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How Sovereign Sustainable Bond Issuance Shakes Up the Corporate Sustainable Bond Market?: Evidence From Asian Markets

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ABSTRACT

This study examines how sovereign sustainable bond issuance affects the yields and liquidity of corporate sustainable bonds in eight Asian markets. Using panel vector autoregression (VAR) and daily data from 2018 to 2024, we find that initial sovereign sustainable bond issuance improves corporate sustainable bond liquidity and reduces yield spreads in the medium term. We further find that this reduction is primarily driven by a persistent decline in greenium rather than a lower risk premium. Corporate sustainable bond issuance rises post-sovereign issuance, with more diverse issuers entering the market. Additionally, fund flows into ESG mutual funds increase, reflecting stronger demand for sustainable assets. Our findings highlight the positive role of sovereign issuance in scaling up private sustainable finance.

JEL Classification: G12, C33, E43, Q54.

1 | Introduction

Sustainable bonds have emerged as a critical debt instrument in mobilizing funding for environmental and social investments (Flammer 2026). The amount of global sustainable bonds outstanding grew to around $5.0 trillion[1] by 2024, nearly 18 times the corresponding figure of $0.3 trillion in the first quarter of 2017 (Figure 1). By the end of 2024, Asia's sustainable bond markets reached $1.0 trillion, accounting for around 21.0% of the global sustainable bonds outstanding. While Asia is now the 2nd largest regional sustainable bond market in the world after the European Union (EU), the share of the sustainable bond market in the total bond market remains low in Asia compared to the EU. By the end of 2024, the share of outstanding sustainable bonds in Asia's bond market was 2.3%, much lower than the corresponding share of 8.2% in the EU.

Given the limited public resources and the tight budget constraints facing governments, the private sector must play a larger role in providing sustainable finance. Figure 2 shows that globally, the private sector's share in global sustainable issuance was around 52%. However, meeting the huge investment demand for sustainable projects requires the mobilization of more capital from the private sector. For example, in climate finance IMF (2023), projects that the private sector's share needs to rise to around 90% by 2030. Therefore, promoting private sector sustainable bond financing is an urgent priority for Asian economies seeking to achieve a sustainable future.

Although the literature has documented that sustainable bonds can be attractive to investors, especially those with a clientele or mandate seeking sustainable and resilience benefits (Flammer 2021; Tang and Zhang 2020), various barriers have

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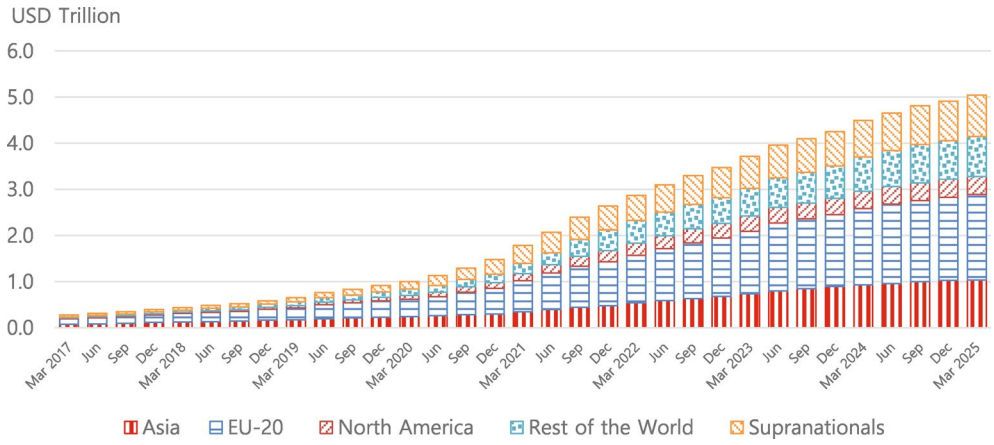


FIGURE 1 | Global sustainable bonds outstanding. *Source:* Asian Bonds Online. [Color figure can be viewed at wileyonlinelibrary.com]

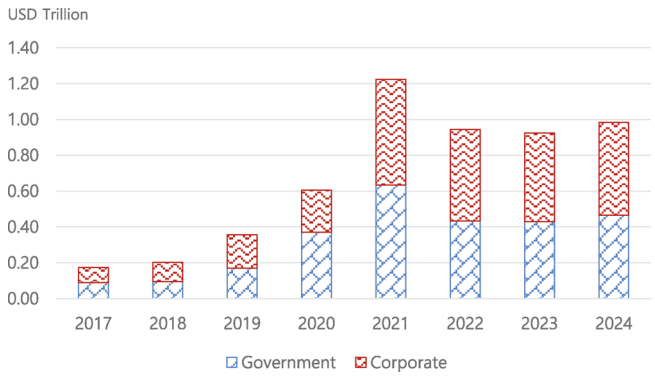


FIGURE 2 | Public and private sector contribution to sustainable bond issuances. *Source:* Bloomberg LP. [Color figure can be viewed at wileyonlinelibrary.com]

been found to discourage the participation of the private sector in sustainable finance. For example, ADB (2024) documents that sustainability-related policy uncertainty and underdeveloped sustainable financial market ecosystems, including taxonomies and disclosure requirements, limit the sustainable financing activities of the private sector.

At the same time, the private sector faces liquidity and cost-related challenges in tapping the sustainable finance market. Although a negative green premium (Greenium) has been widely documented (Zerbib 2019; Larcker and Watts 2020; Baker et al. 2022; Caramichael and Rapp 2022; Ando et al. 2022, 2023), green bonds tend to have lower liquidity than conventional bonds, which may offset the negative greenium (Yan et al. 2025). The relatively small size of the sustainable bond market may magnify liquidity concerns for institutional investors, especially those with actively managed portfolios. For example, Zerbib (2019) highlights that the lower liquidity of green bond markets may offset the potential benefits of a negative greenium. Boutabba and Rannou (2022) also document a liquidity premium in the green bond market, which is higher in the long term (16 bps) than in the short term (13 bps). Moreover, the burden of additional costs of issuing sustainable bonds, including more reporting requirements, monitoring, and securing external reviewers or verification, may also offset the benefit of a negative greenium, especially for first-time sustainable bond issuers.

