

External finance and corporate emissions

Distributional perspective

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Amsterdam, 19 October 2023

Motivation

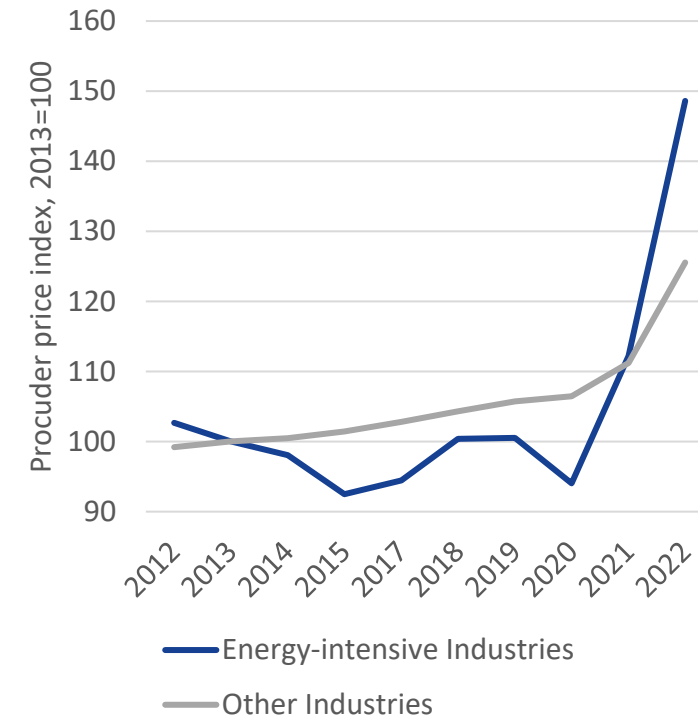
Motivation (I)

Decarbonization and competitiveness dilemma

- EU intends to achieve climate neutrality by 2050, including the intermediate target of an at least 55% net reduction in greenhouse gas emissions by 2030.
- Since 2019 manufacturing sector is the biggest contributor to the EU27 GHG emissions. As of 2022:
 - 22% manufacturing,
 - 20% power production,
 - 19% households.
- Energy price shock in 2022 was asymmetrically transmitted across the industry, with substantial erosion of pricing advantages among energy-intensive industries.
- The surge in production prices among energy-intensive producers was nearly two times faster than in other industries.

Energy intensity threat to competitiveness

Producer-price index



Notes: Energy intensive sectors defined as in CBAM regulation. Coverage for EU27. Source: Eurostat.

Motivation (II)

Firm-level perspective on financing decarbonization is scattered

- Among SMEs and larger firms, subsidized loans and equity capital fosters firms' investment in mitigating natural hazard and climate policy risks. Little evidence on non-subsidized loans and debt securities to support green investment (Ferrando et al, 2023).
- Higher debt levels are associated with lower absolute emissions and lower carbon intensity among firms regulated by the EU ETS. But the effectiveness of debt in reducing carbon intensity decreases for highly indebted firms (Carradori et al., 2023).
- Substantial decarbonization gains in the last decade can be attributed to power producers, largely on the back of an increasing use of renewable energy sources and a switch to less carbon-intensive fossil fuels (Bijmens and Swartenbroekx, 2022).

This project

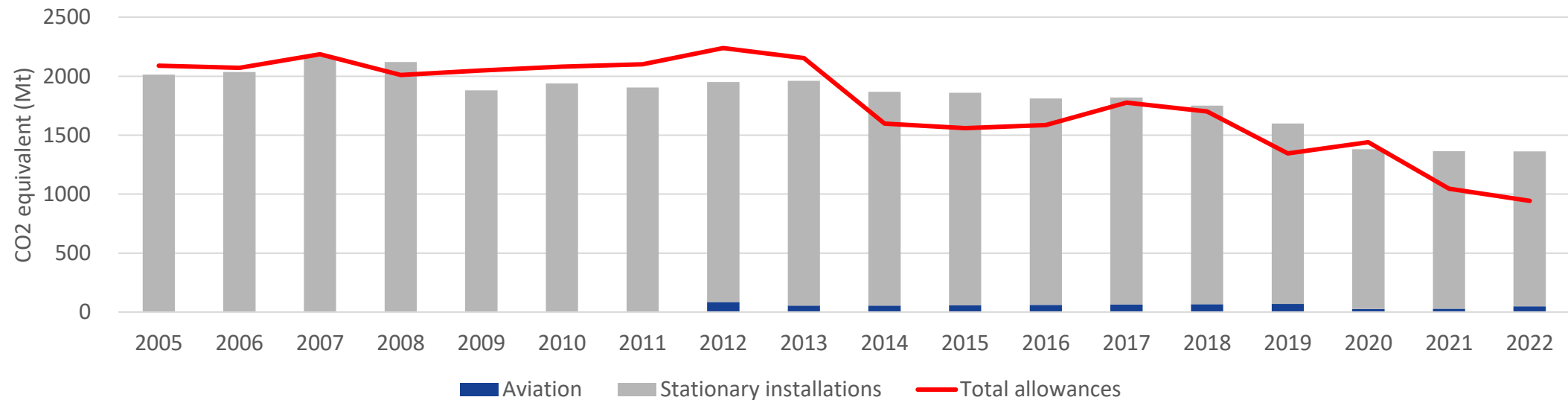
What types of financing enable carbon efficiency
in the manufacturing industry
and why?

