 countries, that firms in which key board members have higher educational levels are more likely to receive better credit ratings[10]. This finding underscores that well-educated boards are perceived as more capable managers by credit rating agencies.

Independent directors with academic backgrounds excel in cultural knowledge, professional theory, and applied skills, and are thus better equipped to exercise their monitoring and advisory functions—for instance, by applying specialized knowledge to dissect corporate financial health and identify potential risks and issues. Under the influence of traditional Chinese culture, scholarly independent directors exert influence on corporate boards that is no less than that of internal directors. Indeed, the proverb “outsiders are better at chanting scriptures” reflects that firms value external experts' opinions, believing that outsiders may possess knowledge, experience, or skills that insiders lack[25].

2.1.3 Academic independent directors and bond credit rating quality

The primary purpose of this paper is to determine whether the academic background of corporate executives affects bond rating quality. Executives with academic backgrounds, having undergone prolonged academic training, possess comparative advantages over those without such backgrounds. Does this advantage result in differences in bond rating quality between firms that hire academically qualified executives and those that do not?

Research indicates that scholarly independent directors are adept at applying theoretical knowledge to practical case analyses and project research—a skill that can be transferred to corporate management. For firms issuing bonds, scholarly independent directors can leverage their expertise and firm-specific knowledge to conduct more incisive analyses of financial health, uncovering potential financial risks and operational issues, thereby improving credit rating agencies' assessments of the firm's creditworthiness. Independent directors with deep academic literacy and professional knowledge are better positioned to identify current or future problems and even crises, providing more effective advice[24]. By virtue of their professional competence, monitoring and advisory functions, and potential interactions with rating agencies, scholarly independent directors are highly likely to have a significant impact on bond rating quality. This provides a novel perspective and direction for further research on the determinants of bond rating quality.

Overall, the review literature reveals that scholars generally agree that scholarly independent directors, by virtue of their professional knowledge and technical proficiency, influence corporate governance. Studies have also analyzed the factors affecting bond ratings, from which one could infer that scholarly independent directors affect bond rating quality. However, several gaps remain. First, most existing research focuses on other backgrounds of independent directors—such as technical, accounting, or banking backgrounds—with relatively few studies addressing academic backgrounds. Our analysis centers on the bond-rating implications of hiring directors with academic credentials, an area that extends current scholarship on this director type. Notably, previous research has been heavily skewed toward the internal corporate effects of independent directors—such as governance efficiency and strategic policies—with bond ratings seldom featuring in these inquiries. Accordingly, we introduce originality by forging an analytical link between academic board members and the quality of credit evaluations.

2.2 Hypothesis Development

Building on the theoretical and empirical foundations reviewed above, we posit that academic independent directors are likely to enhance bond rating quality (as reflected in narrower credit spreads) through three interrelated mechanisms.

First, from the perspective of information asymmetry theory, academic independent directors possess superior analytical capabilities and professional expertise, enabling them to gain deeper insights into the firm's financial and operational status. Their academic training equips them with advanced methodological skills to dissect complex financial information and identify potential risks that less-educated directors might overlook. During the bond issuance and rating process, academic directors can help firms communicate more effectively with rating agencies, providing more detailed and accurate financial and non-financial information. This reduction in information asymmetry between the firm and external capital providers allows rating agencies to form more precise assessments of credit risk, thereby improving bond rating quality. Consistent with this view, Wu et al. (2024) find that academic directors improve firm performance partly through more efficient resource allocation, while recent evidence confirms that information disclosure quality is a significant channel through which governance characteristics affect credit spreads[26].

Second, from the perspective of monitoring and governance theory, academic independent directors, owing to their career backgrounds in universities and research institutions, tend to place high value on professional reputation and ethical integrity. Unlike industry practitioners whose careers may depend on maintaining relationships with corporate insiders, academic directors derive their professional standing primarily from scholarly achievements and institutional affiliations. This reputational concern strengthens their independence and incentivizes rigorous monitoring of managerial behavior. Academic directors from leading universities often serve as government policy advisors and industry standard-setters, exerting significant influence on industry development. Firms are therefore more receptive to their opinions and suggestions. Through diligent oversight of strategic decisions and capital allocation, academic directors help ensure legal and regulatory compliance, reduce operational and moral hazards, and enhance investor confidence—all of which contribute

positively to bond pricing.

Third, academic directors foster long-term value creation that ultimately benefits bondholders. Their presence encourages greater investment in innovation and R&D, promotes environmentally and socially responsible practices, and curbs excessive risk-taking. These behaviors strengthen the firm's fundamental creditworthiness over time, reducing the probability of default and the risk premium demanded by bond investors. The long-term orientation ingrained in academic culture—where research projects often span years or decades—contrasts with the short-termism prevalent in many corporate settings and aligns well with the interests of long-term creditors.

Based on the above reasoning, we propose our core hypothesis:

H1: Ceteris paribus, the presence of academic independent directors is negatively associated with bond credit spreads, indicating improved bond rating quality.

3. Research Design

3.1 Data Sources and Sample Selection

Our sample includes corporate bonds, enterprise bonds, and midterm notes issued by A-share firms in China between 2010 and 2023 to investigate the effect of academic independent directors on bond rating quality. The bond information is obtained from the Wind database, provincial-level GDP data is sourced from the China Statistical Yearbook, and other data are derived from the CSMAR (China Stock Market and Accounting Research) database. For the purpose of our empirical analysis, we conduct the following sample selection and data processing procedures. First, we exclude firms in the financial sector due to their distinctive capital structure and regulatory environment. Second, we remove observations with special treatment (ST) or particular transfer (*ST) status, as these firms are subject to unusual trading restrictions and potential financial distress. Third, we delete observations with missing values for the key variables used in the regression analysis. Fourth, to mitigate the influence of extreme outliers, we winsorize all continuous variables at the 1% and 99% levels. The final sample consists of 15,204 observations at the bond-year level from 832 firms.

3.2 Major Variable Construction

3.2.1 Explanatory variable

Based on the work of Quan and Li (2017) [1] and other scholars, academic independent directors are defined as those engaged in academic research at universities, research institutes, and other public institutions, and personnel who perform solely administrative functions are excluded from this definition. To quantitatively analyze their role in corporate governance, a dummy variable *Academic* is introduced in the model specification. *Academic* is assigned a value of “1” if at least one university faculty member serves as an independent director involved in decision-making within the firm, and “0” otherwise. Professors holding administrative positions at universities are not included in this classification.

