Closer and greener? Firms' GVC participation and sustainability

Finn Ole Semrau[a,b]
Twitter: @FOSemrau

[a]Kiel Institute for the World Economy
[b]Kiel Centre for Globalization

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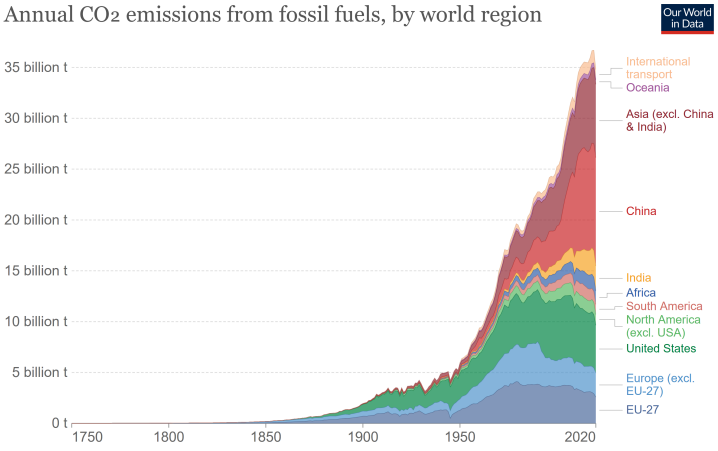
Sustainable industrial development

SDG 9 on industry, innovation and infrastructure:
Target 9.4 states that by 2030 ... 'retrofit industries to make them sustainable, with **increased resource use efficiency** and **greater adoption of clean and environmentally sound** technologies and industrial processes'

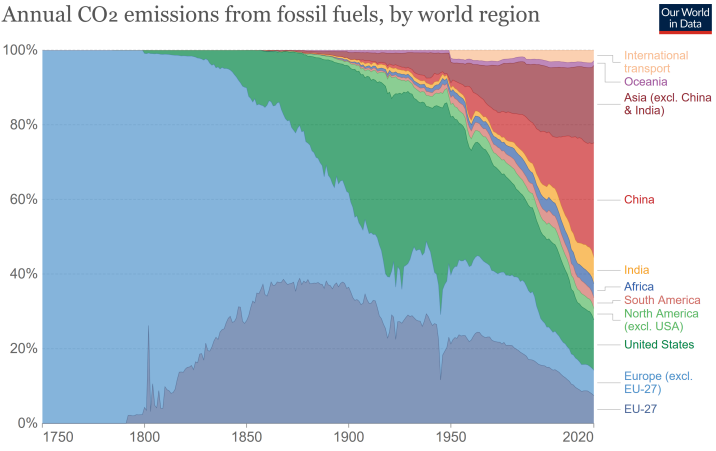
SDG 12 on responsible production and consumption:
Decoupling economic growth from environmental degradation, increasing resource efficiency and promoting sustainable lifestyles

CO_2 emissions split by regions



Source: Global Carbon Project OurWorldInData.org/co2-and-other-greenhouse-gas-emissions • CC BY
Note: This measures CO_2 emissions from fossil fuels and cement production only – land use change is not included. 'Statistical differences' (included in the GCP dataset) are not included here.

CO_2 emissions split by regions



Diffusion of clean technologies

- IEA emphasises that (2021): 'All the technologies needed to achieve the necessary deep cuts in global emissions by 2030 already exist, and the policies that can drive their deployment are already proven.'
- Firms' GVC participation and its environmental performance:
  - Export activity and environmental innovation in Europe
    - Hanley, A. and Semrau, F. O. (2022) 'Stepping up to the mark? Firms' export activity and environmental innovation in 14 European countries', Industry and Innovation.
  - GVC positioning and CO_2 emissions in India
    - Semrau, F. O. (ongoing) 'On the drivers of clean production: A firm's global value chain positioning'.

Export activity and environmental innovation in Europe

- Following Kemp and Pearson (2007): Environmental innovations (EI) is defined as innovations that result in a reduction of the environmental impact in consumption (product-based EI) or production (process-based EI) and are novel to the firm

Hypotheses:

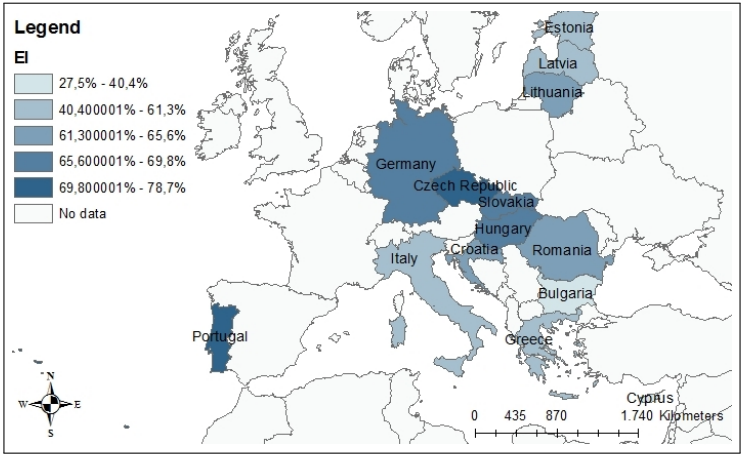
- **H1:** *Exposure to more environmentally regulated foreign markets, characterised by high market-related environmental policy stringency, induces firms to improve their environmental processes and to produce cleaner products.*
- **H2:** *In particular, firms in catch-up economies benefit from learning-by-exporting, a relationship reflected in a positive correlation between process-based environmental innovation and exports.*

Data description

Our main data is the harmonised Community Innovation Survey 2008 and 2014 provided by Eurostat

- Covers detailed information on firms innovation activity, including eight EI typologies (Mairesse and Mohnen, 2010)
- We split the EIs into process-based (five typologies) and product-based (three typologies) (details here)
- We exploit data of 23,653 innovation active firms based in 14 different European countries, including nine Eastern European countries
- In addition, we merged data from the World Input-Output Tables to control if the level of trade integration affects the EI adoption rates (Dietzenbacher, Los, Stehrer, Timmer, and De Vries, 2013)
- And we distinguished between the level of stakeholder environmental demand in the export destination by the score of Environmental Policy Stringency index of the OECD (Botta and Koźluk, 2014)

EI adoption by country



EI typologies adopted split by type and country's development: here.

Empirical specification

We run different estimations for EI adoption, process-based EI and product-based EI:

- For each firm i, producing in sector z, located in region j at time t are:
- (1) $EI_{it} = \alpha + \beta_1 export_{it} + \beta_2 EPS\,exposure_{zjt} + \gamma_n x_{it} + \eta_{zj}$
  - Logit estimation
  - EI is a dummy variable that reflects if a firm has adopted any EI
- (2) $Number\,of\,EI_{it} = \alpha + \beta_1 export_{it} + \beta_2 EPS\,exposure_{zjt} + \gamma_n x_{it} + \eta_{zj}$
  - PPML, which outperforms its alternatives in the presence of many zeros
  - EI is a count variable reflecting the number of EI domains adopted by a firm

Details on EPS exposure here.

