Environmental Liabilities, Borrowing Costs, & Pollution Prevention Activities

Jianqiang Chen, Pei-Fang Hsieh, Po-Hsuan Hsu, and Ross Levine

TRAGEDY OF THE COMMONS

"For that which is common to the greatest number has the least care bestowed upon it."

Aristotle (Politics, 350 BC)

ADDRESSING THE TRAGEDY OF THE COMMONS

1. Regulate it.
2. Make it uncommon,
   - internalize externalities by assigning property rights.

OUR MOTIVATION

- Corporations produce most of the land and water pollution that increases rates of cancer, reproductive/neurodevelopmental disorders, and premature deaths.
- Many evaluate the impact of regulation on pollution.

➢ What about the impact of internalizing externalities through the reassignment of property rights?

THIS PAPER'S PURPOSE & CONTRIBUTIONS

Purpose: Evaluate the impact of reassigning legal liability for firms' environmental damages on:

1) Securities prices and borrowing costs
2) Abatement activities and emissions

Contributions:

- First to conduct such an assessment.
- Identification of the impact of reassigning property rights on corporate behavior.

INSTITUTIONAL DETAILS

- **Environmental Liabilities in Chapter 11.**
- **The Apex Oil decision.**

BASICS

- Chapter 11 allows firms to discharge "claims" such as debts.
- What are dischargeable claims?
  - "A right to payment," e.g., a bond
  - "A right to an equitable remedy for breach of performance" if such a breach "gives rise to a right to payment."
- What about environmental cleanup obligations?

ENVIRONMENTAL OBLIGATIONS

- Landmark 1985 Ohio v Kovacs case
  - Supreme Court: Ohio wanted money to defray cleanup costs.
  - Supreme Court Decision: Environmental obligation gives rise to a right to payment, making it dischargeable in Chapter 11.
- Implications:
  1. Environmental liabilities could be shifted from the corporation and its creditors to taxpayers in bankruptcy, leaving more resources to satisfy creditors' claims.
  2. Among firms close to bankruptcy, the dischargeability of environmental liabilities reduced creditors' incentives to limit their firms' toxic releases.

2008 APEX OIL DECISION

Resource Conservation and Recovery Act (RCRA):

- Covers an explicit list of toxic chemicals.
- Requires firms to clean up environmental damages from those chemicals.

Apex (July 28, 2008)

- District Court orders Apex Oil (successor) to clean up RCRA chemicals.
- Cleanup obligations are not viewed as a right to payment.
- Unsuccessfully appealed to the 7th Circuit and the Supreme Court.

RCRA-related liabilities no longer dischargeable.

- **Firms in Chapter 11 with RCRA-related obligations now have fewer resources available for creditors.**

LEGAL EFFECTS OF *APEX*

- *Apex* was a surprising and consequential decision that had immediate effects.
- It shaped the DoJ's and EPA's litigation strategy.
- Legal and environmental consulting firms alerted firms around the country.

PREDICTED FINANCIAL & CORPORATE EFFECTS OF *APEX*

For firms (1) **close to Chapter 11** and with (2) **RCRA-related obligations**, *Apex* will:

1) Increase risk premia, reducing securities prices, and increasing borrowing rates.
2) Incentivize creditors to pressure their firms to implement pollution abatement activities that reduce RCRA emissions.

ALTERNATIVE VIEWS

- Regulation is so influential that Apex had little effect.
- Corporate governance: CEO compensation might be tied to short-term metrics.
- The Apex-creditor influences minor.
- Limited jurisdictional impact.

➢ **Empirical question**

APEX AND SECURITIES PRICES

DATA

- Match Toxics Release Inventory (TRI) with Compustat, DealScan (loan spreads), Wharton Research Data Services (bond ratings and returns)
  - We match facility-level emissions disclosure data (TRI, EPA) to public firms in finance-related databases.
- Bond Cumulative Abnormal Returns (CARs): Computed using Dickerson, Mueller, and Robotti (2023) bond factors, robust to using repeat-sales method.
- Stock CARs: Fama-French-Carhart 4-factor model.
- Period from 2004-2012. Drop 2008.

