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The Effects of Mutual Fund Decarbonization on Stock Prices and Carbon Emissions

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Motivation

Direct motivation for the paper

Direct channel: Asset allocation

- , Q F U H D V L Q J L Q Y H V W P H Q W V L Q ³ J U H H Q ´ P X W X D O I X Q G V
- Increasing (commitments) to the divestment movement (e.g., Portfolio Decarbonization Coalition)
- Finance theory proves potential impact of divestment
- But: So far no empirical evidence of the impact

Our main empirical questions

- Can mutual funds easily decarbonize their portfolios?
- Did mutual funds actually decarbonize their portfolios?
- Did mutual fund decarbonization have an impact on
  stock prices and
  carbon emissions?

Data set

Relevant universes of equity funds and stocks

Mutual funds

- ~4,600 actively managed domestic US and European equity funds
- Portfolio holdings

Stocks

~10,000 US and European companies

- Stock prices and accounting data
- Scope 1+2 carbon emissions

Period

- 2010 ±2017

Question 1: How easy is it for funds to decarbonize?

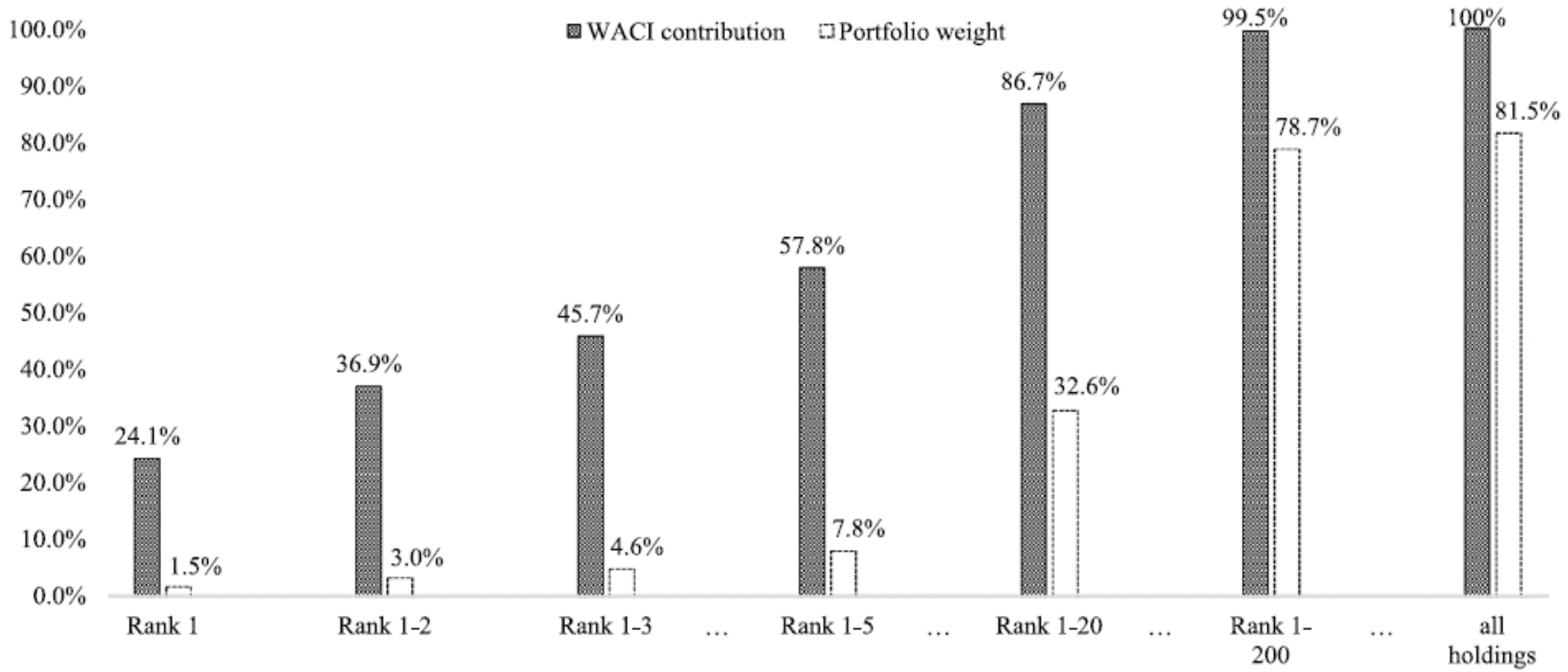
Main fund-level metric

Weighted average carbon intensity (WACI)

$$WACI_{j,t} = \frac{Scope\ 1+2\ emissions_{i,t}}{Net\ sales_{i,t}}\ x\ portfolio\ weight_{j,i,t}$$

- Recommended to use for asset owners and asset managers by the TCFD, 2017.

Hypothetical decarbonziation potential



¾ Selling the dirtiest 5 stocks (4.6% of the portfolio), the WACI could be reduced by 57.8%, on average.

Question 2: Are funds actually decarbonizing? Does it have an impact?

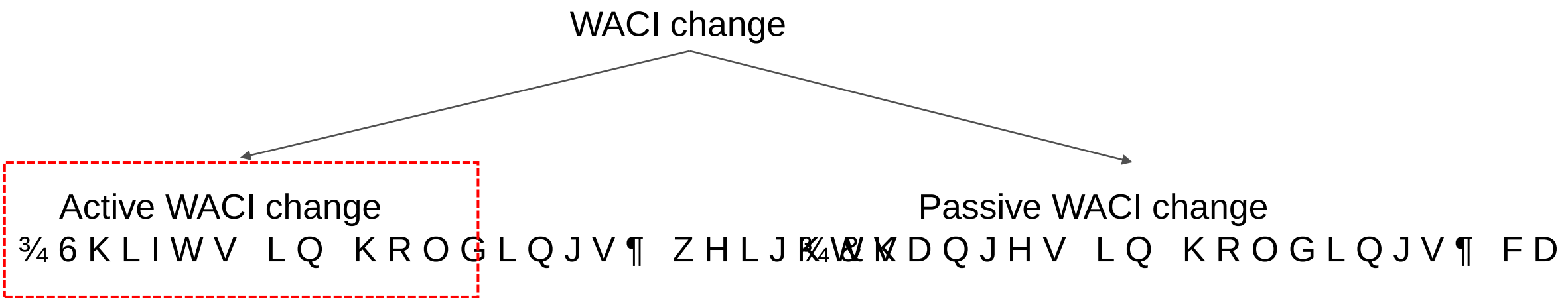
Two steps

1) Identify decarbonizing funds.
2) Identify decarbonization sell trades within decarbonizing funds.

Identification of decarbonizing funds

Relevant metric: active changes in WACI

- Quarterly identification of decarbonizing funds



- Decarbonizing funds: the 10% funds with the highest active decrease in the WACI.

Identification of decarbonization sell trades

Analysis of changes in portfolio composition

For each sell trade by decarbonizing funds, check if

1) within TOP 5 dirtiest holdings (CI)
2) stock CI > fund WACI

¾Both conditions are met: decarbonization sell trade .

