Banking and Climate Risks

Steven Ongena, *University of Zurich, Swiss Finance Institute, KU Leuven, NTNU Business School, CEPR*

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What are the different forms of climate risks?

- Climate risk: the exposure to risks related to climate change

- Typically distinguish between three different forms:

  i. **Physical risks:** changes in the physical climate

  ii. **Transition risks:**

    a. **Technological risks:** technological innovations related to climate change that threaten existing business models

    b. **Regulatory risks:** changes in policies and regulations implemented to combat climate change

How do we measure climate risks?

- Most commonly used measures in the academic finance literature

- *Physical risks*:

    - Expected sea level rise
    - Abnormal temperature and precipitation
    - Extreme weather events (e.g., drought spells)
    - More generally incidence of natural disasters (floods, hurricanes, etc.)

- Technological and Regulatory *Transition risks*:

    - Quantified using greenhouse gas emissions
        - Scope 1: direct emissions from owned or controlled sources of the reporting company
        - Scope 2: Scope 2 emissions are indirect emissions from the generation of purchased energy
        - Scope 3: Scope 3 emissions are all indirect emissions not included in Scope 2 (e.g., use of products, supply chain, etc.)

    - Climate policy stringency exposure

Motivation
Debt financing ⇒ credit allocation ⇒ sustainable development ?

- Financiers could play a beneficial role in the green transition.
  - →Channeling of funds away from fossil fuel and pollution-generating technologies.
  - →Global investments of at least USD 6.9 trillion every year are required until 2030.

OECD, 2017

But financiers (banks) may not always play this beneficial role …

But banks may not always play this beneficial role …

Big banks are pumping billions into new oil and gas production despite net zero pledges, campaigners have said.

BBC

February 14, 2022

Banks including HSBC, Barclays and Deutsche Bank are still backing new oil and gas despite being part of a green banking group, ShareAction said.

Investors should force banks to demand green plans from fossil fuel firms before funding them, it said.

HSBC and Barclays said they were focused on achieving environmental goals.

"Net zero" means not adding to greenhouse gases already in the atmosphere by cutting and trying to balance out emissions.

"Somewhat helpful"	Sea level rise moderately priced	Lenders charge higher interest rates for mortgages on properties exposed to a greater risk of sea level rise. Nguyen, Ongena, Qi & Sila (*RF* forthcoming)
	Fossil fuel stranding priced only after Paris and by "green" banks	**All banks** hike the loan rate on syndicated loans to fossil fuel firms with reserves exposed to climate policy stringency, especially after 2015 (Paris COP 21), and especially "**green**" **banks** do so. Delis, de Greiff, Iosifidi & Ongena
"Maybe not so helpful …"	*Intertemporally*	Loan spreads for cap-and-trade participants in Phase III of the EU Emission Trading System fall by almost 25%. This decrease is almost entirely driven by low permit prices and the firms' proactiveness to store permits. Antoniou, Delis, Ongena & Tsoumas
	Within-business	**Captive banks** grant car loans at lower interest rate to diesel car buyers to modulate local diesel car driving restrictions. Beyene, Falagiarda, Ongena & Scopelliti
	Cross-border	**All banks** increase cross-border lending in response to higher climate policy stringency in their home countries, especially **large**, **lowly capitalized** banks with **high NPL ratios** and banks with **more experience in cross-border lending**. Benincasa, Kabas & Ongena
	Bond to bank	**Big banks** seemingly "lead manage" fossil fuel firms with reserves exposed to climate policy stringency from bond market to bank financing. **Too-big-to-strand? Political pressure?** Beyene, Delis, de Greiff & Ongena

Too-Big-To-Strand: Bond to Bank Substitution in the Transition to a Low-carbon Economy

Winta Beyene (*Zurich, SFI*)

Kathrin de Greiff *(SFI)*

Manthos D. Delis *(Montpellier Business School)*

Steven Ongena *(Zurich, SFI, KU Leuven, NTNU, CEPR)*

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OECD, 2017

- Stranded assets risk – Credit risk related to the re-valuation of carbon-intensive assets as a result of the transition to a low-carbon economy – …. Priced? Affects both market- and bank-based financing?

Batten et al., 2016; Schotten et al., 2016; Caldecott et al., 2016; European Systemic Risk Board, 2016

- Role of market- vs bank-based financing in promoting sustainable allocation of risk and funding. Literature so far has focused on (aggregate) stock markets vs banks.

Diamond & Rajan, AER 2009; Langfield & Pagano, EP 2016; De Haas & Popov, 2019

Focus on the Fossil Fuel Sector

- Much of the global stock of carbon emissions can be traced to a remarkably **small set of largely fossil fuel firms** located **upstream** in production chains reliant on carbon emissions.

Elmalt, Igan & Kirt, 2021; Heede, CC 2014

- Previous work using firm-level emissions has mostly focused on **scope 1 and 2 emissions**.

Reghezza, Altunbas, Rodríguez d'Acri, Marques-Ibanez & Spaggiari, 2021; Ginglinger & Moreau, 2020; Ilhan, Sautner, Vilkov, RFS 2021

- ESG investing has grown. Could ESG incentivize upstream firms to collectively slow production?

Krueger, Sautner & Starks, RFS 2020; Matos, 2020; Starks, 2020; Cornell & Damodaran, 2020

→ ESG scores do not appear to capture differences in emissions growth across large fossil fuel producers.

87 percent of all human-produced carbon dioxide emissions come from the burning of fossil fuels like coal, natural gas and oil (CO2HE, 2017).

Scope 1 covers direct emissions from owned or controlled sources. Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company. Scope 3 includes all other indirect emissions that occur in a company's value chain.

Motivation: Bond ⇒ Banks ?

- Substitutability corporate bonds and syndicated loans

  Becker & Ivashina, JME 2014; Kashyap, Lamont & Stein, QJE 1994; Faulkender & Petersen, RFS 2006; Crouzet, RES 2018

  → Banks «collecting» stranded asset risk more?

- Theoretical literature: Bank finance subject to more monitoring and screening. Still … banks may be «weak» on the environment compared to markets.

  - To date the banking system seems to only price pollution/stranding risk in a limited way.

    Delis, de Greiff, Iosifidi & Ongena, 2021; DeHaas & Popov, 2019; Banking on Climate Change, 2019

  - Banking sector development does not spur growth in innovation-intensive industries, but it has a significant effect on growth in industries with high external financing dependence.

    Brown, Martinsson & Petersen, JFI 2017

  - Bottom-up approach to climate action within the business community. While the impact of shareholder engagement is well supported in the literature, the impact of capital allocation is only partially supported.

    Huynh & Xia, JFQA forth; Kölbel, Leippold, Rillaerts & Wang, 2020

Motivation: Bond ⇒ Banks ⇒ Large Banks ?

Do banks create appropriate economic incentives to facilitate the transition to a green economy? Are some banks more shielded from transition risks?

- Large banks may be **less vulnerable** to carbon-intensive counterparties in their loan-portfolios.
  - Large banks are better able to **diversify risks** and are often subject to **higher capital requirements**.
  - **«Too-Big-to-Fail» (TBTF)**? → TBTF banks expect to be shielded from negative consequences of transition risks; incentive to take greater risks than they otherwise would ➔ Too Big To Strand?
  - Banks are **politically connected**? Responsive to national needs, and feel shielded and in control of the (politically determined) transition risks? Calomiris and Haber, 2014, *Fragile by design*

Overview of Paper: Do bond markets and banks redirect capital away from fossil fuel?

1. **Pricing of stranded asset risk** of fossil fuel firms by the corporate bond market and by banks.
   → Strong evidence of stranded asset risk being priced "more" by the corporate bond market than by banks.

2./3. **Bond to bank substitution**: If the bond market prices climate policy risk more than the banking sector, ceteris paribus, some firms who would issue bonds otherwise instead try to obtain bank loans.

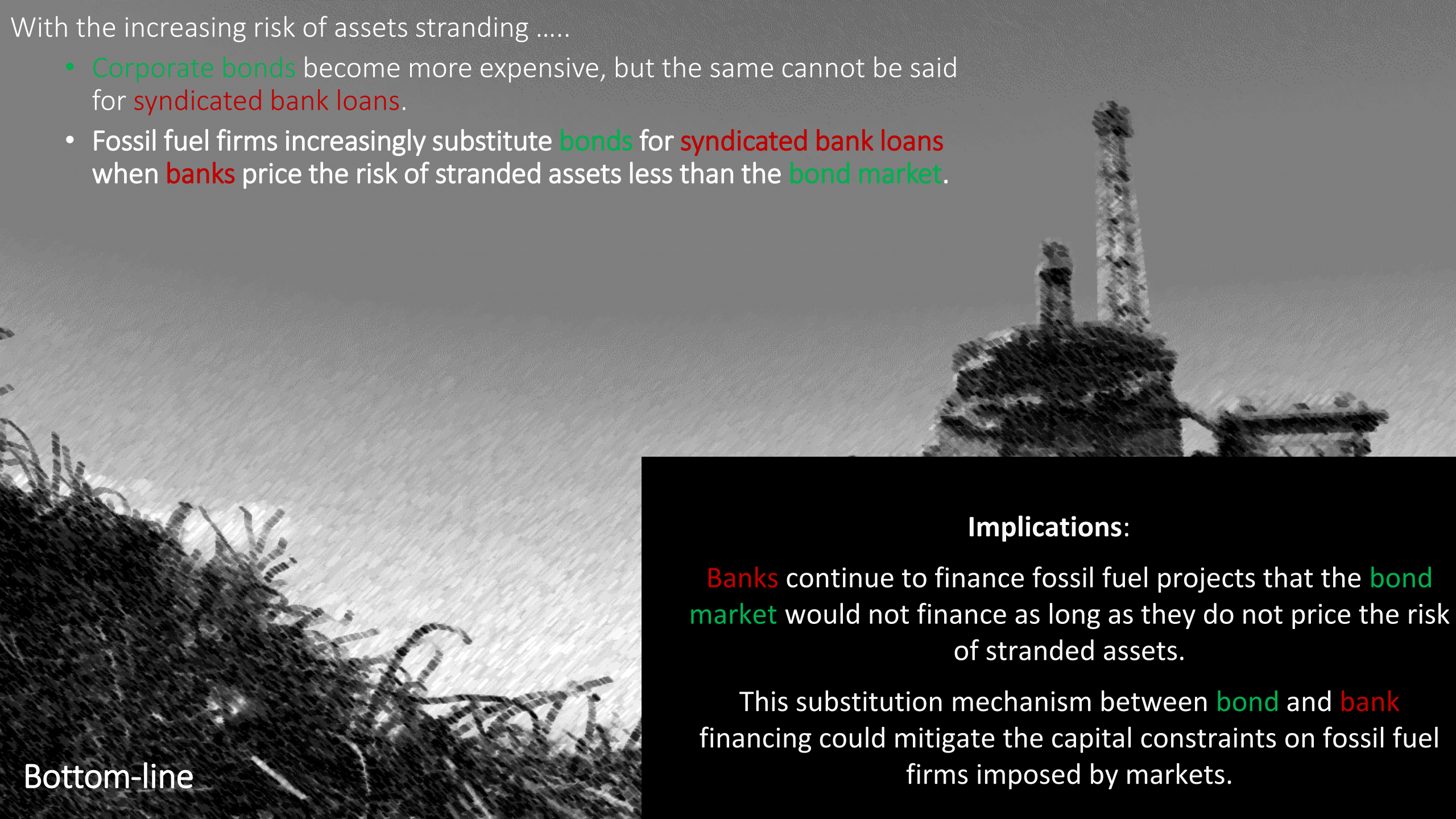
e.g., Rajan, JF, 1992; Becker & Ivashina, JME 2014

→ Fossil fuel firms substitute from issuing bonds to obtaining bank loans as their stranded asset risk exposures increase.

→ Bond-to-bank substitution is unlikely to arise from differences in banks that underwrite corporate bonds from banks that lead syndicated bank loans.

With the increasing risk of assets stranding …..

- Corporate bonds become more expensive, but the same cannot be said for syndicated bank loans.
- Fossil fuel firms increasingly substitute bonds for syndicated bank loans when banks price the risk of stranded assets less than the bond market.



Bottom-line

Implications:

Banks continue to finance fossil fuel projects that the bond market would not finance as long as they do not price the risk of stranded assets.

This substitution mechanism between bond and bank financing could mitigate the capital constraints on fossil fuel firms imposed by markets.

Overview of Paper: Do large banks redirect capital away from fossil fuel?

4. Heterogeneity among banks: Is stranded assets risk increasingly concentrated in a few large exposures for some large banks?

Too-Big-To-Strand (TBTS)?

→Across all syndicated loans, large banks acting as lead managers charge a lower all-in spread drawn than small banks do, and …

→There is a migration towards the very largest lead manager banks along fossil fuel firm's Climate Policy Exposure.

Bank characteristics related to bank size may influence banks' reaction in terms of lending and risk-taking to stranded asset risk impulses.