Data

Empirical playground

EU Emission Trading System (ETS)

- Installation level data for 12,971 stationary installations and 1,427 aircraft operators (Scope 1).
- Cap-and-trade system where the total number of certificates is set by a regulator and decreases over time to align with the European climate objectives. Emission certificates are distributed among the regulated entities, either for free or through auctions, which are allowed to trade the certificates based on their emission and production needs.
- Main focus on the 2nd and 3rd phase of ETS between 2008-2012 and 2013-2020.

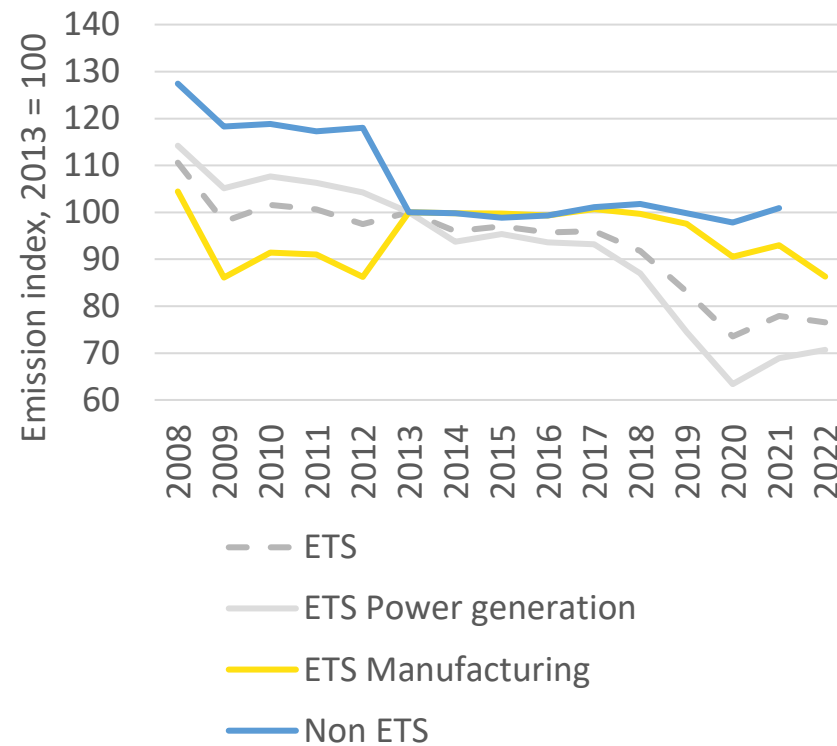


Source: European Environment Agency (2023).

