



Sustainable Investments as Carbon Offsets

Do Investors Compensate for Unsustainable Consumption Using Sustainable Assets?

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1

Setting and motivation

Continued Growth and Significance of Sustainable Finance

- Socially responsible investments are projected to reach 21.5% of total assets under management by 2026, globally.^[1]

[1] PwC, 2022; ESG-focused institutional investment seen soaring 84% to US\$33.9 trillion in 2026, making up 21.5% of assets under management

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- Since August 2022, financial advisors must assess and recommend products based on client sustainability preferences.^[2]

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[2] Article 54 (2) a) of the MiFID II Regulation

The Relationship Between Sustainable Investments and Environmental Behavior

- Investors have a preference for socially responsible investments (SRI) ^[1]
- **Different reasons to invest socially responsible:**
 - Impact (sustainability preference)?
 - Return expectations or sentiment (“hype”)?
 - Warm glow?

[1] Bialkowski and Starks (2016); Riedl and Smeets (2017); Hartzmark and Sussman (2019); Gutsche and Ziegler (2019); Bassen et al. (2019); Barber et al. (2021); Heeb et al. (2023)

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 - **Channel:**
 - 1 Unsustainable consumers attempt to offset their footprints (our focus)
↓ sustainability → ↑ investing
 - 2 Sustainable investors feel morally licensed to consume unsustainably (potential follow up)
↑ investing → ↓ sustainability

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2

Empirical analysis using bank-client transaction data

Data

- Administrative bank-client data of 6,151 individual investors (CS of 2018 – 2021 data)
 - Socio-demographics, **categorized consumption**, income, wealth, debt, **ISIN-level trades**, **portfolio holdings**

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- Estimation of carbon footprints from consumption: [▶ Details](#)
 - Consumption is classified into >100 categories
 - IO data on carbon intensities from HH-level consumption for 200 goods (**EXIOBASE 3**)
 - annual footprint after harmonization and matching:
 - 1 Unrestricted sample: **10.6 tCO₂** p.a.
 - 2 Official estimate: **11.6 tCO₂** (Federal Environment Agency Germany)
 - 3 Restricted (investors only): **14.2 tCO₂**
- FactSet **TruValue Labs** (TVL): GHG emissions

Outcomes: Portfolio sustainability

- Match monthly portfolio holdings for each investor to TVL ratings (ISIN-level):
 - TVL rankings [0,100]: >100,000 public news, publication, social media sources
- **Today: Three measures for PF sustainability:**
 - Holdings in top quintile of rankings: *Holds top rated* [0,1]
 - PF share in top quintile: *% PF top rated* [0,100]
 - Value-weighted PF ESG score: *PF ESG score* [0,100]

Cross-sectional regressions: Compensation behavior?

- Unsustainable consumers: Higher investment in sustainable assets
- Portfolio rating category: **GHG emissions**

	(1) Holds top rated	(2) % PF top rated	(4) PF ESG score
	Marg. effect	Coef.	Coef.
Above median footprint	0.087*** (0.000)	5.311*** (0.000)	7.039*** (0.000)
Observations	6,151	6,151	6,151
Controls	Yes	Yes	Yes

Note. p-values in parentheses.

Note. Also holds for: Asset share in top quintile; PF ranks in top quintile of PF ESG scores

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- Results robust to alternative measure: Carbon intensities (CI) abstract from income/consumption levels:
→ sustainability of “lifestyle”: Emissions of consumers for each Euro earned (spent)?

▶ Carbon Intensity

Robustness and additional findings

■ Rule out alternative explanations:

→ Results are not driven by **sustainability preferences** or **return chasing** behavior which might be **heterogeneous** across low- and high-footprint investors

▶ Alternative channels

Robustness and additional findings

- Rule out alternative explanations:

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- Supporting evidence for compensation channel:

- Catholic-exposure alternative yields comparable results**

- ▶ Catholic-share specification

Robustness and additional findings

- Rule out alternative explanations:
 - Results are not driven by sustainability preferences or return chasing behavior which might be heterogeneous across low- and high-footprint investors
- Supporting evidence for compensation channel:
Catholic-exposure alternative yields comparable results
- Main results are **robust to sample selection**

▶ Sample extension

3

Experimentally linking Sustainable Behavior and Investment

Exploring Causality: Unsustainable Behavior and Sustainable Investments

- We established a correlational connection between **unsustainable behavior** and **sustainable investments**

