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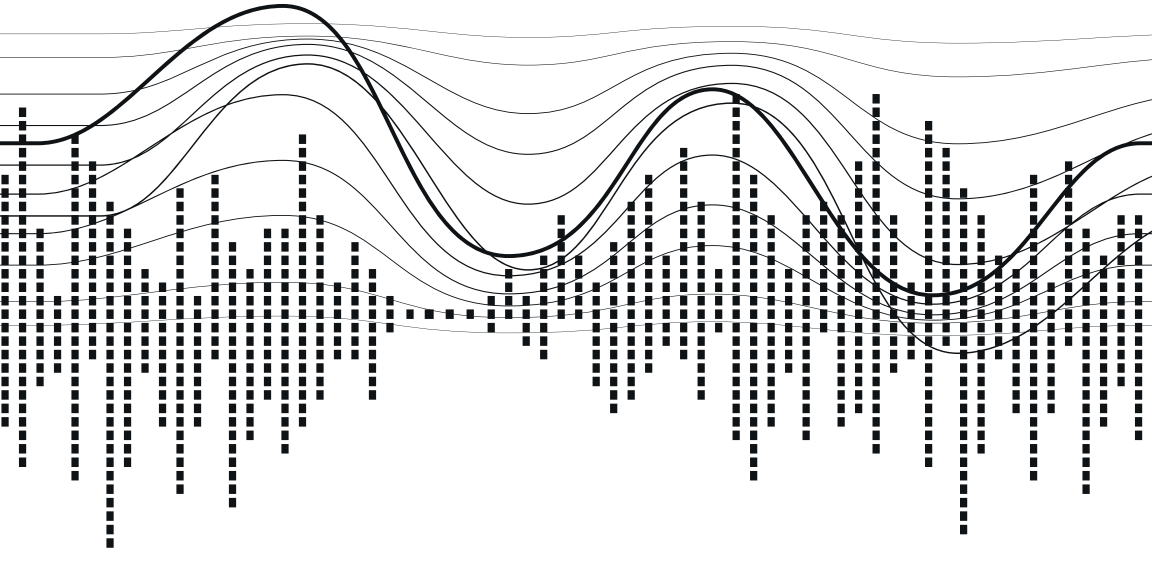

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The Journal of Environmental Investing

State of ESG Data and Metrics

Volume 8, No. 1, (2017)

Edited by Cary Krosinsky

Guest Editors, Prof. Dan Esty and Prof. Todd Cort

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The Editor's word

Cary Krosinsky

Special Issue of the *Journal of Environmental Investing*, State of ESG Data and Metrics

It is with great pride that we bring you this issue of the Journal of Environmental Investing, looking for the first time at the **State of ESG Data and Metrics**, marking our 8th year of publication, and hosted for the first time by two leading academics at Yale, Professors Dan Esty and Todd Cort.

My own journey to sustainable investing took me from earlier careers in technology and what is now mostly referred to as big data (we built the original global institutional ownership data one now sees on Bloomberg terminals), towards an eventual goal of 'let's take this ownership data on global institutional ownership and add environmental or social metrics' to see how mutual funds were doing on a comparative basis. This brought me into the formation of the PRI process in 2005, and eventually into the Carbon Tracker Initiative and Trucost, both of which had interest in versions of this concept of mutual fund performance (now moving forward as Real Impact Tracker).

However, as we have seen, and can see in this issue of the JEI, the existing ESG Data has strengths and weaknesses.

While I was truly thrilled to see the 2016 launch of the Morningstar Globe system of mutual funds being ranked for the first time on their ESG performance, when Parnassus Endeavor only received 3 out of 5 Globes on launch (and is still at 3 Globes as of this writing), and understanding that fund's significant financial outperformance using value investment strategies, the flaws in simple applications of ESG data were exposed for all to see. It is also a question as to whether an ESG data shop such as Sustainalytics, now owned 40% by Morningstar (or MSCI or Trucost or anyone else who derives their revenue from investors for that matter) would ever want to be seen as critics of their customers. That is just one of the flaws I have seen being embedded in the world of ESG data.

In fact, one would like to suggest we've had the entire ESG data system exactly backwards.

Instead of building ESG databases and then trying to figure out how to use them, let's instead:

1. **figure out what outcomes do we seek,** then
2. **pinpoint the strategies we need to deploy,** and finally,
3. **determine what data we need to see how we are doing**

This way, ESG data can be useful, and I think the most important word I can offer is just that – **useful**.

Data is either useful, or it isn't, and if thought of as information that tells us what else we might need to do differently, then it couldn't be more important. I'm less convinced myself in the word "materiality," which is more loaded and baked in with existing SEC definitions and interpretations which can be local or regionally as opposed to globally relevant.

And all this is why I am truly thrilled and honored to be helping bring you this issue of the Journal of Environmental Investing. We are attempting to bring you just this sort of three-step decision tree described above, with specific use cases demonstrating when ESG data has been useful (and am also thrilled to be co-teaching Sustainable Finance at the Yale School of Management for the first time with Todd Cort, diving into just such questions as well).

Here you will find use cases, such as on satellites and how to use them to derive better ESG data and invest accordingly as well as on machine learning and ESG. A number of papers are also provided on specific alpha strategies, on green bonds and financial performance, on the future of indices and a number of other specific corporate and investor use case perspectives.

Sustainable Investing remains a nascent field of sorts, but now every fund manager needs to be in this game. The race is on to develop the best investment processes and in this age of increasing transparency, investors need to be thorough, and understand where data specifically helps them.

With corporations continuing to see a "wild west" of ESG data requests, and no sign that policy makers have straightened this situation out, we hope to have started an important conversation on just this area of use cases and ESG data utility in this issue of the journal.

Guest Editors' Introduction

Rethinking Environmental/Social/Governance Metrics for the Mainstream Investor

Daniel C. Esty & Todd Cort, guest editors

Interest in *sustainable investing* has broadened and deepened in the past few years. No longer confined to a small niche of *socially responsible* (SRI) investors, the desire for metrics that gauge the environmental, social, and governance (ESG) performance of companies has expanded into the mainstream investment domain. Where the core focus of SRI investors centered on *negative screening*, which entailed the exclusion of disfavored industries – such as alcohol, tobacco, or gun making – or companies with bad track records on critical issues – such as pollution control or respect for labor rights – today's mainstream sustainability-minded investors are more diverse in their interests and therefore in their ESG data needs.

The sustainability interests of these investors, in fact, vary widely. Some have specific issues of concern in mind (such as climate change or a lack of diversity in the workforce) – and they want their portfolios to reflect these values. In this regard, a growing number of investors have asked their account managers to divest from companies with significant greenhouse gas emissions, but exactly how this should be done is often not clear. Likewise, those who care about diversity have signaled their desire not to own shares of companies that lack a significant female presence in their top management, but the data necessary to implement this preference too often are hard to come by.

Other investors wish to put their money into businesses that are helping to address societal challenges. Thus, some *impact* investors with a commitment to climate change action want to put their capital to work in corporations that are bringing renewable power or energy efficiency to the marketplace. How far these impact investors are willing to go in terms of accepting sub-par returns as the price for having their investments aligned with their values again varies widely. Some are willing to undertake significant risks to promote their values and commitment to social change. Others want to lean in the direction of their preferences but only to the extent that this tilt in their portfolio does not produce significantly diminished returns. Yet other investors believe that companies that are out in front on critical issues – such as the push toward a clean energy future or a more diverse workforce – will deliver superior returns from corporate valuation or improved diversification. But too often the ESG metrics available are risk-focused and not very

helpful when it comes to identifying the companies that are delivering value by solving societal problems.

ESG analytics firms have grown with the rising demand from asset owners and asset managers. We have seen an explosion in coverage, metrics, and indices that seek to provide insight into ESG performance even through the recent consolidation in analytic firms. And yet, in our work in the sustainable investment arena, we hear time and time again a frustration with the current state of ESG metrics. Frustration from companies that must fill out questionnaire upon questionnaire asking for the same information, much of which is in the public domain. Frustration from asset managers who see discrepancies between ESG scores across the board – and justifiably retain skepticism as to whether the scores reflect any sort of reality. Frustration among asset owners that must sift through the soup of ESG metrics to find those that match their particular investment strategies. Frustration from society and policymakers who hope to see transformational shifts in capital toward sustainable investments that will improve both the bottom line and the world.

This special issue of the *Journal of Environmental Investing (JEI)* seeks to map the rise of sustainable investing with all of its various dimensions and investor preferences and to sharpen the focus on how ESG metrics must evolve to keep up with growing demand for guidance on what represents corporate sustainability leadership. The articles that follow reflect contributions from scholars and practitioners. Some of them offer frameworks for understanding who the new sustainability-minded investors are and what they want in the way of ESG data. Others put forward ideas about how improved ESG metrics might be constructed and explain ways that advanced data analytics might better highlight sustainability strategies that will have a material impact on financial performance. Yet other articles discuss new tools that can refine ESG analyses in the years ahead including machine learning and statistical techniques for better data normalization.

Yet, despite the wide range of perspectives, approaches, and techniques described in this issue of the JEI, some common themes emerge. First, despite the frustration with the existing ESG data, there exists a sense of optimism and confidence that the world is inexorably turning toward greater focus on sustainability. A focus on ESG factors must, therefore, be understood not as a fad but the new reality of investing. Thus, there is virtually no discussion in these articles of *whether* ESG metrics will become an integral part of investing decisions. Rather, these articles explore the *how* of this transition will unfold. Whether targeted at more integrated risk assessment, or valuation of intangibles, or identifying tomorrow's market leaders, the articles in this issue universally demonstrate pathways to more successful investment strategies using ESG metrics and analyses as a tool.

A second common theme is the acknowledgement that one size of ESG metrics will not fit all. ESG strategies are as diverse as investment strategies more generally. It is thus folly to suggest that a single set of metrics will meet the needs of the investor universe. That said, there are clear mechanisms emerging with which to assess those metrics that are meaningful and those that are not. Whether it is more robust materiality processes, better normalization techniques, the application of big data, or a more refined metrics menu, each paper offers a set of options for engaged investors.

As the guest editors of this special issue of the *Journal of Environmental Investing*, we are pleased with the array of articles that follow – and the contribution that they make, individually and collectively, toward strengthening the foundations for sustainable investing. In many ways, these pieces raise more questions than they answer – a hallmark of important analytic work in a significant new scholarly domain. These questions are also some of our key takeaways from the Issue: Who should drive the process of making ESG metrics more consistent, reliable, and informative? What is the most appropriate role for policymakers in the development of ESG metrics? What are the remaining hurdles to scaled-up sustainable investing? We invite your critique and comment on the articles and look forward to the debates that will follow.

Acknowledgments

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Corporate Sustainability Metrics: What Investors Need and Don't Get

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Abstract

Traditional socially responsible investors use environment, social, and governance (ESG) metrics to exclude "bad actor" companies from their portfolios with little regard to the impact on returns. But new interest in sustainable investing has emerged from mainstream investors who hope to match or beat market results. The prevailing wisdom among mainstream investors suggests, however, that corporate sustainability leadership only rarely translates into financial success. This article challenges that conclusion. It argues that a "next-generation" ESG framework could provide the rigor, integrity, and flexibility needed to meet diverse investor needs and might well demonstrate that some aspects of sustainability (but not all) deliver business gains.

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Introduction

Socially responsible investors (SRI) have long worked to align their portfolios with their *values* – seeking to steer clear of owning shares of corporate bad actors including big polluters. Interest in corporate sustainability has recently emerged among a broader group of mainstream equity investors. Some of these *value* investors (defined by the fact that they *do care* about their portfolio returns) want to put their money into sustainability leaders with an expectation that these companies will outperform the market over time. Others simply want to mitigate risk by dumping shares of companies that they fear will underperform in the years ahead as climate change and other sustainability concerns become more salient. And yet others would like to put their money to work in support of a sustainable future with varying degrees of willingness to have this tilt in their portfolio produce volatility or "tracking error" – and reduced returns compared with benchmark investment vehicles.[1]

Evidence of sustainability's move from the margins of the investment world to the mainstream can be seen in the groundswell of interest in the United Nations Principles for Responsible Investment (UNPRI). This initiative strives to integrate sustainability, including environmental responsibility, into the financial arena by requiring investors to adopt six guiding principles.[2] In 2016, the UNPRI reported over 1700 signatories including almost 1200 investment managers and asset owners representing over $59 trillion in assets under management (up from $4 trillion in 2006) (UNPRI, 2015). In another gauge of this trend, the Global Sustainable Investment Alliance (GSIA) reported that $6.57 trillion of U.S. assets under management are invested in *sustainable*, *responsible*, or *impact* investment strategies. This total represents an increase of 76% since 2012 (GSIA, 2014). In a similar vein, the US Forum for Sustainable and Responsible Investment Foundation identified $8.10 trillion in US-domiciled assets that apply various environment, social, and governance (ESG) criteria in their investment analysis and portfolio selection (US SIF, 2016). Sustainability in fixed income markets is also growing including the rise of green bonds (Desclée et al, 2016) and associated standards for labeling (Climate Bonds Initiative, 2017).

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[1] Tracking error (sometimes called "active risk") is defined as the divergence between a particular portfolio and the baseline investment framework against which it is benchmarked.

[2] The Six Principles of Responsible Investing are as follows: 1. We will incorporate ESG issues into *investment analysis* and decision-making processes; 2. We will be active owners and incorporate ESG issues into our ownership policies and practices; 3. We will seek appropriate disclosure on ESG issues by the entities in which we invest; 4. We will promote acceptance and implementation of the Principles within the investment industry; 5. We will work together to enhance our effectiveness in implementing the Principles; 6. We will each report on our activities and progress towards implementing the Principles. "PRI Six Principles," accessed June 7, 2016, https://www.unpri.org/about/the-six-principles.

A range of thought leaders are adding momentum to mainstream investor interest in sustainability. Michael Bloomberg, for example, recently called on companies to report more fully on their climate change impacts (Ralph, 2016). Likewise, Larry Fink, the CEO of BlackRock, the world's largest asset manager, authored a widely disseminated letter to corporate leaders arguing for more attention to environmental and social elements of corporate performance (Turner, 2016).

Sustainable investments nevertheless represent a relatively small percentage of total assets under management. For example, the $8.72 trillion of sustainable investments in the US reported by the GSIA represents only about 21.6% of the estimated $41 trillion in US assets under management. Moreover, more than, $4 trillion of these investments are in narrowly cast SRI negative screened or exclusionary funds, leaving only about 10% of assets under management in the US targeted toward more broadly defined sustainable investments (GSIA, 2016).

The focus on sustainable investing thus seems to be more discussion than broad-based action at present. Despite growing *interest* in sustainability, many investors and even more investment advisors remain wary of making sustainability a factor in their portfolio decisions. A BNY Mellon survey suggests that investment managers often perceive a trade-off between ESG emphasis and stock market performance (Stewart et al., 2012). Our own interviews (discussed below) of participants in various aspects of the sustainable investment world corroborate both *rising interest* in sustainability and *ongoing doubt and uncertainty* among mainstream investors about whether and how to bring this interest into their investment decision making.

This tension brings us to the puzzle that lies at the heart of this article: How can the rising mainstream investor interest in sustainability be squared with ongoing skepticism among investors, market analysts, and academics about whether a "sustainability" focus hurts marketplace results? Or to put the point more precisely: Why is there persistent doubt about whether the available ESG metrics cover meaningful sustainability issues, let alone track corporate performance elements, that are *material* to stock market success?

For purposes of clarity, we define "sustainability" to include environmental and socio-economic issues that both affect or are impacted by business – leading to a broad ESG definition:

> "*The term that has emerged globally to describe the environmental, social, and corporate governance issues that investors are considering in the context of corporate behaviour. No definitive list of ESG issues exists, but they typically display one or more of the following characteristics: Issues that have traditionally been considered non-financial or not material; a medium- or long-term horizon; qualitative objects that are*

readily quantifiable in monetary terms; externalities (costs borne by other firms or by society at large) not well captured by market mechanisms; a changing regulatory or policy framework; patterns arising throughout a company's supply chain (and therefore susceptible to unknown risks); a public-concern focus" (Krosinsky and Robins, 2008).

Our focus on identifying the ESG issues that mainstream investors need to have addressed unfolds in four parts. In Part I, we explore the prevailing wisdom that sustainability leadership will only rarely materially affect a company's market value. We survey a wide range of studies and analyses – and find the data and conclusions about the correlation between sustainability and marketplace success to be divergent. Taken as a whole, these inconsistent results may help to explain the significant skepticism about the stock market payback of sustainability leadership found in the academic literature and reiterated in our interviews with market participants. But we believe the conclusion that has been drawn by many – that sustainability is not a *material* factor in determining financial performance – is wrong, or at least over-stated. On the contrary, we argue that the lack of a robust relationship stems from three "disconnects:"

- Divergent definitions of what sustainability means and a corresponding lack of clarity about the goals of sustainability-oriented investors;

- Methodological weakness both in the analyses of sustainability as a driver of corporate financial results and in many ESG metrics used to gauge sustainability; and

- Regulatory shortcomings which allow corporate externalities (notably pollution) to go uninternalized – permitting companies whose business models build on *un*sustainable practices to outperform their more sustainable peers.

Inattention to these issues results in confusion about *which* ESG metrics matter and to *whom* as well as inconsistency in *how* the numbers are collected, structured, normalized, validated, updated, and used.

In Part II, we pick up the first of these three confusions (lack of definitional clarity) and propose a *next-generation* corporate sustainability metrics framework that would strengthen the analytic foundations for sustainable investing and give mainstream investors confidence in bringing a sustainability lens to their portfolio choices – on whatever terms they wish to do so. Specifically, we suggest: (1) the need for greater conceptual clarity in any discussion that purports to address *sustainability* in the investor

context, and (2) a recognition that different investors will want different types of ESG information. This conclusion argues for a menu of ESG metrics from which individual investors and investment managers choose the elements relevant for their own purposes.

In Part III, we address the methodological issues that drive skepticism over the validity of ESG metrics. We propose a taxonomy of ESG data reforms and *best practices* that would make corporate sustainability reporting and analyses more rigorous and useful. While ESG data providers have begun to recognize these issues, we also note the potential value of a government-mandated ESG reporting framework that would standardize (and perhaps simplify) ESG data and presentation methodologies – and provide a greater degree of investor confidence that the metrics have been validated and can be trusted as a basis for cross-company comparisons. Such a structure would give investors what they really *need*: a reliable set of core, mandatory ESG indictors coupled with a carefully specified data reporting methodology that ensures comparability across companies, makes benchmarking possible, and provides confidence to a broad swath of investors about the integrity of ESG metrics. An improved ability to gauge corporate sustainability and to connect it to stock market results would create incentives for greater focus in the business world on environmental, social, and governance performance – and might provide a logic for capital to flow toward more sustainable enterprises.

To the extent that some dimensions of sustainability leadership may be found not to correlate with financial success – or even to be negatively correlated – these findings will put pressure on policymakers to make regulatory changes to ensure that corporate behavior that is socially or environmentally damaging is not rewarded in the marketplace. This push toward an "end to externalities" (Esty, 2017) addresses the third disconnect highlighted above.

In Part IV, we conclude that the foundations for better integration of sustainability into investment decisions are being laid. The realities of divergent sustainability interests and investor preferences are increasingly being acknowledged. Moreover, as ESG data sets and analytic studies improve, specific relationships between *some* corporate sustainability performance indicators and stock market success will likely be demonstrated, inducing a further shift in investment capital toward enterprises that lead on these elements, if not sustainability more generally. Likewise, as regulatory regimes tighten – and polluters are more systematically required to pay for their emissions or other harms they cause – the link between material ESG metrics and financial performance will also tighten.

Table 1: Key Terms and Definitions

Term	Definition
ESG	Environmental, Social, and Corporate Governance – representing the core sub-categories of sustainability issues that investors want tracked and which might affect an investment's financial performance.
Material (Materiality)	Information that significantly impacts investor decision making. Defined by the US Supreme Court as information that presents "a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the 'total mix' of information made available." (Bean and Thomas, 1990)
Metric	In the context of this article, *metric* refers to a gauge or measurement that tracks company-scale performance of an issue or indicator of interest.
Use Case	As used here, "use case" refers to the purposes to which sustainability metrics are being put – recognizing that investors, market analysts, and academics may use the same ESG datasets to assess very different dimensions of sustainability.

Methodology

Our analysis and conclusions are based on a comprehensive survey of the existing academic and practitioner literature on ESG metrics and the relationship between sustainability and financial performance. We also reviewed existing ESG metrics and data frameworks and analyzed their methodological processes, standards, and gaps. In addition, we conducted interviews with practitioners to check and deepen the conclusions that emerged from the literature survey. Details on our interview subjects can be found in the Appendix.

These interviews yielded a number of valuable insights. First, it became clear that the term *sustainability* is being used in very diverse ways by different marketplace participants. Second, sustainability-minded investors vary widely in their willingness to accept subpar returns as the price for advancing their environmental, social, or governance values. Such divergent values and sustainable investing strategies mean that investors have wide-ranging ESG data needs. The practitioner interviews further revealed the spectrum of shortcomings that plague today's corporate sustainability metrics reporting and confirmed the hypothesis that, where government regulations allow pollution or other harms to go unaddressed, it is much more difficult to establish that strong ESG performance will translate into marketplace success.

I. Sustainability and Market Value

The parallel facts of growing demand for corporate sustainability information among mainstream investors and persistent skepticism that sustainability leadership translates broadly into stock market success raise two important questions about ESG reporting. First, does sustainability leadership *systematically* lead to improved business results and thus stock market outperformance? Second, are the available ESG metrics adequate to separate *real* leadership from more superficial and financially immaterial sustainability claims?

Empirical studies of the relationship between corporate sustainability (as measured by various *social* and/or *environmental* metrics) and financial performance diverge widely in their conclusions. Some scholars report finding statistically significant relationships between corporate sustainability (or social responsibility) and financial performance. Orlitzky et al. (2003) conducted a meta-analysis of 52 studies on the topic and concluded that: "corporate virtue in the form of social responsibility and, to a lesser extent, environmental responsibility is likely to pay off." Other academic studies reach similar conclusions. Eccles, Ioannou, and Serafeim (2014), for example, observe that "High Sustainability" companies (based on interviews and adoption of sustainability practices in

1993) significantly outperform other companies in both stock market and accounting results, a conclusion supported by others (Trudel and Cotte, 2009; Friede et al., 2015; Borgers et al, 2013; Cai and He, 2014; Dimson et al, 2015, Gottsman and Kessler, 1998, Herring, 2009). Other studies find a positive correlation between corporate social performance and financial performance (Shazad and Sharfman, 2015; Gartenber, Prat, and Serafeim, 2016). In an attempt to capture the full relationship between ESG and financial results, Oxford University researchers and Arabesque Partners reviewed 190 academic studies then examined the business case for corporate sustainability – and found significant quantitative evidence that strong standards and top-tier ESG performance result in better operational results, lower costs of capital, and improved stock price performance (Clark et al., 2015). The International Integrated Reporting Council has gone further and argued that companies that integrate into strategy and reporting can create value above and beyond financial capital including manufactured, intellectual, human, social and natural "capitals" (IIRC, 2013).

Other prominent studies find no correlation between financial performance and sustainability. Vogel has raised doubts about the payoff from corporate environmentalism for years, arguing that the opportunities for environmental initiatives to make a material difference to a company's profitability will be few and far between (Vogel, 2005). Marcus provides recent reinforcement for this view. His book, *Innovations in Sustainability,* explores 20 corporate case studies of sustainability-driven innovation and finds that making such efforts pay off is a "formidable task" (Marcus, 2015). He notes, for example, that the much-vaunted investments of Intel Capital and Google Ventures in cutting-edge clean tech projects have not translated into successful financial returns for the parent companies. Flammer, using "close-call" sustainability shareholder resolutions, finds that labor productivity and sales increased following the adoption of these resolutions, but the correlation breaks down when looking beyond these close-call examples (Flammer, 2015). Kim et al. find that corporate socially irresponsible activites actually improve firm financial performance when firm competitive action (to increase competitive positioning) is low (Kim et al, 2015). Barnett (2014) looks specifically at stakeholder reactions to corporate misconduct and finds that response to be inconsistent. Kitzmueller and Shimshack (2012) look across the literature of empirical studies and find a mixture of results, from "consistent empirical evidence" of the effect of corporate social responsibility (CSR) initiatives on consumer markets, to "limited systematic empirical evidence" between CSR and innovation or shareholder preference.

How does one explain these inconsistent results? One possible answer is that the scope of "green to gold" opportunities that Esty and others have identified (Esty and Winston, 2009; Esty and Simmons, 2011; Reinhardt, 2000; Hawkin et al, 2013; McDonough and Baungart, 2010; Savitz, 2012; Anderson and White, 2009, Lovins et al, 1999) is much narrower than

has been posited. It may be that regulatory failures permit externalities to go uninternalized in too many cases, allowing companies operating on an *unsustainable* basis to be more profitable than their competitors who attend more assiduously to their pollution impacts and other sustainability concerns. *Or* perhaps only a small number of ESG factors have any impact on financial performance. Vogel makes this argument when he notes that CSR and sustainability efforts may only make strategic sense "if virtue pays off" – the circumstances for which he finds rather limited (Vogel, 2005).

Others take this line of logic even further, arguing against specific aspects of corporate social responsibility as valuable or responsible endeavors for business (Crane et al., 2014; Bannerjee, 2008; Peter and Jones, 2013). Kotchen and Moon (2011), for example, note a correlation between CSR activities and corporate *irresponsibility* – suggesting that companies that have misbehaved may initiate CSR efforts as a counterbalance to their perceived problems. Orlitzky suggests that the disconnect may arise because CSR is not related to financial value, but rather creates *noise* in the marketplace leading to volatility. Under conditions of volatility, investors more frequently fall back on common perceptions in assessing corporate value (e.g., giving higher valuations to consensus sustainability leaders) even though these factors, including CSR leadership, may not systematically result in improved financial performance (Orlitzky, 2013). Even those who think that sustainability outperformance may translate into sales success or other business gains acknowledge that this relationship does not seem to be consistently recognized in stock market valuations. Eccles et al. (2013), in particular, concede that, in many cases, capital markets do not reward firms for their ESG efforts.

A second possible answer is that many of the existing studies have not been carefully framed. Some are unclear on theory and fail to specify which elements of sustainability are hypothesized to correlate with marketplace success – and why. Others fail to disentangle the range of elements of sustainability and control for interdependent variables that might confound the reported results (Lourenço et al., 2014; Kurapatskie and Darnall, 2013; Ameer and Othman, 2012). Endrikat (2015) finds, for example, correlations between negative and positive environmental events and financial valuations. Klassen and McLaughlin (1996) similarly identify correlations between stock market performance and environmental awards. But neither study controls for other potential sustainability drivers such as corporate governance, environmental performance, or management strength. Ueng (2015) likewise finds a strong correlation between financial performance and corporate governance structures such as board strength, compensation policies, accounting practices, and formal governance policies – all of which are inter-related aspects of sustainability.

