Levelling Up Your Green Mojo: The Benefits of Beneficent Investment

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AFBER

January 2023

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What can (going-)green do for you?

- Increasing global awareness of environmental challenges
  - Social and financial costs
- Rising investor demand for environmentally responsible investments
- Conceptually, difficult to understand using the traditional corporate governance paradigm based on shareholder value maximization
  - Friedman (1970)
  - Hart and Zingales (2022)
- The wedge between socially- and privately-optimal investments
  - Who harvest the benefits and who bear the costs of going-green?

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How to align socially-optimal investments with privately-optimal investments?

- Various mechanisms proposed
  - Institutional investors
  - Stakeholders such as customers, suppliers, and employees
  - News media, legal traits, etc.
  - Regulations
- Are they effective? → Zoom into regulations
  - Environmental regulation can be costly
    - Generates adverse economic and social consequences (Liu et al. 2017; 2021)
    - Distort resources (Bartram et al. 2022)
    - Does not justify environmental gains (Clara et al. 2022)
  - Improve local educations
    - Chhaochaharia et al. (2022)
  - Increase firm value and encourage R&D investment
    - Dowell et al. (2000); Brown et al. (2022)

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This paper

- Explores the role of regulations on corporate environmental investment
  - To what extent can regulatory mechanisms be effective in triggering change in corporate policies?
  - Under what conditions is the regulation-induced investment substantiable and welfare-enhancing?
- Examines how firms alter their investments in response to increased stringent environmental regulations
  - Exploiting a nationwide environmental protection policy in China – the establishment of "major cities for environmental protection (MCEPs)"
- Assesses the corporate and social consequences of environmental investment

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The establishment of MCEPs

- In November 2007
  - Selected 113 prefecture-level cities as "*major cities for environmental protection*" (MCEPs)
- Targeted for integrated pollution prevention and control
  - Improved environment protection and enforcement
  - Close monitoring on air quality
  - Establish Photochemical Smog Pollution Early Warning System
  - Required to meet various environmental targets
  - Subject to periodic assessments from the government and stringent public scrutiny
- →Faces significantly increased intensity and compliance of environmental regulations

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MCEP Selection

- 43 cities based on *Article 17 of the 2000 Air Pollution Prevention and Control Act*
  - Municipalities, provincial capitals, coastal cities in special economic zones, and tourism cities
- 70 cities
  - Located in provinces with promises to meet the air quality target in 2005
  - Mandated requirements by *10th Five-Year Plan on Acid Rain and Sulfur Dioxide Pollution Control* to meet the target standard in 2005
  - Currently with heavy air pollution but likely to meet the air quality target in 2005
- The list is modified in 2010
  - 7 cities removed
  - 7 cities added
- In 2012, expands the list of 113 cities to all 337 prefecture-level cities in China

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Sample construction and textual analysis

- Sample period: 2001-2014
  - Initial sample contains all A-share firms listed on Shanghai or Shenzhen Stock Exchanges
- Manually collect project information from *the Appendix of On-going Projects* of a firm's annual report
- 196,700 corporate investment projects with descriptions (name, amount, etc.) from 2,484 unique firms

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Environmental vs. non-environmental projects (1)

- Construct a bag of words related to environment
  - Form a random subsample of 30,000 projects out of the 196,700 sample
  - 5 RAs manually read the project name description
    - Identify words/phrases related to environment
- The bag of words contains 467 unique words/phrases
  - Niche language that is fast moving
    - Sauter et al. (2022)
  - Technical, project-specific
- Examples
  - Energy saving, emission reduction, low carbon, solar power, photoelectricity, nuclear power generation, waste-to-energy, circular economy, desulfurization, denitrification, coal-to-gas conversion, straw power generation, acid bath degassing, wild honeysuckle plantation

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Environmental vs. non-environmental projects (2)

- Build an initial sample of environmental projects
  - Use the bag of words to screen the entire 196,700 projects
  - Classify as an environmental project if the project name contains at least one of the dictionary
- Goal: minimize the likelihood that an environmental project is excluded from the initial sample
- Caveat: Type I errors
  - Allows non-environmental projects to be included