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- We established a correlational connection between **unsustainable behavior** and **sustainable investments**
- Next - Execution of a field experiment:
 - Help us understand the **causal** drivers of sustainable investment preferences
 - Get information on the mechanism behind the effect
 - Rule out that alternatives (spuriously) drive empirical results: income, preferences, . . .
 - Differentiate negative externalities of ESG investments → aid the development of **effective policies** by targeting the adequate behavioral mechanism

Experimental Design

■ Three Treatments

	<i>Control</i> (n = 1,069)	<i>FP Treatment</i> (n = 1,161)	<i>Full Treatment</i> (n = 1,018)	<i>Don Treatment</i> (n = 1,001)
Calculation Footprint	Calculation of own CO ₂ -Footprint for one year			
1. Treatment	N/A	Visualization of own carbon footprint compared to peer group	N/A	N/A
2. Treatment	N/A		Allocation decision between carbon offsets and oneself	
Investment Decision	Finance investment decision between conventional and sustainable fund			

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■ Visualization of FP generates positive/negative "sustainability awareness"

▶ Visualization Footprint

■ Carbon offsets as channel for prior signal

■ *Primary Outcome Variable*: Investment allocation between sustainable and conventional fund

Experimental Setup

- Experiment conducted June-July 2023

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- Sample:
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 - All regressions control for: age, gender, carbon footprint and income
- Level of heterogeneity:
 - Expected impact of sustainable investments (Likert scale: 1 - very little to 7 - very much)

Sustainable Investments as Carbon Offsets

● — *In this regression* — ●

Con FP Treat Full Treat Don Treat

- A exogenous shock reducing perceived sustainability prompts a 9pp (€1125) increase in sustainable fund investments

Sustainable Investments as Carbon Offsets

● *In this regression* ●

Con

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- A exogenous shock reducing perceived sustainability prompts a 9pp (€1125) increase in sustainable fund investments
- This change is evident solely in individuals anticipating lower sustainability impacts from their investments

% invested sustainably	Low Impact	High Impact
FP Treatment	-2.507 (1.764)	3.354* (1.762)
Above Peer FP	-3.146 (3.053)	0.636 (2.925)
FP Treatment x Above Peer	11.385*** (3.282)	-5.884* (3.163)
Constant	61.995*** (2.617)	69.188*** (2.434)
Observations	1133	1097
Controls	Yes	Yes
R2	0.075	0.027

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Moral Licensing of medium impact belief individuals

● *In this regression* ●

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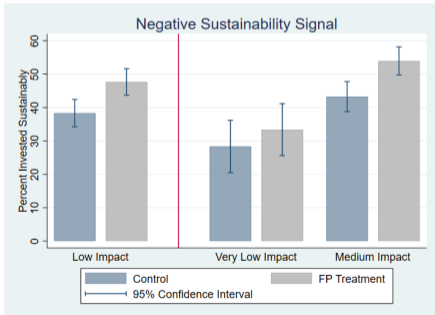
- Focused analysis on individuals holding "Low Impact" beliefs

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- Specifically, we consider those with beliefs rated as 3 & 4 (medium) and 1 & 2 (very low)

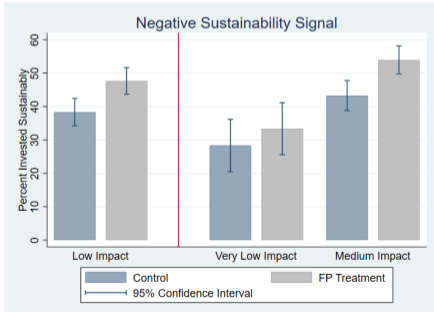


Moral Licensing of medium impact belief individuals

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- Focused analysis on individuals holding "Low Impact" beliefs
- Specifically, we consider those with beliefs rated as 3 & 4 (medium) and 1 & 2 (very low)
- The observed effects are primarily driven by individuals with "Medium Impact" beliefs, showing an increase of 10.9 pp or €1362.5 → strong prior beliefs remain unaffected



% invested sustainably	Very Low Impact	Medium Impact
FP Treatment	0.337 (3.205)	-2.145 (2.031)
Above Peer FP	-0.236 (5.978)	-5.673 (3.528)
FP Treatment x Above Peer	4.323 (6.023)	13.069*** (3.681)
Constant	65.516*** (6.387)	62.156*** (3.795)
Observations	365	768
Controls	Yes	Yes
R2	0.116	0.044

General Shift in Demand?

