Financing Green Transition *

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Abstract

Using a novel loan-level identification of loans financing the environmental transition, we study non-bank lenders' involvement in green lending. After the Paris Agreement, we find that syndicated corporate loans are more likely to be green loans (2%) if they include institutional loan tranches that cater to non-bank lenders. The effect is further amplified when non-bank lenders actively participate in the primary corporate lending market for such tranches, i.e., they join the syndication group at the loan origination stage. Robustness of the results are tested through a falsification test based on a placebo shock and through a reversed treatment test based on the US's withdrawal from the Paris Agreement.

JEL classification: G21, G23, G30, Q50

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1 Introduction

The current level of sustainable investments is falling short of the overall economy's financing need for delivering decarbonization and meeting the targets set by the Paris Agreement (PA). According to the World Economic Forum, the future investment in nature-based solutions needs to increase fourfold by 2050, equating to an annual investment of over $536 billion a year.[1] Different approaches and solutions have been discussed including the critical role of banks. Banks are the dominant type of financiers for most companies including those in need of green transition, and especially for private firms with limited access to financial markets. Given their specialisation in screening and monitoring, they are better suited to finance risky and innovative projects such as those financing the transition. Under the pressure of the PA, banks have started adopting greener lending standards as documented by Degryse et al. (2022), Delis et al. (2019) and Fatica et al. (2021) and joined numerous initiatives, such as Net Zero Banking Alliance and Science-Based Targets initiatives (SBTi), actively committing to finance the transition to low carbon economy (Kacperczyk and Peydro, 2021). However, two barriers limit the role of banks in this process. First, banks alone would hardly have the balance sheet capacity to close the investment gap. Second, they are heavily invested in the brown economy, which reduces their incentives to speed up the financing of the transition.

Differently from banks, non-bank investors have less legacy positions at risk and might be less exposed to asset overhang problems as they can rebalance their portfolios quickly and more efficiently by holding more liquid positions. Thus, investors of non-banks could be potential facilitators of the transition that the economy needs to achieve (Degryse et al. (2022)). Whether non-bank can play a role in green lending is part of the current debate on climate finance, also accelerated by the pressure on sustainable investment post-PA. One of the key trends in financial intermediation in the last decade has been the growth of the Non-Bank Financial Intermediaries (NBFI) sector including insurance companies, pension funds, mutual funds and private equity. Since the global financial crisis in 2008, the overall growth in financial assets can almost entirely be traced to these non-bank financial entities, accounting for 48.3% of total global financial assets (FSB, 2021). Non-banks' participation in green lending therefore would allow financing

[1] https://www.weforum.org/press/2022/01/g20-countries-can-help-close-climate-finance-gap-by-investing-in-nature-based-solutions/

of green transition to tap into the ever-growing market-based funding, reducing the pressure on banks. However, lending requires the experience in resolving informational problems for which banks have better expertise. On the other hand, non-banks are better trained in arm's length arrangements of market transactions (Boot and Thakor, 2010). This paper studies potential complementarities between banks and NBFIs towards the common goal of financing green transition in the corporate lending market, i.e. whether banks' expertise in borrower screening and monitoring and NBFIs' substantial financing capacity can collectively contribute to reducing the sizeable investment gap to reach the PA goals.

We provide empirical evidence on the bank-market partnership in the context of the US syndicated corporate lending market, investigating the role of NBFI in green lending. Adopting a novel loan-level approach to identify green lending based on the loan purpose we show that, after the Paris Agreement, we find that loans are 2% more likely to be green loans when there is an institutional loan tranche (Term B) included in the deal, which is the type of tranche that is most frequently sold to institutional investors. We also find that non-bank lenders increase their participation in the syndication of such tranches in green deals, i.e. participation in the primary market of the loan. The results are confirmed in a falsification test where we adopt a different time period with a placebo shock and through a reversed treatment test based on the US's withdrawal from the Paris Agreement.

The findings are based on a textual analysis of DealScan data, in which we identify whether a specific loan is used to finance green transition by producing a measure of greenness at the loan level. Our loan-level approach has the advantage that the identification is more granular compared to measures relying on greenness at the firm level. Another key feature of our analysis is that it captures the intention of firms to become greener by observing their use of finance instead of focusing on financing firms that are already green, which is usually the case when firm level greenness is used. Finally, we avoid relying on firm level ESG-scores that have proven controversial in term of reliability. Our measure is constructed by a textual analysis of loan purpose remark on DealScan. On the database, banks are requested to report not only their lending activities but also their loan purposes. Loan purpose are reported using keyword

definition of the use of funds, such as refinancing or LBO, but banks often add loan purpose remarks to provide more details on the intended use of the funds. Therefore, we exploit the valuable qualitative information provided in the remarks to define a loan as green financing. Importantly, loan purpose remarks provide detailed information on the use of funds which can be readily fact-checked, thereby mitigates concerns on the possibility of green-washing reporting of our measure.[2]

In performing our test, we employ a set of fixed effects that helps us to ensure that we are capturing the NBFI's response to the Paris agreements rather than other factors. For identification, we use lead arranger-quarter fixed effects approach that exploit the fact that majority of lead arrangers in the syndicated lending market originate multiple loans per quarter. The empirical approach is to measure the likelihood of a loan to become a green loan as a function of the participation of NBFI within a syndicate arranged by the same lead arranger in a given quarter. From an identification standpoints, this approach accounts for changes in the purpose of the loans (green vs non-green) that could correlates with lead arrangers' characteristics (preferences for green activities, green expertise, policy-induce changes in green lending, balance sheets' capacity, brown legacy). We also include borrowers' industry and country fixed effects to account for industry- and country-specific time-invariant features that can influence lending-borrowing activities.

