Biodiversity risk and corporate lending

PhD Finance Programme 21-month Review

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What is the motivation?

- Background: Biodiversity loss → physical risks and transition risks for ecosystem services → damage on economic activities[1]
- Banks' role: supporting green transition via capital allocation
  - Capable of adjusting loan costs for firms with different biodiversity risk exposure via quantity or pricing
  - Make commitments on biodiversity by stating the goals in disclosures or joining biodiversity-related initiatives
- Research question: Do banks care about borrowers' biodiversity risk exposure in lending, especially after banks made the commitments to do so?

[1] NGFS (2021), "Biodiversity and financial stability: building the case for action"

Related literature

- *Strand 1*: Biodiversity finance and risk measurement
  - Research areas: returns of portfolios sorted on the biodiversity measures (Giglio et al. 2023); private capital in biodiversity financing (Flammer et al. 2023); stock prices of firms with large biodiversity footprints (Garel et al. 2023); biodiversity risk and audit fees (Steindl et al. 2024); country-level biodiversity risk and loan pricing in EU (Becker et al. 2023)
  - Measurement of biodiversity risk: (1) third-party data, such as Corporate Biodiversity Footprint by IDL (Garel et al. 2023), ESG indicators by EIRIS (Hoepner et al. 2023) (2) 10-K based textual measures by Giglio et al. (2023)

- *Strand 2*: Bank lending and environmental considerations
  - Evidence for banks' divestment/imposing higher costs for brown firms (e.g., Kacperczyk and Peydró 2022, Ye 2022, Ivanov et al. 2022, Delis et al. 2019, Degryse et al. 2023)
  - No evidence for banks' divestment/higher costs for brown firms (Bruno and Lombini 2023, Giannetti et al. 2024, Sastry et al. 2024, Berg et al. 2024)

Our findings and contributions

- Findings
  - Lenders do not treat high biodiversity risk firms and industries differently in terms of loan amount, maturity, and yield spread
  - Banks do not make adjustments on these loan terms after their commitments on biodiversity, compared to non-committed banks

- Contributions
  - Constructing a set of biodiversity risk measures at the firm and the industry level based on the textual analysis of the Q&A section of earnings call transcripts
  - First study to examine the effect of firms' biodiversity risk exposure on loan quantity and costs using a global sample of lenders and borrowers
  - Our findings on the effectiveness of banks' commitment provide implications for policymakers that banks' voluntary commitments do not result in stricter loan terms for biodiversity risk borrowers

Data overview: Sources and matching

- Main data sources
  - Earnings call transcripts: Refinitiv AdvEvents
  - Syndicated loans: DealScan
  - Bank-level commitment on biodiversity: BEI, FfB, PBAF, and Forest500
  - Financial data for borrowers: Refinitiv, Compustat
  - Financial data for lenders: Compustat, Refinitiv, BankFocus, Call Report

- Data matching:
  - Old DealScan to Worldscope: Link table of Beyhaghi et al. (2021)
  - Old DealScan to new DealScan: WRDS mapping
  - Compustat to DealScan (lender): Chava and Roberts (2008)
  - Compustat for DealScan (borrower): Schwert (2018)
  - Unmatched borrowers and lenders: algorithm based on Google Search Engine

Data overview: Sample coverage

- Sample coverage:
  - Sample period: 2010 to 2022
  - Data level: loan level (for the main tests), with loans of 715 global banks to 3,250 borrowers
  - Number of observations: 7,888 (after excluding unmatched lenders and borrowers & requiring the disclosure of borrowers' earnings call transcripts)
- Country distribution
  - Lenders' country distribution: 244 banks (34.1%) have parent operating country in the US, 188 (26.3%) in the EU, 31 (4.3%) in Japan, and 252 (35.2%) elsewhere
  - Borrowers' country distribution: 2,102 firms (64.6%) have headquarters located in the US, 460 (14.1%) in the EU, 141 (4.3%) in the UK, and 547 (16.8%) elsewhere

Text-based measurement in finance

- Finance literature using text-based measurement
  - For example, Li et al. (2020, RFS) use the word embedding model on earnings call transcripts to measure corporate culture; Bellstam et al. (2021, MS) develop a new measure of innovation using the text of analyst reports of S&P 500 firms; Li et al. (2024, RFS) conducts a textual analysis of earnings call transcripts to quantify climate risk exposure at the firm level

- Text-based measurement for biodiversity risk
  - Giglio et al. (2023) construct several firm-level measures of exposure to biodiversity risk, based on textual analyses of firms' 10-K statements
  - In comparison, to quantify the biodiversity risk at the firm level: (1) we conduct the textual analyses on earnings call transcripts, instead of 10-Ks; (2) we adjust the counting algorithm to deal with some challenges in text mining

Text-based measurement: Earnings call based measures

- Reasons for us to use the Q&A section of earnings call
  - Flexible and investor-related, with unscripted discussion reflecting investors' attention
  - Timeliness and informativeness, with quarterly frequency and detailed information on firms