Decarbonization sell pressure (DSP)

Main stock-level metric

Quarterly DSP =

Number of shares sold by mutual funds for decarbonization
relative to number of shares traded overall

Stock samples and event studies

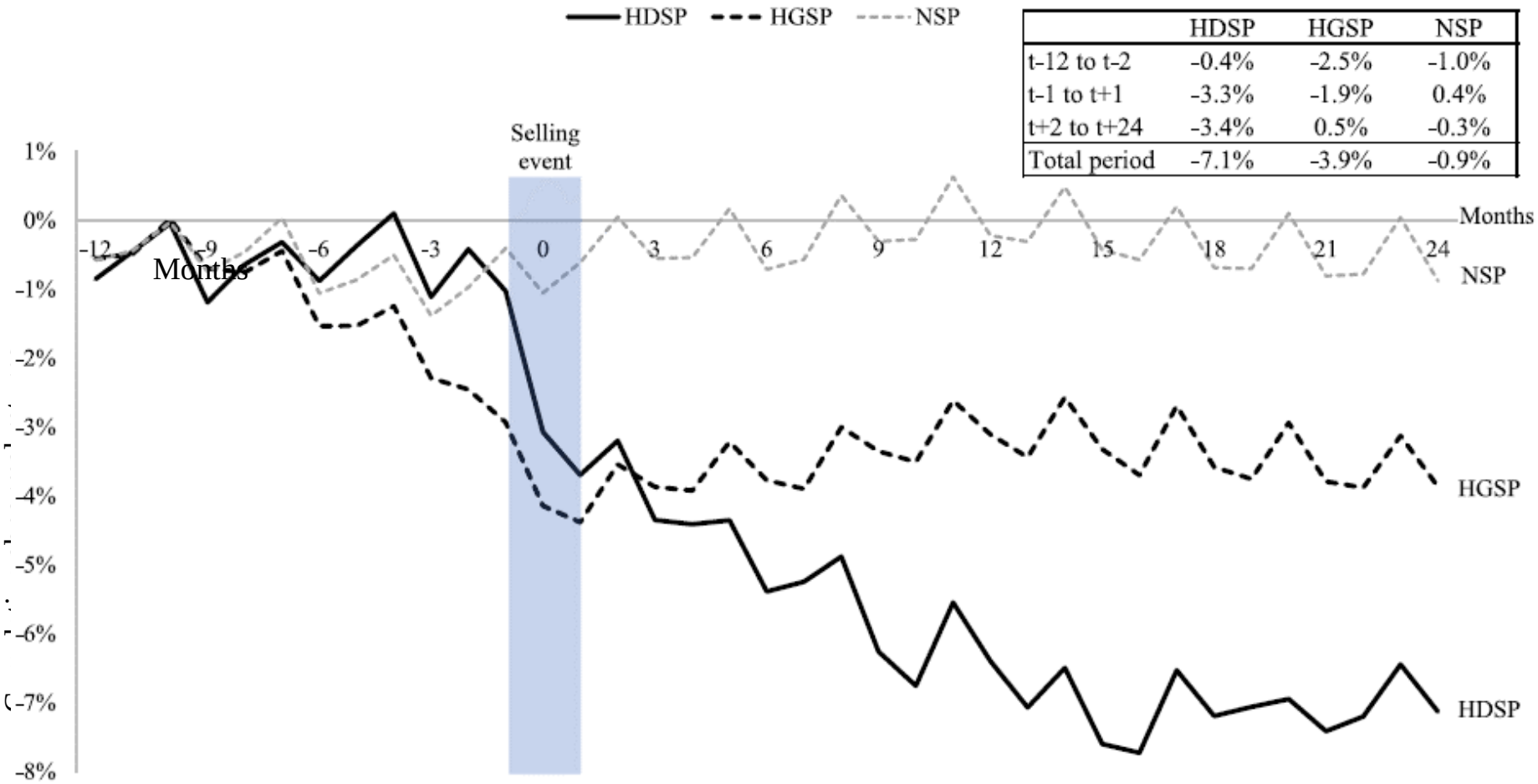
Three stock samples

1) Treatment: Divested stocks with high decarbonization sell pressure (HDSP)
2) Control 1: Stocks with high general sell pressure (financial reasons) (HGSP)
3) Control 2: Stocks with no selling or buy pressure (NSP)

Event studies: Does mutual fund decarbonization have an impact on

a) Stock prices
b) Carbon emissions?

Event study: Stock returns



	HDSP	HGSP	NSP
t-12 to t-2	-0.4%	-2.5%	-1.0%
t-1 to t+1	-3.3%	-1.9%	0.4%
t+2 to t+24	-3.4%	0.5%	-0.3%
Total period	-7.1%	-3.9%	-0.9%

No buy/sell pressure sample (NSP)

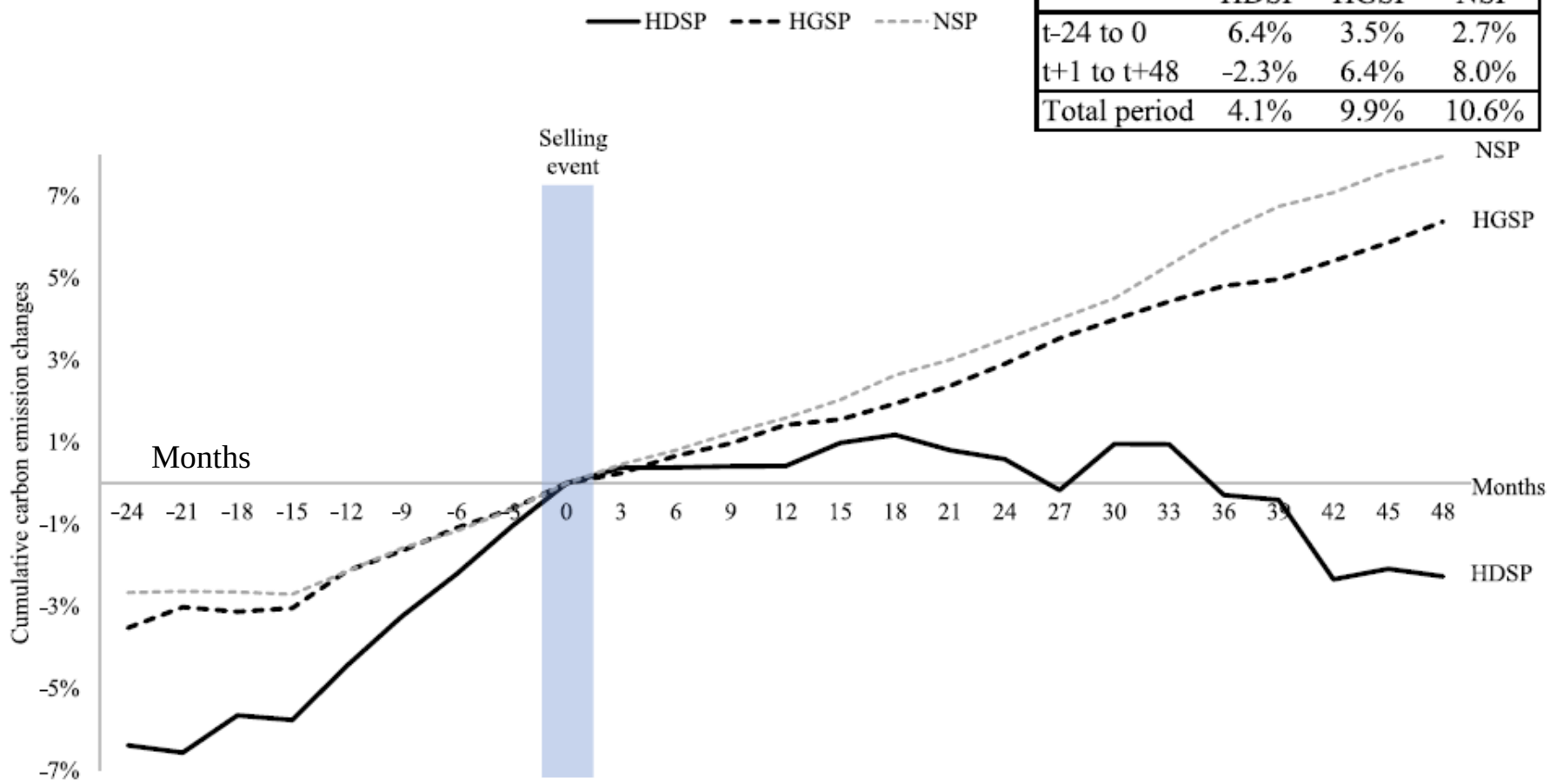
High general sell pressure (HGSP)