Implications:

Stranded assets risks may have shifted to large banks … at a net cost to society.

Observation: World's biggest banks fund fossil fuels with trillion-dollar finance.

Banking on Climate Change, 2019

Our Contribution

- Vigorously discussed: potential effect of the risk of stranded fossil fuel reserves on financial stability.

  Weyzig, Kuepper, van Gelder & van Tilburg 2014; Schoenmaker, van Tilburg & Wijffels 2015; Batten, Sowerbutts & Tanaka 2016

- But literature on the impact of stranded asset risk on firms' (bank) funding cost is still very limited.

  E.g., Atamasova & Schwartz, 2019; Delis, de Greiff, Iosifidi & Ongena, 2021

- Role of the two primary sources of debt - public bonds and private bank loans - in the climate transition.
  - New angle to literature on the interaction between the public and private debt
    - ***Reversal of usual pecking order*?**

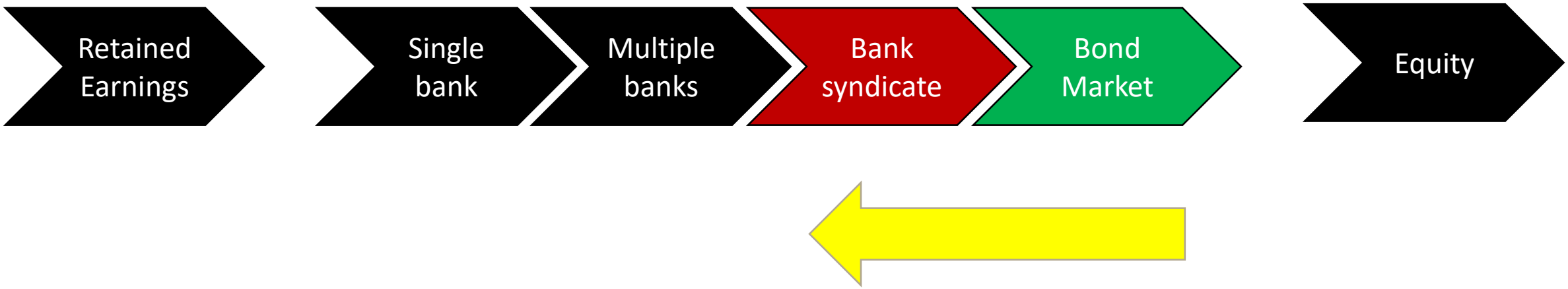
  E.g., Diamond, JPE 1991; Rajan, JF 1992; Chemmanur & Fulghieri, RFS 1994;
  Faulkender & Petersen RFS 2006; Rauh & Sufi, RFS 2010; Schwert, JF 2019

Pecking Order Theory
"Financial Graduation"

Increasing risk, hence increasing cost of financing →

→ Information asymmetry leading to higher cost of financing from external parties

Internal Financing	External Financing



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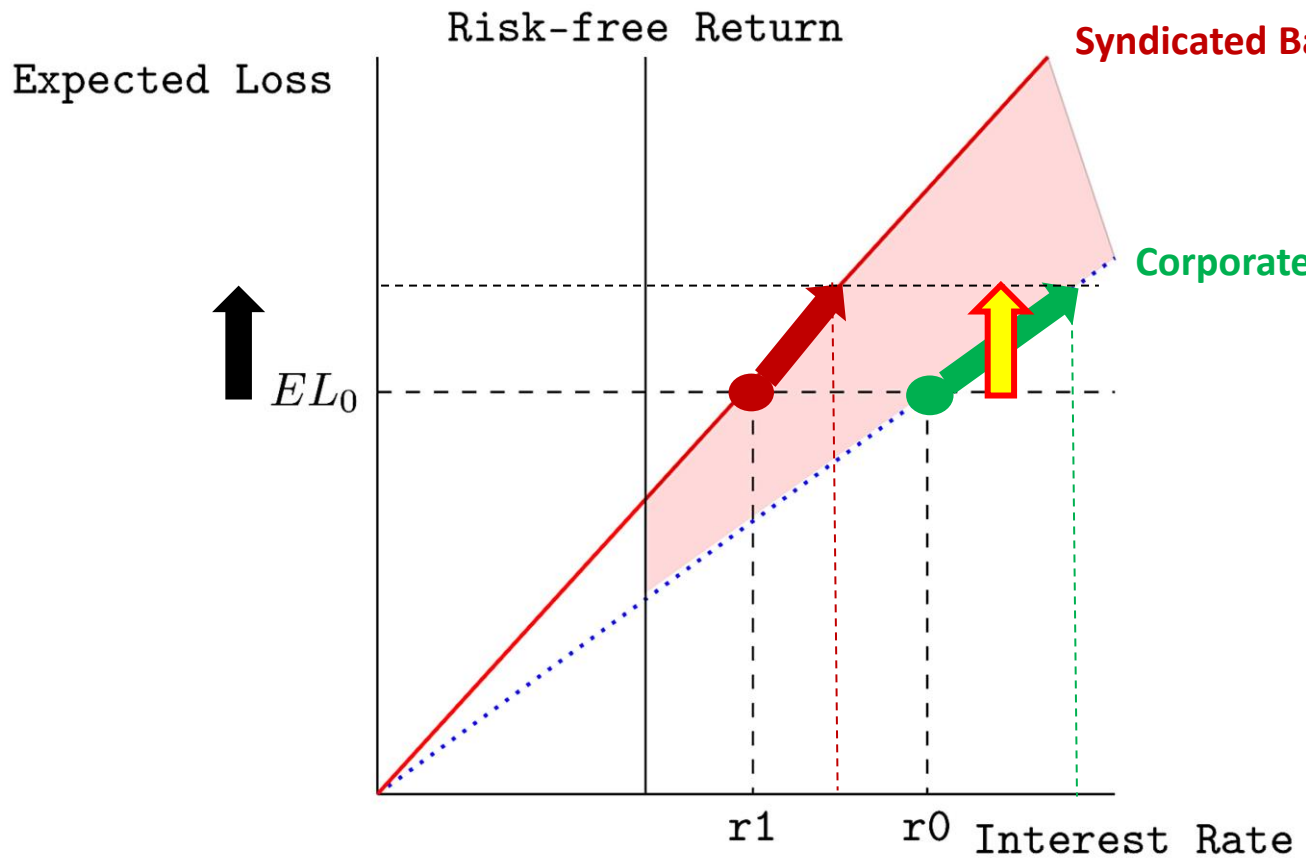
With Increasing Risk of Stranded Assets …

↑ Climate Policy Exposure ⇒ Δ Expected Loss > 0



Bonds charge more & extra

Stranding assets move to banks

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$$Climate\ Policy\ Exposure\ (CCPI)_{t,i} = \sum_c Relative\ Reserves_{t,i,c} \times CCPI_{t,c}$$

- Hand-collected firm-year data on the fossil fuel reserves of firms across countries, 2007-2018.
- Country-year climate policy index: Climate Change Performance Index (CCPI).

Burck, Hermwille & Bals (2016)

Location of Fossil Fuel Reserves 2007-2018

Country	Freq.	Country	Freq.
Algeria	4	Mauritania	3
Argentina	14	Malaysia	13
Australia	44	Mexico	9
Azerbaijan	1	Mongolia	4
Bangladesh	3	Morocco	1
Brazil	4	Myanmar	1
Bulgaria	2	New Zealand	2
Canada	381	Nigeria	4
China	18	Norway	33
Colombia	39	Netherlands	11
Congo	1	Oman	1
Czech Republic	5	Pakistan	3
Denmark	4	Peru	12
Vietnam	10	Papua New Guinea	6
Ecuador	8	Poland	6
Egypt	22	Romania	1
Equatorial Guinea	4	Russia	25
France	10	South Africa	3
Gabon	6	Sudan	2
Germany	3	Syria	2
India	26	Thailand	4
Indonesia	29	Trinidad and Tobago	3
Ireland	8	Tunisia	7
Iraq	1	Turkey	2
Israel	6	United Kingdom	47
Italy	5	United States of America	748
Kazakhstan	3	Venezuela	1
Libya	2	Yemen	4
		Observations	1222

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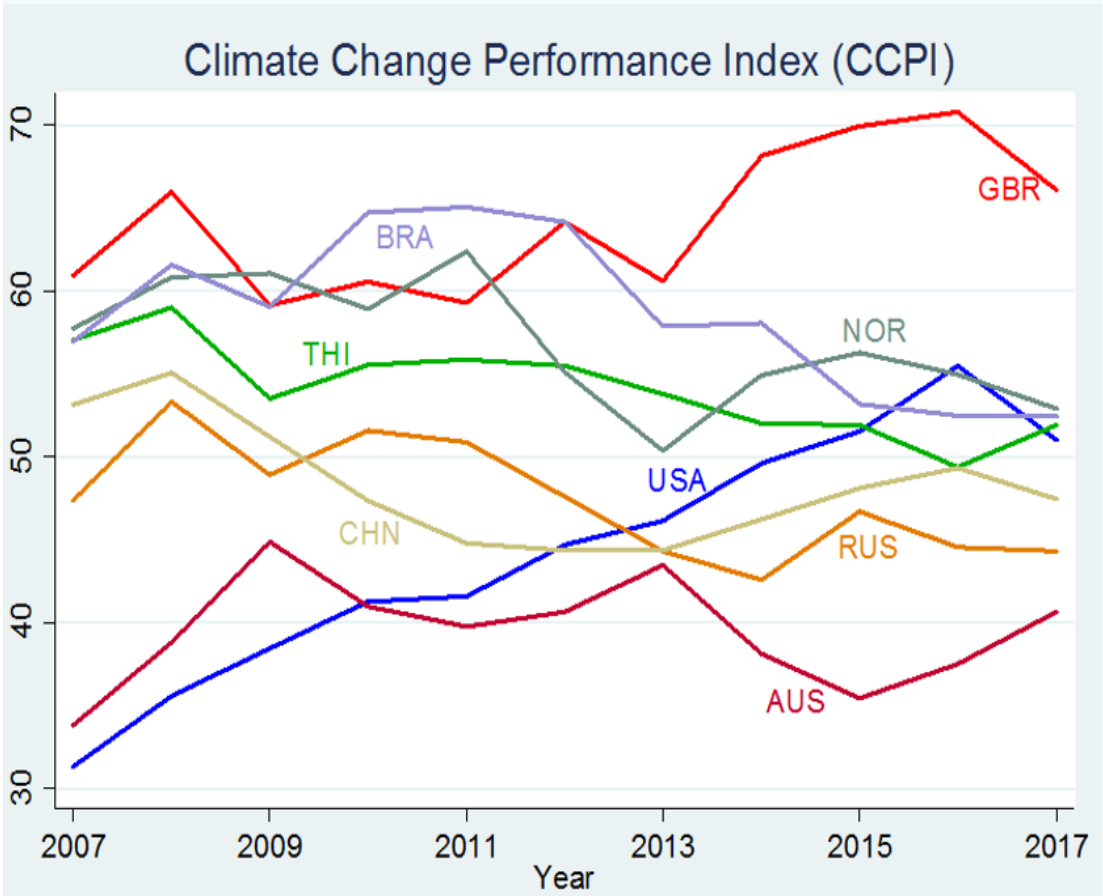
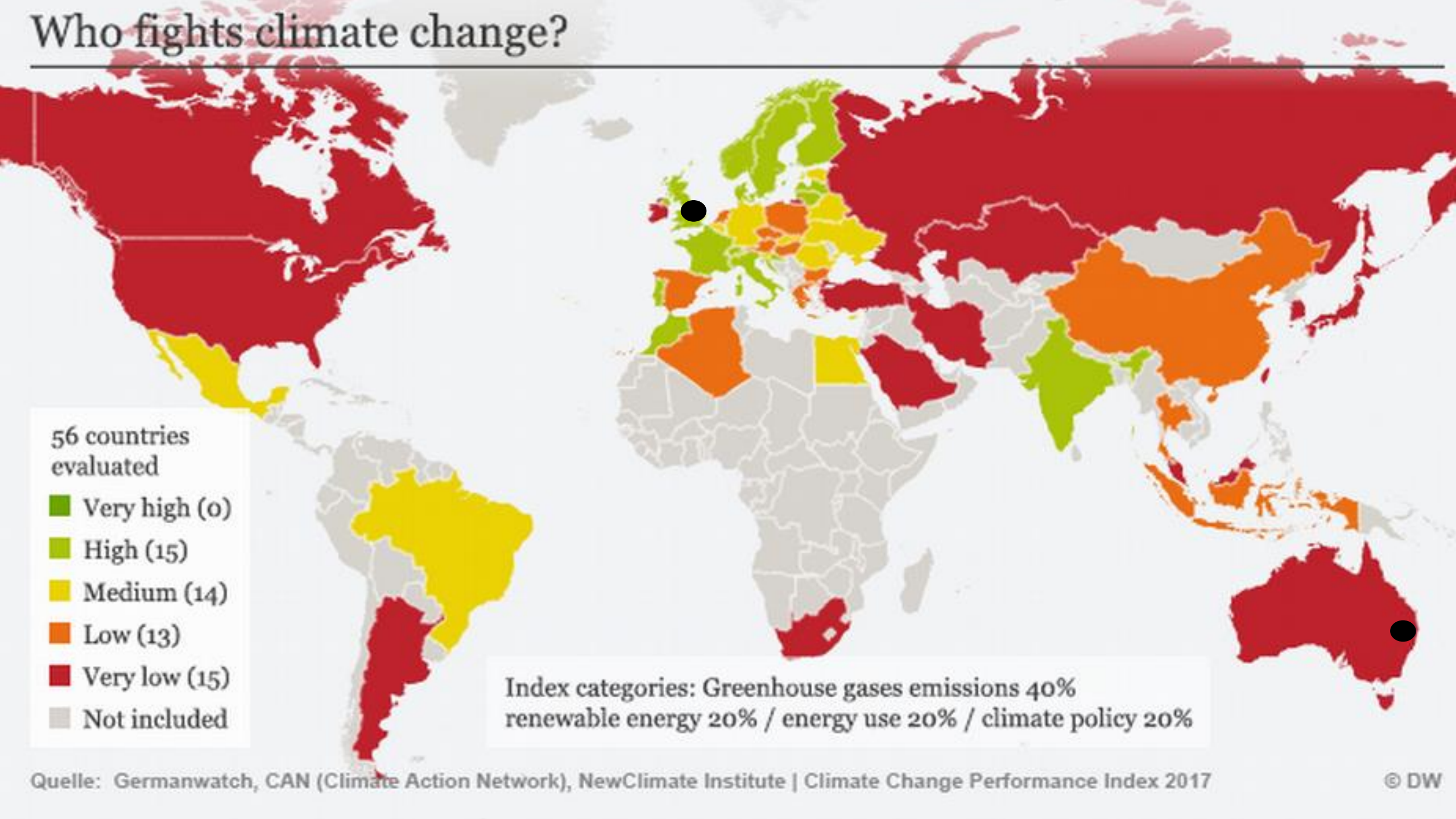


