Does Sustainability Generate Better Financial Performance? Review, Meta-analysis, and Propositions

Ulrich Atz
Stern School of Business,
New York University, NY, USA

Tracy Van Holt
Insight Network
New York, NY, USA

Zongyuan Zoe Liu
Council on Foreign Relations,
New York, NY, USA

Christopher C. Bruno
The Wharton School,
University of Pennsylvania, PA, USA

Abstract

Sustainability in business and ESG (environmental, social, and governance) in finance have exploded in popularity among researchers and practitioners. We surveyed 1,141 primary peer-reviewed papers and 27 meta-reviews (based on ~1,400 underlying studies) published between 2015 and 2020. Aggregate conclusions from a sample suggest that the financial performance of ESG investing has on average been indistinguishable from conventional investing (with one in three studies indicating superior performance) – in contrast with research in the wider management literature as well as industry reports. Until recently top finance journals did not publish climate change related studies, yet these studies capture the frontier of corporate risk and ESG investment strategies. We developed three propositions: first, ESG integration as a strategy seems to perform better than screening or divestment; second, ESG investing provides asymmetric benefits, especially during a social or economic crisis; and third, decarbonization strategies can potentially capture a climate risk premium.

Keywords: sustainability, climate change, financial performance, ESG, meta-analysis, review

JEL Classification: A13, G23, G30, M14, M41

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The Online Appendix (available at https://papers.ssrn.com/abstract=3919652) contains the methodology, codebook, and study sample and codes. Replication data is available on Harvard Dataverse at https://doi.org/10.7910/DVN/WLRZYE.

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Author statement: UA and TVH wrote the proposal to secure funding and designed the research. UA and TVH developed the codebook. UA led the data collection and analysis. ZL created the investor and climate-themed paper database. CB created the corporate database and analyzed climate-themed papers. UA provided the first draft with input on the framework and propositions from TVH. All authors contributed to the manuscript. All authors reviewed the propositions and provided feedback on all paper drafts. All authors contributed to the online appendix**.**

1 The rise of ESG

Sustainable investing has arrived in the mainstream, even in the US. Total inflows into ESG funds, for example, rose to more than $50 billion USD in 2020 compared to $5 billion in 2018 (Morningstar, 2021). Whether this trend stems from a bubble or overdue risk control remains to be seen. Regardless, business and society are facing perhaps the greatest existential threat in history: climate change. The US Fourth National Climate Assessment estimated that climate change can wipe out up to ten percent of the US economy by the end of the century (Reidmiller et al., 2018). Relevant managerial and investing strategies then ought to make for savvy, long-term business decisions. Despite that some researchers recognized climate change as fundamental to business decades ago (Nordhaus, 2019, 1977), such studies have been elusive in economics and finance until very recently (Diaz-Rainey et al., 2017; Giglio et al., 2021; Hong et al., 2020; Zhang et al., 2019). What has not been rare are researchers grappling with the question: do corporate sustainability and ESG investing strategies improve financial performance?[1] One might expect that the vast literature produced a general consensus, yet new ambiguity seems to emerge continually.[2]

Our overall objective is to provide researchers and practitioners with an assessment of the rapid developments of the last five years on whether it pays to be sustainable. By offering three propositions, we hope to go beyond a general finding that obscures underlying details. Climate change, discussed in proposition 3, may be a key driver for the acceleration of corporate effort and financial products to address ESG topics. In many respects, it constitutes the frontier of ESG research and allows us to glimpse into the future. For example, the E in ESG has been a cornerstone since the emergence of ESG analysis decades ago (Eccles et al., 2020); yet even

[1] Many issues arise from the unclear definition of corporate social responsibility (CSR), ESG, and related terms. The terms related to sustainability also evolved over the years, which is well documented in Van Holt and Whelan (2021). We also adopted their definition of sustainability: "(1) at minimum do not harm people or the planet and at best create value for stakeholders, and (2) focus on improving sustainability performance in the areas in which the company or brand has a material environmental or social impact (such as in their operations, value chain, or customers)." Traditionally, CSR was seen as voluntary (Liang and Renneboog, 2017) and beyond the interest of the firm (McWilliams and Siegel, 2001). In our study, ESG goes beyond philanthropy or voluntary CSR (e.g. increasing the racial diversity of the board of directors) and includes legitimacy and compliance issues as well (e.g. following safety standards in the automotive industry). Strong ESG performance can also be considered a competitive advantage (Ioannou and Serafeim, 2019).

[2] For example, in the US the Security and Exchange Commission (SEC) issued a "Risk Alert" titled *The Division of Examinations' Review of ESG Investing* highlighting the diverse approaches on April 9, 2021.

greenhouse gas emissions, a core metric for understanding the impact of a corporation, are still deficient in assessing climate change performance (Grewal and Serafeim, 2020). Research before 2015 amassed a vast body of literature consisting of thousands of studies. But determining whether corporate sustainability and ESG investing strategies improve financial performance can be confusing because studies differ in what they analyze and how they address causal inference. A common, but unsatisfying, conclusion interprets the results as ambiguous, mixed, or at worst invalid (e.g. Albertini, 2013; McWilliams and Siegel, 2000; Wood and Jones, 1995). In contrast, we found that there exist at least two "stylized facts" that hold for the period before 2015 and thereafter: (1) there is robust evidence for corporate managers that justify investments in sustainability for better corporate financial performance, while (2) returns from ESG investing—averaged across many portfolio management strategies—are indistinguishable from conventional investing.

We contribute to the ESG finance literature in three ways. First, we provide a descriptive analysis of contemporary ESG research and its characteristics. We screened approximately 3,000 articles, reviewed 1,141 of them, and coded several hundred studies into a new dataset that allowed us to investigate the factors and characteristics that could explain differences in the papers' conclusions. We then link the ESG finance literature to research in economics, accounting, and management, and propose several alternative explanations for why the two stylized facts mentioned above do not align across corporate and investor studies. While we are not the first to consider the manager-investor distinction, we are the first to interpret this as a key explanation for why past and recent results were sometimes labeled as ambiguous.[3] We hope this moves us beyond a simplistic view of conflicting evidence.

Second, we highlight the gap between academic research and finance practitioners. Until very recently, top journals in finance have ignored sustainability research (Diaz-Rainey et al., 2017; Zhang et al., 2019). Scholars continue to be challenged by the many dimensions of sustainability, the shortcomings of ESG data (Kotsantonis and Serafeim, 2019), and pooling different investment strategies (Kronsinky, 2016) – an underlying issue of individual studies a meta-

[3] For example, Matos (2020), in his critical review on ESG investing, distinguished the evidence between "Does E&S/CSR Matter?" and "Do ESG/SRI Strategies Pay Off for Investors?", however, this distinguishment was not foreground.

analysis cannot disentangle. For example, socially responsible investing or ethical funds do not share the same risk-reward ambitions as other ESG investment strategies (Ielasi and Rossolini, 2019), so a pooled sample of (self-declared) ESG funds will likely lead to a confounded null result. We show that even on the highest level (the study type), a simple distinction matters for the overall conclusion's direction.