These methodological shortcomings make it difficult to draw useful conclusions from the studies as a group. What these studies *actually* seem to say is that some aspects of ESG performance correlate with financial results – and others do not. But the broad framework of these studies makes it impossible to determine which aspects are which. Indeed, several authors point to this variance and conclude that the data do not allow testing of specific causal factors (Cai and He, 2014; Kim and Statman, 2012). Even within the population of market analysts and corporate ratings, there is enormous variability in which companies are deemed "responsible" or "green" (Rintoul, 2016). For example, the ESG rankings of the two leading data providers — MSCI and Sustainalytics — show only a 32% correlation, suggesting significant discrepancies in how they score companies.[3]

II. Moving Toward a More Investor-Focused ESG Reporting Framework

Our analysis suggests equivocal results in the relationship between sustainability and financial performance may well stem in part from conceptual confusion about what *sustainability* means.

A. Definitional Confusion

Much of the debate over the link between sustainability and business success appears to be a function of loose use of the term *sustainability*. Indeed, *sustainability* covers many issues across a broad spectrum of environment, social, and governance concerns (Elkington, 1997; Krosinsky and Robins, 2008). Many of the ESG data providers offer hundreds of separate scores in their corporate ESG databases (Table 3), including global issues such as greenhouse gas emissions and energy sources, as well as more localized impacts such as air and water pollution, water consumption, protection of biodiversity, and energy efficiency. The range of social issues covers an even broader scope, including: human rights, workplace diversity, consumer protection, animal welfare, poverty, employment, safety, health, and community development. Many databases will also track external economic impacts such as benefits of tax payments, employee wages, economic support to communities, and charitable contributions. Governance metrics includes board composition and performance, executive leadership, management systems, corruption, fraud, employee relations, and executive compensation metrics – among other things.

[3] http://sustainability.thomsonreuters.com/2016/10/25/executive-perspective-second-generation-esg-metrics-will-affect-tens-of-thousands-of-companies/

Table 2: Sample of ESG and Sustainability Frameworks Offered by Major Data Providers

Provider	Product	Metrics
MSCI	Sustainable Impact Metrics[4]	Six social themes (Nutrition, Disease Treatment, Sanitation, Affordable Real Estate, SME Finance, Education) and five environmental themes (Alternate Energy, Energy Efficiency, Green Building, Sustainable Water, Pollution Prevention)
MSCI	ESG Fund[5]	Includes metrics "across three dimensions: Sustainable Impact (to measure fund exposure to companies that address core environmental & social challenges); Values Alignment (to screen funds for investments that align with ethical, religious or political values); and Risk (to understand fund exposure to ESG-related risks)"
MSCI	ESG Rating[6]	Includes "80 Exposure Metrics (business segment and geographic risk exposure" and "129 Management Metrics (based on policies, programs, & performance data)."
MSCI	Carbon Solutions[7]	Includes "a comprehensive range of data on fossil fuel reserves, carbon emissions and sector application"
Bloomberg	ESG Disclosure Scores[8]	Over 120 Environmental, social and governance indicators keyed to the Global Reporting Initiative list of performance indicators
Thomson Reuters	ESG Data[9]	Includes "over 70 Key Performance Indicators" in three categories: Environmental (Resource Use, Emissions, Innovation); Social (Community,

[4] MSCI ESG Research Inc., "MSCI ESG Sustainable Impact Metrics," (2016) https://www.msci.com/documents/1296102/1636401/ESG_ImpactMetrics-2016.pdf/0902a64f-af8d-4296-beaa-d105b7d74dc3.

[5] MSCI ESG Research Inc., "MSCI ESG Research Fund," (2016) https://www.msci.com/documents/10199/242721/MSCI_ESG_FundMetrics_Productsheet.pdf/731c6d72-3c21-4aae-8fc1-5b864b057da3.

[6] MSCI ESG Research Inc., "MSCI ESG Ratings," (2016) https://www.msci.com/documents/1296102/1636401/MSCI_ESG_Ratings.pdf/9f0a999b-4419-4a0a-b6ef-0248f40ca2c9.

[7] MSCI ESG Research Inc., "MSCI Carbon and CleanTech Tools," (2016) https://www.msci.com/documents/1296102/1636401/MSCI_ESG_Carbon_Metrics_June2015.pdf/42211287-241c-4344-8b36-628501499f54.

[8] Bloomberg Professional, (2016) http://www.bloomberg.com/professional/equities/.

		Workforce, Human Rights, Product Responsibility); and Governance (Management, Shareholders, CSR Strategy)

Some of these *sustainability* metrics have clear theoretical ties to financial results or stock market performance. Investing in energy efficiency, for example, often lowers costs and produces "eco-advantage" (Esty and Winston, 2009; McKinsey and Company, 2010). But other indicators have no clear link to better business outcomes, or are even negatively correlated with marketplace success. Providing the most generous child care benefits or reducing greenhouse gas emissions ahead of legal requirements may well win corporate leaders plaudits for sustainability, but these initiatives are likely to result in added costs that the competition does not bear – and thus may well produce diminished business results.

B. Divergent Sustainability Interests and Expectations among Investors

Investors range widely in how much they prioritize optimizing financial returns versus having their portfolios aligned with their environmental values, social justice views, and other issues. Many SRI investors have screened out companies operating in certain industries, such as alcohol, gaming, gun-making, or other categories that generate opprobrium, without regard to the impact of these exclusions on their returns (Renneboog et al., 2008).

But mainstream investors – those who prioritize having their investments generate strong returns – need clarity on what *sustainability* means in a particular investment context. They need a framework of sustainability metrics that are relevant, material, accurate, and comparable – covering the full spectrum of sustainability issues that might be of interest to them. More importantly, mainstream investors increasingly want to know which ESG metrics correlate with financial performance and how strongly (Hayat and Orsagh, 2015).

Alongside these practical challenges, sustainability presents complex conceptual issues. Even when two investors agree on a topic's salience, they may differ on what constitutes the *sustainable* position. For example, some environmental advocates, such as Michael Shellenberger of Environmental Progress, view nuclear power as critical to a low-carbon future and would put utilities with nuclear generation portfolios on the positive side of the ledger. Other environmentalists and NGOs, such as the Sierra Club, see nuclear power as dangerous and would want utilities operating nuclear power plants placed in a negative

[9] Thomson Reuters, "Thomson Reuters ESG Data," (2016) http://financial.thomsonreuters.com/content/dam/openweb/documents/pdf/financial/esg-research-brochure.pdf.

category. Likewise, some investors see stem cell research as a critical technology for the future while others would put companies involved in this line of research on their blacklist.

The diversity of indicators considered by different organizations to be within the bounds of sustainability has been documented in several analyses of corporate sustainability reports.[10] Roca and Searcy (2012) examine the corporate sustainability reports of 94 Canadian companies and identify 585 different indicators of sustainability performance. Comparisons of the reports show little in the way of issue overlap, meaning that the companies have very divergent views as to what indicators constitute the core measures of sustainability. Locke and Seele (2016) point to this diversity of indicators when discussing the lack of credibility in reporting from 237 company reports in Europe. Monteil and Delgado-Ceballos (2014) argue, based on literature reviewed between 1995 and 2013, that this lack of clarity on the indicators within sustainability pervades both academic and practitioner articles. Without agreement on what constitutes *sustainability,* and with so many issues and divergent values in play, it is unsurprising that the correlations between generic *sustainability* performance and stock market results do not seem meaningful. Perhaps the most significant evidence in support of this conclusion is the low correlation (14% for Governance and 31% for Environment) between the sustainability scores of MSCI and Sustainalytics (Barclays, 2016).

Our review of the ESG metrics available to investors and interviews with market participants suggest that the data providers understand the gaps just described as do the various groups developing sustainability reporting frameworks, such as the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB). Virtually all of the entities involved in the ESG arena are working to improve their conceptual frameworks, data collection methods, and the analytic tools they deploy to make their ESG metrics more reliable, comparable, and responsive to investor needs. MSCI, for example, now offers a low-carbon index as well as the MSCI ACWI Sustainable Impact Index – which looks across multiple factors of sustainability to identify stand-out companies. SASB has undertaken extensive stakeholder engagement to sharpen the focus

[10] For example, a recent McKinsey survey found that, among executives whose company had articulated a definition of sustainability, 55 percent defined sustainability as environmental management, 48% defined sustainability to include governance issues, and 41% said sustainability included social issues, such as labor standards. The report suggests that these varying conceptions of sustainability reflect inherent ambiguities in the definition of the word. McKinsey & Company, How Companies Manage Sustainability: McKinsey Global Survey Results (2010), http://www.mckinsey.com/business-functions/sustainability-and-resource-productivity/our-insights/how-companies-manage-sustainability-mckinsey-global-survey-results. A 2014 study produced by Columbia University's Earth Institute similarly concludes that companies diverge in their understanding of sustainability. In particular, the researchers report: "Each company we interviewed had different measures to operationalize the broad concept of sustainability." Steven Cohen, Satyajit Bose, Dong Guo, Alison Miller, Kelsie DeFrancia, Olin Berger, Brian Filiatraut, Maureen Loman, Wen Qiu, and Cheng Hang Zhang, "The Growth of Sustainability Metrics," Sustainability Metrics White Paper Series (Earth Institute, Columbia University, 2014), http://spm.ei.columbia.edu/files/2015/06/SPM_Metrics_WhitePaper_1.pdf.

on a core set of sustainability issues that are most *material* in each major industrial sector.[11] Ceres provides a "Roadmap for Sustainability" that seeks to assist companies to better understand material environmental and social considerations[12]. The World Business Council for Sustainable Development (WBCSD) has been working to develop ESG indicators and metrics that can be integrated into financial reports for investors based on enterprise risk management processes (WBCSD, 2017). And the Betty and Gordon Moore Foundation Conservation Financial Markets Initiative (CFMI) is funding a set of projects that aim to better integrate ESG and financial reporting.[13]

Asset managers are also working to refine their understanding and responsiveness to different investor types (BlackRock, 2016). Bank of America (2016) and MorganStanley (2017), for example, both offer multiple social-impact investment funds targeting specific aspects of ESG ranging from environmental sustainability to human rights. The work of these organizations as well as the International Integrated Reporting Council (IIRC),[14] the World Federation of Stock Exchanges,[15] and a number of scholars (see, e.g., Kahn et al., 2015) are providing valuable contributions to the creation of an ESG metrics *menu* -- which is what we believe is needed to meet the diverse set of investor use cases. As discussed below, however, many of the needs of mainstream investors are not yet fully addressed by these efforts.

C. Classifying the Investor Perspective

Our research reveals that investors vary widely in what they want from an ESG screen. Indeed, we have identified at least five distinct categories of sustainability-minded investors – each with different criteria for sustainability:

1. SRI or *values* investors who wish to exclude "bad actor" companies from their portfolios with little concern about the effect on returns;

2. *Impact* or Social Return on Investment (SROI) investors who want to change the world with their capital deployment. They therefore emphasize measurable *social* or *environmental* impacts of their investments *on the community* as well as (or in some cases instead of) financial returns;

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[11] See the SASB website for more information: "Sustainability Accounting Standards Board," accessed June 8, 2016, http://www.sasb.org.
[12] https://www.ceres.org/roadmap/how-use-ceres-roadmap-sustainability
[13] See a description of the CFMI at https://www.moore.org/initiative-strategy-detail?initiativeId=conservation-and-financial-markets-initiative
[14] See the Integrated Reporting website for more information: "Integrated Reporting," accessed June 8, 2016, http://www.integratedreporting.org.
[15] See the Sustainability Insights Page for more information: "World Federal of Exchanges," accessed June 8, 2016, http://www.world-exchanges.org.

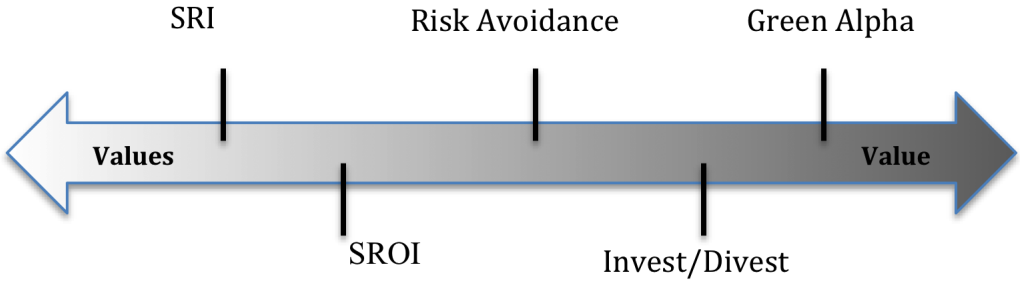
3. Risk-oriented mainstream investors who perceive that sustainability issues are becoming more salient and want to mitigate potential losses from being invested in *unsustainable* companies — or even fully divest from such stocks;

4. Mainstream investors who want to tilt their portfolios away from unsustainable companies and, in other cases to *invest* in sustainability leaders (with wide variations in how strong a sustainability tilt the investor wants and how much risk of diminished returns she is willing to accept);

5. Green Alpha investors who believe sustainability leaders will out-perform the market.

The categories of sustainability-minded investors described above can be arrayed on a spectrum from those driven fundamentally by their values (and thus willing to sacrifice returns) to those who focus entirely on maximizing returns (Lewis et al, 2016).

Figure 1: Spectrum of Sustainability Investor Types



As noted above, investors diverge significantly in their fundamental understanding of what sustainability means and what aspects of corporate behavior should be included within an ESG analysis. Investors range even more widely on how the various ESG aspects should be prioritized. They further diverge on how much portfolio volatility, and thus diminished returns, they are willing to accept. It can be little wonder that the current set of ESG metrics disappoint so many investors. Careful scholars, we should note, never claimed that *all* company sustainability efforts succeed or produce positive business outcomes (Bose and Springsteel, 2017; Esty and Winston, 2009; Rangan et al., 2015; Schendler, 2001; King and Lenox, 2001).

Given the multiple dimensions of sustainability and the range of opinions and preferences about which elements are important and even which direction is positive, no single definition of *sustainability* will work in all circumstances. We therefore conclude that investors need the ability to define *sustainability* for themselves – and tools that will allow

them to align their portfolios with their *own values* and priorities. ESG data providers should therefore offer a *menu* of sustainability metrics that provide a framework from which individual investors can construct their own analyses tailored to their own interests and investment strategies.

III. Moving Toward More Robust Sustainability Data

The equivocal empirical results regarding the relationship between ESG leadership and financial performance might also be the result of flawed data – metrics that are too narrowly focused or data that is so methodologically weak they provide no useful signal to investors.

Our careful review of the existing ESG data finds that most metrics were created in past decades to meet the needs of SRI investors who simply wanted the ability to *negatively* screen out certain industries from their portfolios. To these investors, aligning their portfolios with their values was the over-riding concern. They paid little concern to increased volatility or diminished returns – simply excluding industry categories that they defined as problematic. But as we have spelled out, the new mainstream sustainability-minded investors care about *both* values alignment and returns. So a different ESG framework that goes way beyond *negative screening* by industry category is now required.

One of our core observations is that repurposing ESG metrics that worked for the "values" investors of the past does not work for the sustainable investors of today. Mainstream investors now want a more comprehensive and carefully curated perspective on the companies in their portfolios – which existing ESG data sets to often cannot provide. Below, we lay out a range of problems that have emerged around ESG metrics as *value*-minded investors have come into the sustainable investing arena.

The ESG metrics available today are almost entirely backwards-looking rather than oriented to future results. They track *reputational* issues, not *operational* factors that might deliver lower costs, reduced risks, faster growth, improved productivity, or enhanced innovation capacity. Likewise, much of the existing data focus on ESG *risks* rather than the promise of sustainability-enabled *growth* or *productivity*. Thus, ESG data that are available to investors provide little foundation for identifying the companies whose sustainability strategies offer the promise of delivering marketplace upside (Yates-Smith, 2013) or results based on a "value driver" model (Lubin and Esty 2014; Lubin and Krosinsky 2013).

More remarkably, the available ESG data have so many gaps and errors that they do not provide clear guidance on which companies are delivering superior environmental results. Indeed, Chaterji et al. (2009) found, using environmental data from one of the leading ESG

analytic firms, that the metrics used are a poor predictor of environmental performance except under a very narrow set of circumstances. Likewise, Matisoff et al. (2013) show that data reported to the Carbon Disclosure Project (CDP) suffer from inconsistencies, lack of standardization, and mixed results in terms of transparency. A 2012 Rate the Raters survey found only 40% of investors are "very" or "extremely" satisfied with ESG ratings. Their unhappiness stems in large part from poor data quality and opaque methodologies (SustainAbility, 2012). A recent investor survey by Amel-Zadeh and Serafeim (2017) found that the lack of comparability across company reports represents a major impediment to ESG confidence. A recent summary of ESG data provider products reaches a similar conclusion: that the variance in data quality, metrics utilized, applied models and reporting is creating confusion in the marketplace (Douglas et al, 2017).

Developing the *next generation* of corporate sustainability data that meet the expanded *use cases* to which investors are interested requires improvements in both *methodological rigor* and *theoretical logic* of the underlying data. Fundamentally, investors need to have confidence in the reliability of the metrics. Without t*rust*, capital will not flow based on sustainability performance. We also see a need for new *empirical analysis* of the full range of ESG metrics so as to provide clarity on which elements of sustainability show a relationship with financial performance. We discuss each of these recommendations below.

A. Theoretical Logic for Next-Generation Data

A series of ESG data reforms would make the available corporate sustainability metrics more useful and reliable. We spell out below a set of *best practices* that our analysis and interviews with participants in the sustainable investing world have highlighted:

Table 3: Data Recommendations – Theoretical Logic

Gap	Summary
Operational vs Reputational Metrics	In the absence of quantifiable performance metrics, much of the current data focuses on stakeholder perceptions of companies drawn from media reports on controversies and reputation rather than operational performance.
Forward vs Backward-looking Metrics	Most sustainability metrics measure past impacts while relatively few assess future potential for performance.
Footprints vs Handprints	While a company's own environmental impact (footprint) is useful, it is incomplete. To assess a company's contribution to a sustainable world, investors also need to be able to track the impact of the company's products and services.
Upside Opportunities vs Downside Exposure	Much of the current data looks backwards to measure impact, while much of the potential value of sustainability to financial performance lies in the ability of the company to recognize and take advantage of opportunities to become more sustainable.
Materiality	To make corporate sustainability metrics more meaningful, much more focus needs to be given to what really matters in terms of environmental impacts – and the structure of metrics needs to be re-geared to reflect this *materiality* analysis.
Broad Frameworks vs Narrow Focus	Most guidelines for data disclosure are broad to be inclusive of many sectors and many issue areas. What is needed is a mix of core issues broadly applicable combined with additional industry-specific metrics.
Policy Alignment	Policy makers will play a key role in improving ESG data through a discreet set of core metrics, methodological standard regulation and continuing to internalize detrimental externalities.

Operational versus Reputational Metrics

Is Dow Chemical a sustainable company? From a reputation point of view, Dow has a long legacy of pollution, including dioxin contamination, and a troubled image based on its role as a major manufacturer of Agent Orange during the Vietnam War. It might well be excluded therefore from sustainability-screened portfolios. But in recent years, Dow has become a recognized leader in sustainable operations. The company reported in 2016 that 10% of sales ($5.8 billion) came from products that were "highly advantaged by sustainable chemistry" (Dow, 2015). Dow also won a 2015 Heroes of Chemistry Award (Bandlow and Schikorra, 2015) and was named one of the top 10 "impact" Companies to Work For by Net Impact (HIP Investor Team, 2015). But little of the widely available ESG datasets focused on reputation or legacy issues would capture these accomplishments or Dow's potential to benefit from delivering sustainability solutions for its customers.

We think additional ESG metrics that help distinguish companies that are using their sustainability strategies to deliver value through *eco-efficiency (*or productivity) initiatives and growth need to be developed and standardized. In this regard, Lubin and Esty (2014) highlight a process for gauging sustainability-oriented *value drivers.* Porter and colleagues (2011) similarly offer a framework for determining metrics that create *shared value* between companies and stakeholders (Kramer, 2011).

Forward-Looking versus Backwards-Looking

Many ESG metrics currently available look at past performance rather than future plans and their market-place promise. Of course, measurements of past results are much easier to acquire than projections about a company's future performance. But backwards-looking metrics (especially ones that go back decades) may not be relevant as investors seek to understand which elements of sustainability offer the prospect of future stock market success.

GE, for example, gets black marks on its sustainability scorecard for dumping PCBs in the Hudson and Housatonic Rivers in the middle of the last century (DePalma, 2007). But isn't it more useful to investors to know where the company is going with its efforts to make jet engines more fuel efficient or expand wind power? A new set of ESG metrics that gauge management vision and capacity for execution on sustainability issues is urgently needed.[16]

[16] See, for example, David Lubin and Daniel Esty, "Sustainability: Bridging the Sustainability Gap," MIT Sloan Management Review (June 2014). Others have echoed this call for forward-looking performance indicators. Sean Gilbert and James O'Loughlin, "Reaching Investors: Communicating Value through ESG Disclosures, Global Reporting Initiative" (2009), https://www.globalreporting.org/resourcelibrary/Reaching-Investors.pdf.

Handprints versus Footprints

To the extent that the current ESG framework offers metrics on present performance, almost all of the data centers on the environmental impacts – or *footprint* – of the companies being scored. These data sets offer a gauge of energy and water use, waste generation, and carbon emissions. Although it can be significantly more difficult to measure, it may be more important to know a company's sustainability *handprint* (sometimes referred to as "product impact"), which might be orders of magnitude larger than its sustainability footprint. Alcoa, for example, helped Ford in 2015 redesign its iconic F-150 pick-up truck around an aluminum frame. This shift in materials dramatically lowered the vehicle's weight and increased its fuel efficiency (Voelcker, 2014), a fact that should be captured in ESG assessments of Alcoa. Salesforce.com likewise makes the case that its network IT solutions can reduce the carbon emissions of its customers by 95% compared to on-premises applications (Salesforce, 2011). As these examples demonstrate, one of the most important aspects of sustainability leadership centers on a company's ability to solve the energy and environmental problems of its customers.

Upside Opportunities versus Downside Exposure

To the limited extent that ESG providers offer future-oriented data, most of these metrics are *risk-focused*. Carbon footprints, for instance, are now widely available – and allow investors to identify which corporations or sectors might suffer losses if CO_2 emissions were priced or faced more severe regulation. But there is little information available on *upside* climate change *exposure* that might allow investors to put money into companies or sectors that will thrive as carbon pricing becomes more widespread. We believe there is particular demand for metrics on sustainability-derived *growth* including both top-line expansion of sales (from goods or services that provide sustainability solutions) and bottom-line profitability (combining both growth and improved eco-efficiency and resource *productivity*) (Lubin and Esty, 2014). Lubin and Esty (2014) and Lubin and Krosinsky (2013) have proposed such a *value driver* model that would capture these elements. But this line of thinking has not been translated into widely available metrics. In line with this thinking, conceptualization of risk has expanded to move away from specific elements of behavior that might create risk (systematic risk) to assessments of external market risks that can be addressed by companies to create greater opportunity and consistent returns (idiosyncratic risks) (Funk and Powell, 2017).

Materiality

Work is being done to bring a materiality lens to sustainability reporting. Organizations such as GRI and AccountAbility have long recommended that companies undertaking sustainability reporting and management should reflect on those issues that are most

material to the company and its stakeholders.[17] More recently, the Global Environmental Management Initiative (GEMI) released its "Quick Guide: Materiality" in an effort to give corporations a simple tool to identify and prioritize sustainability issues (GEMI, 2015). SASB has linked materiality to reporting specifically through the eyes of the investor by referencing the US Supreme Court's definition of materiality, based on the perspective of a "reasonable investor" (SASB, 2016a). SASB is parlaying this materiality-centered approach into a set of industry-specific, comparable sustainability metrics that investors can more easily access and analyze. Our analysis suggests however, that the SASB structure which identifies a small number of material issues for each industry and labels all other issues as immaterial is too narrow.

Over the last year, a number of groups have focused on materiality in ESG and its relationship with Enterprise Risk Management processes. The WBCSD, Ceres, the Committee of Sponsoring Organizations of the Treadway Commission (COSO) and others in collaboration with the Moore Foundation have been working to understand how materiality of ESG indicators fits within the context of financial reporting. If successful, this work may lead to a more complete and refined understanding of which ESG issues impact financial value and under what circumstances. We discuss this work in Part IV of this paper.

A sharper focus on materality needs to be central to the *next-generation* ESG metrics framework. We believe that there will be a small set issues of over-arching concern that will be material in all industries. But many other issues need to be judged on an industry-specific basis. We further argue that the materiality cannot be seen as a yes-no question. Rather materiality should be judged in tiers, with each industry having a set of top-tier issues, second-tier concerns, third-tier challenges, etc. Who, for example, would have expected Uber to be humbled by human resources issues? Perhaps not a top-tier issue, but a range of second- or even third-tier human resource management issues have put the company in peril.

Broad Frameworks versus Narrow-Focus

The increasing interest in materiality highlights another tradeoff in corporate sustainability data: whether the reporting framework should be extensive, covering many factors, or more targeted on a core set of metrics. For instance, the GRI, one of the most widely recognized reporting structures, expanded its reporting frameworks over the past two decades; today, companies are asked to assess up to 58 "General Standard Disclosures" and 82 "Specific Standard Disclosures" as well as additional disclosures described in one of the

[17] For more information, see the Global Reporting Initiative's website: "GRI," accessed on June 8, 2016, https://www.globalreporting.org/Pages/default.aspx. Also see Marcy Murninghan and Ted Grant, "Redefining Materiality II: Why it Matters, Who's Involved, and What It Means for Corporate Leaders and Boards" (AccountAbility, 2013), http://www.accountability.org/images/content/6/8/686/aa_materiality_report_aug2013%20final.pdf.

10 Sector Supplements (GRI, 2014). Even though GRI has emphasized the need for materiality assessments to narrow this list, the practice has largely been meant to "cover as many bases as possible" to achieve stakeholder recognition and thresholds of performance defined by the GRI Guideline. The exhaustiveness of the reporting framework has been seen as excessively burdensome by many companies and in tension with GRI's stated goal of highlighting the most *material* issues[18]. Moreover, our interviews with ESG marketplace participants suggests that the sheer workload of producing sustainability reports against the GRI framework is considered counter-productive.[19]

Policy Alignment

Public interest in and focus on sustainability will continue to evolve, as will the sustainability priorites of the political world. ESG reporting practices will need to evolve in parallel. The global community's new emphasis on the UN's Sustainable Development Goals (SDGs) will inevitably lead to questions about corporate performance in supporting the SDG agenda (Cann and Fries, 2016). Metrics to track these issues at the corporate scale are thus being developed.