Results: All types of EI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Logit		PPML		Logit		PPML	
	Full sample		Full sample		East		East	
VAR.	EI adoption		EI breadth		EI adoption		EI breadth	
Exporter	0.034***	0.039***	0.047	0.065	0.047***	0.045**	0.182	0.151
	(0.012)	(0.012)	(0.072)	(0.075)	(0.017)	(0.018)	(0.117)	(0.124)
Exp. dom.	0.035***	0.063***	0.102	0.272***	0.052***	0.043***	0.271***	0.192
	(0.011)	(0.013)	(0.081)	(0.090)	(0.014)	(0.016)	(0.105)	(0.117)
Market EPS		0.221***		1.717***		0.156***		0.925***
		(0.069)		(0.439)		(0.060)		(0.342)
Non-m. EPS		0.223***		0.840		0.139*		0.065
		(0.078)		(0.569)		(0.083)		(0.455)
East		-0.106***		-0.774***				
		(0.027)		(0.162)				
Further controls	...	...	...	...	...	...	...	...
Observations	23,653	23,653	23,653	23,653	13,295	13,295	13,295	13,295
Country	Yes	No	Yes	No	Yes	No	Yes	No
Sector and Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
Average marginal effects are reported
Note: dy/dx for factor levels is the discrete change from the base level
*** p<0.01, ** p<0.05, * p<0.1

Complete regression here

Process-based EIs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Logit		PPML		Logit		PPML	
	Full sample		Full sample		East		East	
VAR.	EI adoption		EI breadth		EI adoption		EI breadth	
Exporter	0.033***	0.037***	0.068	0.081	0.048***	0.045**	0.160**	0.146*
	(0.012)	(0.012)	(0.049)	(0.052)	(0.017)	(0.018)	(0.080)	(0.086)
Exp. dom.	0.036***	0.066***	0.140**	0.288***	0.054***	0.045***	0.250***	0.205**
	(0.012)	(0.013)	(0.056)	(0.063)	(0.015)	(0.017)	(0.074)	(0.082)
Market EPS		0.230***		1.190***		0.148**		0.611***
		(0.069)		(0.306)		(0.059)		(0.223)
Non-m. EPS		0.224***		0.587		0.129		0.115
		(0.080)		(0.386)		(0.084)		(0.311)
East		-0.102***		-0.439***				
		(0.027)		(0.119)				
Further controls	...	...	...	...	...	...	...	...
Observations	23,653	23,653	23,653	23,653	13,295	13,295	13,295	13,295
Country	Yes	No	Yes	No	Yes	No	Yes	No
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
Average marginal effects are reported
Note: dy/dx for factor levels is the discrete change from the base level
*** p<0.01, ** p<0.05, * p<0.1

Complete regression here

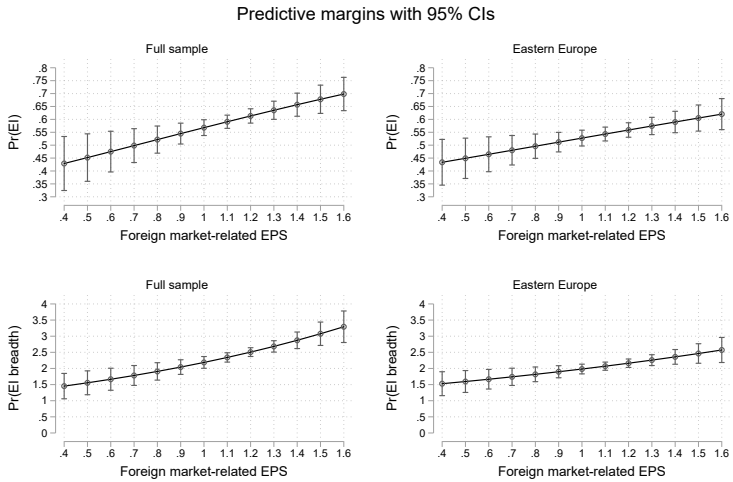
Product-based EIs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Logit		PPML		Logit		PPML	
	Full sample		Full sample		East		East	
VAR.	EI adoption		EI breadth		EI adoption		EI breadth	
Exporter	0.011	0.012	-0.021	-0.018	0.026	0.017	0.021	0.004
	(0.011)	(0.011)	(0.027)	(0.027)	(0.019)	(0.018)	(0.044)	(0.045)
Exp. dom.	-0.007	-0.002	-0.039	-0.017	0.016	-0.000	0.020	-0.014
	(0.011)	(0.012)	(0.029)	(0.031)	(0.015)	(0.016)	(0.037)	(0.040)
Market EPS		0.200***		0.527***		0.148***		0.317**
		(0.055)		(0.147)		(0.056)		(0.131)
Non-m. EPS		0.144**		0.253		0.047		-0.054
		(0.071)		(0.204)		(0.067)		(0.155)
East		-0.133***		-0.334***				
		(0.019)		(0.050)				
Further controls	...	...	...	...	...	...	...	...
Observations	23,653	23,653	23,653	23,653	13,295	13,295	13,295	13,295
Country	Yes	No	Yes	No	Yes	No	Yes	No
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

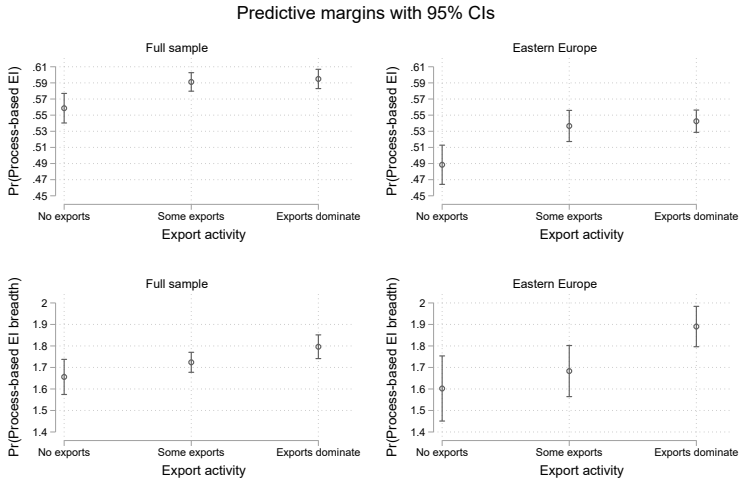
Standard errors in parentheses
Average marginal effects are reported
Note: dy/dx for factor levels is the discrete change from the base level
*** p<0.01, ** p<0.05, * p<0.1

Complete regression here

Predicted margins of EI adoption and market-related EPS



Predicted margins of process-based EI and export



Conclusion

- European catch-up countries stand to benefit significantly from exports: Exporters are 4.8 percentage points more likely adopting any process-based EI and adopt on average 18.1% more process-based EIs
- Regardless of a firm's origin, exposure to strong environmental regulation in export markets links to a firm's EI adoption
- The revealed environmental premium to exporters represents a hidden benefit of EU integration