- Procedure
  - *Step 1*: Bag of words searching for biodiversity-related sentences, using Giglio et al.'s (2023) biodiversity dictionary based on similarity to "biodiversity" in Google's *word2vec*[2]
  - *Step 2*: BERT sentiment classification for biodiversity-related sentences[3]
  - *Step 3*: Calculating biodiversity risk measures (e.g., percentage/frequency measures, negative/positive measures, *Negative Score*, industry-level measures)

[2] Bag of words includes: biodiversity, ecosystem(s), ecology (ecological), habitat(s), species, (rain)forest(s), deforestation, fauna, flora, marine, tropical, freshwater, wetland, wildlife, coral, aquatic, desertification, carbon sink(s), ecosphere, and biosphere

[3] In this step, we use pre-trained BERT model from huggingface.co

Text-based measurement: Challenges and solutions

- *Challenge 1*: Words are mentioned in irrelevant contexts
  - Example: the word "ecosystem" in the dictionary is often used in a business context referring to the network of all stakeholders
  - Solution: (1) dependency parsing → manually identify relevant collocations (e.g., ecosystem restoration) and irrelevant collocations (e.g., Pollo Tropical); (2) additional condition of counting: "ecosystem" must show up with another biodiversity term in a transcript

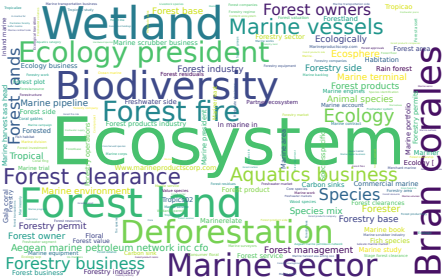
- *Challenge 2*: Noise from spurious mention
  - Situations: the terms are discussed by low biodiversity risk firms (accidentally or for some reasons); the terms are not discussed by high biodiversity risk firms
  - Solution: additional tests by aggregating the firm-level biodiversity risk measures into 178 industries classified BLS. Industry-level measure: more risk exposure, if firms of the industry have more discussion

Text-based measurement: Description and distribution

- Percentage of firms' mention of biodiversity-related terms
  - Q&A section: 3% transcripts mentioned at least once, 1.2% at least twice
  - Presentation section: 4.5%: transcripts mentioned at least once, 1.9% at least twice
- Consistency of mention
  - If a firm mentioned any biodiversity term in Q&A section, the firm has: 32% chance to mention any term again in the following Q&A, 8.7% in the consecutive four Q&As, 53.9% in any of the consecutive four Q&As
  - If a firm mentioned any biodiversity term in Presentation section, the firm has: 46% chance to mention any term again in the following Presentation, 18.1% in the consecutive four Presentations, 64% in any of the consecutive four Presentations
- Sentiment
  - Q&A: 10.6% are negative, 27.5% are positive, and 61.9% are neutral
  - Presentation: 13.1% are negative, 56% are positive, and 30.9% are neutral

Text-based measurement: Word frequency

- Q&A section: terms with top five highest frequency are “marine” (9,550), “forest(ry)” (8,357), “flora” (537), “tropical” (474), and “ecosystem” (426)
- Presentation section: terms with top five highest frequency are “marine” (14,743), “forest(ry)” (10,942), “tropical” (944), “biodiversity” (926), and “ecosystem” (869)
- Plots of word (phrase) cloud with dependency (left: Q&A; right: Presentation):



Text-based measurement: Main proxies and alternatives

- Main measures for baseline tests (based on Q&A sections)
  - (a) *Biod perc*: (# of biodiversity sentences / # of total sentences) $\times$ 100
  - (b) *Biod negative perc*: (# of negative biodiversity sentences / # of total sentences) $\times$ 100
  - (c) *Biod positive perc*: (# of positive biodiversity sentences / # of total sentences) $\times$ 100
- Industry-level aggregated main measures
  - *Ind biod perc*, *Ind biod negative perc*, and *Ind biod positive perc* are the averagely aggregated industry-level measures of (a), (b), and (c), respectively

Text-based measurement: Summary statistics

Biodiversity measures (%): firm-quarter (transcript) level						
Variable	Obs	Mean	STD	Min	Median	Max
Biod perc	117,078	0.02509	0.1678	0	0	5.8963
Biod negative perc	117,078	0.0003802	0.004439	0	0	0.2436
Biod positive perc	117,078	0.0008093	0.007631	0	0	0.3893
Ind biod perc	128,611	0.02770	0.05954	0	0.01054	1.8867
Ind biod negative perc	128,611	0.0004031	0.001251	0	0	0.0761
Ind biod positive perc	128,611	0.0008861	0.002117	0	0.0001401	0.0690
Biodiversity measures (%): loan level						
Biod perc	7,826	0.02691	0.1825	0	0	4.4346
Biod negative perc	7,826	0.0004169	0.004557	0	0	0.1463
Biod positive perc	7,826	0.0008501	0.007820	0	0	0.2044
Ind biod perc	10,520	0.02711	0.06015	0	0.01068	1.6101
Ind biod negative perc	10,520	0.0003812	0.001275	0	0	0.0761
Ind biod positive perc	10,520	0.0008419	0.002100	0	0.000112	0.0657