Diving deeper into the ETS

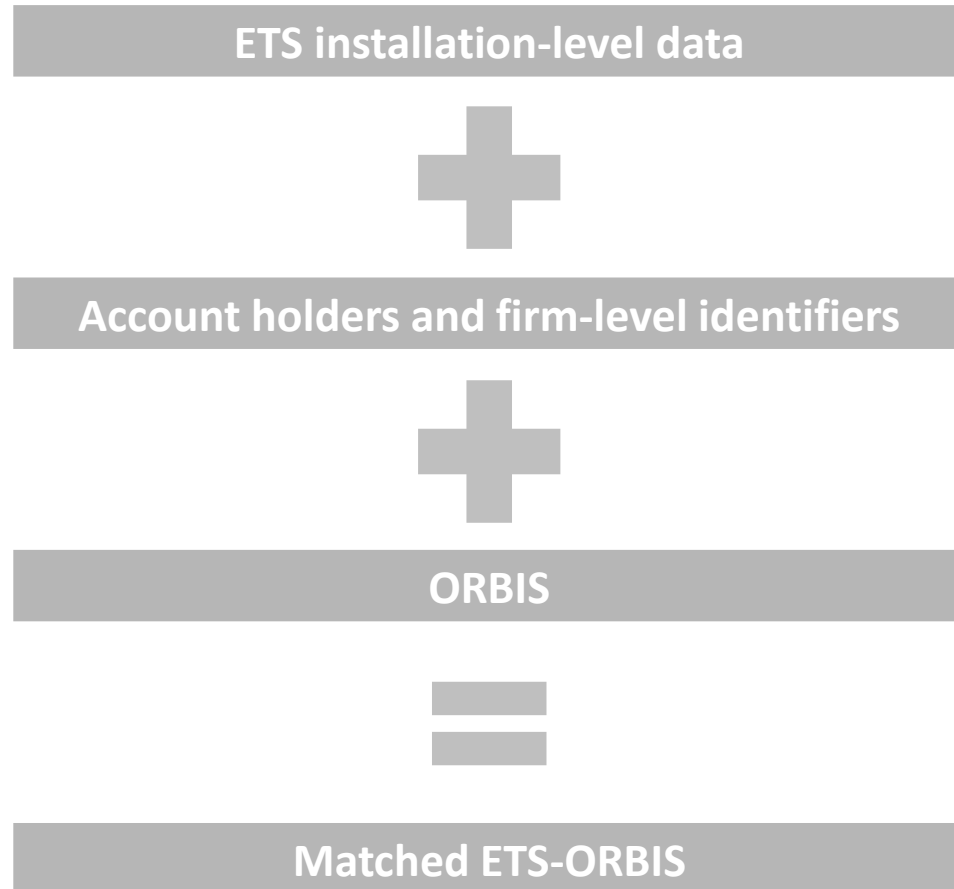
Power generation drives the ETS trends

EU-wide emission index



Source: European Environment Agency (2023).

Enhancing ETS with firm-level financial data



Reported ETS amounts (DG CLIMA)

- Verified emission levels
- Free emission allocations
- Allocation reserves

Quasi correspondence table (DG JRC)

- One account may hold several installations
- One firm may hold several accounts
- Sectoral reclassification of installations (WIIW, 2022)

Firm-level financial statements and firms' demographics

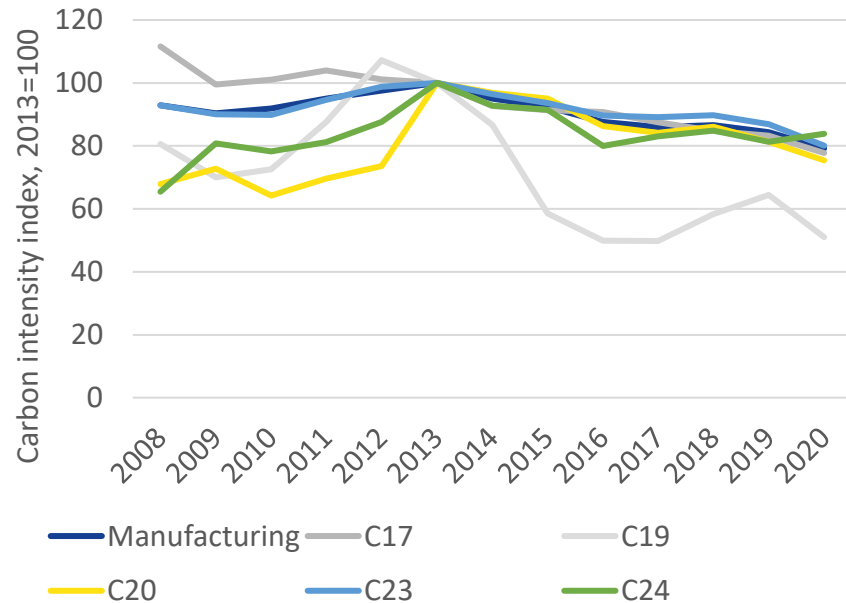
- Shareholder structure
- P&L accounts
- Balance sheet accounts

