APPENDIX A2

Does credit risk reflect climate transition risk? Evidence from the CDS market for the utility sector

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Research question and context

Contribute to the question: to what extent perceived credit risk reflects climate transition risk?

- Debate (also at COP27): finance acknowledges climate risk, yet financial investments into high carbon assets have not decreased, and no substantial differential in risk indicators is reported

What is transition risk?

- The low-carbon transition can only be achieved if firms engage in reallocation of CAPEX to low-carbon technology (see e.g., EU 2050 Roadmap, NetZero2050 IEA, IPCC AR6 2022). Hence transition risk is the risk arising from the mis-management of the technological shit.

Current literature in financial econometrics focus on GHG emissions and emission intensity

- GHG emission intensity variations: can mix up changes in emissions with accounting factors (e.g., changes in prices hence revenues, and carbon offsetting)
- Thus, firms can achieve some level of emission (intensity) reduction without changes in technology

Approach and results in a nutshell

Approach

- Here, we aim to test if the technological profile of firms wrt to the energy transition is reflected in their Credit Default Swap (CDS) spreads.
- Clear-cut case is utility electricity sector: technologies are easily observable.
- Proxy used for technology profile = % of capacity in electricity generation from fossil vs renewable sources.
- Control for usual drivers of credit risk, e.g., financial ratios

(Preliminary) Results

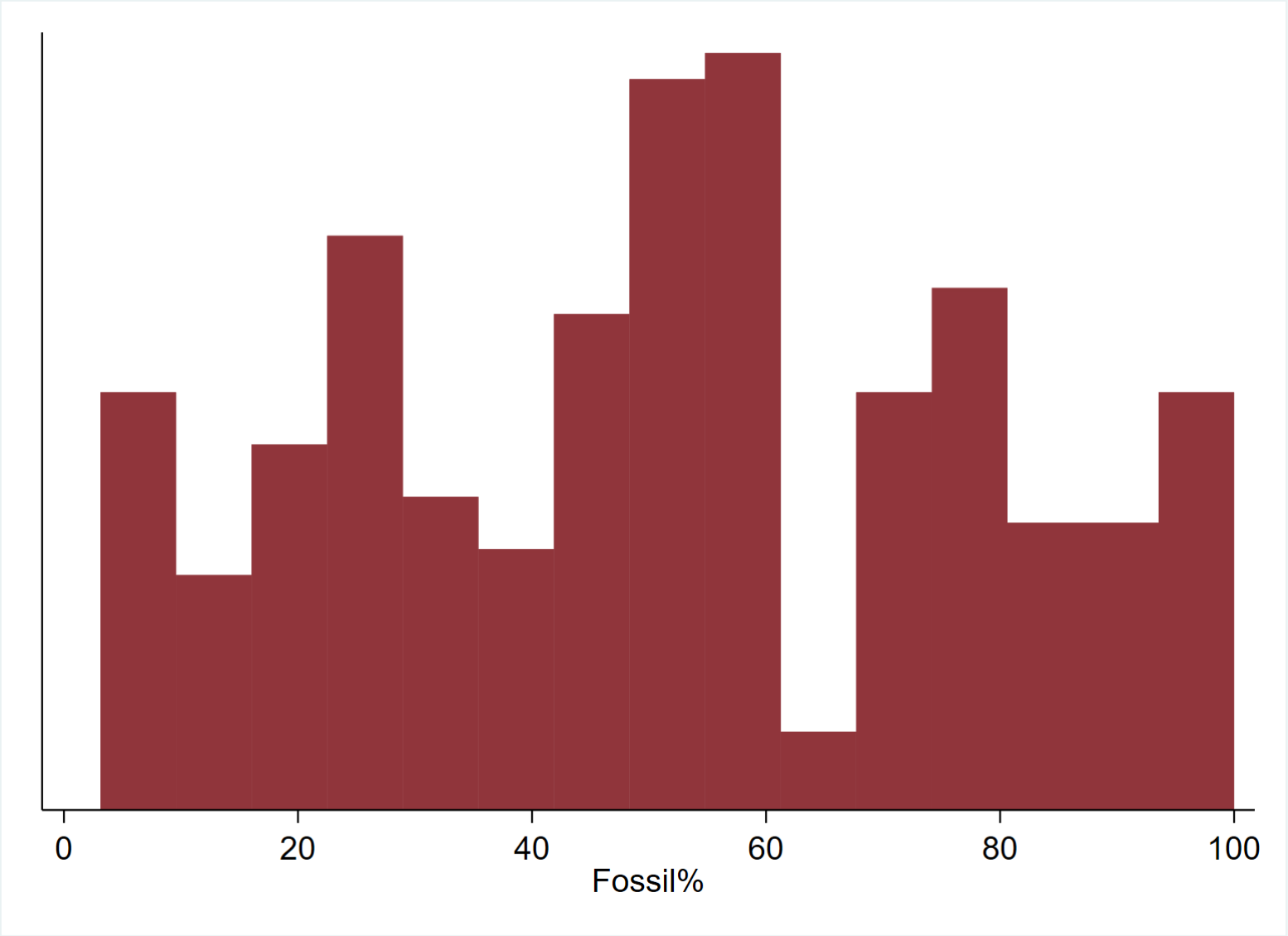
- At this stage, we find that the technology profile has no impact on the CDS spreads globally
- However, we find evidence that after the PA agreement high fossil (renewable) utility firms in EU27 are associated with higher (lower) CDS spreads
- Further work will focus on refining country risk and analysis of the impact of transition risk based on NGFS scenarios