Note: Ind stands for industry-level aggregated measures

Text-based measurement: Country-level aggregated risks

- Country-level biodiversity score (accessed from http://www.biodiversityrisk.org/)
  - *bio_degradation*: dummy = 1 if the country mention biodiversity degradation in IMF reports
  - *bio_regulation*: dummy = 1 if the country mention biodiversity regulation in IMF reports
  - *bio_species*: Endangered Species Score: the share of endangered species (source: IUCN)
- IMF indexes reflect the biodiversity transition risks of a country, and IUCN index the physical risks. The correlation between our measures (aggregated at country-year level) and IMF/IUCN measures:

Variable	Biod perc	Biod negative perc	Biod positive perc
bio_degradation	-0.031	-0.026	-0.006
	(0.472)	(0.538)	(0.883)
bio_regulation	0.108**	-0.035	0.133***
	(0.011)	(0.411)	(0.002)
bio_species	-0.027	-0.057	-0.064
	(0.542)	(0.186)	(0.138)

Bank commitment: Sources of assessment

- *Source 1*: Signatories of biodiversity-focused initiatives
  - Banking Environment Initiative (BEI): launched in 2014; to support the goal of zero net deforestation
  - Partnership for Biodiversity Accounting Financials (PBAF): launched in 2019 by a group of financial institutions; to support transparent disclose on biodiversity
  - Finance for Biodiversity (FfB): launched in 2020 by a group of 26 financial institutions; to support protecting and restoring biodiversity through finance activities

- *Source 2*: Banks' statements in disclosure, assessed by Forest500
  - Description: a project for assessing the most influential companies and financial institutions in the deforestation economy, developed by Global Canopy, a not-for-profit organization
  - Assessment on bank commitment: For each year, Forest500 identifies 150 financial institutions with the greatest exposure to deforestation risk, and assesses them on the strength and implementation of their commitments on deforestation, with commitment type and evidence in supporting materials (e.g., annual report) provided

Bank commitment: Identify the earliest commitment year-quarter

- If a bank is a signatory of BEI, PBAF, or FfB:
  - Retrieving the earliest year-quarter of the banks' commitment on the initiative
- If a bank is assessed by Forest500:
  - First, selecting the earliest year when the bank is assessed to have a non-zero score in the "overarching commitment" subsection
  - Next, extracting the date from the URL links of the supporting materials
  - Choosing the earliest between (1) the URL material year, and (2) the assessment year
  - Assuming the last quarter of the year as earliest assessment time
- If a bank appears in different commitment data source:
  - Using the earliest among the earliest commitment times
- If a bank never signed any initiative, and is assessed by Forest500 with zero in "overarching commitment" score during the sample period:
  - Classifying the bank as a non-committed bank in our sample

Bank commitment: One-to-one lending relationships

- Reason for building one-to-one lending relationship: to identify the effect of a bank's commitment on the lending to high biodiversity risk firms using syndicated loans
- Procedure
  - *Step 1*: For deals with more than one tranche, keep the tranche(s) with the earliest active date
  - *Step 2*: Selecting the largest tranche within deal that starts at the loan origination date
  - *Step 3*: Keeping lead arrangers following the ranking of Chakraborty et al. (2018)
  - *Step 4*: Matching lead arrangers with the committed/assessed banks via parent company
- Bank distribution
  - Out of 79 matched banks: 52 banks (65.8%) have claimed or pledged to tackle the biodiversity loss with commitment with a goal; 21 banks (26.5%) only mentioned their understanding of the risk without a goal; 6 banks (7.5%) have made no statement
  - In our loan-level sample from 2010 to 2022: only 25 out of 52 committed banks have post commitment loan records (28.3% of the loan-level observations)

Bank commitment: Distribution of the earliest commitment year

- (1) signatory to BEI; (2) signatory to FfB; (3) signatory to PBAF; (4) signatory to another imitative; (5) deforestation-free commitment; (6) zero-net deforestation commitment; (7) understanding of the risks (treated as non-committed)

Earliest year	# of banks	# of committed banks	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2010	1								1
2011	1								1
2012									
2013									
2014	8	8	3				5		
2015	3	2					2		1
2016	5	2	1			1			3
2017	2	1						1	3
2018	24	17	1				8	8	7
2019	6	3					2	1	3
2020	8	4		2			1	1	4
2021	4	4		1	2		1		
2022	11	11		4	6		1		
Total	73	52	5	7	8	1	20	11	23
Percentage	100%	71%	6.8%	9.6%	11.0%	1.4%	27.4%	15.1%	31.5%