We see three key alignments of policy and ESG metrics. First, we anticipate an alignment of the top-priority ESG issues with matters of significant global importance. For example, the imminent and significant impacts of climate change suggest that this issue should be one of a handful of universal sustainability metrics – applied to disclosure for all companies. Second, the policy world should support the needs of investors for more robust, comparable and trusted ESG data to facilitate the movement of capital toward more sustainable companies and investments. Finally, policy needs to internalize externalities which otherwise threaten to undermine market incentives for responsible environmental and social performance.

B. Methodological Standards for Next-Generation Data

Not only do questions of *what* ESG data is being collected arouse concern, but so do questions of *how* it is being collected. As the Big Data Revolution sweeps the world, statistical techniques have improved and, in many contexts, methodological rigor has increased in many contexts. But little progress has been made on a series of basic

[18] As a former Chief sustainability Officer at Intel and AMD, GRI's new CEO, Tim Mohin, understands the reporting burden from a company perspective — and promises that GRI will address it. Esty interview with Mohin (7 May 2017).

[19] Ebrahim and Rangan have argued that an overload of measurements provided for funders may help, but "it runs the risk of being counterproductive in the long run, both by drawing precious resources away from services and by putting too much emphasis on outcomes for which the causal links are unclear…" Alnoor Ebrahim and V. Kasturi Rangan, "What Impact?: A Framework for Measuring the Scale and Scope of Social Performance," California Management Review 56 (2014): 118-141.

methodological challenges in the sustainability domain. The *next-generation* ESG framework needs to address a range of fundamental issues including:

Table 4: Data Recommendations – Methodological Standards

Gap	Summary
Self-Reported Data	While mandatory metrics of performance in sustainability continue to grow, the majority of material issues remain voluntary resulting in gaps and inconsistencies.
Verification and Assurance	Although a growing number of companies now provide third-party validation of their sustainability reports, many do not, meaning their data is simply self-reported.
Estimated Data	Very little sustainability data comes from actual measurements. The majority of ESG metrics are modeled or estimated using assumptions of varying validity.
Coverage	Significant gaps in disclosure remain despite the growth in corporate sustainability reports over the years.
Gap-filling	Where critical data are not disclosed, the companies selling data streams will often attempt to fill the data gap using proxy metrics, imputed results, or non-transparent extrapolations.
Normalization	Many data sets require normalization to a common benchmark to allow for meaningful ("apples to apples") comparison – but a surprising number are not normalized.
Timeframes and Updating	The collection of data and the updating of data in analyst databases is inconsistent and generally infrequent compared to the expectations of mainstream investors.

Self-Reported Data

The existing ESG datasets build on a patchwork of mandated environmental reporting and company self-disclosure. Environmental data in the United States reported to the Environmental Protection Agency (EPA) and Energy Information Agency (EIA) offer some of the most solid data in the existing ESG frameworks. To the extent that these data are publicly available, the ESG analytics companies take advantage of them. But beyond these narrow categories, companies report when and how and to whom they deem it to be convenient. In addition, because much of the data in the ESG arena comes from voluntary

company responses to surveys, additional inconsistencies and gaps plague the data sets (Clarkson et al, 2011).

Verification and Assurance

While many of the leading companies in sustainability use some form of assurance and data verification (WBCSD, 2016a), only half of the companies in the world that produce sustainability reports pursue any form of third-party audit, verification or assurance – collectively referred to as "audits" (KPMG, 2013). Of these, most audits cover only a small portion of the information in the reports (Hubbard, 2009). A requirement for audited data could easily be embedded in a government-led data standard, just as corporate accounting and SEC filings must be verified. But even in the absence of government-mandated methodological standards for ESG data, we believe that verification of ESG metrics should be seen as a best practice. We would urge ESG data providers to be more diligent in flagging unverified metrics and in validating the information that they report. Likewise, we believe that data platforms, such as GRI and CDP, should "certify" audited data points to allow those users to be clear on how much trust to place in various numbers. WBCSD has argued that carefully constructed assurance of sustainability reports can create additional value. WBCSD thus proposes an *Assurance Maturity Model* to guide companies toward greater value from the assurance process (WBCSD, 2016b).

The primary argument against mandatory ESG data quality auditing has focused on the costs of such validation.[20] While a narrower focus on *material* issues might mitigate some of this cost compared to strategies that cover a broad range of sustainability issues, lessons from the Sarbanes Oxley experience suggest that the costs of additional mandatory auditing could be significant, particularly in the first years after adoption (Zhang, 2007). However, empirical evidence on sustainability reporting in China, Denmark, Malaysia, and South Africa, where mandatory data auditing has recently been required, showed no adverse impacts on shareholder value. This finding suggests that the additional costs, at least for basic ESG data, are not significant (Ioannou and Serafeim, 2014). A recent study by Grewal et al. (2017) suggests mandated reporting (and associated auditing) would positively affect companies already engaged in non-financial disclosure and negatively impact those with poor performance and little existing ESG disclosure.

[20] See for example Steve Lydenberg, Jean Rogers, and David Wood, From Transparency to Performance: Industry-Based Sustainability Reporting on Key Issues, The Hauser Center for Nonprofit Organizations at Harvard University, http://www.sasb.org/wp-content/uploads/2012/03/IRI_Transparency-to-Performance.pdf: "The arguments most often made against mandatory reporting, and in favor of continuing the current regime of voluntary reporting, are typically ones of practicality and costs—it is difficult for regulators or stock exchanges to determine what data should be required and how to monitor the adequacy of its reporting; and it is expensive for companies to compile sustainability data."

Estimated Data

Another weakness of existing ESG data frameworks is that many of the indicators provided are modeled or estimated rather than reflecting actual measaurements. Moreover, those using the data often cannot tell whether a particular ESG metric comes from measurement or from estimations. In some cases, the data providers do not even make clear which metrics are based on company reports and which derive from their own modeling and gap filling. For the sake of comparison and analysis, metrics work best when the underlying data come from *actual* measurement, but measurement-based data on many critical environmental factors are scarce.

As noted above, some environmental datasets derive from legal requirements and are therefore *actual* rather than *estimated*. Air emissions data from industrial facilities in the United States, for example, must follow strict measurement requirements using in-line monitors that record the presence of chemicals such as sulfur dioxide, nitrous oxides, and volatile organic compounds. However, even these data sets can present serious methodological issues. Smaller smokestacks and combustion sources, for instance, are allowed to estimate emissions based on fuel type and volume burned while some sources are exempt from providing any data. Even for highly regulated sources like large smokestacks, a single company might report emissions from operations in multiple countries where the sampling protocols, error rates, and boundaries of reporting vary significantly. Once again, as the importance of ESG analysis becomes more widely recognized, we argue for standardization of reporting rules – and transparency about which data are measured (and how carefully) and which are estimated (and on what basis).

Coverage

As of 2016, slightly over 1,000 predominantly public corporations worldwide report their greenhouse gas emissions to CDP (CDP, 2016), representing approximately 2% of listed companies globally (World Federation of Exchanges, 2017). Even fewer provide metrics on other critical issues. GRI, the largest voluntary reporting guideline, offers a database listing the number of companies that have reported against each of its disclosure recommendations (based on companies that submit their report to GRI). As of late 2015, the database included 1,395 companies (less than 2% of publicly traded companies). Even those reporting *something* often ignored important sustainability issues: 19% did not report on water consumption, 58% did not report on water withdrawals, and 72% did not report on their water discharges.[21] This spotty coverage limits the accuracy and usefulness of the existing ESG datasets and makes intra-industry comparative analysis difficult. Indeed, there exists a constant risk that those reporting more robustly will *look* more

[21] See the Global Reporting Initiatives' database on sustainability disclosures for full list: http://database.globalreporting.org/benchmark.

problematic from a sustainability perspective than those who report little – simply because they put forward some numbers.

Gap filling

In the absence of good data on actual environmental outcomes, ESG data companies provide the *best available* data they can find. They may use proxy metrics to gauge performance or use statistical techniques, including extrapolation and interpolation, to fill data gaps. A variety of gap-filling strategies can be employed and will sometimes, but not always, be disclosed in a methodological appendix. Some companies fill gaps based on imputation from other data that is available and careful analysis of which related indicators best predict the missing data points. Many others give non-reporters an average score – or sometimes the average score of similarly situated companies. But these techniques induce hidden biases – including incentives not to report if one's actual numbers are below average. A few of the most reliable data providers, such as Oekom, use averages to fill gaps but penalize non-reporters by placing them at the 20th percentile, not the average (50th percentile), which creates an incentive for those who have not provided data to do so in the future. We believe that non-reporters should be placed at the 1% level so that there is *never* an incentive to avoid reporting.

Normalization

Even if everyone were equally committed to accuracy, the lack of consistency in the scope of data would be a problem. With regard to greenhouse gas emissions, some companies report just Scope 1 (emissions resulting from direct burning of fuels), others report Scopes 1 and 2 (adding emissions resulting from purchased energy such as electricity or steam), and a small number report Scopes 1, 2, and 3 (including supplier emissions and all other indirect emissions, beyond Scope 2, that occur in the value chain of the company). The lack of consistency makes benchmarking difficult as those who report just Scope 1 may appear to be better performers than those reporting Scopes 1 and 2.

Company structure can also affect results and the accuracy of comparisons. For example, unless everyone in an industry reports on Scopes 1, 2, and 3 greenhouse gas emissions, a vertically integrated company will likely have much higher reported emissions than one that has been structured to focus on downstream (marketing) activities. Indeed, those who have hived off their emissions-intense manufacturing operations may be particularly problematic. We know of cases where companies reduced their emissions overnight by 75% by restructuring and outsourcing their manufacturing.[22]

[22] Esty interview with Tim Mohin (7 May 2017), noting that AMD cut its GHG emissions by 75% when it outsourced its production.

Normalization is required – and often not done – in the construction of many other datasets. For instance, MSCI, one of the most respected ESG data companies, reports on corporate controversies as part of its Intangible Value Assessment Methodology for the companies in its data matrix (MSCI, 2014). Other companies, such as RepRisk, similarly look at negative media mentions as a core metric. But there is no indication that the count or severity of the controversies or negative media mention is normalized against company characteristics (notably size) or the source of data (media, social media, regulatory response, etc.). Thus, Coca-Cola, which has global sales of $45.91 billion and five controversies mentioned in the press, would score worse than a $1 billion company with two controversies of similar impact, even though Coca-Cola's normalized negative media score per dollar of sales would be almost 20 times better.[23] Nor is it clear how long controversies "count" against the company. Should, GE, for instance, continue to be penalized for its dioxin releases in the first half of the 20th century?

Timeframes and Updating

One of the most important questions is the consistency of the timeframes of the data being put forward (i.e., when was the data collected by the company). The methodology statements for three of the most common ESG-weighted Indices (the MSCI ACWI Sustainable Impact Index, Dow Jones Sustainability Index, and Vigeo Eiris Ethibel Sustainability Index Excellence Global) do not specify the span of timeframes for data that can be included for an evaluated company. While it may not be possible in every case for the data on each company to cover the same time period, such consistency should be the goal. A team of graduate students at Columbia University recently published the results of a series of interviews with 10 major data analytics firms (Chan et al, 2014). The reported frequency of data updating ranged from annual to "based on alerts from webcrawlers." While the right timeframe for updates will vary depending on the metric in question, a principle of regular refreshment of all datasets should be on the list of ESG metrics best practices as should transparency about data vintage.

C. Refined ESG Empirical Studies

As our discussion in Part I revealed, the analytic foundations for bringing ESG metrics into mainstream investor decisions are shaky. Sweeping statements about whether sustainability leadership correlates with stock market or other financial performance are unhelpful. Given the range of elements that might be embedded in any one definition of *sustainable* or *socially responsible* companies, it is no surprise that empirical studies come to divergent conclusions. What is needed is more granular focus and detailed empirical

[23] Global sales value found at: "Coca-Cola," Forbes, last updated May, 2016, http://www.forbes.com/companies/coca-cola/.

analysis of specific elements of sustainability leadership that have a theoretical link to business success and, therefore, stock market valuations.

This analytic ground has just begun to be plowed. For example, companies that try to improve their energy efficiency should be able to reduce costs – and improve their profitability. But do such initiatives systematically translate into improved financial results? We have little evidence to answer this question. Likewise, recent business theory suggests that having a more diverse workforce allows a company to better connect with diverse customers (Thomas, 2004). But does greater diversity produce better business outcomes in practice? More robust analysis is needed. And does separation of the roles of CEO and Board Chair lead to better decision making and greater profitability? Again, empirical work on such questions is essential and just starting to appear. We thus conclude (as have prior studies) that more careful statistical studies will reveal more nuanced ESG conclusions (Vo, 2010).

ESG data providers should be urged to do more (and more careful) correlation studies so as to begin illuminating the relationship between the metrics they report and various gauges of corporate financial performance. Multivariate regression analyses that control for interactions among ESG metrics would be especially useful to determine which dimensions of ESG are materially linked to market performance.

D. The Path Forward

Our interviews in the sustainable investing arena makes it clear that many mainstream investors do not trust the available ESG data. Without confidence in the numbers reported, movement of capital based on sustainability performance will continue to be slow in comparison to the global aggregate of assets under management. Two movements are needed to grow comparability, trust and utility of ESG metrics. First, a standardized *menu* of ESG metrics is needed that provides a perspective across a broad array of companies. A small number of these metrics will likely be universal to all reporting organizations, while the majority would create comparability across industry sectors and regions. Second, it is time to move from a world of informally developed *Data Quality Principles* such as those codified by the GRI (2016) covering Balance, Comparability, Accuracy, Timeliness, Clarity, and Reliability, to a more systematic and unified set of ESG *Methodological Standards* supported by a government-mandated framework and more rigorous requirements for validated data.

The requisite trust would be most easily established if the ESG metrics menu and methodological standards were prescribed by a governmental body and made part of a formal reporting structure such as the SEC's 10-K requirements. The "legal" underpinnings of such a system would be the quickest and most reliable way to ensure data consistency,

comparability, and integrity.[24] There have been movements in this direction, in part due to investor pressure (Fleming, 2016; Vittorio, 2016), including the SEC Regulation S-K Concept Release (SEC, 2016; DavisPolk, 2016); the SEC guidance on climate related disclosure (SEC, 2010); regulations in the UK under the 2006 Companies Act; and the EU Directive 2014/95/EU, which all call for varying levels of reporting against climate change risk. However, these regulatory efforts, as well as others the European Union, India, Norway, United Kingdom, Finland, Japan, Korea, Pakistan, Malaysia and Canada fall short of prescribing a limited set of metrics or dictating specific methodological standards for data collection that ensures comparability.

The push for a regulated methodological standard can be guided by the numerous data quality and methodological standards present in the world of finance, including internal control guidelines from FASB, the International Monetary Fund (IMF, 2001), and the Bank of England (2014). These standards also provide procedures for statistical analysis; processes for data management; strategies for avoiding data collection problems; guidelines for the use of proxy metrics, data aggregation, and weighting; and protocols for the normalization of divergent metrics and reporting (Kahn et al, 2015).

In the near-term, and as regulation evolves, there is substantial movement underway in voluntary efforts to better define material ESG issues for companies and investors, and to create more meaningful disclosures of ESG issues in financial reporting. Landmark efforts such as the Task Force for Climate-related Financial Disclosures (TCFD) and the Climate Disclosure Standards Board (CDSB) have created methodologies for reporting financial material data on climate mitigation and adaptation to investors through the annual and quarterly financial reporting mechanisms. TCFD released its Final Recommendations Report on June 29, 2017 in which it calls for disclosures in governance, strategy, risk management and metrics/targets with regard to climate risk, climate opportunity and financial impacts from climate change (TCFD, 2017). The TCFD recommendations also provide guidance on disclosure, but stop short of prescribing metrics or data collection methods. In fact, the Report highlights the need for data quality and availability as part of its "Key Issues Considered and Areas for Further Work" section.

SASB has recommended that companies adopting their standard integrate sustainability data collection into existing internal financial data controls and procedures (SASB, 2016b). In practice, this might be done through the use of the COSO Internal Control-Integrated

[24] See Benjamin Hulac, "SEC Considers Overhaul to Climate Rule," E&E News, April 15, 2016, accessed June 8, 2016, http://www.eenews.net/climatewire/2016/04/25/stories/1060036172. Here, Hulac describes the SEC's April announcement that "it is considering modernizing disclosure requirements in a regulation called S-K to help investors see how companies approach social issues like global warming."

Framework.[25] In fact, COSO, in partnership with WBCSD, Ceres and others and in cooperation with the Conservation and Financial Markets Initiative effort, is due to release an updated framework that explicitly integrates ESG in Enterprise Risk Management processes including internal control procedures for data handling. This framework could be a substantial step forward in comparability of material ESG data and a model for regulation in the future.

Stock exchanges are also moving forward to better define material ESG indicators for listed companies. We note that while stock exchange rules for sustainability disclosure have expanded dramatically over the last five years (SSE, 2012; Sustainable Stock Exchanges Sevretariat, 2015; World Federation of Exchanges, 2015), mandatory standards for data collection, accounting, and verification have not kept pace.

Looking to the longer term, we see three main parties who should be called upon to guide government-led Data Quality and Methodological and a *next-generation* ESG reporting framework: (1) investors, represented not only through existing bodies such as Ceres and SASB, but also through new entities that reflect the diversity of interests in sustainability; (2) ESG analytics firms that aggregate and disseminate the data collected including both for-profit and not-for-profit entities such as CDP and GRI; and (3) research centers and academic institutions, which can undertake sustainability research, including empirical investigation of the interaction between specific metrics and financial performance. Based on the need for comparability and transparency, it is important that the output of such an effort result in publicly available data frameworks that can be easily accessed by reporting companies and data analytics firms aggregating the metrics.

IV. Conclusion

Progress on several fronts will be needed to solve the puzzle put forward at the outset of this paper. Specifically, sustainability must be recognized as a multi-dimensional concept about which no two investors will agree precisely. In addition, because sustainability-minded investors vary widely not only in their interests, but also in their financial goals and willingness to accept diminished returns, investors need a *next-generation* ESG framework that offers a *menu* of metrics that provide choice and individual prioritization. Investors of all types also need a more carefully constructed set of ESG metrics that meet a high standard of methodological rigor. Government-mandated ESG *methodological standards* would provide the easiest pathway to much-needed reporting consistency and data integrity. Applied to a *menu* of metrics, such standards would allow investors to choose those ESG factors that best fit their investment priorities and remain confident in the robustness of the underlying data. In the absence of government action, the burden will

[25] For more information on the COSO Internal Controls – Integrated Framework, see the COSO website, www.coso.org/guidance

be on ESG data providers to provide greater consistency, transparency, and verification of the metrics they publish in line with the suggested approach of SASB and others.

Our interviews suggest that mainstream investors would include sustainability assessments in some part of their market analysis if they had better data, clarity on the elements of sustainability that translate into superior financial performance, scorecards designed with specific investment purposes in mind (Krosinsky and Robins, 2008; Gottsman and Kessler, 1998), and confidence that regulatory frameworks were in place to ensure that enterprises would be penalized for their externalities. This broader sustainable investment interest would, in turn, induce capital to flow toward companies with strong ESG performance on material issues, reinforcing policy efforts to promote sustainability.

Where ESG leadership is found not to correlate with stock market success – or to be negatively correlated – further scrutiny is required. If the issue in question is one where divergent views on what constitutes *sustainability* (e.g., on the value of nuclear power) are expected, then the lack of relationship is not of concern. But a negative relationship with business success on an issue that is fundamental to society's interest in a sustainable future (e.g., greenhouse gas emissions) should be a red flag for policymakers – perhaps indicating a regulatory failure that needs to be addressed.

Fundamentally, establishing a better foundation for sustainable investing requires a reconceptualization of the task at hand. Defining a common vision of *sustainability* that applies broadly seems unlikely. Given the diversity of investor sustainability interests and values, what is needed is a *standardized ESG metrics framework* from which individuals can construct their own analyses consistent with their own investment strategies. We argue that such a framework should be understood to be a public good – and thus we suggest that government-mandated ESG *methodological standards* be established – building on the emerging best practices for metrics construction. With better analytic underpinnings, the sort of granular studies needed to identify which elements of corporate sustainability leadership correlate with financial success can be undertaken – and the puzzle posed at the outset of this article resolved.

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Appendix: May 2015 Roundtable Participants and Additional Interviewees

Participant/Interviewee	Organization
Arnold, Tammie	Generation Investment Management
Bolton, Patrick	Columbia Business School
Booth, David	Dimensional Fund Advisors
Collins, Andrew	Sustainability Accounting Standards Board
DeCew, Stuart	Yale Center for Business and the Environment
Gentry, Brad	Yale Center for Business and the Environment
Goldstein, John	Imprint Capital
Irwin, Rodney	World Business Council for Sustainable Development
Jenkins, Bob	Thomson Reuters
Karp, Erika	Cornerstone Capital Group
Kauffman, Richard	State of New York
Kenning, Jenn	Abacus Wealth Management
Kessel, Brent	Abacus Wealth Management
Krause, Kahne	Dimensional Fund Advisors
Kriss, Mark	Macroclimate, LLC
Krosinsky, Cary	Author of *Sustainable investing: The art of long-term performance*
Lee, Linda-Eling	MSCI
Lubin, David	S3
Macey, Jonathan	Yale Law School
Matthews, Jessica	Cambridge Associates
Mohin, Tim	Global Reporting Initiative
Park, Kyung-Ah	Goldman Sachs
Pierce, Lance	CDP North America
Ravenel, Ramsey	Grantham Foundation

Ross, Leola	Russell Investments
Sherman, Spencer	Abacus Wealth Management
Sobotka, David	Bank of America
Spitler, Chad	CamberView Partners
Swensen, David	Yale Investments Office
Takahashi, Dean	Yale Investments Office
Urie, Sandra	Cambridge Associates
Walker, Chris	World Business Council for Sustainable Development
Yovanjak, Logan	Morgan Stanley

The Value and Current Limitations of ESG Data for the Security Selector

Satyajit Bose, PhD

Satyajit Bose is Lecturer at Columbia University, where he teaches sustainable investing, cost benefit analysis and mathematics, and serves as Associate Director of the Program in Sustainability Management. Satyajit is also Co-Chair of the University Seminar in Sustainable Finance, a forum for faculty and finance practitioners to discuss and research methods for using the financial system, along with technology, innovative design, and disruptive change, to mobilize capital for sustainable development and widespread beneficial impact. His current research interests include the optimal use of a broad array of environmental performance metrics for long horizon investment choices. Satyajit has extensive expertise in investment banking, asset management and financial restructuring. Among other positions, he was chief financial officer of a luxury retailer and directed quantitative trading strategies at a convertible arbitrage hedge fund managing $1.5 billion in assets. Satyajit Bose holds a BA and a PhD in economics from Columbia University.

Amy Springsteel

Amy Springsteel works in the Office of Corporate Responsibility at Voya Financial® (formerly ING U.S.), a leading provider of retirement, insurance and investment management products and services. She creates and implements corporate responsibility (CR) strategy, methodology, and policies for aligning CR with the company's business objectives and disseminating them enterprise-wide. Prior to her position at Voya Financial, she worked as a client service director and strategist in the sustainability communications practice at Addison Design and formerly operated her own consultancy, Competitive Edge Consulting Associates, Inc. (CECA). Her vast background spans across numerous sectors such as corporate, public, non-profit and political with a select client roster including General Electric (GE), PepsiCo, Deloitte, IBM, The Princeton Review, the New York State Department of Banking, the New York City Agency for Child Development, Benjamin for U.S. Senate, the Stella Adler Studio of Acting and the Boys Choir of Harlem. She earned both BA and MS degrees from Florida State University.

Abstract

Many mainstream investment managers cite ambiguous evidence on the financial impact of specific environmental, social, and governance (ESG) factors as well as data sufficiency and quality challenges as obstacles to fast adoption of ESG integration. Those in ESG integration roles must demonstrate the incremental value of incorporating ESG information, despite its cost, into the security selection process, identify the data sources to mine and monitor that may provide decision-relevant information, determine what ESG topics are material to a security's industry, and determine the relevant ESG metrics and benchmarks necessary to develop sound security selection and portfolio construction.

We build on previous attempts to construct roadmaps for integrating ESG considerations into the security selection process such as the Practical Guide to ESG Integration (PRI, 2016) and How Investors Integrate ESG (IRRC Institute, 2017). We outline a survey of the literature on the value-relevance of specific ESG metrics that demonstrates the business case for incorporating ESG information. We describe the diverse range of data sources, including structured issuer-level key performance indicators (KPIs) available from ESG data providers to unstructured geographic, industry, or relationship-level data not currently organized by ticker. We consider the data generation process and its limitations for the security selector. We identify line item level metrics, document research on their relevance for valuation and construct specific questions to ask in the due diligence process.

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Disclaimer. This paper does not claim to provide any guidance on investment in any particular investment products and is not a solicitation of investment. The opinions expressed herein are those of the authors, are theirs alone, and do not reflect the opinions of any of their employers or the organizations with which they are affiliated. Such employers and organizations are not responsible for the accuracy of any of the information supplied in this article.

Introduction

Assets controlled by managers focused on environmental, social, and governance (ESG) integration continue to grow sharply.[26] Large institutional investors in the United States such as BlackRock,[27] CalPERS,[28] and Vanguard[29] have made statements on the importance of incorporating ESG into their investment strategies and have implemented processes for ESG integration in their portfolios. The largest pension fund in the world, Japan's Government Pension Investment Fund, has allocated 3 percent of its domestic stock portfolio to ESG strategies and expects to increase that to 10 percent.[30] The rapid growth in the assets under management deployed in responsible investment strategies has led to this segment controlling more than a quarter of all professionally managed assets.

Nevertheless, ESG integration remains a daunting task for many portfolio managers. Many mainstream investment management companies cite ambiguous and contingent results as well as data sufficiency and quality challenges as obstacles to fast adoption. In a survey of 461 large asset owners and managers, BNP Paribas found that 55 percent of respondents cited "lack of robust data" as the significant barrier to greater adoption of ESG across the investment portfolio (BNP Paribas, 2017).[31] Those in ESG integration roles must identify the specific ESG data sources to mine and monitor that may provide decision-relevant information, determine what ESG topics are material to a security's sector and industry, determine the relevant ESG metrics and benchmarks necessary to develop sound analysis, and, last but not least, demonstrate that the cost of incorporating ESG due diligence processes is justified by enhanced financial return. Additional details on the growth and challenges of ESG integration are outlined in the paper by Dan Esty and Todd Cort entitled *Corporate Sustainability Metrics: What Investors Need and Don't Get.*

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[26] According to the 2016 Global Sustainable Investment Review, assets managed according to socially responsible principles doubled between 2012 and 2016.

[27] In his most recent letter to the CEOs of portfolio companies, Larry Fink, CEO of BlackRock, said "Environmental, social, and governance (ESG) factors relevant to a company's business can provide essential insights into management effectiveness and thus a company's long-term prospects."

