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by

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Can Climate Actions Reduce Green Financing Costs?[§]

Yu Cai[*] and Huanhuan Zheng[**]

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Abstract: China laid out specific road maps to become carbon-neutral by 2060 in its 14th Five-Year Plan (FYP), which mobilized public and private climate actions to pursue the national climate goal. We explore the impact of the FYP-guided climate actions on green financing costs using a difference-in-differences approach. Comparing yields to maturity (YTM) for green and regular bonds issued by similar firms before and after the FYP, we find that climate actions significantly reduce YTM for green bonds by 31 basis points or 5% of their average YTM. Such an impact is particularly pronounced for green bonds with higher credit ratings, lower coupon rates, and shorter maturities. Moreover, firms benefit more from the FYP in lowering their green financing costs when they have better ESG performance, are headquartered in cities with tighter carbon regulations, and depend less on carbon emissions for production. Our results provide evidence that climate actions reduce green financing costs, which play a pivotal role in stimulating climate investments.

Keywords: Climate change, carbon price, bond yield, green finance, sustainable investment
JEL: G18, F34, Q54, Q58

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1. Introduction

China pledged to become carbon neutral before 2060 in the 74th regular session of the United Nations General Assembly in September 2020. This was an ambitious pledge for the world's biggest emitter that contributed to 28% of the global carbon emissions in 2020. Despite the doubts of many, China officially incorporated this climate agenda in its 14th five-year plan (FYP), a centrepiece of the blueprint that set strategic policy priorities and national goals for social and economic development in the next five years (2021–2025). It is the first time that China has clearly specified its long-term climate goals within an FYP, which signals its determination to combat climate change and implies significant resources allocations towards climate actions. Reaching carbon neutrality within such a short time—through boosting renewable and nuclear energy, cutting fossil fuels, and upgrading technologies on carbon capture and storage—requires significant climate investments (Mallapaty, 2020). To stimulate climate investments necessary to achieve carbon neutrality, it is important to lower green financing costs. We explore the impact of climate actions mobilized by the 14th FYP on the funding costs of green bonds in this paper.

China's ambitious climate actions and fast-growing green bond markets offer several advantages to evaluate the policy impacts. First, the FYP-endorsed climate actions are unprecedented for the world's largest carbon emitter, which facilitates causal identification. The FYP, central to almost all public policymaking in China, is well known for its efficiency in mobilizing and coordinating public and private resources to achieve national goals (Heilmann and Melton, 2013; Hu, 2013; Li, Zheng and Liu, 2020). By upgrading carbon neutrality to a national policy priority, the FYP motivates public and private sectors to enhance their climate actions in the pursuit of climate goals. Second, China's green bond market, which is one of the largest and fastest growing (Flammer, 2021; Zheng, 2021), provides a rich context for exploring which bonds, issuers, and industries benefit more from climate actions. Third, like China, most emerging economies rely heavily on intensive carbon emissions for their economic growth. They are reluctant to adopt climate actions largely due to the associated economic and financial costs. Should China's climate actions successfully reduce green financing costs, it points to a new avenue of accessing sustainable capital at relatively low costs, which would encourage capital-scarce emerging economies to scale up their climate actions.

We apply a difference-in-differences (DID) approach to evaluate the impact of the 14th FYP on green financing costs. In particular, we compare the yield to maturity (YTM) for green and regular bonds after the initial release of the drafted 14th FYP (from November 3, 2020 to June 30, 2021) relative to the pre-treatment period before the FYP from June 1, 2019 to November 2, 2020. During our sample period, the 14th FYP was the major new policy for green financing—regional emission trading system (ETS) pilots have been in place for many years even before our sample starting period, and national ETS had not yet launched. We focus on a group of green and regular bonds that are comparable in issuance and maturity dates, credit rating, amount of capital raised, pre-treatment YTM, and issuers' characteristics. This allows us to better ascribe the estimated YTM difference to the green nature of the bond instead of other bond- or firm-level characteristics. Our DID estimation suggests that the 14th FYP reduces the green bond YTM by 31 basis points (bps) or 5% of its average YTM. The result is robust when we control for various static and time-varying bond- and firm-level fixed effects. Delving into dynamic treatment effects, we find that the green bond YTM dropped relative to the regular bond YTM immediately upon the initial release of the 14th FYP in November 2020, declined further in December 2020, and stabilized thereafter. The swift reactions of green financing costs to the FYP echoes the literature that the FYP is efficient in mobilizing resources to achieve strategic national goals (Heilmann and Melton, 2013; Hu, 2013; Li, Zheng and Liu, 2020).

The climate actions underlying the impact of FYP on green financing costs could come from several sources. First, to support the national pursuit of the net-zero climate goal, state entities like pension funds and state-owned asset management companies directly increase their holdings of green bonds to support climate investments. Second, governments adjust policies and regulations such as the ETS trading quota or carbon prices to stimulate carbon reductions and climate investments. Third, with greater public climate actions, the likelihood of accumulating sufficient resources to generate significant social impacts increases, which attracts socially responsible investors (SRIs) to increase their climate investments. Fourth, the rising demand for green assets increases green bond prices (and lowers YTMs), which motivates profit-seeking investors to increase their holdings of green bonds. Rising demand of green bonds by these types of investors, the major sources of green capital, are likely to reduce green financing costs. Our analysis provides evidence that green bonds with higher credit ratings, shorter maturities, and lower coupon rates enjoy lower YTMs after the FYP, suggesting they are more popular among green capital.

We further explore which types of firms benefit more from the FYP. We find that green bonds issued by firms headquartered in the eight Chinese cities/provinces that regulated carbon emissions with ETS enjoy lower green financing costs after the FYP, which is particularly pronounced when the carbon prices are relatively high. This suggests that tightening climate regulations strengthens the impact of the FYP on lowering green financing costs. We argue that this is because climate policies align firms' profit motive with their imperative to cut emissions, which encourages firms to turn the proceeds of green bonds into emission reductions and reduces the likelihood of greenwashing—the practice of exaggerating or falsifying green actions. The policy design of ETS endorses firms' green practices and increases their popularity among green capital. Turning to the cross-industry variations, we find that firms whose production relies heavily on carbon emissions benefit less from the FYP, which suggests that green capital favours carbon-light firms. Furthermore, we find that firms with better performance in environmental, social and corporate governance (ESG) enjoy lower green financing costs after the FYP. These results provide evidence that firms' efforts to cut carbon emissions and pursue sustainable growth are rewarding when it comes to green financing.

Our contribution to literature is threefold. To the best of our knowledge, we are the first to establish the causal impact of a national policy on reducing green financing costs. Cutting green financing costs could stimulate climate investments that foster research and development of green technology, promote clean production, and preserve ecosystems, among others, which could accelerate carbon reductions and mitigate global warming. Second, we document the role of ETS in facilitating access to relatively cheap green capital. It implies that even though implementing ETS may be costly, it could reduce the green financing costs, which are important for firms to adapt to the new regulatory environment and for the national and global pursuit of climate goals (Paroussos et al., 2019). Third, we find that firms with better ESG performance and less intensive carbon emissions benefit more from the national climate policy in lowering green financing costs. The result points to a new direction of rewarding non-profit ESG practices and highlights the importance of sustainable growth in accessing green capital.

This study is related to the literature on green finance, climate actions, and sustainable investments.

There is an ongoing debate about whether green bonds enable issuers to raise funds at lower costs than regular bonds. A higher bond price indicates a lower YTM, which measures the issuer's funding cost. A green bond is said to be issued at a premium relative to an otherwise similar regular bond if it is sold at a higher price and therefore enjoys a lower YTM. Karpf and Mandel (2018) find that green US municipal bonds are not issued at higher prices than regular US municipal bonds until after 2014. Baker et al. (2018) show that green US municipal bonds enjoy a premium upon issuance because SRIs are willing to sacrifice financial gains for holding green bonds (Pástor, Stambaugh and Taylor, 2021), which lowers green financing costs. Zerbib (2019) documents similar evidence using international green bonds. However, Larcker and Watts (2020) find that the green premium disappears after matching the green US municipal bonds with otherwise similar regular bonds, i.e. issued by the same entity in the same year. Applying the same method to international corporate bonds, Flammer (2021) and Zheng (2021) also find no evidence that green corporate bonds enjoy lower funding costs upon issuance than regular bonds. Fatica et al. (2021) point out that the green premium varies across issuers, absent for bonds issued by financial institutions, which are the major issuers in the green bond market. These studies have advanced our understanding of green bonds, the emerging financial instruments that aim to finance climate investment projects. While existing studies focus on green premiums upon issuance, we track how the YTM differences between green and regular bonds respond to policy-guided climate actions. We contribute to this strand of literature by providing casual evidence of climate actions on green financing costs, which also elucidates why green premiums exist in certain contexts but not in others.