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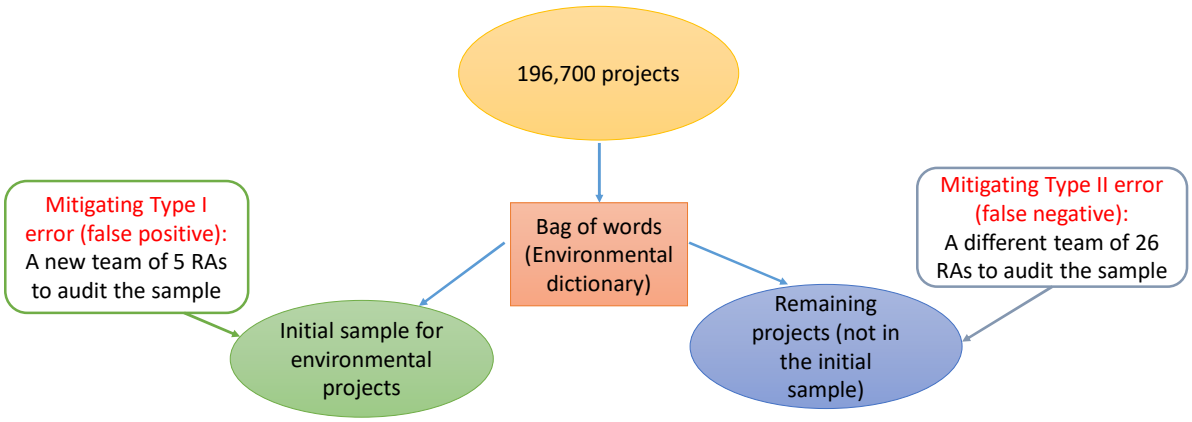
Environmental vs. non-environmental projects (3)



Final sample of environmental projects
18,765 (or 9.54% of total) environmental project investment, involving 1,489 unique firms

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Firm-specific vs. non-firm-specific environmental projects (1)

- A "bottom-line" approach
  - Judging whether a project produces *direct* economic and social value to the society
- Firm-specific ("shareholder-oriented")
  - The nature of the project is beneficial to the firm (i.e., increase sales, improve operations, or reduce cost)
    - Without adding *direct and immediate* social value to the society
- Examples
  - Energy-saving glass line expansion project, energy-saving fluorescent lamp production line, energy-saving and thermal insulation bricks for exterior wall

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Firm-specific vs. non-firm-specific environmental projects (2)

- Non-firm-specific ("Stakeholder-oriented", "*Beneficent*")
  - The nature of the project is *non-firm-specific* → generates direct externalities that are largely beneficial to local communities
- Examples:
  - Sewage treatment station, power plant waste residue treatment project, exhaust gas treatment system, sulfuric acid sewage treatment device

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Firm-specific vs. non-firm-specific environmental projects (3)

- A new team of 14 RAs
  - Assign 2 RAs for each of 18,756 environmental projects
  - Each RA independently reads the name description and cross-verifies via Internet searches
  - →based on the description and purpose of the project, classifies whether the project is firm-specific or non-firm-specific
  - In case of disagreement, a 3rd RA is involved
- Final breakdown of 18,756 environmental projects
  - 7,719 firm-specific (1,045 firms)
  - 11,037 non-firm-specific (1,200 firms)
  - 756 firms have both

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The MCEP effect on corporate environmental investments

- A difference-in-differences regression framework
  - $Environmental\ Investment = f(Post, Controls, FEs)$
    - EI(Total)/Sales, EI(Firm-specific)/Sales, and EI(Non-firm-specific)/Sales
  - *Post*: set to one if a firm's city becomes a MCEP city and zero otherwise
- Controls
  - Firm-level characteristics
    - Size, leverage, profitability, cash, market to book, age, SOE
    - Board independence and institutional holding
  - Local characteristics
    - City-level GDP growth
  - Firm FE, year FE, industry x year FE, and province x year FE

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Corporate investments in response to intensified environmental regulation