[28] CalPERS adopted a set Investment Beliefs in September 2013 among which are the following: A long time investment horizon is a responsibility and an advantage; Long-term value creation requires effective management of three forms of capital: financial, physical and human.

[29] Vanguard's responsible investment policy states "We believe responsible investment is inherently part of Vanguard's culture and is consistent with our fiduciary duty to manage investments in the best interest of clients."

[30] "Biggest Pension Fund Craves More After Foray Into ESG Assets" by Yuko Takeo & Shigeki Nozawa. Bloomberg July 13, 2017.

[31] Anne Simpson, (Investment Director, Sustainability at CalPERS) is quoted in the survey thus: "There is a blizzard of information out there, but it's not so much quantity that is the problem, but quality, consistency and relevance."

As ESG integration becomes more widespread, the apparent challenges and opportunities afforded by ESG due diligence processes will be closely followed even by mainstream investors not educated about ESG integration (currently the majority among investors). This is because *all* rational investors, including those without a mandate to consider social responsibility, would eventually choose to adopt any due diligence process that is demonstrated to enhance value in the security selection and portfolio construction procedure. Admittedly, the demonstration period might be drawn-out – its duration will depend on the speed and ease with which signals from ESG data can be shown to select winners that other accounting information does not select, or, conversely, avoid losers that signals from other data fail to avoid.

There is now also an extensive body of academic and practitioner oriented literature on the benefits of integrating ESG information into security selection and risk management. We build on previous attempts to construct roadmaps for integrating ESG considerations into the security selection process such as the Practical Guide to ESG Integration (PRI, 2016) and How Investors Integrate ESG (IRRC Institute, 2017). We outline a survey of the literature on the value relevance of composite ESG metrics that demonstrate the business case for incorporating ESG information at an aggregated level. We also provide references to the literature that correlates specific aspects of ESG to financial performance, and link these with associated due diligence questions. We outline the increasing availability of a diverse range of ESG data sources and describe the data generation process and its limitations for the security selector. We describe the data generation and reporting process for a full range of data sources, including structured issuer-level KPIs available from ESG data providers to unstructured geographic, industry, or relationship level data not currently organized by ticker or ISIN. We conclude by describing two specific examples where careful review of ESG information might have generated warnings, whereas other standard sources provided no such signal.

Why Incorporate ESG Data?

For an investor that has no mandate to consider the ethical value of investment choices, the extra cost of information processing in ESG integration must be justified by a corresponding increase in expected risk-adjusted returns. Given the variety of ESG data sources, even ESG-focused investment managers must make a business case for each *additional* ESG data source. That is, each data source must not only add value to the security selection process, but it must add value that is *incremental* to other sources already being utilized.

The Decision Theoretic Basis for Integrating ESG Information

A well-established truth in decision theory states that combining multiple forecasts (generated by different methods, models, or experts) leads to significantly increased forecast accuracy (Clemen, 1989). The principle of averaging multiple diverse sources of expertly generated information to produce more accurate estimates underpins many applications in climate and meteorology forecasting, real-time macro-economic forecasting, electricity demand forecasting, demographic prediction, and psychiatric diagnosis, among other fields. It has been demonstrated, for example, that while currency trading strategies based on fundamental macroeconomic variables and those based on technical trading rules are both value-enhancing, trading strategies based on a combination of fundamental and technical methods exhibit improved risk-adjusted performance over both single-method strategies (de Zwart, Markwat, Swinkels, & van Dijk, 2009). It should not be surprising, therefore, that investment managers would expect to improve the security selection process by combining standard accounting and financial information with ESG data.

The Value-Relevance of ESG Information

A segment of the accounting literature considers whether there is incremental explanatory power or value to non-financial ESG disclosures. Accountants refer to this as the "value-relevance" of nonfinancial (i.e. ESG) information. The question is investigated by testing a general valuation model inspired by Ohlson (1995). Ohlson argued that if the stock price is the present discounted sum of future expected net dividends, then the price will be a function of book value, abnormal earnings and "other information," such as non-financial information. In an early application of this method, Hughes shows that nonfinancial measures of air pollution in the electric utility sector are value-relevant (Hughes, 2000). Environmental liability information disclosed by the EPA is found to be value-relevant for credit ratings of new bond issues (Graham, Maher, & Northcut, 2001). More recent studies find that corporate social performance is value-relevant and associated with greater earnings persistence (Gregory, Whittaker, & Yan, 2016) and that short-sellers rationally avoid firms with high ESG scores (Jain, Jain, & Rezaee, 2016). Crucially, Clarkson et al. find that voluntary environmental disclosures are *incrementally* informative over current environmental performance measures available to the public, as proxied by the firm's Toxics Releases Inventory (TRI) emissions data reported by the EPA (2013).

The Financial Impact of Specific Aspects of ESG Performance

Composite ESG scores can only be a starting point of investment due diligence on an issuer. In the Appendix, we present a due diligence checklist with specific ESG questions for a security selector to ask about each issuer. The questions are organized into four categories:

input efficiency and reliability, customer loyalty, employee engagement, and other stakeholder relationships. These questions are associated with specific results from the literature that support the relationship to financial performance. For example, for raw materials and waste product management practices (under Input Efficiency and Reliability), we note that, based on an event study methodology, the implementation of environmental management systems such ISO 14001 certification amongst publicly traded U.S. firms between 1996 and 2005 is followed by significant financial improvement relative to matched firms in the long run (Jong, Paulraj, & Blome, 2014). Similarly, corporate carbon performance is positively related to financial performance (Busch & Lewandowski, 2017) and continuous investment in energy efficiency is associated with higher productivity in manufacturing industries (Bergmann, et al., 2017). Corresponding results are cited for customer loyalty, employee engagement, and other stakeholder relationships in the Appendix.

Sources of ESG Data

Where there once was a dearth of ESG data and data sources, there now is increasingly more data available. Issuers are aware of the demand for disclosure of their ESG performance due to the numerous requests they receive from various stakeholders and third-party ESG raters. In addition, there are more data frameworks such as those produced by the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) to help guide the process of generating and managing ESG data and reporting ESG-related performance.

While interest in ESG data from consumers, prospective clients, management, and civil society has increased, the stakeholders with the most demanding information needs are security selectors – that is, asset owners, investment managers, securities analysts, and portfolio managers. In monetary terms, security selectors have the most to gain from ESG data and are therefore the stakeholder most likely to be able to fund the resource costs of data collection and processing. They are hence the key stakeholder that the ESG data industry must satisfy.

Security selectors generally value a diversity of sources for information, subject to the costs of extra information processing, which we address in the next section. Diversity of sources helps to reduce the adverse effects of the information asymmetry between investor and corporate management and can help to mitigate agency problems.[32] The variety of sources enables comparison of issuer-sourced information with third-party product certifications,

[32] The principal-agent problem, or the agency problem between shareholders and managers occurs whenever managers have incentives to pursue their own interests at shareholder expense. The problem is a by-product of the separation of ownership and control.

employee commentary, civil society perceptions, media stories, and unstructured publicly available data. This comparison and crosscheck is essential to developing a comprehensive understanding of an issuer, but does make the analyst's task more difficult. She must develop procedures to parse that which is unsubstantiated hearsay or a poorly-formed opinion from that which is accurate and material to an issuer's future performance.

It is now feasible for the security selector to tap a significant diversity of sources of ESG data. We describe briefly the range of source types below:

Issuers: Issuers are generally the first source for ESG data. The corporate responsibility and sustainability report supplemented by annual reports, or the integrated annual report of the issuer provides an overview of how companies are integrating ESG strategies into their strategy and operations, and increasingly, a data-rich picture of their ESG performance.[33] What is often missing, though, is how that performance links to financial performance. A strong example, however, of the connections can be seen in SAP's 2016 Integrated Report, where they state "We believe that social, environmental, and economic performance are interrelated, with each creating tangible impacts on the others." In it, SAP reports on metrics such as their one-percent decrease in carbon emissions that would have a €5 million impact on non-IFRS operating profit and a +/- one percentage point change in Employee Engagement Index that had a €45–55 million impact on non-IFRS operating profit.

ESG Data Providers/Raters: In response to questionnaires, issuers disclose detailed ESG data to a number of ESG data providers who in turn make that data available to investors through a subscription-based or licensed-based model, with varying levels of verification and data-processing. ESG data providers generally supplement the data with analytics, including proprietary ESG scores, ratings, rankings, indices, and visualization tools. The Global Initiative for Sustainability Ratings (GISR) is a multi-stakeholder initiative whose mission is to drive ratings transparency and excellence. GISR's Ratings Directory, which aims to be a comprehensive database of rating organizations, lists 250 different ratings product families offered by 130 different owners. Between 2010 and 2012, SustainAbility, an ESG consultancy, conducted a research effort entitled *Rate the Raters*, among whose outputs are unedited, publicly available responses from a number of rating providers to a questionnaire covering rating description, governance and transparency, inputs to the rating process, the research process, and rating outputs.

[33] An integrated report includes performance on both direct and indirect financial information and specifically, how ESG-related strategies are feeding the bottom line. Companies that issue integrated reports generally follow a triple bottom-line approach where goals and targets are set in three areas: people (the "S" in ESG), planet (the "E" in ESG) and profits (the results of integration of E, S, and G into business strategy).

Information Aggregators: ESG data is available from mainstream information aggregators such as Bloomberg, Thomson Reuters, and FactSet. These aggregators make information available from other sources without further processing of their own and also carry out their own aggregation and analytics to construct their own scoring models.

Index Providers: A number of indices of high-performing ESG issuers exist. Index providers may simply list index members, or may provide underlying KPIs that support the index composition choice. Examples of index providers are MSCI KLD, Dow Jones Sustainability Index (DJSI), FTSE4Good, *Newsweek* Green Rankings, DiversityInc, and the Ethisphere Institute.

Algorithmic ESG Data Processors: The broad availability of unstructured data on the Internet has created an opportunity for algorithmic data processors that convert unstructured, keyword-based information into structured data organized by issuer-identifiers such as ticker and ISIN. Examples of algorithmic data processors include Datamaran (developed by eRevalue), CSRHub, and RepRisk.

Stakeholder-derived Information Processors: Websites like Glassdoor contain "insider" perspective from employees and others who claim to know a company's operations. Glassdoor provides reviews of 600,000 companies and ratings in the form of net promoter scores (whether the company would be recommended to others), CEO approval rating, and various top company awards and recognition. Brand Finance issues the World's Most Valuable Brands/Global 500, which calculates the values of brands by estimating the likely future sales that are attributable to a brand and a royalty rate that would be charged for the use of the brand if it were to be purchased.

Product Certification Organizations: There are now numerous product certification schemes, particularly in the environmental arena, and websites that offer ranking and ratings such as EPA Energy Star and Environmental Working Group (EWG) programs. The EWG VERIFIED™ program, for example, provides certification for products that are free of contaminants that pose health, ecotoxicity, and/or contamination concerns. EWG also maintains databases such as Skin Deep® that rate products on the same criteria. Skin Deep® ratings are provided for all versions of products, showing increases or decreases in ratings over time as ingredients change. Its existence has incentivized many companies to improve their transparency, quality, and safety of ingredients.

Supply Chain Certifiers: EcoVadis provides ratings and scorecards for the global supply chain, including a benchmarking tool that helps companies monitor environmental, ethical, and social practices of suppliers and business partners across 150 purchasing categories and 110 countries. For many companies, understanding and managing the ESG

performance of suppliers is as important to risk as it is to managing its own ESG performance.

Industry-level Sustainability Initiatives: Lastly, an often underused source of ESG information on both private and public companies are ESG-related industry associations, such as the Conflict Free Smelter Initiative (CFSI) and The Better Cotton Initiative, as well as signatory initiatives such as the Principles for Responsible Investing (PRI) and the United Nations Global Compact (UNGC).

ESG Data Availability on Private Companies

There are very few regulations, particularly in the United States, requiring ESG disclosure. As such, what and how much publicly traded companies disclose varies; there is even less information on private companies and public sector entities. Additionally, only public companies qualify for most of the ESG-related recognition (e.g. DJSI, *Newsweek* Green Rankings) so the credibility incentive for private companies to disclose voluntarily is virtually nonexistent. CSRHub, RepRisk, GRI (the GRI Sustainability Disclosure Database), and CDP are comprehensive sources of information on private companies, governments, universities, and even nonprofit organizations. The other options for analysts of private companies and public sector institutions are tools that cater to ESG-specific topics, supply chain information, and "listening tools" or software that uses natural language processing technology (NLP) to aggregate perception of a brand or company from sources across the Internet and social media. Many of these tools are also helpful in analyzing public companies.

The Cost and Limitations of ESG Data

The increase in the availability of ESG data does not necessarily ease the work of a security selector. Depending on the nature of ESG information incorporated, the cost of data acquisition and processing and the potential for economies of scale can vary considerably.

Most rating organizations, including for-profit and nonprofit providers, sell their data in some form – through a subscription to access data and scores, licensing of indices, consulting services, memberships, research papers, industry briefs, and other related products and services. Some offer high level data or a subset of the data to the public without subscription. While most ratings providers generate revenues from the users of data and analysis, some also charge issuers an administrative fee to disclose their data.

ESG integration necessarily broadens the range of issuer-level metrics that must be tracked by a security selector. Investment managers must systematically incorporate both financial

and ESG information into their decision process. Given a fixed information-processing capacity in the human brain and associated information aggregation costs, the question of whether additional information is useful (that is, value-enhancing) to the process of security selection must be raised. In addition to subscription fees, the extra information has significant resource costs associated with it, comprising analyst time and the potentially significant costs of making incorrect decisions based on information that is wrong or badly processed. Automated information processing or algorithmic security selection processes can reduce the expenditure of human resource time and perhaps subscription fees, but it may increase the expected costs of bad decisions if it increases complexity and model risk and reduces the likelihood that incorrect data or faulty inferences will be discovered. For an investor that has no mandate to consider the ethical value of investment choices, the extra cost of information processing in ESG integration must be justified by a corresponding increase in expected risk-adjusted returns. Crucially, as noted earlier, each data source must not only add value to the security selection process, but it must add value that is *incremental* to other sources already being utilized.

The research to establish the incremental value of each type of data source (for example, the value of algorithmic ESG data processors or natural language processing for those who already incorporate structured ESG data) has yet to be completed. As the number and type of data sources increase, an investment manager must ask whether it is worth paying the extra cost in resources and complexity to incorporate each additional source. While most commercial data providers have conducted studies that demonstrate the business case for the value of their own data and readily provide such studies as part of their marketing materials, the credibility of these analyses is reduced due to the absence of peer review and common standards of objective academic research.

Reliance on ESG data for investment decisions has its limitations. It is as important to understand how the data are prepared and collected as it is to understand the strategies for analyzing them. The data preparation and collection process can affect their efficacy, reliability, and comparability. The security selector must consider these limitations when incorporating ESG data into investment analysis and in some cases may want to engage companies directly to elaborate on ESG disclosures.

It is therefore highly recommended that analysts do not rely solely on one source of ESG data and, wherever possible, engage issuers directly. It can also be helpful to understand the source within companies that manages the data reporting process. While the traditional approach to active engagement in investment management most often includes contact with investor relations (IR) staff, ESG data is not often "owned" or housed in IR, but rather lies with the corporate responsibility and/or sustainability (CR&S) function. Depending on the level of CR&S integration into the business, there are often data owners across the

company; but, generally, the CR&S department (or sometimes corporate communications, marketing, or corporate affairs) is responsible for reporting and disclosure, and is therefore the main point of contact. In companies that are advanced in managing ESG, or where ESG issues are in the mainstream for their industry, IR is often the main point of contact.

Materiality

When ESG performance is managed well, it is preceded by a materiality analysis, which determines the specific types of ESG risks and opportunities that are significant to a particular issuer. The GRI Standard and framework defines material topics as follows: "Relevant topics are those that may reasonably be considered important for reflecting the organization's economic, environmental and social impacts, or influencing the decisions of stakeholders, and, therefore, potentially merit inclusion in the report. Materiality is the threshold at which Aspects become sufficiently important that they should be reported." SASB utilizes the U.S. Securities and Exchange Commission (SEC) definition as follows: " 'Material information' is defined by the Supreme Court as presenting a substantial likelihood that the disclosure of the omitted fact would have been viewed by the reasonable investor as having significantly altered the total mix of information made available."[34]

Whereas GRI suggests the process of assessing materiality should relate to all stakeholders, SASB suggests it should relate solely to the investor stakeholder. It is important for an analyst to understand what stakeholders a company has identified as key and the associated definition of materiality.

Materiality is industry-specific. What is an important operational requirement or reputational issue to one company may not be to another in a different industry. In the absence of regulations requiring ESG disclosure in most jurisdictions, companies determine their own materiality and therefore, strategize, implement, manage, measure, report, and disclose accordingly. Several frameworks, standards, and guidelines on KPIs continue to co-exist and there is no uniform consensus on the salience of specific KPIs. Companies manage and report on those KPIs they deem to be material and choose the frameworks, standards, and guidelines that best fit them.

Companies therefore decide what they believe is key to their operations, which may or may not be a perspective shared by peers. Within an industry, variation in business models implies that the relevance of specific ESG metrics may vary across peers. If a security selector makes her own determination of a company's industry segment without confirmation, she may not be clear on which material issues the company is focused on and

[34] TSC Industries, Inc. v. Northway, Inc., 426 U.S. 438 (1976).

why. This may lead to an analysis and scoring based on ESG information that is not relevant or, worse, non-existent. If a company issues little to no information in a particular ESG area because they deem it non-material, an analyst who incorrectly categorizes a company may misinterpret that as a signal of poor management or evasion.

The Data Collection Process

Each rating organization has its own methodology, collection, and reporting cycle. Among those that engage issuers directly, raters may receive corrections or updates from companies that are off-cycle. Such updates are rarely incorporated into analysis mid-cycle. For a security selector, accessing issuer disclosures and engaging a company directly may provide clarity, timely updates, and corrected data not immediately reported by rating organizations. The discussions during engagement may provide investors with information about upcoming initiatives that have not yet generated concrete metric-level disclosure.

Data collection questionnaires vary in length and complexity. Some, like the Corporate Sustainability Assessment (CSA) from RobecoSAM, which underlies the DJSI, consist of approximately 100 questions, depend on sector and industry, take months to complete, and require the participation of 30-50 internal subject matter experts (SMEs). Others, such as the *Newsweek* Green Rankings, comprise approximately 10 questions and require the involvement of only a few SMEs. Depending on investment style and rating methodology, a security selector will need to select among different ratings providers, use multiple providers as crosschecks, and review variation and correlation across providers.

The information requests may involve the completion of a blank survey by the issuer or review of a report completed by an analyst at the rating provider. Some analysts are industry or sector specialists and may write the entire report while other reports are written by several analysts who specialize in one or more ESG areas. The rules for completion of the requests also vary – some rating and ranking agencies accept corrections or augmented data from publicly available sources only, others accept all information, maintaining confidentiality for the inputs and disclosing only the analysis. Others are completed by in-house analysts who interpret publicly available data. Certain providers outsource the rating computation process to third-party analysts. There are also certain providers that do not engage the company unless approached proactively by the issuer. Their analysis and scores are independent of knowledge gained when speaking directly to the source and could therefore be inaccurate, out-of-date, or miscategorized. Often, the rationale for this approach is not a consequence of strategy, but rather a lack of resources. A notable exception is RepRisk, an ESG tool that chooses to capture and analyze data from media, stakeholders, and other public sources external to the company. RepRisk argues that this "helps balance and substantiate the information provided by the company itself,

and helps assess whether a company's intention – policies, processes, and commitments – translates into practice."

Data Assurance and Comparability

The data reporting process may be targeted towards different audiences. This may reduce the comparability of ESG measures across sources. The GISR directory categorizes each data product as being targeted to investors, customers, or companies. While the security selector might gravitate toward data targeted to investors, the need to crosscheck and validate the diversity of sources implies that data targeted to companies or consumers may also be decision-relevant. The GRI Standard and the Natural Capital framework, a method of natural capital accounting,[35] assume that ESG data should target an even broader range of stakeholders, including communities, regulators, the environment, and society at large.

Not all CR&S annual reports are verified by external, independent third-parties. A 2015 survey (KPMG, 2015) found that 63 percent of the world's largest 250 companies assured their CR&S reports, and that just half of these assured the entire report. The French government requires listed, and some non-listed, companies to publish third-party verified corporate responsibility information in the annual directors' report. Consequently, 96 percent of CR&S reports from French companies are assured. The United States is not among the five countries with the highest percentage of assured CR&S reports. When companies assure a portion of the report, it tends to be the area(s) that are either most material or contain the most data, which is often environmental sustainability. When externally assured, letters from third-party assurers detailing the level of assurance and observed irregularities, inconsistencies, or inappropriate practices are almost always included in the CR&S report. Some companies choose only to internally assure their reports. This is not best practice and therefore provides a limited level of credibility.

How to use ESG Data in the Security Selection Process

The dimensions of ESG performance are industry-specific because what is material to a company in relation to ESG depends largely on the business model, industry, and sector. SASB, focused on the investor as the key stakeholder, suggests those that analyze companies take into account performance factors that meet one or more aspects of the following Five-Factor test (Sustainability Accounting Standards Board, 2015):

1. **Financial impact and risk**: ESG issues that may have a financial impact or may pose a risk to the industry in the short-, medium-, or long-term.

[35] Whereby a company manages and reports on what is material to them in relation to natural (e.g. forests, water), built (infrastructure, roadways) and human (workforce) capital.

2. **Legal, regulatory, and policy drivers**: ESG issues that are being shaped by emerging or evolving government policy and regulation (e.g., carbon emissions regulation).
3. **Industry norms and competitive drivers**: ESG issues that are reported by companies in specific industries and recognized as important drivers for their type of business.
4. **Stakeholder concerns and social trends**: ESG issues that are of high importance to stakeholders, including communities, nonprofit organizations, and the general public, or reflect social and consumer trends, and which rise to the level of interest to investors when they have economic implications.
5. **Opportunities for innovation**: competitive advantages created from potential ESG-related innovative solutions that benefit the environment, customers, and other stakeholders.

The range of ESG data sources can help analysts access the information on which to apply the five factors. Once an analyst has determined the type of data needed to assess each company, she can begin to manipulate it to better understand a company's ESG risks and opportunities and its practices for managing them.

Normalization and Comparison

Given there is little to no uniformity in the disclosure of ESG data, analysts will generally need to normalize KPIs to render them comparable to benchmark. This means applying activity or scale metrics such as revenue, number of sites or employees, products sold, or asset size, and taking into account contextual information such as dispersion and year-over-year (YOY) performance.

Once data is normalized, analysts can consider the dispersion of normalized metrics between and within industries. Contextual information that must be taken into account includes societal trends (shifts in consumer preference), the regulatory climate (legislation and compliance costs), company's operating environment (the business and economic climate, industry trends, commodity prices) and the region(s) in which the company operates (that includes differences in cultural norms). In recent years, consumers have become more sophisticated in purchasing, researching how and where a product is made and a company's brand reputation before buying. It is important for analysts to take into consideration consumer trends specific to a given industry to determine whether companies are leveraging that to their advantage or lagging behind.

Taking all these factors into account as a full set of information and data, and not one metric in isolation, will provide an overall ESG performance picture for a company. Once this analysis is complete, an analyst can start the process of linking ESG performance to

financial performance in the areas of revenues and costs, assets and liabilities, and cost of capital.

Analysts will want to deliberate on the following factors when seeking linkages: the likelihood, severity, and timeframe in which negative or positive impacts from ESG issues could affect a company and whether the company is actively managing these impacts due to the incorporation of ESG into its strategy or is simply managing each crisis as it develops. Is the company likely to experience a low-probability, high-intensity, near-term impact such as customer data breach or a high-likelihood, high-intensity, long-term impact from extraction of water in water-stressed regions? In these cases, is it systemic or a one-time event? Asking the following questions may be helpful in understanding the depth of impact:

1. Is the incident highly public with the potential to affect the brand?
2. Is the issue likely to persist and affect the company over a period of time?
3. How do the costs to remediate this issue affect short-term earnings and the long-term bottom line?
4. How often does this incident happen to the company and happen in the industry?

Two Examples of Missed Signals from Unstructured ESG Data

Taking ESG factors into consideration during the portfolio construction process provides analysts, portfolio managers, and investors with a more complete picture of corporate performance in relation to all the risks and opportunities posed by its operating environment. Analysts may also uncover risks or opportunities not generally considered when solely factoring financial information into a valuation model. For example, soon after the 2010 Deepwater Horizon oil spill, the Center for Public Integrity's review of government safety records showed that two refineries owned by British Petroleum (BP) accounted for 97 percent of all flagrant violations found in the U.S. refining industry by government safety inspectors in the preceding three years. BP accounted for 829 of the 851 willful violations among all refiners cited by the Occupational Safety & Health Administration (OSHA) during the period analyzed by the Center (Morris, 2010). The violations cost the company a capped $70,000 per incident, a direct financial effect, but the spill cost $18.7 billion in settlement dollars alone, yielding a larger effect to financials, reputation, license to operate, and many more operational aspects. Fines from violations are a "G" ESG issue and comparison of that metric would have alerted analysts to a possible systemic governance issue leading to bottom line and stock price effects. While OSHA records were not easily available at the time in the form of data fields in an ESG data source organized by ticker, they were available in letters published in response to Freedom of Information Act requests on their website.

Similarly, a review of Datamaran analysis on Volkswagen (VW) CR&S reports demonstrates that non-carbon gases were mentioned less often in VW's sustainability disclosures in recent years, despite the fact that the reports themselves grew in size (Vittorio, 2015). About a year before the tailpipe emissions cheating scandal broke in 2015, VW reports essentially went silent on the topic of tailpipe nitrogen oxides (NOx) emissions, instead devoting more space to the topic of carbon emissions. While an analyst studying this would not necessarily know that malfeasance was occurring, this red flag would have been helpful to the analytical process and may have promoted a deeper dive and, therefore, more data to contemplate impacts. The case demonstrates the importance of noticing what is not being said as well as what is said.

Concluding Remarks

There is a strong case for analysts to incorporate ESG data into their security selection process. The impetus stems from the uptick in corporate ESG integration into business strategy as a business value-driver, coupled with the increase in ESG reporting standards and frameworks, research-based evidence, ESG data sources, and stakeholder demand, particularly from investors. The efficacy of the portfolio construction process, however, must include an understanding of the underlying methodologies with which the ESG data was collected, prepared, and reported. Analysts who rely solely on scores, rankings, or high-level data may lack the benefit of a full understanding of the ESG performance of a company, and, consequently, may not have an accurate, complete picture of corporate operations. This can affect the analysis of stock performance potential.

