Are Carbon Emissions Associated with Stock Returns?

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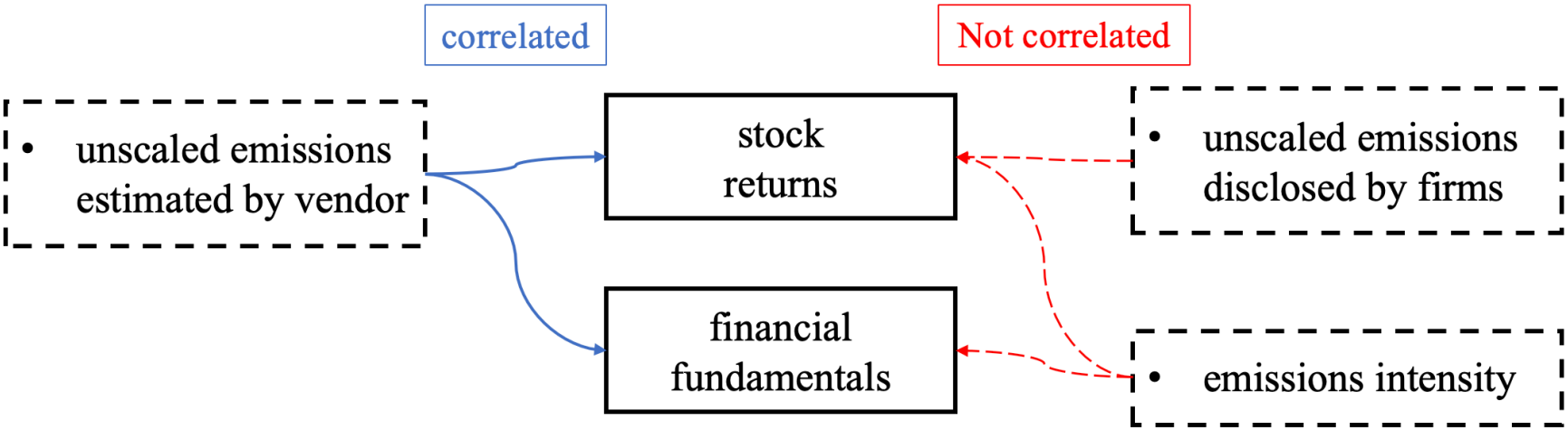
Motivation

- Markets are interested in this topic
  - The SEC, managers, and media care about the disclosure and eventual reduction of US firms carbon emissions.
  - Investors are interested in understanding whether emissions reduction can contribute to higher expected stock returns.
- Prior papers research this question rely on
  - vendor-estimated carbon emissions are accurate
  - specific research design choices, most notably a reliance on unscaled emissions
- This paper fills this gap in detail, finds
  - Vendor-estimated emissions systematically differ from firm-disclosed emissions.
  - prior findings of a link between stock returns and emissions are simply documenting a link between returns and fundamentals

Desgin

Are Carbon Emissions Associated with Stock Returns? (Depends on emissions measure)



Emissions intensity is an appropriate measurement choice to assess carbon performance.

Research Question

- Are Carbon Emissions Associated with Stock Returns?
  - Depends on emissions measure.
  - First, stock returns are correlated only with unscaled emissions estimated by the data vendor, but not with unscaled emissions actually disclosed by firms.
  - Second, unscaled emissions is correlated with stock returns but emissions intensity is not.

Contribution

- Literature on why should emissions be Associated with stock returns
  - Prior: views carbon emissions as risk or investors tastes.
  - Extend: highlight the effect of such measurement choices.
- Literature on Carbon Risk Premium
  - Prior: a relation between a firms total emissions and both lower firm values and higher stock returns
  - Extend: it reflects the link between firm output and capital market performance.

