Banks and Regulatory Transition Risks

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BANCO DE PORTUGAL
CONFERENCE ON FINANCIAL STABILITY
LISBON, 2 OCTOBER 2023

All banks tepidly increase the loan rate on syndicated loans to fossil fuel firms with reserves exposed to climate policy stringency, after 2015 (Paris COP 21 and when a UNEP bank.

Delis, de Greiff, Iosifidi and Ongena (FMII Forthcoming)

TBTF banks lend cheaper and more to fossil fuel firms as stranding risk increases, while bond markets lend less: **Too-Big-To-Strand**?!

Beyene, Delis, de Greiff and Ongena

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 and Tsoumas

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, and especially to lower stringency countries.

Benincasa, Kabas and Ongena

Captive banks grant car loans at lower interest rate to diesel car buyers to modulate diesel gate and local diesel car driving restrictions.

Beyene, Falagiarda, Ongena and Scopelliti

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

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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

- 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 and Rajan, AER 2009; Langfield and Pagano, EP 2016; De Haas and 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 and 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 and Spaggiari, 2021; Ginglinger and Moreau, 2020; Ilhan, Sautner, Vilkov, RFS 2021

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

Krueger, Sautner and Starks, RFS 2020; Matos, 2020; Starks, 2020; Cornell and 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 and Ivashina, JME 2014; Kashyap, Lamont and Stein, QJE 1994; Faulkender and 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 and Ongena, 2021; DeHaas and 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 and 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 and Xia, JFQA forth; Kölbel, Leippold, Rillaerts and 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.

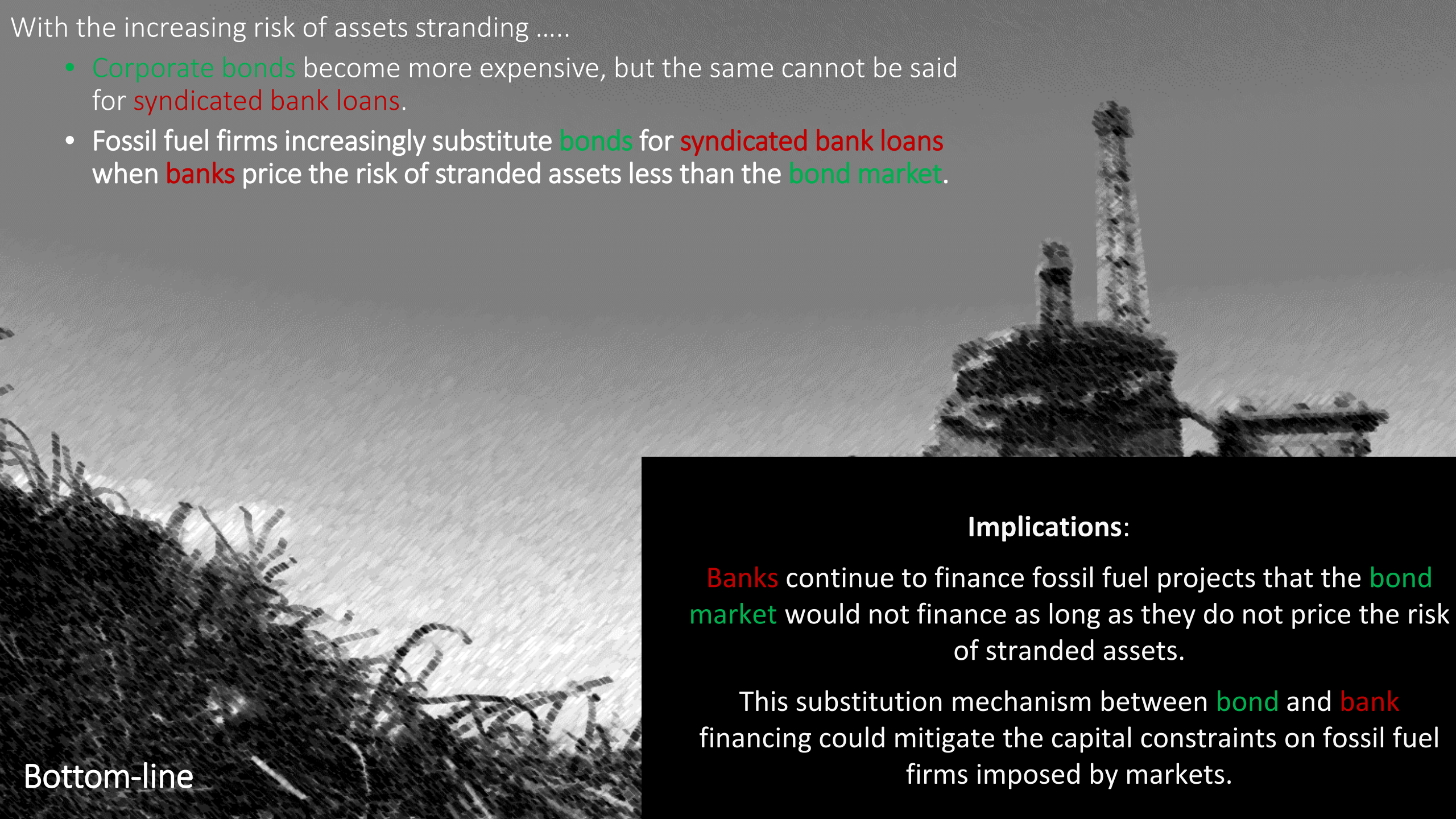
e.g., Rajan, JF, 1992; Becker and Ivashina, JME 2014