High decarbonization sell pressure (HDSP)

¾ Decarbonization (HDSP stocks) leads to long-term negative abnormal stock prices of divested stocks.

Event study: Carbon emission changes

Panel A: HDSP, HGSP and NSP



	HDSP	HGSP	NSP
t-24 to 0	6.4%	3.5%	2.7%
t+1 to t+48	-2.3%	6.4%	8.0%
Total period	4.1%	9.9%	10.6%

No buy/sell pressure (NSP)

High general sell pressure (HGSP)

High decarbonization sell pressure (HDSP)

¾ Decarbonization (HDSP stocks) leads to lower carbon emissions of divested stocks.

Robustness Checks

Robustness, selection bias, endogeneity

- Different treatment and control groups (divested vs. non-divested within high carbon intensity firms) ✓
- Panel regressions controlling for firm characteristics, financial performance, CE, CE change, sales growth ✓
- Firm FE, time FE, industry FE, country FE, time-within-industry FE, time-within-country FE ✓
- Alternative explanation: Effect of shareholder intervention (shareholder proposals) ✓
- Financial selling reasons (Index delisting, Earnings surprises) ✓
- Long-term decarbonization of funds ✓
- Stocks that have been decarbonized more frequently ✓
- Risk-adjusted returns ✓
- Cross-sectional cuts (Europe vs. USA) and time-series cuts ✓
- Changes in CI ✓
- «

Regression: Carbon emissions event study

Table 4
Calendar time panel regressions of cumulative CE changes.

Cumulative CE changes	*t*+3 to *t*+24	*t*+3 to *t*+24	*t*+3 to *t*+36	*t*+3 to *t*+36	*t*+3 to *t*+48	*t*+3 to *t*+48
Negative post-event return (t0 to *t*+5)	−0.007	−0.001	−0.001	0.006	0.003	0.003
	(−0.51)	(−0.07)	(−0.04)	(0.51)	(0.15)	(0.20)
Positive DSP	0.079***	0.052***	0.126***	0.058***	0.177***	0.041**
	(4.85)	(6.74)	(6.19)	(5.16)	(8.09)	(2.73)
Negative post-event return : Positive DSP	−0.056***	−0.037***	−0.081***	−0.042***	−0.107***	−0.027
	(−4.03)	(−3.73)	(−4.51)	(−3.28)	(−5.70)	(−1.65)
Positive GSP	0.039***	0.005	0.068***	0.008**	0.091***	0.007**
	(5.02)	(1.31)	(7.46)	(2.23)	(8.44)	(2.14)
Negative post-event return : Positive GSP	−0.027***	−0.007	−0.039***	−0.009**	−0.048***	−0.011**
	(−4.09)	(−1.69)	(−4.44)	(−2.13)	(−4.54)	(−2.60)
Current CE level	−0.000***	−0.000*	−0.000**	−0.000	−0.000**	−0.000
	(−3.89)	(−1.73)	(−2.76)	(−1.44)	(−2.53)	(−1.65)
Cumulative CE change (t−24 to t−1)	0.020**	−0.336***	0.041***	−0.437***	0.049***	−0.476***
	(2.51)	(−12.42)	(3.47)	(−17.53)	(3.33)	(−10.81)
Cumulative return (t−15 to t−1)	0.082***	0.043***	0.121***	0.034***	0.151***	0.025**
	(8.97)	(5.24)	(12.54)	(3.05)	(13.43)	(2.56)
Cumulative net sales change (*t*+3 to ...)	0.000**	0.000	0.000**	0.000	0.000*	0.000
	(2.35)	(1.39)	(2.18)	(1.19)	(2.11)	(1.58)
Constant	0.037**	0.111***	0.033	0.166***	0.031	0.234***
	(2.21)	(12.15)	(1.58)	(13.78)	(1.38)	(15.09)
Firm fixed effects	No	Yes	No	Yes	No	Yes
Time fixed effects	No	Yes	No	Yes	No	Yes
Observations	191,641	191,548	155,193	154,814	123,551	123,406
R-squared	1.8%	43.5%	2.4%	62.0%	2.8%	77.9%
Adjusted R-squared	1.8%	40.6%	2.4%	59.9%	2.8%	76.4%

¾ DSP in connection with negative post-event returns negatively and sustainably relates to carbon emissions.

Robustness Checks

Robustness, selection bias, endogeneity

- Different treatment and control groups (divested vs. non-divested within high carbon intensity firms) ✓
- Panel regressions controlling for firm characteristics, financial performance, CE, CE change, sales growth ✓
- Firm FE, time FE, industry FE, country FE, time-within-industry FE, time-within-country FE ✓
- Alternative explanation: Effect of shareholder intervention (shareholder proposals) ✓
- Financial selling reasons (Index delisting, Earnings surprises) ✓
- Long-term decarbonization of funds ✓
- Stocks that have been decarbonized more frequently ✓
- Risk-adjusted returns ✓
- Cross-sectional cuts (Europe vs. USA) and time-series cuts ✓
- Changes in CI ✓
- «

Summary

Good news: Investors can have a positive impact on climate mitigation through their decisions

Main findings

Question 1: How easy is it for mutual funds to decarbonize?