3.2.2 Dependent variable

Following the methodology of Chen et al. (2021)[27], we measure bond rating quality using the

credit spread (*CS*). *CS* is defined as the difference between the yield to maturity of a bond and the yield of a risk-free government bond with the same maturity. This spread reflects the additional compensation demanded by investors for bearing credit risk, liquidity risk, and other risks associated with bonds relative to risk-free sovereign securities. A larger *CS* indicates a higher credit risk premium priced by the market, implying lower rating quality, while a smaller *CS* suggests higher rating quality.

Table 1. Variable definition

Variable	Symbol	Definition
Dependent variable		
Credit spread	<i>CS</i>	Difference between a bond's yield to maturity and the risk-free yield of a government bond with the same maturity
Independent variable		
Academic independent director	<i>Academic</i>	Dummy variable: 1 if the firm has at least one independent director with an academic background (engaged in research at a university), otherwise 0
Control variables at issuer level		
Leverage	<i>Lev</i>	Total liabilities divided by total assets
Firm size	<i>Size</i>	The natural logarithm of total assets
Cash status	<i>Cashflow</i>	Cash and transactional financial assets divided by total assets
Profitability	<i>ROA</i>	Earnings before interest and taxes (EBIT) divided by total assets.
Sales growth	<i>Growth</i>	Growth rate of sales revenue.

Asset turnover	<i>AT</i>	Operating revenue divided by total assets.
Tangibility ratio	<i>Tangibility</i>	Property, plant, and equipment divided by total assets.
Cash-to-Revenue Ratio	<i>TTM</i>	Cash received from sales of goods and services divided by operating revenue
Industry Competition Position	<i>Position</i>	Ratio of a firm's sales revenue to total sales revenue of all firms in the same industry and year
Industry competition	<i>HHI</i>	Herfindahl-Hirschman Index: Sum of squared market shares of firms.
State ownership	<i>SOE</i>	Dummy variable: 1 if the firm is state-owned, otherwise 0.
Big-4 Auditor	<i>Audit</i>	Dummy variable: 1 if the financial report is audited by a Big-4 international accounting firm, otherwise 0
Largest Shareholder Ownership	<i>CRI</i>	Number of shares held by the largest shareholder/Total shares outstanding
Control variables at bond level		
Bond maturity	<i>MATURITY</i>	The natural logarithm of

		bond issuance maturity (years).
Control variables at province level		
Per Capita GDP	<i>PerGDP</i>	Total GDP (in 100 million RMB) divided by Population (in 10 thousand people)
Mechanism variables		
Corporate innovation	<i>Innovation</i>	The natural logarithm of one plus the number of invention patents granted to the firm during the fiscal year (Innovation = $\ln(1 + \text{InventionPatents})$).
Social responsibility disclosure quality	<i>SR</i>	A composite score measuring CSR information transparency, based on 12 evaluation criteria from the CSMAR “Basic Information Table of Corporate Social Responsibility Reports.” Each criterion is scored as 1 if satisfied and 0 otherwise, with the total score ranging from 0 to 12. Higher scores reflect greater CSR transparency.
Informati	<i>Transparency</i>	Based on the

on Transpare ncy		information disclosure quality ratings from the Shenzhen and Shanghai Stock Exchanges, where A = 4 (Excellent), B = 3 (Good), C = 2 (Fair), and D = 1 (Poor). Higher values denote greater corporate transparency.
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3.3 Regression Model

To investigate the effect of academic independent directors on bond rating quality, we estimate the following fixed-effects model, taking into account the availability of bond-level data:

$$CreditQuality_{i,t} = a_0 + a_1 Academic_{i,t} + \sum_k a_k Controls_{i,t} + Industry_{FE} + Year_{FE} + \varepsilon_{i,t}$$

Where the dependent variable, $CreditQuality_{i,t}$, represents bond rating quality. The key independent variable, $Academic_{i,t}$, is a dummy variable indicating whether the firm has at least one independent director with an academic background. $Controls_{i,t}$ is a vector of issuer, bond and province level control variables. $Industry_{FE}$ and $Year_{FE}$ denote industry and year fixed effects, respectively, which absorb time-invariant industry-specific heterogeneity and common time trends. The term $\varepsilon_{i,t}$ is the random error term.

This specification enables us to identify the net effect of academic independent directors on bond rating quality more accurately while ensuring the robustness and reliability of the results. We implement two basic strategies to enhance model validity. First, we include a comprehensive set of control variables ($Controls_{i,t}$) to absorb the influence of confounding factors such as managerial ability on bond rating quality. Second, we simultaneously control for both industry and year fixed effects to capture the maximum amount of unobserved heterogeneity at the industry and temporal levels.

The coefficient of interest, a_1 , captures the net impact of scholarly independent directors on bond rating quality. We expect a_1 to be negative and statistically significant, implying that the presence of academic independent directors enhances bond credit ratings.

4. Results and Discussion

4.1 Descriptive Statistics

Table 2 reports the descriptive statistics for the main variables based on 15,204 bond-year observations over the period 2010-2023. The mean value of $Academic$, our key independent variable, is 0.8345, indicating that 83% of the bond-year observations have at least one academic independent

director. The dependent variable, *CS*, has a mean of 2.0431 and a standard deviation of 1.1668, suggesting moderate cross-sectional variation in bond credit risk pricing. The median of *CS* is 1.7981, with a range from -0.4068 to 6.7390. All control variables exhibit distributions broadly consistent with prior literature. For instance, the mean leverage ratio (*Lev*) is 0.6311, the average return on assets (*ROA*) is 4.4073, and state-owned enterprises (*SOEs*) account for 69.3% of the sample. Overall, the sample is well balanced and provides a solid foundation for the subsequent regression analyses.

Table 2. Descriptive statistics of variables

Variable	Observations	Mean	Standard Deviation	Minimum	Median	Maximum
<i>CS</i>	15204	2.0431	1.1668	-0.4068	1.7981	6.7390
<i>Academic</i>	15204	0.8345	0.3716	0.0000	1.0000	1.0000
<i>Lev</i>	15204	0.6311	0.1526	0.2360	0.6517	0.9390
<i>Size</i>	15204	24.7784	1.6541	21.5302	24.5979	28.5016
<i>Cashflow</i>	15204	0.0443	0.0565	-0.1247	0.0416	0.1938
<i>ROA</i>	15204	4.4073	4.5704	-15.0548	4.2486	18.6637
<i>Growth</i>	15204	0.1323	0.3006	-0.5272	0.0983	1.5120
<i>AT</i>	15204	0.5079	0.4341	0.0343	0.3887	2.7512
<i>Tangibility</i>	15204	0.2273	0.2156	0.0013	0.1611	0.7531
<i>TTM</i>	15204	105.0422	25.2112	50.3812	104.7723	222.7051
<i>Position</i>	15204	6.9383	10.2580	0.0456	2.6182	54.9306
<i>HHI</i>	15204	0.1112	0.1043	0.0149	0.0729	0.6421
<i>SOE</i>	15204	0.6932	0.4612	0.0000	1.0000	1.0000
<i>Audit</i>	15204	0.2699	0.4439	0.0000	0.0000	1.0000
<i>CRI</i>	15204	0.3885	0.1557	0.0952	0.3800	0.8025
<i>Maturity</i>	15204	1.4329	0.3542	0.6931	1.6094	2.3026
<i>PerGDP</i>	15204	9.7936	4.6423	2.8792	8.8210	20.0278

