



The Impact of Green Bond Issuance on Stock Price Crash Risk in Asian Banking Firms

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How to Cite :

Ernest., Maria. (2026). The Impact of Green Bond Issuance on Stock Price Crash Risk in Asian Banking Firms . EKOMBIS REVIEW: Jurnal Ilmiah Ekonomi Dan Bisnis, 14(4). doi: <https://doi.org/10.37676/ekombis.v14i4>

ARTICLE HISTORY

Received [20 May 2026]

Revised [15 October 2026]

Accepted [19 October 2026]

KEYWORDS

Green Bond Issuance, Stock Price Crash Risk, Asian Banking Firms.

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ABSTRACT

This study examines the impact of conventional and sustainable financing strategies on stock price crash risk in Asian banking firms. Sustainable financing is proxied by green bond issuance, while crash risk is measured using negative conditional skewness and down-to-up volatility. The study employs a difference-in-differences approach using panel data from banking institutions across several Asian countries. The findings are expected to provide empirical evidence on whether sustainable financing strategies mitigate stock price crash risk and offer insights for corporate managers and policymakers in designing optimal financing structures.

INTRODUCTION

Climate change and increasing pressure for environmental sustainability have driven the transformation of the global financial system toward the concept of green finance. One of the instruments that has developed rapidly within this framework is the green bond, which serves as a financing tool for environmentally friendly projects while also signaling a commitment to sustainability to investors. Globally, green bond issuance has shown a significant upward trend, including in Asia, which has become one of the major contributors to the sustainable finance market.

However, the heterogeneous institutional characteristics across Asian countries particularly in terms of governance, transparency, and investor protection create the potential for high information asymmetry. This condition may increase stock price crash risk (SPCR), defined as an extreme decline in stock prices resulting from the accumulation of negative information that is not disclosed in a timely manner by management. This phenomenon is explained by agency theory and information asymmetry theory, which highlight conflicts of interest and imbalances of information between management and investors.

In this context, green bond issuance has the potential to serve as a mechanism that enhances transparency and corporate governance quality. From the perspective of signaling theory, issuing green bonds can provide a positive signal to the market regarding a company's

sustainability commitment and credibility, thereby potentially reducing information asymmetry and stock price crash risk. In addition, green bonds may alleviate financing pressure and encourage more prudent risk management practices, particularly in the banking sector, which is characterized by high leverage and a central role in the financial system.

Various empirical studies indicate that green bond issuance tends to be associated with improved market responses and a reduction in extreme stock price risks. However, most studies remain focused on a single country—primarily China—thus limiting the generalizability of findings in a cross-country Asian context. On the other hand, differences in regulatory frameworks and the level of green finance policy implementation across Asian countries may also influence the effectiveness of green bonds in enhancing transparency and market stability.

In addition to their potential benefits, there is also the risk of greenwashing, defined as the use of a “green” label without substantive sustainability implementation, which may further exacerbate information asymmetry and increase future market risk. Therefore, it is important to empirically examine how green bond issuance affects stock price crash risk, particularly in the banking sector in Asia.

This study aims to analyze the impact of green bond issuance on stock price crash risk and to examine differences in such risk before and after the adoption of green bonds in banking firms in Asia. This research is expected to contribute to the green finance literature and serve as a reference for management, investors, and regulators in understanding the role of green bonds in enhancing transparency and capital market stability.

LITERATURE REVIEW

Information Asymmetry Theory

Information asymmetry theory explains that management holds more information than investors, which can distort market valuation. This often leads to bad news hoarding, where negative information is withheld and later released simultaneously, triggering stock price crash risk.

Lower transparency and poor reporting quality increase this risk, as they allow management to delay disclosing negative information. In this context, green bond issuance can reduce information asymmetry through stricter reporting, environmental disclosures, and external verification.

As a result, improved transparency and monitoring from green bonds can limit bad news hoarding and reduce the likelihood of stock price crash risk.

Signaling Theory

Signaling theory states that under information asymmetry, management can send signals to the market to reduce uncertainty and enhance firm credibility. Financing decisions, including green bond issuance, serve as important signals of a company's quality and prospects.