Firms' GVC positioning and clean production in India

- Stylized Fact #3 on globalisation and the environment (Copeland, Shapiro, and Taylor, 2021): "Dirty industries are more upstream."
  - Shapiro (2021) detects an environmental bias in trade policy: upstream firms face lower tariffs but emit higher levels of CO_2-emissions
  - The relation between industry's upstreammness and CO_2-emissions is monotone and in some cases fairly linear
- I contribute to the understanding on the relation between upstreamness and clean production, by:
  - investigating at the firm-level whether a firms' GVC position relates to its CO_2 emissions and intensity
  - In addition: I analyse whether export activity and exposure to environmentally demanding markets moderate the expected relation

Hypotheses

- *H1: A firm's CO_2 emissions increases with upstreamness*
- *H2: A firm's CO_2 intensity, measured as CO_2 emitted per unit of sales and value added, increases with upstreamness*
- *H3: Export activity negatively moderates the link between upstreamness and dirty production*
- *H4: Exposure to stringent environmental policy in export markets negatively moderates the link between upstreamness and dirty production*

Firm-level data for India merged with WIOD

- Firm-level data from the Prowess database provided by the Centre for Monitoring the Indian Economy (CMIE) and designed for academia
  - Use of firm-level information on physical energy consumption in line with Barrows and Ollivier (2018, 2021)
  - Use of product-level information to capture GVC positioning (Goldberg, Khandelwal, Pavcnik, and Topalova, 2010b,a; Herkenhoff, Krautheim, Semrau, and Steglich, 2021; De Loecker, Goldberg, Khandelwal, and Pavcnik, 2016)
  - Covers information on large and medium firms in India that account for approximately eighty percent of the Indian economy (Bos and Vannoorenberghe, 2018)
- WIOD covers industry trade statistics for the period from 2000 to 2014 (Timmer, Dietzenbacher, Los, Stehrer, and Vries, 2015)
  - Analysis focuses on tradable industries
  - I focus on 17,541 observations of manufacturing firms spanning the period from 2000 to 2014

Main specification: OLS

$$ln(CO_2\,emissions_{ft}) = \alpha_0 + \beta_1 Upstreamness_{ft} + \beta_2 X_{ft} + \gamma_t + \delta_f + \epsilon_f + \zeta_f, \quad (1)$$

$$ln(CO_2\,intensity_{ft}) = \alpha_0 + \beta_1 Upstreamness_{ft} + \beta_2 X_{ft} + \gamma_t + \delta_f + \epsilon_f + \zeta_f, \quad (2)$$

- CO_2 emissions are captured in absolute and relative terms (using sales and value added respectively)
- U_{ft} measures a firm's upstreamness in t, click here for ▸ Measure, ▸ Descriptives
- X_{ft} includes other control variables for a firm's export status, exposure to EPS ▸ details, foreign ownership, R&D expenditure, productivity, size, state ownership, age and producing service, mining, agricultural or purely manufacturing products
- γ_t, δ_f and ϵ_f are industry, years and state fixed effects
- ϵ_f is the iid error term clustered at the firm-level

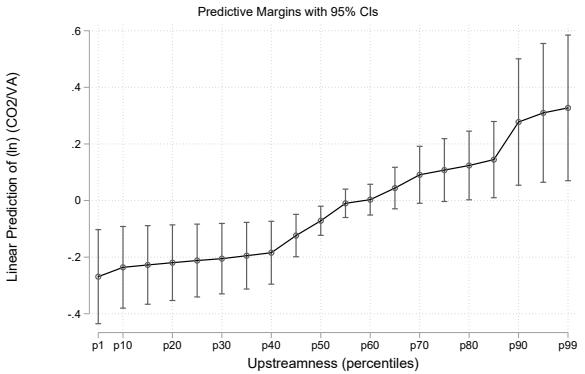
OLS-estimation: Upstreamness and clean production

VARIABLES	(1) CO_2	(2) CO_2/SA	(3) CO_2/VA	(4) CO_2	(5) CO_2/SA	(6) CO_2/VA
Upstreamness	0.334***	0.289***	0.445***	0.248**	0.238**	0.303***
	(0.055)	(0.053)	(0.055)	(0.104)	(0.108)	(0.107)
...	...	...	...	...	...	...
Observations	17,542	17,542	17,542	17,541	17,541	17,541
R-squared	0.535	0.172	0.202	0.627	0.341	0.365
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	No	No	No	Yes	Yes	Yes
State dummy	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

Complete regression here, IV-Specification here and robustness here.

Estimated relation between GVC positioning and CO_2 over value added



- Switching from the 1st to the 99th percentile increases predicted CO_2 intensity by 82.21% from 0.76 kg CO_2 to 1.39 kg CO_2 emissions per US-Dollar value added.

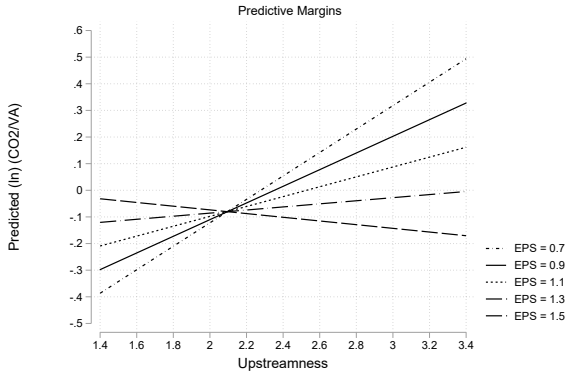
OLS-estimation: Export activity and exposure to EPS

VARIABLES	(1) CO2	(2) CO2/SA	(3) CO2/VA	(4) CO2	(5) CO2/SA	(6) CO2/VA
Upstreamness	0.225**	0.206*	0.270**	0.988***	0.768***	0.886***
	(0.112)	(0.114)	(0.114)	(0.298)	(0.289)	(0.299)
Export status	-0.364**	-0.595***	-0.543***	-0.242***	-0.427***	-0.368***
	(0.181)	(0.174)	(0.177)	(0.055)	(0.054)	(0.054)
EPS	-0.045	0.124	0.032	1.614***	1.307**	1.335**
	(0.237)	(0.233)	(0.228)	(0.609)	(0.581)	(0.592)
Upstreamness x Export status	0.056	0.077	0.080			
	(0.081)	(0.077)	(0.079)			
Upstreamness x EPS				-0.809***	-0.579**	-0.637**
				(0.298)	(0.277)	(0.288)
...	...	...	...	...	...	...
Observations	17,541	17,541	17,541	17,541	17,541	17,541
R-squared	0.627	0.341	0.365	0.627	0.341	0.365
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
State dummy	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

Complete regression here and robustness here.

Predicted CO_2 over value added by upstreamness depending on EPS



- For firms exposed to weak EPS (EPS=0.7), a change of upstreamness by one unit is associated by an increase of CO_2 over value added of 55.29%.

Conclusion

- Dirty production increases with upstreamness
  - The relation holds at the firm-level for absolute and relative measures CO_2 emissions
  - The negative relation does not relate to the export status
  - Exposure to environmentally demanding markets negatively moderates the effect
- Policy implications
  - Climate-related actions should especially take the spotlight on upstream firms
  - Currently, upstream firms are confronted with lower tariffs, which serves as an implicit subsidy for dirty production and is the opposite of a climate-friendly trade policy (Shapiro, 2021)

Thanks!