Third, our main finding—ESG investing is on average indistinguishable from traditional investing—challenges some of the most recent industry reports. For example, Morningstar's (2021) analysis found that the three-year trailing performance of more than half of US-based ESG equity funds scored in the top quartile. It is possible that such findings may not necessarily furnish proof of an "ESG alpha" per se, but rather have been driven by volume factors such as the massive amounts of recent inflows into the ESG space. Finally, we reconcile this tension by arguing that a generic claim, where ESG is either flawed or successful, obscures the underlying mechanisms. The details of *how* sustainability/ESG leads or does not lead to financial performance (through what we call mediating factors and others call materiality pathways), hence, becomes more and more important for research and practice.

2 Methodology

Our main research goal was to analyze differences in studies' conclusions in a systematic manner. Therefore, we split the research process into three types of studies that also tend to reflect different fields in academia, which are not, however, mutually exclusive:

1. "Corporate" refers to studies that analyzed how the ESG performance of firms relates to their financial performance, linked to the perspective of a manager.
2. "Investor" refers to studies that analyzed the financial performance of ESG funds, ESG portfolios, or ESG indices, linked to the perspective of an asset manager.
3. "Thematic" refers to the specific theme "climate change", which currently comprises a major part of ESG considerations for managers and investors.

Examples and details of the sample collection and systematic review protocol are reported in the Online Appendix (A and B).

2.1 Sampling

In sum, we queried ProQuest, Web of Science (WoS), Google Scholar, Social Science Research Network (SSRN), and National Bureau of Economic Research (NBER) for variations of the term sustainability/ESG and variations of the term financial performance/CFP, where both sets of keywords were linked with an AND operator. Over several months, a team of five researchers worked in parallel to complete the process with the help of DistillerSR, a systematic review software. Two levels of screening restricted the final sample to relevant studies for the period of January 2015 to February 2020.

Figure 1 shows the chart that produced our final study sample. The level 1 screening attempts to capture at least 80 percent of peer-reviewed, academic papers, which we conjecture to have reached because of our validation efforts and the large number of irrelevant studies. This forms the population or "universe" of ESG research published between 2015 and 2020.[4] Level 2 screening attempts to create a stratified, random sample that is feasible to code for dozens of study characteristics (Online Appendix B). We also made the decision to heavily weigh the sample towards more recent studies (past 2016) because of the substantial lag in ESG data and academic publishing. In total, we included 238 studies as a basis to generalize to the universe of studies (1,141), for which we used binomial confidence intervals correcting for finite population size.

The complete list of studies and codes are available via Online Appendix C. This data is the result of a coding process stretching months. We conducted several rounds of audits.

We also found 27 meta-reviews (based on an estimated 1,400 underlying studies) of which 15 were suitable (i.e., quantitative) for a second-order meta-analysis. Most of the underlying primary studies were published before 2015. Online Appendix D contains the list of all in-sample meta-reviews.

[4] Our original cut-off date of February 2020 excluded all COVID research, so we added a sample of salient articles based on a comparable search strategy (albeit without the detailed coding), which extends until May 2021, for the discussion of the proposition: ESG investing provides asymmetric benefits, especially during a social or economic crisis.

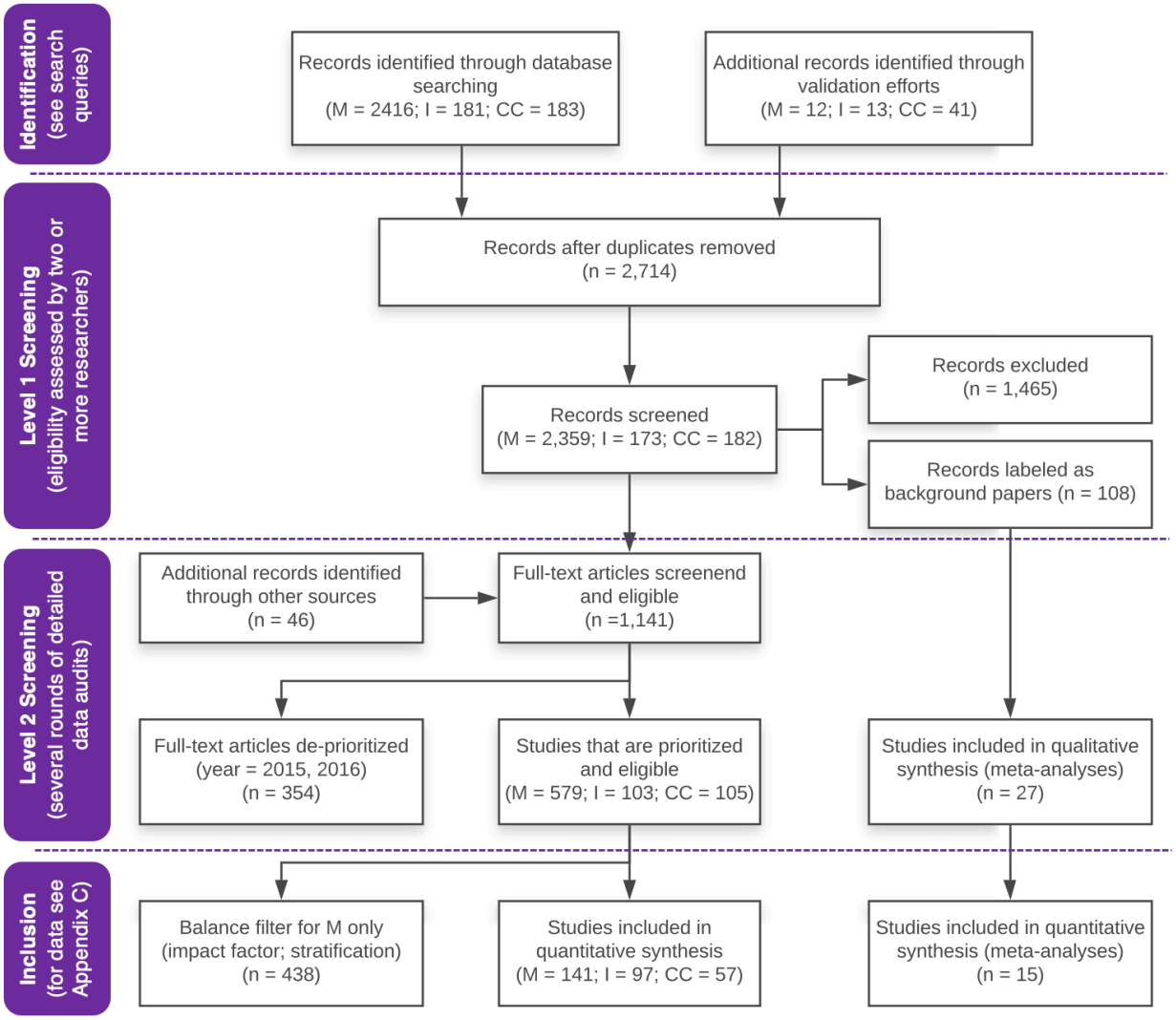

Figure 1. Study selection based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Sample period was 2015 to 2020; additional details are reported in Appendix A. Note: M = corporate/manager type; I = investor/asset manager type; CC = climate change; n = count

