BACKGROUND NOTE

Corporate Green Bonds in Asia

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DISCLAIMER

CORPORATE GREEN BONDS IN ASIA

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I. INTRODUCTION

Green bonds are bonds whose proceeds are committed to the financing of green projects, such as renewable energy, waste reduction, recycling, water conservation, and the building of green facilities.

In two recent articles (Flammer 2020 and 2021), I study the global green bond market, with a focus on green bonds issued by corporations (that is, corporate green bonds). In these studies, I document the growing popularity of corporate green bonds, and examine the implications for the issuing companies' financial and environmental performance. I find that the stock market responds positively to the issuance of corporate green bonds, and that the issuing companies exhibit lower carbon emissions post-issuance. Overall, these findings suggest that green bonds yield both financial and environmental benefits, and hence may provide a powerful instrument in the fight against climate change.

While these studies focus on the global green bond market, much less is known of the Asian market. In this note, I focus on green bonds issued by Asian companies, characterize this market (both across countries and industries), and examine the implications for the issuing companies' financial and environmental performance. In a nutshell, I obtain similar results for the Asian market compared to the global market. While corporate green bonds had a slower start in Asia, the market really picked up as of 2015, with the total issuance amount jumping from $2.4 billion in 2015 to $35.1 billion in 2018. I further document that Asian stock markets respond positively to the issuance of corporate green bonds, and that the issuing companies achieve higher environmental performance post-issuance. Overall, these findings are consistent with those obtained for corporate green bonds issued on the global market.

II. DATA AND DESCRIPTIVE ANALYSIS OF CORPORATE GREEN BONDS IN ASIA

A. Data

The data on corporate green bonds are obtained from Bloomberg's fixed income database. I extract all bonds that satisfy the following criteria: (i) the issuance date is between 1 January 2013 and 31 December 2018, (ii) the field "asset class" is "corporate", (iii) the field "green bond indicator" is "yes", (iv) the issuer is located in Asia (using the field "country of domicile"), and (v) the issuer's industry code according to the Bloomberg Industry Classification System is not "government". Note that the latter criterion excludes supranational entities that are not corporations per se. Out of those, two are based in Asia, namely the Asian Development Bank (who issued 19 green bonds in the total amount of $5.1 billion between 2013 and 2018) and the New Development Bank (who issued one green bond in the amount of $0.4 billion in 2016).

After applying these criteria, I end up with a sample of 414 corporate green bonds corresponding to a total issuance amount of $100.4 billion. Given the comprehensive coverage of the Bloomberg's database, this sample is likely to capture the full universe of green bonds issued by Asian companies from 2013 to 2018. Note that this sample is a subset of Flammer's (2021) sample of 1,189 corporate green bonds worldwide (corresponding to a total issuance amount of $301.2 billion). This implies that Asian corporate green bonds account for about 35% of all corporate green bond issues, and about 33% of the total issuance amount.

B. Issuance Over Time

Figure 1 plots the total issuance amount of corporate green bonds (in $ billion) on a year-by-year basis in Asia (solid line) and the rest of the world (dotted line). Outside Asia, the first corporate green bonds were issued in 2013, and the market grew rapidly thereafter. A similar pattern is observed on the Asian market, but with a lag. The first corporate green bonds in Asia were issued in 2014 ($0.3 billion). While issuance remained modest in 2015 ($2.4 billion), the market expanded massively as of 2016 ($33.0 billion). Similar trends are seen in Figure 2 that plots the number of corporate green bonds issued over time.

Overall, the evidence in Figures 1 and 2 is consistent with what practitioners often refer to as the "green bond boom",[1] and shows that this boom is also observed on the Asian market. Presumably, as the green bond market is still at an early stage, this growth is likely to continue in the years to come.

C. Issuance across Countries

Table 1 provides a breakdown by country for the 414 corporate green bonds issued by Asian companies. As can be seen, Chinese companies have issued 190 green bonds corresponding to a total issuance amount of $75.1 billion. This makes the People's Republic of China the main issuer of corporate green bonds, accounting for about 46% of all Asian green bonds and 75% of the total issuance amount. The People's Republic of China is followed by Hong Kong, China (31 green bonds in the amount of $7.4 billion); Japan (37 green bonds in the amount of $6.7 billion); and India (17 green bonds in the amount of $4.2 billion). Among the other countries, it is worth noting that many green bonds were issued in Taipei,China; Singapore; and Malaysia (21, 10, and 98, respectively), but they correspond to relatively small issuance amounts ($1.6 billion, $1.2 billion, and $1.0 billion, respectively).