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- No permanent shift in demand for sustainable investments

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% invested sustainably	Very Low Impact	Medium Impact
Full Treatment	-4.458 (3.292)	4.449* (2.270)
Above Peer FP	-2.013 (5.642)	9.083** (3.798)
Full Treatment x Above Peer	0.881 (5.674)	-10.289*** (3.823)
Observations	378	718
Controls	Yes	Yes

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- Effect only for individuals with medium belief in impact of sustainable investments

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Summary

- Causal evidence that sustainable investments are used as carbon offsets
- Empirical effect of individual carbon offsetting using sustainable assets
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- Causal evidence that sustainable investments are used as carbon offsets
- Empirical effect of individual carbon offsetting using sustainable assets
- Empirical effects mirrored by causal treatment effect
- **But, effect driven by a subgroup of the population:**
 - Medium belief in impact of sustainable investments
 - After negative sustainability shock
- Individuals with strong prior beliefs are unaffected
 - "Robust" demand
 - Might be less likely to be influenced by media sentiment and advertisement on sustainable finance

3

Conclusion and Implications

Why is this important?

- Sustainable investing might have a **net negative effect** on individual carbon emissions

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 - Depending on specification, about **20 tCO₂ (≈ 80%)** of average high-footprint investors' **emissions remain uncompensated**

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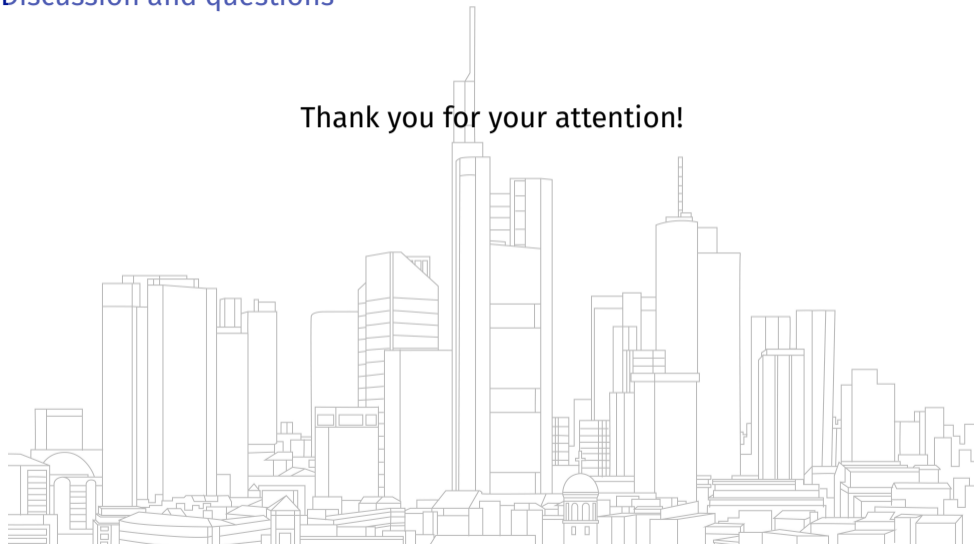
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- Using sustainable investments with an unclear impact as carbon offsets is a convenient & cheap way of indulgence
- Negative externalities of sustainable finance need to cause policy makers to be cautious and should put a focus on:
 - 1 Regulating misleading claims
 - 2 Educate investors on sustainable finance
 - 3 Evaluate the impact (in addition to labels) and communicate it

Discussion and questions

Thank you for your attention!



Proxies for financial and sustainability motives

■ Sustainability preference:

- 1 Buys within 5 days of positive rating changes (% of buys): **PCBR**^[1] ▶ PCBR plots
- 2 Sells within 5 days of negative rating changes (% of sells): **NCSR**^[1] ▶ NCSR plots
- 3 ESG home bias ratio (**EHBR**^[2]):

$$EHBR_i = \frac{\frac{N_{i, ESG \cup home}}{N_{i, ESG}}}{\frac{N_{i, home}}{N_i}}$$

[1] Bialkowski and Starks (2016); Hartzmark and Sussman (2019); Ammann et al. (2019); Chang et al. (2022)

[2] Groen-Xu and Zeume (2021)

[3] Odean (1998); Barber and Odean (2000, 2001); Grinblatt and Keloharju (2009); Dorn and Sengmueller (2009); Campbell and Frei (2010); Xue et al. (2011)

[4] Barberis and Xiong (2009)

◀ Back

■ Financial motive (return chasing):