The issuance of sovereign sustainable bonds has emerged as a possible vehicle for advancing sustainable finance. Issuing sovereign sustainable bonds not only facilitates the financing of environmentally and socially beneficial projects but can help scale up the sustainable bond market. In particular, sovereign sustainable bond issuance promotes corporate sustainable bond financing in different ways. First, by issuing sovereign sustainable bonds, the government sends a strong signal of its commitment to sustainable investments (Cheng et al. 2024). This could enhance investor confidence by reducing policy uncertainty and inspiring public confidence. The possible green policy signaling by the government has been widely discussed in the current literature (e.g., Breuer et al. 2018; Wang et al. 2021; La Rosa et al. 2018). These policies and regulations will affect the cost of sustainable finance by changing the expected cash flows of sustainable investment. Thus, when corporate sustainability strategy aligns with the government's sustainability policy, the cost of capital could decrease (Stellner et al. 2015). This also serves as the mechanism underlying the well-documented negative greenium in the green bond markets. Flammer (2026) provides a comprehensive discussion of greenium. Second, sovereign sustainable bond issuance demonstrates sustainable bond taxonomy and reporting standards, which can become benchmarks for the private sector to follow (Cheng et al. 2022). Third, sovereign sustainable bond issuance improves market depth with additional supply of sustainable bonds and sets a pricing benchmark for corporate sustainable bonds.

The literature shows that sovereign bonds are important for corporate bond market development. They establish a benchmark, facilitate price discovery, and enhance market liquidity. For example, Durbin and Ng (2005) confirm that corporate bond yields closely track movements in sovereign bond yields, and firms in emerging markets rarely achieve credit ratings higher than those of their governments. Dittmar and Yuan (2008) argue that sovereign bond issuance enables investors to better span systematic market risks, thereby improving market liquidity and reducing corporate bond credit spreads. This enhanced liquidity translates into lower borrowing costs for firms, fostering corporate investment and market expansion. Flannery et al. (2023) document evidence that the issuance of government bonds significantly reduces corporate bond spreads, noting that sovereign bonds serve as a benchmark for pricing corporate debt.

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Nevertheless, the literature on the impact of sovereign sustainable bond issuance on corporate sustainable bond markets remains thin. Focusing on demonstration effects and investor confidence, Cheng et al. (2022) argue that sovereign sustainable bond issuances require clear reporting and verification standards that are followed by private issuers, which, in turn, boost investor confidence in sustainable bond markets. Focusing on the signaling effect of the government's commitment to sustainable finance, Cheng et al. (2024) find that sovereign green bond debuts are positively related to more corporate green bond issuance, which improves liquidity and reduces the yield spreads of corporate green bonds. We also differ from Zhan et al. (2025) who examine the impact of green bond issuance on conventional bonds because we look at the impact of sovereign sustainable bond issuance on corporate sustainable bond markets.

In emerging Asian markets, by the end of 2024, sovereign sustainable issuance accounted for only 23% of sovereign sustainable bond markets, lower than the global and EU figures of 47% and 65%, respectively. This leaves us with an important empirical question. Would a more active role of Asian governments in sustainable bond markets benefit issuers and investors in Asia's corporate sustainable bond markets? Since liquidity and yields are two fundamental drivers of investment and financing decisions, this paper complements Cheng et al. (2024) by expanding the scope from the green bond market to the broader sustainable bond markets. We also empirically investigate whether sovereign sustainable bond issuance will benefit funding costs and liquidity in Asia's corporate sustainable bond markets. We focus on developing Asian economies because, as noted earlier, as a whole, they are now the world's 2nd largest sustainable bond market after the EU, but the share of sustainable bonds in the bond market remains substantially lower than the EU, which points to a potentially ample scope for expanding sovereign sustainable bond issuance.

This study contributes to the literature and extends Cheng et al. (2024) by investigating the channels of the reduction in the yield spreads of corporate sustainable bonds through an analysis of both supply and demand factors. On the supply side, we not only look at the size of corporate sustainable bond financing, but also the number and diversity of issuers. On the demand side, we show that there are more fund inflows into sustainable bond markets. Another contribution of our study is that we delve into the sources of the reduction of the yield spread by decomposing the yield spread into a greenium and a risk premium.[2] Moreover, this study differs from Cheng et al. (2024) by using a Panel vector autoregression (VAR) model, which can better capture the dynamic features of the data, to examine the changes in bond yield spreads and bid-ask spreads. Our analysis fills a gap in the literature by providing a systematic, data-based assessment of whether sovereign sustainable bond issuance strengthens corporate sustainable bond market liquidity and yields. Finally, the evidence of this study improves our understanding of how government interventions shape private-sector sustainable finance.

Drawing on a dataset of eight emerging Asian economies from 2018 to 2024, this study investigates the following research questions: (1) how do sovereign sustainable bonds affect the liquidity and yield spreads of corporate sustainable bond markets; and (2) what are the channels through which such impacts pass through? Using a panel VAR approach, we find that the first issuance of sovereign sustainable bonds improves the liquidity of the sustainable corporate bond market in the short run due to improved supply and portfolio rebalancing. Moreover, we find that in the medium term, the first issuance generally reduces the yield spread between corporate sustainable bonds and government bonds with a similar tenor. The narrowing of the yield spread is mostly driven by a persistent lower greenium rather than a reduction of the risk premium.

Further analysis of possible channels suggests that sovereign sustainable bond issuance affects the liquidity and yield of the corporate sustainable bond market due to both supply and demand factors. On the supply side, we find that after the first sovereign sustainable bond issuance, the eight Asian markets witnessed more private sustainable bond issuance, attracted more unique and diversified bond issuers, and extended the financing maturity of bonds. This indicates that sovereign sustainable bond issuance has a significant demonstration effect on private sector issuers, which boosts the supply of corporate sustainable bonds. On the demand side, we find that after the first sovereign sustainable bond issuance, there is an increase in fund flows into Environment, Social, Governance (ESG) themed mutual funds, implying an increase in demand for sustainable assets. Both supply and demand side improvement contributed to the liquidity of the corporate sustainable bond markets.

