

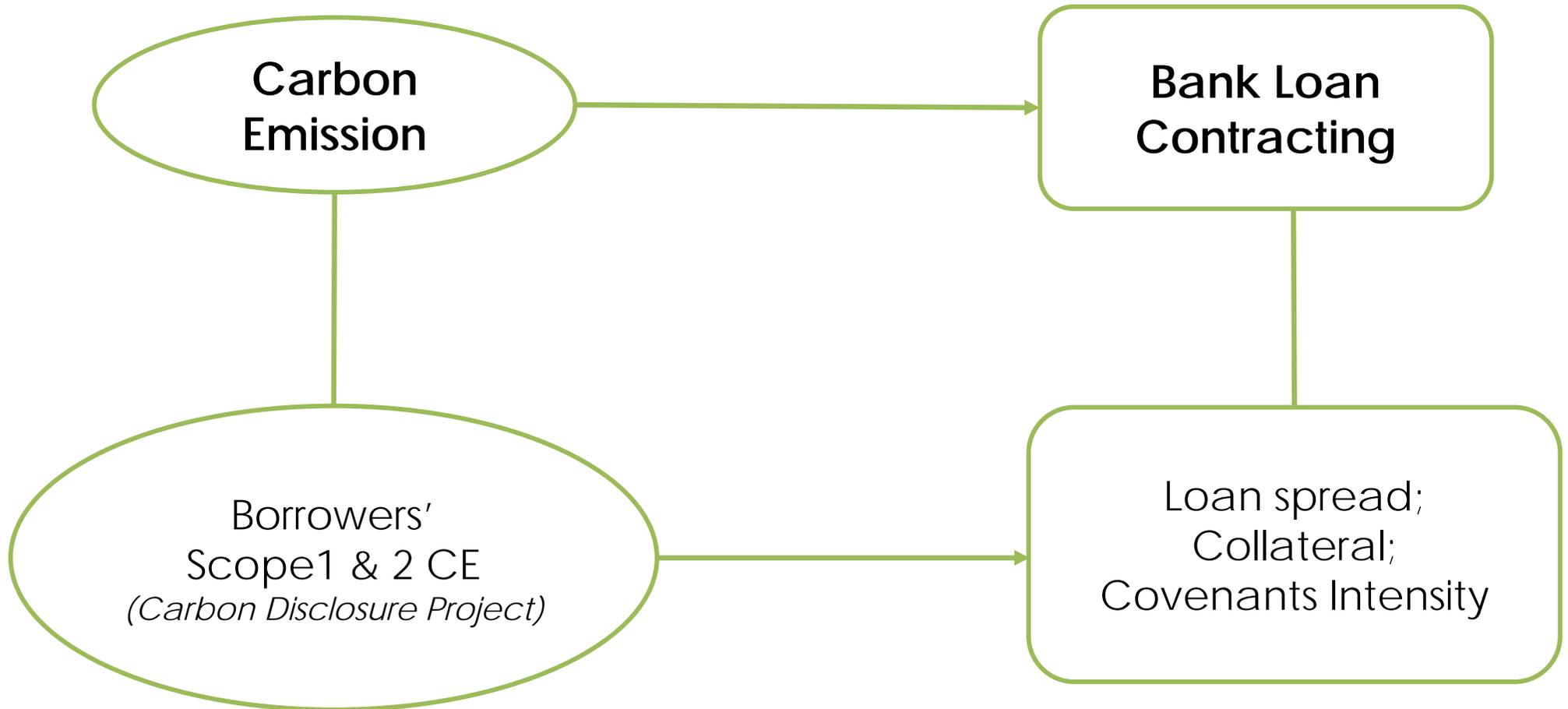
Bank lending in a warming globe:

Carbon emission and loan contracting

Outline

- 1 **Research Question**
- 2 **Literature & Hypothesis**
- 3 **Measurement & Results**
- 4 **Conclusion**

1.1 Research Question



1.2 Why study CE?

- ❑ On average, climate change will cost the global economy a **1% to 3.3% reduction in GDP** (OECD,2015).
- ❑ In term of *likelihood* and *impact*, climate change is **one of top five global risks** the world faces. (World Economic Forum, 2017)
- ❑ The main contributor of climate change is **carbon emission**.

1.2 Why study CE? (cont.)

Carbon emission has evoked tremendous concerns and widespread cooperation throughout the world.