This paper is also closely related to many studies that evaluate the impact of climate actions. Governments all over the world have taken various actions to mitigate global warming, such as implementing carbon tax and ETS to regulate carbon emissions, subsidizing renewable energy, etc. (Meckling and Allan, 2020). These public climate actions are effective in curbing carbon emissions (Arnell et al., 2013; Burtraw et al., 2014; Nippa, Patnaik and Taussig, 2021), yet they are economically costly (Shapiro, 2016; Gillingham and Stock, 2018; Köberle et al., 2021). A growing literature highlights the co-benefits of public climate actions in encouraging innovations of green technology (Weber and Neuhoff, 2010; Calel and Dechezleprêtre, 2016; Cui, Zhang and Zheng, 2018; Fried, 2018) and adoption of clean energy (Avci, Girotra and Netessine, 2015; Cameron et al., 2016), raising fiscal revenues to finance redistribution (Soergel et al., 2021), improving air quality to benefit human health (Li et al., 2018; Tibrewal and Venkataraman, 2021), and enhancing various aspects of human well-being (Creutzig et al., 2022). These studies mitigate the concerns about climate costs and support governments' climate actions. We complement this strand of literature by showing climate actions could also reduce green financing costs, which are pivotal to stimulating climate investments and supporting business activities to combat climate change.

Furthermore, this paper fits into the literature on ESG and corporate financing (see Gillan et al., 2021 for a review). According to Cheng et al. (2014), firms with better ESG performance gain better access to the external capital market, as ESG reduces agency costs and information asymmetry through enhancing stakeholder engagement and transparency. ESG also contributes to lowering the cost of corporate financing via equity (El Ghoul et al., 2011; Chava, 2014; Harjoto and Jo, 2015; Ng and Rezaee, 2015; Breuer et al., 2018) and bank loans (Goss and Roberts, 2011; Chava, 2014). We add to this strand of literature by showing that ESG strengthens firms' capacity to access cheaper green capital.

2. Policy background

China's FYP, which has been updated every five years since 1953, provides important and detailed guidelines to steer the national economy and social development in the five years ahead. It is the centrepiece of almost all domains of public policymaking and has fostered China's rapid and persistent economic growth in the past decades (Heilmann and Melton, 2013). It signals the nation's top policy priorities, which set implicit benchmarks for measuring and evaluating policy makers' performance—those contributing more to important policy goals set by the national leadership typically get promoted faster. Heilmann and Melton (2013) provide a detailed description of how FYPs adjust mandates of institutional authorities and shape policy actions of all levels of governments, which we briefly summarize below.

As soon as the new FYP is released, different levels of governments and ministries first carefully study and interpret the FYP, and then propose thematic special plans on how to achieve the national goals laid out in the FYP. Various policy documents were issued to guide policy execution and coordination, dividing responsibilities, and setting targets tailored to local conditions and resources. Local governments then come up with increasingly specific work and implementation programs to align their policies and regulations with the planned agenda, and even launch reforms to achieve the pre-set national goals. The national mobilization and coordination of resources to support some strategically important sectors in line with the latest FYP provides important signalling effects and creates significant opportunities for private sectors. Profit-seeking private sectors have strong incentives to align their business models with the FYP to ride on the national trends of climate actions. Overall, FYPs are well known for their efficiency in mobilizing and coordinating public and private resources to implement prioritized policies and pursue national goals.

China’s state media, Xinhua News Agency, released the drafted 14th FYP covering the years 2021-2025 on November 3, 2020, and then on March 13, 2021 the official version endorsed by the National People's Congress (NPC) and the Chinese People's Political Consultative Conference (CPPCC), the Two Sessions.[1] The 14th FYP put climate and energy in the spotlight and significantly upgraded their policy priority. It set numeric targets to reduce carbon and energy intensity by 18% and 13.5%, respectively, from 2021 to 2025. This shifts the policy focus from pollution prevention in the 12th and 13th FYPs to carbon emission reductions. This is the first time that China has clearly specified its long-term climate goals within an FYP, which signals its decisive moves to combat climate change.

The 14th FYP upgraded the climate goals to a high-level national policy priority, which directed substantial public and private resources towards climate actions. In the pursuit of the net-zero carbon target guided by the FYP, governments have rolled out new policies and regulations to tighten carbon emissions, boost renewable energy, and fortify clean production and green innovations, among others, while state entities, such as pension funds and state-owned asset management companies, directly allocated capital to support climate investments. The ambitious public climate actions motivate SRIs to invest more aggressively in green assets as they expect to generate greater social impacts with stronger public support. The private sector also joins the campaign of climate actions, either to comply with the new policies and regulations or to profit from the growing climate investments.

All different paths laid out by various parties to pursue national climate goals require finance. To expedite the transitions from emission-dependent fast economic growth to low-carbon sustainable development, it is important to promote green finance, the financial instruments designed specifically to serve climate investments. Many public and private entities have issued green bonds to finance their green projects. To stimulate climate investments necessary for carbon neutrality by the mid-century, it is important to reduce green

[1] Proposal of the 14th FYP: http://www.gov.cn/zhengce/2020-11/03/content_5556991.htm, Official document of the 14th FYP: http://www.gov.cn/xinwen/2021-03/13/content_5592681.htm.

financing costs, just like central banks cut interest rates to boost investments. To lower green financing costs, the supply of green capital needs to outpace the demand for green capital. The collective climate actions mobilized by the 14th FYP direct significant resources to the green bond market. However, it is not clear whether they are sufficient to drive down green financing costs. Applying a DID approach that compares the YTM differences between green and regular bonds after the 14th FYP relative to that before the FYP, we seek to evaluate the impact of the FYP on green financing costs.

3. Data and Methodology

3.1. Data source

We compile bond-, firm-, and city-level data from various sources. Our sample period spans two years from July 1, 2019 to June 30, 2021, covering 16 months before and 8 months after the initial release of the 14th FYP on November 3, 2020.

3.1.1. Bond-level data

Bond issuance information

We obtain from CSMAR bond issuance and maturity dates, size, credit rating, market of listing, currency denomination, and names of issuers. We focus on bonds issued between January 1, 2017 to November 2, 2020, a period before the initial release of the 14th FYP. Bonds issued after November 2, 2020 are excluded from our main sample as they do not have pre-treatment observations, which prevents us from identifying their responses to the policy treatment. In robustness checks, we verify that including these bonds does not affect our key results.

We require bonds to have YTM data to be included in our sample. This reduces the total number of bonds from 4,810 to 4,374, dropping about 9% of bonds. We also require bond issuers to have data on basic financial fundamentals to facilitate controlling for issuer-specific factors that are relevant for financing costs. This drops another 1,003 bonds. Finally, following Larcker and Watts (2020), we exclude bonds with call or put options as their pricing mechanisms are different from regular bonds. After this step, we have 1,751 corporate bonds left, raising a total capital of $288 billion (RMB 1,934 billion) and accounting for 32% of total corporate bonds issued between January 1, 2017 and November 2, 2020.

Bond yields

We obtain daily YTMs of each bond from China Bond Pricing Center (CBPC), a wholly owned subsidiary of China Central Depository and Clearing Company. The CBPC database provides authoritative pricing benchmarks for China's bond market, the quality of which has been well recognized by professional bond investors (Chen, He and Liu, 2020). It carefully considers partial prepayment and related trading activities in calculating bond yields and covers a comprehensive list of actively traded and matured bonds. Of the 4,810 corporate bonds issued between January 1, 2017 and October 30, 2020, 4,374 or 91% have records in the CBPC database.

Green bond indicator

We identify green bonds based on information from three data vendors—CSMAR, WIND, and CBPC. Out of the 1,751 corporate bonds in our sample, 211 of them are labelled as green bonds by at least one of the three data vendors. CBPC labels the largest number of green bonds in our sample (201), followed by WIND (82) and then CSMAR (79). There are 81 green bonds commonly identified by at least two vendors and 70 green bonds recognized by all three vendors. Appendix Table A1 provides a detailed decomposition of green bonds from three data sources. The total amount of green capital raised by the 211 green bonds is $37 billion (RMB 245 billion), accounting for 13% of total funds raised by the bonds in our sample.

To improve the comparability between green and regular corporate bonds, we apply propensity score matching (PSM) to match each of the 211 green bonds to a regular bond in our sample. The one-on-one matching process results in 209 pairs of green and regular bonds, which is our main sample for empirical analysis. Green and regular bonds share the same credit ratings—55% (114) in AAA, 25% (52) in AA+, and 20% (43) in AA.