Our analysis has some significant policy implications. Our finding that sovereign sustainable bond issuance enhances liquidity and reduces bond yields suggests that governments can play a positive role in scaling up private-sector sustainable financing by addressing challenges related to market liquidity, costs, and confidence. By providing empirical insights into the interaction between sovereign and corporate sustainable bond markets in developing Asia, this study contributes to the broader discourse on sustainable finance development in emerging economies, including optimal sovereign issuance strategies.

The rest of this paper proceeds as follows. Section 2 introduces the data and empirical framework. Section 3 reports and discusses the empirical results. Section 4 explores possible channels on both the supply and demand sides. Section 5 discusses the broader policy implications of sovereign sustainable bond issuance for corporate sustainable bond market development and sustainable finance.

2 | Data and Empirical Framework

In this section, we present the data and methodology used in our empirical analysis.

2.1 | Sample Construction

This study covers eight Asian sustainable bond markets, namely Hong Kong, India, Indonesia, Korea, Malaysia, The Philippines, Singapore, and Thailand. These markets were included since they all have sovereign sustainable bond issuance. Sustainable bonds are designed to support environmental, social, and sustainability goals and carry related labels depending on the

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financing purposes. Key sustainable bond instruments include green bonds, social bonds, transition bonds, sustainability bonds, and sustainability-linked bonds, but in this empirical analysis, corporate sustainable bonds only include green, social, and sustainability bonds because the other types of sustainable bonds such as transition and sustainability-linked bonds were not issued by sovereign issuers in these eight sustainable bond markets during the sample period. The definition and classification of sustainable bonds may vary across different labeling requirements and bond standards. As such, this study relies on Bloomberg's classification, as Bloomberg is the main source for data on sustainable bonds. More specifically, we collect all available sustainable bond data from Bloomberg LP, which identifies bonds as green, social, and sustainability bonds based on the reported use of proceeds as well as self-reported classifications. The dataset consists of daily data from October 4, 2018 to March 1, 2024.

To investigate the effects of sovereign sustainable bond issuance on corporate sustainable bond liquidity and bond yields, we use the bid-ask spread to proxy for the liquidity of corporate sustainable bonds. The bid-ask spread is the difference between the corporate sustainable bond bid yield and ask yield, expressed in percentage points. To measure the bond yield spread, we take the difference between the yields of corporate sustainable bonds and government conventional bonds in the same market, denominated in the same currency with the same remaining maturity.[3] To further investigate the sources of the bond yield spread, we decompose the yield spread into a greenium and a risk premium. The greenium is the yield difference between a corporate sustainable bond and the average yield of conventional corporate bonds in the same market with the same credit rating, denominated in the same currency, and with the same maturities, whereas the risk premium is the difference between the average conventional bond yield and the yield on the benchmarking government bonds used to calculate the yield spread.

To describe sovereign sustainable bond issuance, we use a sovereign sustainable bond debut dummy, following Cheng et al. (2024). The sovereign sustainable bond issuance debut dummy captures the date when the very first sovereign sustainable bond was issued in a market. Table 1 lists the dates of the first sovereign sustainable bond issuance in the 8 Asian markets. The sovereign sustainable bond issuance debut dummy equals 1 for the days on and after the first sovereign sustainable bond issuance, and 0 otherwise.

The literature has identified certain macroeconomic factors and investment sentiment as the key determinants of bond market trading and prices. In our analysis, to account for the influence of macroeconomic factors and sentiment on bond market liquidity and pricing dynamics, we follow existing studies such as Sarwar (2023) and include policy rates, government bond yields, exchange rate fluctuations, and stock market volatility as control variables. In addition, we control for the logarithm of sustainable bond outstanding in an economy as the size of the sustainable bond market, which may affect the reaction of the bid-ask spread and bond yields of corporate sustainable bonds to sovereign sustainable bond issuance. For example, a sovereign sustainable bond issuance may have a larger impact in a relatively small sustainable bond market than in larger markets.

TABLE 1 | Issuance date of the first sovereign sustainable bonds.

Market	Sovereign green bond debut date	Type of sovereign sustainability bond on debut
Hong Kong	May 28, 2019	Green bond
India	January 27, 2023	Green bond
Indonesia	March 1, 2018	Green bond
Korea	June 19, 2019	Sustainability bond
Malaysia	April 28, 2021	Sustainability bond
The Philippines	March 29, 2022	Sustainability bond
Singapore	August 15, 2022	Green bond
Thailand	August 19, 2020	Sustainability bond

To investigate the possible channels of sovereign sustainable bond issuance, we constructed a quarterly panel dataset. To show how sovereign sustainable bond issuance may affect the supply of corporate sustainable bond issuance, we constructed the following indicators to capture the broad participation of the corporate sustainable bond market, including the share of corporate sustainable bonds outstanding in total corporate bond issuances during the quarter (Corporate sustainable bond market size), the natural logarithm of the number of first-time corporate sustainable bond issuances during the quarter (First Time), the natural logarithm of the number of unique corporate sustainable bond issuers during the quarter (Unique), and market concentration, measured using the Herfindahl–Hirschman Index of cumulative corporate sustainable bond issuances by sector (HHI-sector) and by issuer (HHI-issuer). To capture the demand side channel, we used aggregated money inflows into all the funds that invest in ESG bonds in that market, scaled by total fund asset value during the same quarter. All the variables are from Bloomberg LP, while the fund flow data is from the EPFR database. A detailed description of the variables is available upon request from the authors.

Table 2 reports the summary statistics of the key variables used in this empirical analysis. As the table shows, the average bid-ask spread for corporate sustainable bonds is 0.1007 basis points (bps), with a standard deviation of 0.1334 bps. The minimum value is 0, suggesting that a certain level of liquidity is consistently maintained in the corporate sustainable bond market. Additionally, the average yield spread is 0.8925 bps.