- ❑ 1992: United Nations Framework Convention on Climate Change (UNFCCC)
- ❑ 1997: Kyoto Protocol
- ❑ 2015: Paris Agreement

1.3 Why study Bank Loan?

❑ Banks facilitate and provide significant amounts of capital.

-Over 95% of new external capital is from debt financing (Armstrong et al., 2010).

❑ Loan contracting is multi-facet: pricing & non-pricing terms.

-Gives banks flexibility in lending decisions and provides richer information about the consequences of carbon emissions.

❑ Financial sector is among the first to establish its management frameworks targeting at carbon emission in project funding.

-Citi, JP Morgan Chase, and Morgan Stanley formed the *Carbon Principles* that call for “enhanced diligence” in evaluating elective power industry borrowers in terms of their use of **energy efficiency** and **low-carbon energy technology**.

2.1 Literature Review

CE and firm value

CE is *negatively* correlated with firm value (Matsumura, Prakash, and Vera-Munoz, 2014; Griffin, Lont, and Sun, 2017).

How do **stock investors** price CE?

CE and Bank Loan Contracting

2.1 Literature Review (cont.)

CSR/ESG and Bank Loan

Toxic chemicals, CSR, ESG and bank loan contracting (Schneider 2011; Chava 2014, Goss and Roberts 2011; Kim, Surroca, and Tribo 2014; Ge and Liu 2015).

These papers do not involve *carbon emissions quantity data*.

Detailed *carbon emission quantities* provide more clear-cut indications for a firm's contribution to global warming than chemical release or CSR/ESG.

CE and Bank Loan Contracting

2.2 Hypothesis

Borrowers with higher CE are more likely to receive additional and unpredicted **regulations**, with resultant compliance costs, potential litigation costs and pollution mediation expenses, leading **higher operational cost and lower profitability**.

Lenders can be legally liable for environmental damages caused by the projects they finance.

Lending money to borrowers with higher CE might be risky to banks.

Higher CE leads more **unfavorable** bank Loan contracting.

3.1. Carbon Emission

❑ Carbon Disclosure Project (CDP)

- ❑ a London-based NGO that represents more than **650 institutional investors** with **\$87 trillion** in assets under management (2017).
- ❑ Each year, CDP asks the top executive managers of the world's largest public companies to disclose climate change risk and opportunity, the strategies to address, and ***firm-level carbon emissions***.
- ❑ Matsumura, Prakash, and Vera-Munoz, 2014; Griffin, Lont, and Sun, 2017.

3.1. Carbon Emission (cont.)

Greenhouse Gas (GHG) Protocol



1

- company facilities
- company vehicles

2

- purchased electricity, steam, heating & cooling for own use

3

- purchased goods, services and capital goods
- fuel and energy-related activities
- business travel and employee commuting
- waste generated in operations
- investments
- processing of sold products and use of sold products
- end-of-life treatment of sold products
- franchises
- leased assets
- transportation, distribution

Reporting Company

Upstream Activities

Upstream Activities

Upstream & Downstream

Downstream Activities

Scope 1: Direct
Greenhouse gas emissions from sources that are owned or controlled by a company.

