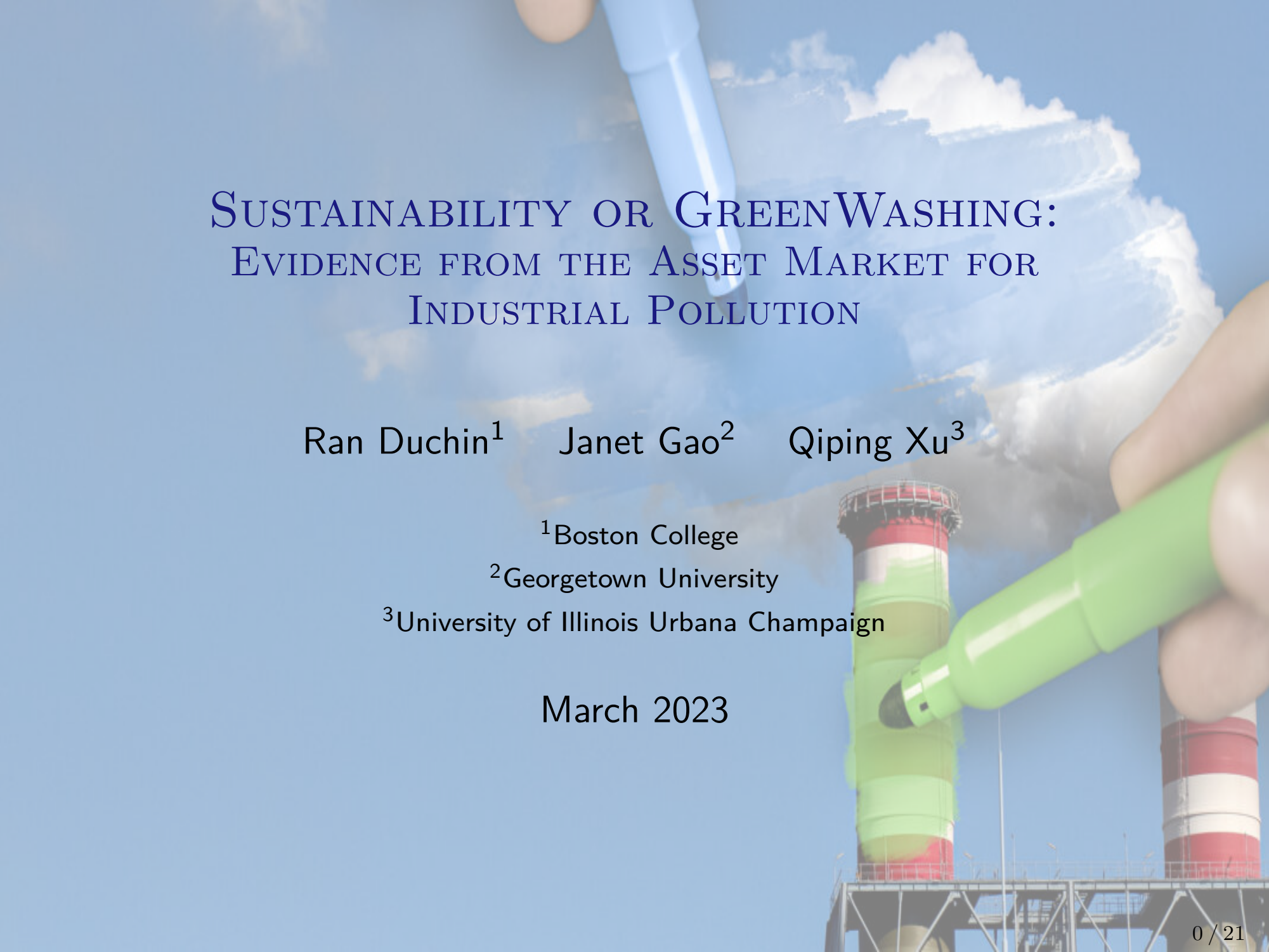

Sustainability or GreenWashing: Evidence from the Asset Market for Industrial Pollution