Model setting 1: Average effect at loan level

- Objective: to examine the average effect of firm-level risk exposure on loan quantity and costs from 2010 to 2022

$$y_{b,f,t} = \beta_1 Biodiversity\ measure_{f,t-4:t-1} + \theta_1 (Loan\ controls)_{b,f,t} + \theta_2 (Bank\ controls)_{b,t-4:t-1} + \theta_3 (Firm\ controls)_{f,t-4:t-1} + FE + \epsilon_{b,f,t} \quad (1)$$

- $y_{b,f,t}$: loan-level outcome, including the log of loan amount, the log of maturity, and the rate value of yield spread
- $Biodiversity\ measure_{f,t-4:t-1}$: three main firm-level measures for overall, negative, and positive biodiversity risk exposure, using moving average value of quarter [-4, -1]

Model setting 2: The effect of bank commitment

- Objective: to examine whether banks could meet their commitments on biodiversity afterwards, by imposing higher loan costs to borrowers with high biodiversity risk exposure

$$
\begin{aligned}
y_{b,f,t} = {} & \beta_1 Biodiversity\ measure_{f,t-4:t-1} + \beta_2 Committed_{b,t} \\
& + \beta_3 Biodiversity\ measure_{f,t-4:t-1} \times Committed_{b,t} \\
& + \theta_1 \left(Loan\ controls\right)_{b,f,t} + \theta_2 \left(Bank\ controls\right)_{b,t-4:t-1} \\
& + \theta_3 \left(Firm\ controls\right)_{f,t-4:t-1} + FE + \epsilon_{b,f,t}
\end{aligned}
\tag{2}
$$

- $Committed_{b,t}$: an indicator that equals one after a bank has commitment on biodiversity, and zero before that. The indicator always equals zero for banks that never commit on biodiversity

Model specification: Controls and Fixed effects

- Loan controls include a set of dummy variables: *If covenant*, *If secured loan*, *If base prime*, *If refinance*, and *If sole lender*
- Borrower controls include *Log total asset (firm)*, *Leverage (firm)*, *ROA (firm)*, and *Cash by asset (firm)*
- Lender controls include *Log total asset (bank)*, *Capital ratio (bank)*, and *Cash by asset (bank)*
- FE represents a vector of fixed effects, including lender fixed effect, year fixed effect, and the borrower's industry (2-digit SIC) fixed effect in the most robust version of the model specification
- $\epsilon_{b,f,t}$ is the error terms, two-way clustered at the lender and year level

Robustness check specifications

- For robustness check, the alternative measures for the three main measures (a)-(c):
  - Variations in calculation: (d) *Negative Score* = # negative - # positive (Giglio et al. 2023); (e) transcript-level negativity measure (= *Negative Score* if negative, = 0 otherwise); (f) transcript-level positivity measure (= - *Negative Score* if positive, = 0 otherwise)
  - Alternative measures: frequency measure instead of percentage measure for (a)-(c); dummy variable (negative/positive or not) for (e)-(f)
  - Averagely aggregating all firm-level proxies into industry level
  - Alternatively, using the full transcript instead of only Q&A section for counting
- Four control/fixed effect specifications for robustness check
  - (a) full bank controls + no bank FE; (b) short bank controls (total assets) + no bank FE; (c) full bank controls + bank FE; (d) short bank controls (total assets) + bank FE

Loan-level costs: Baseline results

- Below tables show the estimation of equation (1), examining the effects of firm-level biodiversity risk exposure on loan quantity at the loan level
- Explanatory variables: *Biod perc* for columns (1)-(2), *Biod negative perc* for columns (3)-(4), *Biod positive perc* for columns (5)-(6)
- Specifications across all 6 columns: Year FE; Industry FE; Loan controls; bank controls; firm controls. SEs are two-way clustered at the bank and year level

Dependent variable: Log loan amount						
Explanatory Variable	*Biod perc*		*Biod negative perc*		*Biod positive perc*	
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity measure	-0.147	-0.0722	-4.576	-4.812	-2.701	-1.443
	(0.156)	(0.155)	(7.880)	(7.534)	(3.525)	(3.314)
Bank FE	No	Yes	No	Yes	No	Yes
Obs.	2,728	2,728	2,728	2,728	2,728	2,728
adj. R-sq	0.154	0.311	0.154	0.311	0.154	0.311

Loan-level costs: Baseline results (*continued*)

Dependent variable: *Log maturity*						
Explanatory Variable	*Biod perc*		*Biod negative perc*		*Biod positive perc*	
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity measure	0.0799	0.0546	1.421	0.871	0.842	0.809
	(0.0608)	(0.0657)	(2.298)	(3.271)	(1.429)	(1.768)
Bank FE	No	Yes	No	Yes	No	Yes
Obs	2,635	2,635	2,635	2,635	2,635	2,635
adj. R-sq	0.138	0.168	0.137	0.168	0.137	0.168