We contribute to the existing literature in several respects. First, we extend the literature on sustainable investing, that has widely recognised the interest of institutional investors for green securities, by documenting institutional investors' participation also in lending markets. The recent literature has looked at institutional investors and market responses to the increasing awareness of climate risks. In this paper, we explore the issue by focusing on the partnership they form with banks. Previous evidence shows that climate-related political events such as the PA meant a dramatic shift among the demand of institutional investors towards green investment such as green stocks and bonds (Seltzer et al., 2022; Bolton and Kacperczyk, 2021). We provide further evidence that non-bank lenders divert their interests also in the corporate

[2]An example of green purpose remark is "Proceeds will back the construction of two wind power projects named Alta Wind VII and Alta Wind IX. they will be built in Tehachapi, California. The two projects will produce 300mw of wind energy combined.

lending market towards green financing, potentially due to the limited options available regarding publicly traded green assets, such as green bonds and stocks. We show that they acquire exposure to green lending in the syndicated loan market by increasing their participation both in the primary and secondary market for institutional loan tranches.

Secondly we contribute to the literature on green bank lending with a novel a novel loan-level approach of identifying green financing. The measure in this paper is ESG-score free and less likely to be driven by greenwashing, which are the two main concerns in the literature. The proposed approach also has the advantage of identifying green loans granted to non-green firms for green purposes, which is the majority of the borrowers. Therefore it produces a more refined measure of green financing compared to company-level approach which often dismisses the purpose of financing but focus on whether green firms obtain finance.

Thirdly, we also contribute to documenting on the extent to which banks rely on non-banks to originate green loans, adding to the understanding of the role played by NBFI in credit markets (for an overview of this role, see Aldasoro et al. (2022)). The increasing relevance of non-bank lenders as a source of funding for non-financial firms, and in credit supply activities in general, is documented with respect to several markets (see Irani et al. (2021) for corporate loans, Gopal and Schnabl (2022) for small business lending, Buchak et al. (2018) for mortgage lending). More recently, Chernenko et al. (2022) documents their increasing role as direct lenders, especially to smaller, younger, less profitable and more R&D intensive firms and Elliott et al. (2021) emphasises their role as shock absorbers in the US monetary policy tightening spillovers, while Aramonte et al. (2022) discuss the potential risks their pose to financial stability. In this paper, we show how NBFIs contribute to closing the financing gap in the economy amid climate change, for which banks alone may not have enough capacity to cope.

The remainder of this paper is organized as follows: Section 2 describes our empirical strategy, our definitions of non-bank lenders, non bank lenders' participation and green lending; Section 3 reports and discusses our main results on non-bank lenders participation and the effect on loans' conditions. Section 4 presents our conclusions.

2 Empirical Strategy

In this section, we describe our dataset on the syndicated lending market, our definitions of non-bank lenders and non-bank lender participation. We also present our novel approach to identify green loans based on their reported loan purpose remarks, which allows us to avoid using borrowers' ESG ratings that are often criticized for being inaccurate. Then, we present our empirical methodology that test our hypothesis that NBFI participation facilitates banks' origination of green loans. Finally, we provide supporting evidence on the role of PA in shifting the interests of non-bank lenders and institutional investors towards green investments, together with a discussion on the evidence from the literature how the PA affected various investment decisions.

2.1 Data

2.1.1 Syndicated Lending and Non-Bank Lenders' Participation

DealScan contains information on syndicated loan deals and tranches that belong to a deal. It also provides information on loan conditions such as loan amount, maturity, spread and use of covenant. Majority of these loan deals are structured into multiple tranches and are syndicated to accommodate two types of primary syndicate lenders: banks and institutional investors. Institutional investors are various non-bank lenders such as structured finance vehicles, mutual funds, insurance companies and private equity companies. Institutional investors play an increasingly important role in the syndicated loan market as their own investor base for loans grew enormously in the last decade as documented by Aldasoro et al. (2022).

When both types of lenders, banks and non-banks, are involved, a deal typically contains Term Loan A, amortizing tranche also called Term A, that is syndicated among banks and Term Loan B or Term B that is an institutional loan tranche. Term B is designed to cater to institutional investors' (non-bank lenders') demand for the loan in the secondary market as described in (Gallo and Park, 2022). Therefore, the existence of a Term B tranche in a syndicated loan is a natural proxy of non-bank lenders' interest to invest in the loan. Based on our measure of greenness, for which the description follows in the section below, we find that the presence of

Term B loans in green deals increases by 25% the Paris Agreement (from 2% to 2.5% of all loans).

Another proxy for non-bank lenders' intention to get involved in certain types of loans (green loans, for example) is their participation in the loan deals in the primary market, i.e. they join the syndicate of the Term B tranche directly from the origination of the loans. While the sale of Term B tranches to institutional investors in the secondary market is an institutional understanding, the participation of non-banks in Term B in the primary market is directly observed through DealScan. Non-banks' involvement in the primary market as providers of finance often ensures a more direct control over trading of the loan in the secondary market, hence can be considered a stronger signal of non-bank lenders' interests to acquire the Term B tranche they participate.

To identify non-bank lenders we rely on the lender's institution type recorded in DealScan. Each participant is often described with multiple types of institutions. We define as banks those that mention "Bank", "Thrift" or "S&L" as their types.[3] Among those that are unclassified by this variable, if the institution's name contains "bank," we consider them to be bank following Elliott et al. (2021). All other types of lenders are considered non-banks in our dataset. The institution types of non-banks in the DealScan include "Mutual Fund," "Institutional Investor," "Private Equity," "Insurance Company" and other types of finance companies. Ultimately, we classify almost 77 lenders as non-banks, out of a total of 221 unique lenders in the regression sample, which is 34.8% of all lenders. This is comparable to the findings of Aldasoro et al. (2022) which identified around 39% of lenders to be non-banks. Of them, the majority is "Finance Company" followed by "Asset Manager".