2.2 | Research Methodology

This study empirically investigates the dynamic effects of the first sovereign sustainable bond issuance on corporate sustainable bond liquidity and yield spreads in eight emerging Asian markets using a panel VAR approach. We control for policy rates, change in exchange rates, bond market size,

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TABLE 2 | Summary statistics of key variables.

Variable	Observation number	Mean	SD	Min	Max
Bid ask spread (bps)	160,139	0.1007	0.1334	0.0000	6.2840
Yield spread (bps)	160,139	0.8925	1.0664	−4.0528	6.0483
Greenium (bps)	71,809	−0.0367	0.5980	−3.4228	49.8025
Risk premium (bps)	71,777	0.8114	0.9039	−49.7400	5.4730
Sovereign sustainable bond debut (Dummy)	160,139	0.9102	0.2857	0.0000	1.0000
Sustainable bond outstanding (ln)	160,139	24.3639	1.0511	21.5403	25.9183
Government bond yield (%)	160,139	3.5889	1.8586	−0.1775	8.7006
Policy rate (%)	160,139	3.1054	1.9203	0.0665	6.5000
Stock market return volatility (%)	160,139	0.0121	0.0069	−0.0074	0.1219
Change in exchange rate (%)	160,139	0.0145	0.0039	−4.3804	4.4329

Note: The Government bond yield (%) is the conventional government bond yield calculated for the same maturity and currency denomination as the corporate sustainable bond. The change in exchange rate (%) is the daily logarithmic change in the bilateral exchange rate (local currency per USD), expressed in percentage terms. Sustainable Bond Outstanding is the natural logarithm of sustainable bonds outstanding.

conventional government bond yield, and market volatility.[4] The change in exchange rate (%) is the daily logarithmic change in the bilateral exchange rate (local currency per USD), expressed in percentage terms. Monthly and quarterly values are obtained by averaging daily data during the month and quarter. Following the standard panel VAR specification of Love and Zicchino (2006), the estimation equation is specified as

$$y_{it} = \sum_{j=1}^{p} \gamma_j y_{i,t-j} + dum_i \beta + \mu_i + \varepsilon_{it} \quad (1)$$

where i denotes corporate bond i, t denotes the time when the variables is recorded, y_{it} are various variables we consider in the estimation framework, including the bid-ask spread, the yield spread, policy rate, stock market volatility, exchange rate, sustainable bond market size, conventional sovereign bond yield, dum_i is a vector of 0–1 dummy variables, including the sovereign sustainable bond debut dummy, a country dummy, and an industry dummy for corporate sustainable bond i, and γ_j and β are matrices of coefficients to be estimated. The optimal number of lags included in the estimation, p, is determined based on 2 information criteria, the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC).

To investigate the possible channels of whether a supply or demand side factor drives the reaction of corporate sustainable bond market liquidity and yield spread to sovereign sustainable bond issuance, we employed a panel regression framework with market fixed effects to estimate the impact of sovereign sustainable bond issuance debut on corporate sustainable bond markets. We look at corporate sustainable bond issuers and diversification to investigate possible supply side drivers. On the other hand, to capture possible shifts in the demand for corporate sustainable bonds, we delve into money inflows into mutual funds that are mandated to invest in ESG bonds. Empirically, we follow Cheng et al. (2024), who employ sovereign sustainable bond issuance as an exogenous shock to examine its impact on the issuance amount of corporate sustainable bonds. Our model specification is broadly similar but focuses on issuers and market diversification on the supply side and inflows into ESG funds on the demand side. The model specification is thus as follows:

$$y_{it} = \alpha + \beta_1 (SSB\ debut)_{i,t} + \beta_2 SS_{it} + \beta_3 IS_{it} + \mu_i + \varepsilon_{it} \quad (2)$$

where i denotes market i, t denotes the time t when the variables are recorded, y_{it} represents a vector of the supply and demand side measures such as corporate sustainable bond financing size, unique issues, first-time issuers, the Herfindahl–Hirschman Index by sector or issuer, the maturity of the sustainable bond issuance, and fund inflows in ESG mandated funds. The key explanatory variable $(SSB\ debut)_{i,t}$ is a 0–1 dummy equal to one for time t when the government issued its first sustainable bond and for all the quarters thereafter, and 0 otherwise. We also control for the natural logarithm of the amount of sustainable bonds outstanding to account for the size of the existing sustainable bond market (SS_{it}) and the natural logarithm of all bond issuances in market i in the quarter to control for macro financing conditions in the market (IS_{it}). μ_i denotes a country fixed effect for market i, while ε_{it} is an idiosyncratic error term.

3 | Empirical Results

In this section, we report and discuss the main results of our empirical analysis. More specifically, we present the estimated impact of a sovereign sustainable bond issuance debut on the liquidity and yield spreads of corporate sustainable bonds. Panel VARs are particularly useful in analyzing dynamic interdependencies between pricing and endogeneity shocks, which make it more suitable than panel regression for understanding the effect of sovereign sustainable bond debut on the liquidity and yield spread of corporate sustainable bonds. The panel VAR model controls for the major endogenous variables that affect bond pricing while controlling for the dynamic features of the sustainable bond market.

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TABLE 3 | Impact of sovereign sustainable bond issuance debut on bid-ask spread of corporate sustainable bonds.