DATA DETAILS

- The EPA's Toxic Release Inventory (TRI) database provides data on releases of toxic chemicals (measured in pounds) at the facility-chemical-year level. Thus, a facility may report several chemicals over time, and firms may have multiple facilities in the TRI database.
- After matching, we have around 120,000 facility-chemical-year observations, covering 5,575 unique facilities owned by 563 unique public firms in our sample. These facility-level observations aggregate to about 4,500 firm-year observations.

CONCERNS AND APPROACH TO TRI DATA

- Researchers have expressed concerns that the TRI database is based on firms' self-reported toxic emissions.
- We do the following to ameliorate such concerns.
  - First, we focus on non-air toxic emissions.
  - Second, we focus on public firms because they tend to be larger and subject to greater oversight, reducing misreporting.
  - Third, our study focuses on RCRA-regulated compounds, which are generally among the more toxic chemicals covered by the TRI and therefore subject to stricter mandatory reporting requirements and monitoring.
- We also note that several studies suggest that the TRI database is not subject to significant measurement errors.

EFFECT OF APEX ON SECURITIES PRICES

We examine the cumulative abnormal returns (CARs) of bonds and stocks around the District Court decision of July 28, 2008.

$$\mathrm{CAR}_i = \alpha + \beta Heavy\ RCRA\ Polluters_i + \delta_1 I_d + \varepsilon_i$$

Variables	Definition
Heavy RCRA Polluters	$Heavy\ RCRA\ Polluters_i$ = 1 if firm's RCRA wastes were larger than the industry (SIC 2-digit) median during the pre-Apex (2003-2007) period and 0 otherwise.
Split Sample by High/Low Default Prob.	High Default Prob.: firms with probabilities of failure (Campbell et al., 2008) in June 2008 > SIC 2-digit industry median. Low Default Prob.: all other firms.

BOND PRICE REACTIONS: MONTHLY BOND CARs

	(1)	(2)
Subsample	High Default Prob.	Low Default Prob.
Dependent var.	CAR(-1,1)	CAR(-1,1)
Heavy RCRA Polluters	-0.0199**	-0.0070
	(-2.2362)	(-1.4780)
Observations	111	125
R-squared	0.148	0.199
Industry FE	YES	YES
High – Low Default Prob.	0.087*	

STOCK PRICE REACTIONS: DAILY STOCK CARs

Subsample	(1) High Default Prob.	(2) Low Default Prob.
Dependent var.	CAR(-5,5)	CAR(-5,5)
Heavy RCRA Polluters	-0.0338**	-0.0039
	(-2.2181)	(-0.3460)
Observations	270	293
R-squared	0.136	0.131
Industry FE	YES	YES
High − Low Default Prob.	0.047**	

EFFECT OF APEX ON SECURITIES PRICES

- Bond CARs fall by around 2% among heavy RCRA polluters with High Default probabilities.
- Stock CARs fall by around 3% among heavy RCRA polluters with High Default probabilities.

➢ Consistent with *Apex* increasing the expected loss to such firms' claimants from bankruptcy.

APEX AND DEBT

- Interest rates on loans
- Loan spreads
- Bond ratings

EFFECT OF APEX ON TOTAL INTEREST RATE

$$\ln(Total\ Interest\ Rate_{it}) = \beta(Apex_t \times Heavy\ RCRA\ Polluters_i) + \gamma Control_{it} + \delta_1 I_i + \delta_2 I_t + \varepsilon_{it}$$

Variables	Definition
Ln(Total Interest Rate)	The natural logarithm of of 10,000 times total interest expenses divided by total liabilities for firm *i* in year *t*.
Apex	Apex equals one when year t >=2009 and set to zero otherwise
Heavy RCRA Polluters	$Heavy\ RCRA\ Polluters_i$ equals one if firm *i*'s RCRA production wastes were larger than the industry (SIC 2-digital code) median during the pre-Apex (2003-2007) period and zero otherwise.
Split Sample by High/Low Default Prob.	High Default Prob.: firms with probabilities of failure at the end of December 2007 > SIC 2-digit industry median, and the Low Default Prob.: all others.
Controls	*R&D Intensity*, capital expenditure/total assets (*CAPX/AT*), advertising expenditures/total assets (*XAD/AT*), *ROA*, *Leverage*, *Tangibility (PPE/Assets)*, *Tobin's Q (Assets+BV Equity)/BV Assets)*, the natural logarithm of the book value of total assets (*Ln(AT)*), capital intensity (*Labor/Capital*), and firm age (*Firm Age*)