Data

- 301 listed firms worldwide in utility electricity sector in 57 countries
  - Two groups: 1) EU27 2) global (all countries in the dataset)
- Credit risk: proxied by the implied CDS spreads at 5-year tenor calculated by Bloomberg, monthly. Period: 2007-2021
- Technological profile: % capacity from fossil sources (coal, oil, gas) and renewable sources (wind, solar), annual. Historical data obtained from Bloomberg. Validation with annual reports from 2019 and capacity computed from asset level data of plant capacity by technology.
- Control variables (size, leverage ratio, stock return and volatility), annual.
- Challenge: small intersection of criteria: 1) historical coverage of technological profile over time and 2) CDS data

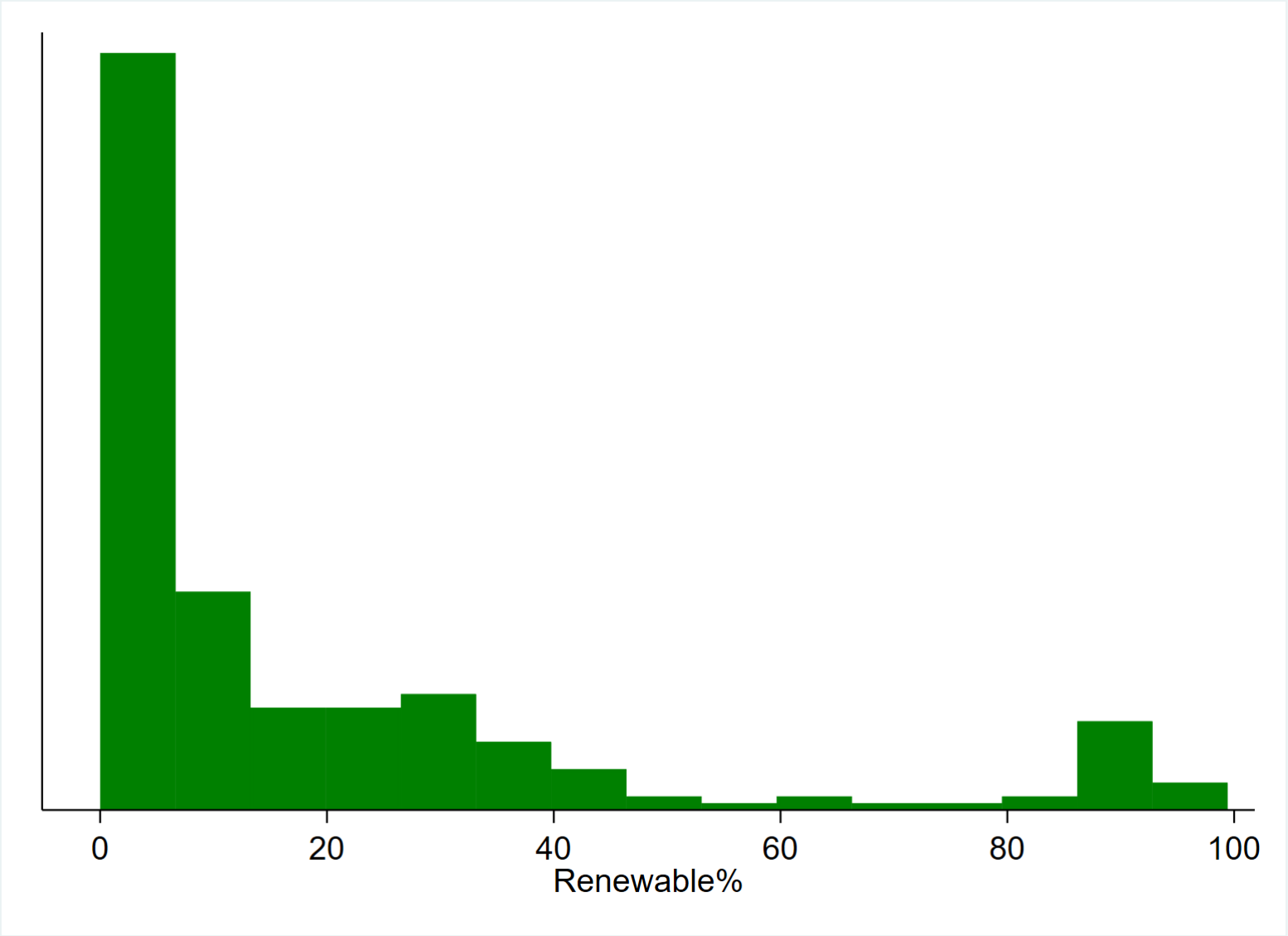
Fossil%

Percentage of capacity in electricity generation from fossil fuel sources (gas, oil and coal)



