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RESEARCH ARTICLE

Climate policy and cross-border lending: evidence from the syndicated loan market

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ABSTRACT

Do cross-country differences in climate policy influence bank lending? This paper focusses on the period 2007–2017 and uses syndicated loan-level data to examine if the stringency of home-country climate policies increases cross-border bank lending. Loan fixed effects allow us to disentangle loan demand from supply and to control for unobserved and observed loan and firm characteristics. I find evidence that a strict home-country climate policy is associated with an increase in banks' cross-border loan shares. This suggests that the transition to a low-carbon economy might be threatened if global coordination between governments is not enforced.

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Cross-border lending; climate policy; syndicated loans

Introduction

Climate change is not new to the attention of researchers and policymakers. The first inter-governmental attempt to contain global warming was made with the ratification of the Kyoto Protocol, followed by the signature of the well-known Paris Agreement in 2016. Nonetheless, not all governments have the same climate ambition and the heterogeneity in the stringency of their policies might affect both firms' competitiveness in seeking external finance and the funding choices of financiers. If new climate laws impose limitations on pollution or require firms to adopt technologies to make their production processes more climate-friendly, do banks increase their lending to foreign firms as a response to limitations imposed by the home-country climate policy? Ultimately, this is a key question since bank lending can threaten efforts towards green societies in a world with cross-country differences in climate policy.[1]

In this paper, I study the link between home-country climate policies and cross-border bank lending using the syndicated loan market as an empirical laboratory and considering two recent empirical findings as the main motivation to the analysis. De Haas and Popov (2019) show that countries with market-based financial systems (hereafter 'market countries') are better placed in fostering green investments than countries with bank-based financial systems (henceforth called 'bank countries') which instead allocate

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funds towards polluting industries. They find that stock markets tend to reallocate investments towards more carbon-efficient sectors and facilitate the adoption of clean technologies in polluting industries. Thus, if bank countries are more prone to invest in carbon-intensive sectors, can it be that banks are more willing to lend to foreign firms when they assess their home-country climate policy to be too stringent? Some foreign firms may be less exposed to climate-induced changes and ultimately be less burned by climate regulation-induced costs. Second, Krueger, Sautner, and Starks (2020) report that investors believe that transition risks are already materialised.[2] Thus, banks may find it more convenient to provide funds to foreign firms located in countries with weak climate policies rather than to firms located in their domestic market. To analyse the link between climate policy and cross-border lending, I use global syndicated loans extended by banks from 47 countries in a ten-year time horizon. The choice of the syndicated loan market as a laboratory of analysis is not trivial. First, syndicates are groups of financial institutions that jointly provide large loans to corporations, and they are one of the main channels of cross-border financing to developed and emerging countries (De Haas and Van Horen 2013). Second, small lenders might benefit from the information advantages of the larger banks involved in the syndicate, so that they can diversify risks across countries and borrowers to which they otherwise would not have access (Cerutti, Hale, and Minoiu 2015). Finally, syndicated loans have a medium-term maturity and carbon-intensive sectors are largely bank debt financed (De Haas and Popov 2019; Delis, De Greiff, and Ongena 2019). All in all, cross-border lending activities induced by the stringency of climate policy are likely to be conducted in the form of syndicated loans.

I find evidence that banks increase their cross-border loan shares in the presence of cross-country differences in climate policy. Results are robust to controlling for loan fixed effects, suggesting that this is not driven by borrowers' characteristics or other time-invariant factors that affect the loan formation. Importantly, the inclusion of loan fixed effects ensures that credit supply is isolated by controlling for borrowers' credit demand determinants.

This paper contributes to the growing body of research that studies how climate-related risks affect banks' financing decisions. Recent studies show that investors have started pricing the 'stranded assets risk' stemming from fossil fuel reserves (Delis, De Greiff, and Ongena 2019; Atanasova and Schwartz 2019) as oil producers are heavily exposed to the risk of being unable to burn all their reserves in cases of stricter climate policies. Research also suggests that banks are technologically conservative since innovation involves assets that are difficult to collateralise (Minetti 2011; Hsu, Tian, and Xu 2014). Dell'Ariccia et al. (2017) provide evidence that banks reallocate their portfolios from firms investing in intangible assets towards real estate assets. This study adds to this literature by studying if the home-country climate policy is a driver for cross-border bank lending.

This paper also contributes to the strand of literature that examines cross-border lending incentives. Previous studies show that banks are less willing to lend to physically and culturally distant firms as screening and monitoring activities are costly (Mian 2006). Due to monitoring efforts required to alleviate agency problems in a lending relationship (Holmstrom and Tirole 1997), banks engage less in foreign loans. As a

result, syndicates tend to be relatively concentrated and composed of domestic banks that are geographically close to the borrowing firms (Lin et al. 2012). I show that differences in climate policy between countries induce banks to increase their cross-border lending.