EFFECT OF APEX ON TOTAL INTEREST RATE

	(1)	(2)	(3)	(4)
Subsample	High Default Prob.	Low Default Prob.	High Default Prob.	Low Default Prob.
Dependent var.	Ln(Total Interest Rate)	Ln(Total Interest Rate)	Ln(Total Interest Rate)	Ln(Total Interest Rate)
Apex*Heavy RCRA Polluters				
	0.2817***	0.0480	0.2770***	0.0058
	(3.3356)	(0.5543)	(3.4632)	(0.0712)
Constant	5.3391***	5.1273***	6.6121***	7.5561***
	(281.1678)	(210.6681)	(3.6654)	(4.7640)
Observations	2,055	2,122	2,055	2,122
R-squared	0.697	0.676	0.716	0.700
Controls			YES	YES
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
High - Low Default Prob.	0.020**		0.004***	

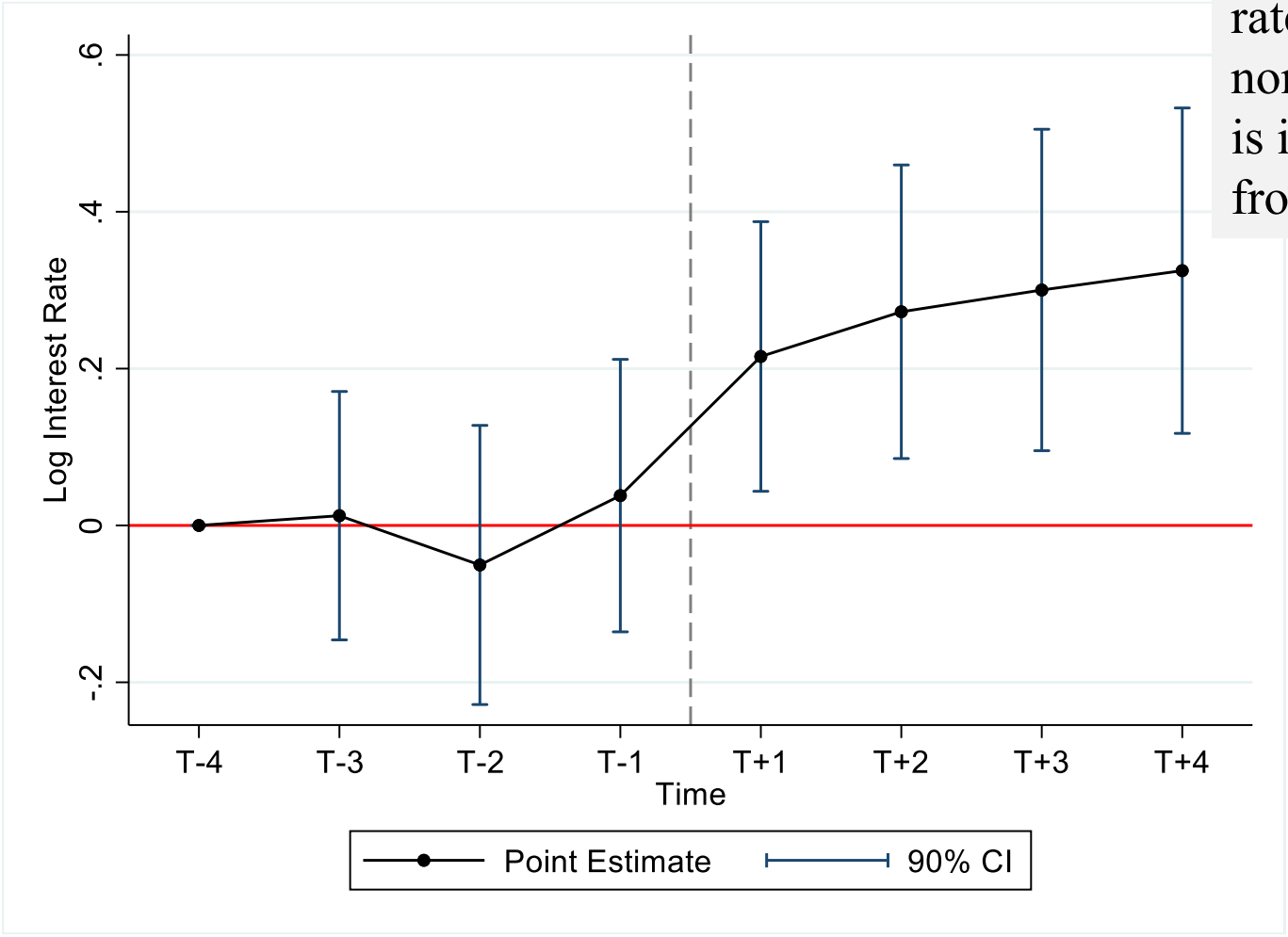
EFFECT OF APEX ON TOTAL INTEREST RATE

- The total interest rate of heavy RCRA polluters with high default probabilities rose by 27.7% more following *Apex* than otherwise similar firms.
- An average heavy RCRA polluter pays, on average, $54 million more in annual interest payments than an average non-heavy RCRA polluter after the ruling than before.
- The average interest payment among all firms with high default probabilities before Apex was $195 million.

	(3)	(4)
	High Default Prob.	Low Default Prob.
	Ln(Total Interest Rate)	Ln(Total Interest Rate)
	0.2770***	0.0058
	(3.4632)	(0.0712)
	6.6121***	7.5561***
	(3.6654)	(4.7640)
	2,055	2,122
	0.716	0.700
	YES	YES
	YES	YES
	YES	YES
	0.004***	

PARALLEL TRENDS OF TOTAL INTEREST RATE

The difference in interest rates between heavy and non-heavy RCRA polluters is insignificantly different from zero before *Apex*.



EFFECT OF APEX ON BANK LOAN SPREADS

	(1)	(2)	(3)	(4)
Subsample	High Default Prob.	Low Default Prob.	High Default Prob.	Low Default Prob.