→ 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.

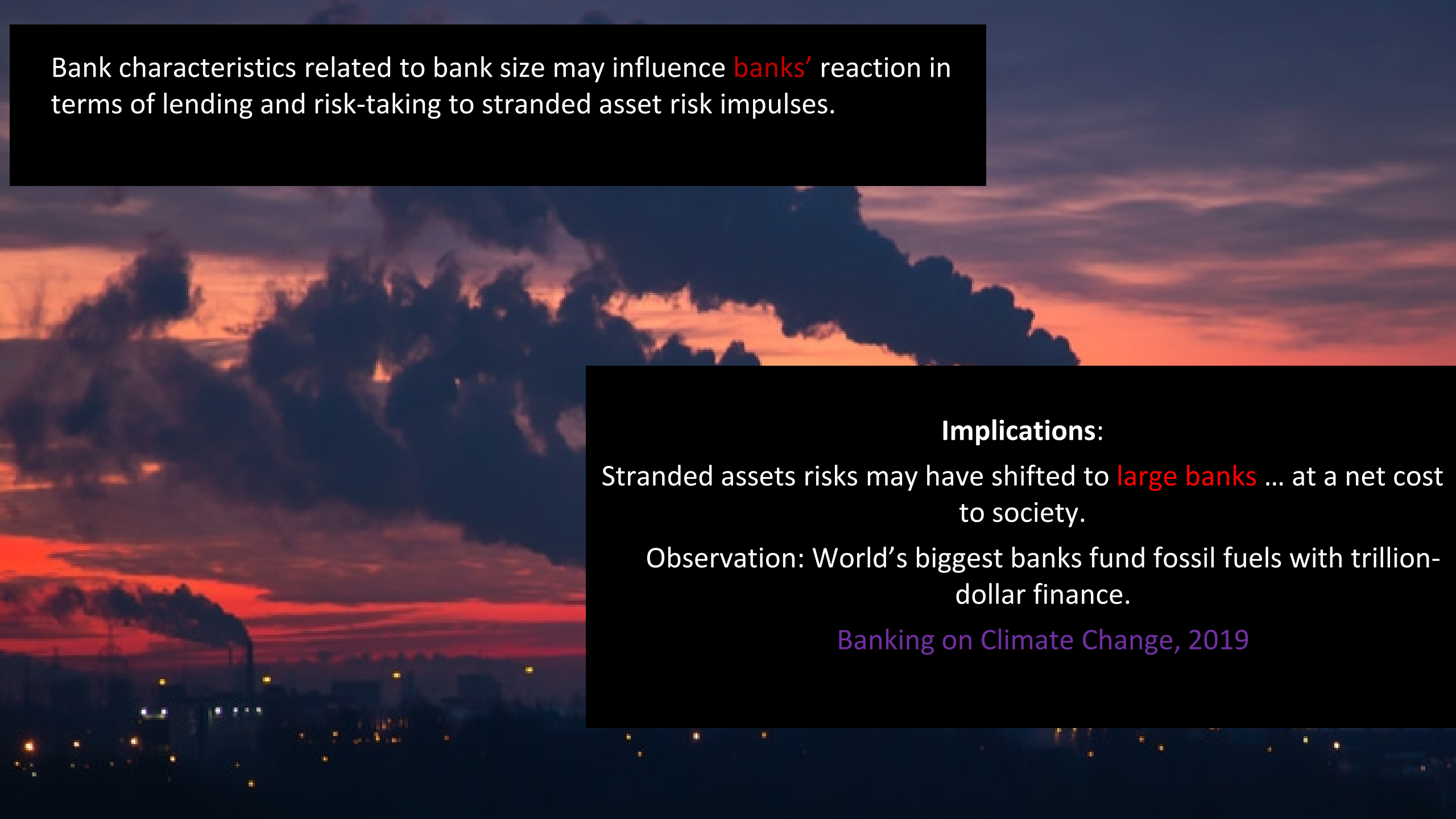
Overview of Paper: Do large banks redirect capital away from fossil fuel?