Feedback is always welcome, now or later via:
finn-ole.Semrau@ifw-kiel.de

Twitter: @FOSemrau

EI typologies

Benefits obtained within the firm (process-based):

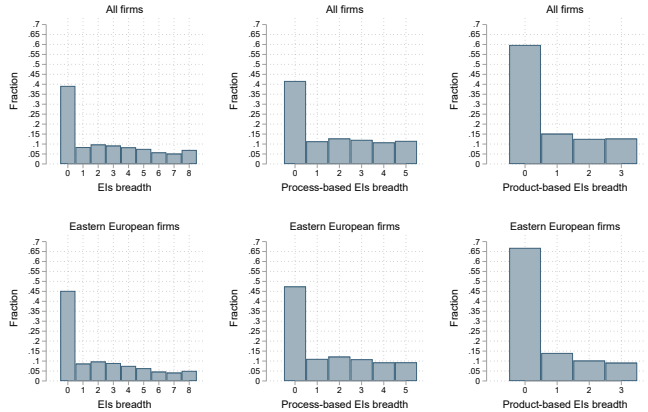
- Reduced material or water use per unit of output
- Reduced energy use or CO2 'footprint' (reduce total CO2 production)
- Reduced air, water, noise, or soil pollution
- Replaced a share of materials with less polluting or hazardous substitutes
- Recycled waste, water, or materials for own use or sale

Benefits obtained during the consumption or use of a good or service by the end user (product-based):

- Reduced energy use or CO2 'footprint'
- Reduced air, water, noise or soil pollution
- Facilitated recycling of product after use

Back to main part.

EI typologies adopted split by type and country's development



Back to main part.

Influence of EPS in a firm's production decision

Are environmental regulation, taxes, charges or fees driving factors in decision to introduce innovations with environmental benefits?

	All firms		Exporters		Non-exporters		
Country	**Yes (%)**	**Total**	**Yes (%)**	**Total**	**Yes (%)**	**Total**	**p-value**
Bulgaria	49.4	1179	56.4	738	37.9	441	0.00***
Croatia	83.3	275	82.9	252	87.0	23	0.69
Cyprus	78.0	59	74.3	35	83.3	24	0.79
Czech Republic	63.3	1215	63.9	1038	59.9	177	0.15
Germany	35.1	1491	35.5	1214	33.2	277	0.24
Estonia	64.8	514	64.8	483	64.5	31	0.49
Greece	76.6	401	77.7	327	71.6	74	0.13
Hungary	68.1	813	67.1	748	80.0	65	0.98
Italy	45.6	1717	47.7	1343	38.2	374	0.00***
Lithuania	76.2	475	75.8	426	79.6	49	0.72
Latvia	64.5	211	63.6	198	76.9	13	0.83
Portugal	64.0	3229	66.5	2594	53.9	635	0.00***
Romania	71.5	1182	74.1	740	67.2	442	0.01***
Slovak Republic	73.1	417	73.9	380	64.9	37	0.11
Non-Eastern Europe	54.0	6,897	55.8	5,513	47.0	1,384	0.00***
Eastern Europe	65.5	6,281	67.6	5,003	57.5	1,278	0.00***
Total	59.5	13,178	61.4	10,516	52.0	2,662	0.00***

Influence of market-demand in a firm's production decision

Is current or expected market demand for EIs a driving factor in decision to introduce innovations with environmental benefits?

	All firms		Exporters		Non-exporters		
Country	**Yes (%)**	**Total**	**Yes (%)**	**Total**	**Yes (%)**	**Total**	**p-value**
Bulgaria	28.2	1179	33.5	738	19.5	441	0.00***
Croatia	50.2	275	50.0	252	52.2	23	0.58
Cyprus	55.9	59	54.3	35	58.3	24	0.62
Czech Republic	26.6	1215	28.2	1038	16.9	177	0.00***
Germany	34.7	1491	37.1	1214	24.2	277	0.00***
Estonia	46.9	514	47.6	483	35.5	31	0.1*
Greece	57.1	401	56.6	327	59.5	74	0.67
Hungary	52.4	813	52.3	748	53.8	65	0.6
Italy	29.4	1649	31.3	1302	21.9	347	0.00***
Lithuania	46.7	475	46.9	426	44.9	49	0.39
Latvia	43.1	211	43.4	198	38.5	13	0.36
Portugal	40.6	3226	42.8	2592	31.5	634	0.00***
Romania	37.6	1182	40.8	740	32.4	442	0.00***
Slovak Republic	41.2	417	41.3	380	40.5	37	0.46
Non-Eastern Europe	37.7	6,826	39.7	5,470	29.6	1,356	0.00***
Eastern Europe	38.1	6,281	40.6	5,003	28.1	1,278	0.00***
Total	37.9	13,107	40.1	10,473	28.9	2,634	0.00***

Measurement of EPS

We use the OECD EPS Index (Botta and Koźluk, 2014) to calculate a continuous variable to proxy a firm's exposure to foreign EPS as followed:

$$EPS\,exposure_{jzt} = \frac{\sum_{k=1}^{n} \frac{EPS_{k(t-2)}}{\sum_{k=1}^{n} EPS_{k(t-2)}} x\,exports_{jzk(t-2)}}{\frac{\sum_{k=1}^{n} exports_{jzk(t-2)}}{n}} \quad (3)$$

- with EPS exposure captured for each firm i, producing in sector z, located in region j at time t are
- We split between market-related and non-market related EPS

Country scores here.
Back to main part here.

EPS Index (Botta and Koźluk, 2014):

Year/Country	2006	2007	2008	2009	2010	2011	2012
France	3.28	2.86	2.90	3.69	3.15	3.70	3.57
Denmark	3.16	2.83	2.96	4.07	4.03	3.98	3.85
Finland	3.15	2.82	3.08	3.25	3.21	3.48	3.43
Sweden	3.03	2.70	2.92	3.34	3.09	3.23	3.10
Germany	3.00	2.67	2.64	3.06	3.02	3.14	2.92
Korea	2.96	2.96	3.38	3.52	3.52	3.44	2.63
Spain	2.96	2.75	2.70	3.00	2.72	2.85	2.22
Czech Republic	2.88	2.55	2.72	2.89	2.89	2.37	2.38
Austria	2.82	2.44	2.91	3.33	3.33	3.08	2.95
Netherlands	2.80	2.64	3.23	3.69	4.13	3.51	3.63
Italy	2.72	2.34	2.60	2.73	2.84	2.79	2.77
Portugal	2.71	2.21	2.26	2.47	2.54	2.27	2.13
Hungary	2.59	2.30	2.55	2.66	2.77	2.68	2.63
Belgium	2.40	2.20	2.34	2.58	2.60	2.53	2.47
United Kingdom	2.29	1.95	2.40	2.58	3.62	3.47	3.29
Poland	2.26	2.08	2.26	2.96	2.96	2.96	2.58
Ireland	2.23	1.71	2.05	2.16	2.22	2.43	2.05
Canada	2.17	3.27	3.31	3.85	3.35	3.67	3.42
Switzerland	2.13	2.13	2.67	3.19	3.33	3.29	3.29
Norway	2.13	2.05	2.34	3.19	3.19	3.19	3.26
United States	2.13	2.34	2.47	2.93	2.68	2.47	3.17
Australia	2.01	2.01	2.26	2.69	2.50	3.34	3.72
Greece	1.84	1.92	1.83	2.08	2.33	2.33	2.13
Slovak Republic	1.78	1.40	1.53	2.39	2.30	3.05	2.99
Japan	1.63	1.69	1.69	1.73	2.03	2.96	3.50
Turkey	1.50	1.50	1.50	1.54	2.06	2.21	1.83
China (People's Republic of)	0.77	0.77	0.81	0.98	1.10	1.35	2.04
India	0.67	0.63	0.63	1.13	1.20	1.26	1.30
Russia	0.65	0.65	0.60	0.60	0.60	0.60	0.60
South Africa	0.52	0.52	0.48	1.52	1.75	1.71	0.71
Indonesia	0.50	0.50	0.50	0.50	1.17	1.17	1.17
Brazil	0.42	0.42	0.42	0.42	0.42	0.38	0.38
Slovenia	n.a.	n.a.	1.64	1.85	2.46	2.42	2.28

Back to EI or back to GVCs.