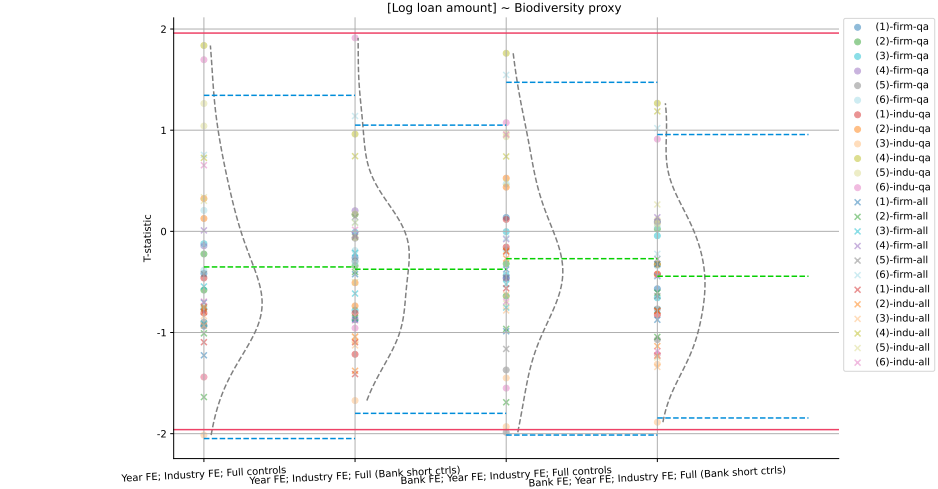
Dependent variable: *Yield spread*						
Explanatory Variable	*Biod perc*		*Biod negative perc*		*Biod positive perc*	
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity measure	0.390*	0.219***	0.479	2.744	4.027	4.046
	(0.191)	(0.0677)	(3.454)	(3.998)	(2.776)	(2.524)
Bank FE	No	Yes	No	Yes	No	Yes
Obs	2,799	2,799	2,799	2,799	2,799	2,799
adj. R-sq	0.304	0.425	0.303	0.424	0.303	0.425

Robustness check: Baseline results on loan-level costs

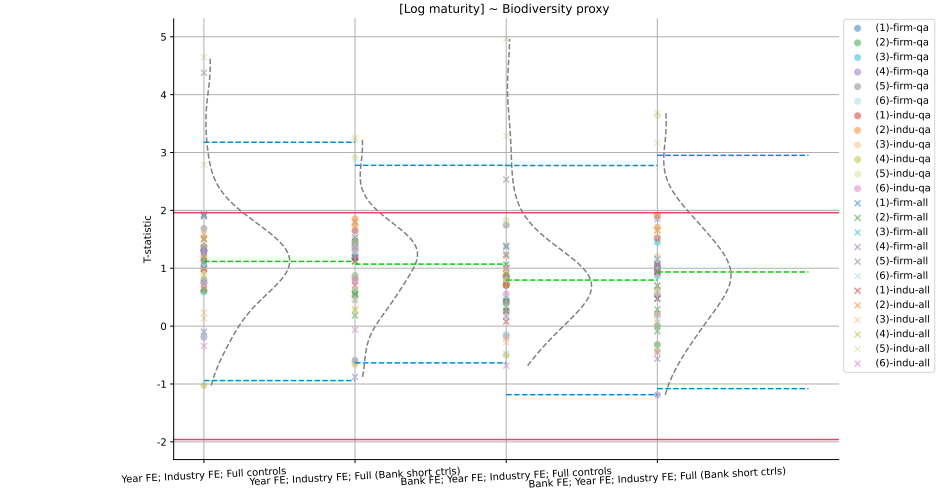
- Definition of t-statistics distribution plot
  - Plots the distribution of t-statistics of the coefficients of all the biodiversity risk measures
  - Number of dots (biodiversity risk measures): 44
  - Two red horizontal solid lines: 1.96 and –1.96
  - Green horizontal dashed line: the mean value of the t-statistics sample
  - Two blue horizontal dashed lines: the mean plus the two standard deviations and minus the two standard deviations, respectively

- Definition of plot legend
  - 24 categories in the legend
  - Each category has three components separated by hyphen in the form of "group number – firm/industry level – Q&A section/full transcript". Group number (1)-(6) corresponds to the measures (a)-(f)

