

Carbon Offsets: Decarbonization or Transition-Washing?

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Motivation



- ▶ Carbon transition risk around the world ([Bolton and Kacperczyk, 2023](#))
- ▶ **Carbon offsets:** Enables firms to lower their carbon footprints by claiming other entities' emission reductions as their own through purchase and retirement of carbon offset credits
- ▶ Do carbon offsets aid corporate carbon transition efforts?

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THE GREAT CASH-FOR-CARBON HUSTLE

Offsetting has been hailed as a fix for runaway emissions and climate change—but the market's largest firm sold millions of credits for carbon reductions that weren't real.

By Heidi Blake
October 16, 2023

Bloomberg

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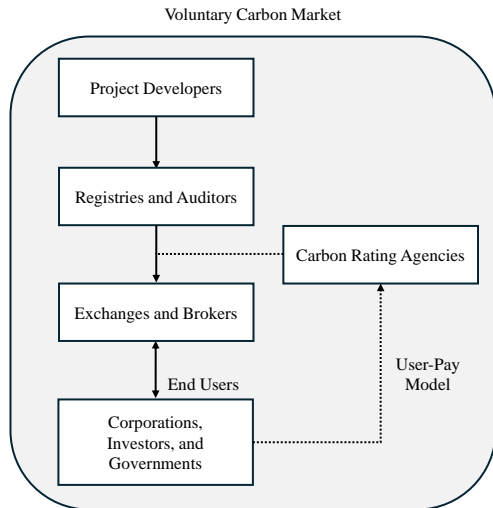
Green Greener Living

A Greenwashing Lawsuit Against Delta Aims to Set a Precedent

A class-action lawsuit targets the airline's claim to carbon-neutrality, which has in the past rested in part on its use of carbon offsets.

- ▶ General public skeptical about authenticity of climate claims made by offset projects and purchasers of offset credits (i.e., “greenwashing”)

Voluntary Carbon Offset Markets



- ▶ Ecosystem of players, but lack of regulatory bodies

Main Findings

- ▶ Larger firms with higher institutional ownership and net-zero commitments more likely to use carbon offsets
- ▶ Carbon offsets used more intensively in low-emission industries
- ▶ ESG rating downgrades cause firms to use more carbon offsets
 - ▶ Firms already close to net-zero
 - ▶ Firms in industries where even a small change in emissions can make a big difference in peer rankings
 - ▶ No corresponding reduction in direct emissions
 - ▶ Cheap, low-quality offsets
 - ▶ But *not* emission-heavy firms in industries that require large reduction in emissions to improve rankings

⇒ **1. Separating equilibrium: Choice of outsourcing transition efforts**

⇒ **2. Firms use offsets strategically for certification and ranking benefits**

Data

- ▶ Carbon offset retirements from four major carbon registries, ACR, Gold, CAR, and VCS
- ▶ Compustat North America and Compustat Global
- ▶ Institutional ownership from FactSet Ownership
- ▶ Net-zero commitments from Net Zero Track
- ▶ Direct emissions from TruCost Environmental
- ▶ Legacy ESG scores and updated ESG risk scores from Sustainalytics
- ▶ Offset project-level quality ratings from BeZero Carbon
- ▶ Proprietary carbon offset pricing data from Viridios