D. Issuance across Sectors

In Table 2, the number of green bonds issued by Asian corporations (along with the issuance amount) is broken down by sectors (using Bloomberg's Bloomberg Industry Classification System codes). As is shown, 228 green bonds were issued by industrial firms, while the remaining 186 green bonds were issued by financial institutions. The latter account for a larger issuance amount ($72.0 billion, compared to $28.5 billion for industrial firms).

Among industrial firms, the main industries are power generation (99 green bonds in amount of $10.8 billion), utilities (17 green bonds in amount of $4.1 billion), and renewable energy (34 green bonds in amount of $2.5 billion). This pattern is intuitive, as the environment plays a key role in these industries. More broadly, the distribution of green bond issuance across industries is

[1] Morgan Stanley. 2017. *Behind the green bond boom*. https://www.morganstanley.com/ideas/green-bond-boom. 11 October.

comparable to what Flammer (2021) documents in the worldwide market for corporate green bonds.

E. Characteristics of Corporate Green Bonds

Finally, to conclude the descriptive analysis of corporate green bonds issued in Asia, Table 3 provides summary statistics for several characteristics of these green bonds. Column (1) refers to all 414 green bonds in the sample, while columns (2) and (3) provide separate statistics for the 280 green bonds issued by private firms, and the 134 green bonds issued by publicly traded firms, respectively.

As can be seen, the 414 green bonds are issued by 185 unique firms, and it is not unusual that a given firm issues several green bonds on a given day (and year, respectively). The average issuance amount per bond is $242.6 million, which is comparable to the average amount of $253.4 million found in the global sample of Flammer (2021). Not surprisingly, publicly traded firms tend to issue larger bonds (average issuance amount of $461.4 million) compared to private firms ($137.9 million). Table 3 further shows that the average green bond has a maturity of 6.5 years, and that 81.9% of the green bonds are fixed-rate bonds, with an average coupon rate of 4.4%. Moreover, the median credit rating is A- based on Standard & Poor's ratings, and A1 based on Moody's ratings. This indicates that corporate green bonds are predominantly in the investment grade segment.

Importantly, about 62% of the bonds are certified by independent third parties. As discussed in Flammer (2020 and 2021), certification plays a major role in the green bond market. The need for certification is because of the lack of public governance in the green bond market. Indeed, the "greenness" of the bond is typically not binding from a legal perspective, which raises concerns that green bonds could be used as a tool of greenwashing—that is, the practice of falsely claiming that products or process are environment-friendly, while in fact they are not. Third-party certification aims to address such concerns and preserve the integrity of the green bond label. Two widely accepted certification standards are the industry-led Green Bond Principles of the International Capital Markets Association, and the Climate Bonds Standards of the Climate Bonds

Initiative, a nongovernment organization based in the United Kingdom.[2] Note that certification is slightly less prevalent in Asia, with about 62% of corporate green bonds being certified, compared to 66% in the worldwide sample of Flammer (2021).

III. IMPLICATIONS FOR FINANCIAL AND ENVIRONMENTAL PERFORMANCE

A. Stock Market Response

To assess how stock market investors respond to the issuance of corporate green bonds, I conduct an event study that quantifies by how much the issuing company's stock price changes in response to the green bond issue. Since this analysis requires stock market data, the sample is reduced to the 134 green bonds issued by public firms. Note that the relevant event date is not the day on which the bond is issued, but rather the day on which the firm *announces* the green bond issue. Intuitively, the announcement date is the day on which the green bond information is released to the public, and hence when stock market participants update their priors about the firm's prospects going forward. In contrast, on the day of the actual issuance, no additional information is made available to the public.

For each green bond, Bloomberg includes the announcement date, which is used as the relevant event date in the event study. Note that, as mentioned above, companies sometimes issue (and announce) more than one green bond on a given day. Specifically, the 134 green bonds issued by public firms correspond to 115 unique events. These 115 events provide the sample used to conduct the event study.