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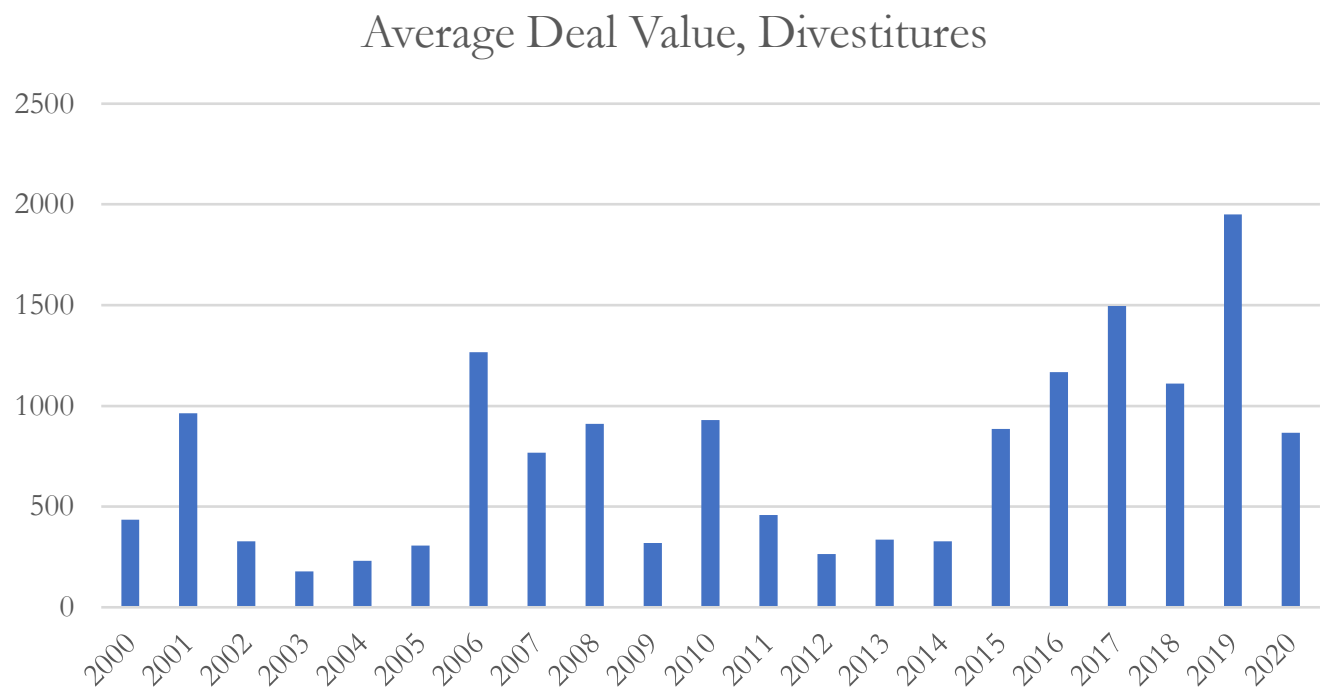
March 2023

Motivation:

Intense debate regarding companies' divestment of pollutive assets

- Advocates encourage companies to sell off pollutive plants, and can point to "successful" pressures
- "..the West's six biggest oil companies have shed $44bn of mostly fossil-fuel assets since the start of 2018." (Economist, 2022)
- "Sadly, selling off assets or shares by itself does nothing to save the planet, because someone else bought them." (WSJ, 2022)



Motivation:

Two competing hypotheses:

- Pollutive assets are sold to firms capable of treating pollution ⇒ pollution reduction ⇒ "Sustainability"
- Pollutive assets are sold to firms facing weaker environmental pressures ⇒ no pollution changes ⇒ "Greenwashing"

Our Paper:

The timing and counterparty selection and corresponding consequences

- How does pollution change following pollutive plant divestitures?
- Which companies buy and sell pollutive assets? When?
- What are the gains from trading pollutive assets?

Findings:

Q: How does pollution change following pollutive plant divestitures?

- No changes in total toxic release, emission intensity, or abatement efforts following the divestitures of pollutive plants

Q: Which companies buy and sell pollutive assets? When?

- Firms tend to divest heavily pollutive plants following negative environmental incidents & media exposure
- Buyers are more likely to be private, non-ESG rated, without negative environmental exposure, facing weaker political pressures

Findings:

Q: What are the gains from trading pollutive assets?

- Sellers obtain higher ESG ratings & lower EPA enforcement costs
- Sellers advertise their environmental progress in conference calls
- Strategic motives: sellers more likely to sell to "friends," i.e., joint venture and supply-chain partners
- Higher CAR for divesting heavily pollutive assets

Conclusions:

- The real asset market facilitates a cosmetic redrawing of firm boundaries without affecting abatement efforts or pollution levels
- Policy implication: incorporate pollution generated along a firm's value chain (Scope 3) to prevent ESG-rating arbitrage

Literature:

- ESG:
  - Better ESG performance helps firms mitigate downside risks [Lins et al. 2017, Hoepner et al.2018, Albuquerque et al. 2020, Ding et al. 2021]
  - ESG monitoring and the effect on corporate ESG performance [Dimson et al.2015, Akey and Appel 2019, Dyck et al. 2019, Barko et al. 2021, Heath et al. 2021, Naaraayanan et al. 2021,...]
  - Role of ESG performance in capital market allocation [Starks et al.2017, Barber et al. 2021, Hartzmark and Sussman 2019, Zaccone and Pedrini 2020, Krueger et al. 2020, Lubos Pastor et al. 2021, Bolton and Kacperczyk 2021, Hong et al.2021]
  - Drawbacks of outstanding ESG rating schemes [Chatterji et al. 2016, Gibson et al. 2019, Dimson et al. 2020, Berg et al. 2020]
- Divestitures:
  - Efficiency gains and resource allocation through the real assets market [Mulherin and Boone 2000, Maksimovic and Phillips 2001, Schlingemann et al.2002, Bates 2005]
  - Divestitures as an ex-post measure of acquisition success [Kaplan and Weisbach 1992, Capronet al. 2001, Maksimovic et al. 2011, Arcot et al. 2020, Mavis et al. 2020]