Carbon Offset Projects Used by Publicly Listed Firms

Number of projects	Geographic region						
	Full sample	Africa	Asia	Europe	North America	South America	Other
Total	1,413	220	689	24	333	135	12
Type							
Agriculture	44	1	8	2	26	7	0
Carbon capture & storage	3	0	0	0	3	0	0
Chemical processes	48	1	2	0	45	0	0
Forestry & land use	218	34	38	1	83	56	6
Household & community	278	166	90	0	13	8	1
Industrial & commercial	53	1	26	17	9	0	0
Renewable energy	585	12	495	2	18	55	3
Transportation	30	0	0	0	27	2	1
Waste management	154	5	30	2	109	7	1
Rated by BeZero Carbon	229	35	106	2	48	35	3
Average price per ton (as of February 2024)	3.6	4.5	2.0	4.6	6.0	3.7	4.9
Median price per ton (as of February 2024)	2.7	4.2	1.3	3.5	4.5	2.4	3.7
Average #credits issued (thousand tons)	876.7	848.2	912.9	398.5	519.3	1,748.7	382.4
Median #credits issued (thousand tons)	194.9	53.5	296.6	348.1	160.9	305.3	198.5
Total #credits issued (million tons)	1,238.8	186.6	629.0	9.6	172.9	236.1	4.6
Average % of credits being retired	73.2%	76.8%	71.4%	81.6%	75.0%	69.0%	84.9%
Issuance year: ≤2015	78.8%	85.0%	76.9%	87.4%	80.9%	73.1%	89.5%
Issuance year: 2016	79.8%	81.3%	77.9%	58.6%	82.3%	79.4%	92.0%
Issuance year: 2017	73.0%	82.7%	72.5%	68.6%	66.2%	72.8%	
Issuance year: 2018	67.9%	72.2%	66.7%		65.8%	51.7%	
Issuance year: 2019	69.8%	73.5%	65.4%		76.0%	67.9%	
Issuance year: ≥2020	54.0%	57.5%	55.3%	51.2%	49.0%	53.9%	31.3%

Carbon Offset Projects Used by Publicly Listed Firms

	Full sample		Africa	Asia	Europe	North America	South America	Other
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(#credits issued)	0.085*** [12.43]	0.084*** [12.31]	0.079*** [4.23]	0.107*** [10.64]	0.212** [2.85]	0.052*** [3.32]	0.076*** [4.17]	0.157 [0.46]
Forestry & land use	0.168*** [4.83]	0.192*** [5.46]	0.141 [1.22]	0.252** [2.72]		0.135* [1.98]	0.068 [0.81]	
Renewable energy	0.028 [1.00]	0.007 [0.26]	-0.064 [-0.73]	0.056 [1.30]	-1.092*** [-4.04]	0.019 [0.20]	-0.053 [-0.62]	-0.035 [-0.46]
Rated by BeZero	0.105*** [4.04]	0.106*** [4.02]	0.034 [0.48]	0.067 [1.38]	-0.293 [-0.95]	0.220*** [4.82]	0.145** [2.13]	
North America based		0.151*** [3.24]						
Europe based		-0.024 [-0.62]						
Project age FE	Y	Y	Y	Y	Y	Y	Y	Y
Registry FE	Y	Y	Y	Y	Y	Y	Y	Y
Geographic region FE	Y	N	N	N	N	N	N	N
Observations	2,916	2,916	530	1,541	54	545	232	14
R-squared	0.204	0.199	0.314	0.186	0.280	0.196	0.291	0.831
% (Dependent variable = 1)	48.5%	48.5%	41.5%	44.7%	44.4%	61.1%	58.2%	85.7%

- Publicly listed firms more likely to use larger offset projects, forestation projects, projects with quality ratings, and North America-based projects

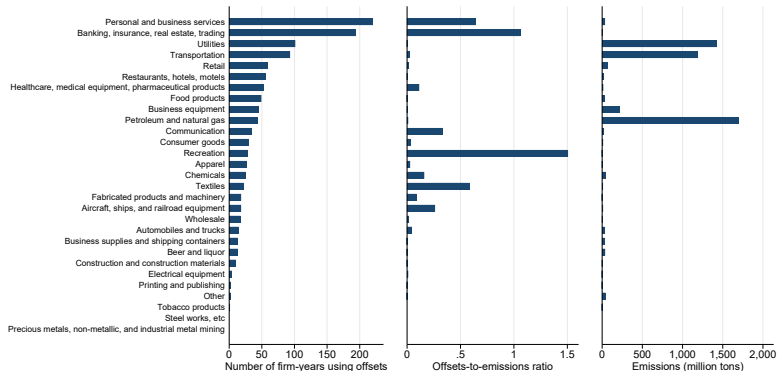
Publicly Listed Firms Using Carbon Offset Projects