VAR.	(1) Logit Full sample EI adoption	(2) Logit Full sample EI adoption	(3) PPML Full sample EI breadth	(4) PPML Full sample EI breadth	(5) Logit East EI adoption	(6) Logit East EI adoption	(7) PPML East EI breadth	(8) PPML East EI breadth
Exporter	0.034***	0.039***	0.047	0.065	0.047***	0.045**	0.182	0.151
	(0.012)	(0.012)	(0.072)	(0.075)	(0.017)	(0.018)	(0.117)	(0.124)
Exp. dom.	0.035***	0.063***	0.102	0.272***	0.052***	0.043***	0.271***	0.192
	(0.011)	(0.013)	(0.081)	(0.090)	(0.014)	(0.016)	(0.105)	(0.117)
Market EPS		0.221***		1.717***		0.156***		0.925***
		(0.069)		(0.439)		(0.060)		(0.342)
Non-m. EPS		0.223***		0.840		0.139*		0.065
		(0.078)		(0.569)		(0.083)		(0.455)
MNC	0.037***	0.038***	0.149***	0.083	0.034**	0.033**	0.059	-0.001
	(0.011)	(0.012)	(0.051)	(0.052)	(0.014)	(0.016)	(0.058)	(0.060)
Ext. coop.	0.050***	0.058***	0.191***	0.218***	0.053***	0.056***	0.189***	0.180***
	(0.006)	(0.006)	(0.023)	(0.022)	(0.007)	(0.008)	(0.024)	(0.023)
R&D	0.052***	0.077***	0.413***	0.519***	0.060***	0.101***	0.411***	0.524***
	(0.010)	(0.012)	(0.047)	(0.055)	(0.015)	(0.016)	(0.069)	(0.074)
Know-how	0.038**	0.035**	0.339***	0.340***	0.086***	0.074***	0.467***	0.414***
	(0.016)	(0.015)	(0.067)	(0.059)	(0.014)	(0.014)	(0.083)	(0.076)
Subsidies	0.048***	0.028**	0.171***	0.055	0.071***	0.072***	0.285***	0.265***
	(0.008)	(0.011)	(0.044)	(0.051)	(0.011)	(0.012)	(0.073)	(0.067)
(ln) turn.	0.014***	0.016***	0.144***	0.148***	0.025***	0.038***	0.205***	0.249***
	(0.005)	(0.005)	(0.025)	(0.024)	(0.003)	(0.003)	(0.013)	(0.019)
EPS (home)	0.090**	0.374***	0.676***	2.478***	0.084**	0.334***	0.563**	2.287***
	(0.035)	(0.066)	(0.254)	(0.517)	(0.038)	(0.059)	(0.258)	(0.385)
East		-0.106***		-0.774***				
		(0.027)		(0.162)				
Observations	23,653	23,653	23,653	23,653	13,295	13,295	13,295	13,295
Country	Yes	No	Yes	No	Yes	No	Yes	No
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Back to main part.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Logit		PPML		Logit		PPML	
	Full sample		Full sample		East		East	
VAR.	EI adoption		EI breadth		EI adoption		EI breadth	
Exporter	0.033***	0.037***	0.068	0.081	0.048***	0.045**	0.160**	0.146*
	(0.012)	(0.012)	(0.049)	(0.052)	(0.017)	(0.018)	(0.080)	(0.086)
Exp. dom.	0.036***	0.066***	0.140**	0.288***	0.054***	0.045***	0.250***	0.205**
	(0.012)	(0.013)	(0.056)	(0.063)	(0.015)	(0.017)	(0.074)	(0.082)
Market EPS		0.230***		1.190***		0.148**		0.611***
		(0.069)		(0.306)		(0.059)		(0.223)
Non-m. EPS		0.224***		0.587		0.129		0.115
		(0.080)		(0.386)		(0.084)		(0.311)
MNC	0.038***	0.037***	0.138***	0.096***	0.036**	0.033**	0.064*	0.036
	(0.011)	(0.013)	(0.035)	(0.036)	(0.015)	(0.016)	(0.038)	(0.038)
Ext. coop.	0.046***	0.054***	0.130***	0.153***	0.050***	0.053***	0.131***	0.125***
	(0.006)	(0.006)	(0.015)	(0.014)	(0.007)	(0.008)	(0.016)	(0.015)
R&D	0.050***	0.072***	0.271***	0.342***	0.058***	0.095***	0.273***	0.349***
	(0.009)	(0.011)	(0.032)	(0.038)	(0.014)	(0.015)	(0.047)	(0.050)
Know-how	0.039***	0.037***	0.202***	0.212***	0.082***	0.072***	0.303***	0.265***
	(0.015)	(0.014)	(0.048)	(0.043)	(0.014)	(0.014)	(0.060)	(0.055)
Subsidies	0.049***	0.028**	0.134***	0.039	0.075***	0.077***	0.198***	0.185***
	(0.008)	(0.011)	(0.028)	(0.036)	(0.011)	(0.012)	(0.048)	(0.044)
(ln) turn.	0.018***	0.019***	0.112***	0.109***	0.028***	0.040***	0.155***	0.185***
	(0.005)	(0.005)	(0.018)	(0.017)	(0.003)	(0.004)	(0.010)	(0.014)
EPS (home)	0.077**	0.368***	0.400**	1.651***	0.070*	0.323***	0.268*	1.512***
	(0.038)	(0.066)	(0.158)	(0.353)	(0.040)	(0.059)	(0.160)	(0.254)
East		-0.102***		-0.439***				
		(0.027)		(0.119)				
Observations	23,653	23,653	23,653	23,653	13,295	13,295	13,295	13,295
Country	Yes	No	Yes	No	Yes	No	Yes	No
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
Average marginal effects are reported
Note: dy/dx for factor levels is the discrete change from the base level
*** p<0.01, ** p<0.05, * p<0.1