- Mutual fund hypothetical decarbonization potential is huge and divestment is likely to be concentrated.

  Divesting the dirtiest 6% of the portfolio would reduce the WACI by >50%.

Question 2: Does mutual fund decarbonization have an impact on stock prices and carbon emissions?

- Lower long -term negative abnormal returns of divested stocks (>5%)
- Relative decrease of carbon emissions of divested stocks (>8%)

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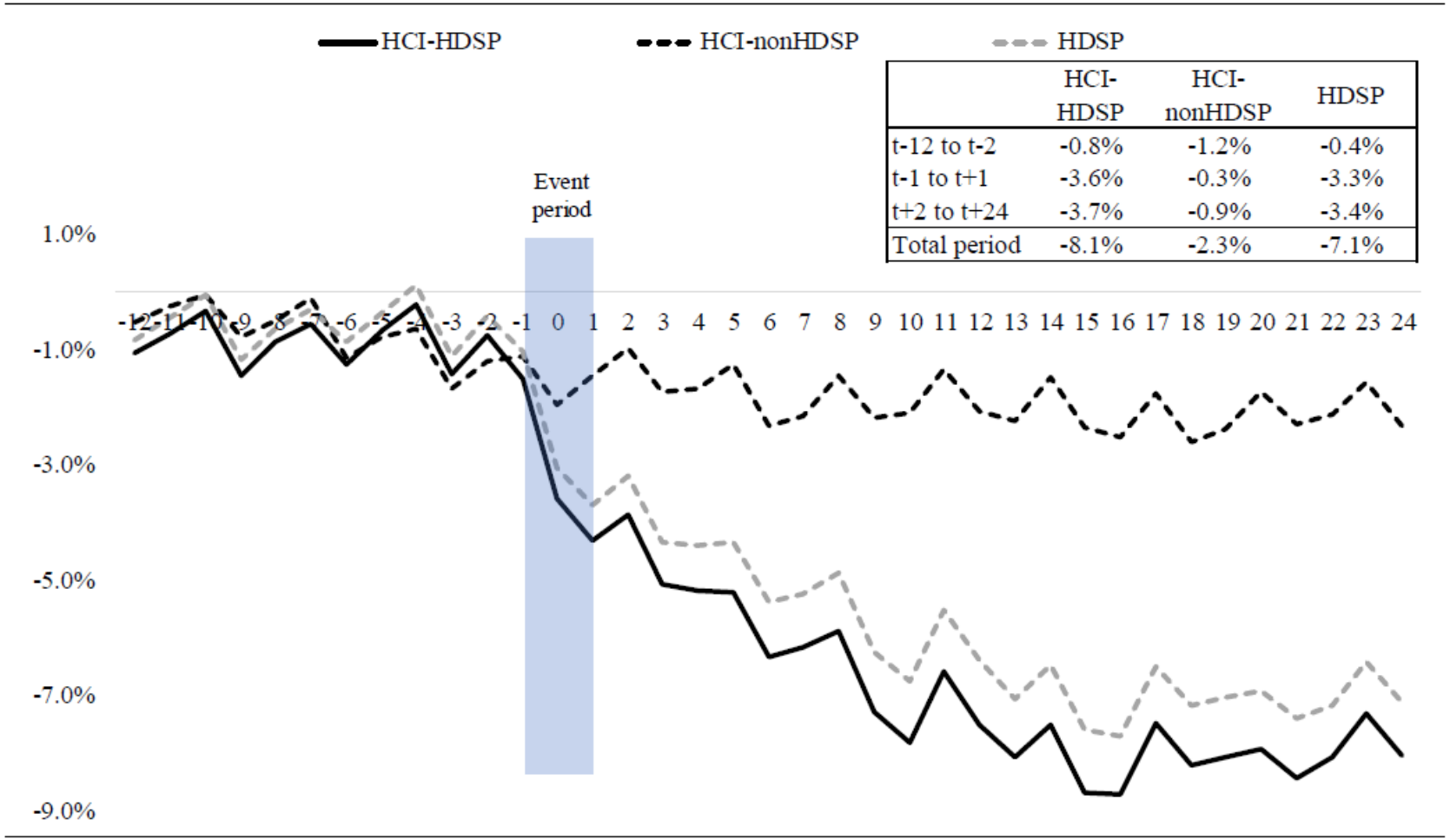
Stock returns event study 2