	Firm-years w/ offset credit usage			Firm-years w/o credit usage			Avg. Diff.	t-stat.
	Average	Median	Std. Dev.	Average	Median	Std. Dev.		
Assets (\$billion)	47.94	35.86	39.91	15.99	5.30	24.66	31.95	49.56
Market capitalization (\$billion)	26.27	22.05	23.97	8.14	3.75	11.89	18.13	57.27
B/M	0.66	0.55	0.57	0.67	0.52	0.70	-0.01	-0.48
q	1.80	1.18	1.61	1.77	1.28	1.52	0.02	0.60
ROA	0.10	0.09	0.08	0.10	0.10	0.11	-0.01	-1.86
Leverage	0.27	0.26	0.19	0.26	0.24	0.20	0.02	3.15
Prior 12-month return	0.13	0.09	0.45	0.16	0.07	0.62	-0.03	-1.69
Dividend yield	0.02	0.02	0.03	0.02	0.02	0.03	0.004	5.57
Institutional ownership	0.47	0.38	0.30	0.41	0.28	0.33	0.06	6.87
U.S. firm	0.37	0.00	0.48	0.31	0.00	0.46	0.06	5.14
Scope 1 emissions (million tons)	3.41	0.08	8.35	1.67	0.04	5.68	1.74	12.11
Scope 2 emissions (million tons)	0.64	0.17	1.00	0.26	0.05	0.59	0.38	25.24
Scope 3 emissions (million tons)	2.53	2.22	1.90	1.25	0.42	1.63	1.28	31.28
Emission intensity ($\times 1,000$)	0.19	0.01	0.56	0.27	0.02	0.86	-0.07	-3.03
Industry emission gap	2.61	2.43	0.73	2.45	2.28	0.70	0.15	8.75
Net-zero commitment	0.24	0	0.43	0.12	0	0.33	0.11	11.68
Retired offsets (thousand tons)	140.10	6.29	904.21					
Vintage of retired offsets (year)	2012.95	2013	3.63					
Observations	1,639			49,362				

- Larger firms with higher institutional ownership and stated net-zero commitments are more likely to use carbon offsets

Industry Distribution of Carbon Offset Users

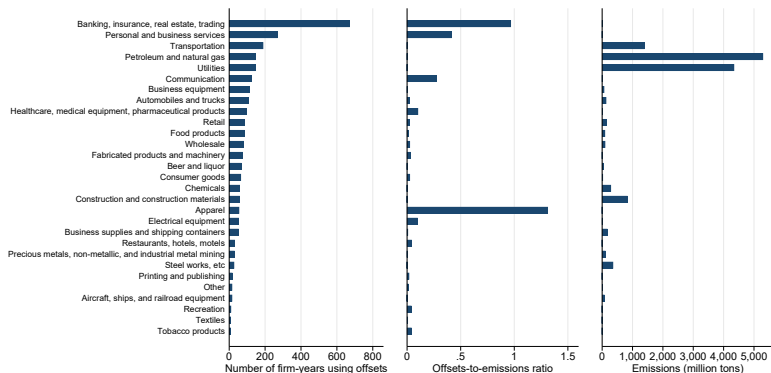
U.S. firms



- ▶ Low-emission industries rank high on how often firms use offsets
- ▶ Low-emission industries offset emissions almost one-to-one
- ▶ High-emission industries offset negligible fractions of direct emissions