Summary of CCPI Composition

Country coverage	$\leq$58
Time period	2007-2017
Emissions component	Trends, levels
Policy component	Expert assessments
Weighing of emissions relative to policy	80%/20%

Bernauer & Böhmelt (2013)

Who fights climate change?



Quelle: Germanwatch, CAN (Climate Action Network), NewClimate Institute | Climate Change Performance Index 2017

Data on Fossil Fuel Firms and Control Group Debt 2007-2017

- Firms included in the sample have had access to **both** the bond market and the syndicated bank loan market at least once from 2007 to 2017, and their credit has a **maturity larger than one year**.

- Frequency of retrieved syndicated bank loan and bond issues in the observation period:

		Syndicated bank loans	Corporate bonds
1	All observations	23,699	20,623
	↳ Fossil fuel subsample	1,611	1,338
2	All observations with pricing data	13,579	9,313
	↳ Fossil fuel subsample	1,106	682

Country of Headquarters of Fossil Fuel Firms 2007-2017

Headquarters	Freq.	Percent
Argentina	2	0.23
Australia	7	0.81
Canada	211	24.53
China	2	0.23
France	1	0.12
United Kingdom	6	0.7
Indonesia	3	0.35
India	23	2.67
Israel	1	0.12
Mongolia	3	0.35
Norway	13	1.51
Romania	1	0.12
Russia	19	2.21
Sweden	1	0.12
United States of America	567	65.93

What Can Go Wrong with Our Measurement?

- Firms are exposed elsewhere, not in the country where their reserves are located, but ...
  - In the country of their main incorporation: we also use Headquarter country to measure exposure
  - Downstream where fossil fuels are sold:
    - Difficult to gather micro data on where fuels are sold
    - Firms may be nimble enough to circumvent such policy constraints?
      - Can ship, burn-off and sell fossil fuels elsewhere (in contrast to reserves that are stuck in the ground)
        - Hence such a measure may be weakened by firms` reactions to it?

- Firms may change their exposures by:
  - Lobbying to have the local rules (i.e., the Climate Change Performance Index) changed
    - Cannot be excluded but coordination needed with many other fossil fuel firms and coordination (and competition) with many other industries that are also affected by many of these rules
  - Changing their fossil fuel reserves:
    - Could slow or speed up their reserve discovery processes: may take time?
    - Could sell their reserves: but still take a loss?

Problem Could Be Smaller Than In (Many) Other Settings?

- We are mainly comparing effects between bond and bank financing

- Yet, we are reflecting/working on:

  - An instrumentation strategy:
    - Distance to water ways
    - CCPI in adjacent countries (*à la* Acemoglu et al …)

  - Difference-in-differences – like approach: Measuring the immediate impact of small versus large changes in the CCPI

  - …

Pricing of Climate Policy Exposure

of fossil fuel firms

by corporate bond market and by banks

Variable	Description	Source
A. Dependent variables		
All-in Spread Drawn	Sum of the spread over LIBOR plus the facility fee.	Dealscan
Bond spread	Yield differential between the bond redemption yield and the Treasury curve.	Thomson Reuters (TR)
Bond LIBOR swap spread	Difference between the bond-yield-to-maturity at issuance and the LIBOR swap rate matched by closest maturity.	TR

The yield to maturity (YTM), book yield or **redemption yield** of a bond or other fixed-interest security, such as gilts, is the (theoretical) internal rate of return (IRR, overall interest rate) earned by an investor who buys the bond today at the market price, assuming that the bond is held until maturity, and that all coupon and principal payments are made on schedule

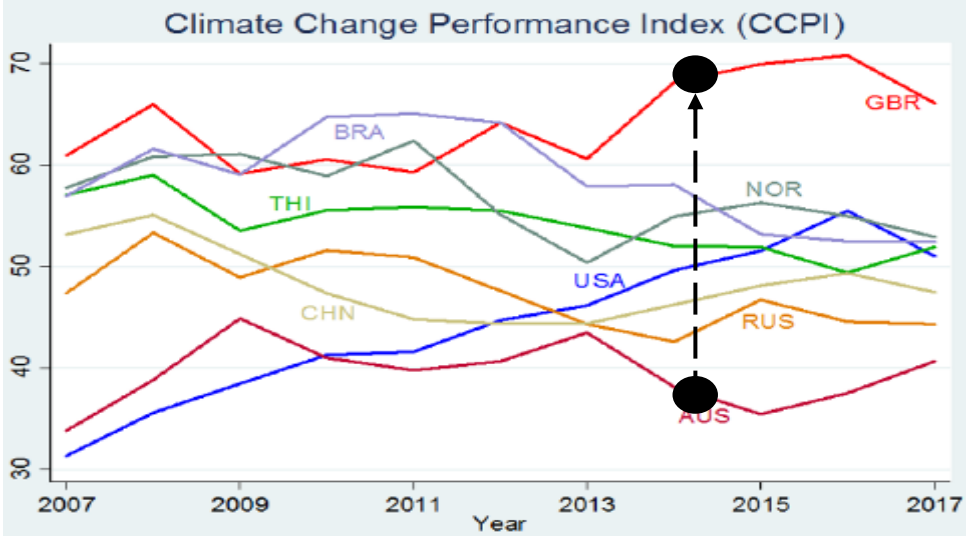
Climate Policy Exposure pricing in syndicated bank loans and corporate bonds

	Corporate bonds	**Syndicated bank loans**
Source	Thomson Reuters, Compustat	Dealscan, Compustat
Coverage	2007-2017	2007-2017
Cost of Debt	Corporate bond spread	All In Spread Drawn (AISD)
Debt-level controls	Amount, maturity, exchange-listed, secured	Amount, maturity, collateral, #lenders, #covenants, performance provisions
Firm-level controls	Firm size, leverage, tangibility	Firm size, leverage, tangibility
Fixed effects	Year, firm's country*year, instrument type, bond purpose	Year, firm's country*year, loan type, bank*year, loan purpose
Clustered SE	Firm	Firm (loan) and bank

All bonds		**Fossil fuel bonds**	
mean	sd	mean	sd
195.31	195.27	**377.38**	246.07

All loans		**Fossil fuel loans**	
mean	sd	mean	sd
231.36	160.70	**247.40**	160.02

$$\text{Cost of Debt}_{f,t,i} = a + \beta_1 \text{Fossil Fuel Dummy}_{f,t} + \beta_2(\text{Fossil Fuel Dummy}_{f,t} \times \text{Climate Policy Exposure}_{f,t}) + \lambda I_{t,i} + \gamma F_{f,t} + \varepsilon_{f,t,i}$$



	Banks	Bonds	
Mean	AISD = 231	Spread = 195	
Extra Basis Points		All	Exchange-listed
Fossil Fuel Firms	*31****	*82***	*32*
Fossil Fuel Firms with all their 2014 reserves in Great Britain versus Australia (+30 index points)	*3*	*43***	*60***

Further analysis on Climate Policy Exposure pricing

- **Time-inconsistency** between climate risk materialization and short maturity of debt; incentive to externalize the long-term costs associated with climate change

  → Impact on bond/loan maturity is very small.

- Policies of importing countries

  → Robustness excercise with **Headquarter country**

- Bonds mostly pay a fixed coupon rate, while the AISD is a fixed spread paid over LIBOR (next slide):

  → **LIBOR Swap rates** instead of corporate bond spreads:

  take difference between the bond-yield-to-maturity at issuance and the LIBOR swap rate matched by closest maturity

- Robustness checks related to Climate Policy Measure (next slide):

  → **Alternative Climate Policy Index**: Climate Change Cooperation Index (C3I)

Bond to bank substitution
along Climate Policy Exposure

Variable	Description	Source
A. Dependent variables		
Loan versus bond choice	Equal 1 if new loan is received, zero if new bond is issued per firm-year.	Dealscan and TR
Loan versus bond choice (non-binary)	Equal 1 if new loan is received, zero if new bond is issued per firm-year, and any number between 0 and 1 if a mix of loan and bond financing is received.	Dealscan and TR
Bank's loan versus bond choice	Equal 1 if a lead manager underwrites a syndicated bank loan and zero if a lead manager underwrites a corporate bond.	Dealscan and TR
Large versus small bank choice	Equal 1 if a firm receives a loan from a syndication group with at least one large lead manager bank in the syndication group, zero other-wise.	Dealscan

Bond to bank substitution along Climate Policy Exposure

$$\text{Loan vs. bond choice}_{f,t} = a + \beta_1 \text{Fossil fuel dummy}_{f,t} + \beta_2(\text{Fossil fuel dummy}_{f,t} \times \text{Climate Policy Exposure}_{f,t}) + \gamma X_{f,t} + \lambda Z_t + e_{f,t,i}$$

- Loan vs. bond choice: Equals 1 if only syndicated bank loans and 0 if only corporate bonds are issued in a year by a firm f
- Sample limited to firms who get debt financing in a certain year
  ⇒ Disentangles credit supply from demand (if demand is homogenous across bond vs bank financing)
- X: Include firm- and debt-level controls for risk characteristics
- Fixed effects at firm level: Observations of the dependent variable for absolute non-switchers and firms that only appear once have no predictive power.
- Control for the cyclicality of bank credit:
  - Year FE
  - Z: Bank non-performing loans, Bank stock index

Loan vs. Bond Choice along Climate Policy Exposure

+30 index points of climate policy exposure,

21 pp Loan vs. bond choice

(mean 62 percent)

	Dependent variable: Loan versus bond choice		
	(1)	(2)	(3)
Fossil fuel	0.034	0.170	0.162
	(0.096)	(0.405)	(0.393)
Fossil fuel*Climate Policy Exposure (CCPI)	0.007***	0.007***	0.007***
	(9.871)	(7.406)	(6.353)
Total amount	0.056***	0.062***	0.059***
	(3.907)	(4.531)	(4.205)
Firm size		-0.093***	-0.090***
		(-4.455)	(-3.707)
Asset tangibility		-0.004	-0.005
		(-1.308)	(-1.623)
Leverage		-0.001	-0.000
		(-1.134)	(-0.783)
Market-to-book		-0.009	-0.020
		(-0.655)	(-1.421)
Lending growth rate	0.124	0.173	0.291**
	(0.866)	(1.292)	(2.519)
Non-performing loans	-0.009***	-0.011**	-0.003
	(-2.865)	(-2.517)	(-0.842)
GDP growth	0.008**	0.008*	-0.001
	(2.284)	(1.791)	(-0.239)
Crude oil price	0.005***	0.004**	
	(2.716)	(2.616)	
Constant	-0.591**	0.180	0.300
	(-2.058)	(0.501)	(0.694)
Borrower FE	Yes	Yes	Yes
Year FE			Yes
Clustered SE	Borrower country	Borrower country	Borrower country
Observations	6908	5862	5862
R^2	0.498	0.510	0.521
$R^2_{adj.}$	0.325	0.328	0.341

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Loan vs. bond choice (non-binary) along Climate Policy Exposure

	Dependent variable: Loan versus bond choice non-binary		
	(1)	(2)	(3)
Fossil fuel	0.051	0.193	0.189
	(0.158)	(0.485)	(0.479)
Fossil fuel*Climate Policy Exposure (CCPI)	0.006***	0.006***	0.006***
	(14.524)	(13.122)	(13.764)
Total amount	0.012	0.017	0.015
	(0.809)	(1.202)	(1.048)
Firm size		-0.067***	-0.062***
		(-5.179)	(-4.015)
Asset tangibility		-0.005*	-0.005**
		(-1.898)	(-2.443)
Leverage		-0.000	0.000
		(-0.496)	(0.309)
Market-to-book		-0.008	-0.015
		(-0.742)	(-1.213)
Lending growth rate	0.187	0.224*	0.305***
	(1.546)	(1.933)	(2.977)
Non-performing loans	-0.005	-0.007*	-0.002
	(-1.487)	(-1.859)	(-0.369)
GDP growth	0.005	0.004	-0.001
	(1.560)	(1.002)	(-0.149)
Crude oil price annualized	0.003**	0.003**	
	(2.211)	(2.095)	
Constant	0.258	0.818**	0.843**
	(0.825)	(2.554)	(2.035)
Borrower FE	Yes	Yes	Yes
Year FE			Yes
Clustered SE	Borrower country	Borrower country	Borrower country
Observations	9251	7902	7902
R^2	0.396	0.405	0.415
$R^2_{adj.}$	0.241	0.242	0.252

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Non-binary loan vs. bond choice variable equals 1 if only syndicated bank loans are issued, 0 if only bonds are issued, and any number between 0 and 1 is indicating a mix of syndicated loan and bond financing.