- 1 High trading activity from overconfidence, past returns, attention paid to finances, gambling motives^[3]
 - Avg. monthly **trades**
 - Avg. monthly **PF turnover**
 - Avg. monthly **online banking logins**
- 2 Disposition effect (investors realize gains more than losses): $\Delta(\mathbf{PGR}, \mathbf{PLR})$ ^[4]
 - PGR: proportion of gains realized
 - PLR: proportion of losses realized

Survey evidence I

- Survey with 3,646 bank clients (same bank that provided the admin data)
- Questions on:
 - Demographics, market participation, household head, . . .
 - **Estimate own footprints** (in kgCO₂)
 - **Rank own footprints from consumption compared to peers:**
Likert scale (1 = much lower, 7 = much higher)
 - Methods to compensate for individual carbon footprints **used currently or in the past**

Carbon Offsets themselves don't effect sustainable investments (CHANGE TABLE STILL + ADD TO APPENDIX WITH BUTTON)

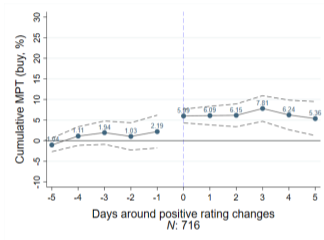
- Investment decision is unaffected by preceding option to offset emissions
- ADD Table ? Including FP interaction? No signal, but might describe different characteristics.

	Low Impact (1)	Medium Impact (2)	High Impact (3)
i_Donationtreat_group	-1.144 (3.161)	1.776 (1.462)	2.743 (2.098)
Constant	33.618*** (2.150)	51.780*** (0.983)	66.561*** (1.449)
Observations	314	1195	561

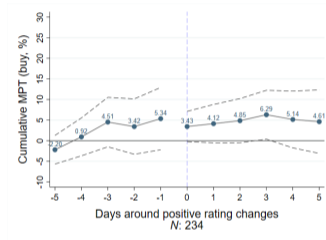
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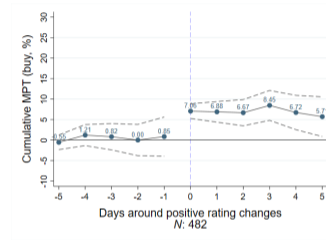
MPT: Positive-change buy rate (PCBR)



All investors



Low footprint



High footprint

◀ Back

Effect of return expectations and financial advice? I

- **Concern 1:** Higher **return expectations** among high-income individuals (with higher carbon footprints)?
 - 1 Proxies are specifically designed to capture heterogeneous return expectations of ESG assets and should take care of this
 - 2 **Carbon intensity specification** abstracts from income:
 - Should take care of this concern
 - Intensity is not positively or negatively related to income

Effect of return expectations and financial advice? II

- **Concern 2:** Higher **demand for financial advice** among high-income individuals (with higher carbon footprints)?
- Would **speak against carbon compensation mechanism** if financial advisers **disproportionately** recommend ESG assets, i.e., exhibit a bias towards ESG assets (which they presumably do. . .)

Effect of return expectations and financial advice? III

I observe admin data on financial advice, will check in next review round, but **mechanism is unlikely to drive results:**

- Why would effects only manifest for assets with ↓ emissions and ↑ air quality, but not ↑ overall ESG ratings?
- **Carbon intensity specification** abstracts from income and should address this concern as well

Effect of return expectations and financial advice? IV

- It is true that \uparrow income \rightarrow \uparrow financial advice, (e.g., Collins, 2012; Alyousif and Kalenkoski, 2017)
but

- **Negative relation of seeking financial advice** and . . .

(Finke et al., 2011; Hanna, 2011; Lachance and Tang, 2012; Tokar Asaad, 2015; Porto and Xiao, 2016; Gentile et al., 2016)