Finally, this study fits in the literature on regulatory arbitrage by bringing in a novel form of regulatory inconsistency: differences in climate policy between countries. The extant research shows that differences in regulation may lead agents to engage in arbitrage behaviours. Ongena, Popov, and Udell (2013) examine whether stricter home-country regulation and supervision induce banks to increase their risk-taking abroad, particularly in their subsidiaries' host countries. Houston, Lin, and Ma (2012) find evidence that banks transfer funds in countries with fewer regulations, while Karolyi and Taboada (2015) show that bank regulation influences cross-border bank acquisitions as these flows involve banks from countries with stricter regulation. In this study, I find evidence that banks increase their cross-border lending if they are located in a country with a strict climate policy, meaning that banks do not find it profitable to lend 'at home' and so increase their lending abroad.

The remainder of this paper is organised as follows. First, empirical methods are described. The next section introduces the sample construction and data used for the analysis, followed by a discussion of the empirical results. Then, robustness checks to the main results are presented. The final section concludes.

The empirical strategy

To study if a strict home-country climate policy is associated with an increase in cross-border loan shares within a syndicated loan, I use the following cross-country specification:

$$Loan\ Share_{b,l,f,t} = \alpha_l + \beta_1 Climate\ policy_{c,t-1} + \beta_2 \boldsymbol{X}_{b,l,t-1} + \beta_3 \boldsymbol{Z}_{c,t-1} + \varepsilon_{b,l,f,t} \quad (1)$$

where $Loan\ Share_{b,l,f,t}$ is the dependent variable of interest, namely the loan share held by bank b in loan l to firm f in year t. The main regressor is $Climate\ policy_{c,t-1}$ which measures the stringency of the climate policy of the country where the bank is located (hereafter 'lender-country') and which is indexed by c. Lagged values of *Climate Policy* account for the fact that financing decisions may consider policies already implemented. $\boldsymbol{X}_{b,l,t-1}$ comprises bank-level controls, such as bank size, represented by *log (Total assets)*, bank capital ratio (i.e. *Tier 1 capital ratio*), and whether the bank has a subsidiary in the country where the borrower operates (hereafter 'borrower-country'). $\boldsymbol{Z}_{c,t-1}$ contains the lender-country's macroeconomic variables to control for specific country characteristics. Particularly, I control for the lender-country's currency appreciation (*Exchange rate return*), economic growth (*GDP per capita*), financial development (*Domestic credit to GDP*), and unemployment level (*Unemployment rate*). Control variables are lagged to alleviate possible endogeneity concerns. α_l denotes the vector of loan fixed effects and ε is the remainder disturbance. Finally, standard errors are clustered at the loan level to account for the serial correlation between originated loans. Here I focus only on cross-border loan shares, meaning that banks and firms are

located in different countries. Thus, if cross-border bank lending relates to the stringency of the climate policy in the bank's home-country, we should observe $\beta_1 > 0$.

The key identification challenge is to disentangle the demand from the supply of bank credit. To this aim, I include loan fixed effects which saturate the model by controlling for unobserved and observed, time-variant and time-invariant, loans' and borrowers' characteristics. Importantly, this allows us to isolate the supply of credit by controlling for demand-driven aspects. The inclusion of loan fixed effects is powerful: it ameliorates the omitted variable concern from the demand side.

Data

Data and sample construction

This section describes data and the construction of main variables and then presents descriptive statistics of the sample.

Loan data

Cross-border lending data come from the LPC Dealscan database. Dealscan includes the most comprehensive loan-deal information at a global level. The unit of observation is a loan or facility, which is usually grouped into deals or packages. I gathered data on bank loans with details on lenders' share and name, loan maturity and amount, loan origination date, the name of borrowers, presence of collateral and covenants, name of the banks, among other characteristics. Raw data are available from 1987 till March 2019; however, I restricted the analysis to the sample of loans that originated between 2007 and 2017 due to the availability of climate policy data. The Dealscan data consist of dollar-denominated loans made by banks (e.g. commercial and investment banks) and non-banks (e.g. insurance companies and pension funds). I restricted the analysis to loans made to non-financial firms by commercial, savings, cooperative, and investment banks.[3] Moreover, I split each loan into portions provided by the syndicate members to obtain granular loan-level data. The variable of interest is the cross-border loan share; the time unit of observation is the year of loan origination. Dealscan contains full information on shares for each bank, which involves about 27% of all loan portions included in the sample. I dropped all observations for which there is a missing lender's share and for which I found an incorrect entry (lender share >100%, which involved about 49 observations). The choice to retain only observed loan shares aims at reducing the noise in the sample.

For each bank, I used loan shares both to calculate banks' loan portions and to reconstruct the country distribution of cross-border bank lending.[4] I defined cross-border lending as loans where the nationality of the parent bank is different from the nationality of the borrower company. Therefore, my analysis focusses only on loan shares financed by parent banks rather than loan shares financed via subsidiaries and/or branches. As noted in De Haas and Van Horen (2013), subsidiaries typically do not participate in syndicated loans as the involved amounts are too large for their balance sheet, and therefore, funds are provided directly by the bank headquarters. However, they are often involved by providing the parent bank with local information (De Haas and Van Horen 2013). For this reason, I identified bank subsidiaries and branches

using information available in Dealscan to control for banks' willingness to lend to firms located in a country where their subsidiaries/branches operate.