We limit our sample to those loans for which lead arrangers are operating in the US or Europe as non-bank lenders are most active in these countries. Also, well developed secondary loan markets for Term B tranche can be found in these countries. We focus on deals with total size in the top 65 percentile. This is because smaller size of syndicated loans tend to miss Term B tranches, therefore not comparable to those deals with Term B tranches which are the main

[3]For example, "US Bank" or "European Bank"

subjects of our study.[4] Our sample is constructed with deals that contain at least one tranche of Term A or Term B and excludes the deals that only contain revolving tranches (credit lines).

Our final sample is composed of 8,822 lender-tranche level observations. There is non-banks participation in 6.5% of the observations, among which 4.2% is directly involved in Term B tranche lending. This shows that non-banks have a significant presence in the primary loan market in which banks most frequently act as lead arrangers.

2.1.2 Identifying Green Purpose Loans

In this paper, we propose a novel identification for the green loans based on the "Deal Purpose Remark" available for each loan on DealScan. This is an open box question where lead arrangers can type comments and remarks adding more details to explain the purpose of the loan, unlike a drop-down menu selection which is applied to many other variables. Usually, this remark takes the form of one or sentences, explaining the use of the funds.

Using the text reported as loan purpose remark, we identify the green loans based on a list of keywords from the Climate Bonds Taxomomy.[5] This document is meant for institutional investors as it "identifies the assets, activities, and projects needed to deliver a low carbon economy." It is one of the key resources for green investors that provides common green definitions across global markets. We extract all the keywords in the asset type and asset specifics tables which are reported as "Paris Agreement compliant." Some examples of the keywords are "renewable", "solar", "clean energy" and "biofuel". Using the keywords, we classify loans to be green when their loan purpose remarks state the use of finance in line with the keywords. [6] In doing so, we first identify the green loans primarily relying on keyword search and then, we go through the entire texts of the identified purpose remarks to refine the variable by correcting

[4] Among deals with size below 35 percentile, only 7.9% contain Term B, while, among deals with size above 35 percentile, 45.7% contains Term B. By keeping the deals with size above 35 percentile, we obtain more comparable treat (deals with Term B) and control (deals without Term B) samples.

[5] Available at https://www.climatebonds.net/standard/taxonomy

[6] An example of such purpose remark is "Credit backs the acquisition of a 1.19 GW portfolio of renewable operating assets inclusive of 7 wind projects and a 50% interest of 3 solar projects located across the 10 states of Nevada, Iowa, North Dakota, Illinois, Michigan, Arizona, Washington, Oregon, New Mexico and Minnesota."

misidentification.[7]

A deal purpose remark is available for 60.8% of the sample, of which 2.13% are identified as green. For this approach, a concern could be that lead arrangers can suddenly increase the frequency of loan purpose remark reporting, especially with the aim to emphasize "green" keyword after the Paris Agreement simply due to higher attention paid on the topic. If this is the case, the reporting frequency of loan purpose remarks should go up post-PA, potentially with more frequent mention of "green" keywords within them. However, we find that purpose remark was reported for 65% of the sample before the PA while it is reported for 56% post-PA. Therefore, we are assured that the reporting frequency for this variable did not increase which reduce the possibility that it was used by lead arrangers with different intentions before and after the PA. Second, the reporting of green loans does go up from 1.6% of sample in the pre-PA period to 2.6% in post-PA. We are unable to disentangle to what extent it is a genuine increase of green financing and to what extent the increased reporting stems from lead arrangers' intention to increase reporting of greenness in loans they arrange. However, given that after the Paris Agreement, most economic entities had increased incentives to transit into green economy, there is high likelihood that green financing requirement has gone up resulting in increase in green loans (also documented in the literature on green bank lending). It is also important to note that the loan purpose remarks recorded in DealScan are not publicly available to third parties or the general public but remain only visible to the database users with a significant time lag after loan origination, therefore this mitigates the potential risk of reporting being used for green washing purposes.

Our measure of greenness at the loan level has several advantages: i. it is not based on ESG ratings/scores, which have been documented to be noisy (among others, Berg et al. (2022)); ii. it is a more direct measure of green financing compared to firm-level measures of greenness such as ESG-compliance because it captures loans with green purposes regardless of whether they were granted to green firms or non-green firms (i.e. any firms' efforts to become more energy efficient), thus expanding the definition of green financing; iii. it is based on banks' disclosure

[7]For example, those cases where a company name mentioned in the remark simply includes green keywords, while the loan itself is not necessarily used for green purpose.

of information that are not meant for the public or investors, reducing the greenwashing bias. These advantages are relevant because after the Paris Agreement investors' demand to hold green assets such as green-purpose loans has gone up significantly and they are not necessarily limiting their investment to green firms only. Furthermore, providing green loans to green firms is unlikely to meet the current demand for green financing as well as the demand for green financing by non-bank lenders. Finally, ESG ratings have been highly criticized for its inaccuracy. An even more serious issue with ESG ratings is that they are available for listed banks and listed firms only while our loan-level measure is available for all the firms and banks receiving lending on the syndicate corporate lending market, thus does not exclude private firms.

Table 1 presents the number of green loans and for different types of green loans over time. Adopting our green measure based on loan purpose, we are able to identify 184 green loans over the period 2012-2019, equal to 2.13% of the sample. In terms of types of green loans, we have the largest group relates to "wind" and "solar" , followed by "electric". The time trend reveals, as expected, an increase in both the absolute number and percentage of green loans after the Paris Agreement. While the percentage is relatively small, it is worth noticing we only capture loans that are related to activities that are fully Paris-compliant ("super green"). Table 2 presents loan characteristics and difference-in-means test between green and non green loans in two panels: all sample (Panel A) and sub-sample of loans including an institutional loan tranche (Panel B).