3.1.2. Firm-level characteristics

Companies' fundamentals are important determinants of financing costs in the bond market. We obtain a list of firm-level characteristics from various sources. Data on industry classification, headquarter location, financial fundamentals—total assets (TA), return on asset (ROA), financial leverage (Leverage)—calculated as the ratio of debt to asset, and ESG ratings are from WIND. Out of the 310 distinct corporate bond issuers in our sample, only 20 have data on ESG involving 29 distinct bonds. The ESG ratings corresponding to the 29 distinct bonds are summarized in Appendix Table A2.

3.1.3. City-level carbon regulation and carbon prices

China has piloted emissions trading schemes (ETS) in eight major cities/provinces—Beijing, Shanghai, Shenzhen, Tianjin, Chongqing, Guangdong, Hubei, and Fujian. These piloted ETS were introduced between 2013 and 2016, before the starting period of our sample. Their potential impacts on green financing costs, if any, should have reached a relatively steady state during our sample period from July 1, 2019 to June 30, 2021. We obtain daily carbon prices for the eight ETS from CSMAR. Firms producing in these eight cities/provinces are subject to the carbon regulations there. For these firms, cutting carbon emissions means cost saving. They may have greater incentives to reduce carbon emissions than their peers not regulated by ETS. To explore the role of carbon regulations on green financing costs, we link the carbon price data with bonds via their issuers' headquarter locations. Note that our sample is not affected by the national ETS, which officially made its debut on July 16, 2021, after the end of our sample period.

3.2. Summary Statistics

3.2.1. Comparability between green and regular bonds

Green and regular bonds differ in various dimensions such as maturities, size, and issuers. To increase their comparability in these dimensions, we perform PSM to match green and regular bonds according to a list of bond- and issuer-level characteristics. The logistic regression result is reported in Appendix Table A3. Through matching without replacement, we identify 209 pairs of green and regular bonds issued by 310 distinct firms.[2]

Panels A and B in Table 1 report the difference between green and regular bonds before and after matching. It shows that, after matching, the differences in maturities, size, credit ratings, issuance dates, and pre-treatment YTMs between green and regular bonds shrink substantially and become economically small and statistically insignificant. Note that treatment and control groups share identical credit ratings because we impose exact matching in this categorized variable. We follow the practice in Fang et al. (2014) and Lemmon and Roberts (2010) to match pre-policy YTMs, which allows us to capture some unobserved determinants of bond yields, whose roles may persist after the introduction of new policy. Thus, we may ascribe the yield differences between green and regular bonds after the policy to the nature of being green instead of some unobserved difference between the two types of bonds. Other than bond-level characteristics, we also show in Table 1 that the issuers of green and regular bonds are quite similar in terms of issuers' financial fundamentals such as TA, ROA, and leverage.

Panel C in Table 1 compares YTM differences between matched green and regular bonds before and after the FYP. In the pre-FYP sample (from July 1, 2019 to November 2, 2020), the YTMs for green and regular bonds are 5.21% and 5.18%, respectively, and the difference of which is economically small (0.03%) and statistically insignificant (*p-value*=0.22). After the initial release of the 14th FYP on November 3, 2020, the YTMs remain similar for green bonds but rise for regular bonds, widening the YTM differences between green and regular bonds to 23 basis points (bps), which is statistically significant at the 1% level. Compared to its pre-FYP level, the YTM differences after the FYP have declined by 26 bps, which is statistically significant at the 1% level. The magnitude of change in YTMs resembles a typical move of the Fed in loosening monetary policy—cutting the interest rate by 25 bps. The average green bond yield is lower than average regular bond yields after the FYP, which provides initial evidence that the new policy reduces green financing costs.

Table 1 is here.

[2] In our matched sample, there are 3 firms that issue both green and regular bonds, 130 firms that issue only green bonds, and 177 only regular bonds.

3.2.2. Parallel trends

To justify the application of the DID approach, we verify the parallel trends assumption in Figure 2, which illustrates the average daily YTM for green and regular bonds from July 1, 2019 to June 30, 2021. We observe that the average YTM for both types of bonds mostly overlaps each other before the initial release of the 14^{th} FYP on November 3, 2020, which supports the parallel trends assumption. Approximately two weeks after the initial release of the FYP (since November 19, 2020), the YTMs for green and regular bonds diverged substantially, and such a difference persisted until the end of our sample period. The YTMs for green bonds were consistently lower than those for regular bonds soon after the FYP, which provides preliminary evidence that the FYP reduces green financing costs.

Figure 1 is here.

3.3. Method

China laid out a specific road map to pursue climate goals for the first time in its FYP on November 3, 2020. This mobilizes substantial climate actions and directs significant resources to foster green financing. Note that China's ETS pilots had operated for many years before the start of our sample period (July 1, 2019), and national ETS had not yet launched by the end of our sample period (June 30, 2021), which should not significantly affect the status quo of green financing. During our sample period, the most important national policy is the 14^{th} FYP.

We evaluate the impact of the 14^{th} FYP on green financing costs using a DID approach that compares the YTM difference between green and regular bonds after the FYP relative to that before the FYP:

$$YTM_{i,t} = \beta Green_i \times FYP_t + \gamma FYP_t + \sigma_i + \varepsilon_{i,t}. \quad (1)$$

The dependent variable , is the yield to maturity of bond i at period t. The treatment dummy $Green_i$ equals 1 for green bonds and 0 for regular bonds. The post-FYP dummy FYP_t equals 1 after the initial release of the 14^{th} FYP (or post-treatment period from November 3, 2020 to June 30, 2021), and 0 in the pre-treatment period (from July 1, 2019 to November 2, 2020). The key variable of interest is the interaction between the green bond dummy and the FYP dummy, $Green_i \times FYP_t$. If the 14th FYP reduces green financing costs, the YTM differences between green and regular bonds after the FYP should be lower relative to those before the FYP, that is, the coefficient β should be negative and statistically significant. The FYP may affect not only green bonds, but also regular bonds. If the FYP reduces (increases) the YTMs for regular bonds, the coefficient of FYP_t, γ, should be negative (positive) and statistically significant. The bond fixed effect σ_i absorbs bond-specific characteristics, including the green bond indicator, $Green_i$. To check the robustness of our results, we also control for alternative firm-level and time fixed effects. Finally, , is the error term.

To understand whether some green bonds benefit more from the 14th FYP in lowering financing costs, we compare different groups of green bonds and estimate the following model:

$$YTM_{i,} = \eta Green_i \times FYP_t \times D_i + \beta Green_i \times FYP_t + \lambda FYP_t \times D_i + \gamma FYP_t + \sigma_i + \varepsilon_{i,t}, \qquad (2)$$

where D_i is a dummy that equals 1 for a specific group of bonds, and 0 otherwise. For example, $D_i = 1$ for bonds issued by firms in cities/provinces that have adopted ETS. If this particular group of green bonds benefits more from the 14th FYP in reducing green financing costs, the coefficient of the triple interaction term, η, should be negative and statistically significant. Our classification of green bonds may also apply to regular bonds, i.e. long-term versus short-term bonds, and different regular bonds may also respond differently to the 14th FYP. Thus, we also include $FYP_t \times D_i$ to capture the policy's heterogeneous impacts on regular bonds.

To explore how the response of green financing costs to the 14th FYP varies over time, we follow Agarwal, Liu and Souleles (2007) and estimate dynamic treatment effects:

$$YTM_{i,} = \sum_{s=-4}^{6} \beta_s Green_i \times \; + \gamma_s + \sigma_i + \varepsilon_{i,t}, \qquad (3)$$

where I_s is the dummy for month s relative to the event month (November of 2020) when the 14th FYP was released. The coefficient β_s essentially reflects the difference in YTM between green and regular bonds in month s relative to the period from July 2019 to August 2020. If there is information leakage before the FYP's initial release, at least one of the coefficients β_s for $s < 0$ should be statistically significant. If the impact of the FYP on green financing costs is persistent, the coefficient β_s for $s >= 0$ should be statistically significant in general.