2.2 Analysis

The hand-collected data allowed us to classify studies on whether they came to an overall negative, neutral/mixed, or positive conclusion (see Appendix B for definitions and annotations). We used these results in a generalized linear regression model, where each study entered with its respective codes as dependent variable (study result) and independent variables (study characteristics). We also explored a large number of cross-tabulations to identify any data issues

and to generate propositions. The ordered choice model is a standard approach (Greene, 2012) to accommodate the ordinal nature of the study result variable; specifically, we designed an ordered logit (proportional odds) model. Note that interpreting the coefficients in logit models is not as straightforward as in a typical linear model.[5] Only the signs are unambiguous without further calculations. We built several specifications for this model to test various blocks of independent variables related to the studies' potential confounding characteristics.[6] Finally, to get a sense of which variables are relatively important beyond regression coefficients, we run a Shapley-Shorrocks value decomposition (Shorrocks, 2013). The variables, which in all model permutations contribute most to a measure of model fit, are deemed more important in explaining differences among studies.

We summarized the existing meta-analyses with a basic Bayesian random effects model, which is described in Appendix D. All computations were done in R 4.0 (R Core Team, 2020).

3 Results

3.1 The evidence from prior meta-analyses shows three "stylized facts"

With more than a thousand articles in scope, we documented a steep rise in the number of published ESG articles. The volume is, we estimated, comparable to all ESG/sustainability performance studies published before 2015. For instance, Busch and Friede (2018) found 1,214 unique studies for all years up to 2015. We identified 27 meta-reviews including 15 quantitative meta-analyses published since 2015, which we used as the basis to establish the following "stylized facts":

1. There exists a robust and positive association between sustainability and financial performance on the firm level. Twelve of thirteen recent meta-analyses found a positive

[5] Moreover, standard errors do not follow the same logic with respect to heteroskedasticity as in linear models. While in the latter the point estimates remain the same either way, this consistency generally no longer holds in non-linear models. Thus, either the model is reasonably well specified and the robust sandwich estimator makes little difference asymptotically (see Greene (2012, p. 744) for example) or the model is insufficiently well specified and the robust estimator does not help with estimating the main parameters of interest.

[6] We interpret the results of the regression models in descriptive terms, i.e. as multivariate associations, and do not see the models as an application of the Neyman-Rubin potential outcome framework, so causal interpretations are beyond the scope of this analysis.

association between some aspects of sustainability and corporate financial performance (CFP) covering the period 1976-2018 (studies = 1,272; effects = 7,132). We estimate that under a broad definition of sustainability a new study would, with 95% likelihood, find a partial correlation coefficient between 0.05 and 0.13. The small magnitude itself is harder to interpret because, given noisy data and idiosyncratic context, it is still possible that ESG has a large effect on CFP.

2. The financial performance of ESG investments has on average been indistinguishable from conventional investments. The two quantitative meta-analyses in our sample (Kim, 2019; Revelli and Viviani, 2015) analyzed a combined unique 107 studies with 331 effects covering 1978-2016. *Hedges' d*, a measure of standardized mean return differences (e.g., socially responsible investing vs. conventional fund), hovered around zero on average with an lower and upper quartile of -0.086 and 0.139. The total count of studies (107) is a net figure as around 30 papers overlap in both meta-analyses. Revelli and Viviani (2015) concluded that there were neither costs nor benefits to pursuing socially responsible investing (SRI). They explained the differences in primary studies by dimensions such as the investment approach. Kim (2019) corroborated these findings.

3. There exists no meta-analysis on climate finance. We found, however, two review studies that documented the limited attention climate change received in top-tier finance journals (Diaz-Rainey et al., 2017; Zhang et al., 2019). For climate, or green, finance as part of ESG investing there seems to exist no peer-reviewed meta-analysis to date. One systematic review found that only 12 articles (0.06%) before 2015 were related to climate change in the leading 21 finance journals (Diaz-Rainey et al., 2017). A bibliometric analysis extended this finding to 39 relevant publications in 2015 and 86 in 2018 (Zhang et al., 2019), also noting the absence of articles in mainstream finance journals. Recent research is bucking this trend, for example, the *Review of Financial Studies* published a special issue on climate finance in 2020 (Hong et al., 2020).

3.2 Primary studies published after 2015 replicate the stylized facts

In total, 141 studies focused on corporations, 97 focused on investors, and 57 of the combined 238 focused on the issue of climate change.[7] The median start and end date for an individual study's data sample was 2007 to 2015. The market coverage of the study focused on up to a third of studies on a global sample (29%), the USA (33%), and Europe (25%) including some overlap. Around one in five studies committed their analysis to a specific country.

We found robust evidence in our sample that corporate studies suggest sustainability leads to financial performance (60% ± 7.5 percentage points, statistically significantly more than half; Figure 2). We found fewer positive results for investor studies (38% ± 6.1) confirming the results of prior meta-analyses (which we called stylized fact 1 in the previous section). The statistical tests supported this conclusion. Thus, the difference in corporate and investor studies persisted for studies published after 2015. This supported the stylized fact 2—returns from ESG investing are on average not different from conventional investments—for studies published after 2015.

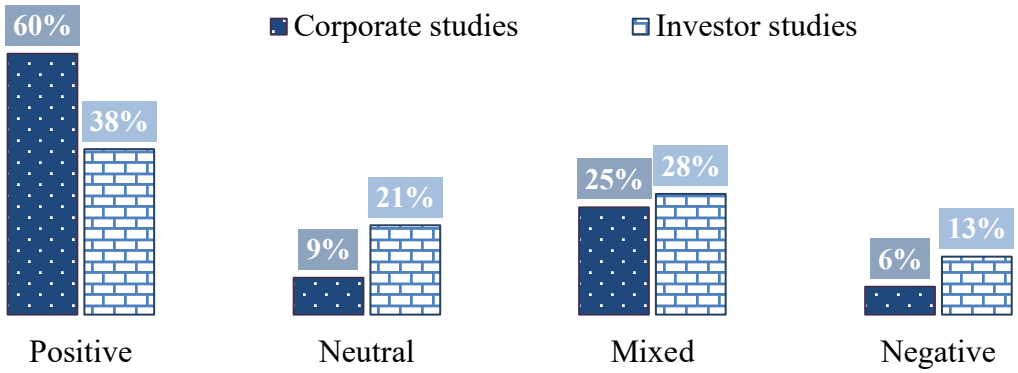

Figure 2. We found strong evidence that positive results, wherein investing in sustainability is positively correlated with financial performance, dominate for corporate but not investor studies (based on 238 studies published between 2015 and 2020). Binomial tests were statistically significant for corporate (p-value <0.0001), but not investor studies (p-value = 0.281). The Wilcoxon signed rank test rejected the null hypothesis of a neutral/mixed median only for corporate studies (p-value <0.0001 and 0.809, respectively). The number of negative studies for both corporate (9) and investor studies (13) was small.