2.2 The Paris Agreement and Investors' Demand for Green Investments

The Paris Agreement was the world's first climate agreement that involved the highest level of enforcement to date which augmented the level of urgency and commitment made by many of governments around the world. It significantly raised public awareness of climate risks and sentiment for green transition of the world economy. According to Degryse et al. (2022), the Agreement shifted the perception of investors in the financial market regarding climate change and its related risks. It materially changed the behaviors of investors in the way that they become more committed to contributing to green transition and this in turn resulted in high demand for green assets and investments. This is in line with the literature showing that in-

vestors react to political events related to firms' climate strategies. Ramelli et al. (2021) provide evidence that political events that focus on firms' climate strategies mobilise investors to shift their behavior. Seltzer et al. (2022) show that after the PA investors reevaluate their portfolios of bonds to take into consideration their climate risk exposure. Bolton and Kacperczyk (2021) document that, as concerns for environment grows, investors ask for a premium on stocks when firms are highly exposed to environmental risks.

Related literature is on the reasons why institutional investors would react to the political initiation on climate risk and adopt more climate-friendly strategy, although this topic is beyond the scope of analysis in this paper. Previous studies suggest both pecuniary and non-pecuniary motives. For example, "doing well by doing good" by Benabou and Tirole (2010) mainly suggests pecuniary motives while to the survey-based evidence by Krueger et al. (2020) suggest more mixed motivations that investors responds to climate risks because of fear of both reputation loss and financial implications for portfolio firms. The underlying assumption in the two streams of argument is that financial market investors indeed react to the topical issues in our society such as climate change.

In line with the literature on sustainable investing, we consider the Paris Agreement an exogenous shock on the investors' demand for green loans and test whether non-bank lenders' increased demand for green investment promotes an increase in green lending by financial intermediaries. Following Degryse et al. (2022), we use the Paris Accord agreement date, December 12, 2015, as the critical date and design a differences-in-differences (DID) analysis that measures whether banks' origination of green loans increases when the loans contains a tranche that caters to investors' demand. To capture the effect of the PA on investor sentiment, we restrict our sample to tranches that are originated between 2012 and 2019. All our tests employ lender-time, borrower-industry, and borrower-country fixed effects. This is to account for the increasing demand for green investments in general and the impact of the Paris agreements on bank's behaviour as documented in the recent literature (among others, Degryse et al. (2022) and Delis et al. (2019)). The fixed effects also allows us to control for industry-related and country-specific factors to count for different green regulations and macro conditions. As institutional investors

are more likely to be invited to join a syndicate when the loans are organised to finance larger projects, we restrict our sample to large size loans.

Most of the evidence on institutional investors and their climate-related responses relates to their portfolio decision with references to financial markets (stocks and bonds) rather than capital markets, while our paper is on the latter market. One could argue that for these investors to participate in lending markets it would require enormous efforts to being able to evaluate borrowers' projects as well as the climate risks associated with each of them, which are even more difficult to price and hedge. While this is true to some extent, recent evidence document the key role, as well as significant presence, of non-bank lenders in main lending markets, suggesting that they have better expertise that expected (Irani et al. (2021) for corporate loans, Gopal and Schnabl (2022) for small business lending, Buchak et al. (2018) for mortgage lending). More recently, Chernenko et al. (2022) documents their increasing role as direct lenders, especially to smaller, younger, less profitable and more R&D intensive firms. We continue this discussion and emphasize the role of NBFIs in capital markets.

We recognise that non-bank lending is partially accelerated by the possibility to securitize. This is especially true in the corporate lending markets where loans are often sold to CLO managers (Gallo and Park, 2022). Structured finance vehicles such as CLOs that are the main buyers of corporate loans on the secondary market started adopting climate friendly investment principle. This is shown in a CLO manager's report submitted to Capital IQ: "We haven't written ESG criteria into our CLO documentation, but we have ESG watch flags in our investment processes. Lots of institutional investors are stressing the importance of it, but it needs to be clear that this should not only be a marketing strategy to boost reputation." In our additional test, we explore this alternative explanation for the presence of non-bank lenders in the green lending market, i.e. the ability to securitize the loans via CLO (Collateralized Loan Obligation) market.

Table 3 presents characteristics for loans that include non-bank lenders' participation, i.e. they include an institutional loan tranche (Term B) vs loans without this tranche, comparing

the pre- and post-Paris Agreement periods. Panel A includes all loans in our sample and shows that loans with Term B have larger size after the PA compared to the non-Term B loans, and this difference is primarily driven by green loans (Panel B). The average spread is higher for loans with Term B, but it decreases for green loans after the PA. Loans with Term B tends to require more often a collateral than other loans, and this seems also true for green loans, without a notable difference between the two periods. Covenants decrease for all loans after PA but less for green loans with Term B, while for these loans the maturity increases while decreasing for the rest of the sample. Overall, this preliminary evidence suggest that institutional investors' participation after the PA is associated with longer maturity, more covenants, lower average spread but larger amounts. In the primary market (Panel C), when there is non-bank lenders' direct participation in the syndicate of Term B, we find that the loans tend to be smaller and even smaller after the PA. Their presence is associated with an higher average spread with a marginal increase after the PA. They finance loans with shorter maturity and less covenants after the PA, and also join syndicate with fewer other lenders. Overall, they seems to prefer smaller projects, both in terms of size and number of participants, but riskier.

3 Empirical Models and Results

Our empirical approach is based on the idea that NBFI participation facilitates banks' origination of green loans. That is, under the impact of the PA on investors' preferences for sustainable investments, NBFIs have incentives to partner with banks and finance the Term B tranches of syndicated loans with green purposes more than for loans without green purpose. In this section, we provide the regression models and their results.