Dependent var.	Ln(Loan Spread)	Ln(Loan Spread)	Ln(Loan Spread)	Ln(Loan Spread)
Apex*Heavy RCRA Polluters	0.2555***	-0.0018	0.2543***	-0.0294
	(2.9325)	(-0.0209)	(3.0436)	(-0.3697)
Constant	4.8687***	4.4177***	3.8505	8.1523***
	(239.3995)	(231.9591)	(1.5886)	(6.7506)
Observations	737	824	737	824
R-squared	0.816	0.851	0.831	0.869
Controls			YES	YES
Year FE	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES
High - Low Default Prob.	0.015**		0.004***	

Bank loan spread: basis points above LIBOR that banks charge the firm. Aggregate to firm-year observations by weighting each loan granted to a firm by loan size.

EFFECT OF APEX ON BOND RATINGS

	(1)	(2)	(3)	(4)
Subsample	High Default Prob.	Low Default Prob.	High Default Prob.	Low Default Prob.
Dependent var.	Equal-Weighted Bond Ratings	Equal-Weighted Bond Ratings	Value-Weighted Bond Ratings	Value-Weighted Bond Ratings
Apex*Heavy RCRA Polluters	-0.1699***	0.0787	-0.1808***	0.0688
	(-2.6043)	(1.1889)	(-2.7402)	(0.8994)
Apex	0.0244	-0.0840	0.0223	-0.0243
	(0.3695)	(-0.8978)	(0.3269)	(-0.2383)
Heavy RCRA Polluters	0.2572	-0.3679*	0.2644	-0.2766
	(1.3052)	(-1.6932)	(1.3429)	(-1.2589)
Observations	1,048	1,254	1,045	1,251
Pseudo R2	0.181	0.228	0.174	0.214
Firm Controls	YES	YES	YES	YES
Month Dummy	YES	YES	YES	YES
High – Low Default Prob.	0.004***		0.006***	

- **Monthly data:** March 2008 to January 2009, excluding July 2008.
- Ordered probit using ordered bond ratings from Standard and Poor's, Moody's, and Fitch for individual bonds, we (a) assign an integer value for each bond-month observation, (b) construct equal-weighted and value-weighted bond ratings for each firm-month, and (c) round that firm-month rating to the nearest whole number.