Lead (underwriter/) manager banks of fossil fuel bonds and loans

Lead manager banks of fossil fuel corporate bonds and syndicated bank loans

Endogeneity of underwriter choice

→Difference in bond lead and bank loan manager? Sorting of better-quality fossil fuel firms to the loan market?

Empirical Identification

- Combine the bond and loan subsets with lead manager information.
- Dependent variable:

$$\boldsymbol{Bank's\ loan\ versus\ bond\ choice} \begin{cases} 1: Lead\ bank\ underwrites\ loan \\ 0: Lead\ bank\ underwrites\ bond \end{cases}$$

- Fixed effects at borrower and lead manager bank level

Overview of lead manager in the corporate bond and syndicated bank loan market

Lead manager	Bond	Loan	Lead manager	Bond	Loan
ANZ Banking Group	3	255	IMI - Intesa Sanpaolo	12	89
Agricultural Bank of China	3	7	ING	6	351
Axis Bank Ltd	4	11	Industrial & Comm Bank China	3	7
BBVA	25	84	Itau Unibanco	2	18
BMO Capital Markets	51	96	JP Morgan	332	624
BNP Paribas SA	72	560	Jefferies LLC	8	26
Bangkok Bank	5	15	Landesbank Baden-Wurttemberg	2	15
Bank Mandiri	2	29	Lloyds Bank	1	80
Bank Negara Indonesia PT	2	10	Macquarie Group	3	20
Bank of China Ltd	4	117	Mediobanca	6	3
Bank of Shanghai	1	2	Mitsubishi UFJ Financial Group	72	496
Barclays	232	251	Mizuho Financial Group	35	13
BofA Securities Inc	326	496	Morgan Stanley	160	81
CIBC World Markets Inc	15	125	National Australia Bank	1	95
CIMB Group Holdings Bhd	2	35	Natixis	10	220
CITIC	9	3	Nordea	2	105
Capital One Financial Corp	13	49	PNC Financial Services Group	14	108
China Construction Bank	2	19	RBC Capital Markets	125	30
Citi	255	495	SEB	3	76
Comerica Inc	5	3	Santander Corp & Invest Bkg	11	34
Commerzbank AG	2	83	Sberbank CIB	14	23
Commonwealth Bank of Australia	2	159	Scotiabank	46	32
Credit Agricole CIB	32	331	Siam Commercial Bank PLC	2	1
Credit Suisse	129	161	Societe Generale	48	261
DBS Group Holdings	6	202	State Bank of India	3	39
DNB ASA	18	250	Sumitomo Mitsui Finl Grp Inc	17	466
Danske Bank	2	34	Swedbank	2	31
Deutsche Bank	146	212	TD Securities Inc	35	103
Fifth Third Bancorp	1	16	UBS	61	83
Gazprombank	18	11	UniCredit	20	131
Goldman Sachs & Co	113	111	United Overseas Bank Ltd	1	103
HDFC Bank Ltd	1	3	VTB Capital	20	1
HSBC Holdings PLC	77	262	Wells Fargo & Co	244	602
ICICI Bank Ltd	1	20			

Bank's Loan versus Bond Choice

	Dependent variable: Bank's Loan versus Bond Choice			
	(1)	(2)	(3)	(4)
Fossil fuel	-0.110	-0.180	-0.177	-0.562***
	(-0.778)	(-1.177)	(-1.155)	(-3.309)
Fossil fuel*Climate Policy Exposure (CCPI)	0.008***	0.008***	0.007***	0.008***
	(2.971)	(3.134)	(2.967)	(4.299)
Debt-level controls	Yes	Yes	Yes	Yes
Borrower-level controls	Yes	Yes	Yes	Yes
Lead manager-level controls		Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes
Lead manager FE	Yes	Yes	Yes	
Borrower FE	Yes	Yes	Yes	
Year FE			Yes	Yes
Lead manager*Borrower FE				Yes
Clustered SE	Lead manager	Lead manager	Lead manager	Lead manager
Observations	64824	55963	55963	53501
R^2	0.541	0.530	0.533	0.646
$R^2_{adj.}$	0.526	0.514	0.517	0.580

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

+30 index points of climate policy exposure, 24 pp Loan vs. bond choice
→ Within-lead manager-bank there is a bond-to-bank substitution

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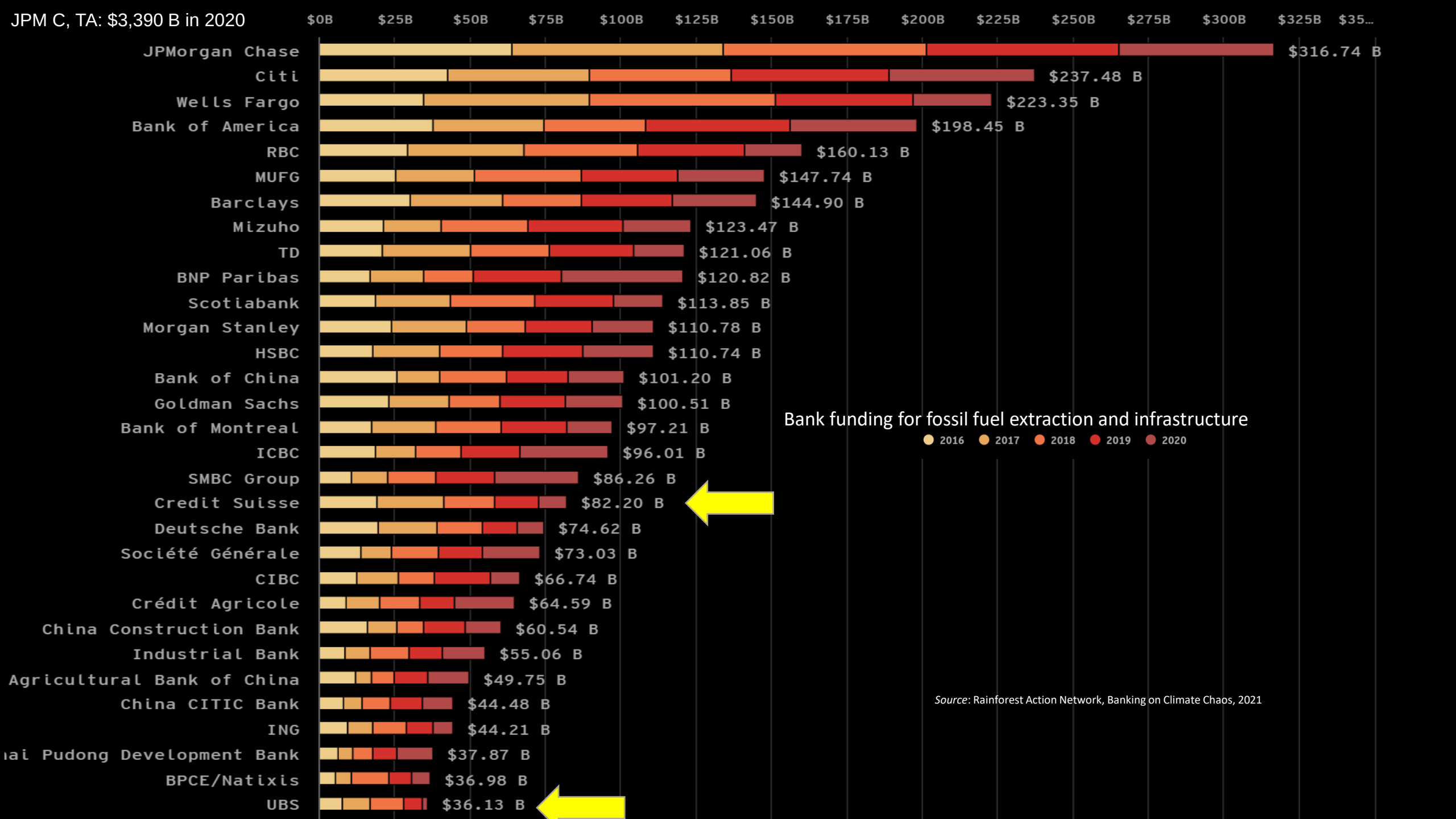
Heterogeneous bank responses

to the risk of stranded assets in their lending and risk-taking behavior?

JPM C, TA: $3,390 B in 2020



Source: Rainforest Action Network, Banking on Climate Chaos, 2021

Small-to-Large Banks Substitution

$$\text{Large vs. small bank choice}_{f,t} = a + \beta_1 \text{Fossil fuel dummy}_{f,t} + \beta_2(\text{Fossil fuel dummy}_{f,t} \times \text{Climate Policy Exposure}_{f,t}) + \lambda I_t + \gamma F_{f,t} + \delta Z_t + \varepsilon_{f,t,i}$$

- Separate lead manager banks into two size categories based on the percentile of the distribution of total assets of all the lead manager banks in that particular year.

- Dependent variable:

$$\textbf{\textit{Large versus small bank choice}} \begin{cases} 1: \textit{at least 1 } \textbf{\textit{large}} \textit{ lead manager bank in loan syndicate} \\ 0: \textit{otherwise} \end{cases}$$

Syndicated bank loan spreads, Climate Policy Exposure, and Bank size

The dependent variable is the All-in Spread Drawn and the Climate Policy Exposure is measured by the CCPI. The sample period is 2007-2017. The coefficient of interest is the fossil fuel dummy and Climate Policy Exposure (CCPI) interaction term. We weight each observation by one over the total number of lead manager banks per loan. The lower part of the table denotes the type of fixed effects and clustering used in each specification. Loan level controls include maturity, loan amount, collateral, number of lenders, performance provisions, and number of general covenants. Firm controls include firm size, leverage, market-to-book, asset tangibility. Bank controls include EBIT-over total assets, market value of equity over book value of equity, cash over total assets, deposits over total asset. Marco controls GDP growth rate, lending growth rate, and non-performing loans. For readability, omitted variables due to collinearity are left out.