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 and van Tilburg 2014; Schoenmaker, van Tilburg and Wijffels 2015; Batten, Sowerbutts and Tanaka 2016

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

  E.g., Atamasova and Schwartz, 2019; Delis, de Greiff, Iosifidi and 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*?

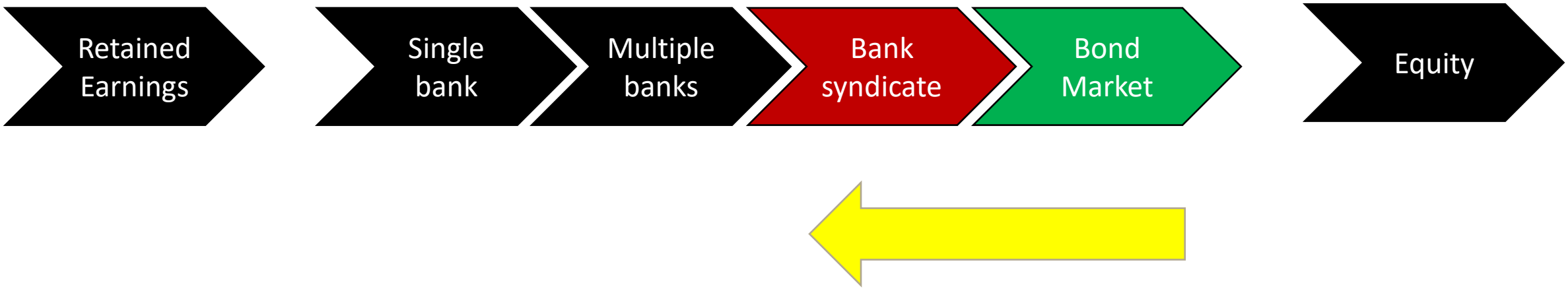
  E.g., Diamond, JPE 1991; Rajan, JF 1992; Chemmanur and Fulghieri, RFS 1994; Faulkender and Petersen RFS 2006; Rauh and Sufi, RFS 2010; Schwert, JF 2019

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

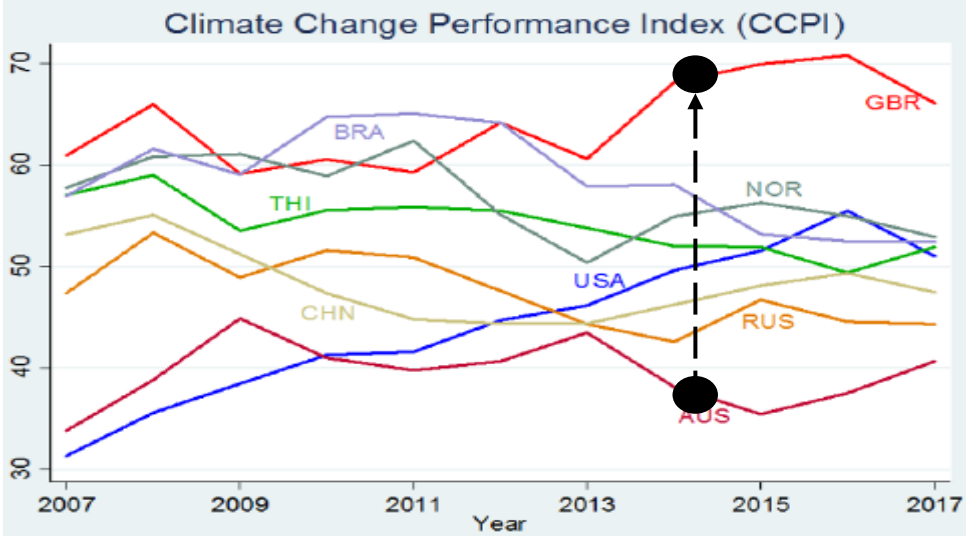
- Hand-collected firm-year data on the fossil fuel reserves of firms across countries, 2007-2018.
- Country-year climate policy index: Climate Change Performance Index (CCPI).

Burck, Hermwille and Bals (2016)

Pricing of Climate Policy Exposure

of fossil fuel firms

by corporate bond market and by banks



	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***

Bond to bank substitution
along Climate Policy Exposure

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 and 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 and 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 and 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 and 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?

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

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

(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.