Variable	Impact on bid-ask spread: y^1_{it}		
	Daily data	**Monthly data**	**Quarterly data**
Sovereign sustainable bond debut (dum_i^1)	**−0.0003 (0.0002)**	**−0.0048* (0.0025)**	**−0.0232*** (0.0087)**
Constant term	−0.0076*** (0.0015)	−0.0945*** (0.0159)	−0.2297*** (0.0499)
Bid-ask spread: y^1_{it-1}	0.8220*** (0.0025)	1.3581*** (0.0138)	1.8258*** (0.0554)
Bid-ask spread: y^1_{it-2}	0.1864*** (0.0025)	−0.2581*** (0.0161)	−0.5910*** (0.0631)
Yield spread: y^2_{it-1}	−0.0002 (0.0007)	0.0016 (0.0023)	−0.0156*** (0.0052)
Yield spread: y^2_{it-2}	0.0002 (0.0007)	−0.0024 (0.0023)	0.0134** (0.0053)
Policy rate: y^3_{it-1}	0.0005 (0.0011)	−0.0055 (0.0030)	−0.0058 (0.0059)
Policy rate: y^3_{it-2}	−0.0006 (0.0011)	0.0037 (0.0028)	0.0041 (0.0053)
Stock market volatility: y^4_{it-1}	0.0287*** (0.0098)	0.1914 (0.1995)	−0.7501 (0.6849)
Stock market volatility: y^4_{it-2}	−0.0112 (0.0099)	−0.4118** (0.1980)	−0.4595 (0.6252)
Exchange rate: y^5_{it-1}	0.0001 (0.0001)	−0.0079 (0.0091)	0.0157 (0.0459)
Exchange rate: y^5_{it-2}	0.0002 (0.0001)	−0.0002 (0.0089)	−0.0014 (0.0536)
Ln of sustainable bond outstanding: y^6_{it-1}	0.0003*** (0.0001)	0.0041*** (0.0007)	0.0106*** (0.0020)
General sovereign bond yield: y^7_{it-1}	−0.0012 (0.0011)	0.0034 (0.0030)	0.0098 (0.0062)
General sovereign bond yield: y^7_{it-2}	0.0013 (0.0011)	−0.0032 (0.0031)	−0.0110* (0.0065)
R^2	0.9718	0.8947	0.7583
Number of observations	160,139	7724	2356

Note: The values in parentheses are the heteroskedasticity robust standard errors. *, **, and *** represent significant at 10%, 5%, and 1% levels, respectively. Panel unit root tests were conducted for all variables, and the results indicate that none of the variables exhibit a unit root at the 10% significance level.
Daily data: $p = 0.1151$ (not significant at the 10% level), monthly data: $p = 0.0545$ (significant at the 10% level), quarterly data: $p = 0.0080$ (significant at the 1% level) (in bold).

Table 3 presents the estimated results of the panel VAR estimation where the bid-ask spread of corporate sustainable bonds (y^1_{it}) is the dependent variable. The first sovereign sustainable bond debut has an immediate negative impact on the bid-ask spread of corporate sustainable bonds. The coefficient of the first sovereign sustainable bond issuance is negative and statistically significant in the monthly model (−0.0048) and the quarterly model (−0.0232), indicating a monthly or quarterly-run improvement in the liquidity of the corporate sustainable bond market. Improved liquidity could be driven by the immediately available supply of sustainable bonds in the market. Investors trade and adjust their portfolios, thus lowering the bid-ask spread.

Moreover, to determine whether the liquidity improvement is a monthly or quarterly-lived impact due to portfolio rebalance trading or a long-lived change, we also investigate the liquidity impacts of sovereign sustainable bond debut over longer time horizons. More specifically, we re-estimate the panel VAR models using monthly and quarterly data, respectively. As the last two columns of Table 3 show, when re-estimated with monthly or quarterly data, the impact of sovereign sustainable bond debut on corporate sustainable bond liquidity becomes more significant. This suggests that the liquidity-improving effect intensifies over a longer time horizon as the market reaches a new balance between supply and demand.

Across all data frequencies, the bid-ask spread exhibits a strong autoregressive behavior, with a significantly positive first lag and a significantly negative second lag. The magnitude of these lag coefficients increases as the frequency of the data falls, consistent with the idea that illiquidity shocks are persistent and more clearly evident in lower-frequency data. Taken together, the results indicate that monthly and quarterly data reveal medium-run improvements in corporate sustainable bond liquidity, the daily model suggests that the impact is mostly due to medium-term market adjustment or capital reallocation. The dynamic pattern highlights the need to attract more actively trading investors and promote greater market depth to sustain the improvement in market liquidity beyond the very short term.

To better understand the dynamic implications of an exogenous variable, in our case the introduction of a sovereign sustainable bond shock, we specify a simple autoregressive distributed lag model of order two in the above panel VAR model as

$$y_t = \theta_1 x_t + \beta_1 y_{t-1} + \beta_2 y_{t-2} + \epsilon_t \quad (3)$$

where x_t denotes the introduction of sovereign sustainable bond and y_t denotes the bid-ask spread of the corporate sustainable bond. The lag polynomial in operator L is given by Equation (4) below:

$$C(L) = 1 - \beta_1 L - \beta_2 L^2 \quad (4)$$

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The short-run effect of the policy variable is captured by θ_1. The long-run effect, which is the cumulative effect of a one-unit shock to x_t as it propagates through the autoregressive structure of y_t, is obtained by evaluating the lag polynomial at unity as

$$Long-run\ effect = \frac{\theta_1}{C(1)} = \frac{\theta_1}{(1-\beta_1-\beta_2)} \quad (5)$$

To understand the dynamic properties of the panel VAR model, the mean lag provides a summary statistic of the average timing of the effect. It is computed using the derivative of the lag polynomial as follows:

$$Mean\ Lag = \frac{\theta_1 \cdot C'(1)}{C(1)} \quad (6)$$

Where $c'(L)$ is the derivative of $C(L)$ with respect to L, in this case $c'(L) = \beta_1 - 2\beta_2 L$. Table 4 reports the long-run effect of the sovereign sustainable bond introduction on private sustainable bond market bid–ask spread. All long-run effect estimates are negative: −0.0110, −0.0859, and −0.1255. In other words, in the long run, the sovereign sustainable bond introduction increases liquidity in the private sustainable bond market by narrowing the bid–ask spread.