4. Empirical Results

4.1. Baseline result

Column 1 in Table 2 summarizes the baseline impact of China's 14th FYP on green financing costs based on Eq.(1). The coefficient of the interaction term, *Green×FYP*, is negative and statistically significant at the 1% level. In particular, the average YTM for green bonds drops by 31.4 bps relative to regular bonds in response to the FYP. Note that major central banks like the Fed adjust the benchmark interest rate by 25 bps in a typical monetary policy action; the impact of the FYP on green financing costs is equivalent to loosening monetary policy 1.26 times. Given an average YTM of 6.03% for green bonds in the pre-policy sample, our finding suggests that the FYP reduces the green financing costs by 5.2% (=0.314/6.03). This can save a significant amount of financing costs when compounded over long borrowing horizons. In particular, for every billion green bond issuance, the policy could have saved firms 3.14 million interest payments annually, which generates additional cash flows of 52 million over 10 years.[3]

Columns 2–4 of Table 2 show that the coefficient of *Green ×FYP* remains negative and statistically significant when we employ alternative specifications that control for firm (the issuer) or firm-year fixed effects, or drop all fixed effects (column 4). Depending on the model specification, our finding suggests that the FYP reduces green financing costs by 22.5–31.7 bps, or between 3.7% (=0.225/6.03) and 5.3% (=0.317/6.03) in relative changes.[4]

The coefficient of *FYP* is positive and statistically significant across all four specifications in columns 1–4. It suggests that average YTM for regular bonds increases after the policy, which is consistent with the eyeball observation of Figure 1 and summary statistics in Table 1. When bond fixed effects are dropped, we can estimate the green premium before the FYP. The coefficients of *Green* are negative and statistically significant in columns 2 and 3, which suggests that YTM for green bonds is lower than that for regular bonds even before

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[3] It is easier to assume the tenor of the green bond to be 1 year, and firms keep on rolling over these green bonds after their maturity. Without the policy, the interest payment for B$1 (1 billion USD) green bond compounded over 10 years is $[(1+6.03\%)^{10}-1]\times$B$1= B$1.796. When the policy reduces the YTM by 0.23%, the interest payment for the same green bond over 10 years is [(1+6.03%-0.23%)-1]×B$1= B$1.757, which saves the interest payments by M$39 (=1.796-1.757). Similarly, when the policy reduces YTM by 0.32%, the cash flow saved over 10 years is M$54.

[4] One singleton observation is dropped from model 3.

the FYP. However, when all fixed effects are dropped, the coefficient of *Green* becomes positive (see column 4). This may be driven by the relatively low liquidity in the green bond market or higher credit ratings of green issuers before the 14th FYP, which were absorbed by either bond or firm fixed effects. This result also highlights the importance of controlling for bond or firm fixed effects.

<u>*Table 2 is here.*</u>

4.2. Heterogeneity analysis

We are interested in which firms and bonds benefit more from the 14th FYP in lowering green financing costs in this section. In particular, we explore how a firm's exposure to carbon regulations, ESG performance, and financial fundamentals affect their green financing costs in response to the FYP-guided climate actions. We also investigate how green bonds' credit rating, tenor, and coupon rate affect their response to the FYP.

4.2.1. Carbon regulations

Climate policy

There are eight ETS operating in eight major cities/provinces to regulate local carbon emissions throughout our sample period. By increasing the cost of carbon emissions, ETS motivates firms to adopt green technology and clean production. Firms operating in these eight locations are subject to tighter carbon regulations than firms located elsewhere. Regulated firms are motivated to turn the proceeds of green bonds into emission reductions to save emission costs. Cutting carbon emissions not only improves social image but also provides financial rewards as regulated firms can pay less for carbon emissions or sell the quota of emissions saved. These firms are less likely to engage in "greenwashing"—the practice of exaggerating or even falsifying environmental commitment to access cheap green capital.

To turn green capital into impactful climate actions, both state-owned entities and SRIs seek to invest in firms that could ultimately mitigate climate change. Private investors that prioritize financial gains also have the incentive to follow the lead of state-owned entities and SRIs so as to profit from rising demand for genuine green assets or hedge against climate risk effectively. ETS attracts these investors because it provides a market mechanism to encourage the transformation of green bonds into genuine climate actions. Thus, green bonds issued by firms directly regulated by ETS should be more popular among investors. As long as the demand for green bonds from these parties is sufficiently large to determine bond price movements, their trading behaviour would lower green financing costs. As a result, firms located in cities with ETS and therefore subject to tighter carbon regulations are likely to reduce their green financing costs more substantially after the 14^{th} FYP than their peers.

To test this hypothesis, we compare green bonds issued by firms headquartered in cities/provinces with and without ETS to understand how carbon regulations reshape the impact of the FYP on green financing costs. In particular, we replace the dummy variable D_i in Eq.(2) with *ETS*, a dummy variable that equals 1 for bonds issued by firms directly regulated by ETS and 0 otherwise. Column 1 of Table 3 reports a negative and statistically significant coefficient of the triple interaction term *Green×FYP×ETS*, which supports our hypothesis that green bonds issued by firms exposed to tighter carbon regulations enjoy lower YTMs than their peers not directly regulated by any ETS. In particular, in response to the FYP, the average YTM drops by 58 bps for green bonds issued by firms located in the eight regions with effective ETS, which is 37 bps or 119% more than that for green bonds issued by firms whose carbon emissions are not directly regulated by ETS (21 bps).

Table 3 is here.

Carbon price

Not only the existence but also the intensity of carbon regulations could matter. We further measure carbon regulation intensity by carbon prices. As carbon prices increase, firms face higher emission costs and have greater incentives to take ambitious climate actions to achieve the climate goals set out by the FYP. This in turn attracts green capital from state-owned asset management companies, SRI investors or even private investors, which leads to a reduction in green financing costs. We therefore conjecture that YTM for green bonds declines more when carbon prices are higher in response to the FYP. Consistent with our conjecture, column 2 of Table 3 reports a negative and statistically significant coefficient of the triple interaction term *Green×FYP×CP*—for every unit increase in the carbon price, the policy reduces YTM for green bonds by an extra 3.2 bps. The average carbon price in our sample is only RMB 45 ($7) per tonne. Should China raise carbon prices to be on a par with the European Union (RMB 317 or $50 per tonne as of 2021), our result suggests that green financing costs would drop by 8.7 percentage points (= 3.2×(317-45)/100).

Carbon emission intensity

Firms that emit more carbon are more likely to be constrained by carbon regulations. To comply with regulations and reduce emission costs, they may make greater efforts to reduce carbon emissions through innovating green technologies and adopting clean production. However, given the reliance on intensive carbon emissions for their business, these firms, such as oil producers, face a significant challenge to achieving the net-zero emission target despite their efforts. The market may value their efforts to reduce carbon emissions on the one hand and concern the threat of their intensive emissions to climate change on the other hand, which has mixed implications for green financing costs.

To see which effect dominates, we compare green bonds issued by firms in carbon-intensive industries (CII), including energy, mining, and transport, with those issued by firms in other industries and explore whether their YTMs respond to the FYP differently. Column 3 of Table 3 reports a positive and statistically significant coefficient of the triple interaction term (*Green×FYP×CII*), which suggests that green bonds issued by carbon-intensive firms benefit less from the FYP in lowering green financing costs. Indeed, the YTM for green bonds issued by carbon-intensive firms increases by 3 bps, which is economically small and statistically insignificant (F-statistics = 0.51, p-value = 0.4757). It suggests that the response of green financing costs to FYP-guided climate actions concentrates on carbon-light firms.

4.2.2. ESG

Firms performing well in ESG may benefit more from the policy in lowering their green financing costs for several reasons. First, good ESG performance signals firms' commitment to sustainable growth, which is associated with better returns that further attract more investments (Flammer, 2015). Second, ESG reduces the probability of greenwashing and increases the likelihood of turning green capital into impactful investments that benefit society, which attracts SRI capital. Third, through building up their ESG profile, firms accumulate experience in how to pursue the climate goals advocated by the FYP.

Out of the 330 issuers in our sample, only 20 have data on ESG ratings.[5] We focus on this subsample to explore how ESG reshapes the response of green financing costs to the FYP. In particular, we replace the dummy variable D_i in Eq.(2) with *ESG*, which equals 1 for firms with the highest ESG rating "AAA" and 0 otherwise. Column 1 of Table 4 shows that the coefficient of *Green* × *FYP* × *ESG* is negative, which suggests firms with better ESG performance benefit more from the FYP in reducing green financing costs. However, the result is only statistically significant at the 10% level. We further delve into each aspect of ESG and report the results in columns 2–4. We find that both the "E" and "G" aspects of ESG strengthen the impact of the FYP on lowering green financing costs. In particular, firms with good environmental practice enjoy 43 bps lower green financing costs than their peers in response to the FYP. Similarly, the green financing costs for firms with relatively good governance ratings are 24 bps lower than their peers. However, we find no statistical evidence that the "S" aspect of ESG affects the impact of the FYP on green financing costs.