Outline

1. **Data**
2. **Changes in Pollution around Divestitures**
   - Plant-level pollution, abatement activities, alternatives
3. **Buyers and Sellers of Pollutive Plants**
   - Pollution level, ESG risks, buyer and seller characteristics
4. **Gains from Trade**
   - ESG ratings, regulatory costs, strategic motives, and equity returns
5. **Conclusions**

1. Data

Data sources

- The EPA's Toxic Release Inventory (TRI)
  - Plant-chemical-level emission & production scale, 1990–2020
  - Pollution quantity&intensity, abatement activities, RSEI toxicity measures
- SDC M&A
  - Identify buyers and sellers, remove deals between financial firms
- Compustat: Parent company financial characteristics
- Reprisk: Negative ESG incidents that are known to public
- ESG ratings: KLD, Refinitive, MSCI
- EPA Enforcement and Compliance History Online (ECHO)
- Business connections: Factset, Compustat, SDC (joint ventures)
- Thomson Street Events: Conference call scripts

2. Changes in Pollution Following Divestitures

Changes in Pollution Following Divestitures

- No significant changes in toxic emission, emission intensity, or abatement efforts
- Robust to stacked cohorts of matched divested and never-divested plants in the same industry-state-year (Gormley and Matsa 2011, Baker et al. 2022)
- MDES shows non-results not driven by lack of statistical power (Bloom 1995)

Plant Pollution, Generalized DID Regressions

Dep. Var.:	*Total Release*			*Release/Prod Ratio*		
	(1)	(2)	(3)	(4)	(5)	(6)
Divested × *Post*	0.030	0.022	0.024	0.046	0.027	0.044
	(0.035)	(0.037)	(0.035)	(0.046)	(0.046)	(0.048)
Plant-Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Chemical-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State-Year FE		Yes	Yes		Yes	Yes
Industry-Year FE			Yes			Yes
Observations	992,424	992,418	992,313	992,424	992,418	992,313
Model	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson

Changes in Pollution Following Divestitures

- No significant changes in toxic emission, emission intensity, or abatement efforts
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Plant Pollution, Stacked Regressions

Dep. Var.:	*Total Release*			*Release/Prod Ratio*		
	(1)	(2)	(3)	(4)	(5)	(6)
Divested × *Post*	0.037	0.054	0.038	0.028	0.066	0.071
	(0.041)	(0.040)	(0.040)	(0.051)	(0.050)	(0.049)
Cohort-Plant-Chemical FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort-Chemical-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Cohort-State-Year FE		Yes	Yes		Yes	Yes
Cohort-Industry-Year FE			Yes			Yes
Observations	3,406,359	3,406,296	3,405,723	3,406,359	3,406,296	3,405,723
Model	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson

Changes in Pollution Following Divestitures

- No significant changes in toxic emission, emission intensity, or abatement efforts
- Robust to stacked cohorts of matched divested and never-divested plants in the same industry-state-year (Gormley and Matsa 2011, Baker et al. 2022)
- MDES shows non-results not driven by lack of statistical power (Bloom 1995)

Pollution Abatement Activities, Generalized DID Regressions

Dep. Var.:	(1) *#Source Reduction*	(2) *%Recycling*	(3) *%Recovery*	(4) *%Treatment*
Divested × *Post*	-0.005	0.477	-0.551	0.438
	(0.079)	(0.560)	(0.615)	(0.755)
Plant-Chemical FE	Yes	Yes	Yes	Yes
Chemical-Year FE	Yes	Yes	Yes	Yes
State-Year FE	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes
Observations	1,218,156	1,035,311	1,035,311	1,035,311
R^2	0.933	0.870	0.749	0.821
Model	OLS	OLS	OLS	OLS

Changes in Pollution Following Divestitures

- No significant changes in toxic emission, emission intensity, or abatement efforts
- Robust to stacked cohorts of matched divested and never-divested plants in the same industry-state-year (Gormley and Matsa 2011, Baker et al. 2022)
- MDES shows non-results not driven by lack of statistical power (Bloom 1995)