3.1 Institutional Loan Tranche (Term B) and Green Purpose Lending

To verify whether non-bank lenders' participation increase green financing, we start using the following pre-post analysis:

$$Green_{i,b,l,t} = \alpha + \beta \cdot Post + FE + X_i + \varepsilon_{i,b,l,t} \tag{1}$$

The outcome variable $Green_{i,b,l,t}$ is a binary indicator whether a loan deal i given to a borrower b by a lender l originated in quarter t is green lending or not according to the loan purpose remark reported in DealScan. It is equal to 1 if the debt financing is specifically used for green transition purposes such as construction or acquisition of wind farms or solar power facilities or financing of hydroelectric generating facilities, and 0 otherwise. The explanatory variable of interest, *Post*, is equal to 1 for post-Paris Agreement (after Dec 12th, 2015), and 0 otherwise. Therefore, β captures whether likelihood of green lending changes post-Paris Agreement. *FE* stands for various fixed effects included in the model: lender fixed effects to control for the lender-specific decision to lend, borrowers' industry and country fixed effect to control for industry- and country-specific time-invariant features that can influence lending-borrowing activities. Depending on the model, lender-time fixed effects replace lender fixed effects to control for the lender-quarter specific effects.

Insert Tables 4 here

The results are reported in Table 4 columns (1) and (2). The coefficient for *Post* is positive although not significant. After the Paris Agreement the likelihood that one would encounter a green-purpose loan in the syndicated loan market appears to go up marginally. The result can be driven both by the demand of the borrowers as well as increased willingness to supply green financing by originating banks. We do not necessarily differentiate these two effects at this stage. The main focus of this paper is to investigate whether such increase in green financing is supported by a more active involvement of non-bank lenders in the corporate loan market, which we test in the next regression.

To test non-bank lenders' involvement in green financing, we set up the following differences-in-differences (DID) model by augmenting the previous model with an interaction term between *Post* and an indicator of whether an institutional loan tranche is included in a loan, *Term B*.

$$Green_{i,b,l,t} = \alpha + \beta Post \cdot TermB_i + FE + X_i + \varepsilon_{i,b,l,t} \tag{2}$$

$TermB_i$ is equal to 1 if a deal i contains Term Loan B that is designed to be either invested by or sold to institutional investors. Therefore, β, measures whether the likelihood of being a

green loan is higher in case the loan contains the type of tranches that are more likely to be participated by non-bank lenders post-PA. Lender-time (quarter), borrower country and borrower industry fixed effects are included.

As presented in Table 4 columns (3) and (4), the coefficient for the interaction term is positive and significant at 1% or 5% level depending on the model, indicating that when a deal contains loan tranches that involves non-bank lenders' participation, it is more likely to be a green-purpose loans after the Paris Agreement. Interestingly, the coefficient for Term B is negative and significant, indicating that before the PA, those deals with institutional tranches were less likely to be green deals. This result presents the lack of interests on or even avoidance of green financing among institutional investors before the Paris Agreement, which in turn proves how dramatically the PA changed non-bank lenders' appetite for green financing in the corporate loan market.

The involvement of non-bank lenders in the syndicated market can be either their direct supply of debt financing as a participating lender of the Term B or indirect one as an ultimate buyer of the Term B in the secondary market. The result in this section shows that whichever format of non-bank involvement it may be, their participation in the corporate lending market accelerates origination of green loans. In next test, we differentiate these two different levels of involvements by non-bank lenders to further prove the green pressure that non-bank lenders bring to the corporate lending market.

3.2 Non-bank Lenders in Term B and Green Purpose Lending

In this section, we adopt an approach to directly measure the non-banks' interests to hold or take over (purchase) a specific tranche of a corporate loan, i.e. the presence of non-bank lender in the syndicate of the institutional loan trance (Term B). Term B is typically sold to non-bank institutional investors in the secondary market for corporate loans soon after syndication (Blickle et al., 2020). Less often, non-bank lenders can have a direct involvement in the primary market of the tranche through their participation as a lender in Term B. This guarantees them

a better control over the conditions of the tranches as well as on trading of the tranche on the secondary market. Therefore, we interpret the non-bank institutional investors' participation in the primary market for Term B as a proxy for a stronger interest in participating the loan and test whether non-bank lenders' interests to hold a tranche of a green-purpose loan increases after the Paris Agreement. The test is as follows:

$$Green_{i,b,l,t} = \alpha + \beta Post \cdot Non - bankTermB_i + FE + X_i + \varepsilon_{i,b,l,t} \tag{3}$$

The interaction term between $Post$ and $Non - bankTermB_i$ in the above DID model measures whether a loan is more likely to be a green-purpose loan when there is non-bank lenders' participation in the institutional tranche Term B, i.e. when non-bank lenders have interests to hold that tranche, after the PA.

Insert Tables 5 here

The results are presented in Table 5. We run the model firstly using the full sample of loans in columns (1) and (2). As shown in the model with controls, non-bank lenders' presence in the syndicate of Term B is less likely in green purpose loans before the Paris Agreement (-0.009**). However, their interests for green lending becomes positive and significant after the Paris Agreement (0.007**). In columns (3) and (4), we limit the sample to those loans which contain Term B. The reason for limiting the sample is to improve the comparison within the same type of loans, since loans with Term B and loans without Term B can be different from each other in terms of lender composition, borrower characteristics and/or deal characteristics. Within this more homogeneous sample of loans, we find consistent results that institutional investors' interests in the primary market for green lending significantly increases. In terms of magnitude, the increase in their interests almost cancels out the lack of interests in the pre-period. The results are reinforced both in magnitude and significance within the comparison of loans that contain Term Bs, i.e. when we compare the loans that have non-bank participation for its Term B tranches to other loans that equally contained Term B but without non-bank lenders' involvement in them. This effect being reinforced in cleaner comparison confirms that non-bank lenders' participation in the syndicate of Term B tends to lead to increased green financing in the corporate lending market.