The mean lag is interpreted as a measure of time, so we reinterpret all values in days. The daily estimate of 5.25 is already in days. The monthly estimate of 0.1630 months translates to 4.9 days. The quarterly estimate of 0.0841 quarters translates to 7.5 days. The similar magnitudes of the mean lag estimation results across daily, monthly, and quarterly estimations indicate robust estimation and consistent impacts of the sovereign sustainable bond introduction on the liquidity of the private bond market.

We now investigate how the sovereign sustainable bond issuance debut affects the dynamics of the yield spread between corporate sustainable bond yields and conventional sovereign bond yields. Table 5 presents the panel VAR estimation results for corporate sustainable bond yield spreads, using data at daily, monthly, and quarterly frequencies. Yield spreads show persistent autoregressive dynamics across all models. The first lag is positive and significant in every specification, and its magnitude increases with lower data frequency, suggesting that price adjustments in bond markets unfold gradually over time. The estimated effect of sovereign sustainable bond issuance is negative and statistically significant in both the monthly and the quarterly model specification, with the estimated impact of −0.0284 and −0.2071, respectively. However, such a reduction in bond yield spread does not happen immediately following the sovereign sustainable bond issuance debut, as the coefficients of the daily models show. Such results indicate that the sovereign issuance reduces corporate yield spreads only over the medium term, which may reflect signaling effects that strengthen investor confidence in sustainable markets, which gradually increases demand for sustainable bonds (Cheng et al. 2024).

Control variables also reveal notable macro-financial influences. In the quarterly model, stock market volatility and exchange rate fluctuations have large and significant positive effects on corporate yield spreads, suggesting that corporate bond pricing is highly sensitive to external shocks and sentiment, particularly in emerging markets. In sum, our findings suggest that sovereign sustainable bond issuance contributes to a long-term decline in corporate sustainable bond financing costs.

A natural question that arises is what is the source of the reduction in yield spreads. Is the reduction driven by a lower cost of the sustainable component, that is, the greenium, or by a lower risk premium? To analyze this issue, we decompose the yield spread into two components. One component is the greenium, which is defined as the yield difference between a corporate sustainable bond and a benchmark corporate conventional bond in the same markets, with the same credit rating, the same currency denomination, and the same remaining term to maturity. The other component is the risk premium, which is the yield difference between a benchmark corporate conventional bond and a benchmark conventional government bond with the same currency denomination and the same remaining term to maturity. In the empirical analysis that follows, we further investigate the impact of sovereign sustainable bond debut on corporate sustainable bond market by separating the yield spread into a Greenium, that is, the corporate sustainable bond yield—the corporate conventional bond yield, and a Risk Premium, that is, the corporate conventional bond yield—the sovereign conventional bond yield.

Table 6 reports the estimated results of the panel VAR estimates of the impacts of the sovereign sustainable bond debut on greenium and risk premium components of corporate sustainable bond yield spread, respectively. For all three time horizons, there is a significant reduction in the greenium, which can be related to improved investment sentiment due to the signaling effect of sovereign sustainable bond issuance. For example, the estimated coefficient of sovereign sustainable bond debut obtained using daily data on greenium is −0.0284. This negative impact can be related to stronger demand for corporate sustainable bonds. Meanwhile, the results show that the risk premiums on corporate bonds with similar risk–return profiles rose for daily frequency, which is consistent with the results in Table 3 on liquidity. This could be driven by reduced demand for conventional corporate bonds linked to medium term lived portfolio rebalancing, but supply and demand will return to balance over the medium horizon. With a large supply of sovereign sustainable bonds immediately after

TABLE 4 | Dynamic properties of SSB introduction on bid-ask spread.

	Daily	Monthly	Quarterly
Short run effect	−0.0003	−0.0048	−0.0232
Long run effect	−0.0110	−0.0859	−0.1255
Mean lag	5.2553	0.1630	0.0841

Note: The short-run effects are the estimates of sovereign sustainable bond debut reported in Table 3. The long-run effect, which is the cumulative effect of sovereign sustainable bond debut is estimated by $Long-run\ effect = \frac{\theta_1}{C(1)} = \frac{\theta_1}{(1-\beta_1-\beta_2)}$. The mean lag provides a summary statistic of the average timing of the effect by $Mean\ Lag = \frac{\theta_1 \cdot C'(1)}{C(1)}$. The daily estimate of the mean lag is 5.25 days. The monthly estimate of the mean lag is 0.1630 month which translates to 4.9 days. The quarterly estimate is 0.0841 quarters which translates to 7.5 days.

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TABLE 5 | Impact of sovereign sustainable bond issuance debut on the yield spread of corporate sustainable bonds.

Variable	Impact on yield spread: y^2_{it}		
	Daily data	**Monthly data**	**Quarterly data**
Sovereign sustainable bond debut (dum_i^1)	**−0.0012 (0.0009)**	**−0.0284** (0.0129)**	**−0.2071*** (0.0347)**
Constant term	−0.0159** (0.0063)	−0.0682 (0.0823)	0.1151 (0.1983)
Bid-ask spread: y^1_{it-1}	0.0632*** (0.0094)	0.1372* (0.0716)	−0.2819 (0.2201)
Bid-ask spread: y^1_{it-2}	−0.0579*** (0.0097)	−0.1022 (0.0832)	0.3381 (0.2504)
Yield spread: y^2_{it-1}	0.9245*** (0.0027)	1.1046*** (0.0118)	1.1790*** (0.0208)
Yield spread: y^2_{it-2}	0.0723*** (0.0027)	−0.1382*** (0.0118)	−0.2662*** (0.0210)
Policy rate: y^3_{it-1}	0.0045 (0.0042)	0.0390** (0.0154)	0.0272 (0.0233)
Policy rate: y^3_{it-2}	−0.0063 (0.0042)	−0.0520*** (0.0147)	−0.0291 (0.0211)
Stock market volatility: y^4_{it-1}	0.1654*** (0.0379)	5.0034*** (1.0322)	13.9919*** (2.7195)
Stock market volatility: y^4_{it-2}	0.2183*** (0.0379)	−1.2388 (1.0246)	−9.8215*** (2.4823)
Exchange rate: y^5_{it-1}	0.0002 (0.0006)	0.2294*** (0.0470)	2.7421*** (0.1823)
Exchange rate: y^5_{it-2}	0.0029*** (0.0005)	0.4103*** (0.0458)	0.6329*** (0.2127)
Ln of sustainable bond outstanding: y^6_{it-1}	0.0005** (0.0003)	0.0023 (0.0034)	0.0050 (0.0080)
General sovereign bond yield: y^7_{it-1}	−0.0163*** (0.0043)	0.1054*** (0.0157)	0.0447*** (0.0246)
General sovereign bond yield: y^7_{it-2}	0.0184*** (0.0043)	−0.0896*** (0.0162)	−0.0534*** (0.0258)
R^2	0.9924	0.9333	0.8335
Number of observations	160,139	7724	2356