Final data

- From 7,257 matched firms overall, we take 2,683 firms with at least one manufacturing installation
- EU27+UK (no Malta)
- Time span between 2008-2020

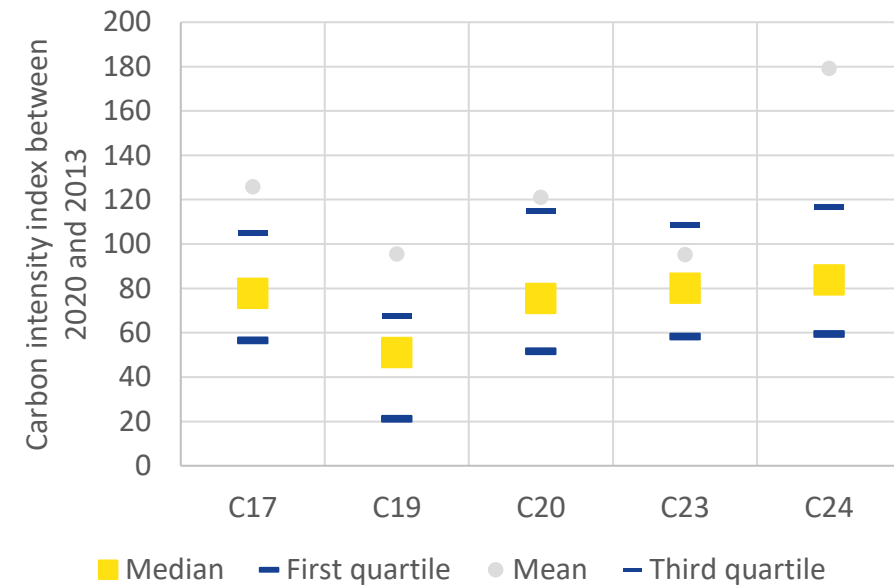
Green manufacturing?

Slower progress among manufacturing... EU-wide carbon intensity index



Notes: Product sectors are based on EU ETS installation-level sectors and are assigned to firms based on the installations which constitute the majority of firm-level emissions. C17 represents the pulp and paper sector, C19 is for refineries, C20 is for chemicals, C23 for non-metallic minerals and C24 is for basic metals. Source: EIB calculations based on EU ETS and Orbis databases.

...with substantial heterogeneity between firms Changes in carbon intensity between 2020 and 2013

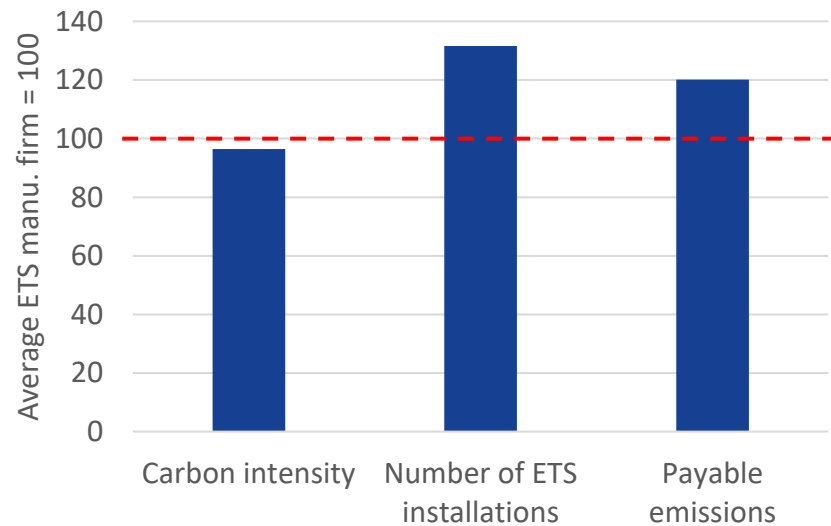


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Who lags behind?