3.3 Robustness Test: Falsification Test based on a Placebo Shock

In this section, we run a falsification test that repeats the main analyses (Equations (2) and (3)) using a placebo shock by moving the Paris Agreement 4 years prior to the actual date, i.e., we assume that the Paris Agreement was announced on December 12, 2011 instead of December 12, 2015. The design of the test is similar to Degryse et al. (2022). The purpose of this robustness test is to show that our main finding, an increase of NBFI's participation in green lending after the PA, is indeed a reaction to the major call for green transition of economies advocated by the Paris Agreement. By finding no significant results in an adjacent but different sample period, we show that our finding is not due to a simple time trend in the recent decade in which NBFIs increased participation in corporate lending, but is due to the significant shift of investors' perspective on green financing that followed the Paris Agreement.

The sample period of the falsification test is 4 years prior to the main analysis period: 2008-2015 with a placebo shock set on December 12, 2011. We verify that there is no significant event on or around this date that would have influenced the perception of global warming, green transition, and green financing.

Insert Tables 6 here

The analysis repeats the regressions in Tables 4 and 5 using the new sample period and the results are presented in Tables 6. Unlike when we use the Paris Agreement as a shock, there is no significant increase in green lending after the placebo shock as shown in columns (1) and (2). In differences-in-differences analysis on the deals that contain Term B, we find that non-banks' interests for syndicated loan market do not increase the likelihood of a loan deal being green after the placebo shock. These prove that our finding is not simply capturing a time trend in green lending or in non-bank participation in green lending.

3.4 Reversed Treatment (US Withdrawal from the Paris Agreement)

In this section, we present an additional test that is based on a reverse treatment of green pressure: the Trump administration's withdrawal from the Paris agreement in the US. On June 1, 2017, the ex-president of the US, Donald Trump, announced US's withdrawal from the Paris Agreement that was agreed two years before. This event can be seen a reverse treatment in our experimental set-up given that it imposes the opposite sentiment towards the green transition requirement in the economy in comparison to the Paris Agreement.

This analysis allows us to investigate the mechanism behind the increased partnership between bank and NBFIs towards green financing that we document soon after the Paris Agreement. On one hand, if the reason behind the NBFIs' increased investment into green lending after the PA is investors' genuine concern towards the need of green transition, we hypothesize that such increasing trend in green lending by these institutions would be unaffected regardless of the US government's announcement of the withdrawal from the climate agreement. On the other hand, if the reason for increasing green lending was simply based on the transition risk concerning potential regulatory disadvantages for brown investments, we hypothesize that the appetite for green assets may subdue after the withdrawal announcement of the US government that signalled that such regulatory disadvantages are not imminent.

To analyse, we limit the sample to the US loan deals where the treatment is valid. We also limit the sample period to the post-Paris Agreement period to avoid confounding effects created from pre-post difference resulting from the PA. The sample period is therefore from 13 Dec 2015 to December 2018 which is approximately 1.5 years before the US withdrawal and 1.5 years after.

Insert Tables 7 here

Table 7 presents the results. $Post - PAwithdrawal$ in columns (1) and (2) presents the pre-post analysis of the event which shows that there was no significant impact on the percentage of green loans in the syndicated loan market from the withdrawal event. However, the differences-in-differences analysis in columns (3) and (4) shows that NBFIs, therefore institu-

tional investors, are no longer more likely to participate in green lending after the withdrawal of the US from the Paris Agreement. While this result emphasizes the robustness of the main findings that the Paris Agreement was effective in inducing institutional investors to invest more in green financing, it also shows that the interests were rather transient and were motivated more from the transition risks rather than interests to finance green transition.

4 Conclusion

The recent literature on NBFI has confirmed their dominant role as financiers in several lending markets, including SME, corporate and mortgage markets. Also in relation to green lending, they are expected to play a key role as they face increasing pressure from more climate aware clients. At the same time, they are less regulated and, more importantly, own less legacy in the brown economy than banks. Moreover, the scale of investments around the world to achieve low carbon is so vast that the balance sheets of banks are not going to be able to cope. In this paper, we report on the partnership between banks and non-bank lenders in the corporate lending market, and document that green loan financing is facilitated by participation of non-bank lenders in either the primary or the secondary market of corporate loans via the so called institutional loan tranche, i.e. the tranche designed to cater to institutional investors' demand. Our evidence is based on a novel approach to identify green loans that rely on the loan purpose, avoiding the increasing concerns on the use of ESG-scores and their noise. Our measure is also less likely to be biased by greenwashing attempts and allows us to capture green lending for both public and private firms. As the measure is loan-level, it captures green loans for the transition of any type of firms (green and non-green; public and private).

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Table 1: Time Trend of Green and non-Green Lending

	2012	2013	2014	2015	2016	2017	2018	2019	N or %
No of Loans	1,008	1,221	1,275	1,029	958	1,144	1,184	1,003	8,822
No of Non-Green loans	998	1,215	1,246	993	938	1,128	1,148	972	8,638
No of Green loans	10	6	29	36	20	16	36	31	184
as % to all loans	1.00%	0.49%	2.33%	3.63%	2.13%	1.42%	3.14%	3.19%	2.13%
No of "solar" loans	0	0	16	13	8	7	5	12	0.7.%
No of "wind" loans	6	4	3	18	12	4	18	20	1.00%
No of "electric" loans	2	4	9	8	4	4	10	5	0.52%
No of "photovoltaic" loans	0	0	0	0	0	0	2	1	0.03%
No of "hydro" loans	0	1	0	0	1	2	0	4	1.00%
No of "renewables" loans	0	0	0	0	0	1	3	1	0.06%
No of other types of green loans	1	0	0	1	0	1	0	0	0.03%

This table reports yearly statistics of green and non-green loans for the sample period. Number of loans is the count of each type of loans while percentage is yearly proportion of each type of loan in the year's sample.