4.2 Baseline Results

Table 3 presents the baseline regression estimates examining the effect of academic independent directors (*Academic*) on bond credit spreads (*CS*). The model includes a comprehensive set of firm-level and bond-level control variables, along with industry and year fixed effects, with robust standard errors reported in parentheses.

The coefficient on *Academic* is negative and statistically significant at the 1% level ($\beta = -0.0868$, $p < 0.01$). In economic terms, the presence of at least one academic independent director on the board is associated with a reduction of approximately 8.68 basis points in the credit spread, ceteris paribus. Given the mean credit spread in our sample, this effect represents a non-negligible economic magnitude. This finding supports our core hypothesis that academic independent directors contribute to lower perceived credit risk and, consequently, higher bond rating quality.

The control variables generally behave in line with theoretical predictions. Leverage (*Lev*) is

positively associated with credit spreads ($\beta = 1.7447$, $p < 0.01$), while firm size (*Size*) and profitability (*ROA*) exhibit significantly negative coefficients, consistent with the notion that larger and more profitable firms are perceived as less risky by bond market participants. Bond-specific characteristic *Maturity* also enter with the expected signs and statistical significance.

The model yields an R-squared of 0.499, indicating a reasonable goodness-of-fit. Overall, the baseline results provide robust evidence that academic independent directors significantly reduce bond credit spreads, thereby enhancing bond rating quality. This effect is both statistically significant and economically meaningful, and it persists after accounting for a wide range of confounding factors and fixed effects.

Table 3. Regression results of academic independent directors on bond rating quality

Variables	CS
<i>Academic</i>	-0.0868*** (0.0192)
<i>Lev</i>	1.7447*** (0.0706)
<i>Size</i>	-0.2266*** (0.0081)
<i>Cashflow</i>	0.6273*** (0.1803)
<i>ROA</i>	-0.0111*** (0.0023)
<i>Growth</i>	0.0659** (0.0298)
<i>AT</i>	-0.0338 (0.0219)
<i>Tangibility</i>	0.1153** (0.0501)
<i>TTM</i>	-0.0006* (0.0003)
<i>Position</i>	-0.0046*** (0.0010)
<i>HHI</i>	0.7118*** (0.0968)
<i>SOE</i>	-0.8265*** (0.0197)
<i>Audit</i>	-0.1078*** (0.0185)
<i>CRI</i>	-0.3976***

	(0.0550)
<i>Maturity</i>	-0.2502***
	(0.0202)
<i>PerGDP</i>	-0.0394***
	(0.0020)
Constant	8.1540***
	(0.1876)
Observations	15,185
R-squared	0.499
Industry FE	YES
Year FE	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3 Robustness Tests

4.3.1 Excluding the COVID-19 pandemic period

The COVID-19 pandemic triggered widespread disruptions in global credit markets, potentially confounding the relationship between corporate governance attributes and bond pricing. To ensure that our baseline findings are not driven by this unprecedented shock, we exclude observations from 2019 to 2021 and re-estimate the main specification. As reported in Table 4, the coefficient on *Academic* remains negative and statistically significant at the 1% level (−0.1171, robust s.e. = 0.0237). The magnitude is slightly attenuated relative to the full-sample baseline (−0.1421), yet remains economically meaningful. Key control variables retain their expected signs and significance: leverage (*Lev*) is positively associated with credit spreads, while firm size (*Size*) and profitability (*ROA*) exhibit negative associations. The model explains approximately 50.9% of the variation in credit spreads ($R^2 = 0.509$).

These results confirm that the inhibitory effect of academic independent directors on borrowing costs is not an artefact of the extraordinary conditions during 2019–2021. The persistence of the effect in the post-pandemic subsample reinforces the robustness of our main conclusion.

Table 4. Excluding the COVID-19 pandemic period

Variables	CS
<i>Academic</i>	-0.1171***
	(0.0237)
<i>Lev</i>	1.6041***
	(0.0868)
<i>Size</i>	-0.2414***
	(0.0106)
<i>Cashflow</i>	0.2396

	(0.2198)
<i>ROA</i>	-0.0099***
	(0.0028)
<i>Growth</i>	0.1564***
	(0.0368)
<i>AT</i>	-0.0349
	(0.0277)
<i>Tangibility</i>	0.0423
	(0.0621)
<i>TTM</i>	-0.0007
	(0.0005)
<i>Position</i>	-0.0054***
	(0.0013)
<i>HHI</i>	0.6305***
	(0.1136)
<i>SOE</i>	-0.7703***
	(0.0244)
<i>Audit</i>	-0.1042***
	(0.0232)
<i>CRI</i>	-0.3855***
	(0.0675)
<i>Maturity</i>	-0.1775***
	(0.0251)
<i>PerGDP</i>	-0.0337***
	(0.0028)
Constant	8.4622***
	(0.2390)
Observations	9,535
R-squared	0.509
Industry FE	YES
Year FE	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3.2 Alternative measure of the dependent variable (CR)

As a robustness check, we replace the dependent variable—credit spread (*CS*)—with an alternative indicator of bond rating quality (*CR*). Following the quantification approach of Afonso et al. (2007), we assign numerical values to credit rating categories in ascending order, with the lowest rating (C) coded as 1, CC as 2, and increasing incrementally up to the highest rating (AAA) coded as

20. A higher value of *CR* thus corresponds to a superior credit rating assessment.

Table 5 presents the regression results. The coefficient on *Academic* is positive and statistically significant at the 10% level (0.0526, robust s.e. = 0.0277). This positive coefficient corroborates our baseline inference: firms with academic independent directors tend to receive more favourable credit ratings. The control variables generally perform as expected. Leverage (*Lev*) is negatively associated with rating quality, while firm size (*Size*) and audit quality (*Audit*) exhibit positive associations, consistent with prior literature.

The directional consistency across specifications supports the robustness of our primary conclusion that academic independent directors contribute to improved bond rating quality.