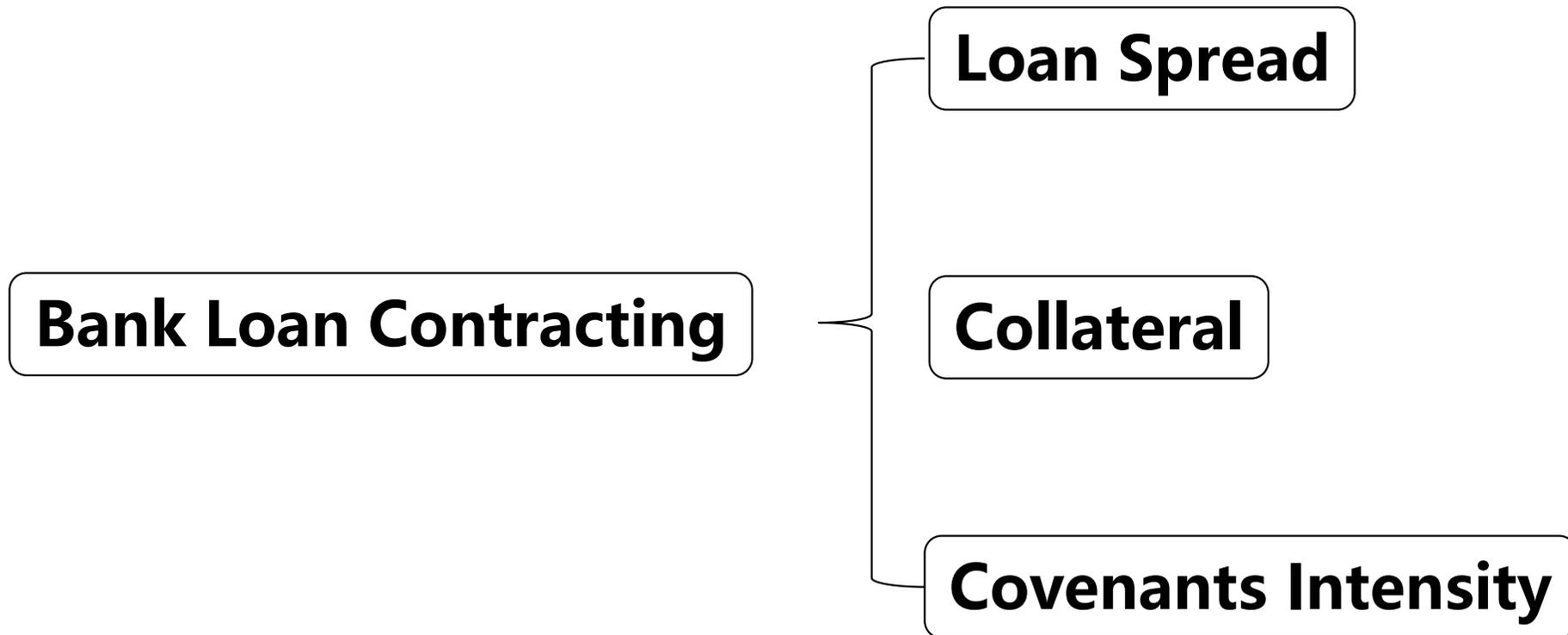
Scope 2: Indirect
Greenhouse gas emissions resulting from the generation of electricity, heat or steam purchased by a company.

Scope 3: Indirect
Greenhouse gas emissions from sources not owned or directly controlled by a company but related to the company's activities.

3.2. Bank Loan Contracting

Pricing-term and Non-pricing term

(Qian and Strahan, 2007; Bae and Goyal, 2009; Kim, Song and Zhang, 2011; Kim, Tsui, and Yi, 2011; Giannetti and Yafeh, 2012; Chen, Huang, Lobo and Wang, 2016)



3.3 Sample

Sample Period: *2007 to 2014 (8 years)*

Bank Loan data: *Dealscan*

Firm-level controls & Country-level controls:

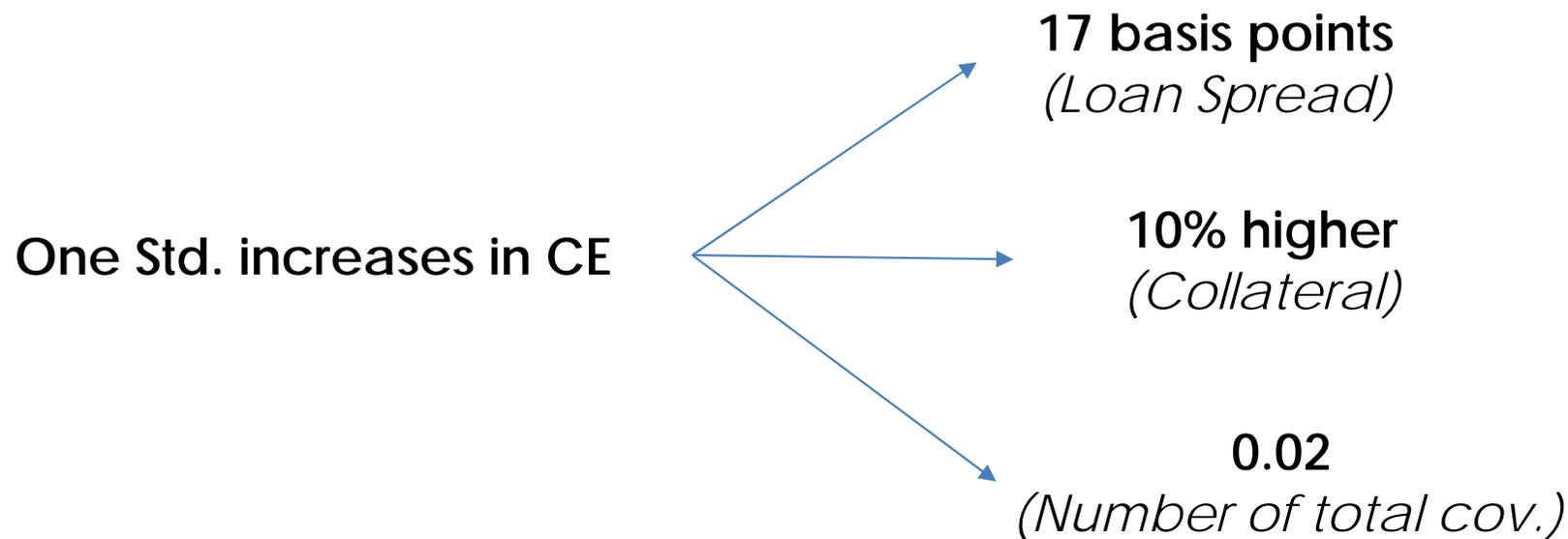
Controls: *Firm Size, Tangibility, Leverage, ROA, Z-score, Operation Risk, Inflation, Economic growth, Log GDP, Legal Origin, Creditor rights.*