For a minimum to maximum change in bank size

A +30 index points

of climate policy exposure implies…

-136 bps difference

	Dependent variable: All-in Spread Drawn			
	(1)	(2)	(3)	(4)
Fossil fuel	16.849	-47.046	35.517	29.999
	(0.149)	(-0.650)	(0.616)	(0.491)
Bank size	-7.072	-7.744**	-5.469**	-5.207**
	(-1.583)	(-2.216)	(-2.568)	(-2.340)
Fossil fuel*Climate Policy Exposure (CCPI)	3.714	5.873*	7.190**	6.717*
	(0.986)	(1.788)	(1.986)	(1.839)
Fossil fuel*Bank size	1.142	5.875	0.202	0.462
	(0.143)	(1.126)	(0.048)	(0.105)
Fossil fuel*Climate Policy Exposure (CCPI)*Bank size	-0.247	-0.401*	-0.502**	-0.466*
	(-0.936)	(-1.753)	(-1.979)	(-1.818)
Constant	703.608***	745.739***	691.915***	687.389***
	(8.542)	(9.467)	(12.940)	(12.735)
Loan-level controls	Yes	Yes	Yes	Yes
Borrower-level controls			Yes	Yes
Bank-level controls		Yes	Yes	Yes
Macro-level controls	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	
Bank country FE	Yes	Yes	Yes	
Borrower country FE	Yes	Yes	Yes	Yes
Bank country*Year FE				Yes
Loan purpose FE	Yes	Yes	Yes	Yes
Loan type FE	Yes	Yes	Yes	Yes
Clustered SE	Borrower & Bank	Borrower & Bank	Borrower & Bank	Borrower & Bank
Observations	35888	33092	26529	26504
R^2	0.522	0.517	0.530	0.537
$R^2_{adj.}$	0.520	0.515	0.527	0.531

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Large versus small bank choice and Climate Policy Exposure (CCPI)

+30 index points of climate policy exposure,

12 pp Large vs. small bank choice

(20 percent large banks)

	Dependent variable: Large versus small bank choice		
	Large bank= top 1/5	Large bank= top 1/4	Large bank= top 1/3
	(1)	(2)	(3)
Fossil fuel	-0.257**	-0.282	-0.291*
	(-2.297)	(-1.357)	(-1.948)
Fossil fuel*Climate Policy Exposure (CCPI)	0.004*	0.002	-0.003
	(1.832)	(1.043)	(-0.828)
Total amount	0.077***	0.077***	0.080***
	(3.602)	(3.962)	(4.046)
Firm size	0.121**	0.091**	0.069**
	(2.377)	(2.527)	(2.478)
Leverage	0.007	0.001	-0.010*
	(0.900)	(0.147)	(-1.689)
Asset tangibility	-0.004	-0.002	-0.000
	(-1.385)	(-0.534)	(-0.094)
Market-to-book value	0.066***	0.052***	0.011
	(2.833)	(2.720)	(1.302)
GDP Growth	0.022***	0.006	0.010
	(3.903)	(0.506)	(1.299)
Crude oil price annualized	-0.004	-0.006	-0.005
	(-1.239)	(-1.590)	(-1.449)
Constant	-2.303***	-1.872***	-1.554***
	(-3.360)	(-4.340)	(-5.225)
Firm FE	Yes	Yes	Yes
Clustered SE	Borrower country	Borrower country	Borrower country
Observations	7836	7806	7809
R^2	0.556	0.566	0.645
$R^2_{adj.}$	0.406	0.420	0.525

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

(Very) Tentative Conclusions

- Market discipline, on its own, seems to be more effective in driving bondholders, rather than banks, to price the negative externalities associated with the risk of stranded assets.
- Ability of large banks to hold large exposures to firms with stranded asset risks may lead to misallocated credit towards the fossil fuel sector.

“There is No Planet B”, But for Banks “There are Countries B to Z”: Domestic Climate Policy and Cross-Border Lending

Emanuela Benincasa *(Zurich, SFI)*

Gazi Kabas (Tilburg, Zurich, SFI)

Manthos D. Delis *(Montpellier Business School)*

Steven Ongena *(Zurich, SFI, KU Leuven, NTNU, CEPR)*

Climate change: A global challenge

- Climate change is a challenge that requires global coordination and cooperation

THE WHITE HOUSE

JANUARY 27, 2021 • PRESIDENTIAL ACTIONS

Executive Order on Tackling the Climate Crisis at Home and Abroad

The United States and the world face a profound climate crisis. We have a narrow moment to pursue action at home and abroad in order to avoid the most catastrophic impacts of that crisis and to seize the opportunity that tackling climate change presents. Domestic action must go hand in hand with United States international leadership, aimed at significantly enhancing global action. Together, we must listen to science and meet the moment.

There is a significant heterogeneity across countries regarding climate policy stringency…

Climate policy: Active climate protection and regulation by governments

IMF, 2019

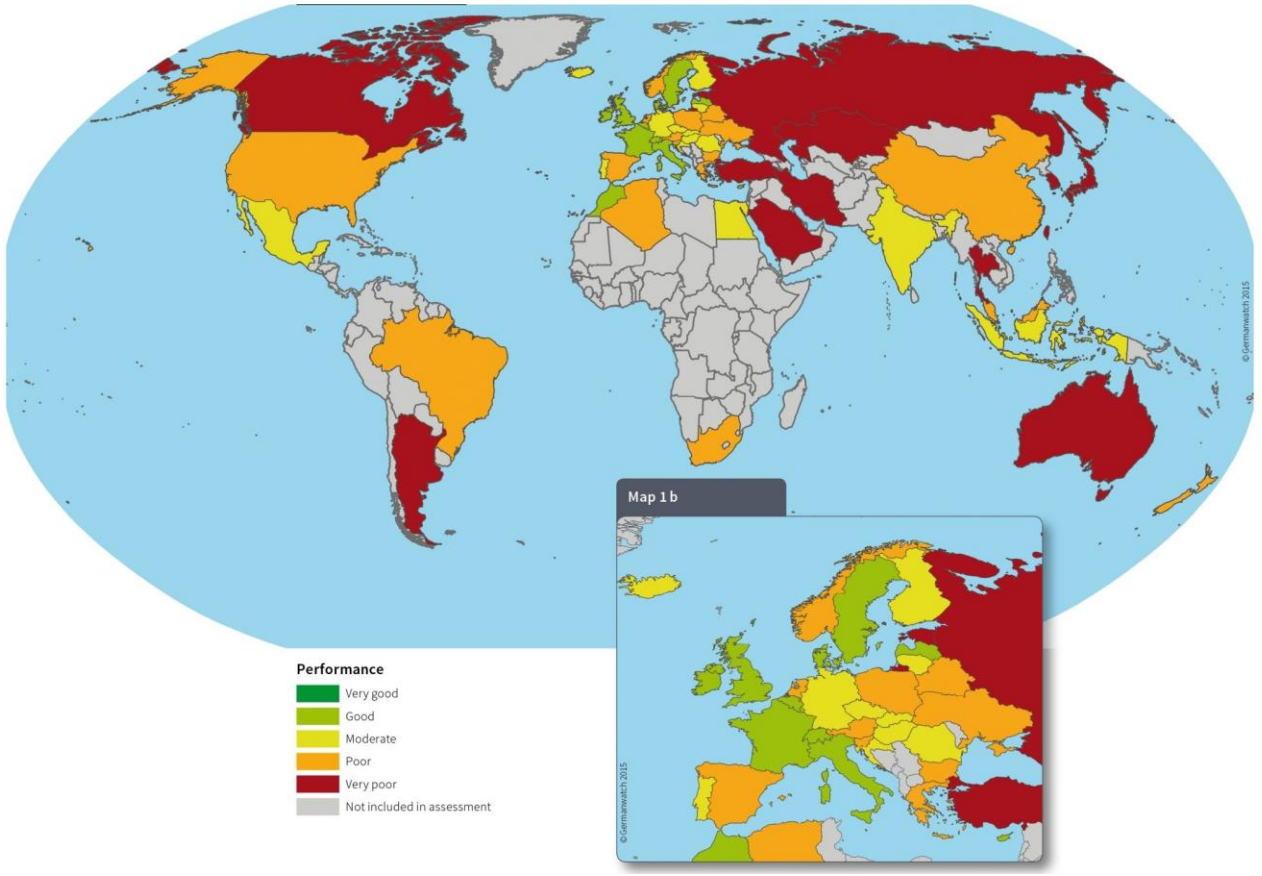


Figure: *The Climate Change Performance Index 2016: Results*

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Climate policy: A global challenge

- In the **domestic market**, stringent climate policy may
  - Increase the demand for funds for innovation and green technologies
    → Bank lending not well-suited to finance (green) innovation

    Minetti, 2011; De Haas and Popov, 2021; Degreyse, Roukny, and Tielens, 2022
  - Require a change in firms' business model or production process
    → Domestic lending less appealing?

Do banks react to the heterogeneity in national climate policy?

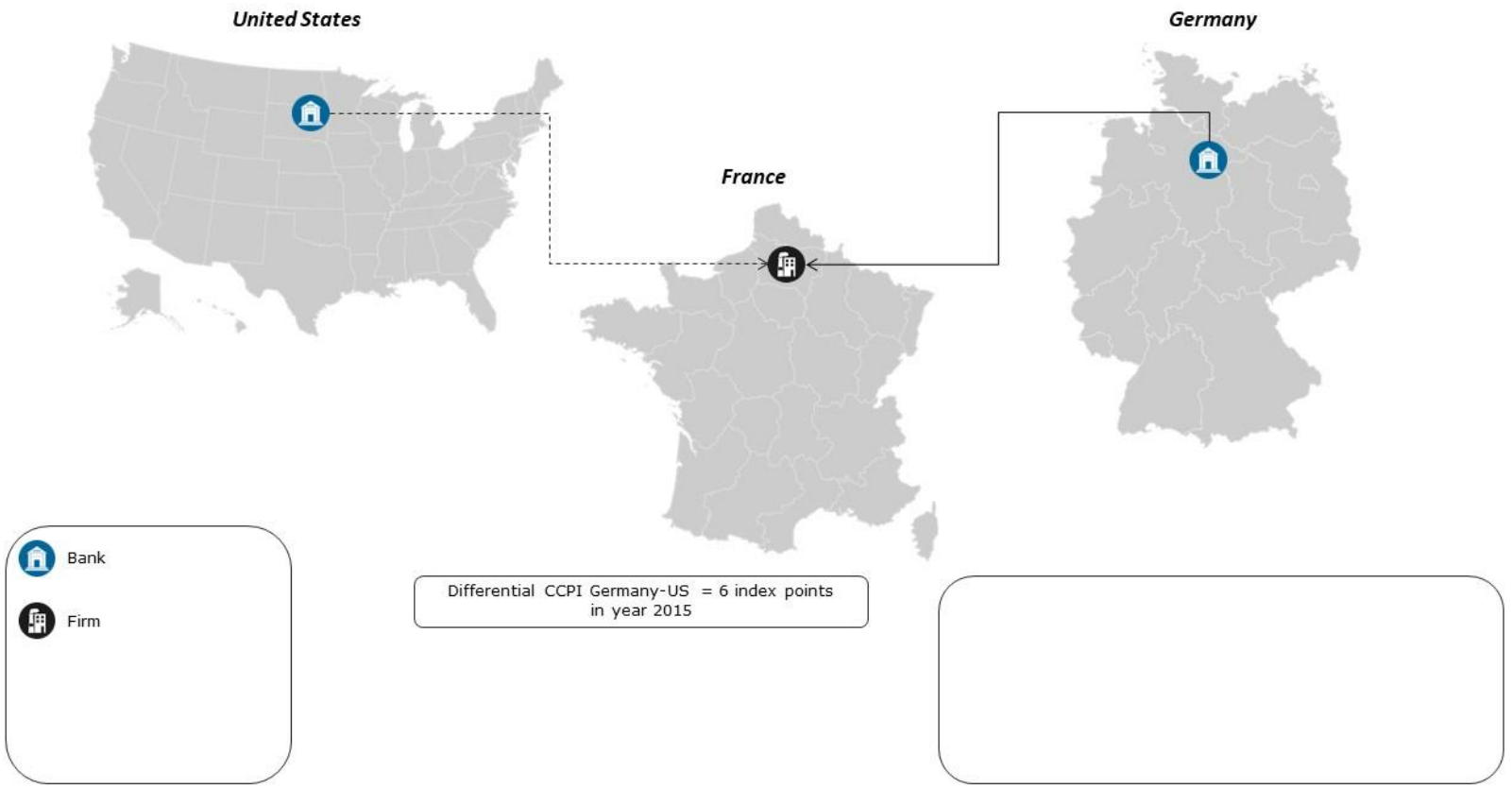
What does this heterogeneity means for cross-border lending?

Overview of paper: : Do banks refocus cross-border lending from “green” to “brown” firms and countries?