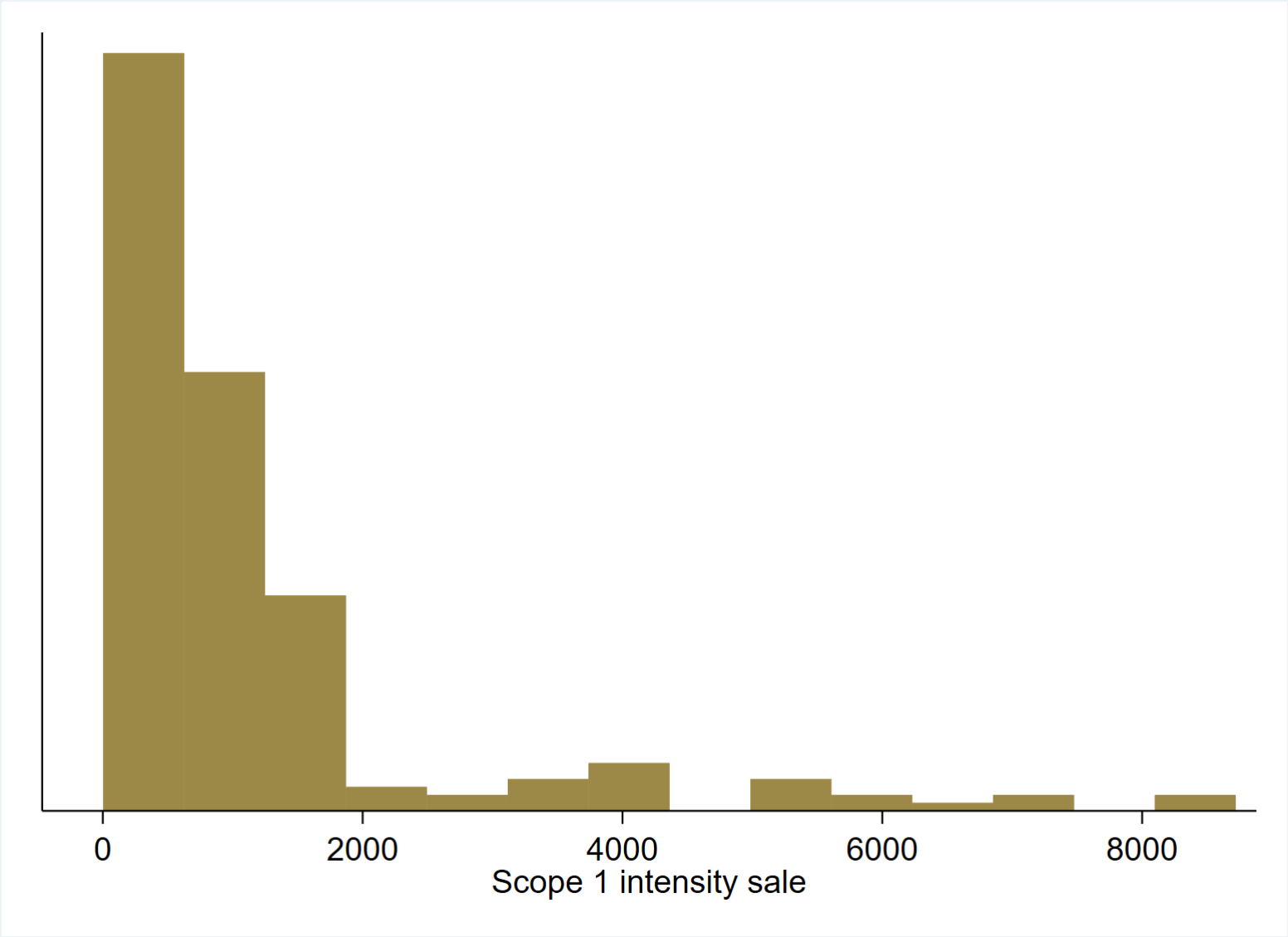
Renewable%

Percentage of capacity in electricity generation from selected ren sources (wind + solar)



Scope 1 intensity sale

Scope 1 GHG emission intensity sale expressed in tonnes CO2e/th USD.



Data coverage for Fossil%, Renewable%, and Scope 1 Intensity sale

	Fossil%	Renewable%	Scope 1 intensity Sale
2007	15%	9%	4%
2008	18%	12%	7%
2009	19%	14%	9%
2010	21%	16%	10%
2011	22%	19%	12%
2012	24%	20%	14%
2013	24%	21%	16%
2014	25%	22%	17%
2015	26%	23%	20%
2016	26%	24%	23%
2017	27%	25%	25%
2018	27%	26%	28%
2019	28%	26%	29%
2020	28%	27%	31%
2021	28%	27%	32%

Empirical Analysis – part I

- We consider the EU27 and the global perspectives.
- We categorize the technological profile in terciles: low, medium, and high.
- We measure the relationship between the fossil and renewable technological profile categories and the CDS spreads
- We select the medium category (second tercile) as the baseline
- We compute the margins of responses for the high and low fossil categories.
- The model:

$$\text{CDS}_{i,t} = \alpha + \beta_{category}\text{Technological\_profile}_{category,t} + \sum_{j=1}^{N}\gamma_j \text{ Controls}_{j,i,t} + \rho\,\text{FirmFE}_i + \tau\,\text{TimeFE}_t + \varepsilon_{i,t}$$

EU27

Results

- The baseline is the medium category (2nd tercile)
- No statistically significant difference between the medium and the highest category for fossil and renewable energy.
- The lowest category (1st tercile) for GHG Scope 1 intensity exhibits a statistically significant reduction of 44 bps with respect to the medium category. No statistically significant difference w.r.t the highest one.

	CDS 5y	CDS 5y	CDS 5y
Low Fossil	-63.9105		
	(59.2906)		
High Fossil	-120.9843		
	(104.3981)		
Low Renewable		13.0023	
		(20.6120)	
High Renewable		7.6024	
		(19.8124)	
Low Scope1 intensity			-44.2847**
			(19.3953)
High Scope1 intensity			-11.0703
			(18.5266)
Observations	167	171	153
Number of iTicker	15	17	16
Leverage	Yes	Yes	Yes
Size	Yes	Yes	Yes
Stock Return	Yes	Yes	Yes
Volatility	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
SE	Clust.	Clust.	Clust.
R-squared Within	0.395	0.318	0.445
R-squared Between	0.937	0.974	0.965
R-squared Overall	0.563	0.540	0.645

Predictive margins of Scope 1 intensity - EU27

- The lowest class (1st tercile) for GHG Scope 1 intensity exhibits the lowest CDS spreads.