Table 5. Robustness check: alternative measure of the dependent variable (*CR*)

Variables	<i>CR</i>
<i>Academic</i>	0.0526* (0.0277)
<i>Lev</i>	-1.8685*** (0.1672)
<i>Size</i>	0.3036*** (0.0171)
<i>Cashflow</i>	-0.6050 (0.3939)
<i>ROA</i>	0.0133 (0.0091)
<i>Growth</i>	0.5029*** (0.0706)
<i>AT</i>	0.1463*** (0.0356)
<i>Tangibility</i>	0.1378 (0.0935)
<i>TTM</i>	0.0016** (0.0007)
<i>Position</i>	-0.0012 (0.0016)
<i>HHI</i>	-0.4031** (0.1818)
<i>SOE</i>	0.6404*** (0.0428)
<i>Audit</i>	0.0893*** (0.0217)
<i>CRI</i>	0.6816***

	(0.0841)
<i>Maturity</i>	-0.1170***
	(0.0349)
<i>PerGDP</i>	0.0374***
	(0.0040)
Constant	10.5170***
	(0.3405)
Observations	13,340
R-squared	0.277
Industry FE	YES
Year FE	YES

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.3.3 Additional governance controls

To address the concern that our baseline specification may omit confounding governance characteristics, we augment the model with three additional issuer governance variables: executive compensation (*TMTPay*), measured as the natural logarithm of total compensation paid to directors, supervisors, and top management; institutional ownership (*Inst*), defined as the percentage of shares held by institutional investors (including mutual funds, insurance companies, and qualified foreign institutional investors); and board size (*Board*), measured as the natural logarithm of the total number of board members. These variables capture distinct dimensions of internal and external governance mechanisms—incentive alignment, external monitoring, and board structure—that could plausibly affect both the appointment of academic independent directors and the pricing of bonds.

Table 6 presents the estimation results. The coefficient on *Academic* remains negative and statistically significant at the 1% level (-0.0868 , robust s.e. = 0.0194), with a magnitude almost identical to the baseline estimate (-0.0868). Among the newly added controls, executive compensation (*TMTPay*) exhibits a negative and significant association with credit spreads, consistent with the view that better-compensated management is subject to stronger incentive alignment, thereby mitigating agency conflicts. Institutional ownership (*Inst*) also enters negatively and significantly (-0.3150 , $p < 0.01$), supporting the notion that active monitoring by institutional investors reduces information asymmetry and lowers financing costs. Board size (*Board*) is positively associated with credit spreads (0.2423 , $p < 0.01$), which may reflect the higher coordination costs or diluted monitoring intensity associated with larger boards.

The stability of the *Academic* coefficient across specifications—remaining negative, economically meaningful, and statistically significant—suggests that our findings are not driven by omitted governance characteristics. This robustness check reinforces the validity of our main conclusion that academic independent directors exert a significant negative influence on issuer borrowing costs.

Table 6. Robustness check: additional issuer governance controls

Variables	CS
<i>Academic</i>	-0.0868*** (0.0194)
<i>Lev</i>	1.7019*** (0.0706)
<i>Size</i>	-0.1837*** (0.0097)
<i>Cashflow</i>	0.5627*** (0.1792)
<i>ROA</i>	-0.0075*** (0.0023)
<i>Growth</i>	0.0749** (0.0297)
<i>AT</i>	-0.0181 (0.0218)
<i>Tangibility</i>	0.0260 (0.0519)
<i>TTM</i>	-0.0006* (0.0003)
<i>Position</i>	-0.0045*** (0.0010)
<i>HHI</i>	0.7278*** (0.0961)
<i>SOE</i>	-0.8478*** (0.0202)
<i>Audit</i>	-0.0698*** (0.0186)
<i>CRI</i>	-0.3131*** (0.0641)
<i>TMTPay</i>	-0.1116*** (0.0156)
<i>Inst</i>	-0.3150*** (0.0585)
<i>Board</i>	0.2423*** (0.0362)
<i>Maturity</i>	-0.2481*** (0.0202)
<i>PerGDP</i>	-0.0398***

	(0.0020)
Constant	8.5290***
	(0.2500)
Observations	15,174
R-squared	0.505
Industry FE	YES
Year FE	YES

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.3.4 Reverse causality

A potential endogeneity concern is that firms with better governance or lower risk may be more likely to appoint academic independent directors, thereby creating a reverse causality issue. To partially mitigate this concern, we re-estimate the model using one-year lagged explanatory variables—particularly focusing on $Academic_{t-1}$ —to predict the current credit spread. The results are presented in Table 7. The estimated coefficient on $Academic_{t-1}$ is significantly negative at the 1% level (-0.0867 , $p < 0.01$), with a magnitude closely aligned with the baseline estimate (-0.0868). Most control variables retain their expected signs and significance levels. For instance, leverage (Lev_{t-1}) continues to be positively associated with credit spreads, while firm size ($Size_{t-1}$) and profitability (ROA_{t-1}) remain negatively associated. The model explains approximately 49.1% of the variation in credit spreads ($R^2 = 0.491$).

Table 7. Robustness check: one-year lagged explanatory variables

Variables	CS
$Academic_{t-1}$	-0.0867*** (0.0221)
Lev_{t-1}	1.7503*** (0.0793)
$Size_{t-1}$	-0.2173*** (0.0094)
$Cashflow_{t-1}$	0.3177 (0.2052)
ROA_{t-1}	-0.0128*** (0.0027)
$Growth_{t-1}$	0.1085*** (0.0350)
AT_{t-1}	-0.0318 (0.0256)
$Tangibility_{t-1}$	0.1024* (0.0570)

TTM_{t-1}	-0.0001 (0.0004)
$Position_{t-1}$	-0.0055*** (0.0012)
HHI_{t-1}	0.7852*** (0.1092)
SOE_{t-1}	-0.8167*** (0.0222)
$Audit_{t-1}$	-0.1033*** (0.0216)
$CR1_{t-1}$	-0.3577*** (0.0627)
$Maturity_{t-1}$	-0.2539*** (0.0233)
$PerGDP_{t-1}$	-0.0417*** (0.0025)
Constant	7.8917*** (0.2150)
Observations	11,191
R-squared	0.491
Industry FE	YES
Year FE	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.3.5 2SLS

To further address potential endogeneity arising from reverse causality and omitted variables, we employ a two-stage least squares (2SLS) approach, using the industry-year mean of the proportion of academic independent directors (*IV*) as an instrument for *Academic*. The rationale is that firms' director selection decisions are shaped by industry norms and peer practices, while the industry-year mean—computed as the average ratio of academic independent directors among firms in the same industry and year—is unlikely to directly affect the focal firm's credit spread except through its own board composition. The approach of using industry-level peer averages as instruments for firm-level governance variables has been widely adopted in the literature.

