Do investors care about biodiversity ?

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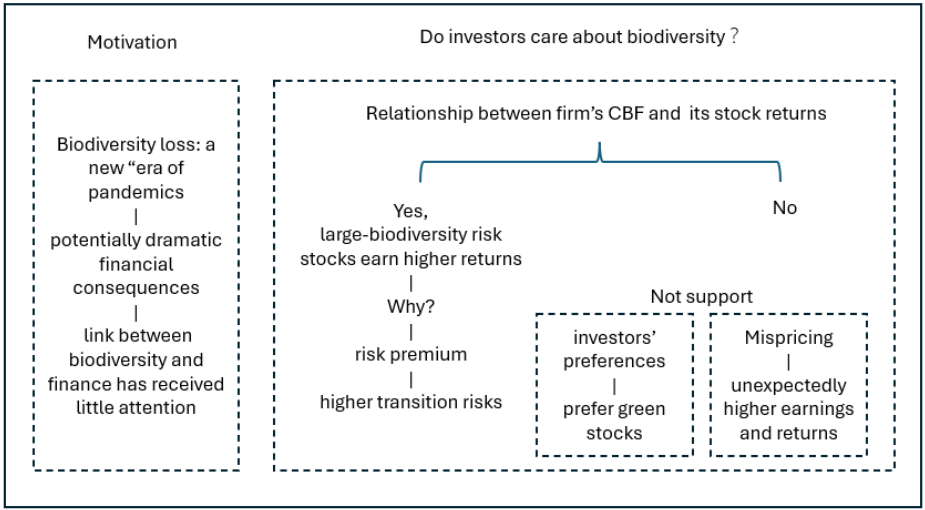
Summary


Motivation
Biodiversity loss: a new “era of pandemics
|
potentially dramatic financial consequences
|
link between biodiversity and finance has received little attention
Do investors care about biodiversity ?
Relationship between firm’s CBF and its stock returns
Yes,
large-biodiversity risk stocks earn higher returns
|
Why?
|
risk premium
|
higher transition risks
No
Not support
investors’ preferences
|
prefer green stocks
Mispricing
|
unexpectedly higher earnings and returns

Research Question

- Do investors care about biodiversity? Yes
  - How to measure firm's biodiversity
  - How can a firm' s biodiversity be expected to correlate with its stock returns

Motivation

1. Biodiversity loss may bring about a new "era of pandemics" (IPBES 2020).
   - potentially dramatic financial consequences of the loss of biodiversity.
   - increasing attention on protecting biodiversity like Kunming Declaration (2021) and the Montreal Agreement (2022).
2. the link between biodiversity and finance has received little attention by academics.
3. filling this gap by introducing a science-based measure, the corporate biodiversity footprint (CBF), and exploring whether investors price this footprint.

Contribution

1. Literature on firm's biodiversity measurement
   - Prior: construct measures of U.S. firms' biodiversity risks from a binary firm-level indicator for disclosures in 10-Ks(Giglio et al.,2023)
   - Extend: quantifies the impact of a firm on biodiversity
2. Literature on the pricing of biodiversity
   - Prior: firms with better biodiversity risk management have more favorable financing conditions(Hoepner et al., 2023).
   - Extend: study the relation of firm-specific monthly returns with the biodiversity footprint

Hypothesis

1. large-CBF stocks will earn higher returns due to higher transition risks
   - higher transition risks – future regulation or litigation uncertainty– risk premium
2. large-CBF stocks will earn lower returns due to unexpected shifts in investors' preferences
   - growing concerns about biodiversity loss – shift in investor preferences for green stocks
3. large-CBF stocks will earn higher returns due to mispricing
   - not invest in mitigating or reducing their biodiversity impacts – unexpectedly higher earnings and returns
4. CBF is unrelated to returns
   - hard to measure and disclose firm's biodiversity impact, little investor awareness, ignore impact materiality.