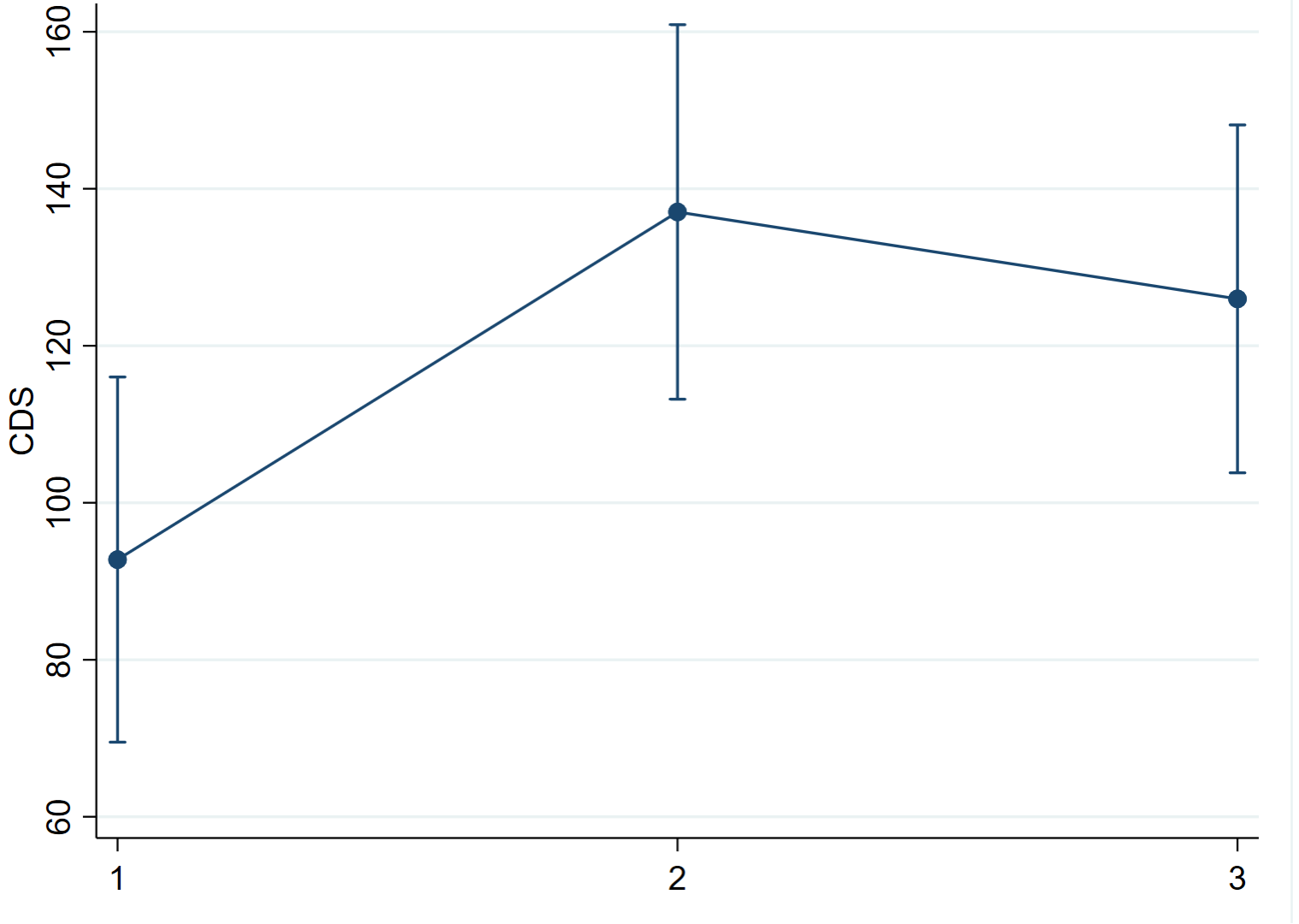
- **Test the equality of the coefficients**