Figure 3

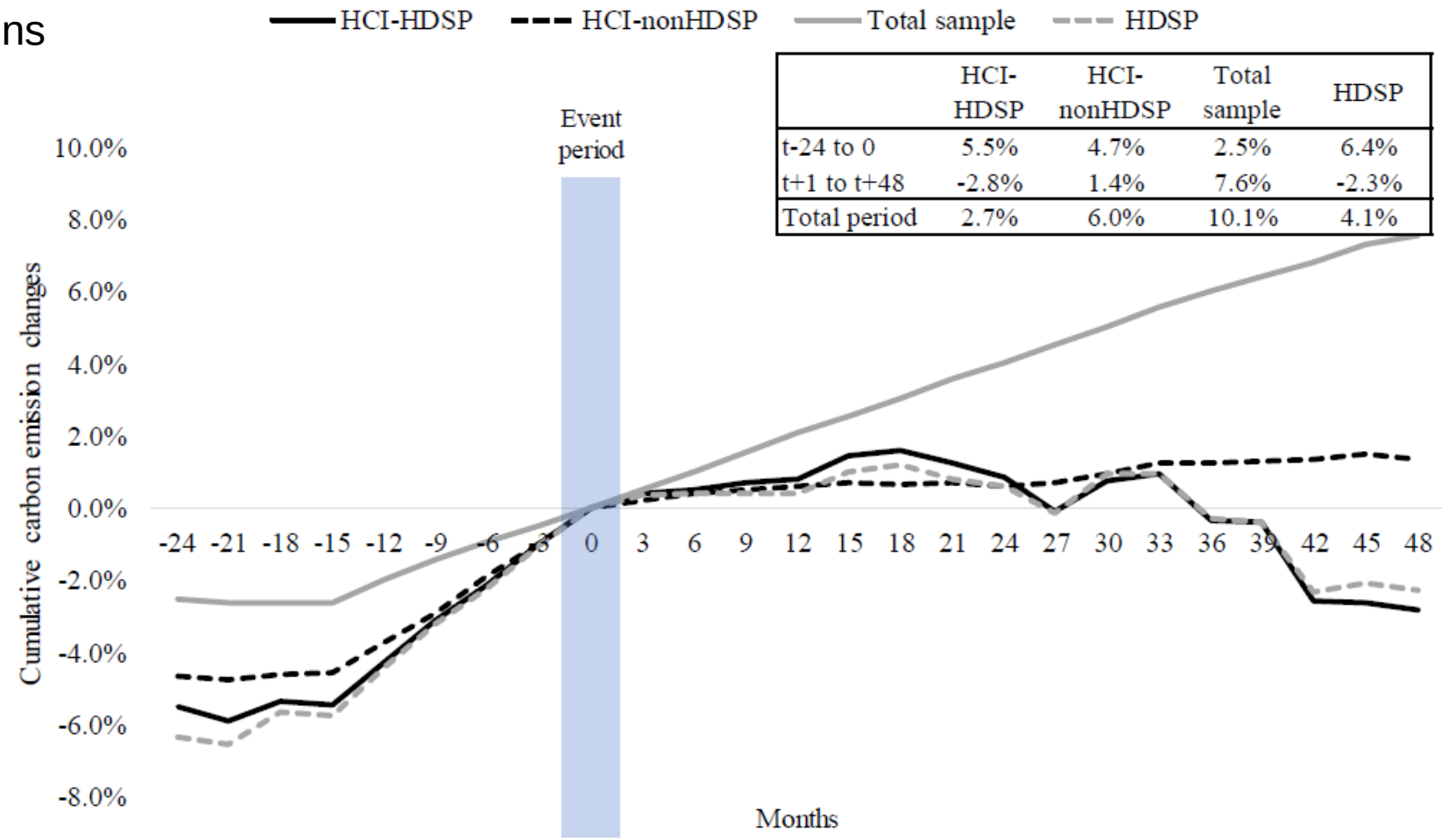


	HCI-HDSP	HCI-nonHDSP	HDSP
t-12 to t-2	-0.8%	-1.2%	-0.4%
t-1 to t+1	-3.6%	-0.3%	-3.3%
t+2 to t+24	-3.7%	-0.9%	-3.4%
Total period	-8.1%	-2.3%	-7.1%

Carbon emission changes event study 2

Figure 4

Carbon emissions



	HCI-HDSP	HCI-nonHDSP	Total sample	HDSP
t-24 to 0	5.5%	4.7%	2.5%	6.4%
t+1 to t+48	-2.8%	1.4%	7.6%	-2.3%
Total period	2.7%	6.0%	10.1%	4.1%

Regression: Stock returns event study

Table 3
Calendar time panel regressions of cumulative industry-adjusted returns.

Cumulative industry-adjusted returns							
	t0	t0 to t+1	t0 to t+3	t0 to t+6	t0 to t+10	t0 to t+16	t0 to t+24
DSP	−0.004***	−0.007***	−0.008***	−0.009***	−0.011***	−0.010***	−0.007***
	(−9.49)	(−11.45)	(−9.61)	(−8.13)	(−8.33)	(−6.43)	(−3.92)
GSP	−0.003***	−0.004***	−0.005***	−0.005***	−0.005***	−0.006***	−0.004**
	(−5.51)	(−5.88)	(−5.25)	(−4.74)	(−3.86)	(−3.53)	(−1.99)
Stock-level CI	−0.000	−0.000	0.001	0.001	0.004	0.011***	0.017***
	(−0.39)	(−0.14)	(0.43)	(0.56)	(1.48)	(3.32)	(4.24)
Past performance	−0.015***	−0.028***	−0.050***	−0.087***	−0.128***	−0.202***	−0.306***
	(−8.72)	(−11.90)	(−15.45)	(−21.40)	(−26.18)	(−35.14)	(−45.57)
Constant	0.001**	0.002***	0.004***	0.005***	0.008***	0.007***	0.012***
	(1.99)	(4.05)	(5.50)	(5.37)	(6.60)	(5.09)	(7.08)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	37,497	37,497	37,497	37,497	37,497	37,493	34,411
R-squared	6.3%	11.1%	17.0%	23.2%	29.7%	38.0%	49.6%
Adjusted R-squared	2.3%	7.3%	13.4%	19.9%	26.7%	35.3%	47.3%

¾ DSP has a strong and sustainable negative effect on abnormal stock returns.

Additional materials

Feel free to to contact us

Policy Brief (English): https://wpsf.de/en/publikation/pb-10-2021-equity-portfolio-divestment-leads-to-lower-co2-emissions/

Policy Brief (German): https://wpsf.de/publikation/pb-10-2021-divestment/

5 min summary in Video (English) : https://youtu.be/dorMMn2BBn4

5 min summary in Video (German): https://youtu.be/i3r30iRbtI8

Event study validations: Abnormal returns

Table 5
Cross-sectional Double Diff-in-Diff (DDID).

Panel A: Cumulative industry-adjusted returns

	Cumulative abnormal returns			Chi^2 tests		
	Pre-Event [t−12; t−2]	Event [t−1; *t*+1]	Post-Event [*t*+2; *t*+24]	Pre-Event vs. Event	Pre-Event vs. Post Event	Event vs. Post-Event
HDSP	0.003	−0.029***	−0.034***	14.58***	11.25***	0.21
	(0.49)	(−7.02)	(−3.95)			
HGSP	−0.017***	−0.019***	0.006	0.08	12.54***	14.06***
	(−4.05)	(−8.30)	(1.45)			
Chi^2 tests (H0: HDSP - HGSP = 0)	14.06***	10.92***	22.46***			
Constant	−0.001	0.001	0.004			
	(−0.22)	(0.25)	(0.52)			
N	110,347	110,347	110,347			
Adjusted R^2	0.1%	0.4%	0.0%			

¾ HDSP has a statistically strong and negative post-event effect on abnormal returns.

Event study validations: Carbon emissions

Panel B: Cumulative CE changes			
	Cumulative CE changes		Chi^2 tests
	Pre-Event [t−24; t−1]	Post-Event [t0; t+48]	Pre-Event vs. Post Event
HDSP	0.002	−0.074***	16.74***
	(0.15)	(−4.57)	
HGSP	0.006	−0.002	0.64
	(1.21)	(−0.25)	
Chi^2 tests (H0: HDSP - HGSP = 0)	0.11	10.97***	
Constant	0.052***	0.087***	
	(12.17)	(12.50)	
N	9,321	9,321	
Adjusted R^2	0.00%	0.09%	

¾ HDSP has a statistically strong and negative post-event effect on carbon emissions.