APEX, SECURITIES PRICES, AND DEBT

For firms (1) close to Chapter 11 and with (2) RCRA-related obligations, *Apex* was associated with sharp:

- Reductions in bond and stock prices,
- Increases in risk premia: total interest rates, bank loan spreads, and bond ratings

APEX AND POLLUTION

- Pollution prevention activities
- Toxic emissions

QUESTION

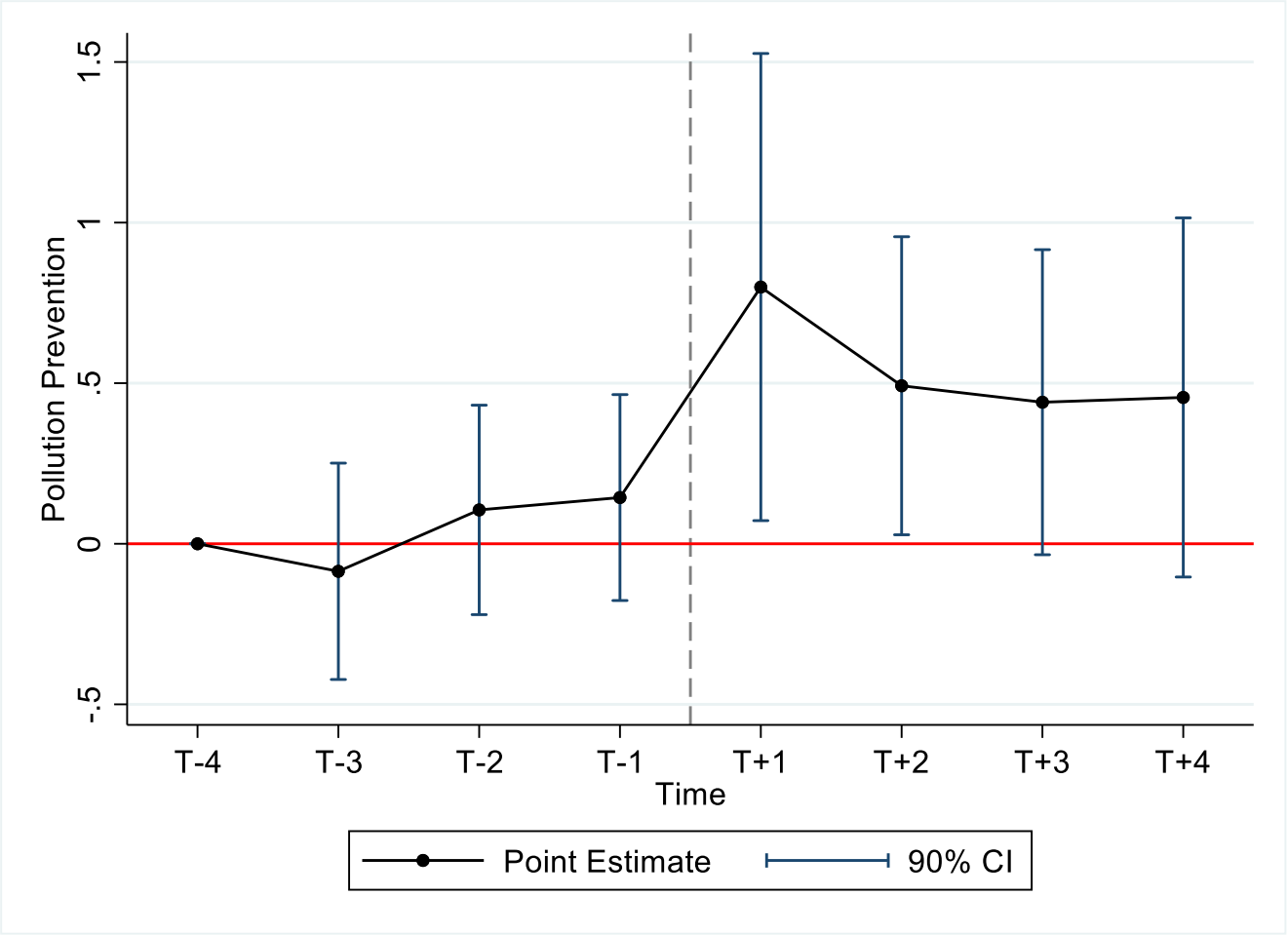
Does Apex intensify incentives for the creditors of RCRA-polluting firms near bankruptcy to reduce emissions of RCRA pollutants?