Column (1) of Table 8 reports the first-stage regression. The instrument is positively and significantly associated with *Academic* (0.502, $t = 8.41$). The Cragg-Donald Wald F-statistic (70.379) substantially exceeds the Stock-Yogo 10% critical value of 16.38, confirming instrument relevance and strength and rejecting the null of weak identification.

Column (2) presents the second-stage results, where the fitted value of *Academic* is entered alongside the full set of controls. The coefficient on *Academic* remains negative and statistically

significant at the 1% level (-0.854 , $p < 0.01$), consistent with the baseline OLS findings.

Overall, the *IV* results corroborate our baseline inference that the negative relationship between academic independent directors and credit spreads is not merely driven by reverse causality.

Table 8. Endogeneity analysis: 2SLS regression

Variables	(1) First-stage <i>Academic</i>	(2) Second-stage <i>CS</i>
<i>IV</i>	0.502*** (8.41)	
<i>Academic</i>		-0.854*** (-2.88)
<i>Lev</i>	0.063** (2.27)	1.805*** (23.86)
<i>Size</i>	-0.023*** (-7.28)	-0.243*** (-23.64)
<i>Cashflow</i>	-0.107* (-1.90)	0.547*** (2.99)
<i>ROA</i>	0.001* (1.72)	-0.008*** (-3.36)
<i>Growth</i>	0.006 (0.57)	0.064** (2.21)
<i>AT</i>	0.008 (0.95)	-0.028 (-1.26)
<i>Tangibility</i>	-0.042** (-2.13)	0.126** (2.40)
<i>TTM</i>	-0.000 (-0.43)	-0.000 (-1.24)
<i>Position</i>	-0.001*** (-3.03)	-0.007*** (-5.11)
<i>HHI</i>	0.162*** (4.27)	0.778*** (7.34)
<i>SOE</i>	0.065*** (9.00)	-0.764*** (-27.67)
<i>Audit</i>	-0.021*** (-2.75)	-0.127*** (-6.37)
<i>CR1</i>	-0.154*** (-6.83)	-0.558*** (-7.55)
<i>Maturity</i>	0.025***	-0.238***

	(2.81)	(-10.70)
<i>PerGDP</i>	-0.005***	-0.042***
	(-5.60)	(-15.98)
Observations	15,202	15,202
R-squared		0.295

Robust t-statistics in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.4 Mechanism Analysis

To elucidate the underlying channels through which academic independent directors reduce bond credit spreads, we conduct a series of mediation analyses following the established approach of Baron and Kenny (1986). Specifically, we examine three potential transmission mechanisms: corporate innovation (*Innovation*), social responsibility (*SR*) disclosure quality, and information transparency (*Transparency*). For each mechanism, we estimate a two-stage model: the first stage regresses the proposed mediator on *Academic* and controls, while the second stage includes both *Academic* and the mediator as predictors of credit spreads (*CS*). Partial mediation is suggested if the coefficient on *Academic* is attenuated after controlling for the mediator.

4.4.1 Corporate Innovation

Corporate innovation is widely recognised as a driver of firm performance and creditworthiness. A higher level of innovation helps improve corporate fundamentals, reduce the risk of bond default, and signal higher credit quality to the market. Following prior literature, we measure corporate innovation using the natural logarithm of one plus the number of invention patent applications, i.e., $Innovation = \ln(1 + Patent)$. A higher value indicates greater innovation output.

We conduct a two-step mediation analysis to examine whether corporate innovation serves as a channel through which academic independent directors affect credit spreads. Column (1) of Table 9 reports the regression of *Innovation* on *Academic* and control variables. The coefficient on *Academic* is positive and statistically significant at the 1% level (0.5440, $p < 0.01$), indicating that the presence of scholarly independent directors significantly increases corporate innovation output. This finding supports the view that academic directors, with their deep expertise and long-term orientation, foster a more innovative corporate environment.

Column (2) presents the regression of *CS* on *Academic*, *Innovation*, and the full set of controls. The coefficient on *Innovation* is negative and significant at the 1% level (-0.0160 , $p < 0.01$), implying that firms with higher innovation output enjoy lower credit spreads. This is consistent with the notion that innovation reduces default risk and signals higher credit quality to the market. Meanwhile, the coefficient on *Academic* remains negative and significant (-0.0486 , $p < 0.1$) after controlling for innovation.

Taken together, these results support the hypothesized transmission mechanism: academic independent directors reduce credit spreads partly by enhancing corporate innovation.

Table 9. Mechanism analysis: corporate innovation

Variables	(1) <i>Innovation</i>	(2) <i>CS</i>
<i>Academic</i>	0.5440*** (0.0844)	-0.0486* (0.0268)
<i>Innovation</i>		-0.0160*** (0.0040)
<i>Lev</i>	0.3219 (0.2574)	1.1080*** (0.1159)
<i>Size</i>	-0.0539 (0.0335)	-0.1992*** (0.0136)
<i>Cashflow</i>	-2.5182*** (0.7213)	-0.5165 (0.3471)
<i>ROA</i>	0.0073 (0.0075)	-0.0107*** (0.0036)
<i>Growth</i>	0.3516*** (0.1232)	0.1024* (0.0531)
<i>AT</i>	0.1952** (0.0919)	-0.1029*** (0.0379)
<i>Tangibility</i>	0.1554 (0.2159)	0.4519*** (0.0881)
<i>TTM</i>	0.0073*** (0.0017)	-0.0006 (0.0007)
<i>Position</i>	0.0285*** (0.0049)	-0.0044** (0.0017)
<i>HHI</i>	-4.3767*** (0.4471)	0.8198*** (0.1766)
<i>SOE</i>	0.0024 (0.0734)	-0.6568*** (0.0320)
<i>Audit</i>	0.6077*** (0.0939)	-0.2007*** (0.0283)
<i>CR1</i>	1.1038*** (0.2275)	-0.4079*** (0.0875)
<i>Maturity</i>	0.1423 (0.0945)	-0.1706*** (0.0291)
<i>PerGDP</i>	0.0356*** (0.0088)	-0.0128*** (0.0034)
Constant	1.2765* (0.7331)	7.4123*** (0.2973)

Observations	5,834	5,834
R-squared	0.148	0.528
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.4.2 Corporate social responsibility

Corporate social responsibility (CSR) has long been recognized as a multidimensional construct encompassing environmental, social, and governance-related activities. Prior literature suggests that transparent CSR disclosure enables firms to communicate their environmental, social, and governance performance to external stakeholders, thereby improving corporate image and reputation. Such enhanced transparency is expected to mitigate information asymmetry between the firm and its bondholders, potentially lowering the risk premia demanded by creditors. Given that CSR-related information is typically disclosed in narrative and qualitative formats, it presents inherent challenges for quantitative measurement. To overcome this difficulty, we construct a composite index of CSR disclosure quality (*SR*) using detailed CSR indicators obtained from the CSMAR (China Stock Market and Accounting Research) database. This index reflects the extent to which firms comprehensively and transparently communicate their social, environmental, and governance practices to external stakeholders. A higher value of the index denotes superior CSR disclosure quality.