Green bond issuance acts as a reputational signal of a firm's commitment to sustainability and transparency. It increases visibility, attracts long-term investors, and strengthens governance standards. This improved credibility can reduce uncertainty and limit the accumulation of undisclosed negative information, thereby lowering stock price crash risk.

However, the effectiveness of this signal depends on the strength of regulatory frameworks and standards across countries. With strong regulation, green bonds function not only as financing instruments but also as credible signals that enhance transparency, boost investor confidence, and reduce extreme stock price risk.

Financing Constraints Theory

Financing constraints theory explains that firms may face difficulties in obtaining external funding due to information asymmetry, credit risk, and uncertainty. In the banking sector, these

constraints are more complex due to regulatory requirements for capital, liquidity, and funding stability, making banks more sensitive to market risk perceptions.

Financial pressure can incentivize management to delay disclosing negative information, increasing the risk of accumulated bad news and triggering stock price crash risk. In this context, green bond issuance can help alleviate financing constraints by expanding the investor base, enhancing reputation, and providing more stable and diversified funding.

Empirically, green bonds are associated with lower stock price crash risk, partly because reduced financial pressure decreases managerial incentives to hide negative information. Therefore, green bond issuance not only improves transparency but also reduces financing pressure, ultimately lowering stock price crash risk, especially in the banking sector in Asia.

Green bond issuance affects stock price crash risk

Green bond issuance not only functions as a source of sustainable financing but also as a governance mechanism that has the potential to influence market risk. From the perspective of information asymmetry theory, stock price crash risk arises from the practice of withholding negative information by management, which, when accumulated and disclosed simultaneously, can trigger an extreme decline in stock prices. Green bond issuance, which is accompanied by stricter reporting and verification requirements, has the potential to enhance transparency and reduce the likelihood of such practices.

From the standpoint of signaling theory, green bond issuance reflects a company's commitment to sustainability and better governance. This signal can enhance a firm's credibility in the eyes of investors, strengthen market confidence, and mitigate overreactions to negative information. Furthermore, within the framework of financing constraints theory, access to alternative funding sources such as green bonds can reduce financial pressure on firms, thereby lowering management's incentives to conceal adverse information.

Particularly in the banking sector, which is characterized by high leverage and strong sensitivity to investor confidence, increased transparency and funding stability are crucial factors in maintaining stock price stability. Therefore, green bond issuance is expected to contribute to reducing stock price crash risk, especially in a heterogeneous market context such as Asia.

Based on the theoretical framework and empirical findings, the research hypothesis is formulated as follows:

H¹: Green bond issuance has a negative effect on stock price crash risk in banking firms in Asia.

METHODS

This study employs a quantitative approach using secondary data from financial statements, international financial databases, and capital market data. The sample consists of banking firms listed on Asian stock exchanges during 2019–2024. Green bond issuance data are obtained from Refinitiv Eikon, while daily stock prices and financial variables are sourced from S&P Capital IQ Pro.

The initial population includes 33,728 banks, which are filtered based on data availability. Using purposive sampling, the final sample comprises 112 banks from 11 Asian countries, including 39 green bond issuers (treatment group) and 73 non-issuers (control group).

The dependent variable is stock price crash risk (SPCR), measured using Negative Conditional Skewness (NCSKEW) and Down-to-Up Volatility (DUVOL). The main independent variable is green bond issuance, analyzed using a Difference-in-Differences (DID) approach with Treat, Post, and Treat × Post variables. Control variables include firm size, leverage, profitability (ROA), market-to-book ratio (MBR), and stock return volatility (SRV).

Empirical analysis uses panel data with DID and fixed effects regression to examine the causal impact of green bond issuance on SPCR. The model compares changes in SPCR before and after issuance between issuing and non-issuing firms, controlling for firm and year effects.

Additional analyses include descriptive statistics, a parallel trends test to validate the DID assumption, and robustness checks using Propensity Score Matching–Difference-in-Differences (PSM-DID) to address potential self-selection bias.