Data

- Emissions Data from Trucost
  - Disclosed sources, such as CDP, 10-K reports
  - Not disclose, uses an environmentally extended inputoutput (EEIO) model to estimate environmental impacts for a companys own operations and across its global supply chain.
  - **More than 70%** of emissions figures in standard US emissions databases are vendor-estimated.
- Financial Data from CRSP and COMPUSTAT

Correlations between the three types of carbon emissionss

- scope 3 emissions are harder for the firm to directly measure, they are more likely to be estimated by the data vendor
- the correlation between carbon intensity and firm size is much lower

	Log scope 1	Log scope 2	Log scope 3	Intensity scope 1	Intensity scope 2	Intensity scope 3	Log market cap	Log assets	Log sale
Log scope 1	1								
Log scope 2	0.776	1							
Log scope 3	0.842	0.891	1						
Intensity scope 1	0.532	0.072	0.211	1					
Intensity scope 2	0.418	0.519	0.284	0.194	1				
Intensity scope 3	0.522	0.346	0.535	0.354	0.383	1			
Log market cap	0.525	0.670	0.710	0.060	0.056	0.060	1		
Log assets	0.463	0.548	0.637	0.138	−0.005	0.005	0.825	1	
Log sale	0.699	0.847	0.905	0.090	0.118	0.171	0.820	0.811	1

Disclosed versus Vendor-Estimated Emissions

- The source variable
  - a high correlation (**around 0.97**) among disclosed emissions values reported by various commercial data providers
  - the correlation among estimated values reported by these vendors is only **0.66**.
  - proprietary estimation methods appear to rely heavily on firm fundamentals and industry-level factors
- Estimates are systematically different from company-disclosed emissions
  - within-industry differences in estimated emissions figures would only reflect differences in financial fundamentals.
  - estimated emissions maybe a mechanical function of growth

Do Carbon Emissions Explain Stock Returns?

- there exist sensitivity of conclusions to design choices
- controlling for size and how it may induce **multicollinearity** in specifications using log (unscaled) emissions.

Variables	(1) Ret	(2) Ret	(3) Ret	(4) Ret	(5) Ret	(6) Ret	(7) Ret	(8) Ret	(9) Ret
Log scope 1	−0.034			−0.048			0.089**		
	(0.029)			(0.039)			(0.040)		
Log scope 2		−0.039			−0.047			0.139***	
		(0.034)			(0.041)			(0.049)	
Log scope 3			−0.041			−0.044			0.245***
			(0.041)			(0.051)			(0.069)
Firm size							−0.238***	−0.292***	−0.386***
							(0.087)	(0.097)	(0.106)
Observations	178,354	178,354	178,354	178,354	178,354	178,354	178,354	178,354	178,354
R^2	0.189	0.189	0.189	0.190	0.190	0.190	0.191	0.191	0.191
Other controls	No	No	No	No	No	No	No	No	No
Industry	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Month-year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Vendor-Estimated versus Firm-Disclosed Emissions

- positive relation between returns and emissions found in prior work stems from estimated emissions values generated by Trucost.

	Firm-disclosed emissions			Vendor-estimated emissions		
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Ret	Ret	Ret	Ret	Ret	Ret
Log scope 1	−0.022			0.135***		
	(0.047)			(0.051)		
Log scope 2		0.028			0.204***	
		(0.032)			(0.063)	
Log scope 3			0.223***			0.300***
			(0.082)			(0.073)

Do Carbon Emissions Explain Operating Performance?

- no compelling evidence implys that emissions indirectly affect stock returns through a link with firm fundamentals.

Panel A: Unscaled emissions versus scaled emissions

Variables	(1) ROA	(2) ROS	(3) EBIT margin	(4) EBITDA margin	(5) ROA	(6) ROS	(7) EBIT margin	(8) EBITDA margin
Log scope 1	0.016***	0.581***	0.581***	0.608***				
	(0.002)	(0.079)	(0.079)	(0.085)				
Intensity scope 1					0.000	−0.002	−0.002	−0.002
					(0.000)	(0.003)	(0.003)	(0.004)

Panel B: Disclosed versus estimated

	Firm-disclosed emissions				Vendor-estimated emissions			
Variables	(1) ROA	(2) ROS	(3) EBIT margin	(4) EBITDA margin	(5) ROA	(6) ROS	(7) EBIT margin	(8) EBITDA margin
Log scope 1	0.001	0.005	0.005	0.001	0.027***	0.983***	0.983***	1.031***
	(0.002)	(0.006)	(0.006)	(0.006)	(0.003)	(0.117)	(0.117)	(0.126)

Ideas

- Self-selection bias, firms that disclose carbon emission data may differ systematically from non-disclosing firms
- Unscaled emissions may mainly influence idiosyncratic firm events (e.g., regulation, reputation, financing costs). Ignoring these channels may lead to a premature dismissal of their relevance.