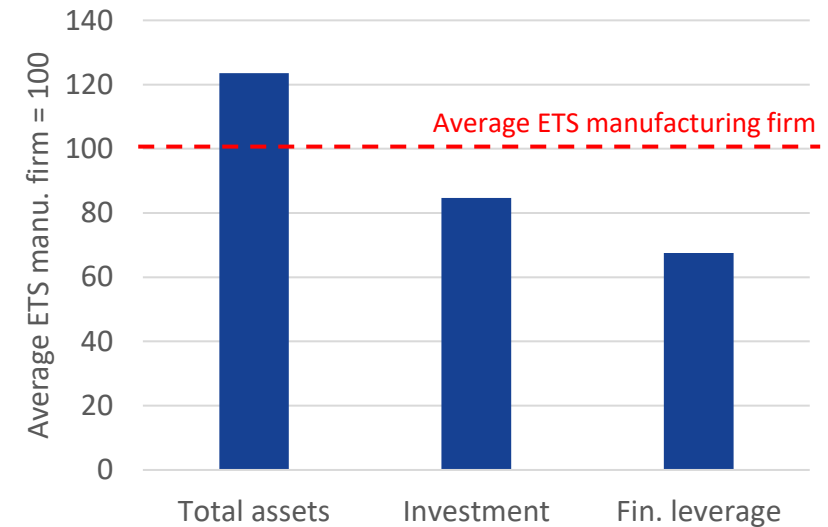
Laggards are more carbon-dependent...

25% of firms with the slowest decarbonization progress



...and they have different balance sheets

25% of firms with the slowest decarbonization progress



Notes: Average statistics calculated on a sample of EU ETS manufacturing firms between 2013 and 2020. Decarbonization laggards are defined as 25% of firms with the slowest improvement in carbon intensity between 2020 and 2013 in each of the product sectors. Financial leverage is defined as the sum of short-term loans and long-term debt scaled by the total assets. Payable emissions describe the share of verified emissions for which a firm has to pay. Source: EIB calculations based on EU ETS and Orbis databases.

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Empirical investigation

Model specification

Baseline regression (+ robustness)

$$\ln\left(\frac{CO2_{icst}}{VA_{icst}}\right) = \beta_0 + \beta_1 FLev_{icst-1} + \beta_2 X_{icst-1} + \beta_3 ETS_{icst-1} + (\mu_i) + v_{cst} + \varepsilon_{icst}$$

Real Value Added

Fixed effects (firm-level + country-sector-year)

- # of installations
- Emission allowances
- Tangible investment
- RoA (Net income/Total Assets)
- Tax ratio (Taxes payable/EBITDA)
- Cash ratio (Cash/Total assets)
- Size (total assets, log)
- Firm age
- Financial leverage (Loans/TA + LT Debt/TA)

Base results

Financial leverage is negatively correlated with firm-level carbon intensity.

Size and profitability help with decarbonization while taxes seem to hamper it.

Emission allocations matter for decarbonization.

Firm-level FEs on/off

Financial leverage and firm-level carbon intensity

	(1) log(CO2/VA)	(2) log(CO2/VA)	(3) log(CO2/VA)	(4) log(CO2/VA)
Fin. leverage	-0.165** (0.066)	-0.153** (0.076)	-0.159** (0.066)	-0.150* (0.077)
Tangible investment	0.000*** (0.000)	-0.000 (0.000)	0.000*** (0.000)	-0.000 (0.000)
RoA	-0.008*** (0.002)	-0.007*** (0.001)	-0.008*** (0.002)	-0.008*** (0.001)
Taxes payable / EBITDA	0.173*** (0.034)	-0.004 (0.021)	0.170*** (0.035)	-0.006 (0.021)
Cash ratio	-0.222* (0.134)	-0.166 (0.141)	-0.194 (0.133)	-0.210* (0.121)
Total assets (log)	-0.330*** (0.011)	-0.158*** (0.055)	-0.325*** (0.011)	-0.185*** (0.055)
Firm age	0.001 (0.001)	-0.004 (0.005)	0.001 (0.001)	-0.004 (0.005)
N. of installations	0.052*** (0.008)	0.173*** (0.026)	0.055*** (0.008)	0.187*** (0.027)
Free emission allowance	1.205*** (0.026)	0.680*** (0.085)	1.202*** (0.025)	0.591*** (0.080)
Constant	4.238*** (0.186)	1.211 (1.002)	4.146*** (0.187)	1.703* (0.998)
Firm-level FE	No	Yes	No	Yes
Country x Year FE	Yes	Yes	No	No
Sector x Year FE	Yes	Yes	No	No
Country x Sector x Year FE	No	No	Yes	Yes
Observations	12382	12257	12291	12166
R-squared	0.355	0.882	0.404	0.889
Adjusted R-squared	0.342	0.862	0.367	0.864

Notes: Robust standard errors in parentheses. Source: EIB calculations based on EU ETS and Orbis databases.