[7] Note that the vast majority of pruned articles are corporate studies because of the 1,141 eligible articles only 159 where investor studies. This implies that the resulting sample of 97 studies are a meaningful representation of the potential complete set of studies.

As a precursor for the ordered choice regression model, we explored the cross-tables of key variables to aid the model building (e.g., to spot data issues). Table 1 shows selected codes that we included in the regression model. Investor studies, for example, had fewer positive results when the study did not consider risk management (14% versus 46%, Table 1 Panel A). Negative screening & divesting as a portfolio management strategy had a larger relative share of negative studies (31% versus 3% for ESG integration, Table 1 Panel B), though the count of studies was low. If the count of studies was low (<10) for a variable, we interpreted the results only in the context of the individual studies.

Table 1. Frequencies and shares of selected study codes across overall findings.

Panel A: Mediating factors (example risk management)	**Count**	**Positive**	**Neutral/ mixed**	**Negative**
Mediating factor risk in corporate studies	13	85%	15%	0%
No mediating factor risk in corporate studies	128	58%	35%	7%
Mediating factor risk in investor studies	26	46%	42%	12%
No mediating factor risk in investor studies	71	14%	51%	35%
Panel B: Study characteristics	**Count**	**Positive**	**Neutral/ mixed**	**Negative**
Study design				
• ESG disclosure	80	45%	41%	13%
• ESG performance	189	56%	36%	8%
• Accounting-based measure	71	52%	35%	13%
• Market-based measure	181	49%	41%	10%
• Aggregate ESG score	50	50%	42%	8%
Identification proxies				
• Implied long-term relationship	132	55%	35%	11%
• Lagged dependent variable	75	53%	36%	11%
• Fixed effects / matching methods / instrumental variables / event study (any)	141	50%	41%	9%
Asset class (investor studies only)				
• Equities	80	38%	49%	14%
• Fixed income	24	33%	54%	12%
Management style (investor studies only)				
• Active	46	37%	46%	17%
• Passive	7	43%	43%	14%
Portfolio management strategy (investor studies only)				
• Negative screening & divesting	13	31%	38%	31%

• Pooled strategies	42	21%	62%	17%
• ESG integration	34	59%	38%	3%

Panel C: Climate change theme characteristics	Count	Positive	Neutral/ mixed	Negative
• Decarbonization	39	59%	31%	10%

Notes. See Online Appendix B: Codebook for further details on variable definitions. Interpret rows with low counts with caution. Counts within groups may not add up to the total number of studies, because studies were either assigned multiple codes or a "not applicable" or "other" code. **Panel A, mediating factor risk:** We assigned a risk management indicator to a study if it particularly considered a strategic risk or ESG risk exposure. When the study used risk-adjusted returns as dependent variable only, then it was not included. An example study is Henisz and McGlinch (2019). **Panel B, portfolio management strategy:** Investors describe practical portfolio management strategies in many ways, sometimes inconsistent. We broadly follow Matos (2020): "ESG and Responsible Institutional Investing Around the World: A Critical Review from the CFA Institute Research Foundation." Existing literature explores several ESG investing strategies in portfolio management. Oftentimes the strategies are used interchangeably without clear distinctions. *Negative screening & divesting* is an investing strategy where companies that do not comply with pre-established ESG principles are excluded from the portfolio. If the paper focuses on the so-called "sin" industries alone, investing (or not) in the tobacco industry or staying away from oil and gas companies, it is coded as negative screening, also. For an example see Richey (2016). *Pooled strategies*: Instead of excluding companies, investors analyze and select firms and assets that exemplify sustainable business practices. If a paper compares ESG investing versus conventional investing, such as comparing ESG mutual funds vs. conventional mutual funds, or SRI mutual funds versus conventional mutual funds, or ESG index vs a benchmark conventional index, the strategy is coded as pooled strategies. For an example see Pereira et al. (2019). *ESG integration* as studied by researchers incorporates ESG analysis into fundamental research and portfolio construction beyond screening or pooled strategies. **Panel C, climate change theme:** Decarbonization relates to carbon intensity, greenhouse gas emissions, or related emissions topics examined in a study such as performance comparison between a carbon-intensive portfolio and low-carbon portfolio (Herbohn et al., 2019).

3.3 Study type was a robust, important predictor for a study's overall finding

Our ordered logit regression model (Table 2) produced stable, statistically significant coefficients for our main variable of interest, the indicator for investor studies, at the conventional threshold of 5%. The results persisted in the individual models (columns 1-4) and the full regression (column 5). The investor study regression coefficient for the latter (-1.594 or positive results were on average 79% less likely) implies that recent papers still show that investor studies were less optimistic, even after controlling for various aspects such as sample region. The climate change theme, in contrast, did not stand out. Study type was also the largest predictor in relative terms. Directionally interesting were also other results, although the statistical significance is secondary for our interpretation: the size of the coefficient for accounting-based measures of financial performance (versus market-based) seemed to suggest a strong negative influence on the overall conclusion. While it is tempting to ascribe a story to other variables, for example, the indicators for identification proxies, we do not think that is appropriate and only took them into

account as tiny pieces of evidence when we developed the propositions. We also tested the grouped variables jointly with appropriate statistical *F*-statistics (not reported).

Table 2. Ordered logit regression model for all studies

	Dependent variable:				
	Overall finding (negative, neutral/mixed, positive)				
	(1)	(2)	(3)	(4)	(5)
Investor study	-0.966*** (0.267)	-1.394*** (0.330)	-1.021*** (0.344)	-1.080*** (0.297)	-1.594*** (0.413)
Climate change theme	0.432 (0.313)	0.625* (0.335)	0.303 (0.339)	0.474 (0.319)	0.550 (0.360)
ESG disclosure (vs performance)		-0.455 (0.280)			-0.278 (0.291)
Accounting-based (vs market)		-0.768** (0.327)			-0.651* (0.336)
ESG score (vs E/S/G/other)		0.492 (0.347)			0.615* (0.357)
Implied long-term relationship			0.290 (0.300)		0.419 (0.313)
Lagged dependent variable			-0.008 (0.337)		-0.040 (0.349)
Fixed effects / matching methods / instrumental variables / event study (any)			-0.486 (0.308)		-0.584* (0.324)
No mainstream social science theory			-0.209 (0.341)		-0.305 (0.355)
Mediating factor: Risk				0.699* (0.377)	0.752* (0.401)
Mediating factor: Operational efficiency				-0.576 (0.486)	-0.637 (0.515)
Mediating factor: Innovation				1.093 (0.676)	0.973 (0.686)
Region FE	No	Yes	Yes	Yes	Yes
Observations	238	238	238	238	238
Pseudo-R^2	0.067	0.116	0.091	0.108	0.166

Notes. This table shows the result of an ordered logit regression model for all in-sample studies with five model specifications. Among all estimates, the investor study indicator, the variable of interest (gray), exhibits the largest statistically significant coefficient, suggesting that the type of research is one of the main explanatory variables for positive or negative results. Control variables such as study design factors are arguably important as well. The

indicator variables for the three mediating factors are proxies and are based on few studies, and they should hence be interpreted with caution. As discussed, we interpret the results of the regression models in descriptive terms. Region fixed effects include global, USA, Europe, and other. See Appendix B: Codebook for the definitions of codes and variables. Pseudo-R^2 is based on Nagelkerke (1991). Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01.

