



# Signaling through Carbon Disclosure

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# Motivation

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- Transition risk is diluted by limited observation of firm-level carbon emissions
- Carbon disclosure is a way of reducing uncertainty about emissions
  - *Voluntary disclosure*: a way of signaling firm type/impact on society
  - *Mandatory disclosure*: a way of reducing uncertainty
- A significant policy push towards more disclosure (TCFD, NDC)
- SEC Chair Gary Gensler speech 28 July 2021
- This paper: A global study of the stock return consequences of firm-level carbon emissions disclosure

# This Paper

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- We take a global investor perspective on the emissions disclosure using a large panel of over 14,400 firms from 77 countries over the 2005-18 period
- Main Questions:
- Does voluntary disclosure matter for stock returns?
- Can we identify the mechanism through which disclosure works?
  - What are the key drivers of voluntary disclosure?
  - Do we observe systematic differences in the effects of voluntary vs. mandatory disclosure?

# Data: Sources

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- Our primary database covers the period 2005-2018 and is largely a result of matching two data sets by Trucost and FactSet
  - Trucost: information on firm-level corporate carbon and other greenhouse gas emissions globally (follows the Greenhouse Gas Protocol that sets the standards for measuring corporate emissions)
  - Provides information on whether emissions (scope 1 and scope 2) are directly disclosed by the firm or estimated by Trucost
  - Scope 1 and 2 are fairly easy to estimate (little variation across data providers)
  - FactSet provides data on stock returns, corporate fundamentals, and institutional ownership globally
- The matching produced 14,468 unique companies out of approx. 16,000 companies available in Trucost (about 99% of total market cap)
- Representing 77 countries and spanning all industries

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# Disclosure Frequency: Time-Series Variation

Date	Reported	Estimated	%Reported
2005	217	2,993	7.25%
2006	300	3,202	9.37%
2007	444	3,216	13.81%
2008	474	3,235	14.65%
2009	541	3,381	16.00%
2010	779	3,273	23.80%
2011	975	3,208	30.39%
2012	1,048	3,179	32.97%
2013	1,139	3,739	30.46%
2014	1,345	3,940	34.14%
2015	1,281	4,102	31.23%
2016	1,625	10,205	15.92%
2017	1,714	10,907	15.71%
2018	1,346	8,446	15.94%

# Empirical Challenges in the ESG Literature

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- Challenge to separate the effect of the **activity** from the effect of **disclosure of the activity**
  - The decision to disclose may be correlated with the decision to engage in the activity (we usually do not observe pre-disclosure values)
  - The activity itself may be subject to manipulation (**moral hazard**)
- CSR activities are difficult to measure and quantify
  - In contrast, carbon emissions are relatively straightforward to measure (scope 1 and scope 2)

# Disclosure and Carbon Premia

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- Carbon emissions and disclosure decisions are observed on an annual basis
- Disclosure = 1 if a firm discloses its scope 1/scope2 emissions;  
= 0 if the information is estimated
- **Intensive margin is important**: need to control for carbon emissions
- We consider two different measures of emissions across scope 1 & 2:
  - Firm-level **total emissions** (in logs of tons of CO<sub>2</sub>): **long-term effect**
  - **Percentage changes in firm-level emissions**: **short-term effect**

# Disclosure and Carbon Premia

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- We estimate the pooled (panel) data return regressions with:
  - monthly stock returns as a dependent variable
  - **interaction** between **disclosure** and **emissions** as the main variable
  - various firm-level characteristics as controls
- We include year-month, country, industry, and firm fixed effects
- We double cluster standard errors at firm and year dimensions
- Coefficient identifies the value effect due to disclosure

# Estimating Carbon Premia (Changes)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Scope1chg	0.618***		0.633***		0.717***	
	(0.132)		(0.130)		(0.120)	
Scope2chg		0.445***		0.451***		0.512***
		(0.100)		(0.102)		(0.101)
Disclosure	0.196***	0.212***	0.182***	0.197***	0.181**	0.203**
	(0.055)	(0.058)	(0.050)	(0.053)	(0.076)	(0.080)
Disclosure*Scope1chg	-0.563***		-0.545***		-0.552***	
	(0.132)		(0.122)		(0.101)	
Disclosure*Scope2chg		-0.490***		-0.481***		-0.487***
		(0.111)		(0.104)		(0.092)
Industry Fixed Effects	N	N	Y	Y	Y	Y
Firm*Discl. Fixed Effects	N	N	N	N	Y	Y