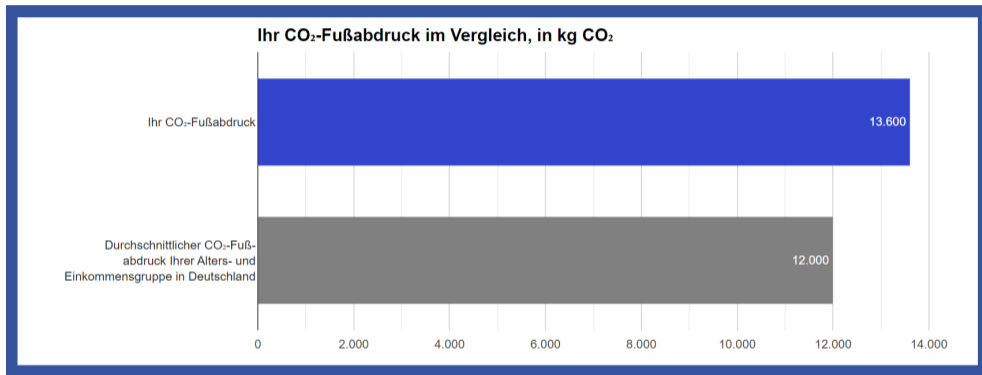
- 1 Overconfidence
- 2 High **self-reported** financial knowledge (\neq financial literacy)
- 3 Distrust
- 4 High risk appetites (independently of income)

- Effects should **balance out** potential effect of income on seeking financial advice

◀ Back to main part (robustness)

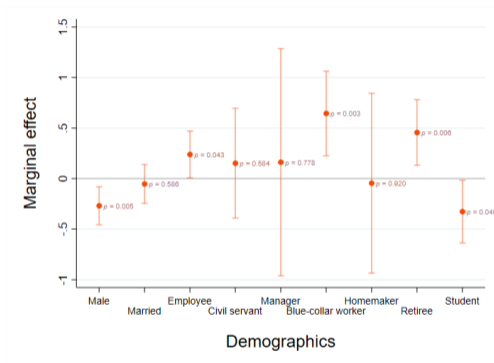
◀ Back to alternative channels intro (Appendix)

Visualization of the carbon footprint I



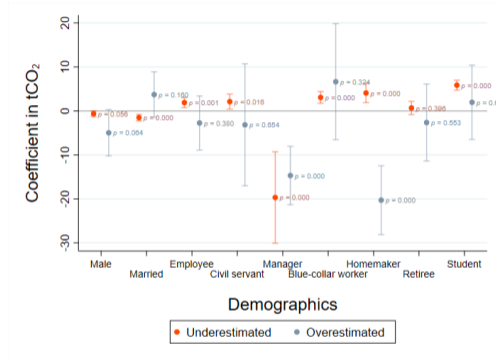
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Misestimation of carbon footprints I



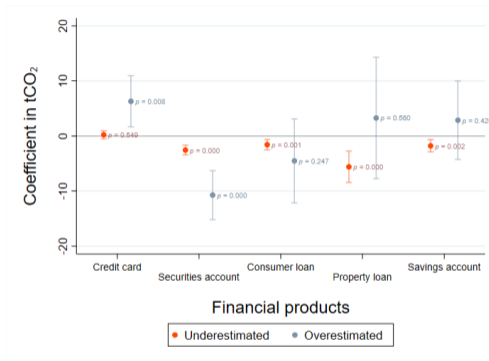
◀ Back

Misestimation of carbon footprints II



◀ Back

Misestimation of carbon footprints III



◀ Back

Robustness: Catholicism specification I

- Catholicism is historically tied to financial atonement (letters of indulgence)
→ **Sins can be paid for and are forgiven**
- Use 2011 German census (last year with religious information)
- Adjust baseline specifications: COI on **share of Catholics** in investors' 5-digit zip code area (%)
- Significant relation of PF sustainability to dominance of Catholicism should **follow from offsetting channel**

Robustness: Catholicism specification II

	(1)	(2)	(3)	(4)	(5)
	Holds top rated	% PF top rated	% AS top rated	PF ESG score	Top PF ESG score
Overall	0.000 (0.339)	0.009 (0.244)	-0.003 (0.209)	0.071*** (0.000)	0.000* (0.028)
GHG emissions	0.001*** (0.001)	0.036** (0.016)	0.002 (0.513)	0.107*** (0.000)	0.000** (0.029)
Ecological	0.000 (0.381)	0.003 (0.679)	0.003 (0.466)	0.065*** (0.002)	0.000 (0.116)
Air quality	0.001** (0.017)	0.020*** (0.004)	0.004 (0.230)	0.055*** (0.000)	0.001*** (0.005)
Investor-level controls	Yes	Yes	Yes	Yes	Yes
Micro status	Yes	Yes	Yes	Yes	Yes
Population	Yes	Yes	Yes	Yes	Yes
Observations	5,732	5,732	5,732	5,732	5,732

◀ Back

Robustness: Sample selection I

- Sample is selected to reflect (i) main and (ii) income account users:
 - ↑ external validity
- Findings unbiased by account use for vacation, cars, children, shopping, ... **only**
- Expand sample and assess robustness of main findings