Variable: Corporate Biodiversity Footprint(CBF)

- Corporate Biodiversity Footprint(CBF): biodiversity loss in units of $km^2 \cdot MSA$, representing the extent of land artificialized from its natural state. For example:

$$\text{CBF} = -100 \text{ km}^2 \cdot \text{MSA}$$

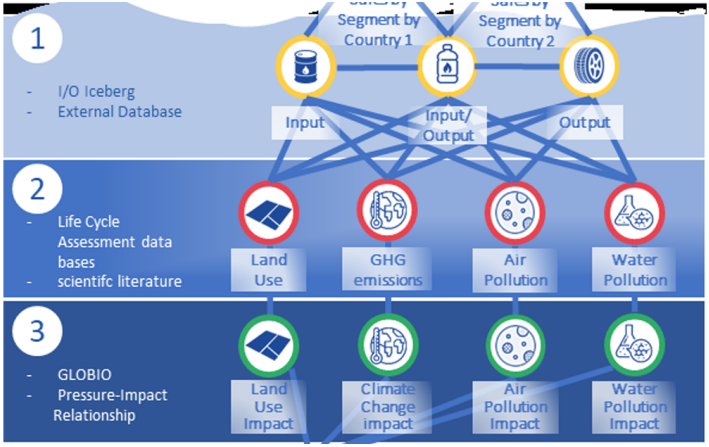
  may indicate a 100% MSA loss over 100 km^2, or a 10% loss over 1,000 km^2.
- Conceptual Foundation: Mean Species Abundance (MSA)
  - MSA = 100%: pristine, undisturbed ecosystem.
  - MSA = 0%: complete loss of native biodiversity.
- CBF aggregates biodiversity losses arising from four environmental pressures (Land use; GHG; Water pollution; Air pollution).

Three-Step Methodology for CBF Construction

1. From business activities to commodities used
   - IDL first identifies each firm’ s business activities by country at the NACE4 (sometimes NACE5) level.
2. From commodities to environmental pressures (km^2)
   - Using life-cycle assessment (LCA), IDL quantifies four types of environmental pressures generated by the firm’ s activities and supply chain
3. From environmental pressures to impact on MSA

$$\text{Impact} = \text{Pressure} \times (\text{Final MSA} - \text{Initial MSA}).$$

Three-Step Methodology for CBF Construction



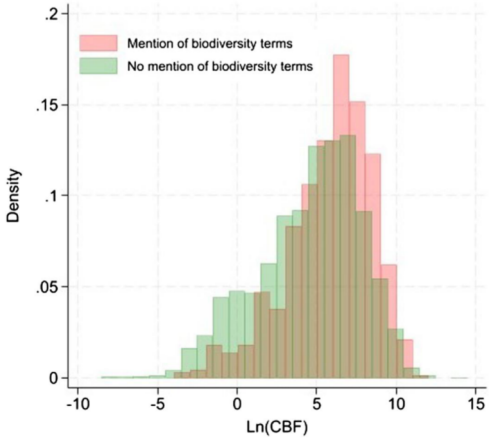
Summary statistics

- all 2,724 publicly listed firms between 2018 and 2021

Variables	#Obs.	Mean	S.D.	Min	25%	50%	75%	Max
Ln(CBF)	89,132	4.79	3.11	–9.25	3.17	5.28	7.01	13.78
Ln(CBF GHG)	89,132	2.27	2.97	–12.33	0.24	2.51	4.42	10.08
Ln(CBF land use)	88,820	3.60	3.56	–15.88	1.75	4.10	6.06	13.77
Ln(CBF water pollution)	89,132	1.37	4.27	–15.53	–1.15	2.21	4.40	11.34
Ln(CBF air pollution)	89,132	1.47	3.29	–13.47	–0.39	1.96	3.71	9.12
Ln(CBF scope 1)	89,012	0.88	3.82	–12.69	–2.03	0.98	3.81	13.77
Ln(CBF scope 2)	88,856	–4.54	5.51	–30.77	–8.70	–3.18	–0.15	6.57
Ln(CBF scope 3)	89,120	4.36	3.45	–11.26	2.78	5.01	6.78	12.11
Ln(CBF/Total assets)	89,132	–4.34	2.73	–11.28	–5.50	–3.86	–2.45	0.10
Ln(CBF/Sales)	89,108	–3.75	2.61	–10.21	–4.88	–3.17	–1.90	0.30
Monthly return (%)	89,132	1.18	10.53	–25.63	–5.28	0.81	7.02	34.40
Monthly ICC (%)	52,315	0.93	0.63	0.00	0.50	0.79	1.21	3.86