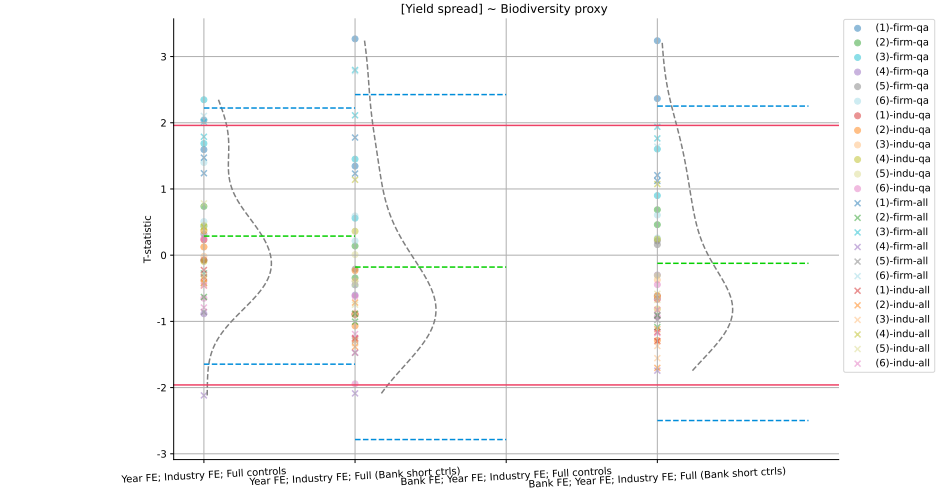
Robustness check: Baseline results on loan-level costs (loan amount)



Robustness check: Baseline results on loan-level costs (loan maturity)



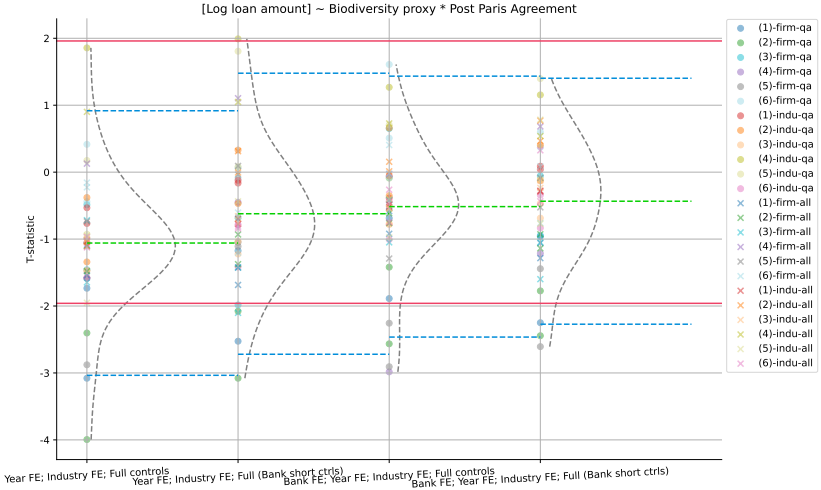
Robustness check: Baseline results on loan-level costs (yield spread)



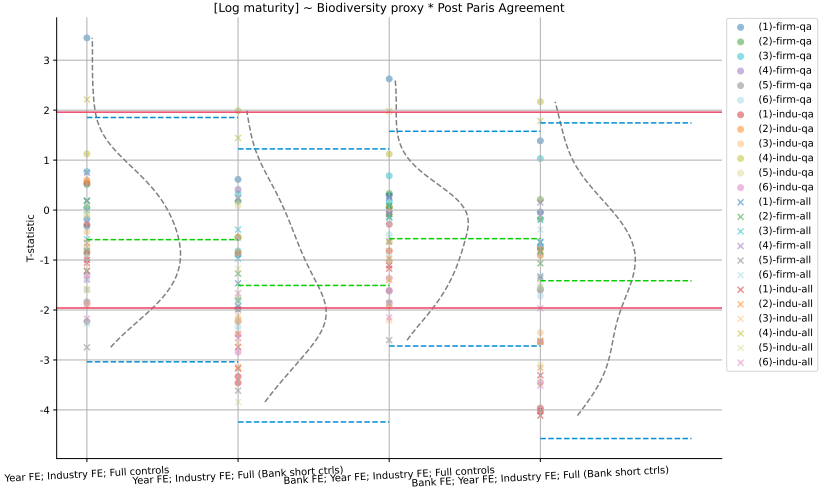
Additional test: Macro-level event: Paris Agreement

- Paris Agreement: an international treaty on climate change, adopted by 196 Parties at the UN Climate Change Conference (COP21) in Paris on 12 December 2015, aiming to enhance the implementation of the UN Framework Convention on Climate Change
- The agreement → policymakers work on green transition → transition risk for brown firms (increased demand for investment; potential punishment from policies) → lower and less stable profitability → higher credit risk
- Objective: to test whether banks realize and react to the increased transition risk of firms with high risk exposure on biodiversity, an important aspect of the environmental concerns, after the Paris Agreement
- Constructing a post Paris Agreement indicator, and show the distribution of t-statistics of the interaction between the biodiversity measure and the post indicator