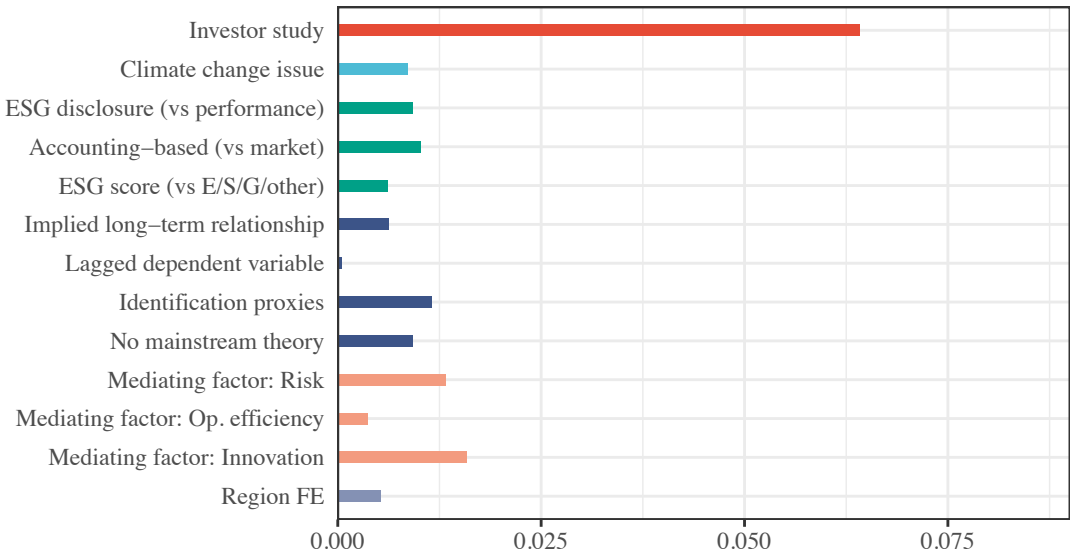

Figure 3. The relative importance of the regression coefficients represented for model (5) in Table 2. The investor study indicator has by far the highest importance. The figures are computed from a Shapley-Shorrocks value decomposition (Elbers, 2021), which uses permutations to infer each regressor's contribution to a measure of overall model fit (here: pseudo-R^2). The colors indicate groupings that enter the model permutations together because it (i) corresponds to the model building in Table 2 and (ii) reduces the computational burden.

In the ordered logit regression model for investor studies only, we were chiefly interested in the predictions of the three variables related to portfolio management strategies (Table 3, gray highlight). As before, it was not simply statistical significance, but the joint evidence from the cross-tables (Table 1) and the papers themselves that led to our propositions. In sum, ESG integration seems to be more associated with positive and/or neutral results than negative screening or pooled strategies. The coefficient signs also corroborated this finding. Finally, the difference between the regression coefficients of negative screening/pooled strategies and ESG integration was statistically significant (not shown). Many regression coefficients, even if not significant, were on an economically meaningful magnitude (e.g., in model 5 studies with ESG disclosure (coefficient -0.789) are 55% less likely to find a positive or neutral result given equal characteristics). The diminished degrees of freedom compared to the previous model, however, means that results become more model-dependent.

Table 3. Ordered logit regression model for investor studies

	Dependent variable:				
	Overall finding (negative, neutral/mixed, positive)				
	(1)	(2)	(3)	(4)	(5)
Negative screening or divesting	-0.868 (0.620)	-0.792 (0.632)	-0.671 (0.644)	-0.560 (0.665)	-0.406 (0.676)
Pooled strategies	-0.633 (0.473)	-0.382 (0.584)	-0.423 (0.586)	-0.185 (0.611)	-0.229 (0.611)
ESG integration	1.092** (0.498)	1.221** (0.545)	1.103* (0.586)	1.533** (0.612)	1.487** (0.659)
Climate change theme		0.337 (0.519)	0.148 (0.590)	0.244 (0.523)	-0.059 (0.613)
ESG disclosure (vs performance)			-0.662 (0.544)		-0.789 (0.560)
Accounting-based (vs market)			-0.345 (0.885)		-0.240 (0.878)
ESG score (vs E/S/G/other)			-0.455 (0.632)		-0.662 (0.660)
Active management				-0.273 (0.457)	-0.191 (0.464)
Equities				-0.696 (0.635)	-0.893 (0.657)
Region FE	No	Yes	Yes	Yes	Yes
Observations	97	97	97	97	97
Pseudo-R^2	0.165	0.174	0.192	0.188	0.21

Notes. This table shows the result of an ordered logit regression model for investor studies with five model specifications. The coefficient for ESG integration as defined by researchers, one of the variables of interest (gray), was largest among portfolio management strategies suggesting that papers that relied on this particular investment characteristic were more likely to find positive or neutral results. The difference between negative screening or divesting / pooled strategies and ESG integration was statistically significant (not shown). Region fixed effects include global, USA, Europe, and other. See Appendix B: Codebook for the definitions of codes and variables. Pseudo-R^2 is based on Nagelkerke (1991). Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01.

Furthermore, we devised a third regression model for the subsample of climate change studies (Table 4). Decarbonization—carbon intensity, greenhouse gas emissions, or related emissions topics examined in a study—represents our main variable of interest. The model specifications exclude variables that were less relevant to the climate change theme: for example, most of the studies would be coded as "E" (of E/S/G or ESG), so the variables related to ESG scores were

excluded. The small universe of studies is consistent with the findings of Diaz-Rainey et al. (2017) mentioned before. However, this makes it difficult to reliably estimate the model due to issues such as collinearity (compare model 4 and 5, for example). Again, we used the results not in isolation but to develop proposition 3. While it is hard to discern a statistically significant effect for the decarbonization indicator, it appeared to show a positive association with the study's overall finding around a coefficient of 1.1 (i.e., an odds ratio of 3). Broadly speaking, the model estimates are in line with the previous two models (e.g., the negative sign of investor studies).