For each event, I compute the stock market performance in a narrow window around the event. As in Flammer (2021), I consider the event window [-5, 10] that starts 5 trading days prior to the event date (day 0) and ends 10 trading days afterwards. The inclusion of the previous 5 trading days accounts for the possibility that information may have been leaked to the public shortly before the announcement; the inclusion of the subsequent 10 trading days accounts for the possibility that the market may need a few days to fully realize the value implications of green bonds.

[2] Flammer (2020) discusses potential challenges of certification, and draws an analogy with the so-called carbon offsets (and the certification thereof) that are now routinely used by airlines.

For each day within the [-5, 10] window, I calculate the abnormal return, which is computed as the daily stock return (i.e., the percentage change in the issuer's stock price during the day) net of the "normal" return that is predicted by the market model.[3] Intuitively, the abnormal return captures the change in the stock price that is not explained by market fluctuations that may coincide with the event. I then compute the cumulative abnormal return (CAR) by summing up abnormal returns across all days within the [-5, 10] window. As such, the CAR quantifies the extent to which the issuer's stock price responds to the event, taking into account contemporaneous market fluctuations that may confound the response.

In the analysis, I also compute CARs in time intervals that are strictly before and after the relevant event, specifically [-30, -21], [-20, -6], [11, 20], and [21, 60]. Doing so helps validate the setup. If the announcement date truly captures the relevant event, one should not observe significant abnormal returns many days before the announcement. Similarly, the consideration of time intervals up to 60 days after the events allows me to assess whether the stock market response is short-lived, being reversed within the weeks that follow the event.

The event study results are provided in Table 4. For each time interval, Table 4 reports the average CAR across all 115 events, along with the standard error and the corresponding *p*-value. As is shown, the average CAR in the [-5, 10] event window is 0.5%. That is, the issuer's stock price increases by about 0.5% during this interval (on a market-adjusted basis). This 16-day return corresponds to a (substantial) annualized return of about 8% (on a 252-trading day basis). Note that the average CAR has a *p*-value if 0.168, which is close to the 10% threshold for statistical significance.

The CAR of 0.5% obtained in the Asian sample is remarkably similar to the CAR of 0.49% (*p*-value = 0.043) obtained by Flammer (2021) in the worldwide sample. The only notable difference is the higher *p*-value in the Asian sample—and hence the lower statistical significance—which likely reflects the smaller sample size (115 events, compared to 384 events in Flammer 2021). Not surprisingly, the average CAR is less reliably estimated in a smaller sample, which translates to a lower significance level.

[3] A technical description of the computation of abnormal returns is in section 5.1 of Flammer (2021).

The other estimates provided in Table 4 confirm the validity of the event study. Importantly, I find no evidence for significant abnormal returns prior to the event window (the average CARs in the [-30, -21] and [-20, -6] windows are small and insignificant), nor do I find that the stock market response is reversed in the weeks that follow the event (the average CARs in the [11, 20] and [21, 60] windows are also small and insignificant).

Overall, the event study results indicate that the stock market responds positively to the issuance of green bonds by Asian companies. That is, stock market investors see green bonds as *value-enhancing*. In this regard, it is worth noting that the valuation gains are unlikely to solely reflect the (expected) benefits from the green projects that are being financed by the green bond proceeds. Indeed, those are likely too small compared to the size of the issuers (who are large publicly traded companies) to significantly affect their stock market valuation. Instead, investors may see green bonds as a credible signal of the company's overall commitment to the environment going forward. As such, the positive stock market response indicates that investors see such commitment as value-enhancing.

Consistent with this interpretation, the "signaling" role of green bonds is often highlighted by issuers. For example, in a press release announcing their fifth green bond issue in February 2020, Toyota Financial Services (TFS) emphasized that "Green Bonds are an important component of TFS' diversified funding program and serve to enhance Toyota's extensive commitment to environmental causes", further noting that "[t]he TFS Green Bond program is unique in the auto industry and enhances Toyota's reputation for leadership in green innovation across industries".[4]

B. Environmental Performance

In the global market, Flammer (2021) finds that, in the years that follow the issuance of corporate green bonds, issuers achieve higher environmental performance. Together with the stock market results, this indicates that green bonds yield both financial and environmental benefits.

[4] Toyota's press release. 14 February 2020. https://pressroom.toyota.com/toyota-financial-services-issues-fifth-green-bond-reinforcing-toyotas-commitment-to-sustainability/.