# Voluntary vs. Mandatory Disclosure

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- What is the mechanism guiding voluntary disclosure results?
  - Uncertainty reduction
  - Adverse selection/Signaling
- In October 2013, Britain imposed **mandatory disclosure** for publicly listed companies
- Use a one-year window around the rule to assess the difference between voluntary and mandatory disclosure
- **Triple-difference regression** with:  $GBshock = 1$  for period 2013/11-2014/10 and  $GBshock = 0$  for 2012/11-2013/10
- Treatment = 0 (1) are firms that did (not) disclose prior to the shock
- Controls are set at the pre-period levels (robust for time-varying ones)

# First Stage

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VARIABLES (Disclosure)	(1)	(2)	(3)
<b>Pre disclosure = 70%</b>			
GBshock	0.189*** (0.040)	0.193*** (0.041)	0.189*** (0.043)
Industry fixed effects	N	Y	Y
Firm fixed effects	N	N	Y
Observations	4,951	4,951	4,951
R-squared	0.081	0.298	0.477

## 2<sup>nd</sup> Stage

VARIABLES	(1) ret_agg	(2) ret_agg	(3) ret_agg	(4) ret_agg
Ln(scope1)	0.104 (0.120)	-0.007 (0.425)		
Scope1chg			0.062 (0.185)	0.069 (0.130)
Treatment	0.846 (0.787)		-0.101 (0.359)	
Treatment*Ln(scope1)	-0.106 (0.086)	0.333 (0.404)		
Treatment*Scope1chg			-0.384 (0.591)	-0.688 (0.492)
GBshock*Ln(scope1)	-0.087 (0.116)	-0.109 (0.121)		
GBshock*Scope1chg			-0.642 (0.452)	-0.861* (0.420)
Treatment*GBshock	-2.952** (1.322)	-2.935** (1.386)	-0.800 (0.568)	-0.770 (0.509)
Treatment*GBshock*Ln(scope1)	0.234* (0.140)	0.245* (0.138)		
Treatment*GBshock*Scope1chg			1.288* (0.757)	1.313 (0.888)

# Spillover Effects

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- Does disclosure in one market spill over into other markets?

# First Stage: Spillover Effects

Panel A: Disclosure Effects

Variable (Disclosure)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Full Sample (ex. UK)			Europe (ex. UK)	EU (ex. UK)	Non-EU	North America	Asia
<u>GBshock</u>	0.030*** (0.005)	0.029*** (0.005)	0.030*** (0.006)	0.057*** (0.015)	0.050*** (0.015)	0.086*** (0.030)	0.026** (0.009)	0.020*** (0.006)
Log(scope1)	0.003 (0.003)	-0.018*** (0.005)	-0.029** (0.012)	-0.052 (0.036)	-0.028 (0.037)	-0.180*** (0.040)	-0.035 (0.022)	-0.043* (0.021)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	N	Y	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	N	N	Y	Y	Y	Y	Y	Y
Observations	85,271	85,271	85,271	13,775	11,559	2,216	23,637	37,274
R-squared	0.229	0.305	0.857	0.854	0.852	0.868	0.850	0.867

# 2<sup>nd</sup> Stage: Spillover Effects (Europe)

Panel B12: Carbon Premium Effects (Europe cross-section)