Backup: Formula I

- Stock-level carbon intensity

$$CI_{i,t} = \frac{Scope_1\&2_carbon_emissions_{i,t}}{Year_end_net_sales_{i,t}}$$

- Fund-level WACI

$$WACI_{j,t} = \sum_{i=1}^{n} Weighted_CI_{j,i,t}$$

$$= \sum_{i=1}^{n} Portfolio_weight_{j,i,t} \; CI_{i,t}$$

- WACI contribution

$$WACI_contribution_{j,i,t} = \frac{Portfolio_weight_{j,i,t} \; CI_{i,t}}{WACI_{j,t}}$$

Backup: Formula II

- Decarbonization

$$WACI_change_{j,t,t-1} = \frac{WACI_{j,t} - WACI_{j,t-1}}{WACI_{j,t-1}}$$

- Active decarbonization

$$Active_WACI_change_{j,t,t\text{-}1} = \frac{\sum_{i=1}^{n} \Delta portfolio_weight_{j,i,t,t\text{-}1} \; CI_{i,t}}{WACI_{j,t\text{-}1}}$$

- Passive decarbonization

$$Passive_WACI_change_{j,t,t\text{-}1} = \frac{\sum_{i=1}^{n} portfolio_weight_{j,i,t\text{-}1} \; \Delta CI_{i,t,t\text{-}1}}{WACI_{j,t\text{-}1}}$$

Backup: Formula III

- Decarbonization sell pressure

$$DSP_{i,t} = \frac{\sum_j \max(0, \Delta shares_{j,i,t}) \mid decarbonization_trade_{j,i,t}}{Average_shares_traded_{i,\ t-5,t-2}} - \frac{\sum_j \max(0, -\Delta shares_{j,i,t}) \mid carbonization_trade_{j,i,t}}{Average_shares_traded_{i,\ t-5,t-2}}$$

- General sell pressure

$$GSP_{i,t} = \frac{\sum_j \Delta shares_{j,i,t} \mid no_decarbonization_or_carbonization_trade_{j,i,t}}{Average_shares_traded_{i,t-5,t-2}}$$

Source and availability of stock-level carbon intensities

Table 1

	Refinitiv		CDP		Sustainalytics		Superset	
Year	# firms	% reported emissions	# firms	% reported emissions	# firms	% reported emissions	# firms	Market cap
2010	3,730	47.9%	1,318	100.0%	6,057	14.7%	9,954	47,100
2011	3,828	49.8%	1,411	100.0%	6,293	16.7%	9,954	43,500
2012	3,875	52.6%	1,514	100.0%	6,504	17.2%	9,954	48,000
2013	3,961	52.3%	1,527	100.0%	6,661	22.5%	9,954	55,400
2014	4,081	52.9%	1,570	100.0%	6,683	24.6%	9,954	58,700
2015	4,828	48.7%	1,605	100.0%	6,692	27.6%	9,954	56,400
2016	5,463	45.0%	1,609	100.0%	8,009	24.0%	9,954	59,900
2017	5,750	44.6%	1,581	100.0%	—	—	9,954	69,300
# firms	6,755		2,404		8,580		9,954	
Mean		48.8%		100.0%		21.3%		54,800

Stock-level summary statistics

Table 2

	Unit	N	Mean	SD	P10	P50	P90
Carbon emissions (scope 1+2)	metric tons	61,879	1,908,296	12,600,000	3,875	62,462	1,981,082
Stock-level CI	tons/$	79,632	0.00040	0.00324	0.00001	0.00005	0.00068
Net sales	$billion	74,900	5.40	18.30	0.11	1.04	11.20
Market capitalization	$billion	70,316	6.60	21.80	0.19	1.57	13.30
Total assets	$billion	74,321	21.50	137.00	0.21	2.07	26.10
Number of employees	count	60,990	16,925	50,594	330	4,031	38,095
MSCI carbon emission score	count	25,739	6.7	2.5	3.3	6.7	10.0
Refinitiv emission score	count	36,779	50.84	28.83	10.58	51.25	90.34
Monthly returns	%	1,081,842	1.2%	10.6%	–10.7%	0.4%	13.4%
Quarterly shares traded	count (mil.)	171,435	207	1,010	2	40	409

Coverage of mutual fund holdings with stock-level CI

Table 3

	Total # of mutual funds	# Mutual funds with % of equity AUM covered with stock-level CI					
		>40%	>50%	>60%	>70%	>80%	>90%
[redacted]							

Fund-level WACI summary statistic

Table 5

	N	Mean	SD	P10	P25	P50	P75	P90
Panel A: WACI by style (in metric tons/$ x 10,000)								
Large Blend	23,841	1.71	1.43	0.62	0.96	1.44	2.02	2.94
Large Growth	25,946	1.16	1.12	0.34	0.56	0.90	1.41	2.11
Large Value	17,870	2.47	3.26	0.79	1.21	1.81	2.63	3.82
Mid-Blend	8,470	1.84	1.42	0.65	0.97	1.48	2.31	3.36
Mid-Growth	11,239	1.07	0.74	0.39	0.60	0.90	1.31	1.92
Mid-Value	5,378	2.50	1.78	0.63	1.19	2.26	3.38	4.46
Small Blend	4,808	1.50	0.92	0.70	0.97	1.34	1.80	2.32
Small Growth	5,901	0.90	0.51	0.43	0.58	0.80	1.09	1.47
Small Value	2,913	1.78	1.32	0.71	1.05	1.50	2.10	2.82
Total	106,366	1.63	1.82	0.47	0.78	1.25	1.95	2.97
Panel B: WACI by fund sector-designation (in metric tons/$ x 10,000)								
Communications	163	0.31	0.12	0.14	0.23	0.30	0.40	0.44
Financial	654	0.19	0.26	0.06	0.08	0.11	0.18	0.33
Health	824	0.22	0.12	0.13	0.16	0.19	0.24	0.35
Industrials	318	1.90	1.47	0.45	0.77	1.37	2.89	3.84
Natural Resource	823	4.39	1.69	2.35	3.37	4.22	5.28	6.40
Real Estate	2,760	1.19	0.39	0.79	0.91	1.13	1.41	1.65
Technology	1,167	0.32	0.20	0.15	0.20	0.26	0.36	0.59
Utilities	348	21.48	5.98	13.94	16.53	20.80	25.61	29.53
Total	7,057	2.22	4.80	0.15	0.25	0.90	1.53	4.48

Characteristics of different stock samples

Table 6

	Total sample		HDSP		HGSP		NSP		HCI-HDSP		HCI-nonHDSP	
	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean
1-year prior return	106,636	13.8%	759	9.3%	10,547	9.7%	20,786	13.5%	714	8.7%	5,132	13.5%
BTM	142,326	0.63	959	0.76	13,593	0.60	27,483	0.71	903	0.77	6,737	0.80
Net sales (in $ billion)	143,296	7.6	962	7.1	13,669	6.3	27,969	8.5	906	7.2	6,860	7.1
Market cap (in $ billion)	142,992	9.1	959	7.4	13,624	6.7	27,830	9.7	903	7.3	6,812	8.0
Volatility	127,447	16.8%	870	16.1%	12,276	16.8%	24,504	17.4%	820	16.1%	6,016	19.9%
Stock-level CI	144,276	0.03%	969	0.32%	14,056	0.02%	28,092	0.04%	913	0.34%	6,899	0.19%
CI rank	144,276	2,357	969	359	14,056	2,440	28,092	2,285	913	280	6,899	273
DSP	12,653	0.0%	969	3.7%	1,168	0.4%	1,992	-0.2%	913	3.7%	2,491	-0.2%
GSP	144,276	-0.5%	969	-4.7%	14,056	10.4%	28,092	-0.1%	913	-4.4%	6,899	-0.2%