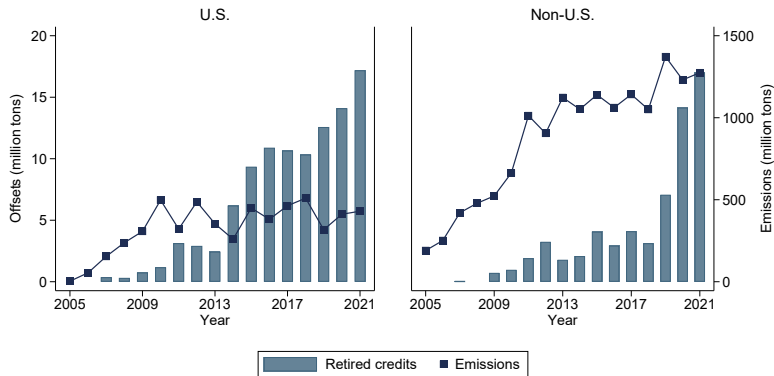
Industry Distribution of Carbon Offset Users

Non-U.S. firms



- ▶ Low-emission industries rank high on how often firms use offsets
- ▶ Low-emission industries offset emissions almost one-to-one
- ▶ High-emission industries offset negligible fractions of direct emissions

Aggregate Offset Retirements and Direct Emissions

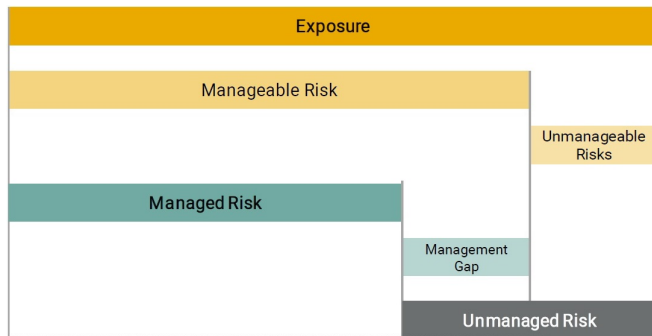


- ▶ Carbon offset retirements have grown substantially, but remain small relative to emissions
- ▶ U.S. firms are less emission-intensive, but use more offsets

Hypotheses

- ▶ **Outsourcing hypothesis:** Consistent with a separating equilibrium, light-emission firms use offsets more intensively, whereas heavy-emission firms are more likely to reduce their emissions in-house
 - ▶ Purchasing carbon offsets incurs increasing marginal costs (i.e., minimal fixed costs, rising variable costs)
 - ▶ Investing in abatement exhibits relatively flat marginal costs (i.e., substantial fixed costs, small variable costs)
- ▶ **Certification hypothesis:** Firms care about credentials with stakeholders, use offsets to signal commitment to reducing carbon footprints
 - ▶ Offset emissions if this helps boost widely used ESG ratings assigned by third party raters
- ▶ These channels are not mutually exclusive

Sustainalytics' Rating Methodology Change



In 2018:

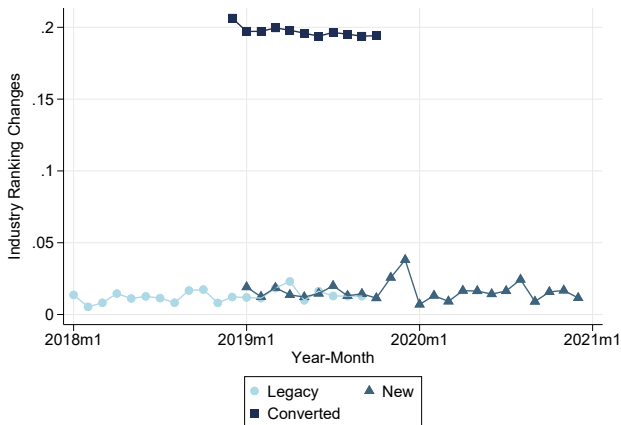
Old measure



New measure

- ▶ Prominently used by investors ([Hartzmark and Sussman, 2019](#); [Rzeźnik, Hanley, and Pelizzon, 2022](#); [Berg, Kölbel, and Rigobon, 2023](#); [Kim and Yoon, 2023](#); [Ceccarelli, Ramelli, and Wagner, 2024](#), ...)