The analysis provided in Table 4 shows that the stock market response is similar in the Asian market. But do Asian issuers also improve their environmental performance post-issuance? To examine this question, I merge my sample of Asian issuers with environmental, social, and governance (ESG) data from Thomson Reuters' ASSET4. ASSET4 gathers both quantitative and qualitative information on the environmental (E), social (S), and governance (G) characteristics of a broad set of publicly traded companies around the world. For each of these three dimensions of ESG, ASSET4 compiles a rating that ranges from 0 to 100. These ratings are available on an annual basis as of 2002. For the purpose of this note, I focus on the environmental rating (ASSET4's data item "ENVSCORE") that provides a metric of the company's environmental performance.

A limitation of this analysis is the small sample size. As shown in Table 3, the 134 green bonds issued by publicly traded firms correspond to 90-firm-year observations (since firms sometimes issue more than one green bond in a given year). The ASSET4 database does not cover the full universe of public firms, though. Out of the 90 firm-year observations, 52 have coverage in ASSET4. To compute changes in environmental performance, ASSET4 data for the post-issuance years are also needed. Since most green bonds are issued in the later years of the sample (with a large share of green bonds being issued in 2018, as shown in Figures 1 and 2), this further restricts the sample. Specifically, the change in environmental performance 1 year (2 years) after the green bond issuance can only be computed for 19 (8) observations.

Despite this caveat, it is informative to examine how, on average, environmental performance changes post-issuance. To do so, I compute the percentage change in the ASSET4 environmental score 1 year and 2 years, respectively, after the green bond issuance.[5] In Table 5, I report the average across all available observations, along with the corresponding standard error and *p*-value. As can be seen, environmental performance increases by 17% (*p*-value = 0.014) 1 year, and 29.9% (*p*-value = 0.123) 2 years, respectively, after the green bond issuance. These findings indicate that Asian issuers achieve higher environmental performance post-issuance.

[5] Formally, if i indexes a given issuer, and t indexes the issuance year, the 1-year change is computed as $(ENVSCORE_{i,t+1} - ENVSCORE_{i,t}) / ENVSCORE_{i,t}$. Similarly, the 2-year change is computed as $(ENVSCORE_{i,t+2} - ENVSCORE_{i,t}) / ENVSCORE_{i,t}$,.

Note that this analysis need not warrant a causal interpretation. Indeed, it is worth highlighting that the above statistics capture a correlation (that is, the issuance of green bonds correlates with subsequent improvements in environmental performance) and that correlations per se need not imply causation. Nevertheless, this correlation is informative—at a minimum, it is suggestive of green bonds having environmental benefits. Importantly, the finding that environmental performance increases post-issuance does indicate that green bonds are unlikely to be a form of greenwashing. Indeed, if greenwashing were to prevail, one would not expect to see any tangible improvement in environmental performance post-issuance.

C. Pricing of Green Bonds versus Conventional Bonds

Corporate green bonds have potential implications for the cost of capital. In principle, it could be that green bonds provide companies with a cheaper source of financing; this could be the case if green bond investors are willing to forgo financial returns for the sake of safeguarding the planet. In this case, green bonds would be issued (and traded, respectively) as a premium, as investors would be willing to pay a higher price (and hence accept a lower return) for green bonds compared to conventional bonds.

Several published articles have studied the pricing of green bonds and find little evidence of a green bond premium. Larcker and Watts (2020) compare green bonds to nearly identical non-green bonds issued by the same issuer on the same day. Using a sample of United States municipality bonds, they find that the pricing difference is essentially zero. Similarly, Flammer (2021) finds no evidence of a green bond premium among corporate green bonds issued on the global market. Using an international sample of green bonds issued by various entities (including supranational, subsovereign, municipality, and corporate green bonds), Zerbib (2019) finds evidence of a statistically significant, but economically small green bond premium on the secondary market.

While studying the pricing of Asian green bonds is beyond the scope of this note, it is worth noting that Zerbib (2019, Table 8, p. 47) provides a breakdown of his results by currencies, three of them—yuan (CNY), Indian rupee (₹), and yen (¥)—referring to the Asian market. Among the set of green bonds denominated in Asian currencies, Zerbib (2019) finds no evidence for a significant green bond premium.