Back to main part.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Logit		PPML		Logit		PPML	
	Full sample		Full sample		East		East	
VAR.	EI adoption		EI breadth		EI adoption		EI breadth	
Exporter	0.011	0.012	-0.021	-0.018	0.026	0.017	0.021	0.004
	(0.011)	(0.011)	(0.027)	(0.027)	(0.019)	(0.018)	(0.044)	(0.045)
Exp. dom.	-0.007	-0.002	-0.039	-0.017	0.016	-0.000	0.020	-0.014
	(0.011)	(0.012)	(0.029)	(0.031)	(0.015)	(0.016)	(0.037)	(0.040)
Market EPS		0.200***		0.527***		0.148***		0.317**
		(0.055)		(0.147)		(0.056)		(0.131)
Non-m. EPS		0.144**		0.253		0.047		-0.054
		(0.071)		(0.204)		(0.067)		(0.155)
MNC	0.003	-0.004	0.009	-0.014	-0.002	-0.015	-0.005	-0.037
	(0.010)	(0.010)	(0.020)	(0.020)	(0.013)	(0.013)	(0.024)	(0.024)
Ext. coop.	0.036***	0.038***	0.060***	0.065***	0.032***	0.031***	0.058***	0.055***
	(0.005)	(0.005)	(0.009)	(0.009)	(0.005)	(0.005)	(0.009)	(0.009)
R&D	0.057***	0.073***	0.142***	0.178***	0.063***	0.085***	0.138***	0.175***
	(0.008)	(0.009)	(0.019)	(0.021)	(0.013)	(0.013)	(0.026)	(0.027)
Know-how	0.057***	0.052***	0.136***	0.129***	0.086***	0.079***	0.164***	0.149***
	(0.012)	(0.011)	(0.023)	(0.021)	(0.012)	(0.011)	(0.028)	(0.026)
Subsidies	0.026***	0.020**	0.038**	0.016	0.043***	0.041***	0.087***	0.080***
	(0.008)	(0.009)	(0.019)	(0.020)	(0.013)	(0.012)	(0.027)	(0.025)
(ln) turn.	0.010***	0.013***	0.032***	0.038***	0.018***	0.027***	0.049***	0.063***
	(0.003)	(0.004)	(0.008)	(0.008)	(0.003)	(0.003)	(0.006)	(0.007)
EPS (home)	0.129***	0.362***	0.275**	0.831***	0.155***	0.343***	0.307***	0.775***
	(0.047)	(0.064)	(0.117)	(0.179)	(0.047)	(0.056)	(0.114)	(0.142)
East		-0.133***		-0.334***				
		(0.019)		(0.050)				
Observations	23,653	23,653	23,653	23,653	13,295	13,295	13,295	13,295
Country	Yes	No	Yes	No	Yes	No	Yes	No
Sector	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses
Average marginal effects are reported
Note: dy/dx for factor levels is the discrete change from the base level
*** p<0.01, ** p<0.05, * p<0.1

Back to main part.

GVC position at the firm-level

main

- Antràs, Chor, Fally, and Hillberry (2012); Antràs and Chor (2018) show how to use World Input-Output Tables to calculate a time varying country's industry's GVC position
  - The measure covers the direct and indirect GVC position
  - $U_t^z \geq 1$, upstreamness of industry z at time t, a higher value is associated with higher distance from final use, for more details: here
- I follow the approach of Herkenhoff, Krautheim, Semrau, and Steglich (2021) to obtain a firm-level measure of upstreamness:
  - Use product sales information of the firms' and generate a firm-specific upstreamness measure
  - Weighting the industry upstream measure with firms' sales in the respective industries z in year t:

$$U_{ft} = \sum_{r=1}^{Z} \frac{sales_{fzt}}{sales_{ft}} U_t^z, \tag{4}$$

Measuring GVC position

main

Upstreamness U_i^r (Antràs, Chor, Fally, and Hillberry, 2012; Antràs and Chor, 2018):

$$U_i^r = 1 * \frac{F_i^r}{Y_i^r} + 2 * \frac{\sum_{s=1}^{S}\sum_{j=1}^{J} a_{ij}^{rs} F_j^s}{Y_i^r} + 3 * \frac{\sum_{s=1}^{S}\sum_{j=1}^{J}\sum_{t=1}^{S}\sum_{k=1}^{J} a_{ij}^{rs} a_{jk}^{st} F_k^t}{Y_i^r} + ... \qquad (5)$$

- It captures the direct sales to final consumers (F) divided by total output (Y) and indirect sales divided by output, for instance in the second stage the sales to final consumers of industry s in country j, which sources intermediates from sector r in country i
- The numerator reduces in the matrix notation to $[I - A]^{-1}Y$, which makes the computation more straightforward
- $U_i^r \geq 1$: A higher value is associated with higher upstreamness from final use

Measurement of EPS main

I apply the approach of Hanley and Semrau (2022) and use the OECD EPS Index (Botta and Koźluk, 2014) to calculate a continuous variable to proxy a firm's exposure to foreign market-related EPS:

$$EPS_{fzt} = \sum_{z=1}^{Z} \frac{sales_{fzt}}{sales_{ft}} \frac{\sum_{k=1}^{n} \frac{EPS_{kt}}{\sum_{k=1}^{n} EPS_{kt}} exports_{zkt}}{\frac{\sum_{k=1}^{n} exports_{zkt}}{n}} \tag{6}$$

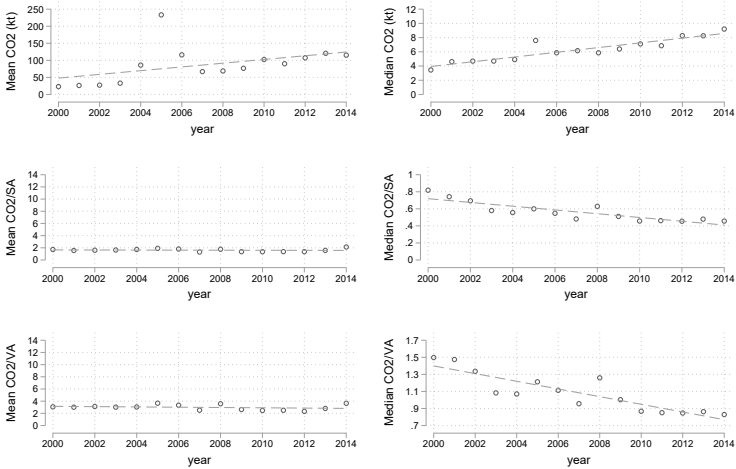
- with EPS exposure captured for each firm f, producing in industry z, located at time t
- EPS_{kt} is the EPS in country k at time t and $exports_{zkt}$ are the exports of sector z to country k at time t
- Country EPS scores: here