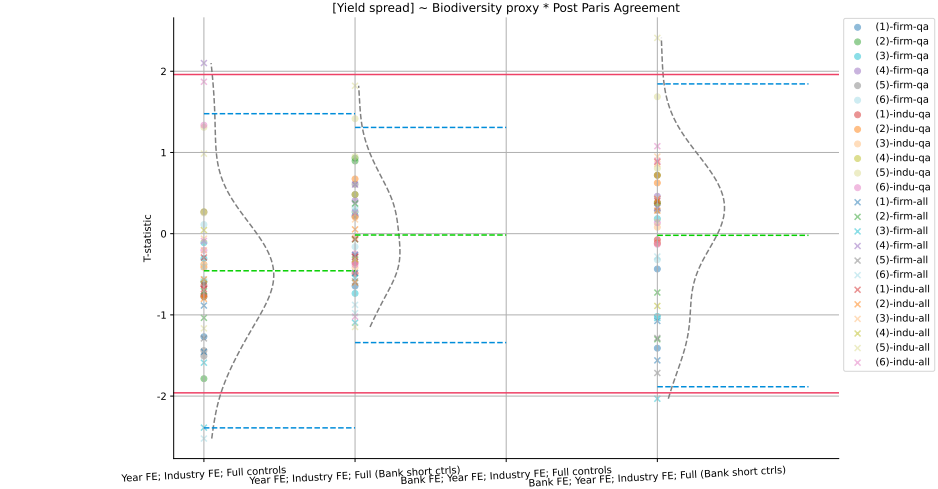
Additional test: Macro-level event: Paris Agreement (loan amount)



Additional test: Macro-level event: Paris Agreement (loan maturity)



Additional test: Macro-level event: Paris Agreement (yield spread)



The effect of bank-level commitment (loan amount)

- Below tables show the estimation of equation (2), examining whether banks impose higher loan costs to high biodiversity risk firms after commitment
- Specifications across all 6 columns: Year FE; Industry FE; Loan controls; bank controls; firm controls. SEs are two-way clustered at the bank and year level

Dependent variable: Log loan amount						
Explanatory Variable	*Biod perc*		*Biod negative perc*		*Biod positive perc*	
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity measure	-0.389**	-0.282*	-16.42***	-15.89***	-8.919***	-8.379**
	(0.127)	(0.156)	(4.960)	(4.264)	(2.587)	(3.073)
Commit	0.150	0.213	0.152	0.213	0.156	0.222
	(0.161)	(0.131)	(0.163)	(0.132)	(0.161)	(0.131)
Biodiversity * Commit	0.438	0.368	23.03*	17.62	12.58	13.79
	(0.413)	(0.410)	(11.05)	(11.53)	(7.530)	(10.37)
Bank FE	No	Yes	No	Yes	No	Yes
Obs.	1,365	1,365	1,365	1,365	1,365	1,365
adj. R-sq	0.143	0.257	0.144	0.259	0.141	0.257

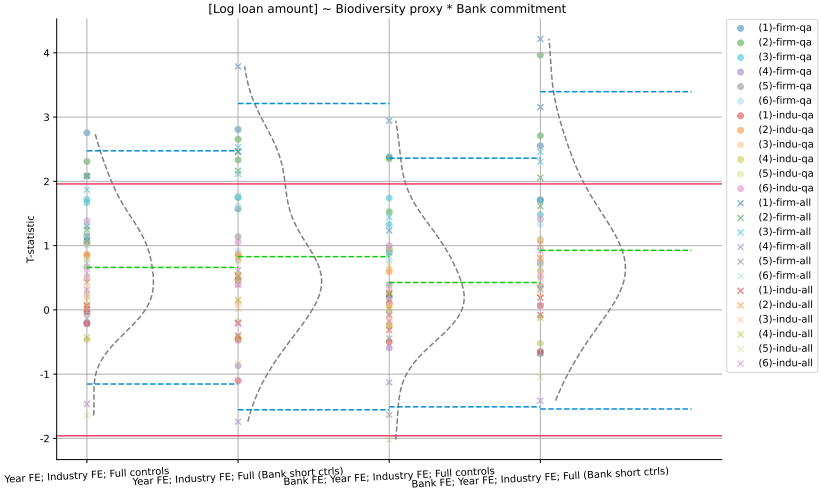
The effect of bank-level commitment (loan maturity)

Dependent variable: Log maturity						
Explanatory Variable	*Biod perc*		*Biod negative perc*		*Biod positive perc*	
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity measure	0.121*	0.0346	6.080**	4.127	0.575	-2.112
	(0.0629)	(0.0582)	(2.394)	(2.676)	(3.433)	(1.943)
Commit	-0.0181	-0.0411	-0.0151	-0.0363	-0.0217	-0.0447
	(0.0748)	(0.105)	(0.0750)	(0.106)	(0.0741)	(0.105)
Biodiversity * Commit	0.0676	0.157	-11.04	-8.305	6.031	8.464
	(0.181)	(0.168)	(12.81)	(12.57)	(6.090)	(5.311)
Bank FE	No	Yes	No	Yes	No	Yes
Obs.	1,321	1,321	1,321	1,321	1,321	1,321
adj. R-sq	0.185	0.195	0.185	0.196	0.184	0.196