Sustainalytics' Rating Methodology Change



- ▶ Comparison of new and old scores for same firm in same month
- ▶ Small ranking changes based on either old or new score
- ▶ Large ranking changes caused by reshuffling from old to new score (20%)

ESG Rating Downgrades and Institutional Ownership

$$IO_{i,t} = \alpha + \beta \cdot \text{Post}_t \times \text{Rating downgrade}_i + \gamma \cdot \mathbf{X}_{i,t-1} + \delta_i + \sigma_{j,t} + \epsilon_{i,t}$$

Dependent variable:	IO		Foreign IO		Domestic IO	
	(1)	(2)	(3)	(4)	(5)	(6)
Post × Rating downgrade	-0.003** [-2.41]	-0.003** [-2.24]	-0.003*** [-3.35]	-0.003*** [-3.32]	-0.000 [-0.17]	0.000 [0.28]
log(assets)	0.010 [0.90]	0.007 [0.87]	0.005* [1.83]	0.003 [1.31]	0.004 [0.45]	0.004 [0.49]
Leverage	-0.001 [-0.05]	-0.009 [-0.51]	-0.005 [-0.94]	-0.003 [-0.60]	0.004 [0.18]	-0.007 [-0.38]
ROA	-0.081 [-0.96]	-0.071 [-1.04]	-0.026** [-2.14]	-0.024** [-2.18]	-0.056 [-0.72]	-0.047 [-0.75]
Past quarter stock return		0.007*** [3.50]		-0.003*** [-2.76]		0.010*** [5.67]
Firm FE	Y	Y	Y	Y	Y	Y
Industry-quarter FE	Y	Y	Y	Y	Y	Y
Observations	13,036	11,714	13,036	11,714	13,036	11,714
R-squared	0.996	0.997	0.993	0.990	0.997	0.998

- ▶ Exogenous ESG rating downgrade followed by decline in overall and foreign institutional ownership, potentially raising cost of capital

Correlations Between Emissions and Sustainability Scores

$$ESGRanking_{i,t} = \alpha + \beta \cdot Emission\ intensity_{i,t-1} + \gamma \cdot \mathbf{X}_{i,t-1} + \delta_i + \sigma_{j,t} + \epsilon_{i,t},$$

Rankings based on:	Legacy scores	Risk scores
Emission intensity	-0.028 [-0.25]	0.383** [2.05]
log(Assets)	0.067 [0.88]	-1.705*** [-3.22]
Leverage	-0.645 [-0.99]	6.426*** [4.40]
ROA	-0.000 [-0.53]	0.167 [0.34]
Institutional ownership	-1.005 [-1.07]	-5.060** [-2.53]
Firm FE	Y	Y
Industry-year FE	Y	Y
Observations	21,645	24,454
R-squared	0.862	0.842

- ▶ ESG ratings become more sensitive to emissions, potentially incentivizing firms to report lower emissions

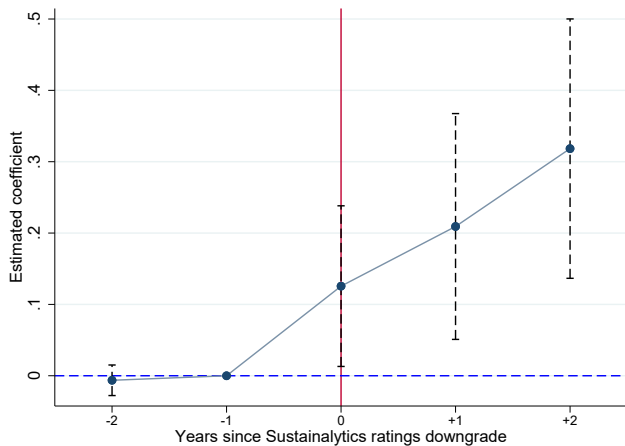
Do Downgraded Firms Use More Carbon Offsets?