Bank and firm data

To obtain financial data, I matched borrowers in the Dealscan loan-level sample to the Compustat North America and Global database following Chava and Roberts (2008). In particular, I used their Dealscan-Compustat link table to match Dealscan and Compustat borrowers' identifiers.[5] The Compustat database provides details both on the country where the company headquarters is located and the country where the company is legally registered. I used the former as a criterion to identify the borrower-country.[6] I merged data on borrower characteristics in the year of the loan origination. In particular, I successfully matched 43% of the loan-level sample. To classify the lender-country, I also followed a two-step procedure. First, I relied on the Dealscan-Compustat lender-link table provided by Schwert (2018).[7] I matched the Dealscan sample and the lender-link table by using both a lender's Dealscan identifier and the date of loan origination to associate each lender with the corresponding unique Compustat identifier.[8] Second, to recover information on all unmatched lenders, I identified each lender's ultimate parent bank with the Dealscan information on the bank ownership structure.[9]

Macroeconomic data

Cross-border bank lending can be affected by the economic conditions in the lender-country. To alleviate this concern, I matched the Dealscan-Compustat sample with macroeconomic (country-year) variables gathered from the Worldwide Governance Indicators and the IMF International Financial Statistics. To control for factors that capture the economic development at the country level, which may affect the supply of credit, I controlled for GDP per capita. I also included the annual exchange rate of return and the ratio of domestic credit to GDP to control for both currency appreciation and a country's financial development. Finally, I controlled for labour market development using the unemployment rate.

Climate policy data

As argued in Delis, De Greiff, and Ongena (2019), the measurement of the stringency of a country's climate policy should account for both the ambition and the effort of the government policy itself. The former is measured by the efficiency of the policy, while the latter is measured by the effectiveness of the policy in reaching specific outcomes. To proxy for the country-level stringency of a climate policy, I used the Climate Change Performance Index (CCPI) developed by Germanwatch, a non-governmental organisation (Burck et al. 2020). This index, which is available for the period 2007–2017, covers 58 countries and takes values in the interval [0,100] (the higher the score, the more stringent is the climate effort and outcome of the given country).[10] Specifically, it is constructed out of 15 measurements classified into five categories: emissions (60%), renewable energies (10%), energy efficiency (10%), and climate policy (20%).[11] I removed all the observations for which I could not obtain the climate policy score of lender- and borrower-countries.

Descriptive statistics

In this section, I present basic summary statistics of the sample and main variables of analysis. Table 1 lists all 47 lender-countries (regions) in the sample, and it shows summary statistics of the CCPI score per country (region) over the period 2007–2017. European countries seem to be more ambitious in terms of climate policy, with Scandinavian countries standing out. The country with the highest average CCPI score is Sweden (65.536),

Table 1. Climate Change Performance Index by country (region).

Country (region)	Mean	Std. Dev.	Min.	Max.
Argentina	51.282	1.816	47.163	51.968
Australia	39.659	2.863	33.824	44.894
Austria	50.149	3.048	44.863	54.473
Belgium	59.540	3.559	54.526	66.812
Brazil	58.076	4.795	52.463	65.061
Canada	37.967	2.563	32.717	43.056
China	47.813	2.695	44.360	55.091
Cyprus	55.090	8.600	45.522	65.196
Denmark	64.617	7.764	51.329	76.620
Egypt	56.717	2.430	52.800	60.029
Finland	53.265	5.898	43.761	58.394
France	60.492	3.546	54.645	66.167
Germany	60.082	3.291	56.577	68.229
Greece	48.711	2.904	45.165	55.311
Hungary	59.419	2.465	55.055	62.061
India	59.823	3.561	53.561	64.962
Indonesia	57.096	1.976	54.653	60.943
Ireland	54.463	4.860	48.854	63.078
Israel	54.186	3.466	51.624	59.474
Italy	53.618	5.592	43.995	60.721
Japan	45.223	4.518	35.929	49.470
Luxembourg	41.963	11.058	31.185	62.865
Latvia	61.165	0.000	61.165	61.165
Malaysia	46.578	2.293	43.725	52.581
Mexico	58.411	1.074	55.960	59.198
Morocco	60.831	2.867	56.565	64.100
Netherlands	53.060	3.336	44.447	57.096
New Zealand	54.302	2.184	52.411	56.193
Norway	56.999	3.597	50.399	62.408
Poland	50.262	3.816	45.742	56.138
Portugal	58.922	3.123	54.628	65.619
Romania	58.384	4.835	51.140	60.967
Russia	46.846	3.396	42.589	53.357
Saudi Arabia	29.744	6.891	22.848	41.837
Singapore	50.370	3.764	43.972	56.269
Slovenia	52.474	4.400	49.359	59.508
South Africa	49.600	2.596	46.099	56.167
South Korea	44.447	4.036	37.207	49.278
Spain	53.320	3.385	47.907	57.628
Sweden	65.536	2.477	60.272	70.470
Switzerland	60.410	3.122	55.328	64.930
Taiwan of China	44.637	0.960	43.388	46.167
Thailand	54.594	2.613	49.408	59.024
Turkey	49.868	4.686	42.937	60.988
Ukraine	49.770	0.645	48.938	50.187
United Kingdom	64.269	4.084	59.173	70.814
United States	44.782	7.130	31.295	55.478
Total	53.067	9.771	22.848	76.620