Overall, the evidence from previous research is inconsistent with a green bond premium, an insight that is likely to apply to the Asian market as well. What explains this finding? In their study, Larcker and Watts (2020) provide a detailed discussion of this point, concluding that the most likely explanation is that the green projects are profitable enough to generate competitive returns. This echoes a growing literature that documents how companies benefit from ESG, both in terms of higher performance (e.g., Flammer 2015) and lower risk (e.g., Hoepner, Oikonomou, Sautner, Starks, and Zhou 2019).

IV. SUMMARY AND CONCLUSION

This note revisits the results of Flammer (2021) in the Asian context. The evidence reveals many similarities between the Asian market for corporate green bond and the global market. In particular, both markets have experienced a massive growth in recent years; the stock market responds positively to the issuance of green bonds; and companies improve their environmental footprint post-issuance. This suggests that green bonds benefit both companies and the planet, and hence may prove effective in addressing climate change while providing financial returns as well.

Arguably, the green bond market is still at an early stage, and is likely to pursue its rapid expansion in the years (and perhaps decades) to come. As such, the evidence gathered to date should be treated with caution. As the market grows in scale, other challenges may arise—e.g., companies may run out of profitable green projects—and hence the effectiveness of green bonds at a larger scale remains to be established. Moreover, while the market relies primarily on private governance (in the form of third-party certification), the question of the optimal governance of this market remains to be assessed. For example, it could be that a mix of both public and private governance may be better suited, especially as the market reaches a larger scale.[6]

Nevertheless, despite these challenges ahead, the existing evidence is encouraging, and suggests that green bonds could potentially provide a powerful tool in the fight against climate chance.

[6] The detailed discussions of the governance of the green bond market, along with potential challenges, are in Flammer (2020) and Park (2018).

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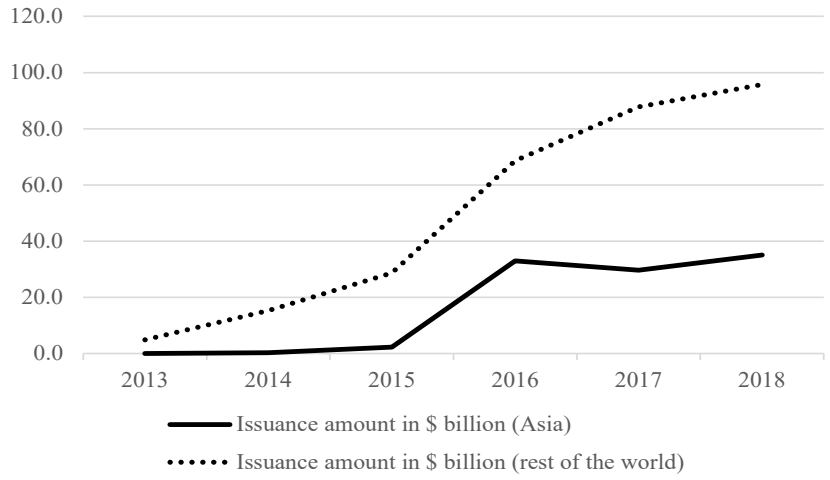
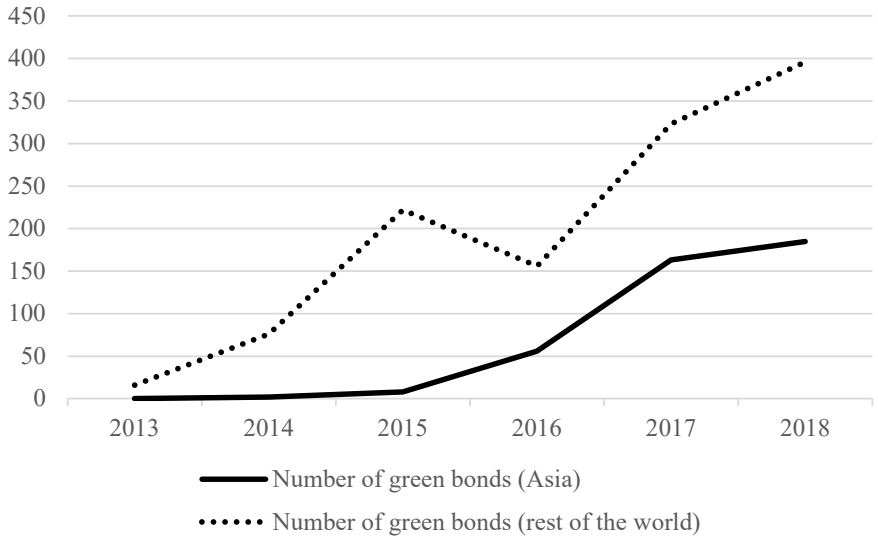
Figure 1: Issuance of Corporate Green Bonds over Time

($ billion)



Source: Bloomberg.