POLLUTION PREVENTION ACTIVITIES

- Facilities pollution prevention activities:
  - Modifying (1) raw material inputs, (2) products & packaging, (3) industrial processes & equipment, and (4) operational practices & monitoring
  - Improving (5) cleaning & degreasing equipment, (6) surfaces & finishings, (7) spill & leakage prevention practices, and (8) inventory storage.
- TRI: ordered coding of each of pollution prevention activity.
- We sum these codes for each facility in each year (Bellon 2021).

POLLUTION PREVENTION: HIGH DEFAULT SUBSAMPLE

ESTIMATED COEFFICIENT ON $\sum_{t=2005}^{2012} \beta_t (I_t \times Heavy\ RCRA\ Polluters_i)$



POLLUTION: NON-AIR TOXIC RELEASES

- Facility-chemical-year panel:
  - We examine the separate effects of *Apex* on RCRA and other chemicals.
  - Sample: 90,830 observations of 4,033 unique facilities and 507 unique firms.

- Ln(1+Non-air toxic releases$_{ict}$): Natural logarithm of one plus the pounds of facility *i*'s total releases of chemical c in year t.

REGRESSIONS FOR POLLUTION

- $ln(1 + Non - air\ Toxic\ release_{ict}) = \beta(Apex_t \times Heavy\ RCRA\ Polluters_i) + \gamma Facility_i + \delta_1 I_{ct} + \delta_2 I_{kt} + \varepsilon_{ict}$
- **where i indexes facilities, c chemicals, k firms, and t indexes years.**

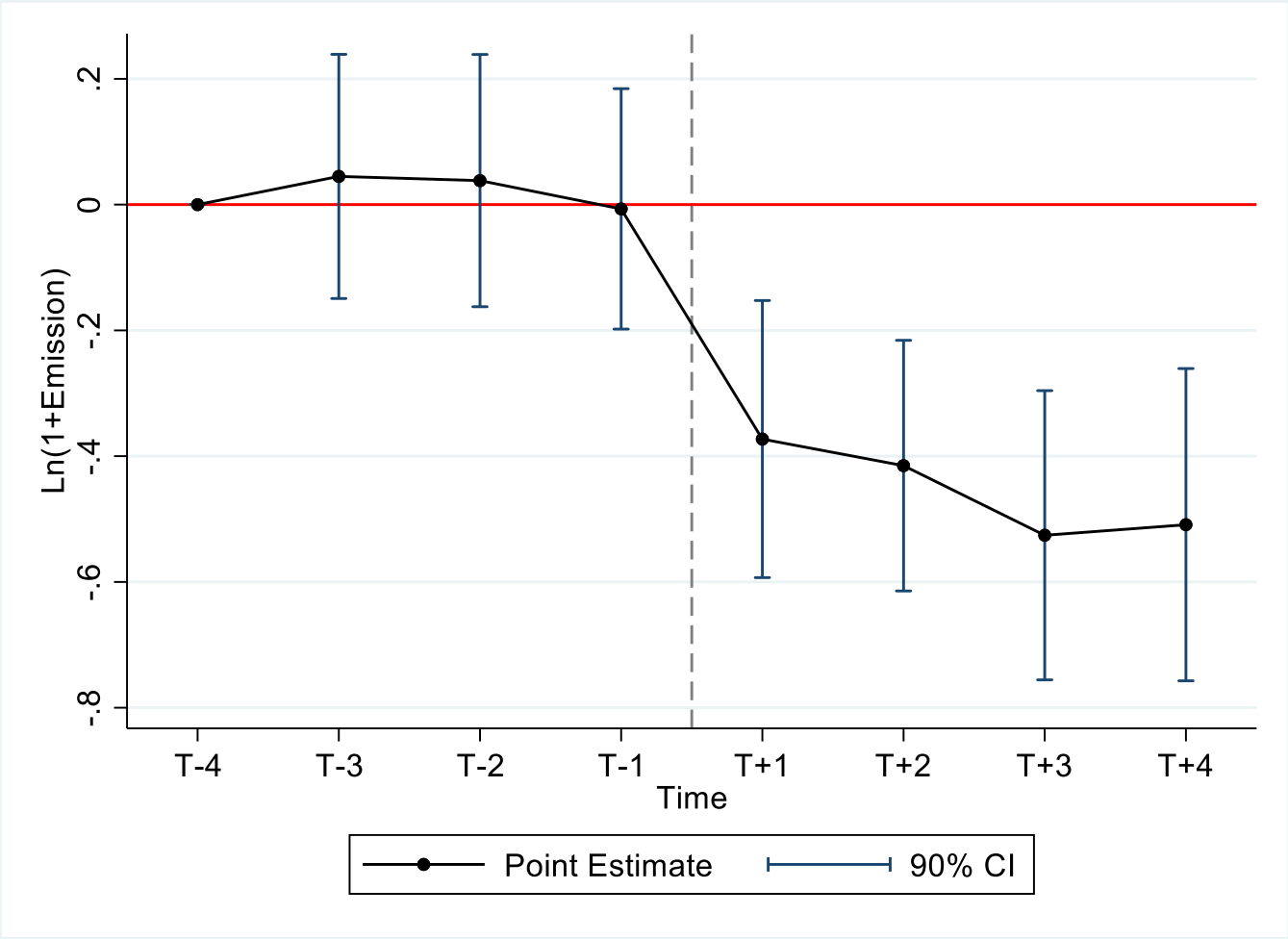
Variables	Definition
Ln(1+Non-air toxic release)	Natural logarithm of one plus the pounds of facility *i*'s total releases of chemical *c* in year *t*.
Apex	Apex equals one when year t >=2009 and set to zero otherwise
Heavy RCRA Polluters	It equals one if facility *i*'s RCRA production wastes >industry median during the pre-Apex (2005-2007) period and zero otherwise.
High/Low Default Prob. subsample	High Default Prob.: facilities of firms with probability of failure in December 2007 > industry (NAICS 3-digital code) median.