Table 4. Ordered logit regression model for studies with a climate change theme

	Dependent variable:				
	Overall finding (negative, neutral/mixed, positive)				
	(1)	(2)	(3)	(4)	(5)
Decarbonization	0.830 (0.624)	1.171* (0.685)	1.149 (0.709)	2.473* (1.432)	1.370 (0.976)
Investor study	-1.300** (0.623)	-1.860** (0.810)	-1.822** (0.831)		
ESG disclosure (vs performance)		-0.942 (0.631)	-0.932 (0.684)	-0.678 (0.870)	-0.961 (0.809)
Accounting-based (vs market)		-0.892 (0.857)	-0.920 (0.882)	0.234 (1.436)	0.856 (1.463)
Negative screening or divesting				-1.810 (1.163)	
Pooled strategies				-1.309 (1.150)	
ESG integration				3.995*** (1.498)	
Active management					-0.288 (0.731)
Equities					0.561 (0.821)
Region FE	No	No	Yes	No	No
Observations	57	57	57	35	35
Pseudo-8R^2	0.101	0.151	0.161	0.552	0.111

Notes. This table shows the result of an ordered logit regression model for investor studies with a climate change theme across five model specifications. Models 4 and 5 only include investor studies. Decarbonization—carbon intensity, greenhouse gas emissions, or related emissions topics examined in a study such as performance

comparison between a carbon-intensive portfolio and low-carbon portfolio (Herbohn et al., 2019)—represents our main variable of interest. Its regression coefficient is estimated around a coefficient of 1.1 (an odds ratio of 3), hence indicating a positive association. The model (and statistical inference) is hobbled by a low sample size and collinearity. Region fixed effects include global, USA, Europe, and "other". See Appendix B: Codebook for the definitions of codes and variables. Pseudo-R^2 is based on Nagelkerke (1991). Standard errors in parentheses; *p<0.1; **p<0.05; ***p<0.01.

4 Discussion and interpretation

4.1 Five explanations that can justify the difference in results between corporate and investor studies

We reported that most studies found that returns from ESG investing—averaged across many portfolio management strategies—are indistinguishable from conventional investing. At the same time, there seems to be robust evidence for corporate managers that justify investments in sustainability for better corporate financial performance as well as plenty of industry reports that show an "ESG alpha" (e.g. Clark and Lalit, 2020; Morningstar, 2021). This is puzzling at first: if sustainability is correlated with better corporate performance, why do the investments in superior sustainability assets not yield improved investor returns*?* To resolve this puzzle, we pose the following hypothetical explanations (E):

1. E1: ESG investing is not a single approach, and while some strategies outperform the market, others do not. Many academic researchers chose a pooled sample of portfolio management strategies without distinguishing different approaches. Ethical investment funds, for example, may not strive to outperform the market, but they will show up as an ESG strategy.
2. E2: ESG investing yields asymmetric benefits (e.g., downside protection), so its benefits are evaluated under particular conditions (e.g., a crisis). Risk parameters for corporate managers and investors may be different, and these differences in how risk is measured in academic studies might lead to diverging results.
3. E3: Investors are not able to implement desired portfolios consistently because of practical (data or accounting) constraints. For instance, ESG metrics for many companies are only recently available and with inconsistent quality.
4. E4: Markets may already be aware of the benefits of high ESG performance. If the market prices ESG strategies correctly, or if they perform at the level of conventional

investing, researchers would not be able to find abnormal results. Together with E1 and E3, we noticed a relative lack of clarity for investor studies compared to corporate studies.

5. E5: Mechanically linking ESG to alpha can lead to specious results for a range of reasons. For example, it is conceivable that results are different for comparing companies cross-sectionally vis-à-vis over time. In that case, and if investor studies were to adopt a long-term analysis and corporate studies were not, we would expect different aggregate results.

Our study did not set out to answer which of these five explanations is most appropriate because we only developed them after we discovered our finding on the corporate-investor study differences. Nonetheless, we attempted to evaluate the relative strength of each below.

We found differences in portfolio management strategies (E1) and that, at least in the short-term, the market does not always price ESG information correctly (E4). For example, the popularity of ESG investing could have led to market inefficiencies (Cao et al., 2019; Jiang and Weng, 2019) that were later corrected. Furthermore, E2 on asymmetric benefits was also supported: risk management stood out as the most salient mediating factor of how sustainability leads to financial success. Studies that looked at performance during social or economic crises corroborated this conclusion, which we elaborate on via proposition 2. Therefore, we do not claim that studies that found abnormal returns for ESG investments must be a statistical aberration; rather that the study may have found a more specific setting where it may be able to document a market phenomenon. As with the meta-analyses before, the danger of aggregating studies is that it obscures the underlying details.

Plenty of technical evidence also points to the shortcomings of accounting metrics and ESG data (Berg et al., 2022; Chatterji et al., 2016; Christensen et al., 2022). Thus, investors may not have access to actionable or material metrics (E3). Eccles et al. (2017), for example, reviewed a global survey of institutional investors and concluded that “the biggest barrier is the lack of high quality data about the performance of companies on their material ESG factors”. We found that at least 40% of studies looking at ESG performance relied on an overall, third-party ESG score. Combined with the fact that many studies used a data sample with years going back to 2010 and beyond, when ESG data was evolving, investors may have appraised sustainability coarsely in

the past. A related explanation is that many investors consider low ESG scores as a simple "red flag" signal for poor management—as such ESG scores act as a disciplinary token—instead of using it as a continuous measure of ESG performance.[8] Similarly, recent studies show that ESG performance can be used as a way to see if firms (Li and Wu, 2020) and funds (Kim and Yoon, 2022) are performing up to their commitments.

We were not able to assess the relative importance of these proposed explanations because it was outside of the original scope and, hence, we were restricted by our research design. For example, we limited ourselves to the most recent peer-reviewed studies (though the in-scope meta-analyses reach back further in time). We treated all studies as equal in weight and did not discriminate based on sample size or journal impact factor (we did, however, select the regression model sample based on stratified quality criteria). Lastly, we assigned codes based on facets of ESG research, with inevitable gray areas, but we did not design those codes to distinguish between the five hypothetical explanations. A future study may specifically set out to research this question.

5 Propositions for ESG finance

5.1 Proposition 1: ESG integration as a strategy seems to perform better than screening and divesting.

If we understand ESG integration as a more sophisticated strategy compared to screening and divesting, then our proposition is intuitive on a basic level. Unfortunately, not many studies were clear on whether their data was based on a specific portfolio management strategy. Where possible, we assigned codes based on negative screening and divesting, pooled strategies, and ESG integration as they were created or defined by researchers (see Table 1 note). Both negative screening and pooled strategies were less often associated with neutral/positive results than what we coded as ESG integration. Given that pooled strategies include all forms of portfolio management strategies, we interpreted this as screening and divesting driving the poorer results. It may also be explained by some of the following reasons. For example, some researchers

[8] We thank an anonymous reviewer for this suggested explanation.

argued that they could explain the underperformance of SRI funds by negative screening or that there were opportunity costs to negative screening (Leite and Cortez, 2015; Trinks and Scholtens, 2017). Some scholars brought inverse reasoning to the table by looking at "sin" portfolios, which sometimes outperform a market portfolio (Richey, 2016). Yet Blitz and Fabozzi (2017) resolved this anomaly by controlling for the two new Fama-French quality factors. The research here, like the markets themselves, are evolving. Especially for climate change, investors pursuing long-term strategies ought to consider ESG integration, risk management, and engagement instead of divestment (Krueger et al., 2020).

ESG integration is not a single approach either. A popular approach uses non-financial ESG data to improve a specific portfolio's exposure to risk and opportunities (instead of analyzing a sample of ESG funds). Typically, researchers were looking for best-in-class companies, for example, those falling into the top 5th quintile. Recently some scholars also explored the idea of relying on the most improving companies or a form of momentum strategy. If the momentum effect is stronger for firms with low ESG ratings, there might be an opportunity for investors to achieve abnormal returns (Kaiser and Welters, 2019). Giese et al. (2019) also showed that when the ESG characteristic of a company change, based on MSCI ESG data, it may be a useful financial indicator for generating alpha.

