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Stock returns and sustainability beyond carbon

A quantitative approach to environmental and social indicators

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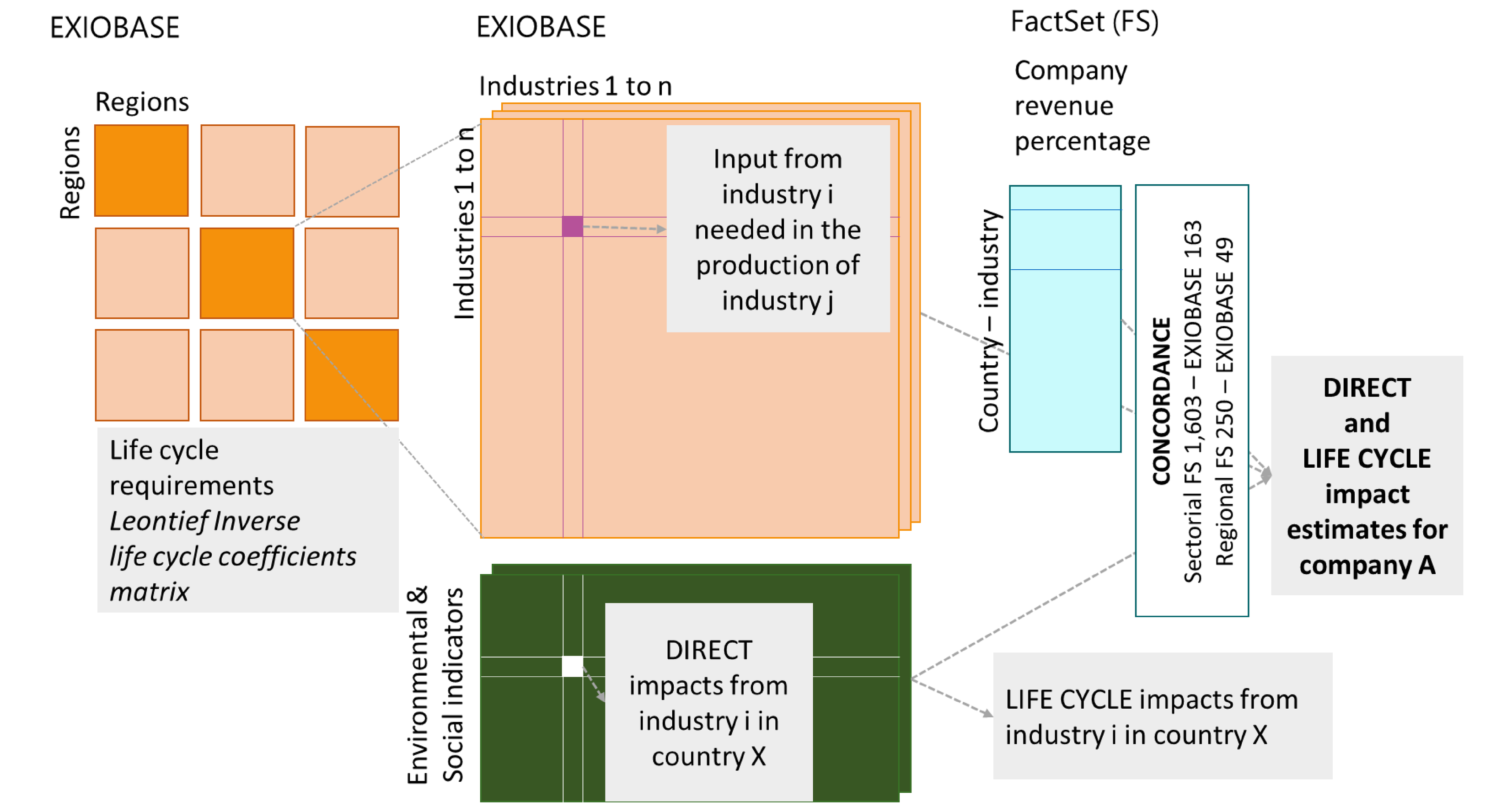
INTRO

Motivation | Sustainability considerations, driven by climate change, but also extended to water scarcity, vulnerable employment and pollution, are increasingly seen as a risk to financial markets and the economy. Investors seldomly have access to harmonized information about the impacts attributable to the companies that they invest in, especially on indirect impacts. Using input-output life cycle assessment, we can estimate the sustainability characteristics of firms and test which of these are included by investors in their stock market investment decisions.

Research Question | Are sustainability characteristics, beyond carbon emissions, priced in the cross-section of stock returns ?

Hypothesis | We hypothesize that investors demand a higher return for companies with large negative impacts, given an implied higher long-term risk, that could materialize via regulatory, reputation, transition or physical risks.

METHOD | Sustainability data estimation



DATA | Corporate-level estimated life cycle sustainability

Monthly return data for period 2012-2021, matched with monthly and yearly financial controls, and estimated sustainability data, yearly frequency. Sustainability data is estimated based on an input-output life cycle assessment (IOLCA) methodology that allocates impacts to companies based on their sub-industry and sub-country distribution of revenue. In terms of sustainability data, we use IOLCA-based country-region impact factors, measured per unit of revenue.