Maturity structure

Maturity structure of external debt and firm-level carbon intensity

Long-term access to finance seems to be correlated with firm-specific improvement in carbon intensity over time. But it is not necessarily a characteristic of carbon efficient firms within a sector.

Access to short-term finance appears to be a characteristic of low-carbon-intensity firms in a given sector but does not seem to be correlated with firm-level decarbonization over time.

	(1) log(CO2/VA)	(2) log(CO2/VA)	(3) log(CO2/VA)	(4) log(CO2/VA)
Long-term debt ratio	-0.072 (0.081)	-0.203** (0.080)	-0.092 (0.082)	-0.216*** (0.083)
Short-term debt ratio	-0.361*** (0.113)	0.014 (0.119)	-0.298*** (0.108)	0.060 (0.121)
Other controls	Yes	Yes	Yes	Yes
Firm-level FE	No	Yes	No	Yes
Country x Year FE	Yes	Yes	No	No
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Excessive debt levels

Nonlinearities in the use of external finance and firm-level carbon intensity

Debt overhang in access to long-term finance rather driven by within sector/country distribution than firm-level changes over time.

No statistical evidence of nonlinearities in access to short-term finance and carbon intensity.

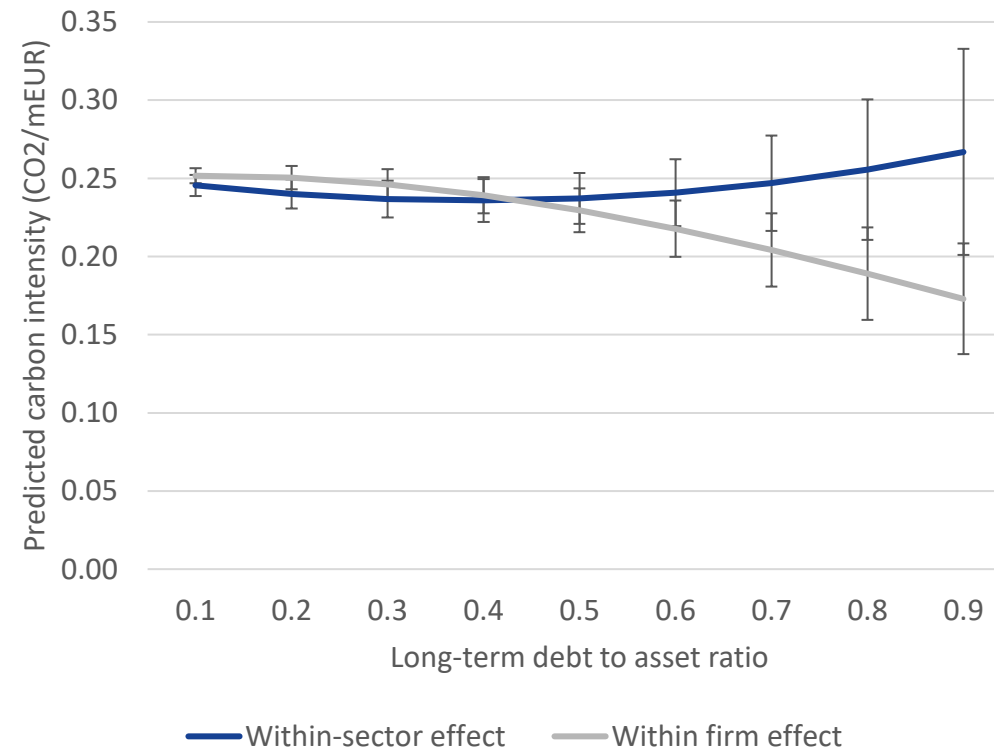
	(1) log(CO2/VA)	(2) log(CO2/VA)	(3) log(CO2/VA)	(4) log(CO2/VA)
Long-term debt ratio	-0.462** (0.185)	0.178 (0.156)	-0.371** (0.186)	0.130 (0.161)
(Long-term debt ratio)^2	0.670** (0.283)	-0.661** (0.261)	0.476* (0.287)	-0.598** (0.270)
Short-term debt ratio	-0.130 (0.270)	0.118 (0.225)	-0.109 (0.252)	0.155 (0.234)
(Short-term debt ratio)^2	-0.458 (0.636)	-0.234 (0.507)	-0.390 (0.554)	-0.216 (0.518)
Other controls	Yes	Yes	Yes	Yes
Firm-level FE	No	Yes	No	Yes
Country x Year FE	Yes	Yes	No	No
Sector x Year FE	Yes	Yes	No	No
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Excessive debt levels as a debt overhang...