Notes: This table lists all 47 lender-countries (regions) in the sample and shows summary statistics (mean, standard deviation, minimum, and maximum) of the Climate Change Performance Index (CCPI) of each country (region). The period of the analysis is from 2007 to 2017.

followed by Denmark (64.617) and the United Kingdom (64.269). Denmark also achieved the highest CCPI score (76.620) within the sample and over the period of analysis. On the other hand, advanced economies, such as the United States, Canada, and Australia, have been assigned relatively low scores.[12] Table 1 shows cross-country heterogeneity, which provides a solid ground to conduct an analysis and test the hypothesis of interest. Figure 1 illustrates the evolution of the CCPI scores over time of eight selected countries within the sample. Table A1 provides definitions of the variables, while descriptive statistics are presented in Table 2. The whole sample comprises a total of 44,521 cross-border bank loan shares (loan shares financed both by parent banks and their subsidiaries). The average cross-border loan share is 12.23%, the loan maturity (reported in the log) corresponds to about 54 months (4.5 years) and almost half of the syndicated loans are securitised. Almost 18% of the cross-border loan shares are financed via bank subsidiaries and, as expected, banks participating in the syndicated loan market are big in their size (total assets). The average CCPI score for lender-countries is higher than the average CCPI score of borrower-countries (52.511 and 48.644, respectively). Arguably, banks that participate in the syndicated loan market are located in countries that are on average more stringent in terms of climate policy than the countries where their borrowers operate. This may show a pattern in favour of the main hypothesis.

Results

Home-country climate policies and cross-border lending

Table 3 reports the results for Equation (1) and shows that the stringency of the home-country climate policy is positively associated with cross-border lending. Column (1) reports results when controlling for bank-level and lender-country characteristics. No statistically significant relationship is found when running this specification. However,

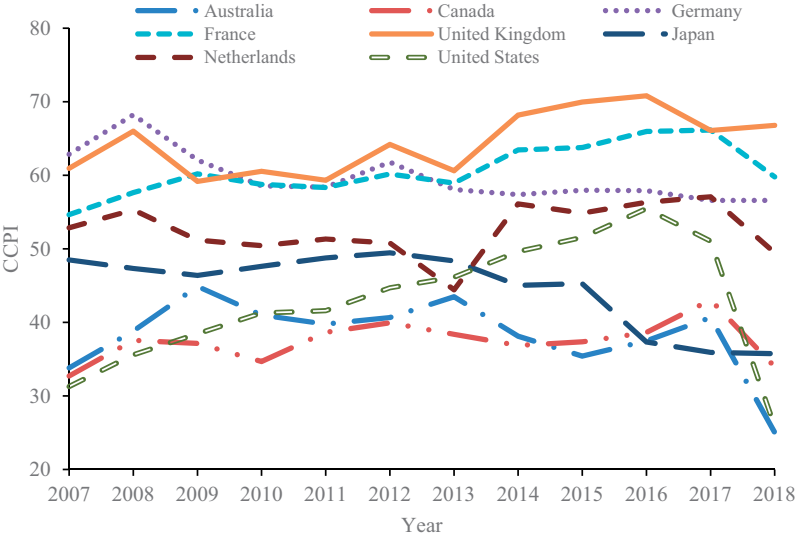

Figure 1. Climate Change Performance Index over time.
Note: This figure illustrates the evolution of the Climate Change Performance Index over time for eight countries.

Table 2. Descriptive statistics: firm, bank, loan, and country characteristics.

	No. Obs.	Mean	Std. Dev.	Min.	Max.
Climate policy (lender-country)	44,521	52.511	9.553	22.847	76.619
Climate policy (borrower-country)	44,521	48.644	8.825	22.847	76.619
Loan share (%)	44,521	12.229	19.746	0	100
Loan characteristics					
log (Maturity)	44,078	3.812	0.580	0	6.216
Collateral	26,618	0.471	0.499	0	1
Firm characteristics					
ROA	44,352	0.106	0.266	−23.578	0.931
log (Total assets)	44,359	9.147	1.754	−3.963	13.586
Tangibility	44,353	0.361	0.259	0	0.983
Leverage	43,375	0.036	3.075	0	312.704
Bank characteristics					
log (Total assets)	22,870	14.215	0.687	9.212	15.142
Tier 1 capital ratio (%)	21,451	12.310	2.024	6.380	19.700
Have a subsidiary	44,521	0.184	0.387	0	1
Lender-country characteristics					
Domestic credit to GDP (%)	38,102	134.867	36.298	13.823	248.185
log (GDP per capita)	41,481	10.600	0.566	6.906	11.685
Exchange rate return (%)	41,481	−0.008	0.056	−0.402	0.137
Unemployment rate (%)	41,481	7.037	4.007	0.488	27.070

Notes: This table shows descriptive statistics (mean, standard deviation, minimum, maximum, and number of observations) for main variables at the loan, bank, lender-country, and firm levels. All variables are for the period 2007 to 2017. For variable definitions, see Table A1.