(1) Low Scope1 intensity = 0

(2) High Scope1 intensity = 0

chi2(2) = 5.28

Prob > chi2 = 0.0714



WORLD

Results

- The baseline is the medium category (2nd tercile)
- No statistically significant difference between the medium and the highest category for fossil and GHG scope 1 intensity.
- The highest category (1st tercile) for renewables exhibits a statistically significant reduction of 32 bps with respect to the medium category. No statistically significant difference w.r.t the lowest one.

	CDS 5y	CDS 5y	CDS 5y
Low Fossil	15.7199*		
	(9.0927)		
High Fossil	-5.0111		
	(11.5372)		
Low Renewable		-22.4681	
		(25.4449)	
High Renewable		-31.8118***	
		(12.0963)	
Low Scope1 intensity			-14.1132
			(10.9739)
High Scope1 intensity			-3.6821
			(6.0760)
Observations	663	606	603
Number of iTicker	76	72	84
Leverage	Yes	Yes	Yes
Size	Yes	Yes	Yes
Stock Return	Yes	Yes	Yes
Volatility	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
SE	Clust.	Clust.	Clust.
R-squared Within	0.337	0.318	0.325
R-squared Between	0.917	0.919	0.817
R-squared Overall	0.645	0.633	0.639

Predictive margins of Renewable (World)

- The highest class (3rd tercile) for renewables exhibits the lowest CDS spreads.

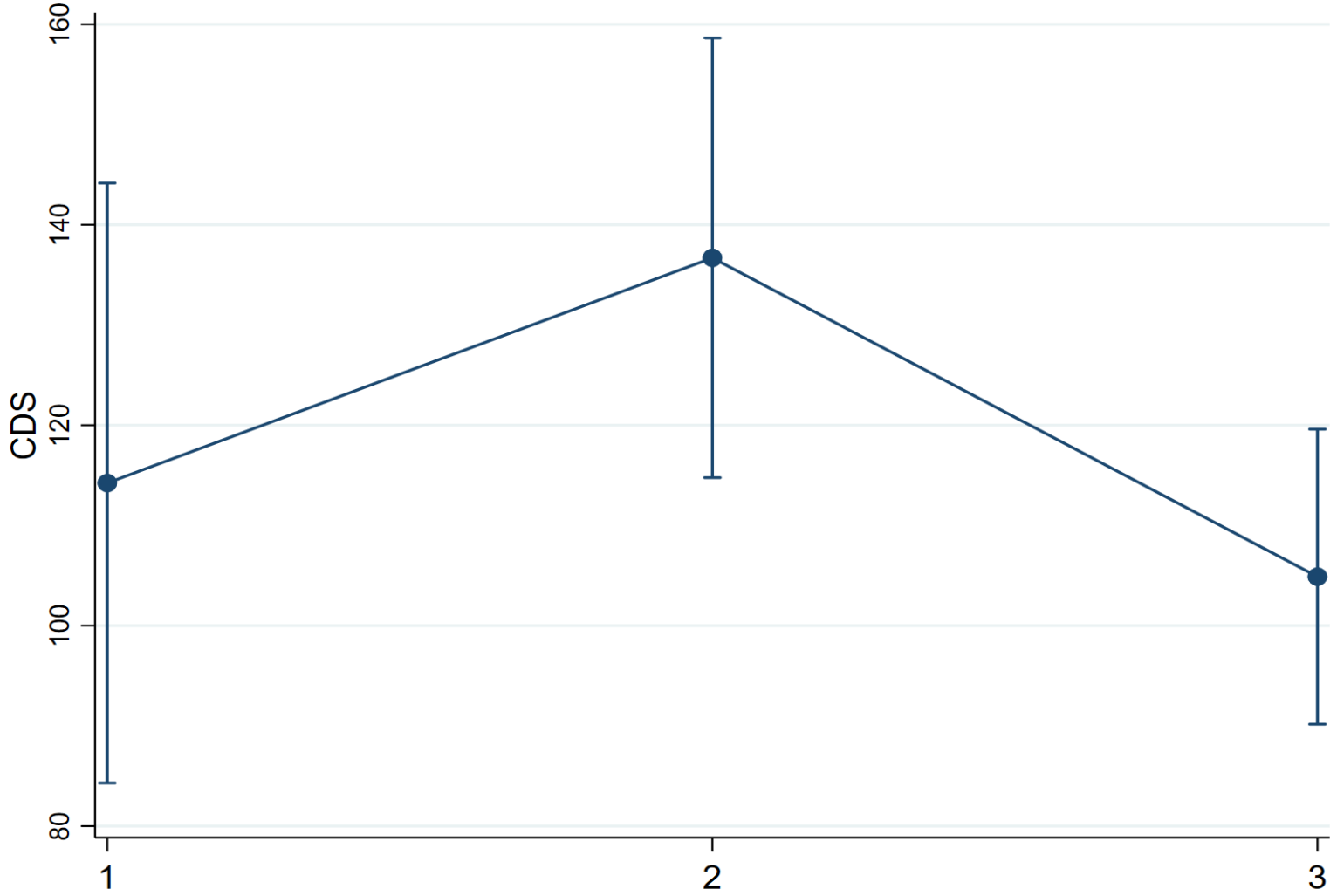
- **Test the equality of the coefficients**