Figure 2: Number of Corporate Green Bonds over Time



Source: Bloomberg.

Table 1: Issuance of Corporate Green Bonds by Countries in Asia

Country	**Number of Bonds**	**Issuance Amount** ($ billion)
China, People's Republic of	190	75.05
Hong Kong, China	31	7.40
Japan	37	6.72
India	17	4.22
Republic of Korea	5	1.68
United Arab Emirates	3	1.59
Taipei,China	21	1.56
Singapore	10	1.21
Malaysia	98	0.98
Indonesia	2	0.03
Total	**414**	**100.43**

Source: Bloomberg.

Table 2: Issuance of Corporate Green Bonds by Industries in Asia

Industry	Number of Bonds	Issuance Amount ($ billion)
A. Industrials		
1. Power generation	99	10.77
2. Utilities	17	4.10
3. Renewable energy	34	2.54
4. Automobiles manufacturing	6	2.45
5. Travel and lodging	13	2.02
6. Waste and environment services and equipment	4	0.61
7. Refining and marketing	4	0.37
8. Transport and logistics	14	0.35
9. Hardware	1	0.30
10. Semiconductors	1	0.30
11. Forest and paper products manufacturing	3	0.27
12. Chemicals	2	0.19
13. Metals and mining	1	0.16
14. Electrical equipment manufacturing	2	0.16
15. Machinery manufacturing	1	0.15
16. Food and beverage	1	0.13
17. Apparel and textile products	1	0.10
18. Software and services	1	0.10
19. Integrated oils	1	0.09
20. Airlines	1	0.09
21. Department stores	1	0.09
22. Consumer services	2	0.08
23. Others	18	3.06
Subtotal (A)	**228**	**28.46**
B. Financials		
1. Banks	122	60.70
2. Real estate	30	4.68
3. Others	34	6.58
Subtotal (B)	**186**	**71.96**
Total	**414**	**100.43**

Source: Bloomberg.

Table 3: Characteristics of Corporate Green Bonds Issued in Asia

	All	Private	Public
	(1)	(2)	(3)
Number of green bonds	414	280	134
Number of unique green bond issuer-days	267	152	115
Number of unique green bond issuer-years	217	123	94
Number of unique green bond issuers	185	105	80
Amount ($ million)	242.6	137.9	461.4
	(500.6)	(167.9)	(804.8)
Certified (1/0 indicator)	0.616	0.604	0.642
	(0.487)	(0.490)	(0.481)
Maturity (years)	6.5	6.8	5.8
	(4.9)	(4.6)	(5.4)
Fixed-rate bond (1/0 indicator)	0.819	0.836	0.784
	(0.386)	(0.371)	(0.413)
Coupon (for fixed-rate bonds)	0.044	0.049	0.033
	(0.020)	(0.016)	(0.024)
Credit rating			
S&P rating (median)	A–	A–	A–
Moody's rating (median)	A1	A1	A1

Source: Bloomberg.

Table 4: Stock Market Response to the Issuance of Corporate Green Bonds Issued in Asia

Event Window	Observations	Average Cumulative Abnormal Return	Standard Error	*p*-value
[-30, -21]	115	-0.138	0.539	0.798
[-20, -6]	115	0.032	0.429	0.941
[-5, 10]	115	0.504	0.365	0.168
[11, 20]	115	0.099	0.271	0.713
[21, 60]	115	-0.142	0.176	0.420

Sources: Bloomberg, Compustat Global, and author's estimates.

Table 5: Changes in Environmental Performance Following the Issuance of Corporate Green Bonds in Asia

	Observations	Mean	Standard Error	*p*-value
Change in ASSET4's environmental score…				
… 1 year post-issuance	19	17.0%	6.2%	0.014
… 2 years post-issuance	8	29.9%	17.1%	0.123

Sources: Bloomberg, ASSET4, and author's estimates.