Table 3. The home-country climate policy and cross-border lending.

	(1)	(2)	(3)	(4)	(5)
Climate policy (lender-country)	0.033 [0.023]	0.029*** [0.003]	0.020*** [0.003]	0.027*** [0.005]	0.040*** [0.006]
log (GDP per capita)	6.191*** [1.447]		0.584*** [0.070]		−2.169*** [0.474]
Domestic credit to GDP	−0.006 [0.007]		0.006*** [0.001]		0.007*** [0.001]
Unemployment rate	−0.155*** [0.055]		−0.031*** [0.008]		−0.119*** [0.019]
Exchange rate return	1.960 [2.611]		0.927* [0.501]		5.386*** [0.761]
log (Total assets)	1.250*** [0.184]			−0.032 [0.060]	−0.185*** [0.056]
Tier 1 capital ratio	−0.597*** [0.122]			0.177*** [0.036]	0.162*** [0.044]
Have a subsidiary					0.949*** [0.255]
Observations	7,957	33,345	27,633	7,999	6,379
R-squared	0.014	0.773	0.808	0.772	0.825
Lender-country controls	Yes	No	Yes	No	Yes
Bank controls	Yes	No	No	Yes	Yes
Loan FE	No	Yes	Yes	Yes	Yes
Dep. var. mean	0.1223	0.1223	0.1223	0.1223	0.1223

Notes: This table shows results for Equation (1). The dependent variable is the cross-border loan share (%). The regressor of interest is *Climate policy (lender-country)* which measures the stringency of the bank's home-country climate policy. Column (1) includes controls but not fixed effects. Columns (2)–(5) include loan fixed effects and add controls at stages. Column (5) reports results from the most saturated version of Equation (1). Standard errors are clustered at the loan level in all specifications. For variable definitions, see Table A1.

when loan fixed effects are included, the coefficients become statistically significant, as shown in Columns (2)–(5). Column (2) reports results when only loan fixed effects are included. Columns (3) and (4) show results when lender-country and bank-specific characteristics are respectively controlled for. Comparing Columns (2) and (4), the size of the sample reduces (this is because only a small part of bank characteristics in the sample was successfully matched), however, the coefficient remains highly statistically significant. Column (5) reports results when the most saturated version of the specification is run, that is, when not only macroeconomic and bank-level characteristics but also the presence of a bank subsidiary in the borrower-country are controlled for. As

illustrated in Column (5), the inclusion of the dummy variable *Have a subsidiary* has an effect on the magnitude of the coefficient of the regressor *Climate policy*, signalling its importance for cross-border lending activities.

Finally, standard errors at the loan level are clustered in all specifications. Specifically, the most saturated version of the baseline specification is run on 2,012 clusters. Clustering at the loan level accounts for the correlations of all loan shares within each given loan and accounts for common random shocks to all banks engaging in that specific loan (Abadie et al. 2017).[13]

The main result, which is consistent across specifications, is that an increase in the CCPI score of lender-countries is associated with an increase in the cross-border loan shares that banks are willing to finance in a syndicated loan. The coefficient has the expected sign, is statistically significant, and is economically relevant: an increase in the CCPI score by one standard deviation increases the cross-border loan shares financed by a given bank by ($9.55 \times 0.040 =$) 0.382 percentage points. This finding supports the hypothesis that the stricter the lender-country's climate policy, the greater the cross-border loan shares, namely the bank's willingness to provide credit within a syndicate to foreign borrowers.

Robustness tests

This section presents robustness tests to check whether the main results are sensitive to changes in variable definitions or estimation techniques. Results are shown in Tables A2 and A3 in Appendices. The analysis of the relationship between the stringency of home-country climate policies and cross-border bank lending builds on full information on the loan breakdown in the Dealscan data. Precisely, I retained only observed loan shares to reduce the noise in the estimation. However, many empirical studies deal with missing lending shares by dividing the loan equally among syndicate members (De Haas and Van Horen 2013; Doerr and Schaz 2021).