Industry statistic about CO_2 emissions and upstreamness

back

Industry	CO_2 average	CO_2 median	CO_2/SA average	CO_2/SA median	CO_2/VA average	CO_2/VA median	Upstr.	Obs.
Chemicals	52.76	6.33	1.09	0.47	2.07	0.98	3.19	2,500
Coke & refined petroleum products	624.97	0.54	0.57	0.12	1.68	0.36	2.75	93
Basic metals	305.77	11.97	1.89	0.60	3.73	1.31	2.67	2,545
Paper	116.43	29.08	4.62	4.00	9.34	7.71	2.62	977
Other non-metallic mineral	332.66	15.48	3.66	1.57	4.90	2.24	2.34	720
Rubber & plastics products	32.40	2.97	0.68	0.33	1.36	0.73	2.30	1,112
Fabricated metal products	15.24	4.88	0.66	0.41	1.44	0.81	2.28	646
Wood	4.46	1.15	1.92	0.91	3.79	1.61	2.17	23
Printing & reproduction of recorded media	0.06	0.06	0.09	0.09	0.09	0.09	2.12	1
Computer electronic & optical products	1.40	0.82	0.31	0.11	0.53	0.18	2.11	171
Electrical equipment	6.30	0.80	0.27	0.09	0.60	0.17	2.00	292
Machinery & equipment	11.41	0.74	0.66	0.12	1.05	0.20	1.95	538
Other manufacturing	49.24	0.90	0.94	0.10	1.41	0.23	1.93	72
Other transport equipment	20.72	1.67	0.15	0.06	0.30	0.17	1.82	46
Motor vehicles	8.50	4.16	0.28	0.17	0.51	0.33	1.78	379
Textiles	22.92	7.72	1.57	1.01	2.97	1.80	1.68	3,061
Leather	2.35	1.76	0.62	0.33	1.69	0.48	1.65	28
Wearing apparel	2.73	1.03	0.32	0.09	0.40	0.21	1.65	82
Beverages	41.79	5.96	0.89	0.29	1.48	0.39	1.60	236
Tobacco	94.17	1.05	0.09	0.04	0.12	0.04	1.59	18
Food	45.24	5.59	1.89	0.70	3.54	1.15	1.57	2,713
Pharmaceuticals	33.07	2.91	0.88	0.18	1.31	0.29	1.57	1,289

Firm-level CO_2 emissions in India over time



VARIABLES	(1) CO_2	(2) CO_2/SA	(3) CO_2/VA	(4) CO_2	(5) CO_2/SA	(6) CO_2/VA
Upstreamness	0.334***	0.289***	0.445***	0.248**	0.238**	0.303***
	(0.055)	(0.053)	(0.055)	(0.104)	(0.108)	(0.107)
EPS	0.062	0.135	0.039	-0.052	0.115	0.022
	(0.273)	(0.269)	(0.270)	(0.238)	(0.233)	(0.228)
Export status	-0.462***	-0.615***	-0.581***	-0.242***	-0.427***	-0.368***
	(0.060)	(0.059)	(0.058)	(0.055)	(0.054)	(0.054)
Foreign ownership	-0.423***	-0.455***	-0.662***	-0.284***	-0.337***	-0.514***
	(0.118)	(0.120)	(0.122)	(0.109)	(0.110)	(0.112)
R&D dummy	-0.201***	-0.320***	-0.448***	-0.009	-0.171**	-0.254***
	(0.075)	(0.078)	(0.080)	(0.070)	(0.070)	(0.072)
SOE	1.544***	1.332**	1.353***	1.372***	1.195**	1.191***
	(0.552)	(0.578)	(0.477)	(0.465)	(0.471)	(0.366)
(ln) productivity	0.083***	-0.179***	-0.331***	0.037*	-0.208***	-0.384***
	(0.022)	(0.021)	(0.021)	(0.021)	(0.020)	(0.020)
(ln) assets	0.998***	0.077***	0.124***	0.947***	0.037**	0.074***
	(0.021)	(0.020)	(0.020)	(0.019)	(0.018)	(0.019)
(ln) age	0.290***	0.112***	0.038	0.200***	0.036	-0.047
	(0.038)	(0.037)	(0.037)	(0.034)	(0.033)	(0.033)
Agricultural products	0.720***	0.565***	0.763***	0.349***	0.216**	0.428***
	(0.115)	(0.119)	(0.120)	(0.105)	(0.109)	(0.111)
Mining products	0.880***	1.104***	0.926***	0.648***	0.873***	0.693***
	(0.199)	(0.197)	(0.196)	(0.192)	(0.198)	(0.190)
Service products	-0.034	-0.203*	-0.128	0.030	-0.126	-0.058
	(0.114)	(0.119)	(0.119)	(0.106)	(0.109)	(0.109)
Exclusive manufacturing	0.172	0.154	0.160	0.093	0.096	0.091
	(0.123)	(0.128)	(0.127)	(0.113)	(0.116)	(0.116)
Observations	17,542	17,542	17,542	17,541	17,541	17,541
R-squared	0.535	0.172	0.202	0.627	0.341	0.365
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	No	No	No	Yes	Yes	Yes
State dummy	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

Going back main

Robustness: IV specification main

- Potential omitted variable problem:
  - There might be unobserved characteristics that influence both firms clean production and their GVC position
- Therefore, I rely on an additional instrumental variable approach:
  - Take the natural logarithm of the spending on advertisement over sales within a firm's 5-digit main product as an instrument for its GVC position
    - I excluded own advertisement spending to ensure that the measure is beyond the influence of the firm

2-SLS Estimation

main

VARIABLES	(1) $\widehat{Upstream.}$ OLS	(2) CO2 2-SLS	(3) CO2/SA 2-SLS	(4) CO2/VA 2-SLS
(ln) advertisement/SA	-0.123***			
	(0.007)			
$\widehat{Upstreamness}$		1.632***	1.215***	1.854***
		(0.169)	(0.152)	(0.172)
...	...	...	...	...
Observations	16,803	16,803	16,803	16,803
R-squared	0.410			
F-stat	283.69			
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	No	No	No	No
State dummy	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

Complete regression here.

VARIABLES	(1) $Upstream.$ OLS	(2) CO2 2-SLS	(3) CO2/SA 2-SLS	(4) CO2/VA 2-SLS
(ln) advertisement/SA	-0.123***			
	(0.007)			
$\widehat{Upstreamness}$		1.632***	1.215***	1.854***
		(0.169)	(0.152)	(0.172)
EPS	-2.874***	3.905***	2.889***	4.162***
	(0.102)	(0.573)	(0.520)	(0.587)
Export status	0.075***	-0.540***	-0.670***	-0.663***
	(0.023)	(0.070)	(0.066)	(0.071)
Foreign ownership	0.166***	-0.509***	-0.512***	-0.759***
	(0.046)	(0.136)	(0.133)	(0.144)
R and D dummy	-0.005	-0.060	-0.209**	-0.300***
	(0.031)	(0.090)	(0.087)	(0.096)
SOE	0.178	1.387***	1.218**	1.181**
	(0.132)	(0.519)	(0.549)	(0.523)
(ln) productivity	0.018**	0.029	-0.215***	-0.388***
	(0.008)	(0.026)	(0.024)	(0.026)
(ln) assets	-0.012*	0.990***	0.073***	0.116***
	(0.007)	(0.023)	(0.022)	(0.024)
(ln) age	-0.029**	0.342***	0.154***	0.103**
	(0.013)	(0.044)	(0.041)	(0.044)
Agricultural products	-0.294***	1.124***	0.864***	1.202***
	(0.037)	(0.132)	(0.128)	(0.137)
Mining products	0.103**	0.720***	0.988***	0.740***
	(0.043)	(0.188)	(0.185)	(0.187)
Service products	0.053	-0.060	-0.225*	-0.163
	(0.032)	(0.115)	(0.116)	(0.120)
Exclusive manufacturing	-0.032	0.274**	0.221*	0.254*
	(0.036)	(0.125)	(0.126)	(0.129)
Observations	16,803	16,803	16,803	16,803
R-squared	0.410			
F-stat	283.69			
Year dummy	Yes	Yes	Yes	Yes
Industry dummy	No	No	No	No
State dummy	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1
Going back to 2-SLS, main