ESG integration, however, depends on quality data, and most ESG disclosures are still voluntary, unstandardized, and unaudited. While there are some guidelines in place, specific firms may pursue all sorts of unconventional (and often not material) ESG disclosures. This makes it difficult to use them across portfolio companies. One study, moreover, pointed to the counter-productive use of sustainability claims (Woodroof et al., 2019), where the authors studied cause-related marketing in an event study and found negative effects. Related to investors, Kim and Yoon (2022) concluded that UN PRI signatories (asset managers), did not improve their ESG score and also had worse sustainability and financial performance than their peers. Without a doubt, investors are looking keenly at the current efforts by the IFRS Foundation, the Security and Exchange Commission, the Sustainability Accounting Standards Board, and other standard setters on how to improve ESG disclosures.

5.2 Proposition 2: ESG investing provides asymmetric benefits, especially during a social or economic crisis

ESG as downside protection. In relative terms, risk management as a mediating factor (or materiality pathway) appeared most often in ESG investing studies. One interpretation of Table 1 Panel A is that ESG investing provides downside protection or an "insurance-like effect" (Bannier et al., 2019). Firms that score poorly on ESG factors would have to offer a risk premium and this may be even more pronounced in volatile capital markets. While we did not find striking evidence in our analysis, the combined weight of Table 1 and the associated studies (particularly those for climate change) led us to the proposition that ESG investing provides asymmetric benefits. One reason for this finding might be that regulatory compliance is a big driver of risk as a mediating factor. ESG news provided a clear illustration of the asymmetric benefits: in one event study, companies gained nothing on average from positive news, but their market value reduced by 0.1% when they had negative announcements (Capelle-Blancard and Petit, 2019). An earlier meta-analytical review of 32 event studies concluded the same (Endrikat, 2016). Thinking in terms of ESG risk management may be more familiar to investors than corporate managers with some studies detailing its financial benefits: for example, portfolios with lower ESG risks can maintain risk-adjusted performance (Hübel and Scholz, 2020). Gloßner (2018) concluded that "controversial firms with a known history of ESG incidents exhibit a four-factor alpha of –3.5% per year, even when controlling for other risk factors, industries, or firm characteristics." Crises are another example when asymmetric benefits arise.

Events before the COVID-19 crisis provided a prime case study for researchers to analyze how ESG investing fared during a crisis. For example, Fernández et al. (2019) found that during the financial crisis (2007-2009) German green mutual funds achieved slightly higher adjusted returns than their peers. This result did not appear during non-crisis years, though they still performed more strongly than SRI funds. Similarly, the FTSE4Good, a set of ESG stock market indices, performed better and recovered its value quicker after the 2008 financial crash (Wu et al., 2017). French and UK SRI funds were not significantly different before and during the crisis but the author found that they were less risky portfolios (Syed, 2017). In the same vein, Leite and Cortez (2018) noted that "SRI funds were significantly less exposed to bonds issued by the countries most affected by the Euro sovereign debt crisis." These findings seem to hold in general for economic downturns as high rated ESG mutual funds outperformed low rated funds

based on the Sharpe ratio (Chatterjee, 2018; Das et al., 2018). Also the specific example of China's food safety crisis showed that ESG performance has an "insurance-like effect" (Kong et al., 2019).

ESG as "safe haven". The COVID-19 crisis suggests that ESG investment strategy and ESG assets exhibit "safe haven" properties. During Q1 2020, for example, the value of capital flowing into sustainable funds reached $46 billion worldwide, contrasting with the $385 billion outflows experienced by global funds in general (Morningstar, 2020a). Immediately following the outbreak of the pandemic, a research note from Morningstar published in April 2020 documented a stronger resilience of ESG index funds, where 24 of 26 of them beat their closest conventional counterparts (Morningstar, 2020b). One interpretation of these statistics ascribes ESG funds of providing downside protection. Regarding the equity markets, ESG stocks were found to exhibit "safe haven" properties but were contingent upon the pandemic (Rubbaniy et al., 2021). Scholars also found that the role of ESG performance is attenuated in non-crisis times (Broadstock et al., 2021). But there exist also dissenting voices that claim that it is other factors such as intangible investment that explain the success of ESG funds during the pandemic (Demers et al., 2021). While our original systematic review ends before March 2020, we extended the sample with a comparable search strategy focused on COVID-19 articles. As we did not follow the same process as before, we caution the reader that the interpretation below represents a particular snapshot in time. Future research will undoubtedly shed more light on this proposition.

Since the start of the pandemic, several studies and working papers examined the impact of the pandemic on the relative performance of ESG strategies. Scholars found evidence suggesting ESG investment strategies generated higher return probability due to spillover effects across different types of asset classes and investment strategies (Singh, 2020). Using sentiment analysis based on news signals, researchers found that a more positive response to the initial crisis in March 2020 was associated with less negative returns (Cheema-Fox et al., 2020). In this case, industry reports of the relative performance of ESG strategy during the COVID-19 pandemic have shown similar results as the academic literature. For example, a research article published by the Asian Infrastructure Investment Bank found an overall outperformance and less volatility of ESG-focused investments as compared to their non-ESG benchmark counterparts (Asian Infrastructure Investment Bank, 2020). Scholars have also attempted to debunk the link between financial return and ESG fund rating and found that "higher sustainability performance for ETFs

do not safeguard within an investor portfolio during a severe market downturn" (Folger-Laronde et al., 2020). The authors explained this disconnect by pointing at two well-known measurement challenges, where indicators are not available in time and ESG ratings are produced in an environment lacking transparency. Ultimately, it remains challenging to present convincing evidence for or against an ESG premium. What seems indisputable, however, is the exponential rise in the interest and inflows in ESG funds, whether that is for a "safe haven" conviction or for other reasons.

5.3 Proposition 3: Decarbonization strategies can potentially capture a climate risk premium.

Over the past five years, major central banks, leading multilateral financial institutions, as well as a growing number of institutional investors have discussed financial stability risk from climate change perspective.[9] The importance of climate risk for companies also shows up in financial reporting: In 2020, two-thirds of companies in the S&P 500 referred to climate change metrics in their 10-K filings compared to less than half in previous year (Datamaran, 2020). Similarly, Benz et al. (2020) found that climate change has arrived in asset management because institutional investors engaged in what they call decarbonization herding: when other investors buy green stock, so do they.