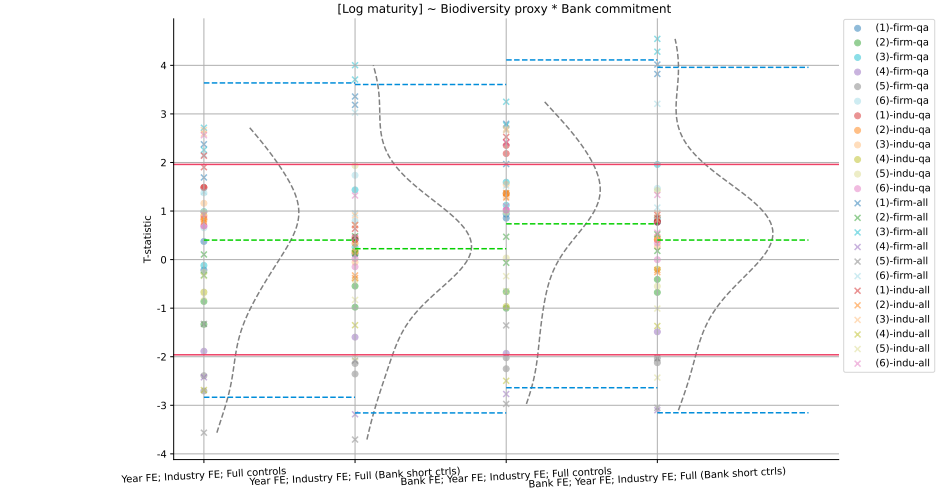
The effect of bank-level commitment (yield spread)

Dependent variable: Yield spread						
Explanatory Variable	*Biod perc*		*Biod negative perc*		*Biod positive perc*	
	(1)	(2)	(3)	(4)	(5)	(6)
Biodiversity measure	0.149	0.207	-2.061	0.507	5.191	7.343
	(0.185)	(0.195)	(3.062)	(4.863)	(8.865)	(8.250)
Commit	0.170	0.227*	0.165	0.218	0.167	0.228*
	(0.175)	(0.120)	(0.178)	(0.126)	(0.178)	(0.122)
Biodiversity * Commit	-0.373	-0.375	-11.15	-10.49	-7.257	-11.12
	(0.657)	(0.635)	(36.91)	(33.39)	(14.09)	(11.47)
Bank FE	No	Yes	No	Yes	No	Yes
Obs.	1,248	1,248	1,248	1,248	1,248	1,248
adj. R-sq	0.342	0.376	0.342	0.376	0.343	0.376

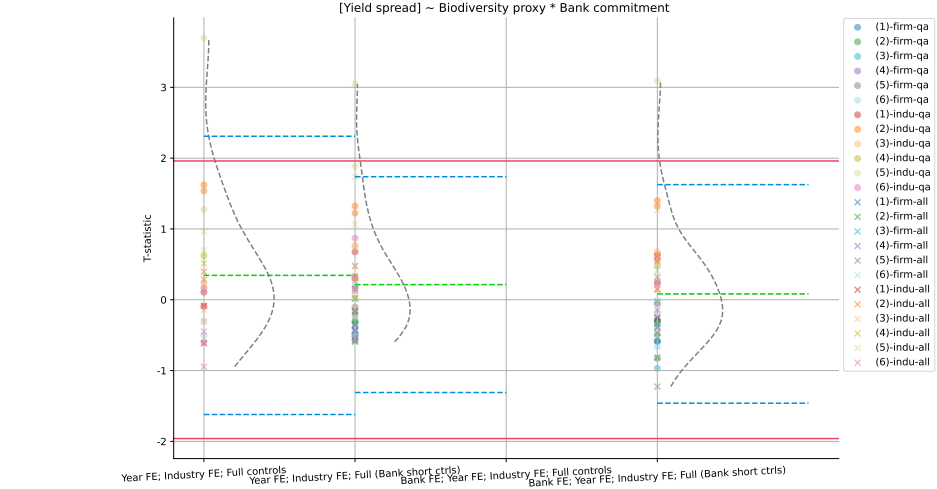
Robustness check: The effect of bank-level commitment (loan amount)



Robustness check: The effect of bank-level commitment (loan maturity)



Robustness check: The effect of bank-level commitment (yield spread)



Conclusion

- Key takeaways
  - Using a set of biodiversity risk measures constructed from the textual analysis on earnings call transcripts of the global firms, this paper finds banks do not care about the biodiversity risk exposure of borrowers in syndicated loans, in terms of loan quantity, maturity and yield spread.
  - In addition, banks do not significantly change their reaction to biodiversity risk after the Paris Agreement compared to before.
  - This paper further collects the bank-level commitment data from biodiversity-related initiatives and third-party financial institution assessment data from Forest500. The results suggest banks with commitments on biodiversity do not make significant changes in their lending to high biodiversity risk firms.
  - The findings have implications for policymakers on the issues of greenwashing and the effectiveness of voluntary biodiversity commitment.