The recommendation, therefore, is to carry-out a due diligence process that includes an understanding of an issuer's industry-based materiality assessment, a large scope of ratings and rankings from several sources whose methodologies vary, a deeper dive into key risks and opportunities based on data sources cited in this paper and resourced elsewhere, and corporate engagement, where applicable and possible. It is also advisable to develop a set of key industry-based and ESG issues-based questions, which can be contemplated as part of a due diligence questionnaire that applies a uniform process across areas of significance for a security.

We also recommend more dialog and linkages between academic research that attempts to test the incremental value of types of ESG data and the analyses performed by ESG data providers. An industry repository for historical data available at low cost for academic purposes that can be used for peer-reviewed analyses would reduce the barriers to objective, provider-neutral studies. Such studies are essential to demonstrating that the benefits of ESG integration exceed the costs and to establishing a credible business case for incremental sources of ESG data.

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Appendix: Due Diligence Checklist

Input Efficiency

Metrics	Questions	Established Relationships	Source for Relationship
Raw materials and waste product management	Does the company have ongoing initiatives to maximize raw material efficiency? Has the company adopted environmental management systems (such as ISO 14001) in its operations? How automated or routinized is the system? How extensive is the company's voluntary environmental disclosures?	Implementation of EMS is associated with longer term improvements in ROA. Direct relationship is mixed and varies by industry, but management focus is an indicator of strategic leadership.	(Jong et al., 2014) (Suh, et al., 2014)
Greenhouse gas (GHG) Emissions management	Does the company have science-based, aggressive targets for emission reduction and a history of meeting them? Are Scope 2 & 3 included in the reduction goals?	Corporate carbon performance is positively related to financial performance.	(Busch & Lewandowski, 2017)
Energy Efficiency	Does the company utilize decision support tools such as cost-benefit analysis to evaluate the energy efficiency of business processes?	Continuous investment in energy efficiency is associated with higher productivity in manufacturing industries.	(Bergmann et al., 2017)

ESG Indices and Corporate Sustainability Research from a Strategic Perspective: A Reflective Appraisal and Suggestions for Improvement

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Abstract

Although ESG indices and datasets from MSCI, Thomson Reuters, FTSE Group, and Dow Jones Indices are primarily aimed at aiding socially responsible investments, they have significant appeal for scholars studying corporate sustainability (CS) behavior and firm performance. The indices offer ready benchmarking of a large universe of firms on these inherently subjective and difficult to quantify, multi-level, multidimensional, and complex concepts. In this paper, we focus illustratively on the environmental, social, and governance (ESG) performance database from MSCI: MSCI-ESG-KLD STATS. Reflecting on our experiences coding over 1,500 CS reports of Fortune Global 500 firms, and triangulating with primary data and insights drawn from onsite visits, inspections, managerial interactions, and archival studies of select firms, we submit that the data structure in most ESG databases constrains investigations into firms' CS behavior from a *strategic* perspective. We highlight three issues: binary scoring schema; functional categorization of discrete activities; and setting off "concerns" against "strengths." We argue that addressing these issues could enhance these databases' utility and appeal to scholars.

Introduction

Socially responsible investments (SRI) have grown steadily and substantively over the last three decades (Hutton, D'Antonio and Johnsen, 1998; Renneboog, Horst, and Zhang, 2008). This has coincided with increased attention and sensitivity to corporate sustainability (CS) or corporate social responsibility (CSR) by business, society, government, and academia. The ESG indices and ratings meant to facilitate SRI have simultaneously flourished, making up a critical market infrastructure (Waddock, 2008). Among the popular databases are MSCI-ESG-KLD STATS, Thomson Reuters ESG Research, FTSE4Good, and Dow Jones Sustainability Index (DJSI), with MSCI-ESG-KLD STATS (MSCI-STATS) counting among the pioneers (ibid).

While ESG indices and databases primarily target SRI investors, they have significant appeal for scholars too. Empirical CS/CSR research published in leading management journals starting from the late 1990s has used databases such as MSCI-STATS (Cheng, Ioannou, and Serafeim, 2014; Hoi, Wu, and Zhang, 2016; Sharfman, 1996; Strike, Gao, and Bansal, 2006; Waddock and Graves, 1997). For a number of reasons, datasets like MSCI-STATS hold a similar appeal for academics and SRI investors.

1. These databases and indices are among the few proprietary sources that offer a ready platform for benchmarking a large universe of firms on environmental, social, and governance (ESG) performance, as compared to the plethora of sources on financial performance data. Reliable ESG databases are relatively rare, as they are built through elaborate recording and coding of non-standard raw data from multiple sources. (Financial databases are widely available, as they capture data that are largely standardized.)
2. Sustainability involves multi-level, multidimensional, and complex concepts (Martens, 2006), rendering the related constructs and variables inherently subjective and difficult to quantify or measure scientifically. Therefore, unlike financial performance, both academics and investors find it challenging to independently generate consistent metrics or assess CS performance for a wide range of firms over time without investing significant effort and resources.
3. The performance indicators in databases such as MSCI-STATS and Thomson ESG are typically aggregated in a telescopic fashion that allows flexibility for users to compare scores at both high and granular levels across E, S, and G dimensions.

For these reasons, prominent ESG databases and indices represent rare sources of well-organized and reliable data for both informed decision making by SRI investors and empirical CS research by scholars.

Scholars have used ESG indices and ratings to examine a wide a range of research issues that lie at the intersection of strategic management and CS. In particular, data from MSCI-STATS has been used to empirically examine the relationships between environmental or social performance and a host of firm and industry level phenomena. The increasing use of MSCI-STATS and other ESG ratings data in CS-related academic research lends credibility to the data and the robustness of methods, even though there is little convergence among ratings from different raters (Chatterji and Levine, 2006; Sharfman, 1996).

Focusing illustratively on mostly MSCI-STATS, reflecting on our experiences of coding over 1,500 CS reports of Fortune Global 500 firms (see Appendix 1), and triangulating with primary data and insights drawn from onsite visits, inspections, managerial interactions, and archival study of select firms, we propose that the data structure and rating schema in ESG databases do not facilitate investigations into firms' CS behavior from a *strategic* perspective. Addressing three features of MSCI-STATS would significantly enhance its utility for strategic CS research. (These three features are also applicable to some other indices.) These features are: binary scoring schema; functional categorization of ESG activities; and the tendency to combine "concerns" and "strengths" into one score.

Binary scoring in most ESG databases artificially reduces the complexity of CS initiatives that have wide variability in application and investment and that emanate from different CS strategies. It simplifies this to a basic "1/0" assessment. While binary scoring facilitates greater objectivity, we contend that the field is mature enough to apply a multi-point rating scale that can capture variation in even inherently qualitative aspects. Given most ESG data providers already use a multi-point rating scale for some of their ESG products, we believe that shifting wholly from a binary to a multi-point rating scale would not be impossible.

In functional and activity-oriented categorization of CS initiatives, labels such as "recycling", "clean energy" (in MSCI-STATS) or "product innovation" (in Thomson ESG) explicate what function a CS initiative serves. However, these labels do not clarify underlying strategic intent. Similarly, "emission reduction" can be achieved within the firm or potentially anywhere along the firm's value chain – that is, with suppliers or logistics partners. This second kind of reform could stem from the firm championing sustainability across its ecosystem, but this would not be self-evident in MSCI-STATS.

A number of performance assessment schemes offset environmental concerns or controversies against environmental strengths. We argue that strengths and concerns derive from different sources or motivations, and combining them obfuscates the underlying CS strategies (Mattingly and Berman, 2006). Although such an approach serves investment managers well by presenting an overall, easy-to-use rating, it may sometimes gloss over important nuance.

The rest of this paper is organized as follows: In the next section we briefly outline the typical data structure in ESG databases along with the manner in which this data has been used in strategy and CS research. We then discuss what CS research entails, from a strategic perspective. Drawing on our understanding of CS/CSR practice from various sources, such as our own coding of CS reports and interactions with CS practitioners, we then expand on three problematic issues that emerge in using these datasets for strategic CS/CSR investigations. In the concluding section we summarize our critique and discuss how some of these issues could be potentially addressed for the benefit of all stakeholders.

ESG Data in Corporate Sustainability Research

Researchers have often used ESG databases – in particular MSCI-STATS and Thomson ESG – in studies related to CS/CSR. Many of these studies have focused on associating various facets of business (accounting performance, market performance, earnings quality, and so on) to corporate environmental or social performance (Cheng, Ioannou, and Serafeim, 2014; Griffin and Mahon, 1997; Ioannou and Serafeim, 2012; Kim, Park, and Wier, 2012; Van der Laan, Van Ees, and Van Witteloostuijn, 2008). Other interesting inquiries that can use ESG databases include drivers of corporate social performance (H.L.Chih, H.H.Chih, and Chen, 2010), strategic implications of CSR (McWilliams, Siegel, and Wright, 2008), and effectiveness of ESG ratings themselves (Chatterji, Levine, and Toffel, 2009). In this section we first discuss the typical data structure in ESG data sets and then focus on the appeal of these databases for CS research.

The Structure of ESG Datasets

ESG databases like MSCI-STATS and Thomson ESG provide performance scores for various parameters grouped under three dimensions: environment, society, and governance. While the performance indicators vary to some extent in the manner they are labeled, grouped, or defined, they demonstrate a fair degree of thematic similarity. For instance, MSCI-STATS's "Biodiversity and Land Use" and "Environmental Opportunities in Renewable Energy" indicators compare well with Thomson ESG's "Biodiversity Impact Reduction" and "Renewable Energy Use," respectively; both have almost identically labeled items for electronic waste management (e-waste reduction), hazardous wastes, and green buildings.

Different databases tend to adopt different modes of scoring. Figure 1 presents a sample list of environment performance indicators that MSCI-STATS and Thomson ESG use to assess firms. On each of these indicators, MSCI-STATS uniformly follows binary scoring: If a firm meets the assessment criteria established for an indicator, then it receives a score of "1." It otherwise receives "0." In comparison, Thomson ESG adopts a quantitative scoring schema for several indicators, though it also scores some indicators on a binary "True"/"False" scale.

Figure 1: Environmental Performance Indicators – Samples from ESG databases

MSCI-STATS	Thomson ESG
Environmental Opportunities - Clean Tech	Biodiversity Impact Reduction
Waste Management - Toxic Emissions and Waste	Carbon Offsets/Credits
Waste Management - Packaging Materials & Waste	CO_2 Equivalents Emission Total
Climate Change - Carbon Emissions	Eco-Design Products
Environmental Management Systems	Environmental Expenditures
Natural Resource Use - Water Stress	Environmental Products
Natural Resource Use - Biodiversity & Land Use	Environmental Supply Chain Management
Natural Resource Use - Raw Material Sourcing	e-Waste Reduction
Natural Resource Use - Financing Environmental Impact	Green Buildings
Environmental Opportunities - Green Buildings	Hybrid Vehicles
Environmental Opportunities in Renewable Energy	Policy Energy Efficiency
Waste Management - Electronic Waste	Policy Water Efficiency
Climate Change - Energy Efficiency	Renewable Energy Use
Climate Change - Product Carbon Footprint	Water Pollutant Emissions
Climate Change - Insuring Climate Change Risk	Water Recycled
Environment - Other Strengths	Water Withdrawal Total

Source: MSCI-ESG-KLD STATS Methodology 2014 and Thomson Reuters ESG Research Brochure 2017

The Appeal of ESG Data for Corporate Sustainability Research

Assessing the ESG performance of a firm is a complex task because sustainability is a multi-level phenomenon influenced by and influencing entities across different levels in the ecosystem (Aguilerra et al., 2007; Martens, 2006). Moreover, performance across E, S, or G dimensions is potentially subjective and typically difficult to measure or quantify. For example, within the environmental dimension, quantitative metrics cannot capture every issue relevant to measures like biodiversity management, waste management, or eco-friendly products. Comparing firms of different sizes in different industries is also challenging. For instance, CO_2 emissions directly attributable to a bank are likely to be far lower than those from an energy company of comparable revenue. However, a comparative

assessment made only on the basis of such direct impact could be misleading, as the bank may be financing several carbon-intensive projects. (Factoring in such indirect impacts is a contentious issue.)

In this context, despite their inability to capture several of the inherent complexities of corporate sustainability, ESG databases currently hold great appeal. For one, databases like MSCI-STATS have achieved a commendable task in organizing ESG data on firms on a very wide range of indicators – as many as 400 – using data from a variety of sources. MSCI-STATS and Thomson ESG also indicate coverage of 2,500 and 6,000 firms, respectively. This includes several years and builds on data from company sources, government archives, and NGOs. Second, these databases have succeeded in introducing a fair degree of objectivity to the assessment of issues that are arguably not as widely appreciated as financial performance, and that otherwise fall into the realm of subjective assessment. ESG data compilation also has to contend with significant non-standard and inconsistent reporting from firms, which makes the task cumbersome. The scoring also involves a high degree of coding, given the challenges to quantitative measurement. The simple availability of ready, organized data to compare a wide universe of firms across several years on hundreds of ESG indicators, even on a binary scale, makes for a tremendously alluring product for scholars. Third, MSCI-STATS and Thomson ESG structure their databases in a telescopic manner. Along with an overall assessment score for each of the ESG dimensions, they provide scores for the primary performance indicators across each dimension. MSCI-STATS (and more recently Thomson ESG) also provides a set of negative or controversial performance indicators. These relate to events, news, or developments like regulatory fines that suggest less-than-desirable conduct by a firm. Both of these features – telescopic data and negative indicators – allow researchers to use not only the aggregate, but also the constituent indicators that may be more relevant to specific research questions.

In this paper we mostly focus on MSCI-STATS, arguably the more widely used empirical source for strategy and CS research. Figure 2 depicts the overall assessment framework of "key issues." It also shows the data structure used by MSCI-STATS, which feeds into other ESG products from MSCI. These key issues are grouped under ten themes and the three pillars of E, S, and G.

Figure 2: Overview of MSCI-STATS Key Issue Assessment Framework

Pillars	Themes	ESG Key Issues
Environment	Climate Change	● Carbon Emissions ● Product Carbon Footprint ● Financing Environmental Impact ● Climate Change Vulnerability
	Natural Resources	● Water Stress ● Biodiversity & Land Use ● Raw Material Sourcing
	Pollution & Waste	● Toxic emissions & Waste ● Packaging Material & Waste ● Electronic Waste
	Environmental Opportunities	● Opportunities in Clean Tech ● Opportunities in Green Building ● Opportunities in Renewable Energy
Social	Human Capital	● Labour Management ● Health & Safety ● Human Capital Development ● Supply Chain Labor Standards
	Product Liability	● Product Safety & Quality ● Chemical Safety ● Financial Product Safety ● Privacy & Data Security ● Responsible Investment ● Health & Demographic Risk
	Stakeholder Opposition	● Controversial Sourcing
	Social Opportunities	● Access to Communications ● Access to Finance ● Access to Health Care ● Opportunities in Nutrition & Health
Governance	Corporate Governance	● Board ● Pay ● Ownership ● Accounting
	Corporate Behavior	● Business Ethics ● Anti-Competitive Practices ● Tax Transparency ● Corruption & Instability ● Financial System Instability

Source: *ESG Rating Methodology – MSCI ESG Research–Executive Summary (2017)*

The MSCI-STATS performance indicators have periodically undergone restructuring and rationalization (MSCI, 2015). We nonetheless believe that these changes do not materially impact the thrust of our critique, as the basic structure and grouping of ESG data has remained fairly consistent.

Strategy Research Perspectives on Corporate Sustainability

Strategic management research has traditionally included understanding and explaining differences in firms' performances. Similarly, inquiries into CS from a strategic perspective seek to examine how and why firms differ in their CS performance, how they differ in the strategies they adopt with respect to CS, and the relationship between CS strategies and CS performance. Much of this research tends to use a firm's rating, position, or inclusion in an ESG index or its score computed out of select indicators from an ESG dataset. However, empirical research that focuses on providing a holistic understanding of the strategies or strategic orientations that determine firms' approaches to CS is rare. We contend that this gap in empirical research is partly attributable to the characteristic of empirical data that are made available through the aforementioned ESG data sources.

Integrated approaches to understanding CS adoption are relatively scant. Munilla and Miles (2005) conceptualize a managerial framework of approaches to corporate social responsibility. They characterize these as Compliance, Strategic, or Forced, and consider the impact of each of these approaches on different stakeholders. Mirvis and Googins (2006) provide one of the more comprehensive conceptual mappings of a firm's strategic approaches to sustainability in their portrayal of the stages of maturation of CS agendas. They conceive firms starting from the most rudimentary stage of "Elementary" and progressively evolving through "Engaged," "Innovative," "Integrated," and ultimately "Transforming." This last stage is characterized by game-changing concepts, intent for social change, and visionary leadership and is supported by transparency and full disclosure.

This kind of holistic analysis and framing of CS initiatives requires an intimate appreciation of what prompt firms to conceptualize and implement a sustainability agenda. For instance, what does sustainability mean to the firm's owners and other stakeholders? What are the underlying philosophy, vision, and intent of the management? What are the constraints and the extent of enabling elements? All of these aspects have a critical bearing on the firm's strategic orientation toward a sustainability agenda; in turn, they influences the firm's ESG choices and the manner in which such choices are exercised. Many of these aspects are not superficially apparent and emerge only through a process of engaging deeply with CS managers, their context, their reasoning, and their narratives. Understanding strategic orientations may also call for associating meaningful themes or categories to seemingly disparate CS actions.

The next section details what in ESG datasets we find limiting when juxtaposed against our objective of extracting strategic intent or orientation that motivate CS initiatives.

The Limitations of ESG Datasets from a Strategic Corporate Sustainability Perspective

Amid wide heterogeneity in the sustainability practices of firms, we seek to understand the phenomenon from an integrated perspective, going beyond conceptual frames and predicating our analysis on actual data. We compare the utility of the data currently available in ESG databases to the requirements of analyzing strategic orientations to CS. We focus in this paper on MSCI-STATS – arguably one of the most widely used ESG databases in CS and strategy research – to explicate the limitations that we perceive. We identify three issues, detailed below.

Binary Scoring of ESG Performance Indicators

MSCI-STATS scores all the identified ESG performance indicators on a binary scale (MSCI, 2015). This represents one manner of dealing with the combination of complexity and subjectivity inherent in most sustainability issues. However, such a reductionist approach does not capture much of the variety and richness in CS initiatives. For instance, the item "Climate Change – Carbon Emissions" in MSCI-STATS includes assessment of a firm's investment in low-carbon technologies, the increase in carbon efficiency of facilities, and comprehensive carbon policies and implementation mechanisms (MSCI, 2015). CS reports reveal that firms such as Shell and ExxonMobil have explored and invested significantly in carbon capture and storage mechanisms. However, BP, a firm whose environmental management initiatives are generally quite similar to those of Shell and ExxonMobil, has articulated economic rationale to not invest in carbon capture and storage. In this instance, all three firms would be scored uniformly as "1" under the above indicator, although there may be merit in debating if Shell and ExxonMobil have exhibited greater intent toward carbon emission control. Similarly, with regard to an item such as "Water Stress," CS reports suggest that while BP and Chevron, firms comparable in size to Shell and ExxonMobil, talk of freshwater management, they provide far less detail of specific water rejuvenation projects or replenishment initiatives. Here again a uniform scoring of "1" for all the four firms does not help differentiate approaches and intents toward water conservation.

The issue is even more complicated when extending comparison to firms operating in different industries. PepsiCo's initiatives related to water management for farming go beyond crops that they themselves procure. Similarly, Anheuser-Busch claims that high-quality water is fundamental to their business. As a result, they not only take initiatives to extensively reduce, reuse, and recycle water, but also to raise awareness of water issues

around the world in partnership with NGOs. This high-level intent around water conservation could merit a "1" on water conservation for these beverage and energy firms. However, since freshwater can be considered far more critical for beverage companies than energy companies, their approach to the water stress may be driven by existential and strategic motivations, whereas energy firms may be driven by environmental responsibility.

Even quantitative measures of carbon or water-usage reduction provide only a measure of the final outcome in a particular sub-dimension pertaining to the issue; it does not adequately convey the extent of activism within firms. This underscores how the complexities inherent in CS do not easily accommodate a uniformly objective scoring schema.

From the perspective of a holistic and strategic approach to CS research, reliance on a binary scoring schema is inadequate and can even be misleading. At a time when average CS reporting rates are about 93% for Global 250 firms and about 73% for the N100 (top 100 firms in 34 countries) (KPMG, 2015) – and given advanced data analytics methods – we argue that there is little justification for well-established ESG data providers that do not develop more nuanced scoring mechanisms.

Alternatives to binary scoring schemas are difficult to implement, but not infeasible. New York-based nonprofit Just Capital recently launched an ambitious and well-organized initiative to provide a ranked assessment to various stakeholders regarding the "justness" of American firms. Just Capital predicates its assessment on 188 indicator "components," many of which are filtered through extensive, systematic, and highly representative public surveys across America. A team of analysts facilitates this work. Most of the indicators correspond to typical ESG parameters. While a full discussion on Just Capital is outside the purview of this paper, what matters is that Just Capital combines qualitative and quantitative assessment to arrive at their rankings. While a few of the qualitative assessments are scored on a binary scale, there are many seemingly qualitative aspects, such as "Benefits Quality" or "Commitment to Work-Life Balance." These are scored on a 5- or 10-point scale and supported by detailed scoring guides. While some of these scores are crowd-sourced, Just Capital generates other scores through a panel of analysts (Just Capital, 2016).

MSCI does have an ESG-rating product that includes an assessment of key issues relevant to a firm's industry and related strategies and initiatives adopted by the firm; both of these products use a "0-10" scale (MSCI 2015, 2017). However, the ESG performance component that is presented in MSCI-STATS, and that is widely used in CS research, follows binary scoring.

Functional Categorization of Key Issues and Performance Indicators

As seen in Figures 1 and 2, ESG themes and key issues/performance indicators in MSCI-STATS are categorized in a functional manner. That is, MSCI-STATS focuses on specific activities or issues, themes or risks, related to ESG. Accordingly, a user of MSCI-STATS is apprised of a firm's status with respect to biodiversity and land use, carbon emissions, waste management, and so on. Such indicators can be useful to assess performance, subject to the limitation of binary scoring.

However, this functional focus does not provide adequate information about the motivations and strategic intent underlying firms' approaches to sustainability, as noted in the examples above on PepsiCo and Anheuser-Busch. A positive score for "Natural Resource Use - Water Stress" would at best reveal that firms are taking initiative with regard to managing water use. But this score does not reveal when firms extend their water initiatives to encourage water conservation in the whole business ecosystem. Nor does the indicator reveal whether the water-related initiatives of a firm are narrow, like rain water harvesting, or extensive and long-term, like the water replenishment initiatives of ExxonMobil in Thailand (ExxonMobil CS Report, 2007).

For basic data capture, the most natural unit of assessment is at the level of ESG initiatives. However, these initiatives are only a manifestation of corporate intent, philosophy, and strategy. A particular CS strategy or orientation could manifest in a range of activities, all of which share a common theme or objective. To reflect this complexity, and to build datasets capable of examining CS from a strategic perspective, we argue that ESG data providers should group initiatives thematically, in a fashion that can reveal strategic intent. For instance, in our self-coding of 1,500 CS reports we used factor analysis to group CS initiatives under strategic themes like "Reduce Environmental Damage," "Champion Business of Green," and "Responsible Governance." These strategic orientation themes would likely vary according to the worldview of the researcher. Despite such bias, it would reveal a strategic intent to CS initiatives rather than having them listed at a functional level.

Combining positive and negative performance scores

To the extent that MSCI-STATS presents positive and negative scores for several of its ESG indicators, researchers tend to set one off against the other to consolidate performance scores on variables of interest.

We posit that positive and negative performance rankings essentially derive from different sources. For instance, under the stated scoring schema of MSCI-STATS, a firm that adopted certain water initiatives to reduce carbon emissions would be scored positively under the Water Stress Positive indicator. At the same time, if it posted any significant water-related

events connected to effluent discharge or was involved in water-related cases it would be scored negatively under the Water Stress Negative indicator.

In analyzing CS initiatives from a strategic perspective, positive and negative performances should hold distinct relevance. An affirmation on a positive performance indicator suggests that the firm is adopting a certain strategy or orientation that seeks to benefit the ecology or society. A score on a negative performance or controversial indicator has two possibilities: The first is poor execution or faulty management of operations. The second is a firm indulging in undesirable practices while seeking to divert attention from such actions by resorting to public-relations exercises, including claims of high environmental performance. Such "greenwashing" by firms could even be considered deliberate strategy (Delmas and Burbano, 2011). However, setting off the negative against the positive does not bring any clarity to understanding CS from a strategic perspective.

We contend that negative performance, or events that generate controversies, need to be judged on their own merit, depending on the seriousness of the issue. A formula that systematically sets the negative against the positive may not render justice to the issue being assessed. For instance, if a firm incurs regulatory fines for not meeting certain emission standards even though it has in place policies and plans to improve its historical performance, it may earn a negative performance score. In this instance, from a strategic perspective, the mere incidence of a fine may not reveal how close a firm was to meeting the performance standards, or even that it has a strategy to address the emission issue. Consider a different instance: revelation of a firm deliberately making false claims on environmental performance. In this case, the issue is arguably a serious lapse of integrity; simply setting this negative score against other positives may be insufficient, as no degree of reported positive performance holds credibility in the face of a track record of deliberate misinformation.

Rather than follow the practice of setting negative scores against positive scores in ESG datasets, we argue that it is preferable to consider the positives and negatives separately. This approach is a better way to assess the strategic motivations that drive firms' actions.

Next Steps for Research and Application

Both SRI investors and academic researchers have long used ESG databases like MSCI-STATS on account of the utility they bring to benchmarking firm performance on CS/CSR initiatives. The fact that these databases offer reliable data and comparison across a fairly comprehensive set of performance indicators has significantly assisted empirical academic research on corporate environmental and social performance. ESG data providers also

regularly enhance and strengthen their offerings, in terms of products, coverage of firms, appropriateness of indicators and methods, and relevance of metrics.

Against this backdrop, the main purpose of our commentary was to bring a fresh academic perspective on using ESG databases in strategy research on CS/CSR. We aimed to highlight issues that we believe, if addressed, can materially enhance the appeal and utility of ESG databases for not only CS scholars, but also CS strategists in firms. These reflections are drawn from a number of the authors' own experiences: coding narratives in CS reports to understand strategic intent; interaction with CS practitioners that underscore the complexity and multiple influences involved in conceiving and implementing CS strategies; and study of managers' philosophical orientations toward sustainability agendas.

Examining CS from a strategic perspective, however, calls for a holistic understanding of what drives firms to adopt one specific set of CS initiatives over any other. While ESG databases provide a wealth of panel data on corporate ESG performance indicators, we argue that three features that are central to the data structure of these databases limit their ability to address strategic inquiries. These are:

1. The dominant use of binary scoring;
2. The functional and activity focus in the capture of ESG themes; and
3. Setting negative and positive performance scores against each other.