Industry	Nb firms (y 2019)	GHG emissions (MtCO2-eq)	Acidifcation (mil mol H+)	Human toxicity cancer (CTUh)	Particulate matter (DALY)	Water use (Mm3)	Vulnerable employment (1,000 persons)	Sales (MUSD)
Agriculture	393	270	7,659	1,366	66,040	24,885	26,323	204,923
Electronics & Telecom	3,659	2,045	20,918	15,394	470,410	30,676	70,364	4,933,295
Finance and Services	7,289	4,302	37,473	16,443	866,973	62,624	169,393	13,671,492
Manufacturing	10,015	13,353	157,316	79,091	3,740,459	335,260	352,948	15,347,237
Mining	439	2,221	15,319	4,491	281,872	7,756	29,058	773,561
Oil & Gas Extraction	448	6,031	20,918	6,296	354,571	16,235	67,996	3,233,424
Retail and Trade	1,703	1,629	13,715	4,315	196,075	33,573	106,265	6,130,248
Transport and Utilities	1,327	9,550	65,294	6,724	887,586	22,588	38,425	3,519,798
Total	**25,273**	**39,401**	**338,612**	**134,120**	**6,863,986**	**533,597**	**860,772**	**47,813,978**

Total absolute life cycle impacts (direct and indirect upstream impacts) of companies in the sample, by impact category, for year 2019. **GHG emissions** are emissions of CO_2, CH_4, N_2O. **Acidification** refers to emissions of NOx, SOx, and NH_3. Human toxicity cancer groups emissions of heavy metals and other chemicals. **Particulate matter**, measured in disability-adjusted life years, refers to emissions of $PM_{2.5}$ and other smaller particles. **Water use** refers to the amount of water withdrawn and consumed by the specific economic activity. **Vulnerable employment** refers to workers not covered by social security or in informal employment.

RESULTS

Regression Model | $ret_{i,t} = a_o + a_1 \times (GHG\ emissions\ absolute)_{i,t-1} + a_2 \times Controls_{i,t-1} + \mu_t + \varepsilon_t$

1. GHG emissions and stock returns

- the coefficient for absolute GHG emissions is statistically and economically significant, robust to including country and industry fixed effects.
- findings consistent with Bolton and Kacperczyk (2022), but using a larger sample

stock return	(1)	(2)	(3)	(4)
logdirabs ghg	0.0424		**0.114*** **	
	(0.0294)		**(0.0290)**	
logindirabs ghg		0.277***		**0.298*** **
		(0.0329)		**(0.0336)**
Observations	1,599,994	1,599,994	1,599,994	1,599,994
Controls	Y	Y	Y	Y
Yr/mo FE	Y	Y	Y	Y
Country FE	Y	Y	Y	Y
Industry FE	N	N	Y	Y
Adjusted R-squared	0.115	0.116	0.116	0.116

2. GHG emissions, water use, water stress dummy and stock returns

stock return	(1)	(2)	(3)
loglifecycleabs ghg	0.0566	0.0914	0.140**
	(0.0792)	(0.0940)	(0.0561)
loglifecycle abs water use	0.143	0.153	0.102**
	(0.0836)	(0.100)	(0.0337)
waterstress dummy x log lifecycle abs water use	0.0102	0.00803	**0.0394***
	(0.0174)	(0.0172)	**(0.0212)**
Observations	1,549,002	1,549,002	1,549,002
Controls	Y	Y	Y
Yr/mo FE	Y	Y	Y
Country FE	N	N	Y
Industry FE	N	Y	Y
Adjusted R-squared	0.116	0.117	0.118

- from all indicators, only **water use** and **vulnerable employment** show significance, in addition to GHG emissions variable
- direct vulnerable employment shows a positive and statistically significant coefficient in relation with stock returns
- water use variable shows positive and statistically significant coefficients in relation to stock returns
- higher water use is correlated with higher returns, under the hypothesis that investors demand a higher compensation for the long-term risk assumed
- for the regression with water use, we find that in countries where water stress is higher the impact on stock returns is higher, compared to countries where water stress is low; the effect is significant when including country and industry fixed effects

CONCLUSIONS

1. **Water use and vulnerable employment are positively priced in the cross-section of stock returns**
2. **Not all sustainability characteristics are priced in by the stock market**
3. **Correlation with stock returns depends on the specificities of the country of incorporation (e.g., water stress, climate performance or respect of human rights)**

Policy implications

→ Better disclosure for other impact categories beyond climate change, and relating to indirect, not only direct effects, should be mandated, as these seem to be significant for investors, and are not perfectly correlated with GHG emissions

→ Investors can influence the practices of companies by engaging on material issues, and IOLCA can be useful as methodology for estimation of impact

References | Bolton, P. and Kacperczyk, M., Global Pricing of Carbon-Transition Risk (2022). Journal of Finance, Forthcoming,

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