VARIABLES	(1) CO2	(2) CO2/SA	(3) CO2/VA	(4) CO2	(5) CO2/SA	(6) CO2/VA
Upstreamness	0.225**	0.206*	0.270**	0.988***	0.768***	0.886***
	(0.112)	(0.114)	(0.114)	(0.298)	(0.289)	(0.299)
Export status	-0.364**	-0.595***	-0.543***	-0.242***	-0.427***	-0.368***
	(0.181)	(0.174)	(0.177)	(0.055)	(0.054)	(0.054)
EPS	-0.045	0.124	0.032	1.614***	1.307**	1.335**
	(0.237)	(0.233)	(0.228)	(0.609)	(0.581)	(0.592)
Upstreamness x Export status	0.056	0.077	0.080			
	(0.081)	(0.077)	(0.079)			
Upstreamness x EPS				-0.809***	-0.579**	-0.637**
				(0.298)	(0.277)	(0.288)
Foreign ownership	-0.284***	-0.337***	-0.514***	-0.282***	-0.336***	-0.513***
	(0.109)	(0.110)	(0.111)	(0.109)	(0.110)	(0.112)
R&D dummy	-0.011	-0.174**	-0.256***	-0.011	-0.172**	-0.255***
	(0.070)	(0.070)	(0.072)	(0.070)	(0.070)	(0.072)
SOE	1.374***	1.198***	1.195***	1.370***	1.194**	1.190***
	(0.460)	(0.463)	(0.359)	(0.468)	(0.473)	(0.367)
(ln) productivity	0.037*	-0.207***	-0.383***	0.037*	-0.208***	-0.384***
	(0.021)	(0.020)	(0.020)	(0.021)	(0.020)	(0.020)
(ln) assets	0.947***	0.038**	0.075***	0.947***	0.038**	0.074***
	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)	(0.019)
(ln) age	0.199***	0.035	-0.048	0.201***	0.036	-0.047
	(0.034)	(0.033)	(0.033)	(0.034)	(0.033)	(0.033)
Agricultural products	0.351***	0.219**	0.431***	0.353***	0.219**	0.430***
	(0.106)	(0.109)	(0.111)	(0.106)	(0.109)	(0.111)
Mining products	0.651***	0.878***	0.698***	0.637***	0.866***	0.685***
	(0.192)	(0.198)	(0.190)	(0.192)	(0.197)	(0.190)
Service products	0.032	-0.123	-0.054	0.034	-0.123	-0.054
	(0.106)	(0.110)	(0.110)	(0.106)	(0.109)	(0.109)
Exclusive manufacturing	0.097	0.101	0.096	0.094	0.096	0.092
	(0.114)	(0.116)	(0.116)	(0.113)	(0.116)	(0.116)
Observations	17,541	17,541	17,541	17,541	17,541	17,541
R-squared	0.627	0.341	0.365	0.627	0.341	0.365
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
State dummy	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

Back to Main

Robustness main

Take energy costs as a proxy for a firm's environmental performance to increase the sample size:

VARIABLES	(1) ENE	(2) ENE/SA	(3) ENE/VA	(4) ENE	(5) ENE/SA	(6) ENE/VA
Upstreamness	0.344***	0.340***	0.424***	1.089***	0.829***	1.012***
	(0.069)	(0.064)	(0.072)	(0.210)	(0.195)	(0.214)
EPS	0.141	0.236**	0.207*	1.723***	1.274***	1.455***
	(0.127)	(0.119)	(0.123)	(0.402)	(0.370)	(0.395)
Upstreamness x EPS				-0.798***	-0.524***	-0.630***
				(0.194)	(0.180)	(0.193)
...	...	...	...	...	...	...
Observations	42,762	42,762	42,762	42,762	42,762	42,762
R-squared	0.632	0.375	0.416	0.632	0.375	0.416
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
State dummy	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	(1) ENE	(2) ENE/SA	(3) ENE/VA	(4) ENE	(5) ENE/SA	(6) ENE/VA
Upstreamness	0.344***	0.340***	0.424***	1.089***	0.829***	1.012***
	(0.069)	(0.064)	(0.072)	(0.210)	(0.195)	(0.214)
EPS	0.141	0.236**	0.207*	1.723***	1.274***	1.455***
	(0.127)	(0.119)	(0.123)	(0.402)	(0.370)	(0.395)
Upstreamness x EPS				-0.798***	-0.524***	-0.630***
				(0.194)	(0.180)	(0.193)
Export status	0.145***	-0.152***	-0.076**	0.145***	-0.152***	-0.075**
	(0.034)	(0.032)	(0.032)	(0.034)	(0.032)	(0.032)
Foreign ownership	0.154**	-0.025	-0.167***	0.155**	-0.024	-0.166***
	(0.062)	(0.060)	(0.062)	(0.062)	(0.060)	(0.062)
R&D dummy	0.069*	-0.121***	-0.191***	0.069*	-0.122***	-0.191***
	(0.039)	(0.038)	(0.039)	(0.039)	(0.038)	(0.039)
SOE	0.746***	0.678***	0.779***	0.747***	0.678***	0.779***
	(0.264)	(0.220)	(0.166)	(0.265)	(0.221)	(0.166)
(ln) productivity	-0.014	-0.301***	-0.487***	-0.014	-0.301***	-0.486***
	(0.014)	(0.012)	(0.014)	(0.014)	(0.012)	(0.014)
(ln) assets	0.812***	-0.121***	-0.073***	0.812***	-0.121***	-0.073***
	(0.011)	(0.010)	(0.010)	(0.011)	(0.010)	(0.010)
(ln) age	0.212***	0.066***	0.003	0.213***	0.067***	0.004
	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)	(0.019)
Agricultural products	0.561***	0.432***	0.614***	0.565***	0.435***	0.617***
	(0.077)	(0.072)	(0.077)	(0.077)	(0.072)	(0.077)
Mining products	0.218**	0.409***	0.280***	0.206**	0.402***	0.270**
	(0.104)	(0.102)	(0.105)	(0.104)	(0.103)	(0.105)
Service products	0.082	0.006	0.034	0.086	0.009	0.038
	(0.080)	(0.077)	(0.078)	(0.080)	(0.077)	(0.078)
Exclusive manufacturing	0.027	0.135*	0.115	0.027	0.135*	0.116
	(0.082)	(0.080)	(0.080)	(0.083)	(0.080)	(0.080)
Observations	42,762	42,762	42,762	42,762	42,762	42,762
R-squared	0.632	0.375	0.416	0.632	0.375	0.416
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummy	Yes	Yes	Yes	Yes	Yes	Yes
State dummy	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses (clustered at the firm-level)
*** p<0.01, ** p<0.05, * p<0.1

Going back robustness

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