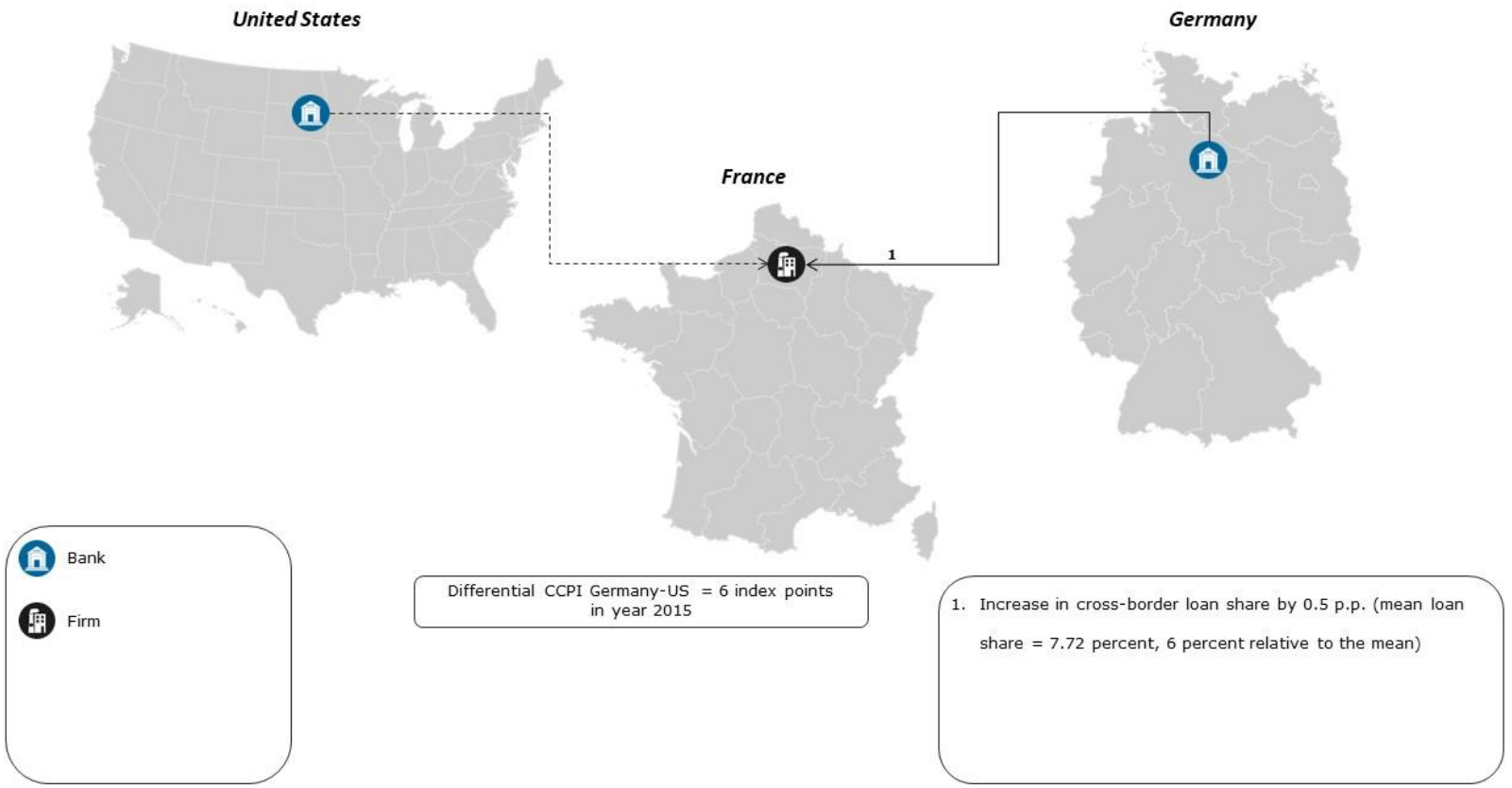
- Evidence that banks exploit the lack of global coordination in climate policies by increasing cross-border lending to ``brown´´ firms in ``brown´´ countries

- Exploit the CCPI Index as a global measure of climate policy stringency to estimate effects of cross-border bank lending in the syndicated loan market
  - → Isolate credit supply by using **loan fixed effects**
  - → Use **change in the green party share** in the parliament as **instrument** to estimate causal effects of domestic climate policy stringency

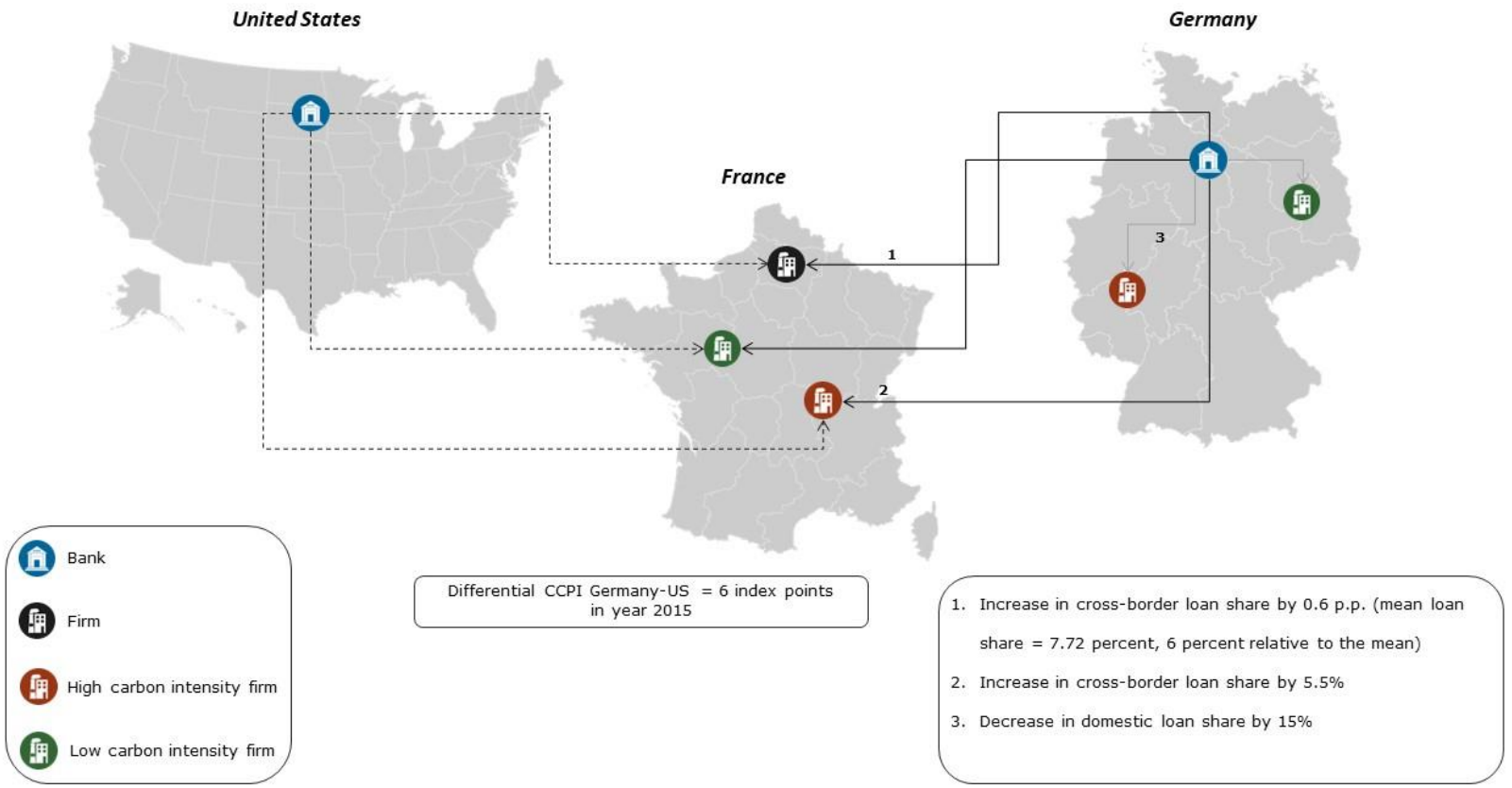
Main results



Main results



Main results



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Our contribution

- Cross-border lending as a tool to protect loan portfolios exposure to transition risks (risks created by the policies implemented for the fight against climate change)

  Krueger, Sautner, and Starks, RFS 2020; Seltzer, Starks, and Zhu, 2020, Stroebel and Wurgler, 2021

  → Empirical evidence shows that firms reallocate their activity to areas with less stringent policy

  Bartram, Hou, Kim, JFE 2021; Ben-David et al., 2021

- Role of banks in promoting sustainable (green) economy an the allocation of the funding. Literature has focused on loan terms and bank- vs bond- financing

  Beyene et al., 2021, De Haas and Popov, 2021, Bolton and Kacperczyk, 2021; Delis et al., 2021; Laeven and Popov, 2021; Mueller and Sfrappini, 2021; Ivanov et al., 2021

- Climate policy stringency as an incentive for cross-border lending. Literature has focused on geographical and cultural proximity, regulatory arbitrage opportunities

  Mian, JF 2006; Lin et al., JFE 2012; Karolyi and Taboada JF, 2015; Houston et al., JF 2012; Ongena et al., JFE 2013; Demyanyk and Loutskina, JFE 2016; Beck et al., 2022

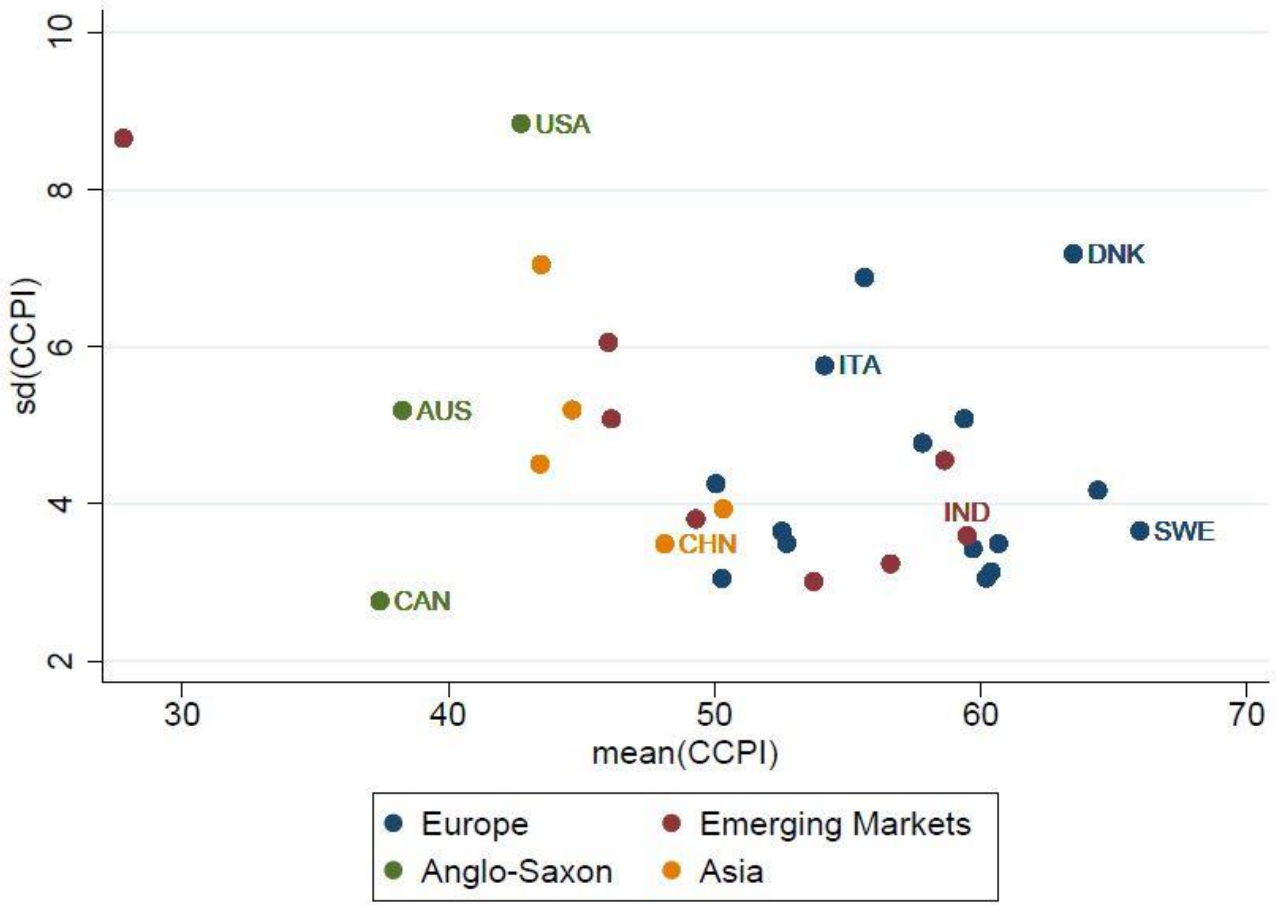
Data: Climate policy stringency

- **Challenge**: It is not easy to measure country-level climate policy stringency
  - → Stringency is a combination of many aspects (energy consumption, emissions, regulation, ect.)
  - → Countries may have different measures

- We measure climate policy stringency using the Climate Change Performance Index (CCPI)
  - → Country-year climate policy index developed by Germanwatch (non-proft, independent, environmental organization)

    Burck, Hermwille, and Bals, 2016
  - → It covers 57 countries
  - → Four main categories: Greenhouse gas emissions (60%), Renewable Energy (10%), Energy Efficiency (10%), and Climate Policy (20%)

Variation in the climate policy stringency



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Data: Cross-border lending

- We use syndicated loans to measure cross-border lending (source: DealScan)
  - → A group of lenders come together (syndicate) and provide funds to a single borrower
  - → Lead arranger is the one who carries the process with the borrower (monitoring, collecting payments)
  - → Other lenders are called participants (limited interaction with the borrower, if any)

- Sample: Only cross-border loan shares
  - → Loans provided by a bank to a borrower with different nationality

De Haas and Van Horen, RFS 2013

  - → Firm's and bank's location: country
  - → Period: 2007-2017
  - → Hand-match loan shares to bank balance sheet data (Bankscope)

Threats to the identification?