Plant RSEI, Generalized DID Regressions

Dep. Var.:	*RSEI Hazard*			*RSEI Score*		
	(1)	(2)	(3)	(4)	(5)	(6)
Divested × *Post*	0.065	0.038	0.028	0.029	0.042	0.017
	(0.103)	(0.111)	(0.102)	(0.110)	(0.107)	(0.101)
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
State-Year FE		Yes	Yes		Yes	Yes
Industry-Year FE			Yes			Yes
Observations	316,806	316,790	316,627	312,530	312,514	312,342
Model	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson

Alternative Explanations

- Maybe sold plants and unsold ones both produce less pollution, thus in net, we do not find any effect
  - Separately examining divested and control plants, we find a small increase in emission by divested one, but not for the control plants See Results
- Maybe firms sell plants they cannot treat but actively reduce pollution among the remaining ones
  - Pollution does not decline among remaining plants across buyers and sellers See Results
- Divestitures may represent retirement of old, obsolete technologies
  - Sales do not decline at sold plants See Results
  - Divested plants have higher survival rates than control ones
- Following divestitures, firms may acquire new, greener plants
  - Sellers are less likely to have new plants See Results

2. Buyers and Sellers of Pollutive Plants

Which Plants are Sold?

- Heavily-pollutive plants are more likely to be divested
- An inter-quartile $\Uparrow$ in pollution volume (intensity) increases divestiture likelihood by 45% (28%) relative to the sample average

Dep. Var.: *Divested*	(1)	(2)	(3)	(4)	(5)	(6)
Past Release(Qrtl)	0.058***	0.046***	0.043***			
	(0.009)	(0.010)	(0.010)			
Past Release/Emp(Qrtl)				0.040***	0.029***	0.027**
				(0.010)	(0.011)	(0.011)
Industry-Year FE		Yes	Yes		Yes	Yes
State-Year FE			Yes			Yes
Observations	301,172	301,044	301,032	242,258	242,125	242,102
R-squared	0.000	0.010	0.015	0.000	0.006	0.012
Model	OLS	OLS	OLS	OLS	OLS	OLS

What Triggers Divestitures

- Negative environmental incidents significantly increase the likelihood of divesting pollutive plants (average 1.3%)
- Do not observe a similar tendency to divest non-pollutive plants

Dep. Var.: *Sell (Pollutive)*	(1)	(2)	(3)	(4)	(5)	(6)
Have RepRisk Event	0.685**	0.729**				
	(0.312)	(0.321)				
Have Environment Event			1.242***	1.300***	1.198**	1.231**
			(0.462)	(0.487)	(0.488)	(0.515)
Have Social, Governance Event					0.090	0.142
					(0.313)	(0.329)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm Char		Yes		Yes		Yes
Observations	8,733	8,336	8,733	8,336	8,733	8,336
R^2	0.258	0.263	0.259	0.263	0.259	0.263
Model	OLS	OLS	OLS	OLS	OLS	OLS

Who Buys Pollutive Plants

- Buyers face less pressure: private, non-ESG rated, no negative environmental events, and headquartered in Republican counties
- Estimates represent 5-19% of sample average value
- Do not observe a similar pattern for non-pollutive plants

Panel A. Pollutive Asset Divestitures

Dep. Var.:	(1) *Private*	(2) *Unrated*	(3) *No Env. Event*	(4) *Republican County*	(5) *Low Pressure*
Buyer	0.079***	0.051**	0.048***	0.058**	0.071***
	(0.024)	(0.022)	(0.013)	(0.028)	(0.014)
Observations	1,753	1,753	1,753	1,144	1,753
Adjusted R^2	0.006	0.002	0.007	0.003	0.013
Model	OLS	OLS	OLS	OLS	OLS

3. Gains from Trade

Sellers' ESG Ratings post Divestitures

- Significant ESG rating improvement (KLD and alternative ratings)–around 25% of the sample standard deviation

ESG Ratings, Generalized DID Regressions

Dep. Var.:	*Overall CSR Scores*			*Environment Scores*		
	(1)	(2)	(3)	(4)	(5)	(6)
Seller(Pollutive) × *Post*	0.701***	0.468**	0.483**	0.501***	0.249**	0.224**
	(0.226)	(0.220)	(0.223)	(0.111)	(0.108)	(0.109)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
R^2	0.623	0.650	0.651	0.510	0.558	0.562
Observations	38,226	38,103	35,962	38,226	38,103	35,962
Model	OLS	OLS	OLS	OLS	OLS	OLS

Sellers' Compliance Costs post Divestitures

- Reduction in regulatory actions (sample std 8%) and enforcement costs such as fines and compliance costs (average decline around $43M)

Enforcement, Generalized DID Regressions

	Enforcement Action			*Enforcement Cost*		
Dep. Var.:	(1)	(2)	(3)	(4)	(5)	(6)
Sell (Pollutive) × *Post*	-0.050***	-0.050***	-0.044***	-2.271***	-2.605***	-3.138***
	(0.014)	(0.014)	(0.014)	(0.662)	(0.726)	(0.994)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
Observations	17,991	17,622	16,612	7,079	5,850	5,453
R^2	0.289	0.322	0.330			
Model	OLS	OLS	OLS	Poisson	Poisson	Poisson

What do Sellers Say?