Table 2: Loan Characteristics and Difference-in-means Test

Panel A: All Sample					
	Non-Green Loans		*Green Loans*		
	Mean	St Dev	Mean	St Dev	Diff. test
Loan Amount	1066.24	2177.35	835.53	1184.60	230.72
Spread	351.92	175.88	324.56	188.39	27.36
Maturity	75.86	30.73	90.41	60.29	-14.55***
N of Lenders	7.52	6.66	5.88	3.54	1.64***
Secured	0.60	0.49	0.22	0.41	0.38***
Covenants	0.19	0.40	0.08	0.27	0.12***
Observations	8638		184		8822
Panel B: Loans With Term B					
	Non-Green Loans		*Green Loans*		
	Mean	St Dev	Mean	St Dev	Diff. test
Loan Amount	1090.43	1330.22	2107.86	1779.26	-1017.43***
Spread	437.98	146.97	386.57	140.56	51.42**
Maturity	86.55	20.96	88.87	10.76	-2.32
N of Lenders	6.77	6.25	7.46	3.55	-0.69
Secured	0.99	0.11	0.92	0.28	0.07***
Covenants	0.19	0.39	0.11	0.31	0.08
Observations	4123		37		4160

This table reports summary statistics for the sample of loans in the analyses. The sample excludes sydnicated deals that contain revolving tranches only. Panel A presents the summary for all loans and Panel B presents the summary a subgroup of loans that contain institutional tranche, Term B. In each panel, green loans and non-green loans are compared for the following characteristics: loan amount which is total deal size (sum of all tranches in a deal), spread which is average of spreads of tranches in a deal, maturity which is number of months from loan start to end date, number of lenders, secured which is 1 if a loan is collateralized and 0 otherwise, and covenants which is strictness of loan covenant measured according to Bradley and Roberts (2015). T-test results are presented in the final column that show whether the values are statistically different between green and non-green loans.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Investors' Participation around the Paris Agreement (PA)

Panel A: All Sample	With Term B		Without Term B	
	Pre PA	Post PA	Pre PA	Post PA
Loan Amount	955.07	1245.29	968.75	1089.00
Avg. Spread (bp)	446.81	428.11	272.77	254.46
Maturity	88.14	85.00	72.26	60.89
Concentration	6.95	6.59	8.84	7.37
Secured	0.99	0.99	0.26	0.21
Covenants	0.25	0.14	0.25	0.12
% of Green loans	0.62%	1.16%	2.43%	3.91%
Panel B: Loans with Green Purpose	With Term B		Without Term B	
	Pre PA	Post PA	Pre PA	Post PA
Loan Amount	893.84	2765.46	732.64	373.63
Avg. Spread (bp)	509.62	313.86	351.36	171.83
Maturity	84.68	90.97	96.97	87.05
Concentration	5.54	8.50	6.95	4.53
Secured	0.92	0.92	0.09	0.01
Covenants	0.15	0.08	0.14	0.02
Panel C: Loans with Non-bank Lenders	With Term B		Without Term B	
in the syndicate of Term B	Pre PA	Post PA	Pre PA	Post PA
Loan Amount	853.84	620.21	962.22	1346.31
Avg. Spread (bp)	488.46	494.44	443.96	417.48
Maturity	86.29	79.37	88.27	85.91
Concentration	5.84	3.59	7.02	7.08
Secured	0.99	1.00	0.99	0.98
Covenants	0.12	0.08	0.26	0.15

This table compares summary statistics for syndicated loan sample with and without institutional tranche, Term B. Panel A presents all sample summary statistics, while Panel B and Panel C restricts the sample to green purpose loans and loans with non-bank participation in Term B, respectively. In each panel, loans with and without Term B are compared for the following characteristics: loan amount which is total deal size (sum of all tranches in a deal), spread which is average of spreads of tranches in a deal, maturity which is number of months from loan start to end date, number of lenders, secured which is 1 if a loan is collateralized and 0 otherwise, and covenants which is strictness of loan covenant measured according to Bradley and Roberts (2015).

Table 4: Green lending with investor participation after the Paris Agreement

	Loans with Green Purpose			
	(1)	(2)	(3)	(4)
Post-PA	0.005	0.002		
	(0.003)	(0.003)		
Deals w/Term B			-0.013***	-0.014***
			(0.004)	(0.003)
Post X Deals w/Term B			0.016**	0.019***
			(0.008)	(0.007)
Spread		0.000		0.000**
		(0.000)		(0.000)
Ln(Deal Amount)		0.005***		0.005***
		(0.001)		(0.001)
Ln(Maturity)		0.002		0.001
		(0.003)		(0.003)
N of Lead Arrangers		-0.001		0.002
		(0.001)		(0.001)
Observations	9943	8964	8822	8016
Adjusted R^2	0.293	0.143	0.317	0.097
FE: Borrower-Industry, Borrower-Country, Lender	Y	Y	N	N
FE: Borrower-Industry, Borrower-Country, Time X Lender	N	N	Y	Y

This table reports the regression results of Equations (1) and (2). The sample consists of all syndicated loan deals originated between 2012 and 2019 except those that contain only revolving loans. The explanatory variable is *Post* in columns (1) and (2), which is equal to 1 for the period after the Paris Agreement (December 12, 2015) and 0 otherwise. In columns (3) and (4), the main explanatory variable is the interaction term between *Post* and *Loan Deals with Term B* which is equal to 1 if the loan contains Term B tranche and 0 otherwise. The dependent variable is a binary variable that indicates whether the loan is green-purpose lending that is equal to 1 for green loans and 0 otherwise. In columns (2) and (4), the following control variables are included: log-transformed deal amount, log-transformed maturity, number of lead arrangers in the loan deal, and covenant dummy which is equal to 1 if covenant is included in a loan. Borrower-industry, borrower-country, and time and lender fixed effects are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Green Lending Post-Paris Agreement: Non-bank Lender Participation