Table 4 is here.

4.2.3. Corporate fundamentals

Firms with stronger balance sheets are less likely to default, which reduces the risk of their bonds. To mitigate investment risk while pursuing sustainable goals, SRI investors may prefer bonds issued by financially healthy firms. Pension funds are also big players in SRI investing. They tend to be relatively conservative in their investments, often prioritizing safety over high returns. We expect these investors to first increase their holdings in green bonds issued by firms with solid fundamentals before moving to more risky green assets.

To explore the role of corporate fundamentals in influencing the policy impact on corporate green financing cost, we compare green bonds issued by firms with strong and weak fundamentals. We first define three dummy variables—D_{ROA}, D_{TA}, and $D_{Leverage}$, which equal 1, respectively, if a firm's ROA, TA, and leverage are above the sample median, and 0 otherwise. We then estimate Eq.(2) by replacing the dummy variable D_i in Eq.(2) with each of these three dummies and report the results in Table 5.

[5] See Appendix Table A3 for the distribution of ESG ratings across the 29 distinct bonds involved.

Column 1 of Table 5 reports a positive and statistically significant coefficient of $Green \times FYP \times D_{ROA}$, which provides evidence that high ROA mitigates the impact of the FYP on green financing costs. In particular, firms with relatively low ROA lower their green bonds YTM by 54.4 bps after the FYP, compared to 10.5 bps for firms with relatively high ROA. As high returns are often associated with high risk, firms with high ROA are typically associated with significant uncertainty, and our result implies that green capital mobilized by the FYP prefers safety over returns.

Column 2 of Table 5 shows that larger firms benefit more from the FYP in cutting green financing costs—the coefficient of $Green \times FYP \times TA$ is negative and statistically significant. In particular, large firms enjoy 77.3 bps lower YTMs than small firms. This suggests that green capital favours large firms, possibly because they are often more stable and more impactful.

Column 3 of Table 5 shows that more leveraged firms enjoy lower green financing costs than their peers after the FYP. This seems to contradict the result in columns 1 and 2 that sustainable investors prioritize safety over returns, yet it reflects that leveraged firms are typically carbon-light firms. When we repeat the analysis by focusing on firms in carbon-intensive industries, the coefficient of the triple interaction term becomes positive and statistically significant (see column 4). It suggests that, among carbon-intensive issuers, sustainable investors favour green bonds issued by those with lower financial leverage, which is associated with lower risk. This result is consistent with the previous findings that green bonds issued by firms with strong financial fundamentals are more popular among sustainable investors.

Table 5 is here.

4.2.4. Bond characteristics

We further explore what types of green bonds benefit more from the FYP in lowering their financing costs. To check whether bonds with higher credit ratings attract more green capital after the FYP, we replace the dummy variable D_i in Eq.(2) with D_{Credit}, a dummy that equals 1 for AAA-rated bonds and 0 otherwise. The coefficient of $Green \times FYP \times D_{Credit}$ is positive and statistically significant in column 1 of Table 6, which suggests that YTMs for bonds with higher credit ratings drop more in response to the FYP. We repeat this exercise by replacing D_i in Eq.(2) with each of the three dummies, D_{Coupon}, $D_{Maturity}$, and $D_{Liquidity}$, which equal 1, respectively, when the coupon rates, remaining maturity, and liquidity measured by the ratio of the transactions of the bond to the total bond outstanding are above the sample median, and 0 otherwise. The results in column 2–4 of Table 6 suggest that green bonds with higher coupon rates, better liquidity, and longer maturities enjoy lower YTMs than their peers after the FYP.

Table 6 is here.

5. Further Analyses

5.1. Heterogeneity analysis

We further explore how the impact of the FYP on green financing costs varies over time and across different samples in this section.

5.1.1. Initial versus official release of the 14^{th} FYP

The 14^{th} FYP was initially released as a draft on November 3, 2020, and then officially on March 13, 2021 as the formal policy document to be disseminated and implemented, after the endorsement of the Two Sessions. Financial markets are forward looking and often respond to policy announcements even before the actual policy implementation. Interested in whether the impacts of the FYP become more pronounced after its official implementation, we define a dummy *Official*, which equals 1 for the post-treatment sub-period from March 13 to June 30, 2021. The estimation results that replace the dummy D_i with *Official* in Eq.(2) are summarized in Appendix Table A4. It shows that the coefficient of the triple interaction term *Green×FYP×Official* is economically small (0.5 bps) and statistically insignificant. There is no evidence that the response of green financing costs to the official release of the FYP is stronger than that to the initial release of the drafted FYP.

5.1.2. Dynamic treatment effects

To have a more granular view of the dynamics in treatment effects, we further estimate Eq.(3) to check the treatment effects from four months before the FYP to six months after the

FYP. Figure 2 shows that the YTM differences between green and regular bonds are economically small and statistically insignificant before the FYP, which further justifies our DID approach and facilitates the attribution of changing green financing costs to the FYP. We observe that YTMs for green bonds drop by 11 bps immediately in the month of initial release (November 2020), which are almost tripled (32 bps) in the following month (December 2020) and remain persistently low afterwards. By the time when the 14th FYP is officially endorsed by the Two Sessions in March 2021, the adjustment of green financing costs has reached a steady state, which is consistent with our previous findings in Appendix Table A4. This suggests that the market responded swiftly to the FYP. Overall, the impact of the FYP on green financing costs persists, at least until the end of our sample period (June 2021).

Figure 2 is here.

5.1.3. Years of issuance

Some bonds have been issued before the start of our sample period (July 1, 2019). While bond fixed effects may have captured the potential impacts of initial issuance on YTMs, one may be concerned about the heterogeneous path dependence in liquidity, investor base, etc., which could affect the time variations in YTMs. To check whether our results are driven by these bonds, we split the sample into two groups based on whether the bond was issued before or after July 1, 2019, the start of our sample period, and report the estimation results in Appendix Table A5. Our key finding that green financing costs decline in response to the 14th FYP holds for both subsamples.

5.2. Robustness checks

5.2.1. Different samples

Could our results be driven by a specific matching algorithm? To mitigate this concern, we show in columns 1–3 of Table 7 that our baseline results continue to hold when we match green and regular bonds using alternative algorithms that (i) allow for replacement; (ii) require green and regular bonds to be issued in the same quarter; and (iii) use one-to-two matching.

To show that our results are not driven by matching, we also repeat our baseline analysis using the original sample without matching and show in column 4 of Table 7 that our key result that the FYP reduces green financing costs remains robust. To ensure pre-FYP comparability, we have restricted our sample to bonds issued before the 14th FYP on November 3, 2020. We show in column 5 of Table 7 that our key result remains robust when including all bonds issued after November 3, 2020 and before the end of our sample period, June 30, 2021.

Table 7 is here.

5.2.2. Different sources of green bonds

So far, we have been using green bonds labelled by at least one of the three data vendors. One may be concerned about different practices of green labelling. To address this concern, we differentiate green bonds from the three data vendors, repeat our estimation procedure based on Eq.(1), and report the result in Appendix Table A6. Our key result that the FYP reduces green financing costs is robust regardless of the source of green labels—the coefficients of *Green×FYP* are negative and statistically significant throughout columns 1–3 in Appendix Table A6.

5.2.3. Alternative model specifications

We have controlled for various fixed effects to mitigate concerns of omitted variables in Table 2. Here, we further control for bond-year, bond-month, firm-month fixed effects to absorb time-varying factors that may affect the variations in YTMs. Across different specifications of fixed effects, we document consistent results in columns 1–3 of Appendix Table A6 that the FYP reduces green financing costs.

6. Conclusion

China's national policy plays an important role in allocating public and private resources. Upgrading the climate goals to a strategic national policy priority, China's 14th FYP has mobilized substantial climate actions to support climate investments. We find that the FYP-guided climate actions reduce green financing costs—green bonds enjoy much lower YTMs than regular bonds after the 14th FYP relative to those before the 14th FYP. Moreover, the impact of the FYP in reducing green financing costs is particularly pronounced for firms subject to tighter carbon regulations, especially when the carbon price is relatively high. We argue that this is because carbon regulations provide financial incentives for emission reductions, which motivates firms to turn the proceeds of green bonds into green technology and clean production and therefore reduce the probability of greenwashing. This in turn attracts capital from state-owned entities and socially responsible investors that seek to mitigate climate change through supporting climate investments. We also find that green bonds issued by firms with better ESG performance enjoy lower YTMs after the FYP, which provides evidence that ESG pays off in reducing green financing costs. Firms with lower returns on assets, larger total assets, and lower leverage benefit more from the FYP in lowering their green financing costs, suggesting that the FYP-guided climate actions favour safety over returns. Finally, we show that bonds with higher credit ratings, coupon rates, and liquidity, and longer maturities enjoy lower green financing costs in response to the FYP. This points to avenues of improving bond designs to attract green investors.