Note: The values in parentheses are heteroskedasticity robust standard errors. *, **, and *** represent significant at 10%, 5%, and 1% levels, respectively. Panel unit root tests were conducted for all variables, and the results indicate that none of the variables exhibit a unit root at the 10% significance level.
Daily data: $p = 0.1616$ (not significant at the 10% level), monthly data: $p = 0.0275$ (significant at the 5% level), quarterly data: $p = 0.0000$ (significant at the 1% level) (in bold).

TABLE 6 | Impact of sovereign sustainable bond issuance debut on greenium and risk premium components of corporate sustainable bond yield spread.

Variable	Daily data	Monthly data	Quarterly data
Sovereign sustainable bond debut (dum_i^1)		Impact on greenium	
	−0.0284*** (−5.2303)	−0.0139 (−0.5039)	−0.1077 (−1.4788)
		Impact on risk premium	
	0.0266*** (4.8415)	0.0117 (0.4113)	0.07173 (0.8777)

Note: Robust *t*-statistics in parentheses $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

a sovereign sustainable bond issuance, investors will adjust their portfolios, selling conventional corporate bonds and buying sustainable bonds with similar risk–return pricing features such as rating and maturity.

4 | Mechanisms

In this section, we empirically explore the possible mechanisms or channels underlying our main empirical results. The evidence in Section 3 shows that there is a medium term lived improvement in corporate sustainable bond liquidity immediately after the sovereign sustainable bond issuance debut. At the same time, our evidence shows a decline in the yield spread of corporate sustainable bonds over the medium horizon, largely due to a lower greenium. The observed improvement in liquidity and decline in yield spreads can be potentially explained by several complementary mechanisms on both the supply and demand sides.

A sovereign sustainable bond issuance acts as a highly visible signal of the government to sustainable goals, boosting investor confidence in sustainable finance markets. This signaling effect may increase both issuer (or supply) and investor (or demand) participation in sustainable finance, thereby deepening sustainable bond markets. Moreover, sovereign issuance often goes hand in hand with the adoption of improved verification and disclosure standards, which further enhance market transparency and strengthen the credibility of corporate sustainable bonds, thus increasing the demand for the bonds. Sovereign sustainable bond issuance debut also sets pricing benchmarks

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for corporate sustainable bonds, improving price discovery and bolstering investor confidence and strengthening both supply and demand. Furthermore, the sovereign sustainable bond issuance debut serves as a good demonstration of issuing sustainable bonds in the local market ecosystem, facilitating corporate sustainable bond issuance by private sector players.

Therefore, sovereign sustainable bond issuance may also drive changes in the behavior of institutional investors and corporate financiers. If sovereign sustainable bonds are available, institutional investors find it easier to hedge against green transition risks by constructing a portfolio that includes both sovereign sustainable bonds and corporate sustainable bonds issued in the same country. Additionally, the sustainability preferences of institutional investors can be influenced by the government's green policies or regulations (Barber et al. 2021). The clear policy signal of a sovereign sustainable bond issuance will increase their holding in sustainable bond markets. In corporations whose sustainability strategy is aligned with the government's sustainability policies, investors would also expect better cash flow patterns and thus an increase in their investments in their corporate sustainable bond markets. Meanwhile, corporates may also issue more corporate sustainable bonds to signal the alignment of their sustainability strategy with the government's sustainability strategy to attract more investors and reduce their funding costs. Overall, sovereign sustainable bond issuance may potentially increase the demand for and supply of corporate sustainable bonds, which further contributes to lower yields and better liquidity. For example, as more sustainable bonds become available in the market, investors find it easier to reallocate their portfolios, which enhances liquidity.

To examine whether sovereign sustainable bond issuance debut promotes the supply of corporate sustainable bonds in the market, we perform a panel regression using quarterly sustainable bond market data. We analyze how sovereign sustainable bond issuance debut affects the size of the sustainable bond market as a share of the corporate bond market, the number of first and unique issuers, size-weighted average maturity of corporate sustainable bond issuance during the quarter after the sovereign sustainable bond issuance debut, and the sector and issuer diversification of the corporate sustainable bond market. Table 7 shows that after sovereign sustainable bond issuance debut, the corporate sustainable bond market witnessed an increase in the share of sustainable bonds in corporate bonds, indicating a relatively faster expansion. Furthermore, after the sovereign sustainable bond issuance debut, there are more unique corporate sustainable bond issuers, and the maturity of corporate sustainable bonds also lengthens. This increase in maturity is likely due to the price discovery effect of sovereign sustainable bond issuance, which tends to have longer financing maturity than corporate sustainable bonds. Meanwhile, the corporate sustainable bond market becomes more diversified in terms of sectors and issuers. Overall, Table 7 indicates that the supply of corporate sustainable bonds increases after a sovereign sustainable bond issuance debut, which can further contribute to liquidity.

Table 8 shows the analysis of whether sovereign sustainable bond issuance debut boosts demand for corporate sustainable bonds. To capture demand, we used the net fund inflows (*Total*), which are the aggregated net inflows into all funds investing in ESG assets in a sample market from global markets, scaled by aggregated net assets held by these funds in this sample market. Total thus captures global investor interest

TABLE 7 | Impact of sovereign sustainable bond issuance debut on the supply of corporate sustainable bonds.