We conduct a two-step mediation analysis to examine whether CSR disclosure quality serves as a channel through which academic independent directors affect credit spreads. Column (1) of Table 10 reports the regression of *SR* on *Academic* and control variables. The coefficient on *Academic* is positive and statistically significant at the 1% level (0.1654, $p < 0.01$), suggesting that the presence of academic independent directors improves CSR disclosure quality. This finding is consistent with the notion that academic independent directors bring stronger ethical awareness and monitoring incentives, thereby encouraging more transparent and comprehensive CSR reporting.

Column (2) presents the regression of *CS* on *Academic*, *SR*, and the full set of controls. The coefficient on *SR* is negative and highly significant at the 1% level (-0.0424 , $p < 0.01$), indicating that better CSR disclosure quality reduces credit spreads. This is consistent with the view that transparent CSR communication mitigates information asymmetry and signals stronger stakeholder engagement, thereby lowering financing costs. Meanwhile, the coefficient on *Academic* remains negative and significant at the 1% level (-0.0799 , $p < 0.01$) after controlling for CSR quality, implying partial mediation.

These results support the hypothesized transmission mechanism: academic independent directors reduce credit spreads partly by improving CSR disclosure quality.

Table 10. Mechanism analysis: corporate social responsibility disclosure quality

	(1)	(2)
Variables	<i>SR</i>	<i>CS</i>

<i>Academic</i>	0.1654*** (0.0526)	-0.0799*** (0.0193)
<i>SR</i>		-0.0424*** (0.0034)
<i>Lev</i>	-1.2362*** (0.2042)	1.6969*** (0.0705)
<i>Size</i>	0.6982*** (0.0216)	-0.1956*** (0.0082)
<i>Cashflow</i>	-0.2888 (0.4950)	0.6320*** (0.1801)
<i>ROA</i>	0.0355*** (0.0061)	-0.0099*** (0.0023)
<i>Growth</i>	-0.2929*** (0.0808)	0.0565* (0.0297)
<i>AT</i>	0.1780*** (0.0623)	-0.0279 (0.0216)
<i>Tangibility</i>	-0.2841** (0.1404)	0.0988** (0.0499)
<i>TTM</i>	-0.0016 (0.0010)	-0.0006 (0.0004)
<i>Position</i>	-0.0044 (0.0032)	-0.0047*** (0.0010)
<i>HHI</i>	-0.9569*** (0.3199)	0.6556*** (0.0961)
<i>SOE</i>	0.6679*** (0.0534)	-0.7963*** (0.0199)
<i>Audit</i>	0.3154*** (0.0509)	-0.0969*** (0.0185)
<i>CRI</i>	-0.4294*** (0.1466)	-0.4216*** (0.0544)
<i>Maturity</i>	0.3225*** (0.0547)	-0.2412*** (0.0202)
<i>PerGDP</i>	0.0350*** (0.0051)	-0.0382*** (0.0020)
Constant	-10.4336*** (0.4982)	7.6779*** (0.1879)
Observations	15,081	15,081
R-squared	0.310	0.504
Industry FE	YES	YES

Year FE	YES	YES
Robust standard errors in parentheses		
*** p<0.01, ** p<0.05, * p<0.1		

4.4.3 Information transparency

Information transparency plays a crucial role in reducing information asymmetry between firms and external capital providers, thereby lowering the risk premia demanded by bondholders. To examine whether the effect of academic independent directors on credit spreads operates through improved transparency, we construct a transparency indicator (*Transparency*) based on the information disclosure quality ratings published by the Shenzhen and Shanghai Stock Exchanges. Following the quantification approach, we assign numerical values to the rating categories: A (Excellent) = 4, B (Good) = 3, C (Fair) = 2, and D (Poor) = 1. A higher value of *Transparency* reflects superior information disclosure quality.

Column (1) of Table 11 reports the first-stage regression, where the dependent variable is *Transparency* and the key explanatory variable is *Academic*, along with the full set of controls. The coefficient on *Academic* is positive and statistically significant at the 5% level (0.0287, $p < 0.05$). The evidence reveals that academic independent directors are associated with enhanced information transparency, reinforcing the theoretical expectation that their participation bolsters monitoring functions and improves the quality of corporate communications.

Column (2) reports the second-stage regression, where *CS* is regressed on both *Academic* and *Transparency*, retaining the same control variables. The coefficient on *Transparency* is negative and highly significant at the 1% level (-0.2820 , $p < 0.01$), confirming that greater transparency is associated with substantially lower borrowing costs. Crucially, the direct effect of *Academic* on *CS* remains negative and significant at the 1% level (-0.0755 , $p < 0.01$) after controlling for the mediator.

Collectively, these findings provide robust evidence that information transparency serves as a significant conduit through which academic independent directors reduce corporate credit spreads. The mediation effect is economically meaningful and remains stable after accounting for extensive fixed effects and control variables, reinforcing the view that academic independent directors create value for bondholders by improving the firm's informational environment.