$$\text{Offsets}_{i,t} = \alpha + \beta \cdot \text{Post}_t \times \text{Rating downgrade}_i + \gamma \cdot \mathbf{X}_{i,t-1} + \delta_i + \sigma_{j,t} + \epsilon_{i,t}$$

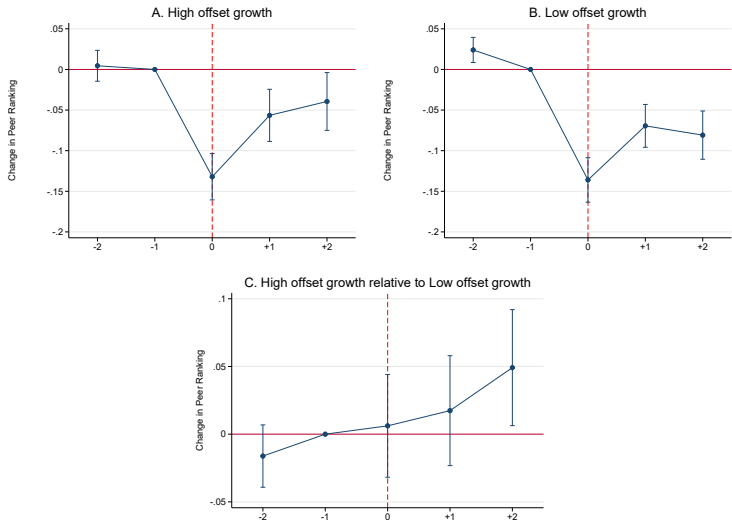
	Full sample	Emissions as of 2018		Industry gap as of 2018	
	(1)	Low (2)	High (3)	Low (4)	High (5)
<i>Panel A: All firms</i>					
Post × Rating downgrade	0.217** [2.31]	0.446** [2.22]	0.028 [1.02]	0.325** [2.08]	0.092 [1.04]
Observations	24,749	11,830	12,914	13,144	11,583
R-squared	0.494	0.496	0.500	0.519	0.426
<i>Panel B: Firms that use offsets at least once</i>					
Post × Rating downgrade	1.017** [2.11]	2.497** [2.21]	0.094 [0.69]	1.582* [1.94]	0.396 [0.79]
Observations	3,292	1,559	1,721	1,665	1,619
R-squared	0.521	0.534	0.561	0.548	0.456
Firm FE	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y

- ▶ Low-emission firms in low-gap industries use more offsets after downgrade

DID Dynamics of Carbon Offset Retirements



Carbon Offset Usage and Post-Shock ESG Rating Recovery



► Increased offset usage → Faster recovery of ESG ranking after downgrade

Do Offset Users Reduce Direct Emissions?

	Full sample (1)	Emissions as of 2018		Industry gap as of 2018	
		Low (2)	High (3)	Low (4)	High (5)
Post × Rating downgrade	-0.057*** [-2.64]	-0.025 [-0.73]	-0.065** [-2.41]	-0.043 [-1.44]	-0.073** [-2.33]
Firm FE	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y
Observations	24,710	11,791	12,914	13,115	11,573
R-squared	0.967	0.886	0.949	0.943	0.976

- ▶ Firms using more offsets do *not* correspondingly reduce direct emissions
- ▶ On the other hand, firms that do not use more offsets rather reduce emissions directly

Do Firms Use More High-Quality Carbon Offsets?