RESULTS

Descriptive Statistics

Table 1: Descriptive Statistics

Variabel	N	Mean	SD	Min.	Max.
NCSKEW	672	0,169	1,123	-5,959	7,669
DUVOL	672	0,040	0,577	-3,752	1,772
lnTA	672	10,880	2,027	4,386	15,716
Lev	672	0,129	0,087	0,000	0,439
ROA	672	0,007	0,012	-0,118	0,053
MBR	672	1,105	2,644	0,103	64,220
SRV	672	0,017	0,008	0,005	0,053
Treat	672	0,348	0,477	0	1
Post	672	0,161	0,368	0	1
DID	672	0,161	0,368	0	1

Source: Output Data (2026)

Descriptive statistics show that the stock price crash risk variable exhibits relatively high variation within the sample. This is reflected in the mean value of NCSKEW of 0.169 with a standard deviation of 1.123, and DUVOL with a mean of 0.040 and a standard deviation of 0.577.

In terms of firm characteristics, firm size (lnTA) has an average of 10.880, indicating that the sample is dominated by banks with relatively large asset scales. The average leverage of 0.129 suggests a moderate level of debt usage, while profitability (ROA) of 0.007 indicates relatively low earnings performance.

The market valuation variable (MBR) shows high variation, with a mean of 1.105 and a standard deviation of 2.644, as well as a very high maximum value, reflecting heterogeneity in market perceptions of firm prospects. Meanwhile, stock return volatility (SRV) is relatively low, with an average of 0.017, indicating that stock price movements in the sample are generally stable.

For variables in the Difference-in-Differences (DID) framework, the proportion of firms in the treatment group (Treat) is 34.8%. The Post and DID variables each have a mean of 0.161, reflecting the proportion of observations in the post-treatment period and those receiving treatment during that period.

Parallel Trends Test

Table 2: Parallel Trends Test Panel A: NCSKEW

Variable	Coef.	Std. Error	t-stat	Significant
event_m3 (t = -3)	0,1128	0,2562	0,44	Not significant
event_m3 (t = -2)	0,1052	0,1993	0,53	Not significant
event_m3 (t = 0)	-0,0239	0,1725	-0,14	Not significant
event_m3 (t = +1)	-0,0163	0,2566	-0,06	Not significant
event_m3 (t = +2)	0,2158	0,2301	0,94	Not significant
event_m3 (t = +3)	0,2868	0,2416	1,19	Not significant
event_m3 (t = +4)	0,8359	0,2783	3,00	***

Source: Output Data (2026)

Table 3: Parallel Trends Test Panel B: DUVOL

Variable	Coef.	Std. Error	t-stat	Significant
<i>event_m3</i> (<i>t</i> = -3)	0,1853	0,1436	1,29	Not significant
<i>event_m3</i> (<i>t</i> = -2)	0,1165	0,1201	0,97	Not significant
<i>event_m3</i> (<i>t</i> = 0)	0,0054	0,0992	0,05	Not significant
<i>event_m3</i> (<i>t</i> = +1)	-0,0067	0,1213	-0,06	Not significant
<i>event_m3</i> (<i>t</i> = +2)	0,0964	0,1168	0,82	Not significant
<i>event_m3</i> (<i>t</i> = +3)	0,1736	0,1262	1,38	Not significant
<i>event_m3</i> (<i>t</i> = +4)	0,3640	0,1142	3,19	***

Source: Output Data (2026)

Based on Table 2 (Panel A: NCSKEW), the coefficients in the pre-treatment periods (*t* = -3 and *t* = -2) are not significant, indicating no difference in trends between the treatment and control groups prior to the treatment. In the post-treatment period, the coefficients are also not significant from *t* = 0 to *t* = +3.

The results in Table 2 (Panel B: DUVOL) show a similar pattern, where the pre-treatment coefficients are not significant, confirming that the parallel trends assumption is satisfied. After the treatment, the coefficients are also not significant in the early periods.

Overall, the absence of differences in pre-treatment trends for both proxies indicates that the key assumption of the Difference-in-Differences (DID) method is met. In addition, the event study results suggest that the impact of green bond issuance on stock price crash risk is dynamic and does not occur immediately.