Climate risk premium. A growing number of studies have focused on portfolio companies' exposure to climate change related risk factors and "stranded assets." The current literature is converging upon the existence of a climate risk premium – but not without conflicting interpretations. For example, using European stock market data, Lucia, Ossola, and Panzica (2019) provided evidence of the existence of a negative and highly statistically significant

[9] For example, Carney, Mark. 2015. "Breaking the Tragedy of the Horizon— Climate Change and Financial Stability." Speech given at Lloyd's of London, September 29; International Monetary Fund (IMF). 2016. "After Paris: Fiscal, Macroeconomic, and Financial Implications of Climate Change." IMF Staff Discussion Note 16/01, International Monetary Fund, Washington, DC; European Systemic Risk Board (ESRB). 2016. "Too Late, Too Sudden: Transition to a Low-Carbon Economy and Systemic Risk." Frankfurt; Bank of England Prudential Regulation Authority. 2018. "Transition in Thinking: The Impact of Climate Change on the UK Banking Sector." London; Lane, Philip R. 2019. "Climate Change and the Irish Financial System." Central Bank of Ireland *Economic Letter* 2019 (1). European Central Bank. 2019. "Special Feature: Climate Change and Financial Stability." *Financial Stability Review*. Frankfurt. Network for Greening the Financial System. 2019. "A Call for Action. Climate Change as a Source of Financial Risk." Paris.

"greenium", a negative risk premium, meaning green bonds tend to have lower yield compared to non-green bonds with otherwise similar characteristics. Balvers, Du, and Zhao (2017) also found a significantly negative risk premium associated with temperature shocks that could increase weighted average cost of equity capital by 0.22%, or a present value loss of 7.92%. However, these findings do not provide a definitive proof against the return potential of a high carbon portfolio. In fact, some scholars suggest a widespread carbon premium, implying that there are higher returns for companies with higher carbon emissions. For example, Oestreich and Tsiakas (2015) documented the presence of a large and statistically significant "carbon premium" in their studies of the effect of the EU Emissions Trading Scheme on German stock returns. Similarly, Bolton and Kacperczyk (2021) also found a significant "carbon premium" in the US stock market as evidenced by stocks of firms with higher total carbon emissions and changes in emissions earning higher returns. They interpret their findings as evidence for a priced-in carbon risk premium in contrast to a carbon alpha.

How can we resolve the paradoxical co-existence of a climate risk premium and a carbon premium? One explanation might be that the findings on the carbon premium are driven by investors who demand to be compensated for their exposure to idiosyncratic risk factors associated with climate risk, which is not necessarily contradictory with a "greenium." Indeed, Bolton and Kacperczyk (2021) found no carbon premium associated with emission intensity. Another explanation could be the discrepancies in different carbon data used in these studies, which suffer from the well-documented shortcomings of ESG data. Future research may provide more conclusive evidence if regulatory changes and investor engagement lead to mandatory and audited carbon disclosures.

Market inefficiency. The climate risk premium, however, may not seem to be accurately priced by the market as it stands now, which points to the possibility of current market inefficiency regarding climate risk pricing. The IMF (2020) warned global equity investors about the possibility of insufficiently pricing climate risk premiums. Investors could potentially achieve higher returns with appropriate investment strategies. For example, Jiang and Weng (2019) demonstrated that a long-short stock trading strategy can earn positive returns with zero cost over a one-year holding period for a 26-year test period. Along a similar line, Bernardini, Di Giampaolo, Faiella, and Poli (2019) showed that investment strategy that focused more on low-carbon companies could have delivered higher returns without modifying the overall risk profile

in the context of European electric utilities. In our exploratory model we found that decarbonization-related strategies are positively associated with studies that found stronger financial returns (Table 3). Our model takes the individual study as the unit of analysis, which assumes that the underlying methodologies are broadly comparable. Nonetheless, as mentioned before, directed research points towards market inefficiencies stemming from the rise in ESG popularity (Cao et al., 2019; Jiang and Weng, 2019).

Research limitations. Contemporary research on climate change particularly exhibits research limitations with quantifying climate risk due to disclosures, perceptions, data quality, and a greater number of not peer-reviewed manuscripts. These issues echo the limitations of ESG data in general. For example, using survey data of around 700 global investors and companies on the materiality of climate risk for financial reporting, Amel-Zadeh (2018) found a lack of disclosures by the companies contributes to the challenges in assessing the impact of climate change. In particular, far fewer companies believe that they are exposed to climate risks and consequently do not make any disclosures. This lack of disclosures makes it difficult for investors to identify and quantify risks. Monnin (2018) argued that current credit risk analysis has not adequately incorporated climate risks and called for continued efforts in developing methodologies that allow integrating physical and transition risks into credit assessment. Ilhan, Krueger, Sautner, and Starks (2019) also surveyed global institutional investors on portfolio firms' climate risk disclosures. Their survey revealed that many investors think that climate risk disclosure needs improvement and that firm-level reporting should be more standardized and mandatory.

Much remains unknown: scholars have acknowledged a dearth of climate finance research in the existing academic literature. We mentioned earlier that to none of the three elite finance journals (*Journal of Finance*, *Journal of Financial Economics*, and *Review of Financial Studies*) published a single article related to climate finance over the time period of the review studies (Diaz-Rainey et al., 2017; Zhang et al., 2019). Progress is happening – for example, the *Review of Financial Studies* published a special climate finance edition in February, 2020 (Hong et al., 2020). This issue covered papers on the social cost of carbon, carbon pricing risks, the effects of varying climate change beliefs, the economic costs of climate change, and corporate short-termism. With rising attention and interests in climate change related investing, this field will move forward briskly, providing an opportunity to further test our proposition. The surge of publications in the past five years supports this conclusion.

6 Conclusion

We found that ESG research is accelerating based on the universe of studies published between 2015-2020: we identified around 1,100 studies concerned with the business case for sustainability and the results of ESG investing. Our systematic protocol allowed us to review more than a fifth of them in detail to confirm two stylized facts from 15 recent meta-analyses. In contrast with research from management and related disciplines as well as findings purported by industry reports, we did *not* find an outsized financial return for ESG strategies. The bulk of studies concluded that there was either no statistical difference compared to a conventional benchmark or that results were positive and negative (i.e., mixed) within a study. We also argued that the academic literature in finance is more challenged by the many dimensions of sustainability, by the shortcomings of ESG data, and by pooling different investment strategies compared to the more mature corporate / management literature. This, in turn, puts more emphasis on field journals and industry reports, whereas the top finance journals, as documented in prior reviews and recent special issues, are catching up.

We interpreted the result of our extensive coding, literature review, and regression model results as a set of three propositions, shown again here:

1. ESG integration as a strategy seems to perform better than screening and divesting.
2. ESG investing provides asymmetric benefits, especially as during a social or economic crisis.
3. Decarbonization strategies can potentially capture a climate risk premium.

While we appreciate the want for an overall, universal result on whether ESG delivers or not, we emphasize again that it is the details and mechanisms of the relationship between sustainable investments and financial performance that matter more. For one, we suggest that the classification of sustainable investment strategies is ambiguous, and so future research, which carefully assesses the different ESG strategies, ought to provide us with richer findings. In academia, we are only at the beginning to tease apart the mediating factors (or materiality pathways) that allow us to discern when and how sustainability strategies are meaningful differentiators.

Finally, finance is not a static field, so it is likely that these propositions will evolve. We encourage researchers and practitioners to test them critically. Over time, markets either adapt—where climate change strategies become a common practice instead of a source of competitive advantage—or our propositions become new stylized facts themselves.

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