We suggest that ESG datasets adopt a multi-point assessment scale for most parameters, supported by a clear scoring guide. Even if more challenging and laborious, we argue that this shift can capture greater variability in CS practices while moderating the subjectivity in assessment. Since datasets such as MSCI-STATS and Thomson ESG both indicate that some of their ESG products derive from a broad-based scoring system, the transition to such a schema may be less daunting than it appears. Alternatively, existing data providers may need to emulate the likes of new ESG data providers like Data Capital, which appears to have a workable method for capturing diversity in qualitative data.

Bringing a strategic management orientation to ESG datasets also requires a restructuring and recombination of ESG measurement indicators. Based on current definitions, each indicator can be regrouped under themes that reflect firms' strategic purpose or orientation. Where necessary, some indicators can be rationalized or merged. This reorientation in grouping will reveal a greater directional and strategic sense in assessing the firms' environmental performance.

Finally, the practice of setting negative and positive performance scores against each other is easily addressed, as it is a matter of application, not an issue fundamental to the datasets. Rather than a simplistic summation of concerns and strengths, researchers and data

providers should consider a more sophisticated rating schema. One such approach would be to attach an appropriate weight to each concern depending on the nature of the controversy or issue. This approach would have the benefit of offering a more holistic perspective to investors and researchers; serious infractions (e.g., integrity issues) might be accorded a high weight that shifts the overall rating. Minor concerns would impact a parameter level score, but may not detract much from the overall.

ESG indices and datasets have played a central role in advancing empirical CS research and facilitating SRI. Nevertheless, with CS practices evolving and many firms across the world now reporting in great detail, CS has evolved from something that was once simply good to have and do to a pillar of corporate strategy. To keep pace with this change, ESG databases ought to adopt a systematic measurement schema that captures the increased diversity in corporate environmental and social initiatives from a *strategic perspective.*

Limitations

Our critique is predicated mainly on the application of a strategy lens to ESG research, and particularly from the perspective of academic research. This is but one ESG indices and rankings stakeholder. Furthermore, our appraisal also suffers from our own methodological bias, as it draws on the coding approach that we used for our analysis of CS reports. The suggestions that emerge from our critique may not be uniformly applicable to other ESG stakeholders. Nevertheless, given the issues we highlight relate to the fundamental structure of popular ESG databases, our comments may hold relevance for other users of ESG data. We hope especially that researchers designing ESG data products and services may be able to constructively build on our reflections from a strategy perspective and strengthen their offerings, to benefit both practice and academic research.

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Appendix -1

Note on Coding of CS Reports for Environment Sustainability Initiatives

The coding adopted by the authors for creating a proprietary database of CS initiatives followed a three-step process. In the first step we generated a consolidated list of environmental sustainability issues by collating items that were available in extant academic literature, from MSCI-STATS and from a sample reading of 70 CS reports spread over 25 firms and seven industries. We combined similar items to eliminate redundancy. In the second step, these items were further reviewed by using them to score a sample of 15 randomly chosen firms. After eliminating a few items that did not emerge as material, we arrived at the final master list of 16 environmental sustainability items. In the third step, CS reports were scored for the presence or absence of these items, for each of the years for which reports were available. If an item was discussed in a material manner – that is, if the firm reported specific measures or initiatives with regard to the particular item – it was scored as a "1"; otherwise it was scored as a "0", as illustrated below:

Illustrative coding of CS reports for environment sustainability items

Code- Short Description	Score	Firm (Year)	Reference Quotes from CS reports
Reduce emissions to environment	1	Shell (2011)	"We work to manage CO2 emissions. Spills can harm the environment and put our employees and neighboring communities at risk. We reduce spills through rigorous controls and standards"
Elaborate disaster prevention measures	1	Shell (2012)	"We prepare thoroughly to prevent incidents. In 2012, we intend to start exploration drilling in waters off Alaska. We have worked closely with communities, coastguards and regulatory authorities to put the necessary safeguards in place"
Utilize carbon Credits/carbon trading	1	3M (2012)	Using product carbon footprint information, 3M has offset greenhouse gas emissions from certain products through the purchase of carbon offsets. To consistently manage carbon offsets, 3M adopted a Product Carbon Footprint Offsets Standard

Responsible Investing: Guide to ESG Data Providers and Relevant Trends

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Abstract

Increased demand for information on corporate environmental, social, and governance (ESG) performance has driven increased ESG data availability. With growing regularity, companies report data in corporate responsibility reports, non-governmental organizations gather and report ESG data, social media makes corporate ESG behavior public, and governments and stock exchanges increase reporting requirements. Many investors attempting to include ESG in their investment strategy purchase ESG data from a growing and diverse field of ESG providers. This paper reviews the landscape of major ESG data providers along three axes. One, their *objectives*: a focus on either market, ESG-exclusive, or specialty ESG data, target audience, unique product offerings, and governance structure; two, *data quality*: companies covered, number of issues included and metrics considered, means of data collection, and company engagement; and three, *rating methodologies*: model method, transparency and complexity, and ability to assess future performance. Related developments and trends are also discussed such as the consolidation of data providers and new ESG investment vehicles. For ESG data to meet its potential to help investor (and management) decision making, ESG metrics need to be standardized, ESG data providers need to adopt a common code regarding their methodologies, and financial performance related to ESG investments needs to be tracked and monetized.

Introduction

Many investors today proactively use environmental, social, and governance (ESG) factors in investment strategy, as strong ESG performance has been correlated with positive financial performance and risk mitigation (Friede, Busch, & Bassen, 2015). U.S. domiciled assets under management using sustainable, responsible, and impact strategies grew 33% to US$8.72 trillion from 2014 to 2016, and now represent $1 in every $5 under management (US SIF Foundation, 2016). An exponential growth in corporate reporting on social and environmental performance has, in part, made this increase possible. The percentage of S&P 500 companies producing corporate social responsibility (CSR) or sustainability reports grew from less than 20% in 2011 to 81% in 2015 (Governance & Accountability Institute, 2016).

In response to significant stakeholder demand for robust ESG performance information, data providers have emerged with a variety of product and service offerings aimed at helping investors and companies with their needs. These include incorporating ESG data into equity screens, portfolio construction and analysis, relative value analysis, competitive benchmarking, and risk analysis. Many data providers offer overall ESG as well as separate environmental, social, and governance ratings and use different data sources and proprietary methodologies for these ratings. Due to the erratic quality and lack of standardization of ESG data at the source (company reporting), data providers operate with subpar data. They augment these data with surveys and publicly available records.

In this paper we review the characteristics, limitations, and key differences between major data providers as a navigational tool for integrating ESG factors in decision While ESG indices and databases primarily target making. We also highlight the challenges presented by low-quality ESG data, opaque rating methodologies and governance structures, and the lack of integrated financial data – all factors that complicate investor decision making. While standardized reporting (by companies) and ratings (by data providers) may evolve over time due to growing investor and regulator pressure, the burden of due diligence now rests on the user.

Methods

Below we outline our methods for rating ESG data providers.

Sampling

There are more than 150 providers of ESG research, ratings, rankings, and indices that follow more than 50,000 companies in total (GISR, 2016). In this paper, we consider 17 well-known organizations that *each* independently rate a minimum of 450 companies

(Table 1) and offer ESG ratings, market indices, and rankings. Three of the 17 providers manage ESG investment funds – mutual funds that incorporate sustainability strategies or that combine sustainability information with stock selection. Four of the providers offer proxy voting advisory services.

Analysis

To assess the current landscape of major ESG data providers, we focused our research on the qualities of best-in-class providers identified in SustainAbility's "Rate the Raters" report (SustainAbility, 2011). We organized these qualities along three axes and added a categorization of data providers to increase clarity regarding their objectives. These axes are: First, their *objectives*: a focus on either market, ESG-exclusive, or specialty ESG data, target audience, unique product offerings, and governance structure; second, their *data quality*: companies covered, number of issues included and metrics considered, means of data collection, and company engagement; and third, *rating methodologies*: model method, transparency and complexity, and ability to assess future performance.

Results and Discussion

We break down our results and discussion along the key differences in data providers: provider objectives, data quality, and rating methodologies.

Provider Objectives

Data provider objectives incorporate their purpose, areas of core strength, target market, and governance structure.

Classifications of Purpose. All companies reviewed provide ESG data for ratings, rankings, or indices.[36] They primarily serve investors by providing data, analysis, and risk assessment tools that are used for stock selection as well as portfolio construction and management. While providers offer multiple types of data, their core strengths can be grouped into three types: *market*, *ESG-exclusive*, and *specialized,* as shown in Table 1.

[36] Rankings compare a company's ESG performance relative to other companies'; ratings evaluate a company based on an objective standard; indices track the trading value of a select set of assets and are used as benchmarks for investment offerings, such as mutual and Exchange Traded funds.

Table 1: Data providers and major product offerings (See Appendix for data sources)

Company	Indices[37]					Ratings[38]				Ranking[39]		Investment Funds	Proxy Voting
	ESG	E	S	G		ESG	E	S	G	ESG		Other Services	
Market													
Bloomberg	✓	✓	✓			✓	✓	✓	✓				
FTSE Russell	✓	✓				✓	✓	✓	✓				
MSCI	✓	✓	✓			✓	✓	✓	✓				
Thomson Reuters	✓	✓	✓	✓		✓	✓	✓	✓				
ESG-Exclusive													
Arabesque						✓	✓	✓	✓			✓	
Covalence	✓					✓	✓	✓	✓	✓			
CSRHub						✓	✓	✓	✓				
Ethos				✓		✓	✓	✓	✓			✓	✓
Inrate		✓				✓	✓	✓	✓				✓
Oekom Research	✓					✓	✓	✓	✓	✓			
RobecoSAM	✓	✓				✓				✓		✓	✓
Sustainalytics	✓	✓	✓	✓		✓	✓	✓	✓	✓			
VigeoEIRIS	✓					✓			✓	✓			
Specialized													
ISS/IW Financial						✓			✓	✓			✓
CDP		✓					✓						
RepRisk						✓				✓			

[37] **Index** – composition of an investment portfolio, made up of the % of companies that reflect the highest ESG ratings. These provide investors exposure to sustainability profiles and have a low tracking error to the overall equity or fixed-income markets.
[38] **Rating** – an evaluation or assessment of ESG performance, overall or in the aggregate of Environmental "E", Social "S" or Governance "G" factors, based on a unique methodology.
[39] **Ranking** – listing of companies based on selected sustainability factors.

Market Data Providers. The *market* data providers include Bloomberg L.P., FTSE Russell, MSCI, and Thomson Reuters. They collect broad market data on equities, fixed income, foreign exchange, and commodities to characterize market trends. They also provide analytic tools for investors to assess these trends and investment performance. Bloomberg L.P. and Thomson Reuters provide global financial data delivered through proprietary technology platforms. MSCI and FTSE Russell are the leaders in research-based indices providing investor analytics and data solutions. Today all *market data* providers offer ESG research, ratings, and indices as a subset of their product and service offerings. These providers also offer specialized thematic indices,[40] like the Bloomberg Financial Services Gender-Equality Index, which provides standardized aggregate data across company gender statistics, employee policies, gender conscious product offerings, and external community support and engagement (Bloomberg L.P., 2016). Relatively few companies track and/or report this data, so the Index is driving more companies to report on it. Thomson Reuters, in addition to several general ESG indices, offers a Diversity and Inclusion Index measuring relative performance of companies against factors that define diverse and inclusive workplaces. MSCI offers faith-based indices for investors interested in companies with religious values, and even ratings and rankings on ESG characteristics.

Market data providers also offer specific risk-centered metrics and tools. On climate change, for example, MSCI analyzes fossil fuel reserves, carbon emissions, and sector-specific applications to screen carbon risk and exposure (MSCI, 2017). FTSE Russell has carbon-focused capabilities similar to MSCI and offers a Coal Asset Data Model that identifies a company's coal revenues, production, and reserves (FTSE Russell, 2017). Thomson Reuters offers a Carbon Data and Estimation Model (Thomson Reuters, 2017). MSCI also offers indices that exclude companies engaged in high-risk weapons (i.e., cluster bombs, land mines, chemical or biological weapons, and depleted uranium weapons).

ESG-Exclusive Data Providers. The *ESG-exclusive* class of data providers focuses solely on ESG research, ratings, and analysis, as compared to the *market* data providers, which offer ESG as a subset of products and services. Of these, Arabesque, Covalence, CSRHub, Ethos, Inrate, Oekom research, and Sustainalytics provide a comprehensive set of ESG data, often with a unique approach to evaluating the issues. One might expect more commonality among ESG-exclusive data providers, but they differ in a number of ways: evaluating distinctive ESG factors, such as reputation and product implications; having a unique rating methodology; and/or providing services beyond research and ratings, including specific risk analysis tools.

[40] Investors who seek to capture the impact of long-term structural or cyclical trends across asset classes use thematic indices. Sustainability performance is one example.

Covalence covers the full ESG spectrum, and provides a grade for a company's reputation on sustainability. CSRHub offers a software platform that incorporates information from other research firms and then normalizes these data to create a broad ESG rating system. This allows direct comparison of ESG performance across competitors.

Arabesque, a relative newcomer, has launched its S-Ray tool. This uses analyst insights, big data, and machine learning to provide ESG ratings based on more than 200 ESG metrics gathered from Sustainalytics and MSCI as well as news data from RepRisk. Arabesque also analyzes corporate performance against the United Nations Global Compact principles to derive a Global Compact or GC score, which is a normative assessment. Arabesque freely provides an aggregated ESG measure. Subscribers can access additional, more detailed data.

Oekom research and Inrate focus on how environmental and social performance affect company products and processes. Inrate, for example, evaluates how companies integrate environmental and social issues through a proprietary framework focused on the sustainability of management and operations, products and services, and on certain controversial business practices.

Sustainalytics is the only *ESG-exclusive* provider that owns and maintains an index, the Jantzi Social Index of 50 leading Canadian companies in sustainability. It is far more common for companies to offer ESG-specific research to various index providers, stock exchanges, and financial institutions. Only Oekom research, Sustainalytics, and VigeoEIRIS offer direct data feeds for use in portfolio composition and analysis.

Some providers within the *ESG-exclusive* category offer unique products and services in addition to ESG ratings. Ethos, Inrate, and RobecoSAM offer proxy-voting services. They accumulate data on voting issues and may support studies of corporate governance. VigeoEIRIS ranks companies operating in emerging markets on the basis of human rights, employment practices, environmental protection, corporate governance, and social and economic development (Vigeo Eiris, 2017). Arabesque, Ethos, and RobecoSAM are also asset managers that offer investment funds comprised of companies selected on the basis of their ESG rating.

In terms of specific, risk-centered offerings, Oekom research offers a Carbon Risk Rating that considers a company's carbon-related performance in assessing how they manage industry-specific climate risk (Oekom Research AG, 2015). Inrate's envIMPACT quantitative input-output model uses Life Cycle Approaches to assess risks and opportunities related to climate change ("Inrate - Climate Change Assessments," 2014).

Specialized Data Providers. The third category is *specialized* data providers who focus on one or more aspects of ESG, but not all three. The Carbon Disclosure Project (CDP) offers extensive information and ratings on company performance and risks related to climate change and water. Trucost analyzes environmental risks, such as natural capital costs. Both provide the research and analysis to measure carbon footprints along with exposure to fossil fuels, stranded assets, and renewable energy. These tools can be used for assessment of risks and opportunities in major global equity indices.

Institutional Shareholder Services, Inc. (ISS) is a provider of governance solutions and proxy-advisory services. ISS began expanding into ESG advisory services with the 2015 acquisition of Ethix SRI Advisors (ISS, 2015). They recently acquired IW Financial, which provides an ESG research and a technology platform that allows asset managers and other investment professionals to comparatively rate companies based on user-defined criteria (ISS, 2017a). With the expanded capabilities of IW Financial, they now offer a breadth of ESG data and services.

RepRisk focuses on reputational risk. They gather data daily from 80,000 sources (media, stakeholders, and other public sources), and deliver analytics and metrics assessing the impact of ESG issues on company compliance, financial, and reputation risks. In addition to being included in the CSRHub platform and Arabesque, RepRisk data are incorporated in CDP, FTSE Russell, and RobecoSAM rating models. They also partner with ISS/IW Financial to add the evaluation of additional governance issues to their client offering (ISS, 2017b). Today there are fewer *specialized* providers because they have merged and formed strategic alliances to address the needs of their expanding client base.

Provider Governance Structures. While most of the data providers are public or private for-profit companies, some have unique governance structures. CDP is a nonprofit. CSRHub is a B-Corp. Orix, a publicly owned Japanese financial services company, runs RobecoSAM. Oekom research is a private company with an environmental foundation, a publishing company, and two religious orders as major shareholders. Foundations, pension funds, and other tax-exempt entities own both Ethos and Inrate. Before Eiris merged with Vigeo, a charity, the Eiris Foundation, owned it. Vigeo was previously a limited company with asset and pension fund managers and trade unions as majority shareholders. In the combined VigeoEIRIS, civil-society organizations remain a major shareholder group (24%) of the combined entity (EIRIS, 2015).

Data Quality

All investors should be aware that ESG data are not going to meet financial quality standards because companies do not use one standard to report their performance. Companies can choose to report on material or immaterial ESG factors, on their own

operations or the entire supply chain, on clear targets or on general policies. They can choose to use a globally accepted ESG standard such as the Global Reporting Initiative (GRI), or they can follow their own criteria. They can choose whether or not to have their ESG reporting audited by a third-party.

Financial reporting is rarely integrated with ESG reporting. Firm managers tend not to track the financial impact of their ESG initiatives, other than operational efficiencies such as energy savings, and even these linkages are not reported explicitly. It is impossible for ESG data providers to assess specifically how financial performance results from ESG practices when the linkage is not tracked or reported.

Data providers attempt to address these weaknesses by augmenting the company's reporting with external sources and/or surveys, and by tracking correlations between ESG performance and financial performance. However, ratings of individual companies produced by different rating providers themselves are often not comparable because ratings providers focus on different issues, indicators, and data. Consequently, one of the most important aspects of selecting a rating provider is assessing the quantity and quality of data they provide, how they source their data, and what methodology they use to synthesize these data into ratings.

Given the number of providers to choose from, deriving a successful investment strategy from ESG data requires understanding the criteria behind each rating, including the source of data, the key issues assessed, and how the data are weighted. (For a summary of the data providers we analyzed, see Table 2.) Ratings providers gather both qualitative and quantitative indicators to judge a company's performance. These data come from public sources, surveys, government reports, news reports, and interviews. The providers evaluate companies on two (CDP) to 178 (Thomson Reuters) key issues, depending on the provider. Among others, these issues include: impact on climate change, energy efficiency, equal opportunity and nondiscrimination, board composition, and transparency. In turn, these issues are assessed using between 70 and 1,000 indicators – water usage, greenhouse gas emissions, investment in low-carbon technologies, safety record, and so on.

Not all providers report how many indicators they track, but for those that do, Bloomberg and MSCI (both market data providers) track the most ESG indicators: 700 and 1,000, respectively. ESG-exclusive providers often follow fewer indicators. Indicators tracked by VigeoEIRIS, CDP, Oekom research, and Sustainalytics range between 70 and 330.

Most providers target investors as their primary clients and cover 2,000 to 17,000 companies.[41] CSRHub, an aggregator of ESG provider ratings, sits at the high end, covering

[41] Some data providers target use in supply chain evaluations.

17,000 companies. Bloomberg provides ESG data on 10,000 companies, a transparency of disclosure (but not performance) rating, and access to a subset of third-party ESG performance ratings. Factoring in its 2014 acquisition of GMI, MSCI provides ESG ratings for 7,000 companies (MSCI, 2014).

Table 2: Target market and scope of data considered in rating methodology (See Appendix for data sources)

Rating Provider	Target Market	Market Coverage (#of firms)	Indicators (#)	Key issues (#)
Market				
Bloomberg	Investors & Companies	>10,000	700	120
FTSE Russell	Investors	>4,000	350	125
MSCI	Investors	>6,000	1,000	37
Thomson Reuters	Investors	>6,000	400	178
ESG Exclusive				
Arabesque	Investors	>4,000	200[42]	NA
Covalence	Investors & Companies	>3,400	NA	50
CSRHub	Companies	>17,000	NA	NA
Ethos	Investors	>1,650	NA	NA
Inrate	Investors	>2,600	NA	NA
Oekom Research	Investors	>3,500	100	37
RobecoSAM	Investors & Companies	>2,400	survey[43]	120
Sustainalytics	Investors	>6,500	70	21
VigeoEIRIS	Investors & Companies	>3,200	330	38
Specialized				
CDP	Investors	*>2,000*	175	2

[42] Also include over 50,000 news sources gathered daily

[43] RobecoSAM sends its Corporate Sustainability Assessment (CSA) surveys to over 3,400 companies and had 867 responses in 2016. The survey covers 80-120 questions (RobecoSAM, 2016a). In addition, they also rate 2,400 companies as part of their Sustainabiity Yearbook (RobecoSAM, 2016b)

The *market* data providers have broader market coverage and also work with more indicators and key issues since they started tracking market data well before mainstream investors became interested in ESG. Sustainalytics is the sole *ESG-exclusive* provider offering a similar breadth of coverage as *market data* providers, at 6,500 firms. *Specialized* ESG provider CDP analyzes solicited information from roughly 2,000 companies and holds the largest collection of voluntarily reported climate change, forest, and water data in the world. This includes companies' environmental policies and practices as well as impact and dependence on the environment (CDP, 2016). CDP was rated the most credible rating provider of ESG data in GlobeScan/SustainAbility's 2013 "Polling the Experts" research survey, which captured stakeholder views on sustainability ratings agencies (Sadowski, 2013).

As discussed earlier, a major data quality challenge is the inconsistency of metrics used by companies. The most widely used reporting framework is GRI, an international, independent organization "that helps businesses, governments and other organizations understand and communicate the impact of business on critical sustainability issues such as climate change, human rights, corruption and many others (GRI, 2017)." Participating companies can pick and choose which GRI indicators to report on, complicating a comparison. Another ESG data framework is provided by the International Integrated Reporting Council (IIRC), a global coalition of regulators, investors, companies, standard setters, the accounting profession, and NGOs that believe that communication about value creation should be the next step in the evolution of corporate reporting (IIRC, 2017).

Investors are concerned with issues that are material to financial performance (Khan, Serafeim, & Yoon, 2015), while regulators and NGOs are interested in broader datasets. Investor concern that neither GRI nor IIRC provided sufficient focus on material ESG factors that most interest investors led to a new reporting standard developed by the Sustainability Accounting Standards Board (SASB). SASB leverages GRI and IIRC frameworks but puts more emphasis on material ESG factors. Despite it being an accounting standard, it is focused exclusively on ESG metrics and does not include metrics that would track the financial impact of a firm's ESG practices. GRI and IIRC have both focused more on materiality of their metrics in response. Currently, only a handful of companies use SASB, but it benefits from the leadership of Michael Bloomberg and broad investor interest; it aims to be adopted by the Securities and Exchange Commission (SEC). The EU has also issued directives mandating sustainability reporting, but it was not prescriptive on the reporting format.

While reporting to GRI, IIRC, or SASB greatly improves data quality, much reporting is voluntary, not audited, and prone to selective disclosure, with companies reporting favorable data and withholding everything else. This creates problems in data consistency

and comparability. Another consideration is that small and medium-sized companies may be underrepresented if they don't have the resources required to complete surveys and publish CSR reports.

Company Engagement

Engaging with companies can help the ratings process by facilitating data verification. But this engagement can also introduce bias. Most providers that we reviewed share their rating results with firms before publishing them. Covalence and Ethos state that they actively engage with companies in the information gathering process. Since Covalence focuses on ESG "reputation," they mitigate bias by sourcing information from multiple news reports. Ethos relies on company engagement to assess ESG exposure and how well ESG issues are being managed.

Several data providers never engage with the companies they evaluate. Thomson Reuters, for example, states that they only use publicly available information to preserve objectivity (Thomson Reuters, 2017). RepRisk, CSRHub, and IW Financial rely solely on third-party sources to assess whether a company's policies, processes, and commitments translate into practice.

When companies have a third-party audited report that complies with the requirements of GRI, IIRC, or SASB, company engagement may not be as important. But when company reporting is opaque or incomplete – often the case – more engagement and supplementary information are often required, either through public record searches or direct engagement.

Data objectivity may be questionable if the rating provider offers advisory services to a company it rates. Inrate, for example, makes it clear on their website that they offer no advisory or consultative services in the interest of objectivity. Ethos also claims to be independent of the companies they analyze and transparent about potential conflicts. Rating providers generally do not disclose their reliance on advisory fees.

Rating Methodology

Beyond feedback from the company under scrutiny, a number of steps can provide assurance regarding data quality and risk of subjective judgment errors in a rating. Some rating providers validate their rating using internal processes (e.g. reviews or statistical analyses), independent boards or committees, or third-party oversight. VigeoEIRIS and oekom research have their methodologies accredited by ARISTA® 3.0 quality standard and RobecoSAM has Deloitte audit the Corporate Sustainability Assessment (CSA) process annually.

Rating models vary from computer-driven models or algorithms, to analyst-based evaluations, to a hybrid of the two. Most providers favor a hybrid approach, as shown in Table 3. Each provider outlines its methodology online, often providing further details on request. Providers help users understand their ratings data, and do address some concerns around consistency and comparability, but because methodologies are proprietary they generally remain opaque. For example, MSCI, which is not alone, limits explanation of its weightings and scoring schemes. Though they examine 37 key issues, they typically select 6-10 of these to rate a company (MSCI, 2015). Why some issues are selected and others are eliminated is unclear.

All rating providers weigh ESG factors for relevance and impact; some consider time-horizon. Most rating providers also factor major incidents and controversies into their ratings, though the weighting of these factors is not well understood. CSRHub normalizes ESG scores from different data sources. The Arabesque model relies on big data and quantitative machine learning models to generate ratings. The model only considers sustainability criteria that have a statistically higher likelihood of predicting future performance and the processing and analysis of that data are not transparent. FTSE Russell, MSCI, Thomson Reuters, Covalence, RobecoSAM, and VigeoEIRIS all have complicated hybrid methodologies, perhaps because they also construct ESG indices. Sustainalytics stands out as an analyst-based model with the largest scope in terms of number of companies covered. The tradeoff is that they cover fewer issues: 21 in comparison to Thomson Reuters' 178. In all cases providers are opaque about which metrics are incorporated and their weighting.