Calendar time panel regressions of cumulative industry-adjusted returns

Table 7

	Return	Cumulative industry-adjusted returns					
	t0	t0 to t+1	t0 to t+3	t0 to t+6	t0 to t+10	t0 to t+16	t0 to t+24
DSP	-0.004***	-0.007***	-0.008***	-0.009***	-0.011***	-0.010***	-0.007***
	(-9.57)	(-11.53)	(-9.76)	(-8.28)	(-8.51)	(-6.53)	(-3.90)
GSP	-0.002***	-0.004***	-0.004***	-0.004***	-0.004***	-0.005***	-0.003
	(-5.31)	(-5.53)	(-4.41)	(-3.75)	(-3.24)	(-2.91)	(-1.39)
Stock-level CI	-0.000	-0.000	0.001	0.002	0.005	0.011***	0.016***
	(-0.35)	(-0.01)	(0.67)	(0.75)	(1.64)	(3.20)	(3.79)
Constant	0.001	0.002***	0.004***	0.004***	0.006***	0.005***	0.007***
	(1.52)	(3.41)	(4.57)	(4.10)	(5.23)	(3.21)	(4.09)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	37,860	37,860	37,860	37,860	37,860	37,856	34,764
R^2	6.2%	10.8%	16.6%	22.4%	28.5%	35.9%	46.3%
Adjusted R^2	2.1%	7.0%	13.0%	19.1%	25.4%	33.2%	43.9%

Calendar time panel regressions of cumulative CE changes

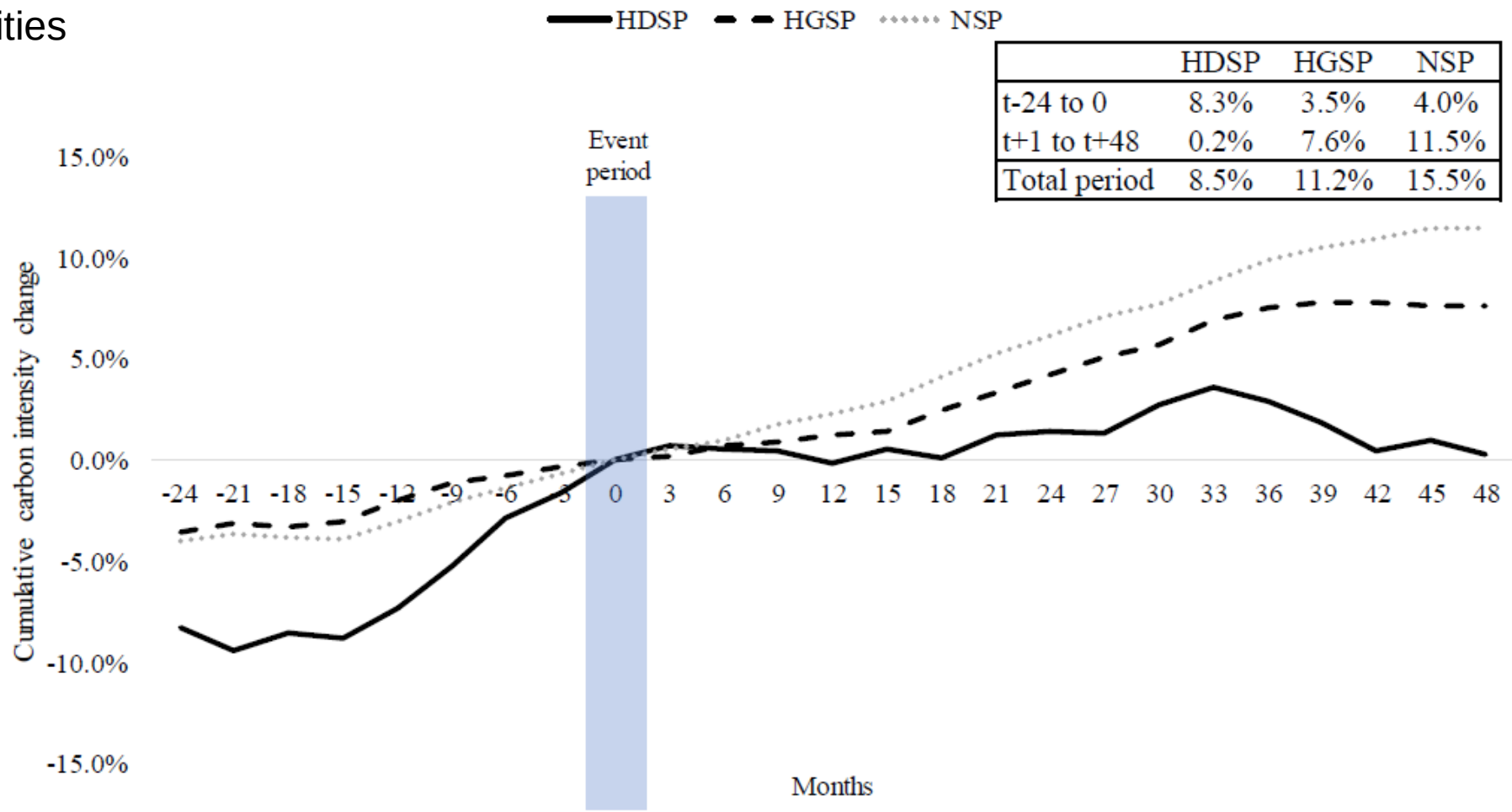
Table 8

	Cumulative CE changes					
	t+3 to t+24	t+3 to t+24	t+3 to t+36	t+3 to t+36	t+3 to t+48	t+3 to t+48
Negative return (t0 to t+5)	-0.007	-0.001	-0.001	0.006	0.003	0.003
	(-0.51)	(-0.07)	(-0.04)	(0.51)	(0.15)	(0.20)
Positive DSP	0.079***	0.052***	0.126***	0.058***	0.177***	0.041**
	(4.85)	(6.74)	(6.19)	(5.16)	(8.09)	(2.73)
Negative return : Positive DSP	-0.056***	-0.037***	-0.081***	-0.042***	-0.107***	-0.027
	(-4.03)	(-3.73)	(-4.51)	(-3.28)	(-5.70)	(-1.65)
Positive GSP	0.039***	0.005	0.068***	0.008**	0.091***	0.007**
	(5.02)	(1.31)	(7.46)	(2.23)	(8.44)	(2.14)
Negative return : Positive GSP	-0.027***	-0.007	-0.039***	-0.009**	-0.048***	-0.011**
	(-4.09)	(-1.69)	(-4.44)	(-2.13)	(-4.54)	(-2.60)
Current CE level	-0.000***	-0.000*	-0.000**	-0.000	-0.000**	-0.000
	(-3.89)	(-1.73)	(-2.76)	(-1.44)	(-2.53)	(-1.65)
Cumulative CE changes (t–24 to t–1)	0.020**	-0.336***	0.041***	-0.437***	0.049***	-0.476***
	(2.51)	(-12.42)	(3.47)	(-17.53)	(3.33)	(-10.81)
Cumulative return (t–15 to t–1)	0.082***	0.043***	0.121***	0.034***	0.151***	0.025**
	(8.97)	(5.24)	(12.54)	(3.05)	(13.43)	(2.56)
Cumulative net sales change (t+3 to …)	0.000**	0.000	0.000**	0.000	0.000*	0.000
	(2.35)	(1.39)	(2.18)	(1.19)	(2.11)	(1.58)
Constant	0.037**	0.111***	0.033	0.166***	0.031	0.234***
	(2.21)	(12.15)	(1.58)	(13.78)	(1.38)	(15.09)
Firm fixed effects	No	Yes	No	Yes	No	Yes
Time fixed effects	No	Yes	No	Yes	No	Yes
Observations	191,641	191,548	155,193	154,814	123,551	123,406
R-squared	1.8%	43.5%	2.4%	62.0%	2.8%	77.9%
Adjusted R2	1.8%	40.6%	2.4%	59.9%	2.8%	76.4%