Our findings point to the importance of policymaking for green financing costs, which determines the size of climate investments—the key to achieving net-zero carbon emissions by 2060. The possibility to cut green financing costs through policy-guided climate actions is encouraging for many emerging economies that rely heavily on carbon emissions for their economic growth. It points out that climate actions could generate potential financial benefits—they could improve access to green capital at lower financing costs. Our results also highlight the value of carbon regulations in strengthening the policy impacts on reducing green financing costs. Again, even though regulating carbon emissions may be economically costly in the short term, it could be rewarding for firms when it comes to green financing.

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Figure 1: Average daily yields of green and regular bonds

This figure shows the cross-sectional average of daily yields for the green and regular bonds in the matched sample from July 1, 2019 to June 30, 2021. The green solid line and the red dashed line represent the average yield to maturity (YTM) of green and regular bonds, respectively.

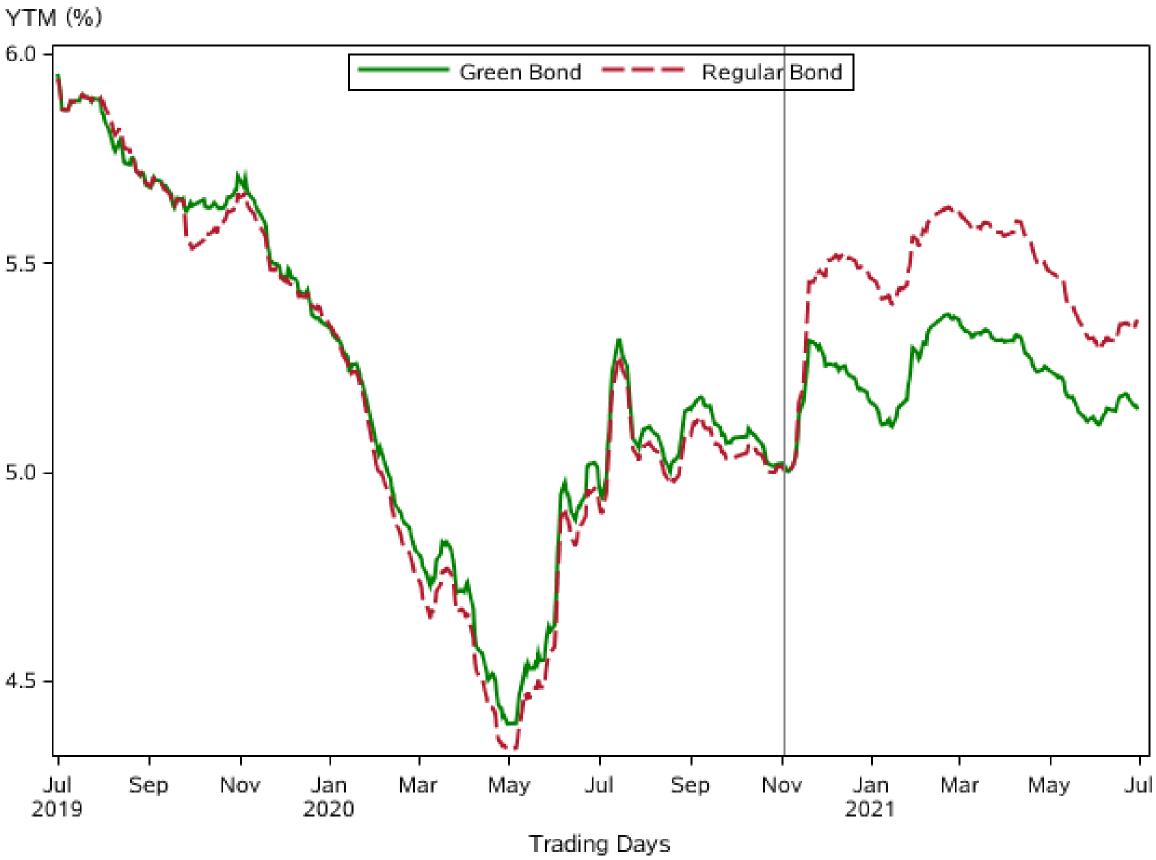

Figure 2: Dynamic treatment effects

This figure shows dynamic treatment effects four months before and six months after the initial release of the FYP in November 2020. The x-axis is the month away from November 2020, with negative value indicating before the FYP and positive value indicating after the FYP. The y-axis is the treatment effect, which captures the YTM difference between green and regular bonds in a particular month specified in the x-axis.

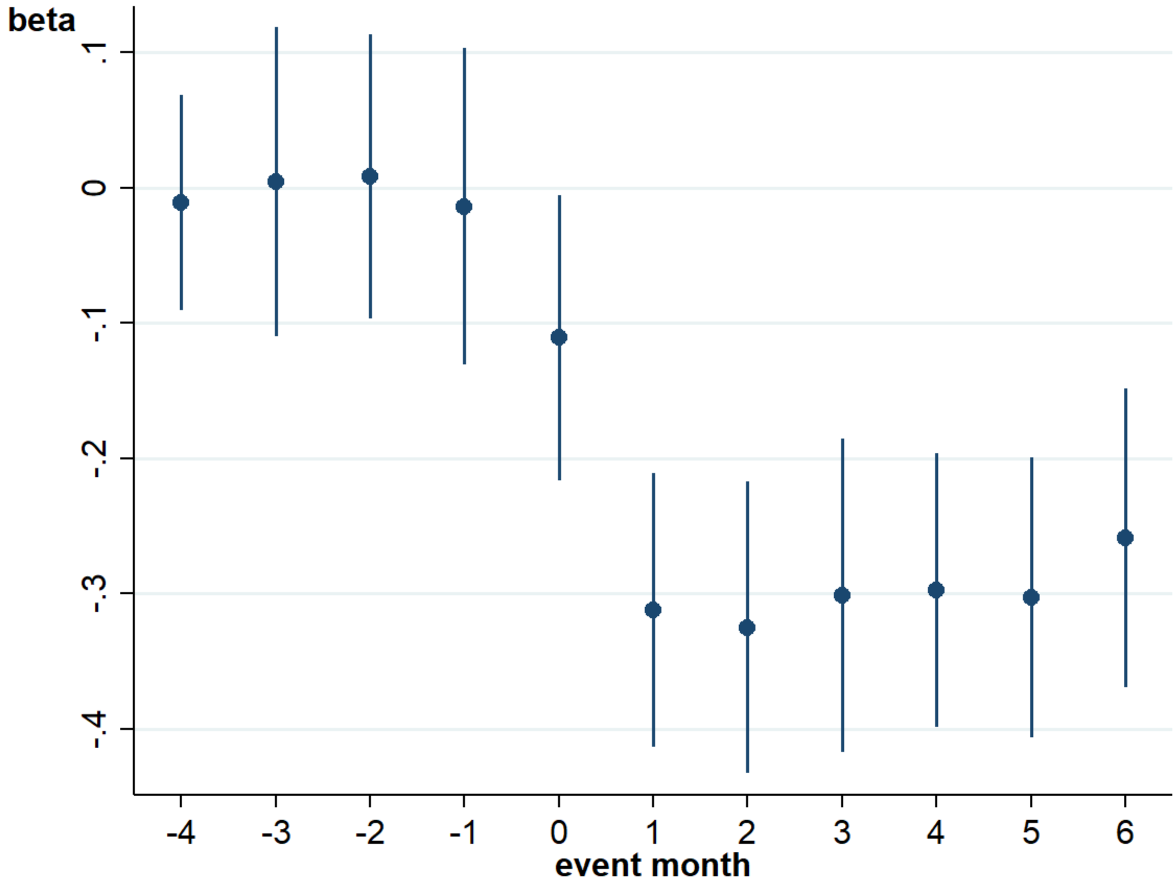

Table 1: Summary statistics

This table reports the summary statistics for the treatment (green bonds) and control (regular bonds) groups and their differences before and after propensity score matching in panels A and B, respectively. Panel C summarizes the yield to maturity (YTM) for treatment and control groups before and after the 14th FYP. *Pre-treatment YTM* is the average daily YTM in the week prior to Nov 3, 2020, the date when the FYP is initially released. *Maturity* is the remaining maturity of the bond. *Ln(Size)* is the log of dollar amount of capital raised upon issuance. *Ln(Issuance Date)* is the log of the numeric issuance date in Stata format. *LGFV* is a dummy that equals 1 if the bond is a local government financing vehicle and 0 otherwise. *Ln(TA)* is the log of total assets. *ROA* is the returns on assets. *Leverage* is financial leverage, calculated as the ratio of debt to total assets. The three credit rating dummies, *AA*, *AA+* and *AAA*, equal 1 if the bond's credit rating falls into the specific category and 0 otherwise. *** denotes $p<0.01$, ** $p<0.05$, and * $p<0.1$, respectively.