Biodiversity footprint: validation and determinants

- many firms that do not mention biodiversity in earning calls have higher CBF values than those that do.



Result 1: Refuse H2

- on average, a larger biodiversity footprint is not associated with higher (or lower) returns
- large-CBF firms should have lower (not higher, as we found) returns in the months after the Kunming Declaration.

	Monthly return (%)					
	Whole period		Pre-Kunming period		Post-Kunming period	
	(1)	(2)	(3)	(4)	(5)	(6)
Ln(CBF)	0.003	–0.000	–0.036	–0.036	0.061**	0.057**
	(0.019)	(0.018)	(0.022)	(0.022)	(0.026)	(0.026)
Ln(Total assets)	0.211	0.158	0.143	0.112	0.336	0.290
	(0.171)	(0.164)	(0.192)	(0.187)	(0.329)	(0.313)
Ln(Market cap)	–0.468***	–0.393***	–0.426**	–0.382**	–0.372	–0.305
	(0.153)	(0.143)	(0.187)	(0.178)	(0.252)	(0.238)
Book-to-market	–0.086	–0.043	–0.072	–0.047	–0.057	–0.043
	(0.159)	(0.158)	(0.196)	(0.189)	(0.285)	(0.289)

Result 2: Refuse H3

- SUE1(SUE2)is the one-year(two-year) earnings surprise measured as the actual EPS minus the I/B/E/S median analyst forecast 8(20) months prior to the end of the forecast period.
- no statistically significant relationship between the CBF and earnings surprises.

	Whole period		Pre-Kunming		Post-Kunming	
	(1)	(2)	(3)	(4)	(5)	(6)
	SUE1	SUE2	SUE1	SUE2	SUE1	SUE2
Ln(CBF)	-0.000	-0.003	-0.003	-0.015	0.006	0.021
	(0.010)	(0.012)	(0.013)	(0.015)	(0.015)	(0.018)

Result 3: Support H1

- Event timing: Pricing changes start after salient biodiversity events.
- Event dynamics: Investors immediately bid down large-CBF stocks around events (negative abnormal returns), consistent with regulatory/litigation uncertainty.

	Daily return (%)				Abnormal daily return (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Large CBF × Post	–0.381***	–0.372***	–0.189**		–0.295***	–0.380***	–0.209**	
	(0.064)	(0.057)	(0.084)		(0.073)	(0.055)	(0.078)	
Large CBF × t = –2				0.040				–0.043
				(0.213)				(0.204)
Large CBF × t = –1				–0.504*				–0.361
				(0.278)				(0.277)
Large CBF × t = 0				–0.671***				–0.590**
				(0.218)				(0.226)
Large CBF × t = +1				–0.642***				–0.461**
				(0.193)				(0.196)
Large CBF × t = +2				–0.301*				–0.241
				(0.164)				(0.166)

Result 3: Support H1

- Longer-run pricing: After the events, large-CBF firms exhibit higher realized returns and higher ICC (expected returns), consistent with a required risk premium for transition exposure.

	Monthly ICC (in %)		
	Whole period	Pre-Kunming	Post-Kunming
	(1)	(2)	(3)
Ln(CBF)	0.008*	0.004	0.014**
	(0.004)	(0.004)	(0.005)

Idea

1. 构造生物多样性因子，做资产定价分析
2. 生物多样性风险 × 投资者关注，新闻文本
3. 基金投资者是否关注生物多样性

CBF calculation for Danone: Overview