Variable	Size	First time issuers	Unique issuers	Sector HH-index	Issuer HH-index	Maturity
SSB debut	0.0396*** (4.20)	0.4496 (1.65)	0.8730* (2.35)	−0.1432** (−2.64)	−0.2621** (−3.45)	2.1647** (2.99)
Ln (all issuance of bonds in the quarter)	0.0028 (0.42)	−0.0323 (−0.37)	0.0103 (0.12)	−0.0306 (−1.71)	−0.0357 (−1.68)	0.0340 (0.12)
Ln (sustainable bond outstanding)	0.0075 (1.60)	−0.0064 (−1.29)	0.0077 (1.03)	−0.0248*** (−5.59)	−0.0357*** (−6.40)	0.2297 (1.11)
R^2	0.18	0.09	0.24	0.42	0.53	0.26

Note: Robust t-statistics in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 8 | Impact of sovereign sustainable bond issuance debut on demand for corporate sustainable bonds.

Variable	ETF	Non-ETF	Total
SSB debut	0.0012* (1.98)	0.0023 (1.03)	0.0034 (1.24)
Ln (total bond issuance in the quarter)	0.0004 (1.46)	−0.0034 (−0.73)	−0.0029 (−0.60)
Ln (sustainable bond outstanding)	0.0000 (1.16)	0.0001 (1.24)	0.0002 (1.22)
R^2	0.13	0.01	0.01

Note: Robust *t*-statistics in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. *Total* is the aggregated net inflows into all funds investing in ESG assets (i.e., ESG funds) in a sample market from global markets, scaled by aggregated net assets held by these funds in this sample market. *Total* is disaggregated into inflows to the exchange-traded ESG funds (ETF) and inflows to the non-ETF ESG funds (Non-ETF) in the sample market from global markets, scaled by aggregated net assets held by ETF ESG and non-ETF ESG funds in this sample market, respectively.

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in ESG assets in a market. *Total* is further disaggregated into inflows to the exchange-traded ESG funds (ETF) and inflows to the non-ETF ESG funds (Non-ETF), scaled by total net assets held by global ETF ESG and non-ETF ESG funds in a market, respectively. Table 8 shows that after the sovereign sustainable bond issuance debut, ETF ESG funds witnessed a significant increase in fund inflows. This suggests that sovereign sustainable bond issuance increases the demand for ESG assets, which fosters a more stable demand for sustainable bonds. Overall, sovereign sustainable bond issuance debut not only increases the supply of sustainable bonds but also increases the demand for ESG assets by sending a strong signal to the markets and attracting more long-term investors into sustainable finance, thus contributing to improved liquidity and lower greenium.

5 | Discussion and Policy Implications

This study contributes to the literature on how sovereign sustainable bond issuance can play a catalytic role in the development of corporate sustainable bond markets in Asia. Our findings demonstrate that in Asian economies, sovereign sustainable bond issuance enhances corporate sustainable bond liquidity in the medium term and contributes to a decline in bond yields in the medium term. The sovereign sustainable bond issuance debut acts as a strong policy signal and has a demonstration effect in the sustainable bond market, which boosts both the supply of and demand for corporate sustainable bonds.

At a broader level, sovereign sustainable bond issuance represents a clear signal of the government's commitment to sustainable finance which, in turn, can potentially mobilize private sector participation. Sovereign issuance also deepens the market by providing a pricing benchmark and demonstrating issuance for private sector players. Our study contributes to the broader sustainable finance literature by providing empirical evidence that supports a facilitating effect of sovereign sustainable bond issuances on the development of corporate sustainable bond markets in Asia. More specifically, sovereign issuance improves market liquidity, reduces financing costs, and boosts the supply of and demand for corporate sustainable bonds.

Our findings underscore the central importance of the strategic participation of Asian governments in catalyzing the development of sustainable bond markets in the region. In particular, our evidence suggests that strategic government intervention can enhance the liquidity and credibility of sustainable finance markets. Therefore, policymakers seeking to scale up private-sector sustainable finance should consider sovereign issuance as a tool to crowd in private investment. The sequencing and structuring of sovereign sustainable bond programs must be carefully designed to maximize their liquidity-enhancing effects. Additionally, complementary policy measures such as stronger regulatory frameworks and incentives for corporate issuers will help private-sector sustainable finance grow alongside sovereign sustainable finance.

Future research may explore the heterogeneous effects of sovereign sustainable bond issuance across different institutional and macroeconomic contexts. In particular, understanding how catalytic effects persist over the long term will provide valuable insights into the optimal design of sovereign sustainable bond interventions. While Asian bond markets share many commonalities with their US and European counterparts, they also exhibit distinct features such as higher yields, greater currency risk, less liquidity, and higher sensitivity to geopolitical events. Further research is needed to examine how sovereign interventions interact with such broader market conditions. Understanding the context of the different markets is essential for investors and policymakers as they search for optimal investment and financing strategies in the sustainable bond markets. Ultimately, a well-structured sovereign issuance strategy, coupled with robust policy support, can help emerging economies develop deeper and well-functioning sustainable bond markets that effectively mobilize private capital for sustainable development.

Conflicts of Interest

The authors declare no conflicts of interest.

Endnotes

[1] Unless otherwise stated, all dollar amounts refer to the US dollar.

[2] The authors thank the designated discussants of this paper, Haruyoshi Ito and Irene Monasterolo, for this valuable suggestion, which significantly improved this paper.

[3] In cases where a conventional government bond with the same remaining maturity does not exist, we estimate the yield using linear interpolation. In a few cases, the residual maturity of a corporate sustainable bond exceeds the maximum maturity of the government conventional bond yield, and in this case we use the yield on the government bond with the maximum maturity available at that time instead.

[4] By incorporating 8 Asian countries' bond market data structure and Hausman test result, we employ a fixed effects model in both the benchmark panel estimation and panel VAR estimation.

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