When disclosing environmental impact, sellers are more likely to emphasize progress

- We parse managerial presentation of firms' conference call scripts based on the environmental word list provided by the SASB
- We use a BERT algorithm to detect positive vs. negative disclosure

Dep. Var.:	*Positive Env Disclosure*			*Negative Env Disclosure*		
	(1)	(2)	(3)	(4)	(5)	(6)
Seller (Pollutive) × *Post*	0.081*	0.101*	0.115**	-0.054	-0.019	-0.015
	(0.047)	(0.056)	(0.057)	(0.040)	(0.042)	(0.041)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Ind-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
Observations	6,722	6,433	5,976	6,722	6,433	5,976
R^2	0.539	0.588	0.596	0.672	0.718	0.721
Model	OLS	OLS	OLS	OLS	OLS	OLS

Buyer-seller Connection

- Sell to friends: buyers tend to have preexisting supply-chain relation/joint ventures with sellers (sample average 16.7%), or develop new relationship after the sale (sample average 2%)
  - For each buyer, construct a matched group with 5 random pseudo buyers who are also acquirers from the SDC database (Bena and Li 2014)

Dep. Var.:	(1) *Buyer of Pollutive Plants*	(2) *Develop New Relationship*
Operationally Related	0.342***	
	(0.067)	
Buyer of Pollutive Plants		0.071***
		(0.013)
Matched Group FE	Yes	Yes
Observations	2,814	2,814
R^2	0.027	0.206
Model	OLS	OLS

Non-pollutive Divestitures

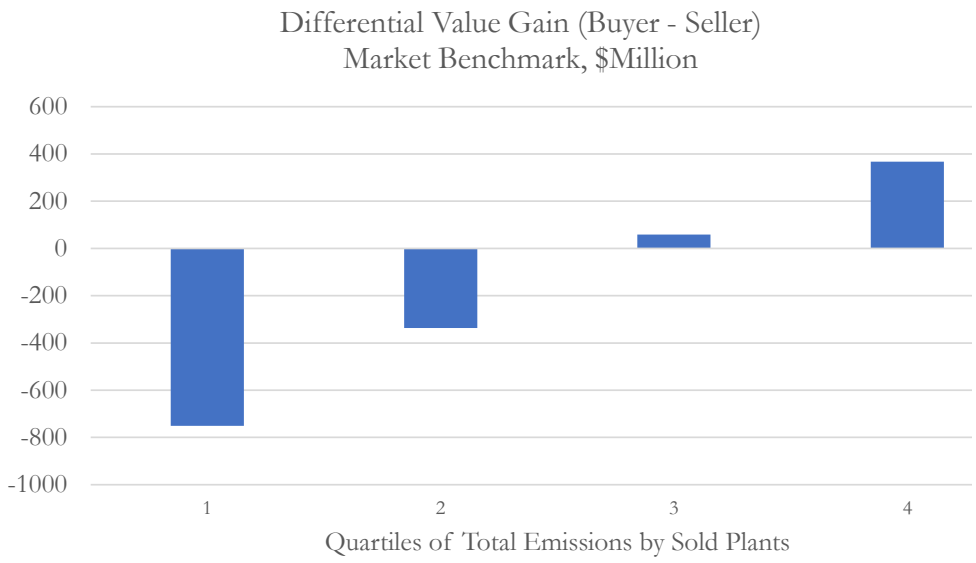
- All gains from trade are specific to the divestitures of pollutive plants, but not present for the divestitures of non-pollutive ones.
- Sellers of non-pollutive divestitures
  - Do not experience increase in ESG ratings
  - Do not experience lower EPA enforcement cost
  - Are not more likely to disclose environmental progress
  - Are not more likely to sell to "friends"
- Address the concerns that we might be capturing generic changes to firms associated with asset sales