	Full sample (1)	Emissions as of 2018		Industry gap as of 2018	
		Low (2)	High (3)	Low (4)	High (5)
Panel A: BeZero-rated offset credits					
Post × Rating downgrade	0.200** [1.99]	0.115 [0.68]	0.241** [2.08]	-0.154 [-0.92]	0.312** [2.54]
Observations	602	163	394	264	333
R-squared	0.710	0.822	0.733	0.730	0.711
% (Dependent variable = 1)	61.6%	59.6%	62.0%	62.5%	61.0%
Panel B: Offset credits with BeZero rating of BBB or higher					
Post × Rating downgrade	0.120* [1.71]	-0.082 [-0.65]	0.168** [2.28]	-0.051 [-0.33]	0.184*** [2.60]
Observations	602	163	394	264	333
R-squared	0.799	0.823	0.824	0.763	0.834
% (Dependent variable = 1)	27.4%	33.3%	25.8%	25.4%	28.8%
Firm FE	Y	Y	Y	Y	Y
Industry-year FE	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y

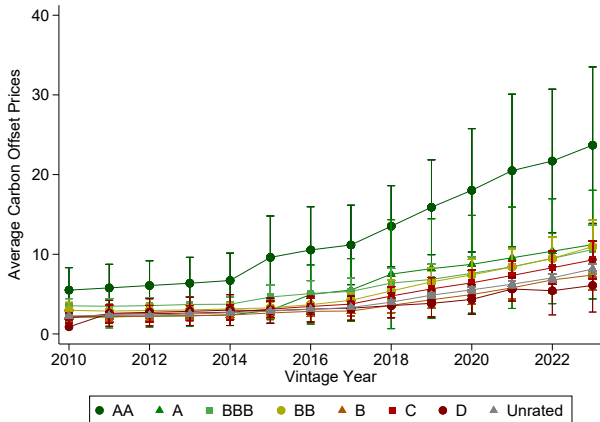
- **Unconditional quality is low:** Average non-missing rating “moderate” to “moderately low”; 97% of sample projects rated below BBB or unrated

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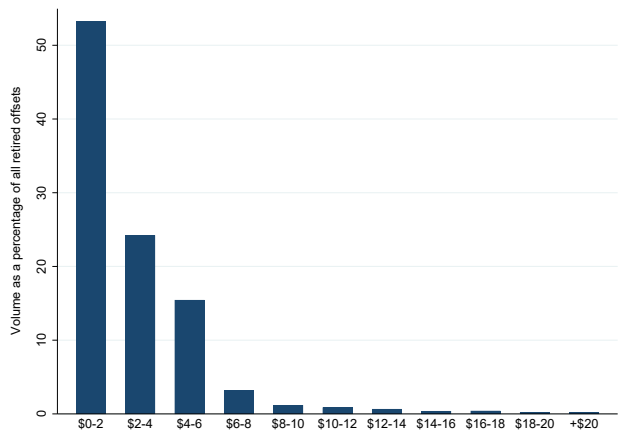
- ▶ Firms using more offsets do not use higher-quality ones, but firms that reduce emissions without using more offsets tilt toward higher-quality ones

The Cost of Carbon Offsets?



- ▶ Recently issued offset credits command higher prices
- ▶ Offset credits issued by poor-quality projects are consistently cheaper
- ▶ Back-of-the-envelope estimate of additional cost: \$41K

The Cost of Carbon Offsets?



- ▶ Demand for cheap offsets is high: More than 50% (70%) of all retired offsets are priced below \$2 (\$4) per ton

Conclusion

- ▶ Separating equilibrium: Firms with smaller carbon footprints use offsets more intensively, while heavy emitters reduce their footprints directly
- ▶ Firms are strategic when using offsets, considering effects on their “emission rankings” relative to peers
- ▶ Some evidence that heavy-emission firms use higher-quality rather than lower-quality offsets, but not in large-enough quantities to meaningfully reduce emissions
- ▶ **Regulatory implications:** Currently, quality of retired offsets generally low, and market sustains low prices for these offsets
 - ▶ Importance of commonly adoptable rules and regulations to ensure transparency of offset projects