Variable (Return)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	EU (ex. UK)				Non-EU			
Log(scope1)	0.067 (0.101)	0.658* (0.376)			0.259 (0.273)	0.021 (0.455)		
Scope1chg			0.384 (0.301)	0.410 (0.464)			1.278* (0.681)	1.897** (0.703)
Treatment	1.013 (0.668)	0.000 (0.000)	0.078 (0.277)	0.000 (0.000)	0.875 (0.740)	0.000 (0.000)	0.500 (0.420)	0.000 (0.000)
Treatment*Log(scope1)	-0.103 (0.064)	1.496 (1.261)			-0.030 (0.065)	2.275 (2.685)		
Treatment*Scope1chg			0.357 (0.808)	0.644 (1.171)			-1.383 (1.256)	-3.583 (2.483)
<u>GBshock</u> *Log(scope1)	0.096 (0.153)	0.046 (0.152)			-0.628* (0.336)	-0.564* (0.329)		
<u>GBshock</u> *Scope1chg			-0.042 (0.498)	-0.224 (0.650)			-1.926 (1.658)	-3.065** (1.392)
Treatment* <u>GBshock</u>	-2.898* (1.477)	-3.135** (1.473)	-0.610 (0.509)	-0.615 (0.512)	-2.480 (1.883)	-4.075** (1.916)	-0.530 (0.849)	-0.359 (0.845)
Treatment* <u>GBshock</u> *Log(scope1)	0.247* (0.134)	0.265* (0.136)			0.186 (0.196)	0.368* (0.202)		
Treatment* <u>GBshock</u> *Scope1chg			0.459 (1.251)	0.032 (1.424)			3.265 (3.040)	5.913 (3.768)
Controls	Y	Y	Y	Y	Y	Y	Y	Y
Firm Fixed Effects	N	Y	N	Y	N	Y	N	Y
Observations	9,378	9,378	9,368	9,368	1,262	1,262	1,262	1,262
R-squared	0.494	0.513	0.494	0.512	0.592	0.604	0.590	0.602

## 2<sup>nd</sup> Stage: Spillover Effects (North America)

Panel B2: Carbon Premium Effects (North America)

Variable (Return)	(1)	(2)	(3)	(4)
Log(scope1)	0.032 (0.076)	-0.383 (0.237)		
Scope1chg			-0.130 (0.349)	-0.272 (0.468)
Treatment	-0.393 (0.788)		0.109 (0.150)	
Treatment*Log(scope1)	0.046 (0.066)	0.604 (0.650)		
Treatment*Scope1chg			0.250 (0.752)	0.680 (0.601)
<u>GBshock</u> *Log(scope1)	-0.005 (0.112)	0.045 (0.133)		
<u>GBshock</u> *Scope1chg			-0.042 (0.480)	-0.090 (0.538)
Treatment* <u>GBshock</u>	0.233 (1.039)	0.747 (1.075)	-0.369 (0.282)	-0.391 (0.303)
Treatment* <u>GBshock</u> *Log(scope1)	-0.053 (0.087)	-0.102 (0.089)		
Treatment* <u>GBshock</u> *Scope1chg			0.431 (1.018)	0.199 (0.882)
Controls	Y	Y	Y	Y
Firm Fixed Effects	N	Y	N	Y
Observations	20,992	20,992	20,982	20,982
R-squared	0.433	0.454	0.433	0.454

# Disclosure and Peer Pressure

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- Does the company's peer pressure affect disclosure?
  - Focus on fraction of firms within the same industry that already disclose
  - Estimate the **hazard model** with “Peer” as a main variable

# Disclosure and Peer Pressure

VARIABLES	Disclosure			
Peer	4.358***	4.039***	6.739***	7.049***
	-0.15	-0.213	-0.289	-0.413
Ln(scope1)	-0.063**	-0.054**	-0.206***	-0.240***
	-0.027	-0.024	-0.027	-0.037
Scope1chg	-0.107	-0.194	-0.029	-0.034
	-0.123	-0.185	-0.116	-0.157
Scope1int	0.01	0.015	0.042***	0.047***
	-0.008	-0.009	-0.011	-0.014
environmental_pillar		0.103***		0.112***
		-0.016		-0.016
social_pillar		0.038**		0.056***
		-0.018		-0.019
governance_pillar		0.076***		0.062***
		-0.018		-0.018
Industry F.E.	N	N	Y	Y

# Conclusions

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- Disclosure of carbon emissions informs the pricing of transition risk
- It is a relatively easy tool to implement, which has gathered interest from regulators and corporate world
- Evidence of the value benefit coming from voluntary disclosure
- Results from the natural experiment suggest that voluntary disclosure reduces adverse selection component of information
- Disclosure effects spill over to firms in most-related economies

# Do Firms Adjust their Emissions to Disclosure?

- The CSR research suggests that firms may disclose information and at the same time alter their ESG activities (moral hazard?)
- This process is less likely for carbon emissions because they are more difficult to manipulate
- Event study analysis for firms beginning to disclose their data
- **We observe imputed values before the disclosure** => can evaluate the moral hazard story
- DC is an indicator variable equal to one for the year of disclosure change (zero for the year before)