Cumulative percentage changes of HDSP, HGSP and NSP stocks

Figure 4: Panel B

Carbon intensities

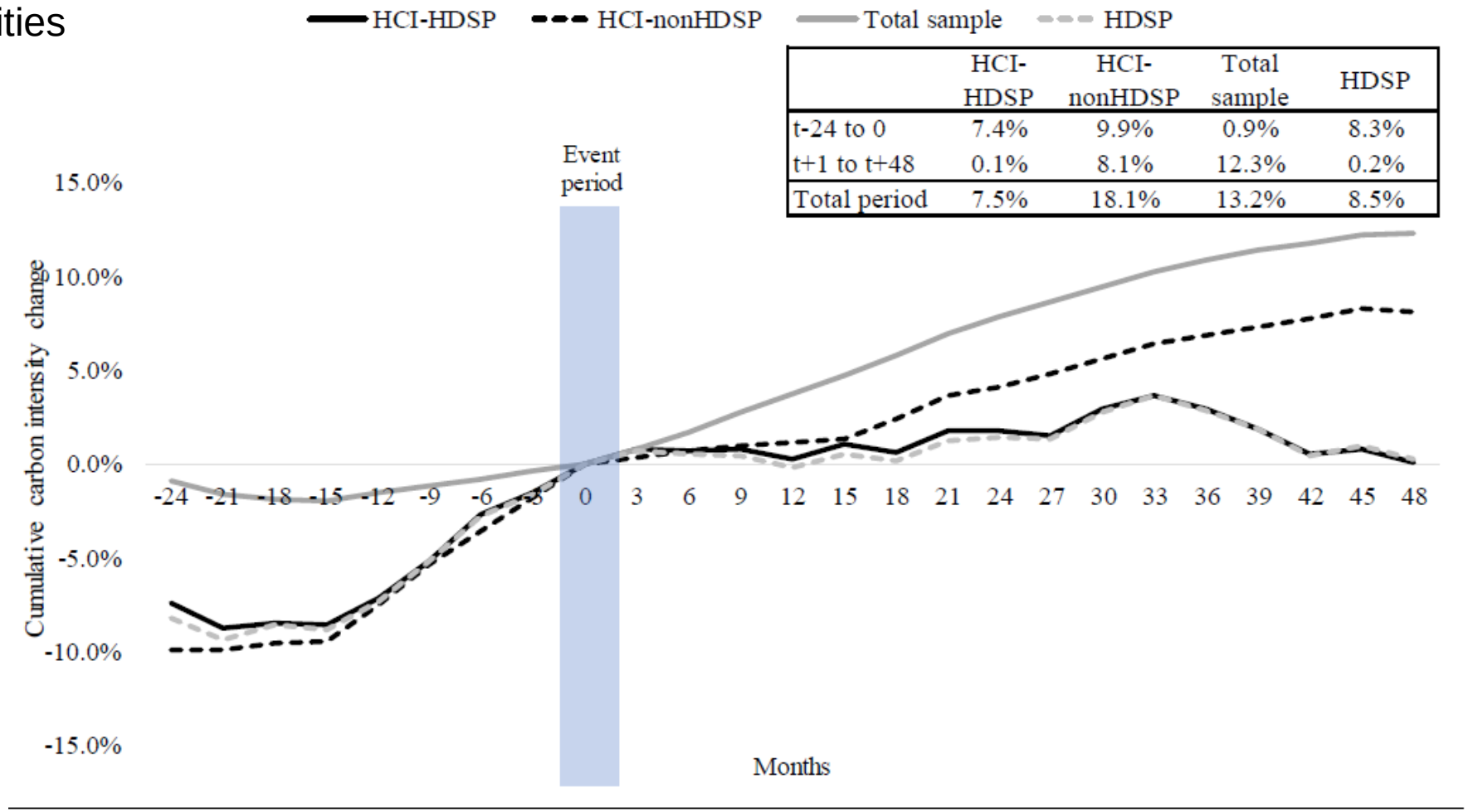


	HDSP	HGSP	NSP
t-24 to 0	8.3%	3.5%	4.0%
t+1 to t+48	0.2%	7.6%	11.5%
Total period	8.5%	11.2%	15.5%

Cumulative percentage changes of HCI-HDSP and HCI-nonHDSP stocks

Figure 5: Panel B

Carbon intensities



	HCI-HDSP	HCI-nonHDSP	Total sample	HDSP
t-24 to 0	7.4%	9.9%	0.9%	8.3%
t+1 to t+48	0.1%	8.1%	12.3%	0.2%
Total period	7.5%	18.1%	13.2%	8.5%

Literature review

Theoretical research on green investing

Pastor/ Stambaugh /Taylor, 2020

- ƒ , Q Y H V W R U V ¶ W D V W H V I R U J U H H Q K R O G L Q J V P D N H I L U P V J U H H Q H U
- ƒ Extension of model by Heinkel/Kraus/Zechner, 2001

Angelis/ Tankov /Zerbib , 2020

- ƒ Green investing spurs companies to reduce GHG emissions by raising cost of capital
- ƒ & R P S D Q L H V ¶ * + * H P L V V L R Q V G H F U H D V H Z K H Q W K H S U R S R U W L R Q stringency increase

Oehmke /Opp , 2020

- ƒ Investors can have impact by enabling a scale increase for clean production
- ƒ Investors have to relax financing conditions

Literature review

Divestment-related literature

Bolton/ Kacperczyk , 2020

- ƒ Institutional investors (including mutual funds) are divesting based on carbon emissions
- ƒ Significant divestment in the US and in Europe

Boermans /Galema, 2019

- ƒ Pensions funds that deviate from market benchmark weights have lower carbon footprints
- ƒ Effect is driven by a reduced exposure to carbon-intensive industries

Dordi /Weber, 2019

- ƒ Divestment announcements lead to long-term negative abnormal returns
- ƒ Divestors can influence share prices of target companies