(1) Low Scope1 intensity = 0

(2) High Scope1 intensity = 0

chi2(2) = 8.48

Prob > chi2 = 0.0144



Empirical Analysis – part II

- We measure the relationship between the fossil and renewable technological profile and the CDS spreads
- We model the Paris Agreement (PA) effect on the fossil and renewable energy consumption relationship with the CDS spreads
- Country and time fixed effects are included
- Methodology: panel regressions
- The model:

$$\text{CDS}_{i,t} = \alpha + \beta \text{Technological\_profile}_{i,t} + \sum_{j=1}^{N} \gamma_j \text{ Controls}_{j,i,t} + \rho \text{ FirmFE}_i + \tau \text{ TimeFE}_t + \varepsilon_{i,t}$$

EU27

Results

- Fossil% is negative related to the CDS spreads
- Renewable% is positive related to the CDS spreads
- Scope 1 intensity is negative related to the CDS spreads
- The Paris Agreement exerts an (opposite) effect on fossil and renewable:
  - Fossil% is penalized
  - Renewable% is rewarded

	CDS 5y	CDS 5y	CDS 5y
Fossil%	-1.3598***		
	(0.3883)		
Fossil% × P.A.	1.4131**		
	(0.6257)		
Renewable%		0.8197**	
		(0.3501)	
Renewable% × P.A.		-1.2881**	
		(0.5877)	
Scope1 intensity			0.0624**
			(0.0296)
Scope1 intensity × P.A.			-0.0171
			(0.0118)
Observations	167	171	153
Number of Firms	15	17	16
Leverage	Yes	Yes	Yes
Size	Yes	Yes	Yes
Stock Return	Yes	Yes	Yes
Volatility	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
SE	Clust.	Clust.	Clust.
R-squared Within	0.345	0.331	0.563
R-squared Between	0.980	0.981	0.978
R-squared Overall	0.543	0.552	0.720

WORLD

No evidence in this case

	CDS 5y	CDS 5y	CDS 5y
Fossil%	-0.3726		
	(0.2368)		
Fossil% × P.A.	-0.0291		
	(0.3512)		
Renewable%		-0.1655	
		(0.7661)	
Renewable% × P.A.		-0.4500	
		(0.7510)	
Scope1 intensity			0.0137
			(0.0130)
Scope1 intensity × P.A.			-0.0107
			(0.0084)
Observations	663	606	603
Number of iTicker	76	72	84
Leverage	Yes	Yes	Yes
Size	Yes	Yes	Yes
Stock Return	Yes	Yes	Yes
Volatility	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
SE	Clust.	Clust.	Clust.
R-squared Within	0.338	0.304	0.355
R-squared Between	0.919	0.916	0.809
R-squared Overall	0.646	0.629	0.645