Difference-in-Differences (DID) Regression Results

Table 4: Comparison Results of DID and PSM-DID (without Control Variables)

Variable	Stat.	DID		PSM-DID	
		NCSKEW	DUVOL	NCSKEW	DUVOL
DID	Coef.	0,198	0,064	0,249	0,096
	Std. Error	(0,176)	(0,097)	(0,211)	(0,108)

Source: Output Data (2025)

Table 5: Comparison Results of DID and PSM-DID (with Control Variables)

Variable	Stat.	DID		PSM-DID	
		NCSKEW	DUVOL	NCSKEW	DUVOL
DID	Coef.	0,154	0,047	0,166	0,054
	Std. Error	(0,176)	(0,096)	(0,206)	(0,103)
InTA	Coef.	0,510	0,211	1,840***	0,972***
	Std. Error	(0,322)	(0,164)	(0,684)	(0,385)
Lev	Coef.	0,678	0,627	1,257	0,431
	Std. Error	(2,073)	(1,373)	(2,259)	(1,461)
ROA	Coef.	1,477	1,719	-107,445***	-57,440***
	Std. Error	(7,397)	(4,804)	(18,936)	(8,827)
MBR	Coef.	0,113***	0,017	0,095	0,032
	Std. Error	(0,021)	(0,014)	(0,272)	(0,160)
SRV	Coef.	50,514***	25,696***	21,353	6,954
	Std. Error	(13,117)	(5,810)	(15,769)	(9,122)

Source: Output Data (2025)

Based on the estimation results presented in Table 4 and Table 5, this study employs both Difference-in-Differences (DID) and Propensity Score Matching Difference-in-Differences (PSM-DID) approaches to examine the effect of green bond issuance on stock price crash risk, proxied by NCSKEW and DUVOL.

Table 4 presents the regression results without control variables. The DID variable shows positive coefficients in both the DID and PSM-DID models. In the DID model, the coefficient of DID is 0.198 for NCSKEW and 0.064 for DUVOL. Meanwhile, in the PSM-DID model, the coefficient increases to 0.249 for NCSKEW and 0.096 for DUVOL. These findings indicate that green bond issuance tends to be positively associated with stock price crash risk. However, considering the relatively large standard errors, the relationship does not appear to be statistically significant.

Table 5 reports the regression results after including control variables, namely firm size (lnTA), leverage (Lev), profitability (ROA), market-to-book ratio (MBR), and stock return volatility (SRV). After controlling for firm characteristics, the DID variable remains positive in both DID and PSM-DID estimations, although the coefficients become smaller compared to the models without control variables. In the DID model, the DID coefficient is 0.154 for NCSKEW and 0.047 for DUVOL, while in the PSM-DID model, the coefficients are 0.166 and 0.054, respectively. These results suggest that green bond issuance does not have a statistically significant effect on stock price crash risk after accounting for firm-specific factors.

Regarding the control variables, firm size (lnTA) shows a positive but statistically insignificant relationship with both NCSKEW and DUVOL in the DID model. However, after applying the PSM-DID approach, lnTA becomes positively and significantly associated with both crash risk proxies, with coefficients of 1.840 for NCSKEW and 0.972 for DUVOL. This finding suggests that larger firms tend to face higher stock price crash risk after controlling for potential selection bias through the matching process.

Leverage (Lev) exhibits positive coefficients in both the DID and PSM-DID models for NCSKEW and DUVOL, but the relationship remains statistically insignificant across all specifications. These results indicate that debt levels are not a major determinant of stock price crash risk among banking firms in the sample.

For profitability (ROA), the DID model shows no statistically significant relationship with either NCSKEW or DUVOL. In contrast, the PSM-DID estimation reveals a negative and statistically significant relationship with both crash risk proxies, with coefficients of -107.445 for NCSKEW and -57.440 for DUVOL. This finding implies that firms with higher profitability tend to experience lower stock price crash risk, likely due to stronger financial stability and greater investor confidence.

Meanwhile, market-to-book ratio (MBR) demonstrates a positive and statistically significant effect on NCSKEW in the DID model, although its relationship with DUVOL is insignificant. However, after applying the PSM-DID approach, MBR becomes statistically insignificant for both crash risk proxies. This result suggests that the significance observed in the initial DID estimation may be sensitive to differences in firm characteristics between the treatment and control groups.