Equity Returns to Deal Announcement

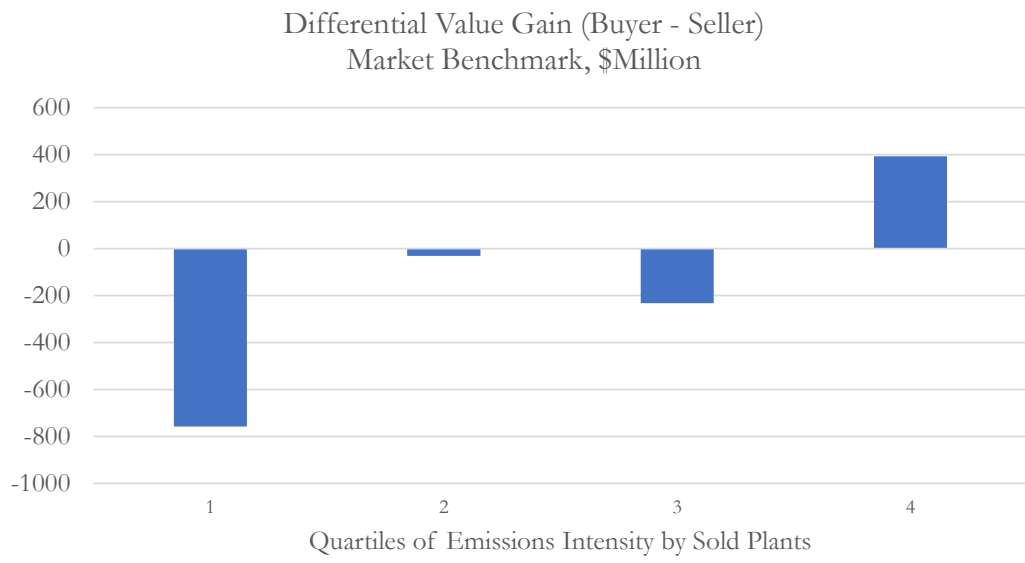
- Higher CARs for divestitures of heavily-pollutive plants

Dep. Var.: Seller $CAR[-1,+1]$	(1)	(2)	(3)	(4)
Benchmark	Market	Market	FF	FF
Past Release Measured By:	Quantity	Intensity	Quantity	Intensity
Past Release (Quartile)	0.011**	0.012**	0.012**	0.013**
	(0.004)	(0.005)	(0.004)	(0.006)
Seller Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	279	248	276	244
R^2	0.308	0.412	0.309	0.433
Model	OLS	OLS	OLS	OLS

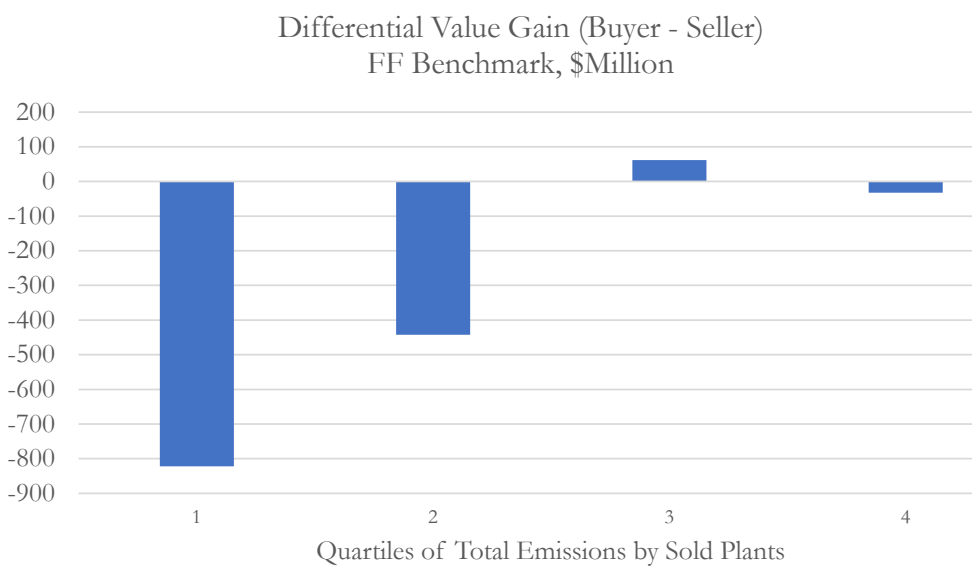
Relative Gains between Buyers and Sellers