Table 3: Model Characteristics of Market and Broad ESG Data Providers
(See Appendix for data sources)

Data Provider	Model Methodology	Rating Scale	Advisory Offered to Companies
Market			
Bloomberg	Model	100-0	No
FTSE Russell	Hybrid	5.0-1.0	No
MSCI	Hybrid	AAA to CCC	Yes
Thomson Reuters	Hybrid	A+ to D-	No
ESG exclusive			
Arabesque	Model	100-0	No
Covalence	Hybrid	100-0[44]	Yes
CSRHub	Model based	100-0	No
Ethos	Analyst based	-	No
Inrate	Hybrid	A+ to D-	No
Oekom Research	Analyst based	A+ to D-	Yes
RobecoSAM	Hybrid	Gold, Silver, Bronze	Yes
Sustainalytics	Analyst based	100-0	Yes
VigeoEIRIS	Hybrid	Double+ to double-	Yes

[44] 100-0 is the ESG Rating: A-D Reputation Index

Differences in the analytical model can result in different assessment outcomes for the same company (Allen L. White, 2012). In 2011, for example, Coca-Cola ranked number #14 out of 100 in Corporate Responsibility (CR) Magazine's Best Corporate Citizens ranking, with ratings provided by IW Financial; yet it didn't make the Dow Jones Sustainability Index (DJSI) that year. In 2016, CR's Best Corporate Citizens ranked Intel #2, but that same year Intel was dropped from the DJSI. Also, in 2016 Dow was dropped from the CR ranking because they settled a lawsuit on price-fixing, but they remained in the DJSI. Without standardized ESG reporting and consistent application of quantitative and non-quantitative ESG metrics, the burden of understanding data and determining its usefulness falls to the user.

Due to opacity in the field, investors ought to first look for third-party assurance that the data provider meets industry standards; second, review the provider for independence from the companies they rate; and third understand oversight and complaint mechanisms in order to ensure that the process is fair.

Future Outlook

Rating providers that rely heavily on past performance or ignore indicators that help predict future performance can provide misleading insights into a company's ESG profile. To address this problem, Ethos, Inrate, MSCI, Oekom research, Sustainalytics, and VigeoEIRIS incorporate company policies and management processes, along with their effectiveness, into their methodologies. This is in contrast to Thomson Reuters, which only uses publicly available information and relies more heavily on quantitative data absent company input. They believe that this improves the reliability of their results.

Select specialized data providers include future-oriented metrics. CDP measures a company's influence on managing future climate change risks and opportunities. Trucost identifies natural-capital dependencies and evaluates these environmental costs by gathering data across a company's operations, product life cycles, and supply chains. Using an in-house academic panel, they convert these metrics into prices to reflect current and future resource constraints and environmental costs. One of RepRisk's models takes data from sources *external* to the company – from media, stakeholders, and other public sources – and combines these with company data to assess whether a company's intention translates into practice. The outcome of this measure affects a company's future risks.

Some data providers that do not provide a future outlook may nevertheless have a wider range of data. Investors may want to combine data from several providers to get a more chronologically holistic view.

Trends and Outlook

For mainstream financial investors, ESG data must be comparable, reliable, and cheaper than currently priced (Amel-Zadeh & Serafeim, 2017); it must match financial data in quality; and disclosure should be required (Park & Ravenel, 2013). SASB has pushed improvements in disclosure by asking public U.S. companies to incorporate in their financial reports specific disclosures on material ESG factors. Governance data will likely improve as of this year, when the SEC will require mandatory disclosure of the pay ratio between CEO and employee average (U.S. Securities and Exchange Commission, 2015). Shareholder engagement, too, will continue to pressure companies into more transparency and data disclosure on ESG issues (Skroupa, 2016).

Government and company efforts related to the Paris Climate Accord will improve data on climate change, but, as of today, investors do not have the information needed to evaluate effects from climate change and vulnerability to losses from stranded assets. Companies need to articulate both how they manage these risks and how they will remain competitive moving forward. For example, in 2017, ExxonMobil's shareholders asked for additional assessment of long-term portfolio impacts from the risks and potential business impact of climate change and new energy technologies. While ExxonMobil argued against the proposal, stating that they already provided sufficient disclosures, investors countered that more useful data and analysis was needed. Sixty-two percent of the shareholders voted in favor of this measure, signaling to other companies a likely increase in future data requests around environmental issues. Finally, as data providers help companies evaluate and implement successful sustainability strategies, they may learn how to improve data validity.

Growing investor interest will help bring ESG data into the mainstream. Today mainstream investors use ESG data to improve investment performance, satisfy client demand, drive company changes, and consider ethics (Amel-Zadeh & Serafeim, 2017). There are now over 1,700 institutional investment companies – asset owners, investment managers, and service providers – that signed on to the Principles for Responsible Investment (PRI), an agreement that promotes responsible investment (and requires annual reporting by signatories on how they are meeting the broad aspirations of the PRI).[45] Growth in "smart beta" investing, which improves passive investment returns, led RobescoSAM and Dow Jones to launch the first index series using ESG factors (S&P Dow Jones Indices, 2016). Retail investment funds that are sold to individuals are now being rated on ESG performance. For example, Morningstar, Inc., the independent research provider,

[45] PRI is an independent organization sponsored by the United Nations that works to understand the implications of ESG factors on investments and incorporate ESG factors in investments and ownership decisions.

incorporates Sustainalytics research in its Morningstar Sustainability Rating of mutual funds (Katie Gilbert, 2016). Similarly, Barron's, the U.S. financial weekly newspaper published by Dow Jones & Company, used research from Morningstar and Sustainalytics to compile its recently announced ranking of the Top 200 Sustainable Mutual Funds (Norton & Kim, 2016). Responsible Property Investments has developed a framework for real estate investors to integrate ESG and climate change information into investment decisions (Bosteels & Sweatman, 2016). Green Bond issuance was $90 billion in 2016, double what was issued in 2015, much of it financing renewable energy in China (Reuters 2017). Most notably, traditional investment firms are entering ESG investing. Goldman Sachs, for instance, bought Imprint Capital, an asset-management firm that advises clients on investing based on their ESG values (Goldman Sachs, 2015).

Role of Future Regulation

Regulation will likely play a role in the future of ESG investment. The U.S. Department of Labor considers ESG factors as "acceptable" under the right circumstances regarding fiduciary duties under the Employee Retirement Income Security Act (ERISA) of 1974 (US Department of Labor, 2015). The SEC requested public comment on disclosure effectiveness in 2016 and groups including SASB (Jean Rogers, Ph.D., 2016), MSCI (Eric Fernald, 2016), and Hermes Investment Management (Tim Goodman, 2016), among others, asked for a greater focus on ESG data.

Standardized data require regulation. Market demand can push only so far. In addition, an industry certification standard for data providers might ensure the quality of the process, especially while provider methodologies remain proprietary. Investors and data providers could develop this as a voluntary certification scheme, or regulators could mandate it.

Conclusion

The proliferation of ESG data, research, and rating providers has fueled the growth of responsible investment and the incorporation of ESG factors into investment decision making. Data providers have consolidated in light of these trends, as increased size, coverage, and scope of service provide competitive advantage. The recent acquisitions of IW Financial by ISS and Trucost by S&P Global, along with the merger of EIRIS and Vigeo, indicate that this trend will likely continue. With growth in responsible investment, we see mainstream finance integrating ESG factors.

However, ESG data must improve if it is to meet its potential. SustainAbility's "Rate the Raters" provides a useful framework for analysis, but improving the usefulness of ESG for investor decision making requires additional criteria. First, we need consistency in the material data tracked and published by companies; SASB provides a first step. Second, we

need a widely adopted and verified data provider standard that sets guidelines for a credible approach and reduces discrepancies across same-company ratings; the Global Initiative for Sustainability Ratings and Arista 3.0 have made a start. Clearly, investors should be able to choose from different approaches to suit their objectives, but the lack of transparency and basic guidelines create industry-wide credibility challenges. Third, corporations must track and report ROI on sustainability investments in order for ESG data to offer managers and investors insights into correlation with financial performance. And standards such as SASB, GRI, and IIRC should include tracking of financial performance related to ESG policies and investments by firms. If, for example, adoption of GHG targets results in process innovation, reduced costs, risk mitigation, and better employee retention, those impacts need to be monetized and reported in addition to the reduction in GHG emissions.

The next generation of ESG data is needed to drive better decision making and financial performance in the responsible investment movement – now $1 in every $5 in the US, and growing. Better and more consistent measurement will also help the listed companies improve their own decision making and performance. *What* gets measured and *how* it gets measured, matters.

Appendix: Data Sources

Sources of company information:

Global Initiative for Sustainability Ratings (GISR) ratings directory: http://ratesustainability.org/

Arabesque http://www.arabesque.com/

Bloomberg http://www.bloomberg.com/professional/sustainable-finance/,

CDP https://www.cdp.net,

CSRHub https://www.csrhub.com/

Ethos https://www.ethosfund.ch/

FTSE Russell http://www.ftse.com/

Inrate http://inrate.com/

ISS/IW Financial https://www.issgovernance.com/esg/iwfinancial/

MSCI https://www.msci.com/

Oekom Research http://www.oekom-research.com/

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The Application of Machine Learning to Sustainable Finance

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Abstract

This article explores the various ways machine learning (ML), one of the applications of artificial intelligence, can be applied to sustainable finance. In the first part of the article we describe the crucial role that ML plays in the financial ecosystem, from managing assets to assessing risks. We also highlight the growing relevance of the global environmental, social, and governance (ESG) market. The second part describes how ML, in combination with big data, can present a robust instrument for ESG data to be assessed in an efficient, standardized, and objective fashion. We argue that ML will eventually enable the identification of materially relevant ESG indicators from the large universe of current ESG metrics, automatically identifying variations by industry, geography, and firm size. However, doing so will require additional standardization of reporting. ML has a role to play in the near-term by providing a set of tools to enable real-time monitoring of sustainability performance.

Introduction

Computer-driven assessment of financial data and human-led assessment of non-financial information are two preponderant trends in financial markets. The first is related to the use of machine learning (ML) in managing financial assets and assessing risks. The latter embodies the integration of environmental, social, and governance (ESG) data into asset management. Both trends started in the 1980s and are showing similar levels of prevalence and acceptance in the industry, but up until now their growth has been independent. We argue that this will not be the case in the future.

Machine learning plays a fundamental role in the financial ecosystem. Fully automated wealth management services (robot-advising) and algorithmic trading or its subtype high-frequency trading (HFT), for instance, are used by financial institutions to optimize financial decisions. Advocates argue that humans come hard-wired with cognitive biases that often lead to suboptimal financial decisions (Kramer, 2016). Unsurprisingly, forecasts indicate that assets under management by robo-advisors will grow to 10 percent of total global assets by 2020 (Kocinaski, 2016). HFT, also a type of algorithmic trading powered by ML, which involves automated quick moves in and out of securities, with the holding period sometimes less than a second, accounted for nearly half of all equity trading in the United States in 2016. This grew from little more than 20 percent in 2006 (Market Watch, 2017). Millennials[46] helped drive the application of artificial intelligence and computerized analysis to finance given their stated preferences for automated interfaces over human interaction, along with their innate trust of online engagements. While algorithmic-driven portfolio management strategies are nothing new, "the merging of these strategies with newer, mobile-friendly, state-of-the-art platforms and consumer-based applications and tools makes robo-advisors innovative and appealing" (Roche, 2017). ML can be used both to extrapolate data (e.g., inferring missing data by detecting patterns in an incomplete data set) and to predict future financial performance (e.g., predicting future financial ratios or relative stock performance based on underlying company and industry metrics). The application of machine learning in financial activities is a solid trend in capital markets.

Responsible investing, or the integration of ESG data into asset management, is also a solid trend. Its origins can be traced to 19th-century Methodist and Quaker opposition to investment in particular assets like tobacco, or anything related to war or the slave trade. In the second half of the 20th century, the war in Vietnam and South Africa's apartheid sparked a renewed interest in responsible investing. Money managers avoided the allocation of capital in companies that could profit from war or from regimes with a poor human rights record.

[46] Born between 1980 and 2000.

ESG investing began to play a larger role in mainstream investment after the 1980s, when the first ESG-driven asset managers and industry associations appeared. (These include Trillium Asset Management, The Forum for Sustainable and Responsible Investment (US SIF), and Ceres.) Globally, there are now US$22.89 trillion of assets professionally managed under responsible investment strategies, an increase of 25 percent since 2014 (Global Sustainable Investment Alliance, 2017). This is approximately one fourth of the US$71.4 trillion currently under management (BCG, 2016). Such staggering growth derives from three interrelated phenomena:

1. Correlation between ESG and increased returns is fairly well established (Deutsche Bank, 2012; Eccles, Ioannou, and Serafeim, 2012; Allianz Global Investors, 2015; Cambridge Associates and the Global Impact Investing Network, 2017; Mercer and LGT Capital Partners, 2015; Morgan Stanley, 2015; Eccles, Verheyden, and Feiner, 2016; Khan, Serafeim, and Yoon, 2015). A recent study demonstrated that listed companies with good ESG practices show lower stock return volatility in comparison to reference companies – 28.6 percent lower, on average. Meanwhile, the average positive effect on equity return is 6.1 percent higher for companies with good ESG practices (Kumar et. al., 2016). Assessing the relationship between ESG and performance in over 2,200 studies from 1970 through 2014, Friede, Busch, and Bassen show that 90 percent demonstrate a positive correlation (2015). Market feedback goes in the same direction: 68 percent of asset owners say the integration of an ESG strategy has significantly improved returns, according to a State Street Global Advisors study (2017).
2. ESG analysis is becoming more refined, expert, and widespread. What started as straightforward negative screening of certain assets is now a robust qualitative and quantitative assessment of equities. This includes the examination of company reports or data provided by third-party ESG/CSR service providers. ESG can also be integrated in fixed-income portfolios by conducting ESG credit rating analysis and assessing issuer-level ESG data. Asset owners and asset managers can integrate ESG data using a plethora of benchmarks, studies, and guidelines.
3. Similar to ML, pressure from younger asset owners is driving ESG integration. A handful of studies show that millennials, more than any previous generation, are prioritizing social and environmental issues when choosing an investing strategy (United States Trust Company, 2017; World Economic Forum, 2013; Deloitte, 2017). For almost half (49 percent) of millennials with a net worth of more than US$1 million, social responsibility is a factor in choosing an investment. This compares to 43 percent of Gen Xers, 34 percent of Baby Boomers, and 27 percent of seniors (Spectrem Group, 2015).

   Despite the growth of the ESG industry over the last decade, however, we claim that it will soon reach a plateau if it does not incorporate the same level of automation as

traditional finance. This automation will come when ML, in combination with big data, assesses ESG data in an efficient, standardized, and objective fashion.

Machine Learning Applied to ESG Investing

In this section, we discuss the current state of machine learning within ESG investing, the challenges that limit its current use, and the path forward.

Machine Learning and ESG: Current State and Limitations on Adoption

Machine learning and ESG investing can be combined to great effect, and some funds have already done this. For example, the Richmond Global Compass Fund utilizes ESG metrics and machine learning as part of a global macro hedge fund. But this kind of combined application of ML and ESG has not achieved widespread adoption. Why not?

The challenge of combining ML and ESG within an investing framework relates to the salience and completeness of underlying data. When compared to traditional financial accounting metrics, ESG reporting is non-standard: Companies voluntarily self-report information that they deem materially relevant. Under this system, cross-company or cross-industry comparisons are difficult, as is finding or developing a consistent data set with which to assess materiality. Machine-learning algorithms that extract complex patterns and signals require complete and historically rich data for research – precisely what is now unavailable in the ESG literature.

The application of ML nonetheless has a vital role to play in ESG-oriented investment. Its foundational impact, though, will not initially be in automated investment decisions, but rather in generating the inputs that allow investment firms to monitor ESG performance with improved granularity and completeness. In fact, we argue that ML represents an appealing way to provide structure to the unstructured ESG data set.

ML, then, can be applied in a number of major ways that build upon each other. In order of development, these applications include:

1) Using natural language processing, speech recognition, and image processing tools based on ML technologies to infer crucial ESG information ahead of, or not available through, data providers;
2) Imputing ESG data for currently unmeasured companies by detecting patterns within the full set of ESG metrics; and
3) In the longer-term, utilizing existing/available high-quality ESG data, together with asset managers' specific material financial data (often also collected through machine learning), to augment and optimize investment decision making by identifying materially relevant metrics and predicting future financial performance.

Related to this, ML will utilize the same input (ESG and financial data) to model investment risk.

Each of these topics is considered below.

Machine Learning and AI Tools for Real-time Monitoring

Foundational applications of machine learning and artificial intelligence in recent years have focused on performing automated tasks that are time-consuming, costly, or unpleasant. These applications include, for example, automatic photo classification and object detection (Joel Janai, 2017). Such technologies are well developed and can be used to supplement self-reported ESG data.

Natural Language Processing. Natural Language Processing (NLP) comprises tools used to automatically extract information from unstructured text. NLP algorithms can organize and structure knowledge to perform tasks such as: automatic summarization (Mohak Sukhwani, 2017); translation (Jiacheng Zhang, 2017); named-entity recognition (Franck Dernoncourt, 2017); relationship extraction (Makoto Miwa, 2016); sentiment analysis (Liu, 2017); speech recognition (Takaaki Hori, 2017); and topic segmentation (Shafiq Rayhan Joty, 2014).

NLP tools can be used to extract and summarize text from public company 10-Ks that reference ESG metrics and topics. For example, the Sustainability Accounting Standards Board (SASB) tracks company disclosure history leveraging NLP tools to automatically identify text relevant to SASB ESG metric disclosures within financial documents.

Sentiment analysis is the process of computationally identifying and categorizing opinions expressed in a piece of text, especially in order to determine whether the writer's attitude towards a particular topic, product, etc., is positive, negative, or neutral. Sentiment analysis can be utilized to monitor public opinion on companies, specifically related to ESG metrics.

Sentiment analysis works by assigning point values (positive, negative, or indifferent) to words, phrases, sentences, and paragraphs based upon a training corpus. For example, TruValue Labs, a provider of real-time sustainability data analytics, analyzes publicly available texts about companies (including articles, blog posts, and Twitter) to establish real-time sentiment specifically tuned to ESG metrics.

Pluribus Labs provides sentiment analysis for U.S. equities by developing custom dictionaries of search terms. This technology could be extended to focus on ESG data.

Video and Image Analysis. Video and image analysis tools focus on two main types of tasks. The first takes account of the entire image, and classifies the scene. The second focuses on extracting objects from within the scene. ClarifAI provides automatic object recognition tools applicable to both images and video. Users submit image and video and

receive responses back documenting the objects identified within the image. To improve the recognition accuracy of specific objects, users can also submit labeled images to train their own object recognition tools.

Enhancing the feasibility of image and video analysis is the concept of transfer learning (Lei Xiao, 2017). Transfer learning enables a developer to utilize a model previously trained to detect one object type, and retrain it to detect something else. Transfer learning generally requires much smaller data sets than the original learning task, and so can be used in situations in which the cost of training data development is high.

Object recognition tools could be used for a variety of ESG estimation tactics. For example, satellite imagery related to production facilities could be analyzed to track objects relevant to environmental goals (trucks entering and exiting a facility, color and size of tailing affected runoff, or production of pollutants from smokestacks). Such tools would supplement quarterly or annual updates from company statements, providing real-time insight into current performance.

Audio Analysis. Audio analysis performs many of the same functions of NLP, but the underlying text is vocalized (Jonathan Malmaud, 2015). Speech-to-text tools like Google Voice can generate a transcript of any spoken words. This text can then be analyzed by the same NLP tools described above, providing an additional source of unstructured information.

ESG information derived from C-level speeches, investor meetings, and interviews could be leveraged in the same way as written text, providing an additional source of unstructured information.

Impute Missing ESG Data

The SASB provides a codified ESG reporting standard of variables that they consider materially relevant. These standards vary across sectors and industries, as defined by the Sustainable Industry Classification System. SASB tracks a company's disclosure history by categorizing disclosure quality: "No Disclosure," "Boilerplate," "Company Tailored," or "Metrics." The last of these indicates disclosure consistent with the SASB standard. Current sparse coverage makes subsequent analysis of metrics challenging.

Machine learning can be utilized to impute missing values for companies with incomplete reporting. All of these techniques infer ESG metric values of non-reporting companies from two sources: the known ESG metrics of reporting companies and data that defines the similarity between companies. Fundamentally, imputed values should rely heavily on similar companies – those within the same industry or that use similar ESG-related language. The data to define similarity between two companies can be drawn from:

- Standard industry classifications;
- Financial metrics, including those defining size (e.g. revenue) and profitability (e.g. net margin);
- Unstructured data sources like website text, standard financial disclosure text, and curated company profiles (e.g. Crunchbase).

Simple algorithms for dealing with missing data include deleting records with incomplete data, assigning missing data a value of 0, or assigning missing data an average value. More advanced algorithms include:

- K-nearest neighbors imputation;
- Random decision forests;
- Expectation maximization algorithm;
- Deep learning, especially deep autoencoder neural networks;
- Matrix completion.

Each of these advanced cases can apply either single or multiple imputation processes. In the latter, the imputation is applied multiple times to subsets of the data and then pooled into a consensus imputation.

Selecting the best algorithm depends on the structure of the missing data. Data can be missing in three basic ways: completely at random, or MCAR, in which missing data does not depend on any independent or dependent variables; missing at random, or MAR, in which missing data depends on independent variables; and missing not at random, or MNAR, in which missing data depends on dependent variables.

ESG data is often MNAR, meaning that missing values are likely biased. Companies choose to self-report ESG metrics that are likely above average and do not report metrics that are likely below average. Assigning a value drawn from this distribution would over-estimate ESG compliance. Under MNAR assumptions, the response and the presence (or absence) of response must be modeled as a joint distribution.

Modeling Investment Return

As ESG data improves, both through more consistent reporting and imputation techniques, analysis will increasingly evaluate the data's materiality and provide quantitative predictions of financial and asset performance. ESG may eventually be viewed as supplementing traditional measures of financial performance, providing an orthogonal view of company performance that is predictive of future returns.

Models can either predict future financial performance metrics (revenue, profit, net margin) or future price movements. Future price movements more closely mimic the desired investing target, but are inherently noisier. Financial performance or price movements relative to a well-chosen benchmark may improve modeling performance by removing market trends from the analysis.

Machine learning does not obviate the need to discern causation and correlation, or future conditions and matching current conditions. Given a complex, dynamic system in which competition between players is a significant component, no approach ever guarantees future effectiveness. However, the best practices of machine learning can minimize these concerns. (This advice is not unique to ESG data, but applies to forecasting in time series data generally.)

To mitigate concerns of over-fitting, researchers should split data into training, testing, and validation sets. Models should be trained on the training data, and then their accuracy iteratively improved on the validation data. Validation data is used to minimize over-fitting when selecting parameters for the ML model. One should use the test data only after completing model fitting, including parameter selection; and this should be done only to confirm the model's accuracy. Iteratively revising the model after measuring accuracy against the test data set can reduce over-fitting.

The standard practice of randomly selecting training, testing, and validation data is difficult for models based on time-series data. In these cases, information about market trends may be implicitly embedded in both training and validation sets. Instead, best practice is to develop a model using a "moving window" approach. That is, divide the data into a series of overlapping training-validation-testing sets and then iteratively train the model on the training data. Use the validation data to avoid over-fitting. Finally, test the model on the testing set. This approach simulates the actual investment activity of repeated decision points based on model training immediately prior to that time.

Outlier detection and removal is an important pre-processing step if the input data is noisy or of variable quality. Tools to identify and remove outliers include:

- Extreme value analysis: identify outliers based on mean and standard deviation (e.g. identifying data points more than 2-3 standard deviations from the mean);
- Proximity methods: identify dependent variables that vary significantly from similar data points within the data set.

After making these design decisions, ML models of increasing complexity can be applied to a problem, though best practice suggests starting with simpler models; progress to more complex models after establishing baseline performance and gaining intuition.

Materiality. The first area in which ML might be applied is in determining materiality – which ESG metrics are material to future financial or asset price performance. To directly estimate materiality, researchers can use linear models to predict financial performance. Multiple linear regression accepts a variety of independent variables, including ESG-related and traditional financial metrics, to predict financial performance. Linear regression coefficients can then be evaluated for their direction of impact and statistical significance to identify those factors that are materially relevant to future financial performance.

It is also possible to estimate materiality using more sophisticated models. One could, for example, train a deep-learning algorithm on traditional metrics and assess performance on validation and test data, then carry out the same process with one ESG metric. The metric is material with some level of statistical confidence if its inclusion improves the predictive power of the model.

If many different ESG metrics are under consideration, researchers must take into account the multiple testing problem (Multiple comparisons problem) (Munroe). As an illustrative example: if 20 ESG metrics are estimated to be material at the 95-percent level without correcting for multiple testing, we should expect that, on average, one of those metrics is immaterial. There are well-established methods for correcting for this, including Bonferroni's correction and multi-armed bandit techniques. Multiple testing requires researchers and investors to collaborate in order to understand the tradeoff between classifying too many metrics as material as opposed to too few.

Predicting Future Performance. Machine learning algorithms can also be used to predict future performance. Although linear models are best for determining materiality, they are frequently less accurate than ML models for predicting future performance. Researchers frequently progress through a series of models, from simple to complex, measuring accuracy at each step. A typical progression might entail:

- Multiple linear regression;
- Support vector regression;
- Random forest regression;
- Xgboost;
- Recurrent neural networks (RNN)

The RNN model is a preferred neural network approach to modeling time series data. RNNs are characterized by an internal "memory" state that enables them to consume time series data. They have been used to model financial performance based on traditional financial metrics (J. B. Heaton, 2016)

Investment Risk. Machine learning tools can be used to model investment risk in addition to investment return. The techniques and tools are identical except for the predicted variable. Models are retuned to predict a metric of risk rather than a metric of return. Alternatively, a backtesting-based approach can be used in which risk is estimated by implementing a strategy on historical data and obtaining, for example, a Bootstrap variance estimate.

Conclusion

Machine learning represents a promising tool for use in ESG investing, but the development of specific ML applications must be matched to the development of the larger ESG data and reporting ecosystem.

Automated investment decisions combining ESG data and ML are currently challenged by non-standardized and incomplete data. Standardization of metrics, as promoted by SASB, will continue to improve the data situation in the long run, but ML has a role to play now. The first role is to leverage tools being developed across industries – including natural language processing and automated image analysis – to generate salient ESG estimators. Second, un-reported ESG data may be estimated via imputation methods, allowing estimate derivation for all companies, regardless of reporting format. In combination, these tools can provide complete coverage and offer real-time monitoring, enabling the cross-company and cross-sector comparisons required for foundational financial analysis.

As the completeness and quality of reported ESG data improve, the industry will evolve towards a standardized set of metrics and reporting formats. As these standardized metrics and formats are developed, investors will deploy ML to provide evidence of materiality, estimate investment risk, predict investment return, and eventually automatically deploy capital. Ultimately, ML will generate automatic investment decisions incorporating ESG factors, just as it does today in traditional finance. The investment groups that now invest in understanding and leveraging ML resources to contextualize and generate ESG data will be best positioned to advance these same technologies of automated investment as ESG data standardizes.