- **Loan demand**
  - → A change in a country's climate policy stringency can alter the loan demand of firms from abroad
  - → For example: A firm can deem the country-level climate policy stringency as an indicator for the lending practices of banks from that country

- **Omitted variables** correlated with climate policy stringency and cross-border lending
  - → Economic conditions, demographics, institutions, etc..
  - → For example: A change in a country's macroeconomic conditions can influence both the climate policy stringency and cross-border lending

$$\text{Lender Share}_{b,l,f,t} = \alpha_l + \beta \text{CCPI}_{c,t} + \gamma \mathbf{X}_{b,t-1} + \varepsilon_{b,l,f,t}$$

- We compare lenders within the same loan saturating the model with loan fixed effects

- We control for variables (culture, distance, quality of institutions, bank regulation, bank competition, economic and demographic conditions) that are associated to cross-border lending

  Qian and Strahan, JF 2007; Mian, JF 2008; Houston, Lin, and Ma, JF 2012; Ongena, Popov, and Udell, JFE 2013; Karolyi and Taboada, JF 2015

- Green Party share in the parliaments as an IV for climate policy stringency
  - → **Relevance condition:** Higher Green Party share can predict stringent policies, thanks to party's mandate
  - → **Exclusion restriction:** To the extent that election cycles are orthogonal to economic cycles, IV can satisfy this assumption

The effect of home country climate policy stringency on cross-border lending

	Lender Share						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$CCPI_{lender}$	0.027	0.043***	0.044***	0.045***	0.042***	0.042***	0.081***
	(0.019)	(0.008)	(0.008)	(0.008)	(0.008)	(0.013)	(0.016)
Controls & Fixed Effects:							
Bank Group Controls	✓	✓	✓	✓	✓	✓	
Borrower FE		✓	✓				
Year FE			✓				
Borrower × Year FE				✓			
Loan FE					✓	✓	✓
Bank Group FE						✓	
Bank Group × Year FE							✓
Obs.	12,478	12,478	12,478	12,478	12,478	12,394	12,105
R^2	0.004	0.735	0.736	0.809	0.842	0.863	0.878
Mean(Lender Share)	7.722						

Column (5) saturated with loan fixed effects

Standard errors clustered at the lender's country-year level

Bank-group level controls: Net interest margin, Tier 1 capital ratio, log(Tot assets), log(Customer deposits), liquidity ratio

German bank has 0.5pp or 6% on average higher loan share than an American bank in the same loan (+6 index points)

Mitigating concerns about omitted variables

This table reports estimates from Equation 1 but adding additional controls. The dependent variable is Lender share and the main independent variable is $CCPI_{lender}$. The sample covers the period 2007-2017. Economic controls are log(GDP per capita), domestic credit to GDP, unemployment rate, GDP growth. Culture controls are log(Distance) and common language. Domestic bank competition control is Top 5 bank concentration. Demographics controls are log(total population), young workforce, old workforce, and population growth. Bank regulation controls are independence of supervisory authority and capital regulatory index (Barth et al., 2013). Institution controls are legal rights index, financial freedom, property rights, and log(Contract enforcing days). Control variables and fixed effects are indicated at the bottom of each column. All regressions include bank group level controls (net interest margin, Tier 1 capital ratio, log(total assets), log(customer deposits), and liquidity ratio). Standard errors are clustered at the lender's country-year level and shown in parentheses. For variable definitions, see Table A4.
*** p<0.01, ** p<0.05, * p<0.1.

	Lender Share					
	(1)	(2)	(3)	(4)	(5)	(6)
$CCPI_{lender}$	0.039***	0.034***	0.032***	0.037***	0.045**	0.058*
	(0.008)	(0.008)	(0.008)	(0.009)	(0.019)	(0.033)
Controls & Fixed Effects:						
Loan FE	✓	✓	✓	✓	✓	✓
Bank Group Controls	✓	✓	✓	✓	✓	✓
Economic Controls	✓	✓	✓	✓	✓	✓
Culture Controls		✓	✓	✓	✓	✓
Bank Competition Controls			✓	✓	✓	✓
Demography Controls				✓	✓	✓
Bank Regulation Controls					✓	✓
Institutions Controls						✓
Obs.	11,530	11,076	11,076	11,076	5,810	3,571
R^2	0.853	0.854	0.854	0.854	0.865	0.872
Mean(Lender Share)	7.722					

Standard errors clustered at the lender's country-year level

In all of these specifications, the positive coefficient of CCPI survives, and its magnitude is similar to the ones in the main table

Green Party share as an instrument for climate policy stringency

	$CCPI_{lender}$	Lender Share		
	(1)	(2)	(3)	(4)
Δ Green Party Share	1.620***			
	(0.277)			
$\widehat{CCPI}_{lender}$		0.120***	0.122***	0.121**
		(0.032)	(0.031)	(0.051)
Controls & Fixed Effects:				
Country Controls			✓	✓
Bank Group Controls				✓
Loan FE	✓	✓	✓	✓
Obs.	3,216	3,216	3,084	3,084
R^2	0.340	0.026	0.033	0.063
1^{st} Stage Eff. F-stat	34.252	34.252	35.612	24.050
Mean(Lender Share)	7.716			

The sample covers the period 2007-2017, European countries

1st Stage Efficient F-statistics by Olea and Plueger, 2013: larger than the threshold level of 23.1 for 10 percent worst-case benchmark

IV = the change in Green party share of won seats in two subsequent election years

Banks increase their cross-border lending as a reaction to stringent home-country climate policy

Exclusion restriction: Is Green Party share correlated with economic conditions?

Panel A

	(1) $\log(GDP)_{pc}$	(2) $\Delta \log(GDP)$	(3) Credit to GDP	(4) Unemp. Rate
	(1)	(2)	(3)	(4)
Δ Green Party Share$_{t-1}$	0.014	0.168	-1.507	0.147
	(0.024)	(0.294)	(2.876)	(0.378)
Obs.	1,602	1,602	1,600	1,602
R^2	0.021	0.019	0.008	0.011

Panel B

	(1)	(2)	(3)	(4)	(5)
	Δ Green Party Share				
	(1)	(2)	(3)	(4)	(5)
$\log(GDP)_{pc,\,t-1}$	0.696				0.902
	(1.026)				(0.731)
$\Delta \log(GDP)_{t-1}$		-0.225			-0.255
		(0.145)			(0.158)
Credit to GDP$_{t-1}$			0.002		0.006
			(0.005)		(0.006)
Unemp. Rate$_{t-1}$				-0.021	0.011
				(0.177)	(0.184)
Obs.	1,622	1,622	1,622	1,625	1,621
R^2	0.008	0.093	0.002	0.001	0.123

The most likely way the exclusion restriction is to be violated is that the Green Party share is correlated with economic conditions

We regress the change in Green Party share on macroeconomic variables and vice versa

In line with the exclusion restriction, the economic condition variables have insignificant coefficients in all of these models

Underlying mechanism: Cross-border lending as a regulatory arbitrage tool

Lender Share	Interaction		$CCPI_{borrower} < CCPI_{lender}$			
	(1)	(2)	(3) Yes	(4) No	(5) Yes	(6) No
$CCPI_{lender}$	0.046***	0.043***	0.061***	0.008	0.060***	0.009
	(0.008)	(0.008)	(0.015)	(0.016)	(0.016)	(0.017)
$CCPI_{lender} \times CCPI_{borrower}$	-0.002**	-0.002***				
	(0.001)	(0.001)				
Controls & Fixed Effects:						
Bank Group Controls	✓	✓	✓	✓	✓	✓
Borrower × Year FE	✓		✓	✓		
Loan FE		✓			✓	✓
Obs.	12,478	12,478	7,980	3,860	7,763	3,519
R^2	0.809	0.842	0.812	0.819	0.851	0.841
Mean(Lender Share)	7.722					
Difference			0.052**		0.052**	

The most likely way the exclusion restriction is to be violated is that the Green Party share is correlated with economic conditions

We regress the change in Green Party share on macroeconomic variables and vice versa

Effect decreases in borrower's stringency and
it is absent if CCPI(borrower) < CCPI(lender)

Underlying mechanism: Does a higher CCPI change the supply of credit domestically?

Lender Share	Carbon-intensive firms				
	(1)	(2)	(3)	(4)	(5)
Same Country × High Carbon Intensity Risk × $CCPI_{lender}$	-0.317**	-0.353***	-0.344***	-0.234**	-0.234**
	(0.125)	(0.110)	(0.111)	(0.097)	(0.096)
Same Country × High Carbon Intensity Risk	19.355***	19.198***	18.794***	11.999**	11.733**
	(7.041)	(6.585)	(6.619)	(5.664)	(5.672)
High Carbon Intensity Risk × $CCPI_{lender}$	0.085	0.070	0.077	0.104**	0.083*
	(0.085)	(0.068)	(0.065)	(0.044)	(0.043)
Same Country × $CCPI_{lender}$	0.066	0.086	0.079	0.011	0.023
	(0.101)	(0.125)	(0.126)	(0.099)	(0.107)
Same Country	-1.752	-2.171	-1.784	2.550	1.799
	(5.998)	(7.491)	(7.539)	(5.939)	(6.354)
High Carbon Intensity Risk	-4.178	-0.698	-1.201		
	(5.066)	(4.887)	(4.680)		
$CCPI_{lender}$	-0.022	0.012	0.002	-0.023	-0.021
	(0.067)	(0.069)	(0.067)	(0.045)	(0.044)
Controls & Fixed Effects:					
Bank Group Controls	✓	✓	✓	✓	✓
Borrower FE		✓	✓		
Year FE			✓		
Borrower × Year FE				✓	
Loan FE					✓
Obs.	2,540	2,540	2,540	2,540	2,540
R^2	0.073	0.540	0.543	0.612	0.701
Mean(Lender Share)	9.008				

Climate policy stringency decreases loan supply to domestic borrowers with high carbon risk
while increasing loan supply if such borrowers are abroad

Firm-level carbon intensity risk data: Sustainalytics

High Carbon Intensity Risk: Dummy variable if a firm is exposed to unmanaged carbon risk based on emissions level

Same Country: Dummy variable if the loan is domestic

Column (5)
→Increase in cross-border loan share by 5.5%
→ Decrease in domestic loan share by 15%

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Underlying mechanism: Climate policy stringency and corporate profits

	ROE	ROC	Net Margin	Opr. Margin
	(1)	(2)	(3)	(4)
CCPI	-0.007**	-0.004*	-0.007**	-0.004*
	(0.003)	(0.002)	(0.003)	(0.002)
Controls & Fixed Effects:				
Controls	✓	✓	✓	✓
Country FE	✓	✓	✓	✓
Obs.	214	213	216	216
R^2	0.302	0.291	0.337	0.395
Mean(Dep. var.)	0.096	0.079	0.076	0.097

We use Return on Equity, Return on Capital, Net Profit Margin, and Operating Margin as firm profit indicators at the country level

Standard errors are robust

The changes induced by stringent climate policy may hurt the firms' profitability, which in turn can lead the lenders to increase their lending abroad

Underlying mechanism: Which component of the CCPI matters the most?

	Lender Share				
	(1)	(2)	(3)	(4)	(5)
Climate policy$_{lender}$	0.040	0.063***	0.058***	0.069***	0.065***
	(0.038)	(0.013)	(0.013)	(0.012)	(0.013)
Renewable energy$_{lender}$	-0.234**	-0.031	0.056	0.020	0.037
	(0.095)	(0.037)	(0.053)	(0.053)	(0.055)
Energy use$_{lender}$	0.103	0.029	0.162*	0.039	0.027
	(0.148)	(0.057)	(0.082)	(0.079)	(0.084)
$CO_{2lender}$	0.053	0.046**	0.012	0.035	0.032
	(0.040)	(0.018)	(0.024)	(0.022)	(0.023)
Controls & Fixed Effects:					
Bank Group Controls	✓	✓	✓	✓	✓
Borrower FE		✓	✓		
Year FE			✓		
Borrower × Year FE				✓	
Loan FE					✓
Obs.	12,478	12,478	12,478	12,478	12,478
R^2	0.006	0.735	0.736	0.809	0.842
Mean(Lender Share)	7.722				

Climate Policy captures policy actions against climate change and is forward-looking

Other three categories capture realized outcomes of such policies and actions

Tentative Conclusions

- We investigate whether banks use cross-border lending to react to a change in climate policy stringency in their home country

- Banks exploit uncoordinated national climate policies by refocusing syndicated lending from ‘green’ to ‘brown’ countries and firms

- Lack of policy harmonization may trigger regulatory arbitrage behavior and threaten the effectiveness of climate policies