In this section, I follow the literature and leverage this rule to impute missing lending shares, and to check the sensitivity of the main results. In particular, both in cases where the lending shares are all missing and in cases with only partial information on loan shares, I split the loan shares on an equal basis among all banks in a syndicate (De Haas and Van Horen 2013; Doerr and Schaz 2021). Table A2 shows that, when these loan portions are included, the sample increases; the results continue to hold (the coefficient is highly statistically significant and positive, though it decreases in magnitude). In the baseline regression, I estimate standard errors with clustering at the loan level. In Table A3, standard errors are alternatively clustered on both the lender-country levels, as shown in Columns (1)–(4), and the bank and lender-country, as shown in Columns (5)–(8). This estimation procedure drastically reduces the number of clusters and accounts for the fact that there can be a random component common to all shares originated by banks located in the same country (Abadie et al. 2017). Notably, the main coefficient of interest of the home-country climate policy remains statistically significant at conventional levels, as well as with the same magnitude and sign.

Conclusion

This paper provides evidence that climate policy is a driver for cross-border bank lending. Specifically, it studies the link between the cross-border credit supply and the stringency of a bank's home-country climate policy using the syndicated loan market as a laboratory of analysis. Indeed, costs stemming from new climate regulation may incentivise banks to take advantage of cross-country differences in climate policy and lend more to foreign firms. This conjecture is well-supported by the literature and by recent empirical findings provided by De Haas and Popov (2019) and Krueger, Sautner, and Starks (2020).

This study finds evidence that banks increase their cross-border loan shares if their home-country has a stringent climate policy. To mitigate the omitted variable bias, this paper saturates the main model with loan fixed effects, allowing us to isolate credit supply from credit demand, and to control for (un)observed loan and firm characteristics. Results show that a one standard deviation increase in climate policy induces banks to increase their cross-border loan shares by almost 0.4 percentage points. This evidence is robust to alternative estimation techniques and variable definitions.

The findings of this paper can facilitate the discussion on how policymakers can better identify the recipients of their climate rules in an environment where the lack of policy harmonisation might threaten the 'dream' of a carbon-free society.

Notes

1. The extant literature shows that the lack of regulatory uniformity among jurisdictions may induce agents to engage in regulatory arbitrage behaviours. For a survey of the literature on regulatory arbitrage, see Carruthers and Lamoreaux (2016).
2. Climate policy stringency belongs to the 'transition risks' category, see Ginglinger (2020) for more details on climate-related risks.
3. For lenders' choice, I followed Doerr and Schaz (2021) and considered as a bank all lenders defined in Dealscan as Commercial Banks, Finance Companies, Investment Banks, Mortgage Banks, Thrift/S&L, and Trust Companies. For borrowing companies, I followed the literature and excluded borrowers with SIC between 6,000 and 6,999 from the sample.
4. This allowed me to carry a loan-bank-firm level analysis.
5. The link table can be accessed through the following link: http://finance.wharton.upenn.edu/~mrrobert/styled-9/styled-12/index.html.
6. A company may be registered in a country different from the one where it is actually conducting business operations due to fiscal reasons.
7. In particular, the lender-link table, which can be accessed through https://wrds-www.wharton.upenn.edu/pages/data/contributed-data/dealscan-lender-link-tables/, allowed me to match all Dealscan lenders with at least 50 loans or at least US$10 billion in loan volume to the corresponding Compustat data. Importantly, the lender-link table accounts for bank mergers over time.
8. Specifically, I matched Compustat lenders' identifiers and the Dealscan sample with the year of the loan issuance as the reference time. This means that the sample is constructed such that the lender-country is identified accounting for banks' mergers as well.
9. As noted by Gao and Jang (2021), Dealscan provides information on the most recent ownership status (the latest ultimate parent bank) for all lenders and for the whole time period covered in the database. I dealt with these very few cases by re-assigning loans to ultimate parent banks and, to control for incorrect matching in a given year, I checked if

a bank and its parent bank were assigned to different countries in a given year. If that was the case, I identified the acquiring bank and the year of merger by checking in news articles.

10. The publicly available CCPI scores include changes in the methodology of calculation applied by Germanwatch from 2013 onwards. Thanks to the Germanwatch team, I received a CCPI dataset based on a uniform weighting on each index component.
11. Of the measurements, 80% are based on objective data; the remaining 20% on national and international climate policies are based on subjective assessments made by about 300 experts and non-governmental organisations from the respective countries. Other studies used the CCPI score for the same end, see Delis, De Greiff, and Ongena (2019), among others.
12. These countries are also those where both domestic banks and firms participate actively in the syndicated loan market.
13. In robustness tests, I checked the sensitivity of the main results to different standard error estimation techniques.

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References

Abadie, Alberto, Susan Athey, Guido W. Imbens, and Jeffrey Wooldridge. 2017. "When Should You Adjust Standard Errors for Clustering?" National Bureau of Economic Research Working Paper No. 24003.

Atanasova, Christina, and Eduardo S. Schwartz. 2019. "Stranded Fossil Fuel Reserves and Firm Value." National Bureau of Economic Research Working Paper No. 26497.