Restriction	No. of investors
Unrestricted sample	19,929
Non-missing income and wealth data	19,011
Permanent net annual income \geq EUR 10,000	17,989
Regular income receivers	9,901
<i>Main sample</i>	6,151

Robustness: Sample selection II

- Repeat analysis across sample breakdown
- Table presents main outcomes of interest (GHG emission ratings)

	(1) Holds top rated	(2) % PF top rated	(3) % AS top rated	(4) PF ESG score	(5) Top PF score
<i>Unrestricted sample (N = 19,929)</i>					
Above-median footprint	-0.047*** (0.000)	-0.049 (0.892)	0.230*** (0.001)	10.603*** (0.000)	0.167*** (0.000)
<i>Non-missing income and wealth data (N = 19,011)</i>					
Above-median footprint	-0.045*** (0.000)	-0.032 (0.929)	0.195** (0.003)	11.172*** (0.000)	0.175*** (0.000)
<i>Permanent net annual income ≥ EUR 10,000 (N = 17,989)</i>					
Above-median footprint	-0.054*** (0.000)	-0.256 (0.520)	0.259*** (0.000)	11.867*** (0.000)	0.181*** (0.000)
<i>Regular income receivers (N = 9,901)</i>					
Above-median footprint	-0.022 (0.178)	-1.557 (0.136)	0.144 (0.445)	15.940*** (0.000)	0.219*** (0.000)

◀ Back

Is the compensation efficient? I

- HH are responsible for 60% of EU emissions, **footprint would have to be 2.5–3.3 tCO₂** to reach 1.5°C by 2030 (Ivanova et al., 2016)
- Average portfolio emissions are **higher for high-FP investors** (who attempt to offset)

Emissions scope	Footprint	Avg. total CO ₂ emissions* from		Δ PF emissions	Δ emissions from cons.	Emissions not offset
		Investments	Consumption			
Direct 1	Low	2.155	7.080			
Direct 1	High	2.562	24.658	0.407	17.578	17.986
Indirect 2	Low	0.478	7.080			
Indirect 2	High	0.654	24.658	0.176	17.578	17.755
Indirect 3	Low	11.844	7.080			
Indirect 3	High	14.454	24.658	2.611	17.578	20.189
Total 1 + 2	Low	2.633	7.080			
Total 1 + 2	High	3.217	24.658	0.584	17.578	18.162
Total 1 + 2 + 3	Low	14.477	7.080			
Total 1 + 2 + 3	High	17.671	24.658	3.194	17.578	20.772

Note. * Emissions in tCO₂.

◀ Back

Is the compensation efficient? II

- Use coefficients from baseline model ▶ Baseline model
- Δ emissions for top-20% and bottom-20% ranked assets \rightarrow offset potential
- Weight offset potential by investor asset share and coefficients from baseline: emissions offset by investing in top-ranked assets

Emissions scope	Footprint	Baseline specification	Coefficient from baseline	Offset potential*	Emissions* after offset	"Exchange rate": Offset efficiency (%) ^x
Direct 1	High	1	0.087	-2.100	19.600	10.712
Direct 1	High	2	0.053	-1.282	20.418	6.278
Direct 1	High	3	0.004	-0.105	21.594	0.487
Indirect 2	High	1	0.087	-0.002	21.698	0.008
Indirect 2	High	2	0.053	-0.001	21.698	0.005
Indirect 2	High	3	0.004	0.000	21.699	0.000
Total 1 + 2	High	1	0.087	-1.191	20.508	5.807
Total 1 + 2	High	2	0.053	-0.727	20.972	3.467
Total 1 + 2	High	3	0.004	-0.060	21.640	0.276

Note. * Emissions in tCO₂, ^x "How efficient is the offset"? 100%: perfectly efficient, 0% completely inefficient.

◀ Back

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 - 3 Efficient carbon taxation system
 - 4 Punitive measures against advertising ESG investments as efficient forms of compensating (e.g., **Dekabank lawsuit** 2021)

Biases from rating schemes?

- Bias from different ESG rating methods of funds and stocks?

- 1 Very good point!

- 2 Options to address this concern:

- 1 Subsample analysis separately for fund and equity investors

- 2 Change in effects after SFDR:

- From 2022, fund providers must additionally provide information on the impact of their investment strategy with regard to ESG criteria in a reporting

- 3 DiD setup? Fund investors x post-SFDR

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