3,694 bank loan facilities

33 countries (regions), including *Australia, Austria, Belgium, Brazil, Chile, Colombia, Denmark, Finland, France, Germany, Greece, Hong Kong, India, Ireland, Israel, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Norway, Portugal, Russia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Turkey, U.K., and U.S..*

3.4 Main Results

Higher CE → Unfavorable Bank Loan Terms



3.4.1 Main Results (split scope 1 vs 2)

Panel B. Relations between Scope 1 and Scope 2 carbon emissions and bank loan terms

Independent Variable	Dependent Variable					
	(1) <i>Ln(Loan Spread)</i>	(2) <i>Secured</i>	(3) <i>Covenants</i>	(4) <i>Ln(Loan Spread)</i>	(5) <i>Secured</i>	(6) <i>Covenants</i>
<i>Ln(Scope 1 Carbon)</i>	0.033*** (3.35)	0.079*** (2.98)	0.046** (2.09)			
<i>Ln(Scope 2 Carbon)</i>				0.004 (0.35)	-0.044 (-1.22)	-0.007 (-0.29)

Scope 1 (direct) NOT by scope 2 (indirect).

Exp: Scope 1 CE is more related to potential regulation.

3.5 Robust Checks

- ❑ Propensity score matching (PSM) test
- ❑ Drop USA; USA& Japan;
- ❑ Drop those countries/regions with less than 10 observations
- ❑ Keep only USA
- ❑ Country-observation-weighted regression

3.6 Cross-sectional test (carbon reduction plan)

*Borrowing firms have **existing mitigation plans** for carbon emissions, banks tend to lower the stringency of loan terms by making the loans cheaper and imposing fewer restrictive covenants.*

3.6 Cross-sectional test (carbon governance)

Carbon Governance:

- ❑ *Rank of the manager in charge of climate change issues*
- ❑ *CCR management arrangements*
- ❑ *Incorporation of climate change into business strategy*

3.6 Cross-sectional test (extreme climate)

*Relationship of carbon emissions and loan spread is **stronger** in countries that experience more **extreme climate**.*

Annual climate extremeness index indicate that the country experiences more extreme climate in that year. Source: Germanwatch.

3.7 Channel Test

***Borrowers** with higher CE are more likely to receive additional and unpredicted regulations, with compliance costs, potential litigation costs and pollution mediation expenses, leading higher operational cost and lower profitability.*

3.8 Real effects of bank lending on CED

*If **banks put higher pressure** on firms with greater carbon emissions through tightened lending terms, firms may **consider lowering their emissions levels** in order to obtain more favorable loan deals.*

4 Conclusion



- *Driven by **Scope 1** not Scope 2.*

- *Cross-sectional Test*

*Weaker: CE reduction plan; Stronger carbon governance.
Stronger: Countries with more extreme climate*

- *Channel Test*

CE is positively related to Regulatory Risk and Prob. of Bankruptcy

- *Real Effects*

Bank can play an important role in CE reduction.

Thank
you