Similarly, stock return volatility (SRV) shows a positive and statistically significant relationship with both NCSKEW and DUVOL in the DID model, indicating that firms with higher stock return volatility are more likely to experience stock price crash risk. Nevertheless, the PSM-DID estimation shows that SRV is no longer statistically significant after the matching process, implying that the initial significance may also be influenced by sample characteristic differences between treatment and control firms.

Overall, the DID and PSM-DID estimation results consistently indicate that green bond issuance does not significantly affect stock price crash risk among banking firms in Asia. These findings imply that the market may not perceive green bond issuance as a major factor influencing extreme stock price declines.

DISCUSSION

Table 6: Hypothesis

Variable	Hypothesis	DID		PSM-DID		Conclusion
		NCSKEW	DUVOL	NCSKEW	DUVOL	
<i>GB (DID)</i>	H1	Not Sig (+)	Not Sig (+)	Not Sig (+)	Not Sig (+)	Not supported
<i>lnTA</i>	-	Not Sig (+)	Not Sig (+)	Sig (+)	Sig (+)	Has an effect (after PSM)
<i>Lev</i>	-	Not Sig (+)	Not Sig (+)	Not Sig (+)	Not Sig (+)	No effect
<i>ROA</i>	-	Not Sig (+)	Not Sig (+)	Sig (-)	Sig (-)	Negative significant effect
<i>MBR</i>	-	Sig (+)	Not Sig (+)	Not Sig (+)	Not Sig (+)	Not robust
<i>SRV</i>	-	Sig (+)	Sig (+)	Not Sig (+)	Not Sig (+)	Not robust

Source: Output Data (2025)

The Impact of Green Bond Issuance on NCSKEW

The estimation results show that the DID interaction variable has a positive but insignificant coefficient on NCSKEW across all model specifications, both using DID and PSM-DID methods. In both models without and with control variables the DID coefficient is not statistically significant. These findings indicate that green bond issuance by banking firms in Asia does not have a significant effect on stock price crash risk as measured by NCSKEW. Although the coefficient suggests a positive relationship, the empirical evidence is not strong enough to support this effect. Overall, the results suggest that green bond issuance has not been able to influence the asymmetric distribution of stock returns that reflects extreme downside risk.

The Impact of Green Bond Issuance on DUVOL

The estimation results show that the DID interaction variable does not have a significant effect on stock price crash risk as measured by DUVOL across all model specifications. In both models without and with control variables the DID coefficient is not statistically significant, although it shows a positive direction. The results are consistent across both DID and PSM-DID methods, indicating no significant impact of green bond issuance on DUVOL. This suggests that green bond issuance by banking firms in Asia has not been able to influence the asymmetric volatility of stock returns that reflects extreme downside risk. Therefore, it can be concluded that green bond issuance does not significantly affect stock price crash risk measured by DUVOL, reinforcing the findings obtained using the NCSKEW proxy.

The Impact of Firm Size on Stock Price Crash Risk

The estimation results show that firm size (*lnTA*) has no significant effect on stock price crash risk in the DID model but becomes significant under the PSM-DID approach. In the DID model, *lnTA* is insignificant for both NCSKEW and DUVOL. However, in the PSM-DID model, firm size has a positive and significant effect on both crash risk measures. These findings indicate that after controlling for self-selection bias, firm size becomes a relevant determinant of stock price crash risk. Economically, this suggests that larger firms tend to have higher crash risk, possibly due to greater operational complexity, higher information asymmetry, and broader disclosure challenges. Thus, firm size may increase stock price crash risk, particularly after accounting for selection bias in the estimation model.

The Impact of Leverage on Stock Price Crash Risk

The estimation results show that leverage has a positive coefficient across all model specifications but is not statistically significant, both in the DID and PSM-DID approaches. This finding is consistent for both proxies of stock price crash risk, namely NCSKEW and DUVOL. These results indicate that leverage does not have a significant effect on extreme stock price decline risk in banking firms in Asia. Thus, debt levels are not a primary determinant of stock price crash risk in this sample. Conceptually, this may reflect the nature of the banking sector, which inherently operates with high leverage, making variations in leverage across banks insufficient to significantly influence market risk perceptions.