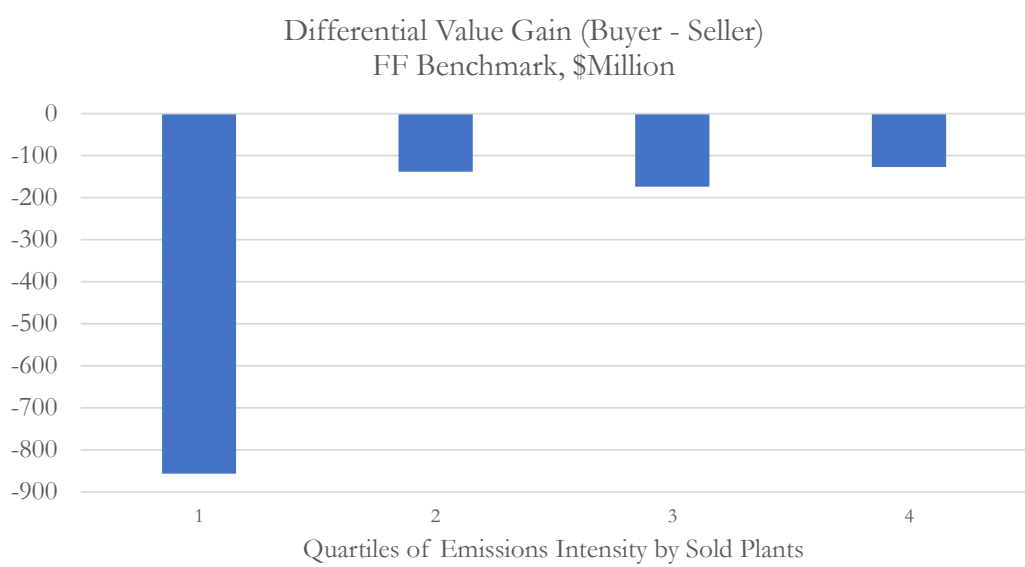
(A) Total Emission – Market Benchmark



(B) Emission Intensity – Market Benchmark



(C) Total Emission – FF Benchmark



(D) Emission Intensity – FF Benchmark

Conclusions:

Interpretation consistent with the "greenwashing" motive

- Pollution does not change at the divested plants or peer plants
- Substantial "gains from trade": sellers obtain multiple benefits by offloading dirty plants
- Asset market allows firms to cosmetically redraw their boundaries without real consequences for pollution
- Policy implication: incorporate pollution generated along a firm's value chain (Scope 3) to prevent ESG-rating arbitrage

Thank you!

Alternative: Peer Plants

- No changes in buyers and sellers' remaining plants either

Peer Plants, Generalized DID Regressions

Dep. Var.:	*Total Pollution*			*Pollution Intensity*		
	(1)	(2)	(3)	(4)	(5)	(6)
Peer × *Post*	0.003	0.008	-0.003	-0.021	-0.024	-0.026
	(0.021)	(0.020)	(0.021)	(0.027)	(0.026)	(0.026)
Plant FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
State-Year FE		Yes	Yes		Yes	Yes
Industry-Year FE			Yes			Yes
Observations	849,798	849,792	849,696	849,798	849,792	849,696
Model	Poisson	Poisson	Poisson	Poisson	Poisson	Poisson

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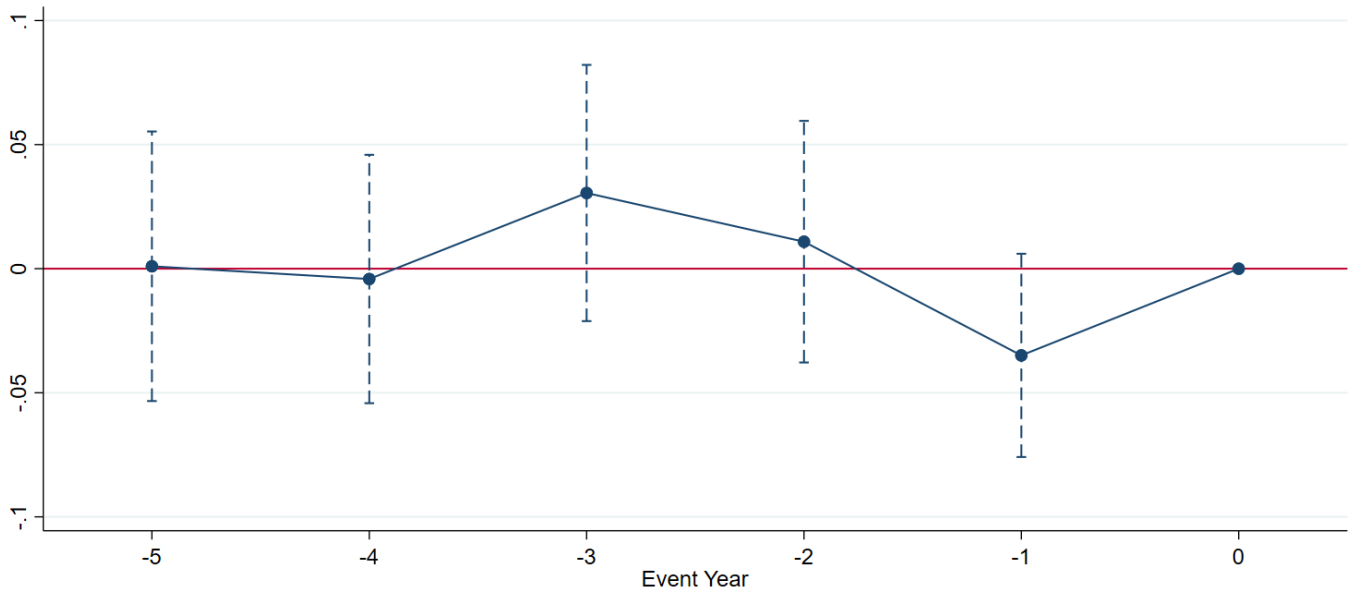
Alternative: Retiring Old Plants