Burck, Jan, Ursula Hagen, Christoph Bais, Violeta Helling, Niklas Höhne, and Leonardo Nascimento. 2020. "Climate Change Performance Index: Background and Methodology." Germanwatch e. V., NewClimate Institute, and Climate Action Network-International. https://germanwatch.org/sites/default/files/CCPI_2020_Background%20and%20Methodology.pdf

Carruthers, Bruce G., and Naomi R. Lamoreaux. 2016. "Regulatory Races: The Effects of Jurisdictional Competition on Regulatory Standards." *Journal of Economic Literature* 54 (1): 52–97.

Cerutti, Eugenio, Galina Hale, and Camelia Minoiu. 2015. "Financial Crises and the Composition of Cross-border Lending." *Journal of International Money and Finance* 52 (C): 60–81.

Chava, Sudheer, and Michael R. Roberts. 2008. "How Does Financing Impact Investment? The Role of Debt Covenants." *The Journal of Finance* 63 (5): 2085–2121.

De Haas, Ralph, and Alexander A. Popov. 2019. "Finance and Carbon Emissions." European Central Bank Working Paper Series No. 2318.

De Haas, Ralph, and Neeltje Van Horen. 2013. "Running for the Exit? International Bank Lending during a Financial Crisis." *Review of Financial Studies* 26 (1): 244–285.

Delis, Manthos D., Kathrin De Greiff, and Steven Ongena. 2019. "Being Stranded with Fossil Fuel Reserves? Climate Policy Risk and the Pricing of Bank Loans." Swiss Finance Institute Research Paper No. 18-10.

Dell'Ariccia, Giovanni, Dalida Kadyrzhanova, Camelia Minoiu, and Lev Ratnovski. 2017. "Bank Lending in the Knowledge Economy." International Monetary Fund Working Paper No. 17/234.

Doerr, Sebastian, and Philipp Schaz. 2021. "Geographic Diversification and Bank Lending during Crises." *Journal of Financial Economics* 140 (3): 768–788.

Gao, Janet, and Yeejin Jang. 2021. "What Drives Global Lending Syndication? Effects of Cross-country Capital Regulation Gaps." *Review of Finance* 25 (2): 519–559.

Ginglinger, Edith. 2020. "Climate Risk and Finance." *Bankers, Markets & Investors* 160 (1): 44–50.

Holmstrom, Bengt, and Jean Tirole. 1997. "Financial Intermediation, Loanable Funds, and the Real Sector." *The Quarterly Journal of Economics* 112 (3): 663–691.

Houston, Joel F., Chen Lin, and Yue Ma. 2012. "Regulatory Arbitrage and International Bank Flows." *The Journal of Finance* 67 (5): 1845–1895.

Hsu, Po-Hsuan, Xuan Tian, and Yan Xu. 2014. "Financial Development and Innovation: Cross-country Evidence." *Journal of Financial Economics* 112 (1): 116–135.

Karolyi, Andrew G., and Alvaro G. Taboada. 2015. "Regulatory Arbitrage and Cross-border Bank Acquisitions." *The Journal of Finance* 70 (6): 2395–2450.

Krueger, Philipp, Zacharias Sautner, and Laura T. Starks. 2020. "The Importance of Climate Risks for Institutional Investors." *The Review of Financial Studies* 33 (3): 1067–1111.

Lin, Chen, Yue Ma, Paul Malatesta, and Yuhai Xuan. 2012. "Corporate Ownership Structure and Bank Loan Syndicate Structure." *Journal of Financial Economics* 104 (1): 1–22.

Mian, Atif. 2006. "Distance Constraints: The Limits of Foreign Lending in Poor Economies." *The Journal of Finance* 61 (3): 1465–1505.

Minetti, Raoul. 2011. "Informed Finance and Technological Conservatism." *Review of Finance* 15 (3): 633–692.

Ongena, Steven, Alexander A. Popov, and Gregory F. Udell. 2013. "When the Cat's Away the Mice Will Play': Does Regulation at Home Affect Bank Risk-taking Abroad?" *Journal of Financial Economics* 108 (3): 727–750.

Schwert, Michael. 2018. "Bank Capital and Lending Relationships." *The Journal of Finance* 73 (2): 787–830.

Appendices

Table A1. Variable definitions.

Variable name	Source	Description
General		
Climate policy	Germanwatch	Country-level climate policy both at the lender- and the borrower-country proxied by the Climate Change Performance Index
Loan level		
Loan share (%)	Dealscan	Cross-border loan share in % values financed by syndicated loan participants
log (Maturity)	Dealscan	Log of loan duration in months
Collateral	Dealscan	Dummy: equal to 1 if the loan is secured; 0 otherwise
Borrower level		
log (Total assets)	Compustat	Log of total assets in USD millions
ROA	Compustat	Ratio of net income to total assets
Leverage	Compustat	Ratio of book value of total debt to book value of total assets
Tangibility	Compustat	Ratio of tangible fixed assets (net property, plant, and equipment) to total assets
Bank-country level		
Domestic credit to GDP (%)	World Bank	Domestic credit to private sectors as % of GDP at the country-year level
log (GDP per capita)	World Bank	Log of gross domestic product divided by mid-year population at the country-year level
Unemployment rate (%)	World Bank	Unemployment rate at the country-year level
Exchange rate return (%)	World Bank and IMF	The annual real exchange rate return of a local currency against a weighted average of foreign currencies, divided by the price deflator
Bank level		
Tier 1 capital ratio (%)	Compustat	Risk adjusted capital ratio in % values
log (Total assets)	Compustat	Log of total assets in USD millions
Have a subsidiary	Dealscan	Dummy: equal to 1 if the bank has a subsidiary in the borrower-country; 0 otherwise

Notes: This table shows variable definitions. The period of analysis is from 2007 to 2017.