	Loans with Green Purpose			
	All Deals		Deals with Term B	
	(1)	(2)	(3)	(4)
Non-bank lenders in Term B	-0.005	-0.009**	-0.009	-0.013**
	(0.005)	(0.004)	(0.006)	(0.006)
Post X Non-bank lenders in Term B	0.005	0.007**	0.008**	0.011**
	(0.003)	(0.003)	(0.004)	(0.005)
Spread		0.000*		-0.000
		(0.000)		(0.000)
Ln(Loan Amount)		0.005***		0.008***
		(0.002)		(0.002)
Ln(Maturity)		-0.000		-0.001
		(0.003)		(0.005)
N of Lead Arrangers		0.002*		0.004***
		(0.001)		(0.001)
Covenant Dummy		-0.006*		-0.008**
		(0.003)		(0.004)
Observations	8822	8016	3904	3840
Adjusted R^2	0.316	0.095	0.085	0.091
FE: Borrower-Industry, Borrower-Country, Time X Lender	Y	Y	Y	Y

This table reports the regression results of Equation (3). In columns (1) and (2), the sample consists of all syndicated loan deals originated between 2012 and 2019 except those that contain only revolving loans. In columns (3) and (4), the sample is restricted to those loans that contain Term B tranche. The main explanatory variable is the interaction term between *Post*, which is equal to 1 for the period after the Paris Agreement (December 12, 2015) and 0 otherwise, and *Non-bank lender in Term B*, which is equal to 1 if a non-bank lender directly participates in the Term B tranche in a loan deal. The dependent variable is a binary variable that indicates whether the loan is green-purpose lending that is equal to 1 for green loans and 0 otherwise. In columns (2) and (4), the following control variables are included: log-transformed deal amount, log-transformed maturity, number of lead arrangers in the loan deal, and covenant dummy which is equal to 1 if covenant is included in a loan. Borrower-industry, borrower-country, and time and lender fixed effects are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Falsification Test: Green lending with investor participation after a placebo shock

	Loans with Green Purpose			
	(1)	(2)	(3)	(4)
Placebo Shock	0.003	-0.002		
	(0.003)	(0.003)		
Deals w/Term B			-0.007*	-0.014***
			(0.004)	(0.004)
Placebo Shock X Deals w/Term B			-0.002	0.003
			(0.005)	(0.005)
Spread		0.000		0.000***
		(0.000)		(0.000)
Ln(Deal Amount)		0.004***		0.005***
		(0.001)		(0.001)
Ln(Maturity)		-0.002		-0.001
		(0.003)		(0.003)
N of Lead Arrangers		-0.001		0.001
		(0.002)		(0.002)
Covenant Dummy		-0.004		-0.004
		(0.003)		(0.003)
Observations	8521	7766	7526	6912
Adjusted R^2	0.265	0.124	0.290	0.188
FE: Borrower-Industry, Borrower-Country, Lender	Y	Y	N	N
FE: Borrower-Industry, Borrower-Country, Time X Lender	N	N	Y	Y

This table reports the regression results of Equations (1) and (2). The sample consists of all syndicated loan deals originated between 2008 and 2015 except those that contain only revolving loans. The explanatory variable is *Post* in columns (1) and (2), which is equal to 1 for the period after December 12, 2011, which is a placebo shock created by moving the Paris Agreement 4 years prior to the actual date, and 0 otherwise. In columns (3) and (4), the main explanatory variable is the interaction term between *Post* and *Loan Deals with Term B* which is equal to 1 if the loan contains Term B tranche and 0 otherwise. The dependent variable is a binary variable that indicates whether the loan is green-purpose lending that is equal to 1 for green loans and 0 otherwise. In columns (2) and (4), the following control variables are included: log-transformed deal amount, log-transformed maturity, number of lead arrangers in the loan deal, and covenant dummy which is equal to 1 if covenant is included in a loan. Borrower-industry, borrower-country, and time and lender fixed effects are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Reversed Treatment: Trump Withdrawal from the Paris Agreement

	Loans with Green Purpose			
	(1)	(2)	(3)	(4)
Post-PA withdrawal	0.003	-0.004		
	(0.005)	(0.004)		
Deals w/Term B			0.014	0.018**
			(0.011)	(0.007)
Post-PA withdrawal X Deals w/Term B			-0.010	-0.016
			(0.012)	(0.010)
Spread		-0.000**		-0.000
		(0.000)		(0.000)
Ln(Deal Amount)		0.002		0.004
		(0.003)		(0.003)
Ln(Maturity)		0.012***		0.003
		(0.003)		(0.003)
N of Lead Arrangers		0.005		0.011***
		(0.004)		(0.003)
Covenant Dummy		-0.017***		-0.009
		(0.006)		(0.006)
Observations	3868	3356	3426	3014
Adjusted R^2	0.340	0.169	0.364	0.174
FE: Borrower-Industry, Borrower-Country, Lender	Y	Y	N	N
FE: Borrower-Industry, Borrower-Country, Time X Lender	N	N	Y	Y

This table reports the regression results of Equations (1) and (2). The sample consists of all syndicated loan deals originated between 2008 and 2015 except those that contain only revolving loans. The explanatory variable is *Post* in columns (1) and (2), which is equal to 1 for the period after December 12, 2011, which is a placebo shock created by moving the Paris Agreement 4 years prior to the actual date, and 0 otherwise. In columns (3) and (4), the main explanatory variable is the interaction term between *Post* and *Loan Deals with Term B* which is equal to 1 if the loan contains Term B tranche and 0 otherwise. The dependent variable is a binary variable that indicates whether the loan is green-purpose lending that is equal to 1 for green loans and 0 otherwise. In columns (2) and (4), the following control variables are included: log-transformed deal amount, log-transformed maturity, number of lead arrangers in the loan deal, and covenant dummy which is equal to 1 if covenant is included in a loan. Borrower-industry, borrower-country, and time and lender fixed effects are included. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$