The Impact of Return on Assets (ROA) on Stock Price Crash Risk

The estimation results show that ROA has no significant effect on stock price crash risk in the DID model but becomes significant under the PSM-DID approach. In the DID model, ROA is not significant for both crash risk proxies, NCSKEW and DUVOL. In contrast, in the PSM-DID model, ROA has a negative and significant effect on both measures. This indicates that after controlling for self-selection bias, firm profitability plays an important role in reducing stock price crash risk. Economically, this suggests that more profitable firms tend to have more stable financial conditions and better transparency, which helps reduce the likelihood of extreme stock price declines.

The Impact of Market-to-Book Ratio (MBR) on Stock Price Crash Risk

The estimation results show differences in the effect of MBR between the DID and PSM-DID models. In the DID model, MBR has a positive and significant effect on NCSKEW, but is not significant for DUVOL, indicating that market valuation may increase crash risk under certain specifications. However, in the PSM-DID model, the effect of MBR becomes insignificant for both crash risk proxies. This suggests that the significance found in the DID model may be driven by differences in characteristics between the treatment and control groups. After applying matching adjustments, the effect disappears, indicating that MBR is not a robust determinant of stock price crash risk in this study.

The Impact of Stock Return Volatility (SRV) on Stock Price Crash Risk

The estimation results show that SRV has a positive and significant effect on stock price crash risk in the DID model for both proxies, NCSKEW and DUVOL. This finding indicates that higher stock return volatility is associated with a greater risk of extreme stock price declines. However, in the PSM-DID model, the effect of SRV becomes insignificant for both crash risk measures. This change suggests that the significance observed in the DID model may be driven by selection bias between the treatment and control groups. After applying matching adjustments, SRV is no longer a robust determinant of stock price crash risk, indicating that its effect in the initial model cannot be strongly generalized.

CONCLUSION

This study examines the effect of green bond issuance on stock price crash risk in banking firms in Asia using the Difference-in-Differences (DID) and Propensity Score Matching-Difference-in-Differences (PSM-DID) approaches, with NCSKEW and DUVOL as proxies. The results show that green bond issuance has no significant effect on stock price crash risk across all model specifications, both DID and PSM-DID, and both with and without control variables. This finding indicates that green bonds have not yet become an effective mechanism for reducing extreme stock price decline risk in the Asian banking sector; therefore, the research hypothesis is not supported. Furthermore, firm size (lnTA) is found to have a positive and significant effect after the PSM-DID estimation, suggesting that larger banks tend to have higher

crash risk. Leverage shows no significant effect across all models. Meanwhile, profitability (ROA) has a negative and significant effect after PSM-DID, indicating that higher profitability reduces crash risk. In contrast, MBR and SRV are not robust, as their significance disappears after applying PSM-DID adjustments. Overall, the findings confirm that green bond issuance has no significant impact on stock price crash risk, and that stability in the results is driven more by firm-specific characteristics rather than sustainable financing strategies.

SUGGESTION

Based on the research findings, companies are advised not to rely solely on green bond issuance as a strategy to reduce stock price crash risk, as the results show that this variable is not statistically significant. Companies need to ensure that green bond issuance is accompanied by improvements in transparency and information disclosure, particularly regarding fund allocation and environmental impact. In addition, sustainability principles should be fully integrated into business strategy and risk management so that they are not merely symbolic, but can also enhance investor confidence in the long term.

For investors, the findings indicate that the presence of green bonds cannot be used as the sole basis for investment decisions. Investors still need to conduct comprehensive fundamental analysis, particularly on firms' financial performance such as profitability (ROA), and pay attention to information quality and transparency, which are proven to be more relevant in influencing extreme stock price risk.

Meanwhile, for academics, future research is recommended to use more comprehensive measures of green bonds, such as issuance value, frequency, or proportion of total financing. In addition, other variables such as corporate governance, transparency level, and cross-country institutional factors should be considered. Expanding the sector coverage and observation period is also suggested to improve robustness and capture the long-term impact of green bond issuance

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