- No decline in sales growth rate before the divestitures



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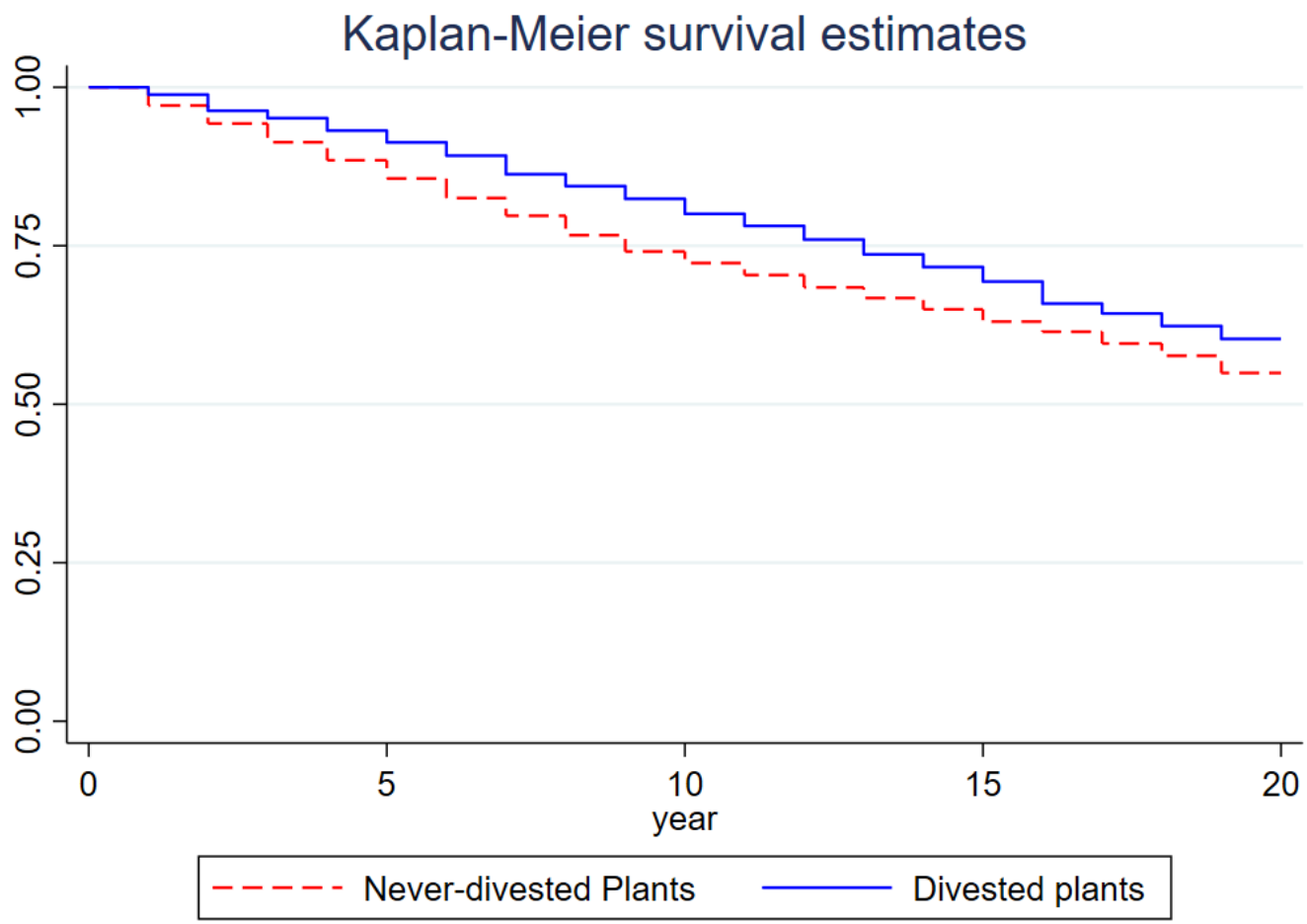
Alternative: Retiring Old Plants

- Divested plants are no more likely to shut down



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Alternative: Replacement

- Sellers do not actively replacing sold plants with greener plants

Generalized DID Regressions

Dep. Var.:	*D(New Plant)*			*Num(New Plant)*		
	(1)	(2)	(3)	(4)	(5)	(6)
Sell (Pollutive) × *Post*	-0.107***	-0.113***	-0.091***	-0.456***	-0.478***	-0.422***
	(0.023)	(0.023)	(0.023)	(0.098)	(0.103)	(0.105)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes			Yes		
Industry-Year FE		Yes	Yes		Yes	Yes
Firm Char			Yes			Yes
Observations	14,210	13,884	13,110	14,210	13,884	13,110
R^2	0.185	0.183	0.193	0.147	0.175	0.187

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