More research seems warranted …

As time may be running out …

Appendix

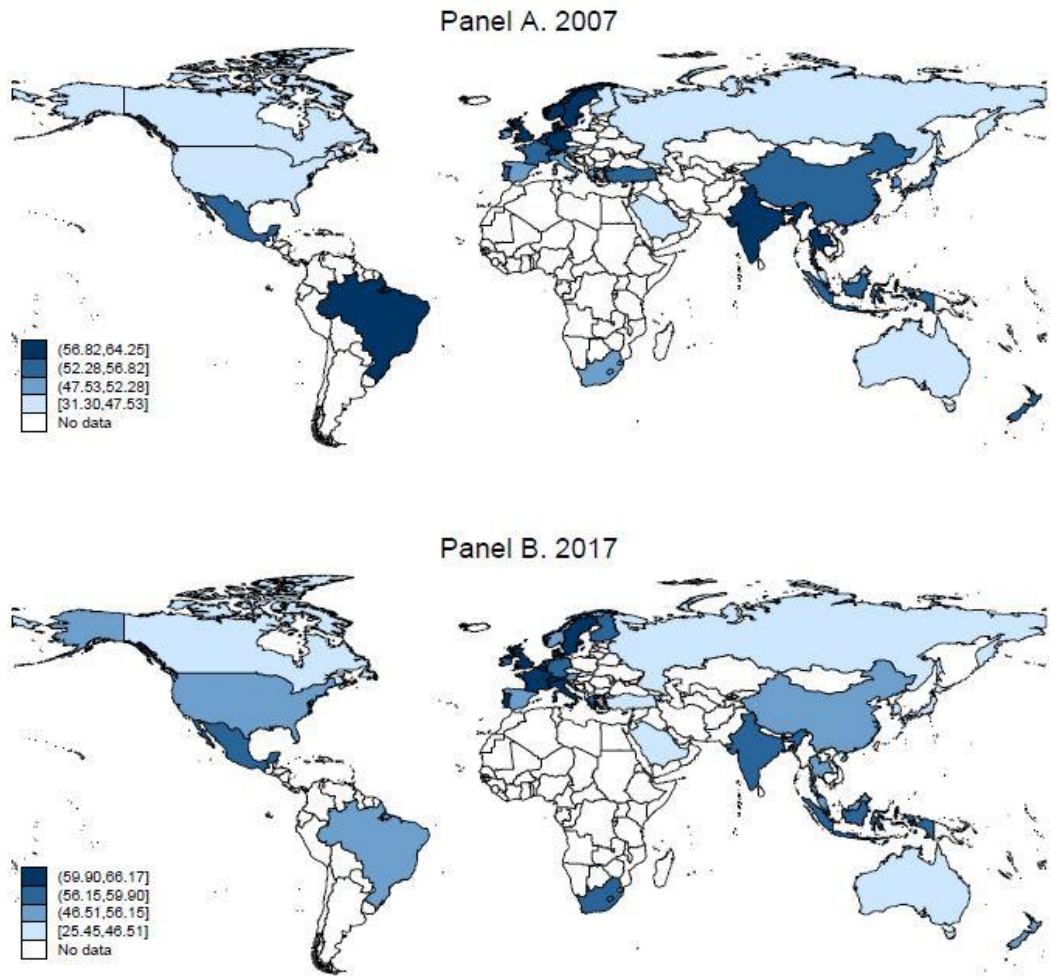
Summary statistics

This table provides summary statistics of the main variables for the period 2007-2017. The sample consists of cross-border loan's shares in the syndicated loan market. Balance sheet variables are at an annual frequency. The mean, standard deviation, minimum and maximum values are shown. For variable definitions, see Table A4.

	Obs.	Mean	Std. Dev.	Min.	Max.
Lender share	12,478	7.722	7.989	0.070	94.210
$CCPI_{lender}$	12,478	55.689	8.179	22.848	76.620
$CCPI_{borrower}$	12,478	49.961	8.887	22.848	76.620
Bank-level controls					
log(Total assets)	12,478	28.097	3.088	11.169	36.838
Tier 1 capital ratio	12,478	12.342	7.255	3.700	182.760
log(Customer deposits)	12,478	27.260	3.375	6.639	36.813
Liquidity ratio	12,478	49.097	35.340	0.720	395.494
ROAE	12,478	5.626	11.212	-223.690	46.090
Net interest margin	12,478	1.481	0.782	-0.130	9.170
Country-level controls					
log(GDP per capita)	11,942	10.497	0.709	6.906	11.685
GDP growth	11,942	1.949	2.605	-8.075	14.526
Domestic credit to GDP	11,705	121.545	37.846	25.456	206.671
Unemployment rate	11,942	7.562	3.457	0.489	27.071
Common language	11,510	0.246	0.431	0	1
log(Distance)	11,510	7.908	1.025	4.798	9.384
Top 5 bank concentration	12,259	73.559	14.744	28.970	100
Population growth	11,943	0.547	0.532	-1.854	5.322
Young workforce	11,942	26.572	4.370	15.767	55.337
Old workforce	11,942	25.379	6.296	4.192	45.125
Capital regulatory index	9,004	6.851	1.778	2	10
Independence of supervisory authority	10,688	2.020	0.813	0	3
Bank supervisory power	11,264	10.106	1.909	6	16
Property rights	11,838	77.153	18.426	20	97.1
Legal rights index	5,514	5.820	2.782	1	12
log(Contract enforcing days)	6,618	4.598	0.494	3.258	5.720
Financial liberalization index	11,838	67.711	14.805	20	90
Others					
$Climate\ policy_{lender}$	12,478	12.053	4.231	0	20
$Renewable\ energy_{lender}$	12,478	2.617	1.704	0.023	8.094
$Energy\ use_{lender}$	12,478	5.715	1.439	1.017	9.124
$CO_{2lender}$	12,478	35.304	5.257	9.570	45.564
Δ Green Party Shr.	7,573	0.286	1.410	-4.500	6.667
High Carbon Intensity Risk	1,419	0.725	0.447	0	1
log(Loan amount)	12,478	17.352	1.539	6.354	21.563
Same Country	28,217	0.512	0.499	0	1
log(Loan volume)	4,211	19.488	2.180	13.153	25.155
log(Number of loans)	4,211	2.192	1.178	0.693	6.704

Figure 1: **Global development of climate policy stringency**

These maps show the climate policy stringency index (Climate Change Performance Index) for the 39 countries included at the beginning (2007 in Panel A) and end (2017 in Panel B) of our sample period. The CCPI score takes values in the interval [0;100], where higher values proxy a country with more stringent climate policy. The shade in color proxies the value for each country. Darker areas indicate higher values of the CCPI, or more stringent climate policy. Countries with no color shade are not part of our sample. For the list of the countries included in our sample, see Figure A1.



How does domestic bank regulation influence climate policy-induced cross-border lending?

This table reports estimates from Equation 1. The dependent variable is Lender share and the main independent variable is $CCPI_{lender}$. The sample covers the period 2007-2017. Panel A splits the sample into three in terms of the *Independence of the Bank Supervisory Authority*. Panel B splits the sample into three in terms of the *Bank Supervisory Power*. Control variables and fixed effects are indicated at the bottom of each column. All regressions include bank group level controls (net interest margin, Tier 1 capital ratio, log(total assets), log(customer deposits), and liquidity ratio). Standard errors are clustered at the lender's country-year level and shown in parentheses. For variable definitions, see Table A4. *** p<0.01, ** p<0.05, * p<0.1.

Panel A

Lender Share	Ind. of Bank Supervisory Auth.		
	(1) Low	(2) Medium	(3) High
$CCPI_{lender}$	0.071***	0.028	-0.001
	(0.024)	(0.018)	(0.022)
Controls & Fixed Effects:			
Bank Group Controls	✓	✓	✓
Loan FE	✓	✓	✓
Obs.	2,353	2,693	2,826
R^2	0.827	0.867	0.867
Mean(Lender Share)	7.722		

Panel B

Lender Share	Bank Supervisory Power		
	(1) Low	(2) Medium	(3) High
$CCPI_{lender}$	0.071***	0.043	0.027**
	(0.021)	(0.069)	(0.011)
Controls & Fixed Effects:			
Bank Group Controls	✓	✓	✓
Loan FE	✓	✓	✓
Obs.	2,963	2,181	3,420
R^2	0.874	0.841	0.849
Mean(Lender Share)	7.722		

In a country with strong bank supervision, banks may be less willing to create the shortcut through cross-border lending

A weak supervision environment can facilitate regulatory arbitrage

The effect of the climate policy stringency on cross-border lending should be larger in countries with weak bank supervision

How does the effect differentiate with respect to lender's characteristics?

This table reports estimates from Equation 1. The dependent variable is Lender share and the main independent variable is $CCPI_{lender}$. The sample covers the period 2007-2017. Columns (1) and (2) split the sample into two with respect to bank size (total assets). Columns (3) and (4) split the sample into two with respect to the ratio of cross-border lending to total lending. Columns (5) and (6) split the sample into two with respect to the Tier 1 capital ratio. Columns (7) and (8) split the sample into two with respect to the non-performing loans ratio (NPL). Split points are the sample's median values. Control variables, fixed effects, and the difference in estimated coefficients between split samples are indicated at the bottom of each column. Standard errors are clustered at the lender's country-year level and shown in parentheses. For variable definitions, see Table A4. *** p<0.01, ** p<0.05, * p<0.1.

Lender Share	Size		Cross-Border		Capital		NPL	
	(1) Low	(2) High	(3) Low	(4) High	(5) Low	(6) High	(7) Low	(8) High
$CCPI_{lender}$	0.018**	0.061***	0.022**	0.107***	0.053***	0.045***	0.031*	0.097***
	(0.008)	(0.010)	(0.009)	(0.013)	(0.013)	(0.009)	(0.018)	(0.031)
Fixed Effects:								
Loan FE	✓	✓	✓	✓	✓	✓	✓	✓
Obs.	5,356	5,337	5,328	5,459	5,406	5,626	847	881
R^2	0.843	0.858	0.842	0.846	0.841	0.861	0.838	0.808
Mean(Lender Share)	7.722							
Difference	0.043***		0.085***		-0.008		0.065*	

Are there regional patterns?

This table reports estimates from Equation 1 in which we cluster countries belonging to the same geographical area. The dependent variable is Lender share and the main independent variable is $CCPI_{lender}$. The sample covers the period 2007-2017. European countries are Austria, Belgium, Denmark, France, Germany, Greece, Netherlands, Ireland, Italy, Norway, Spain, Portugal, and United Kingdom. Emerging market countries are Saudi Arabia, China, Chinese Taipei, India, Brazil, Russian Federation, Indonesia, South Africa, Malaysia, and Turkey. Asian countries are Japan, Singapore, Korea, Chinese Taipei, and China. Anglo-Saxon countries are United States, Canada, Australia, and New Zealand. All lenders in this table are located in Europe. All regressions include bank group level controls (net interest margin, Tier 1 capital ratio, log(total assets), log(customer deposits), and liquidity ratio). Control variables, fixed effects, and the difference in estimated coefficients between split samples are indicated at the bottom of each column. Standard errors are clustered at the lender's country-year level and shown in parentheses. For variable definitions, see Table A4. *** p<0.01, ** p<0.05, * p<0.1.

Lender Share	Europe vs USA	Europe vs Emerging markets	Europe vs Europe	Europe vs Asia	Europe vs Anglo-Saxon
	(1)	(2)	(3)	(4)	(5)
$CCPI_{lender}$	0.029	0.131***	0.008	0.110	0.040*
	(0.026)	(0.032)	(0.016)	(0.071)	(0.023)
Controls & Fixed Effects:					
Bank Group Controls	✓	✓	✓	✓	✓
Loan FE	✓	✓	✓	✓	✓
Obs.	3,751	885	3,069	371	4,091
R^2	0.820	0.894	0.907	0.864	0.833
Mean(Lender Share)	7.722				

Climate policy stringency differentials and cross-border credit flows

This table shows estimation results from the bank-country pairs analysis –bank-country level regressions– and effects on cross-border credit flows. We study the number (first four columns) and the volume (last four columns) of cross-border lending from bank i to destination country j –the country where borrower companies are located. The dependent variables are log(1+loan amount) or log(1+number of loans) and the main independent variable is ΔCCPI, which is equal to the difference between $CCPI_{lender}$ and $CCPI_{borrower}$. The sample covers the period 2007-2017. Columns (4) and (8) include bank group level controls (net interest margin, Tier 1 capital ratio, log(total assets), log(customer deposits), and liquidity ratio). Control variables and fixed effects are indicated at the bottom of each column. Standard errors are clustered at the country-pair level and shown in parentheses. For variable definitions, see Table A4. *** p<0.01, ** p<0.05, * p<0.1.

	log(Number of loans)				log(Loan amount)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Δ CCPI	0.025***	0.028***	0.036***	0.028***	0.029***	0.055***	0.073***	0.057***
	(0.005)	(0.004)	(0.005)	(0.005)	(0.008)	(0.009)	(0.010)	(0.011)
Controls & Fixed Effects:								
Borrower country FE		✓				✓		
Borrower country × Year FE			✓	✓			✓	✓
Bank Group Controls				✓				✓
Obs.	4,211	4,208	4,185	4,185	4,211	4,208	4,185	4,185
R^2	0.058	0.265	0.318	0.354	0.024	0.222	0.309	0.373
Mean(dep. var.)	2.198				19.495			