Table 11. Mechanism analysis: information transparency

Variables	(1) <i>Transparency</i>	(2) <i>CS</i>
<i>Academic</i>	0.0287** (0.0139)	-0.0755*** (0.0217)
<i>Transparency</i>		-0.2820*** (0.0148)
<i>Lev</i>	-0.6895*** (0.0545)	1.6328*** (0.0787)
<i>Size</i>	0.1467***	-0.1833***

	(0.0060)	(0.0090)
<i>Cashflow</i>	0.0355	1.0707***
	(0.1313)	(0.1955)
<i>ROA</i>	0.0404***	-0.0008
	(0.0019)	(0.0025)
<i>Growth</i>	0.0939***	0.0623*
	(0.0224)	(0.0320)
<i>AT</i>	-0.0034	-0.0000
	(0.0161)	(0.0235)
<i>Tangibility</i>	0.0438	0.1439**
	(0.0403)	(0.0570)
<i>TTM</i>	-0.0001	-0.0008**
	(0.0003)	(0.0004)
<i>Position</i>	0.0055***	-0.0048***
	(0.0009)	(0.0011)
<i>HHI</i>	-0.2335***	0.6442***
	(0.0755)	(0.1130)
<i>SOE</i>	0.3321***	-0.7582***
	(0.0149)	(0.0223)
<i>Audit</i>	0.2038***	-0.0437**
	(0.0147)	(0.0207)
<i>CRI</i>	0.0967**	-0.4156***
	(0.0398)	(0.0612)
<i>Maturity</i>	-0.0527***	-0.2643***
	(0.0155)	(0.0228)
<i>PerGDP</i>	0.0152***	-0.0347***
	(0.0015)	(0.0021)
Constant	-0.5302***	7.9203***
	(0.1375)	(0.2069)
Observations	12,658	12,658
R-squared	0.405	0.529
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.5 Further Analysis

We next probe the conditional scope of our baseline estimate, focusing on whether the credit-spread reduction associated with academic directors is intensified or dampened in particular firm contexts. To this end, we carry out a series of split-sample estimations that stratify our observations

along both corporate and boardroom dimensions.

4.5.1 Heterogeneity by ownership type (SOE)

We first investigate whether the effect of academic independent directors differs between state-owned enterprises (SOEs) and non-SOEs. The sample is partitioned based on the firm's ultimate ownership, and the results are reported in Table 12. In column (1), for SOEs, the coefficient on *Academic* is positive but statistically insignificant ($\beta = 0.0081$, $p > 0.1$). In contrast, column (2) shows that for non-SOEs, the coefficient is significantly negative at the 1% level ($\beta = -0.2464$, $p < 0.01$).

This disparity suggests that the governance-enhancing role of academic independent directors is more pronounced in non-state-owned firms. SOEs often benefit from implicit government guarantees, which substantially reduce the market's sensitivity to firm-specific credit risk and governance quality. Consequently, the incremental information and monitoring value provided by academic independent directors are partially crowded out by the sovereign credit backstop. Non-SOEs, however, operate under stronger market discipline and face higher financing frictions. In such firms, the expertise and reputation of academic directors can serve as a more credible signal of governance quality, thereby exerting a more powerful effect in lowering credit spreads.

Table 12. Heterogeneity by ownership type (SOE)

Variables	(1) SOEs	(2) Non-SOEs
<i>Academic</i>	0.0081 (0.0197)	-0.2464*** (0.0422)
<i>Lev</i>	1.6249*** (0.0884)	1.5648*** (0.1399)
<i>Size</i>	-0.2328*** (0.0091)	-0.3180*** (0.0189)
<i>Cashflow</i>	1.2341*** (0.2125)	-0.5924* (0.3249)
<i>ROA</i>	-0.0145*** (0.0031)	-0.0043 (0.0036)
<i>Growth</i>	-0.0070 (0.0363)	0.2864*** (0.0514)
<i>AT</i>	-0.0630** (0.0260)	0.0052 (0.0444)
<i>Tangibility</i>	0.0347 (0.0533)	0.2206* (0.1306)
<i>TTM</i>	-0.0006 (0.0004)	-0.0010 (0.0007)
<i>Position</i>	-0.0021* (0.0012)	-0.0138*** (0.0022)

<i>HHI</i>	0.5972*** (0.1237)	1.5445*** (0.2168)
<i>Audit</i>	-0.0746*** (0.0180)	-0.1539*** (0.0458)
<i>CRI</i>	-0.5504*** (0.0625)	-0.1695 (0.1160)
<i>Maturity</i>	-0.1825*** (0.0208)	-0.4199*** (0.0517)
<i>PerGDP</i>	-0.0308*** (0.0021)	-0.0664*** (0.0057)
Constant	7.3338*** (0.2172)	10.9878*** (0.4435)
Observations	10,520	4,643
R-squared	0.434	0.298
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.5.2 Heterogeneity by board meeting frequency

We next explore the role of board diligence, proxied by the annual number of board meetings. Following the literature, we divide the sample into two groups based on the sample mean of meeting frequency. The estimation results are presented in Table 13.

For firms with meeting frequency above or equal to the mean (column 1), the coefficient on *Academic* is large and significantly negative ($\beta = -0.1853$, $p < 0.01$). However, for firms with below-average meeting frequency (column 2), the coefficient turns small and loses statistical significance ($\beta = -0.0188$, $p > 0.1$). This stark contrast implies that the effectiveness of academic independent directors is contingent upon the active functioning of the board. Frequent board meetings provide a more effective institutional platform for academic directors to voice their professional opinions, challenge managerial decisions, and exert monitoring. In firms with infrequent meetings, the informational and advisory advantages of academic directors may remain dormant, rendering their presence less impactful on market-perceived credit risk.

Table 13. Heterogeneity by board meeting frequency

Variables	(1) High	(2) Low
<i>Academic</i>	-0.1853*** (0.0333)	-0.0188 (0.0248)
<i>Lev</i>	1.8064*** (0.1292)	1.6233*** (0.0891)

<i>Size</i>	-0.2190*** (0.0135)	-0.2348*** (0.0112)
<i>Cashflow</i>	0.9130*** (0.2867)	0.3441 (0.2452)
<i>ROA</i>	-0.0103** (0.0040)	-0.0119*** (0.0029)
<i>Growth</i>	-0.0101 (0.0444)	0.1431*** (0.0407)
<i>AT</i>	0.0194 (0.0374)	-0.0623** (0.0286)
<i>Tangibility</i>	-0.0000 (0.0987)	0.3008*** (0.0624)
<i>TTM</i>	-0.0021*** (0.0005)	0.0007 (0.0005)
<i>Position</i>	-0.0099*** (0.0017)	-0.0017 (0.0014)
<i>HHI</i>	1.0471*** (0.1996)	0.4705*** (0.1109)
<i>SOE</i>	-0.7974*** (0.0311)	-0.8357*** (0.0266)
<i>Audit</i>	-0.2447*** (0.0298)	-0.0045 (0.0253)
<i>CRI</i>	-0.4303*** (0.0985)	-0.3396*** (0.0704)
<i>Maturity</i>	-0.3764*** (0.0332)	-0.1985*** (0.0258)
<i>PerGDP</i>	-0.0423*** (0.0035)	-0.0402*** (0.0027)
Constant	8.4400*** (0.3144)	8.0752*** (0.2626)
Observations	6,372	8,793
R-squared	0.535	0.500
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4.5.3 Heterogeneity by the proportion of academic directors

Our last empirical inquiry asks whether the intensity of the documented effect shifts in accordance with the board's level of academic independent director saturation. We split the full

sample into high-proportion (above or equal to the mean) and low-proportion (below the mean) subgroups. The results are reported in Table 14.