Panel A: Original sample before matching

	Treatment: Green bonds		Control: Regular bonds		Treatment- Control (1) - (3)	
VARIABLES	(1) Mean	(2) SD	(3) Mean	(4) SD	(5) Difference	(6) p-value
Pre-treatment YTM	5.026	1.42	5.015	1.902	0.011	0.9322
Maturity	4.658	2.178	4.030	2.24	0.628***	0.0001
ln(Size)	2.261	0.618	2.197	0.637	0.064	0.1718
ln(Issuance Date)	9.983	0.018	9.98	0.017	0.003**	0.0177
Credit Rating						
AA	0.209	0.407	0.183	0.387	0.026	0.3741
AA+	0.246	0.432	0.216	0.411	0.030	0.3099
AAA	0.545	0.499	0.601	0.490	-0.056	0.1186
LGFV	0.725	0.448	0.584	0.493	0.141***	<.0001
ln(TA)	6.439	1.382	6.483	1.592	-0.044	0.7044
ROA	0.576	0.859	0.537	1.058	0.039	0.6081
Leverage	56.368	10.948	58.064	14.282	-1.696*	0.0973
Observations	211		1540			

Panel B: Matched sample

	Treatment: Green bonds		Control: Regular bonds		Treatment- Control (1) - (3)	
VARIABLES	(1) Mean	(2) SD	(3) Mean	(4) SD	(5) Difference	(6) p-value
Pre-treatment YTM	5.019	1.417	5.004	1.509	0.015	0.916
Maturity	4.576	1.924	4.739	2.288	-0.163	0.431
ln(Size)	2.259	0.619	2.269	0.583	-0.011	0.857
ln(Issuance Date)	9.983	0.018	9.982	0.019	0.001	0.615
Credit Rating						
AA	0.206	0.405	0.206	0.405	0.000	1.000
AA+	0.249	0.433	0.249	0.433	0.000	1.000
AAA	0.545	0.499	0.545	0.499	0.000	1.000
LGFV	0.732	0.444	0.732	0.444	0.000	1.000
ln(TA)	6.434	1.372	6.470	1.536	-0.036	0.800
ROA	0.567	0.855	0.516	0.838	0.051	0.536
Leverage	56.478	10.921	56.829	13.176	-0.351	0.767
Observations	209		209			

Panel C: Average YTM before and after the policy announcement

	Treatment: Green bonds		Control: Regular bonds			
VARIABLES	(1) Mean	(2) Std	(3) Mean	(4) Std	Difference: (1)-(3)	p-value
Before the FYP						
YTM	5.211	0.417	5.178	0.438	0.034	0.223
Number of trading days	335		335			
After the FYP						
YTM	5.229	0.089	5.459	0.137	-0.230***	<0.001
Number of trading days	165		165			
Difference in difference					-0.263***	<0.001

Table 2: Baseline impact of green policy on green financing costs

This table reports the baseline impact of the 14th FYP on green financing costs. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. Columns 1–3 control for bond, firm, and firm-year fixed effects (FE), respectively, and column 4 does not control for any FE. A singleton observation is omitted in model 3. Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

VARIABLES	(1) *YTM*	(2) *YTM*	(3) *YTM*	(4) *YTM*
Green×FYP	-0.314***	-0.317***	-0.225***	-0.267***
	[-20.21]	[-20.55]	[-16.72]	[-11.13]
Green		-0.233***	-0.110***	0.038**
		[-4.38]	[-3.58]	[2.36]
FYP	0.685***	0.697***	0.620***	0.367***
	[62.43]	[63.61]	[64.59]	[21.59]
FE	Bond	Firm	Firm-Year	No
Observations	154,806	154,806	154,805	154,806
R-squared	0.632	0.629	0.891	0.004

Table 3: Exposure to carbon regulations

This table summarizes how firms' exposure to carbon regulations reshapes the response of green financing costs to the FYP. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14^{th} FYP on November 3, 2020, and 0 otherwise. *ETS* and *CII* are dummy variables that equal 1, respectively, for bonds issued by firms headquartered in places that implement emission trading systems (ETS) and in carbon intensive industries (CII)—mining, energy, and transport industries. *CP* is the daily carbon prices that vary across ETS platforms. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

VARIABLES	(1) *YTM*	(2) *YTM*	(3) *YTM*
Green×FYP×ETS	-0.368***		
	[-15.19]		
Green×FYP×CP		-0.032***	
		[-49.91]	
Green×FYP×CII			0.358***
			[7.85]
Green×FYP	-0.207***	0.108***	-0.327***
	[-12.19]	[6.29]	[-19.49]
FYP	0.685***	0.353***	0.751***
	[62.47]	[30.07]	[64.87]
FYP×CP		0.028***	
		[54.40]	
FYP×CII			-0.635***
			[-17.67]
Green×FYP	-0.207***	0.108***	-0.327***
	[-12.19]	[6.29]	[-19.49]
Green×CP		0.039***	
		[44.71]	
CP		-0.034***	
		[-47.20]	
FE	Bond	Bond	Bond
Observations	154,806	154,806	154,806
R-squared	0.632	0.645	0.633

Table 4: The roles of ESG

This table summarizes how firm-level ESG affects the response of green financing costs to the FYP. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14^{th} FYP on November 3, 2020, and 0 otherwise. *ESG*, *S*, and *G* are dummy variables that equal 1 if the ratings on ESG, society, and governance are "AAA", the highest rank, and 0 otherwise. Due to data limitations, dummy *E* is defined as 1 if the firms' environment rating is not below "A" and 0 otherwise. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

	(1) ESG	(2) Environment (E)	(3) Society (S)	(4) Governance (G)
VARIABLES	*YTM*	*YTM*	*YTM*	*YTM*
Green×FYP×ESG	-0.070*			
	[-1.76]			
Green×FYP×E		-0.431***		
		[-11.73]		
Green×FYP×S			-0.060	
			[-1.52]	
Green×FYP×G				-0.242***
				[-5.31]
Green×FYP	0.178***	0.250***	0.146***	0.216***
	[8.45]	[11.76]	[7.20]	[5.19]
FYP	0.164***	0.075***	0.164***	0.230***
	[10.09]	[4.39]	[10.08]	[5.99]
FYP×ESG	-0.194***			
	[-5.46]			
FYP×E		0.177***		
		[5.48]		
FYP×S			-0.194***	
			[-5.46]	
FYP×G				-0.124***
				[-3.00]
FE	Bond	Bond	Bond	Bond
Observations	10,001	10,001	10,001	10,001
R-squared	0.916	0.915	0.914	0.914

Table 5: The roles of strong financial fundamentals

This table shows how the main findings are related to financial characteristics of bond issuers. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. The dummy variables D_{ROA}, D_{TA}, and $D_{Leverage}$ equal 1, respectively, if the green bond issuers' return on assets (ROA), total asset (TA), and financial leverage are above the sample median, and 0 otherwise. Columns 1–3 use the matched sample while column 4 limits the sample to carbon intensive issuers. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

	(1)	(2)	(3)	(4)
Sample		Matched sample		Carbon intensive issuers
VARIABLES	*YTM*	*YTM*	*YTM*	*YTM*
$Green \times FYP \times D_{ROA}$	0.439***			
	[14.17]			
$Green \times FYP \times D_{TA}$		-0.773***		
		[-24.80]		
$Green \times FYP \times D_{Leverage}$			-0.699***	0.107***
			[-22.53]	[5.65]
$Green \times FYP$	-0.544***	0.034	0.041*	-0.035**
	[-25.00]	[1.64]	[1.85]	[-2.42]
FYP	1.022***	0.465***	0.474***	0.206***
	[65.49]	[31.08]	[30.68]	[17.37]
$FYP \times D_{ROA}$	-0.662***			
	[-30.27]			
$FYP \times D_{TA}$		0.474***		
		[21.57]		
$FYP \times D_{Leverage}$			0.425***	-0.150***
			[19.41]	[-9.80]
FE	Bond	Bond	Bond	Bond
Observations	154,806	154,806	154,806	22,655
R-squared	0.636	0.634	0.633	0.857
Median of *ROA*	0.34%			
Median of *TA*	6.06			
Median of *Leverage*	59.07%			