Table A2. The home-country climate policy and cross-border lending: alternative definition of loan share.

	(1)	(2)	(3)	(4)	(5)
Climate policy (lender-country)	0.032*** [0.008]	0.010*** [0.001]	0.007*** [0.001]	0.007*** [0.002]	0.013*** [0.003]
log (GDP per capita)	5.498*** [0.562]		0.211*** [0.035]		−0.824*** [0.156]
Domestic credit to GDP	0.000 [0.003]		0.002*** [0.000]		0.003*** [0.001]
Exchange rate return	−0.893 [1.072]		0.179 [0.229]		1.610*** [0.305]
Unemployment rate	0.126*** [0.024]		−0.010*** [0.004]		−0.035*** [0.008]
log (Total assets)	0.307*** [0.074]			−0.018 [0.022]	−0.054** [0.023]
Tier 1 capital ratio	−0.207*** [0.041]			0.074*** [0.017]	0.078*** [0.020]
Have a subsidiary					0.329*** [0.071]
Observations	28,785	11,1837	97,659	27,016	21,692
R-squared	0.008	0.887	0.898	0.911	0.923
Lender-country controls	Yes	No	Yes	No	Yes
Bank controls	Yes	No	No	Yes	Yes
Loan FE	No	Yes	Yes	Yes	Yes
Dep. var. mean	0.1204	0.1204	0.1204	0.1204	0.1204

Notes: This table explores the robustness of the results to an alternative definition of loan share, following the literature. The dependent variable is the cross-border loan share of syndicate members (%). The regressor of interest is *Climate policy (lender-country)* which measures the stringency of the bank's home-country climate policy. Column (1) includes controls but not fixed effects. Columns (2)–(5) include loan fixed effects and add controls at stages. Column (5) reports results from the most saturated version of Equation (1). Standard errors are clustered at the loan level in all specifications. For variable definitions, see Table A1, and for loan share definition see the section on 'Robustness tests'.

Table A3. The home-country climate policy and cross-border lending: alternative clustering.

	Cluster on lender-country				Double-cluster on bank and lender-country			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Climate policy (lender-country)	0.029*	0.020**	0.027**	0.040***	0.029***	0.020**	0.027***	0.040***
	[0.016]	[0.009]	[0.011]	[0.008]	[0.009]	[0.008]	[0.009]	[0.008]
log (GDP per capita)		0.584***		−2.169**		0.584***		−2.169***
		[0.079]		[0.798]		[0.079]		[0.667]
Domestic credit to GDP		0.006**		0.007*		0.006**		0.007**
		[0.002]		[0.003]		[0.003]		[0.003]
Exchange rate return		0.927		5.386***		0.927		5.386***
		[0.903]		[1.080]		[0.630]		[0.884]
Unemployment rate		−0.031***		−0.119***		−0.031**		−0.119***
		[0.010]		[0.028]		[0.014]		[0.026]
log (Total assets)			−0.032	−0.185**			−0.032	−0.185*
			[0.084]	[0.081]			[0.098]	[0.102]
Tier 1 capital ratio			0.177*	0.162**			0.177***	0.162***
			[0.083]	[0.061]			[0.065]	[0.059]
Have a subsidiary				0.949				0.949***
				[0.647]				[0.346]
Observations	33,345	27,633	7,999	6,379	33,345	27,633	7,999	6,379
R-squared	0.773	0.808	0.772	0.825	0.773	0.808	0.772	0.825
Lender-country controls	No	Yes	No	Yes	No	Yes	No	Yes
Bank controls	No	No	Yes	Yes	No	No	Yes	Yes
Loan FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dep. var. mean	0.1223	0.1223	0.1223	0.1223	0.1223	0.1223	0.1223	0.1223

Notes: This table shows results for Equation (1) to explore robustness at alternative clustering levels. The dependent variable is the cross-border loan share (%). The regressor of interest is *Climate policy (lender-country)* which measures the stringency of the bank's home-country climate policy. Columns (1) and (5) include controls but not fixed effects. Columns (2)–(4) and (6)–(8) include loan fixed effects and add controls at stages. In Columns (1)–(4) standard errors are clustered at the lender-country level. In Columns (5)–(8) standard errors are double-clustered at the bank and lender-country levels. Columns (5) and (8) report results from the most saturated version of Equation (1). For variable definitions, see Table A1.