Dependent Variable	EI(Total)			EI(Non-Firm-Specific)			EI(Firm-Specific)		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post	**0.363*** **	**0.402*** **	**0.389*** **	**0.181** **	**0.235** **	**0.183***	**0.061**	**0.056**	**0.094**
	(2.73)	**(2.84)**	**(2.63)**	**(2.15)**	**(2.55)**	**(1.93)**	**(1.15)**	**(1.01)**	**(1.61)**
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Year FE	**Yes**	**No**	**No**	**Yes**	**No**	**No**	**Yes**	**No**	**No**
Industry × Year FE	**No**	**Yes**	**Yes**	**No**	**Yes**	**Yes**	**No**	**Yes**	**Yes**
Province× Year FE	**No**	**No**	**Yes**	**No**	**No**	**Yes**	**No**	**No**	**Yes**
Observations	21,394	21,394	21,394	21,394	21,394	21,394	21,394	21,394	21,394
Adjusted R^2	0.359	0.366	0.367	0.378	0.386	0.388	0.299	0.301	0.305

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Robustness

- Matched samples
  - PSM
  - Coarsened Exact matching
  - Entropy Balanced matching
- Placebo test
  - Pseudo event years
- Sample restrictions
  - Balanced DiD samples: 3-, 4-, and 5-year before and after the event year
  - Exclude firm-year observations where registration city is different from the city of operation
  - Exclude the event year
- Biases in TWFE estimators
  - Stacked regressions
  - Borusyak et al.'s (2022) estimators for dynamic effect
- Are firms more likely to engage in environmental investment after MCEP?

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Mechanisms: Media attention

- Media coverage on a city's environmental issues
  - Collect all news articles published in 485 newspapers
  - Textual analysis to identify news related to local cities' environmental issues
- *Media coverage increases after MCEP assignment, for state-affiliated, market-oriented, national, and local news outlets*

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Mechanisms: Politician's career path

- Manually collect biographies of city mayors and party chiefs from "Local Official Directories" and track their career movement
- *After MCEP, is an official more likely to be promoted if his city's environment improves?*
  - Environment quality measures
    - PM2.5; Wastewater; SO2; Carbon
  - *Yes*
- *After MCEP, is an official more likely to be promoted if his city achieves more environmental targets?*
  - Manually collect "annual reports on the work of the government" of 282 cities
    - % Targets Achieved = % pre-set city-level environmental targets that are accomplished
  - *Yes*

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Mechanisms: Firm-level incentives

Dependent Variable:	Taxes			Subsidies			Bank Loans		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post × EI(Total)	**-0.030*** **			**0.054*** **			**0.008*** **		
	(-3.57)			**(9.49)**			**(2.80)**		
Post × EI(Non-Firm-Specific)		**-0.028*** **			**0.046*** **			**0.008*** **	
		(-3.22)			**(7.08)**			**(2.74)**	
Post × EI(Firm-Specific)			**-0.028*** **			**0.054*** **			**0.007** **
			(-2.61)			**(6.61)**			**(2.24)**
Post	0.017	0.013	0.012	-0.025***	-0.018**	-0.016**	-0.005	-0.004	-0.004
	(1.59)	(1.27)	(1.12)	(-3.27)	(-2.27)	(-2.07)	(-1.36)	(-1.19)	(-1.00)
Main Effect Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Year FE	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Observations	12,232	12,232	19,389	19,389	19,389	13,376	21,118	21,118	21,118
Adjusted R^2	0.549	0.548	0.294	0.292	0.292	0.444	0.791	0.791	0.791

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Does the city benefit?

- A city-year panel
- After MCEP, when local firms spend more on environmental projects →
  - Environment
    - Reductions in PM2.5 level, wastewater, SO2 emissions, and carbon emissions
  - Economic impact
    - More entry of high-quality young firms
    - Reduction in local unemployment
  - Firm composition
    - Heavily polluting firms contribute less to a city's tax revenue
    - Heavily polluting firms expand to non-polluting sectors

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Does the firm benefit?

- A firm-year panel
- After MCEP, when local firms spend more on environmental projects →
  - Valuation
    - Higher Tobin's Q
    - More patents; especially green patents
  - Labor productivity
    - Lower employment growth
    - Reduction in labor investment inefficiency
    - Higher labor productivity

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Conclusion

- Firms engage in more environmental investments after their cities are targeted for more stringent environmental regulations
  - The effect mostly driven by investment in beneficent projects
- Provide evidence on how corporate environmental investment can be both value- and welfare-enhancing
  - Potentially induce sustainable corporate commitment to green projects

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