EFFECT OF APEX ON POLLUTION

	(3)	(4)
Subsample	High Default Prob.	Low Default Prob.
Dependent var.	Ln(1+Non-air Toxic Releases)	Ln(1+Non-air Toxic Releases)
Apex × Heavy RCRA Polluters	-0.5047***	0.0778
	(-3.8997)	(0.7668)
Ln(Emp)	0.1033	0.0606
	(0.7595)	(0.3753)
Ln(Sales)	-0.0053	-0.0585
	(-0.0419)	(-0.3756)
Observations	30,614	47,893
R-squared	0.801	0.748
Facility FE	YES	YES
Chemical-Year FE	YES	YES
Parent-Year FE	YES	YES
High - Low Default Prob.	0.000***	

DYNAMIC EFFECTS OF APEX ON POLLUTION: HIGH DEFAULT SUBSAMPLE

ESTIMATED COEFFICIENT ON $\sum_{t=2005}^{2012} \beta_t (I_t \times Heavy\ RCRA\ Polluters_i)$



ADDITIONAL CONCERNS

- Obama
- Regulations
- Financial Constraints

ADDITIONAL CONCERNS & EXPLANATIONS

- **It was not *Apex*, Obama did it.**
  - Expectations of his election and more stringent environmental regulations triggered the changes.
  - However:
    - We find no effects when examining non-RCRA pollutants
    - The stock return results involve a five-day window around July 28, 2008.

ADDITIONAL CONCERNS & EXPLANATIONS

- **It was not *Apex*, new greenhouse gas laws in 2009 did it.**

  However:

  - The results hold only for RCRA-emissions, and greenhouse gases are not RCRA-emissions.
  - Some of the new laws were California-specific, but the results were not.
  - When assessing security price reactions, we examine a tight window around July 28, 2008, well before the new laws.

ADDITIONAL CONCERNS & EXPLANATIONS

- **It was not *Apex*, the GFC did it by tightening credit conditions.**

  However:

  - It seems unlikely that heavy RCRA emitters rely more on external finance and were, therefore, more affected by the GFC.
  - The results hold when controlling for firm-specific financial constraint measures (e.g., Whited and Wu, 2006).
  - We focus on a tight window around July 28, 2008, for security price analyses.

CONCLUSIONS

Apex eliminated dischargeability of RCRA-covered obligations in Chapter 11, diminishing the value of creditor claims on such firms.

Following *Apex,* we find that

- Bond and stock CARs fell, and borrowing costs increased among "treated" firms, i.e., heavy RCRA-emitters close to bankruptcy.
- Only treated firms increased pollution prevention activities and reduced emissions of (only) RCRA-covered pollutants.

➢ The reassignment of environmental liabilities substantially influenced corporate credit conditions and pollution decisions.