Table 6: Heterogeneity across bond characteristics

This table reports how the responses of green financing costs to the FYP vary across different bond characteristics. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. The dummy variables D_{Credit}, D_{Coupon}, $D_{Maturity}$, and $D_{Liquidity}$ equal 1, respectively, if the green bond's credit rating is AAA, coupon rate, remaining maturity, or liquidity is above the sample median, and 0 otherwise. Bond liquidity is measured by total bond trading divided by outstanding credit before the FYP. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

	(1)	(2)	(3)	(4)
VARIABLES	*YTM*	*YTM*	*YTM*	*YTM*
$Green\times FYP\times D_{Credit}$	-0.839***			
	[-27.08]			
$Green\times FYP\times D_{Coupon}$		-0.763***		
		[-24.53]		
$Green\times FYP\times D_{Maturity}$			-0.452***	
			[-14.20]	
$Green\times FYP\times D_{Liquidity}$				-0.419***
				[-13.48]
$Green\times FYP$	0.097***	0.051**	-0.025	-0.087***
	[4.46]	[2.37]	[-1.02]	[-3.78]
FYP	0.441***	0.501***	0.334***	0.327***
	[28.79]	[31.61]	[18.72]	[20.21]
$FYP\times D_{Credit}$	0.499***			
	[22.79]			
$FYP\times D_{Coupon}$		0.353***		
		[16.11]		
$FYP\times D_{Maturity}$			0.546***	
			[25.04]	
$FYP\times D_{Liquidity}$				0.658***
				[29.95]
FE	Bond	Bond	Bond	Bond
Observations	154,806	154,806	154,806	154,806
R-squared	0.634	0.633	0.633	0.634
Median of *Maturity*	4.633			
Median of Coupon Rate	5.700			
Median of *Liquidity*	0.128			

Table 7: Alternative samples

This table reports robustness checks using alternative samples. In columns 1–3, we estimate the impact of the FYP on green financing costs based on matched samples with different algorithms that match with replacement, further require green and regular bonds to be issued in the same quarter, and use one-to-two matching, respectively. Column 4 is based on the original sample without any matching, and column 5 expands the original sample to include bonds issued after the FYP. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

Sample	(1) Matching with replacement	(2) Matching by issuance quarter	(3) One-to-two matching	(4) Original sample	(5) Add bonds issued after the FYP
VARIABLES	*YTM*	*YTM*	*YTM*	*YTM*	*YTM*
Green×FYP	-0.365***	-0.086***	-0.217***	-0.138***	-0.111***
	[-22.18]	[-15.89]	[-19.90]	[-17.07]	[-15.51]
FYP	0.733***	0.422***	0.579***	0.474***	0.446***
	[61.69]	[109.96]	[89.20]	[171.81]	[179.93]
FE	Bond	Bond	Bond	Bond	Bond
Observations	146,312	169,838	235,326	747,023	752,243
R-squared	0.625	0.896	0.693	0.751	0.783

Appendix

Appendix Table A1: Decomposition of green bonds by data vendors

This table summarizes the distribution of green bonds labelled by the three data vendors, CSMAR, WIND, and CBPC.

Scenario	CSMAR	WIND	CBPC	Number of bonds
1	Yes			2
2	Yes	Yes		7
3	Yes	Yes	Yes	70
4		Yes		1
5		Yes	Yes	4
6			Yes	127
Total	79	82	202	211

Appendix Table A2: ESG ratings

This table reports the total and sub-category ESG ratings of the issuers for the 29 bonds in the matched sample.

	ESG		E		S		G	
	green bonds	regular bonds	green bonds	regular bonds	green bonds	regular bonds	green bonds	regular bonds
AAA	12	2			10	2	15	7
AA	4	6	11		5	2	4	1
A	3			2	4	4		
BBB			6	6	1			
BB	2		4		1			
B								
CCC							2	
total	21	8	21	8	21	8	21	8

Appendix Table A3: Logit regression result

This table shows the logit estimation result for propensity score matching based on cross-sectional data on November 2, 2020, one day before the initial release of the 14th FYP. The dependent variable is *Green*, a dummy variable that equals 1 for green bonds and 0 for regular bonds. *Pre-treatment YTM* is the average daily YTM in the week before the initial release of the FYP. *Maturity* is the remaining maturity of the bond. *ln(Size)* is the log of dollar amount of capital raised upon issuance. *ln(Issuance Date)* is the log of the numeric issuance date in Stata format. *LGFV* is a dummy that equals 1 if the bond is a local government financing vehicle and 0 otherwise. *ln(TA)* is the log of total assets. *ROA* is the returns on assets. *Leverage* is financial leverage, calculated as the ratio of debt to total assets. The credit rating dummies, *AA* and *AA+*, equal 1 if the bond's credit rating falls into the specific category and 0 otherwise. The credit rating for AAA is absorbed in the regression. Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

	(1)
VARIABLES	*Green*
Intercept	-111.970**
	[-2.31]
Pre-treatment YTM	-0.055
	[-0.78]
Maturity	0.081**
	[2.25]
ln(Size)	0.315**
	[2.12]
ln(Issuance date)	10.873**
	[2.24]
LGFV	0.753***
	[3.60]
ln(TA)	0.055
	[0.71]
ROA	0.161**
	[2.08]
Leverage	-0.007
	[-1.03]
AA	0.426*
	[1.73]
AA+	0.245
	[1.19]
Observations	1,743
Pseudo R-squared	0.0248

Appendix Table A4: Initial versus official release of FYP

This table differentiates the responses of green financing costs before and after the official release of the 14th FYP on March 13, 2021. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. *Official* is a dummy variable that equals 1 after the official release of the FYP on March 13, 2021. Bond fixed effects (FE) are controlled for. Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

VARIABLES	(1) *YTM*
Green×FYP×Official	0.005
	[0.21]
Green×FYP	-0.316***
	[-17.10]
FYP×Official	-0.013
	[-0.83]
FYP	0.691***
	[52.93]
FE	Bond
Observations	154,806
R-squared	0.632

Appendix Table A5: Robustness across bond issuance years

This table reports robustness checks across bonds issued in different years. Columns 1 and 2 are based on bonds issued before and after July 1, 2019. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14^{th} FYP on November 3, 2020, and 0 otherwise. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

	(1) Issuance date<July 1, 2019	(2) Issuance date>=July 1, 2019
VARIABLES	*YTM*	*YTM*
Green×FYP	-0.469***	-0.064***
	[-19.16]	[-11.26]
FYP	0.936***	0.269***
	[53.83]	[68.00]
FE	Bond	Bond
Observations	96,425	58,381
R-squared	0.580	0.946

Appendix Table A6: Different sources of green bonds

This table reports the impact of the FYP on financing costs of green bonds labelled by different data vendors. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds labelled by the data vendor specified in the top row, and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. All regressions control for bond fixed effects (FE). Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

	(1)	(2)	(3)
Data vendor	CSMAR	WIND	CBPC
VARIABLES	*YTM*	*YTM*	*YTM*
Green×*FYP*	-0.448***	-0.444***	-0.308***
	[-17.34]	[-17.42]	[-19.31]
FYP	0.685***	0.685***	0.685***
	[52.18]	[52.39]	[61.64]
FE	Bond	Bond	Bond
Observations	104,508	105,330	150,682
R-squared	0.571	0.570	0.627

Appendix Table A7: Alternative model specifications

This table reports the responses of green financing costs to the FYP using different model specifications. Columns 1–3 control for bond-year, bond-month, and firm-month fixed effects (FE), respectively. The dependent variable, *YTM*, is the yield to maturity, with higher value corresponding to higher financing costs. The dummy variable *Green* equals 1 for green bonds and 0 for regular bonds. The post-treatment dummy *FYP* equals 1 after the initial release of the 14th FYP on November 3, 2020, and 0 otherwise. Heteroskedasticity robust t-statistics are in brackets. *** denotes p<0.01, ** p<0.05, and * p<0.1, respectively.

VARIABLES	(1) *YTM*	(2) *YTM*	(3) *YTM*
Green×FYP	-0.241***	-0.195***	-0.066***
	[-17.72]	[-7.62]	[-3.19]
FYP	0.613***	0.336***	0.273***
	[63.88]	[18.62]	[15.97]
Green			-0.247***
			[-13.00]
FE	Bond-Year	Bond-Month	Firm-Month
Observations	154,894	154,796	154,801
R-squared	0.895	0.978	0.974