Debt and carbon intensity, average effect

Predicted level of carbon intensity based on long-term debt level

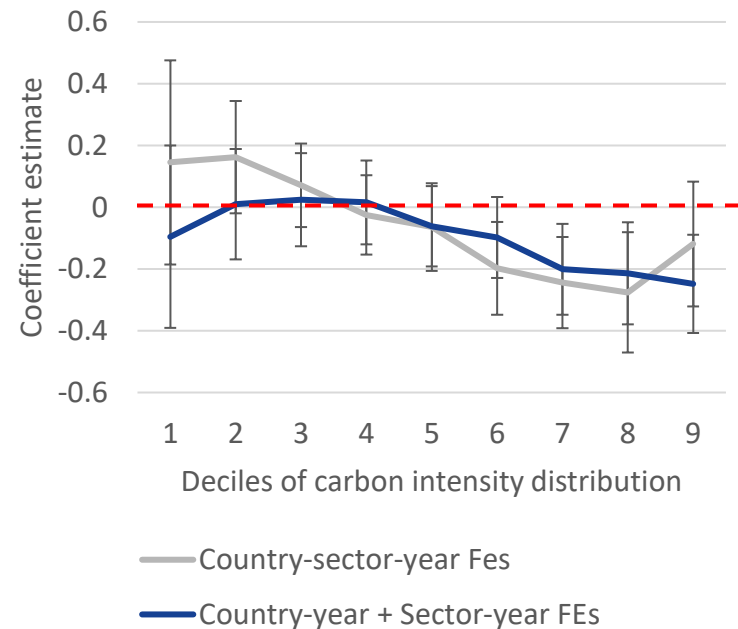


Notes: 95% confidence intervals as error bars. Source: EIB calculations based on EU ETS and Orbis databases.

...or rather an equilibrium outcome?

Debt and carbon intensity, quantile effects

Coefficient estimate of long-term debt on quantiles of carbon intensity



Notes: conditional quantile regression results, regressing real carbon intensity (in log) on long-term debt to assets ratio, by decile of carbon intensity distribution. The model controls for returns on assets, total assets (in log), number of installations reporting under the EU ETS and the amount of free allowances granted under the regulation. All explanatory variables are lagged by 1 year. The model absorbs country-sector-year variation or country-year and sector-year variation using the Mundlak's method. 95% confidence intervals as error bars. Source: EIB calculations based on EU ETS and Orbis databases.

Key take aways

Conclusions

Decarbonization progress has been uneven among firms regulated by the EU ETS

- Progress predominantly driven by power producers, with CO2 reduction nearly twice slower among manufacturing firms.
- More than 25% of manufacturing firms in each of the product sectors increased carbon intensity between 2013 and 2020.
- Firms who lag in carbon intensity improvement are typically larger but invest less and are less dependent on financial leverage.

Access to finance matters for industrial decarbonization

- Access to long-term finance is, on average, associated with firms' improvement in carbon intensity over time but not a characteristic of carbon efficient firms within sector. Short-term finance is an important feature of firms with lower carbon-intensity within a sector but does not correlate with carbon intensity over over time.
- While firms with excessive levels of long-term debt are among the most carbon-intensive ones within a sector, large shares of long-term debt do not necessarily need to be indicative of a debt overhang problem.
- Long-term finance seems to be particularly effective in supporting decarbonization of highly carbon-intensive firms within sector (technological availability, economies of scale).

THANK YOU



European
Investment Bank

Annex

Sample distribution

Geographical distribution

	Freq	Percent
CESEE	532	19.83
South Europe	919	34.25
West and North Europe	1,100	41
No ORBIS	132	4.92
	2683	100

Source: EIB calculations based on EU ETS and Orbis databases.

Sectoral distribution

	Freq	Percent
C17	586	21.84
C19	96	3.58
C20	229	8.54
C23	1,354	50.47
C24	417	15.54
C26	1	0.04
Total	2,683	100

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