The coefficient on *Academic* is significantly negative in the low-proportion subsample ($\beta = -0.0904$, $p < 0.01$, column 2), whereas it becomes statistically insignificant in the high-proportion subsample ($\beta = 0.2139$, $p > 0.1$, column 1).

This result points to a potential diminishing marginal effect of academic expertise. The transition from having no academic directors to having one appears to deliver the most significant governance improvement and risk reduction. This beneficial effect, however, exhibits diminishing returns. For firms that have already accumulated a considerable number of academically trained directors, the decision to add one more—a scenario captured by our dummy variable in contexts where such appointments are already the norm—fails to translate into any measurable further compression of credit spreads. This suggests that a threshold effect may exist, beyond which the marginal contribution of additional academic directors to bond pricing efficiency becomes negligible.

Table 14. Heterogeneity by proportion of academic independent directors

Variables	(1) High	(2) Low
<i>Academic</i>	0.2139 (0.7675)	-0.0904*** (0.0224)
<i>Lev</i>	1.8987*** (0.1089)	1.5607*** (0.0990)
<i>Size</i>	-0.2831*** (0.0120)	-0.1699*** (0.0120)
<i>Cashflow</i>	0.6696*** (0.2462)	0.3360 (0.2804)
<i>ROA</i>	-0.0082** (0.0033)	-0.0148*** (0.0034)
<i>Growth</i>	-0.0149 (0.0402)	0.1833*** (0.0461)
<i>AT</i>	-0.0604** (0.0296)	0.0166 (0.0331)
<i>Tangibility</i>	0.1461** (0.0677)	0.2042*** (0.0769)
<i>TTM</i>	-0.0022*** (0.0005)	0.0015*** (0.0006)
<i>Position</i>	-0.0012 (0.0016)	-0.0068*** (0.0014)
<i>HHI</i>	0.3382** (0.1424)	1.0714*** (0.1501)

<i>SOE</i>	-0.7804*** (0.0269)	-0.8992*** (0.0305)
<i>Audit</i>	-0.0345 (0.0265)	-0.2094*** (0.0276)
<i>CRI</i>	-0.2993*** (0.0777)	-0.5836*** (0.0836)
<i>Maturity</i>	-0.2699*** (0.0297)	-0.2311*** (0.0277)
<i>PerGDP</i>	-0.0367*** (0.0029)	-0.0487*** (0.0031)
Constant	9.2599*** (0.8079)	6.8013*** (0.2820)
Observations	7,698	7,460
R-squared	0.476	0.547
Industry FE	YES	YES
Year FE	YES	YES

Robust standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Our heterogeneity analyses yield a consistent message: the observed reduction in credit spreads attributable to academic independent directors is context-dependent rather than universal. The effect looms largest in firms without state ownership, those featuring highly interactive board processes, and those maintaining a balanced proportion of academic representatives. These conditional observations both fortify our primary claims and delineate the operational arenas where academic independent directors prove most consequential as governance actors.

5. Conclusions

This study empirically examines the impact of academic independent directors on bond rating quality, measured by bond credit spreads, using a sample of Chinese A-share listed companies from 2010 to 2023. The empirical results demonstrate that the presence of academic independent directors significantly reduces bond credit spreads, indicating a substantial improvement in bond rating quality. This finding remains robust after a series of robustness tests, including excluding the COVID-19 pandemic period, adopting alternative measures of the dependent variable, adding additional governance control variables, and addressing endogeneity concerns through lagged explanatory variables and two-stage least squares (2SLS) estimation.

Further mechanism analyses reveal three distinct transmission channels through which academic independent directors exert their positive influence on bond rating quality. First, academic independent directors enhance corporate innovation output, which strengthens firms' fundamental creditworthiness and reduces default risk, thereby narrowing credit spreads. Second, they strengthen the firm's CSR communication with external stakeholders, effectively narrowing the knowledge gap

that separates issuers from their creditors. As a direct consequence, the premium that lenders attach to perceived uncertainties tends to contract. Third, they elevate the overall transparency of corporate information, facilitating more rigorous external monitoring and diminishing the uncertainty faced by capital providers, both of which contribute to superior bond rating outcomes.

Heterogeneity analyses further indicate that the beneficial effect of academic independent directors on bond rating quality is more pronounced in non-state-owned enterprises, firms with higher board meeting frequency, and those with a lower proportion of academic independent directors. These findings highlight the boundary conditions of the governance role of academic independent directors, suggesting that their effectiveness is contingent on firm ownership structure, board diligence, and the existing composition of academic directors on the board.

Our investigation enriches prior research on several fronts. On one front, it channels the academic independent director discourse toward bond market consequences, addressing underserved areas in both rating determinants research and governance-outcomes scholarship. On another front, it demystifies the operational channels linking scholarly board members to rating agencies' evaluations, affording a more intricate perspective on the mechanisms that connect internal oversight structures with external credit signals. From a practical perspective, the findings offer valuable insights for firms, rating agencies, and regulators. The appointment of academic independent directors enables companies to improve their bond rating quality and lower debt-servicing expenses, with this beneficial effect being particularly salient among private firms. Rating agencies may improve the accuracy of credit assessments by incorporating board composition, especially the presence of academic independent directors, into their rating frameworks. Regulatory authorities may consider further incentivizing the appointment of qualified academic independent directors as a means to fortify corporate governance and foster the sound development of the bond market.

We recognize that our study, for all its contributions, is bounded by several constraints that delineate a clear agenda for continued research. To begin, our classification of academic independent directors as a simple binary variable sacrifices the subtlety inherent in their professional backgrounds—such as variations in disciplinary training, scholarly reputation, and research emphasis. Future investigations would benefit from employing multi-dimensional proxies to ascertain whether specific academic attributes yield differential impacts on credit rating outcomes. Furthermore, our analysis is anchored in the Chinese regulatory and market context, leaving it unclear whether our conclusions can be extrapolated to other national settings, be they emerging or industrialized economies. Systematic cross-border studies would help establish the extent to which institutional environments moderate the observed effects. Finally, while we document three mediating routes, this list is not exhaustive; additional factors—potentially encompassing corporate risk-taking propensity and the veracity of reported earnings—could serve as additional conduits. Enlarging the mediating space would deepen our grasp of the mechanisms through which scholarly directors shape bond market evaluations.

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Conflicts of Interest

The authors confirm that there are no conflicts of interest.

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