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A Geofinancial Engineering Initiative: Using Real-Time Environmental Data from Satellites to Move Financial Markets and Improve Climate Outcomes

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Maximillian Horster PhD

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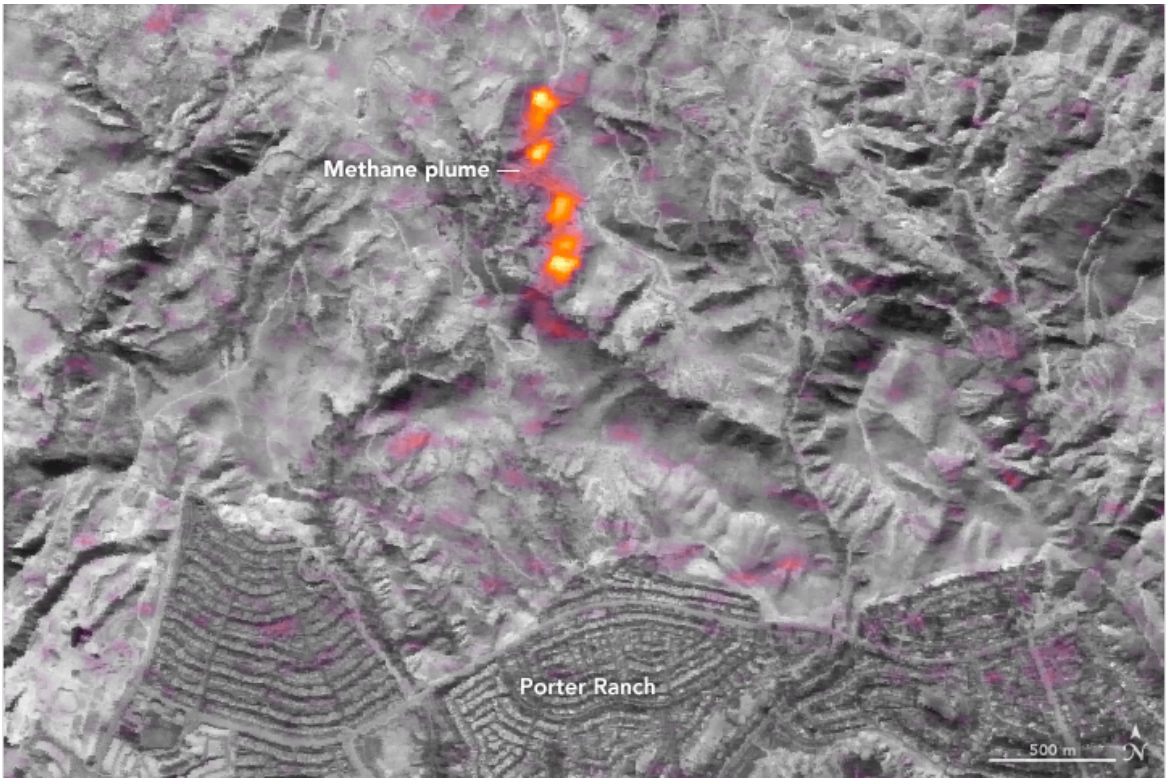
Abstract

Geofinancial engineering is the use of both financial tools and scientific knowledge to leverage the capital markets to alter human impact on the physical world and thus improve the odds of averting catastrophic climate change. While many long-term institutional investors are integrating climate change considerations into their investment decisions, hedge funds and quantitative (or algorithmic) trading systems – which often buy and sell in a matter of milliseconds – are, with few exceptions, inherently climate-agnostic. Although these now-pervasive strategies focus more on signals than fundamentals of underlying securities, they typically do not take real-time signals linked to the environment into account. Such signals are either not systematically accessible in a standardized manner or simply not connected to the datasets and applications available to the trading community. Making relevant, real-time environmental risk data readily available to climate-agnostic traders and investors – both automated and human – could shift financial market sentiment against behavior deleterious to climate stability. At the same time, such transparency could enable those traders and investors who proactively use such new datasets to avoid climate-related market risks and seize opportunities. We describe how and why such *geofinancial engineering* could be effective and explore one promising example: satellite data on methane emissions by publicly traded fossil fuel producers and utilities (Figure 1). A suite of information aggregated from existing and planned public satellites has the potential to detail methane flaring and venting activity at a fine enough spatial and temporal scale to allow for a nearly real-time assessment of methane emissions. By assigning this emission data to the spatial location of specific company assets, changes in both long-term behavior and short-term anomalous emission activity can be acted upon by traders and investors. This example of methane flaring, with complete datasets for emissions points and asset ownership for the entire U.S., illustrates the tractability of *geofinancial engineering* and how it might be executed via financial trading platforms. We also discuss the data gaps, open issues, and possible unintended consequences of advancing this new climate mitigation strategy.

Acknowledgments

Jonathan Foley's "Breaking the Cycle of Climate Inaction" blog post (October 2013) calling for a science-based approach that finds *planet levers* to climate solutions sparked the idea of *geofinancial engineering* as a potentially powerful example of such a lever. Extensive conversations with Edwin Lennox also informed the development of the *geofinancial engineering* approach and are gratefully acknowledged.

Figure 1: Methane plume detected from space. Sempra Energy (SRE) Aliso Canyon Disaster (2016); Photo: NASA Earth Observatory



Introduction

Climate experts estimate that burning known and extractable fossil fuel reserves would lead to dramatic climate change, far beyond the threshold necessary to stabilize the climate at 2 °C above pre-industrial levels (Blanco et al. 2014). More specifically, in a poll of climate scientists, 92% of expert panelists believe that if all the world's current fossil fuel reserves are burned, it is likely or very likely that Earth's average temperature will increase to levels not experienced for millions of years (≥ 3 °C of warming versus pre-industrial levels).[47]

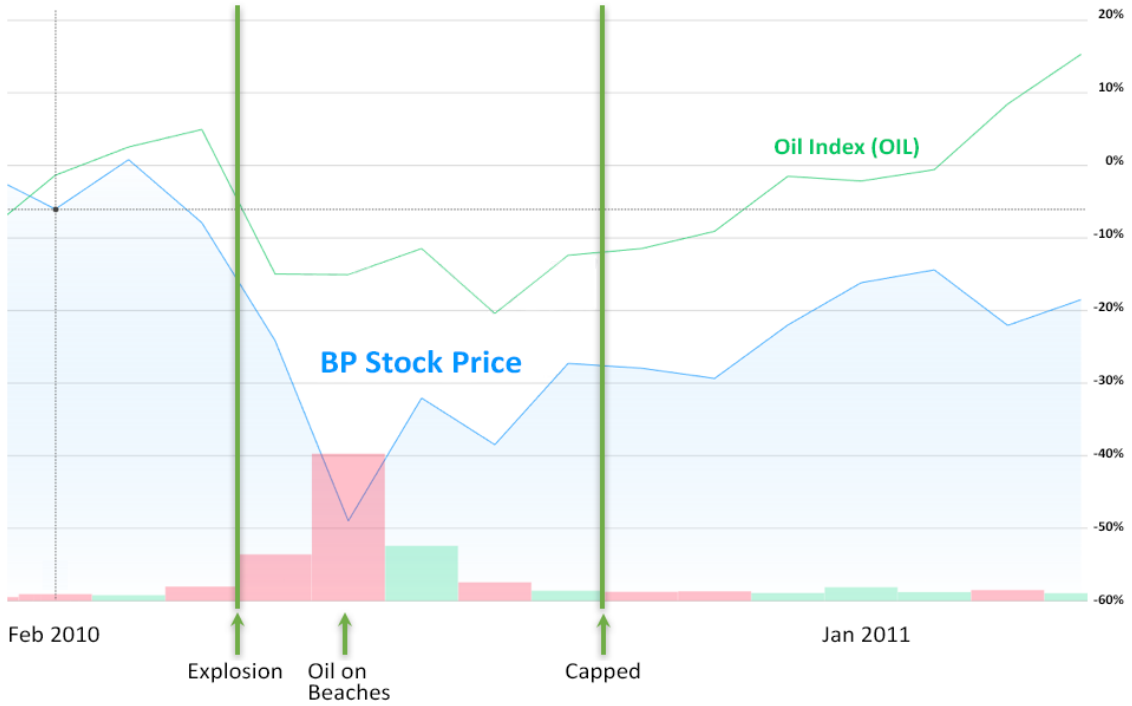
Reducing emissions remains a substantial challenge even for those actors who want to do so. Limiting global temperature rise to 2 °C above pre-industrial levels may require shifting $3 trillion per year for the next 23 years from the fossil-based to the green economy (Tweed 2016). Meanwhile, the recent withdrawal of the United States from the Paris Climate Agreement has injected global policy with a renewed sense of uncertainty over whether emissions will be regulated to the degree necessary. But even if the U.S. were to keep its commitment, the Paris goals are insufficient to avoid substantial, worldwide climate impacts.

Additional levers beyond governmental policy are necessary to improve the odds of averting catastrophic climate change, and financial market pressure is already playing a central role. While long-term institutional investors such as sovereign wealth and pension funds are integrating climate change considerations into their investment decisions, such efforts fall well short of this challenge (SIF Foundation 2016). One of the main reasons for this shortfall is the difficulty of connecting specific investment assets, such as stocks of publicly traded companies, to the negative consequences of companies' actions. However, if such environmental externalities can be both quantified and attributed to a given company or asset in near real-time, then asset prices may begin to more accurately reflect the costs of irresponsible behaviors.

This is not merely hypothetical. Environmental disasters have already affected market sentiment and stock prices – and, in the case of the British Petroleum (BP) Deepwater Horizon disaster of 2010, even inspired blockbuster movies. When impacts are vivid – explosions and oil slicks on Gulf Coast beaches reported live on CNN – movement of stock price for the company responsible can be swift and dramatic (Figure 2). This stock price change is consistent with a rational concern about expected financial consequences for the company's assets (e.g. lost oil) and liabilities (cleanup costs and damages) – and is not necessarily influenced by the decisions of environmentally responsible investors.

[47] Full results of the Vision Prize Poll of Climate Scientists, led by two of the authors (Kriss and Kriss 2015), can be found at http://poll.visionprize.com.

Figure 2: BP stock price before and after the Deepwater Horizon disaster.



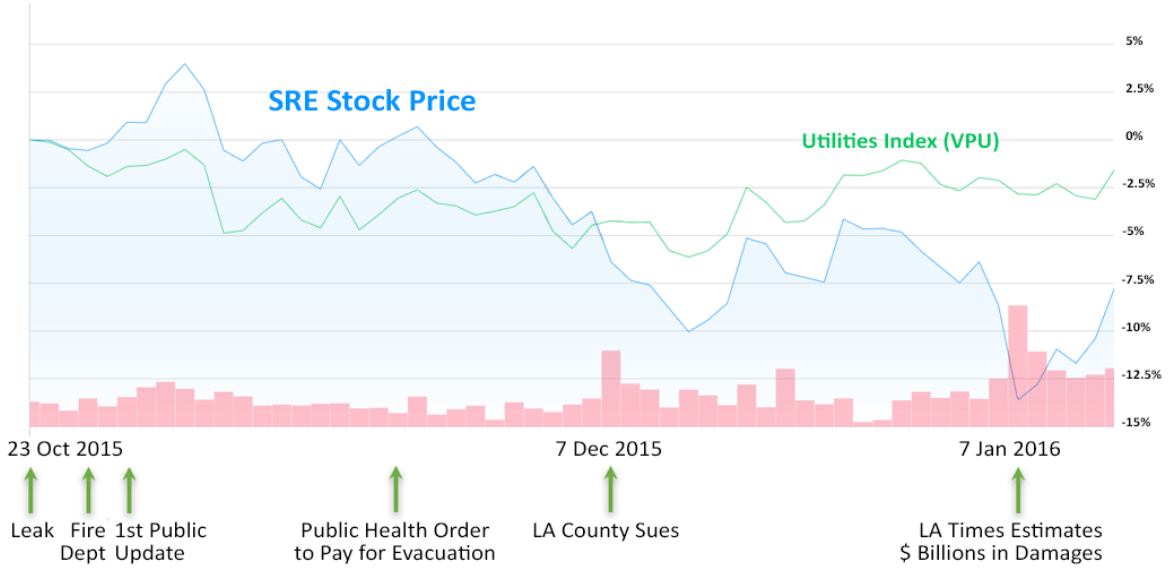
Source: Yahoo Finance 2017

Despite this, climate impacts that are directly attributable to companies are largely invisible to traders and investors or diffuse and unattributable to companies (A. R. Brandt et al. 2014). For instance, consider Aliso Canyon, the California methane blowout disaster in 2015, which was the second largest methane leak in US history. Researchers say the nearly 100,000-ton methane leak is likely to have had a significant impact on California's greenhouse gas (GHG) emission targets for 2015; given methane gas produces 86 times the warming power of carbon dioxide for its first 20 years in the atmosphere, this leak was equal to annual GHG emissions from 572,000 passenger cars (Vaidyanathan 2015; Conley et al. 2016). But release of the colorless and odorless gas was only visible with infrared imaging – not to the naked eye (Figure 1). As shown in Figure 3, at the same time the size and scope of the leak was reported, Sempra (SRE) stock price went up, not down, presumably since the expected impact on the company's assets (lost gas) was not in itself financially material while the environmental implications were not (and could not be) vividly portrayed by the news media. Only when the potential financial consequences of the disaster for Los Angeles County[48] – and, by implication, Sempra's liabilities as the

[48] Estimated by the *Los Angeles Times* on December 7, 2015 to be in the "billions of dollars". The company subsequently reached a plea agreement with Los Angeles County to a single misdemeanor and $4 million fine, and a $8.5 million settlement with Southern California Air Quality Management District. Global warming consequences were not considered in the settlements.

responsible party – became apparent six weeks later, did SRE's stock price underperform its Utilities Index benchmark.

Figure 3: Stock price of Sempra Energy (SRE, owner of Socal Gas) during 2015 Aliso Canyon methane blowout disaster.



Sources: Yahoo Finance, Bartholomew (2016)

When impacts are not visible and financial consequences not readily quantified, environmental disasters may have little to no effect on market sentiment and stock price. Revealing the true impacts of such events[49] to investors could improve the ability of market forces to internalize the costs of bad practices and incentivize responsible behavior. For example, it could make the connection between methane leaks and financial risk from lawsuits much stronger (by giving quantitative evidence to the plaintiffs) and more immediate (hours as opposed to days or months), even when direct financial losses to the company are negligible. Thus, the environmental externalities of these disasters, not just the direct loss in assets, may be more fully and immediately reflected in stock prices.

We propose a new approach – *geofinancial engineering* – that leverages scientific knowledge and financial technology to make environmental risk data actionable for traders and investors. This market pressure may drive positive behavior change in companies, pushing them to reduce emissions that are directly attributable and known to investors. To

[49] Ideally making them visible includes quantifying the liability of the responsible party for impacts on climate systems – perhaps like Environmental Protection Agency ratings for cars and appliances – not just human impacts in the affected regions (e.g. Gulf of Mexico and Los Angeles County).

describe how *geofinancial engineering* would work, we use the example of 'super emitter' methane flaring and venting sites by companies such as Sempra Energy – defined as those sites in the top 1% of emissions in the natural gas supply chain (Zavala-Araiza et al. 2017).[50]

Geofinancial Engineering

We live in the Anthropocene epoch, which means that human activities significantly impact the Earth's geology, climate, and ecosystems (Lewis and Maslin 2015; Waters et al. 2016; Zalasiewicz et al. 2016). This represents an existential threat – as well as an opportunity. *Geofinancial engineering* is the use of financial tools and scientific knowledge to leverage the capital markets to alter human impact on the physical world and thus improve the odds of averting catastrophic climate change.[51] As a market-based initiative, it can operate independently from governmental action or it can amplify the effectiveness of market-based regulation like carbon pricing or emission penalties. Given the recent policy swing from the science-driven Obama administration to the climate denialism of the Trump administration, policy-independent mechanisms are particularly timely.

As a mitigation strategy, *geofinancial engineering* aims to preemptively reduce the prevalence of behaviors that cause the most damage – such as extracting and burning high-carbon fossil fuels, deforestation, methane-intensive agricultural practices, and loss of non-renewable water sources (Figure 4).

Geofinancial engineering aims to improve climate outcomes by increasing the cost of capital for companies engaged in deleterious behavior, and by reducing the cost of capital for more climate-resilient alternatives. Divestment, socially responsible investing (SRI), and impact investing are already entering the mainstream, but making real-time environmental risk data available to climate-agnostic traders and investors – both automated and human – is a new promising area of opportunity for effecting change (Figure 5).

Hedge funds and automated trading systems, in particular, can be influenced to trigger volatility, negative sentiment, and downward price movements.

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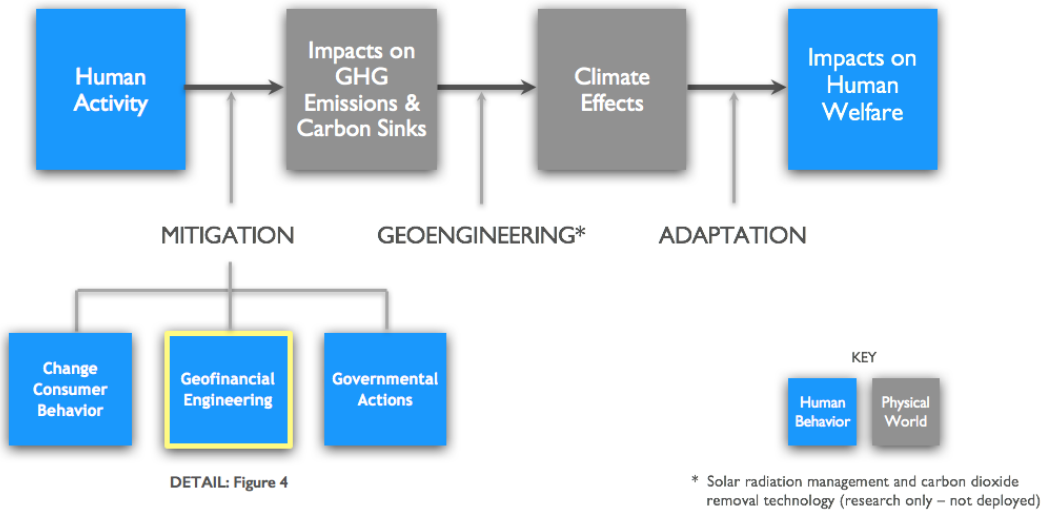
[50] Zavala-Araiza *et al.* find that the top 1% of 'super emitting' sites are responsible for nearly half (44%) of U.S. methane emissions in the natural gas supply chain. A previous study by Brandt *et al* (2016) defined super emitting sites as those in the top 5%, finding they account for over 50% of such emissions.

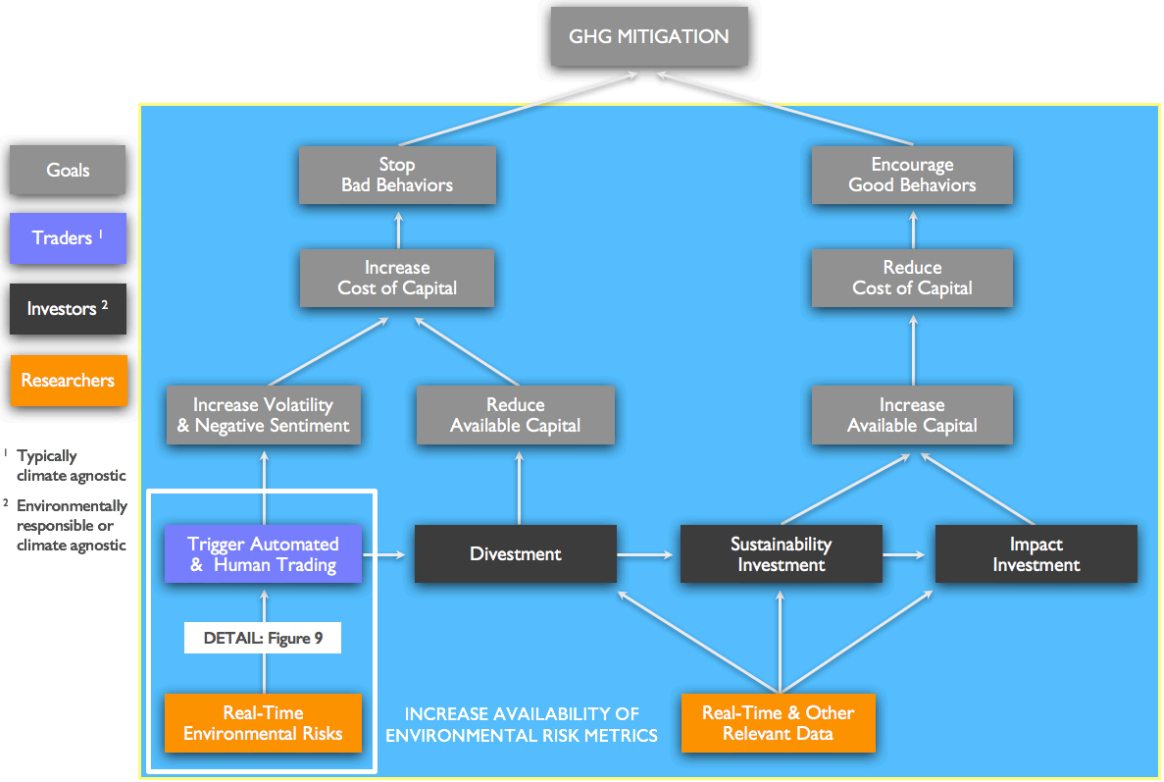
[51] Macroclimate® derived the term from *Financial Engineering* and *Geoengineering*. *Financial Engineering* uses tools and knowledge from the fields of computer science, statistics, economics and applied mathematics to devise new and innovative financial products. *Geoengineering* would alter the physical world to disrupt the connection between burning fossil fuels, and other deleterious behavior, and their climate change impacts – an untested and problematic last resort with wildly uncertain effectiveness, side effects, and financial costs.

Figure 4: Process model showing geofinancial engineering as a complementary alternative to consumer behavior change and governmental actions on greenhouse gas (GHG) mitigation.



Sources: Adapted from macroclimate.com, schema based on K. Ricke (2013)

Figure 5: Detail – Geofinancial Engineering process model.[52]



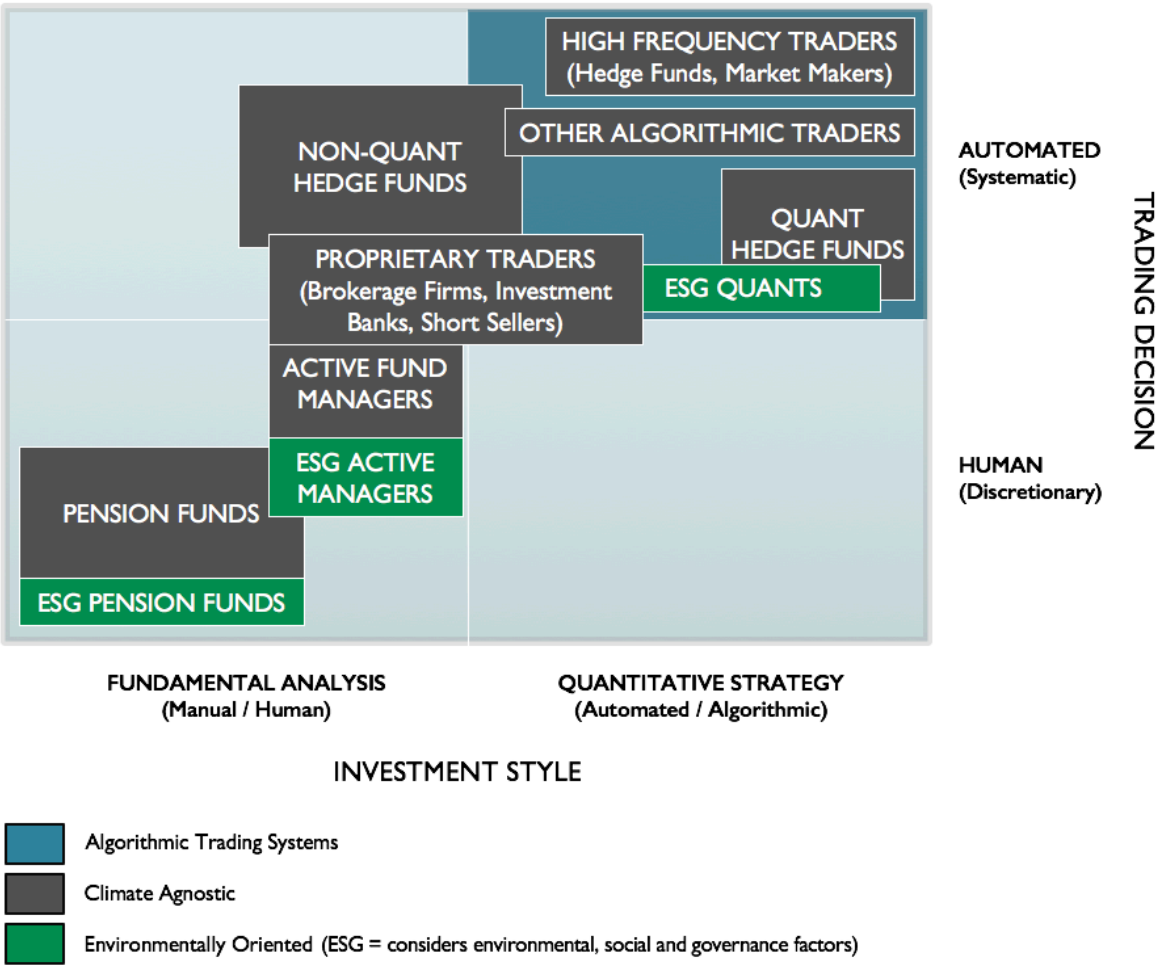
Hedge funds and quantitative, or rules-based, traders seek to exploit perceived short-term inefficiencies in the market, using back-tested models, real-time data feeds, and high-speed automated trading systems. Since these now-pervasive[53] automated data-driven strategies typically have short or ultra-short time horizons and focus more on *signals* than fundamentals of underlying securities, they are – with few exceptions[54] – inherently climate agnostic. We use the term *algorithmic trading systems* to describe this class of market participants, which includes high-frequency traders, other algorithmic and systematic traders, hedge funds, and quant-oriented proprietary traders (Figure 6).

[52] "The main difference between a trader and an investor is the duration for which the person holds the asset. Investors tend to have a longer-term time horizon, while traders tend to hold assets for shorter periods of time to capitalize on short-term trends." (Investopedia 2007)

[53] Automated trading is by now pervasive across a wide variety of financial markets worldwide. For example, it accounts for about two-thirds of the activity in Eurodollars and Treasury futures contracts. Source: Keynote Address of CFTC Commissioner J. Christopher Giancarlo before the 2015 ISDA Annual Asia Pacific Conference (Cespa and Vives 2017).

[54] An emerging group of ESG (Environmental, Social and Governance) quant funds combine quant strategies with sustainability-oriented fundamental analysis (Grene 2016).

Figure 6: Map of selected financial market participants



Divestment, socially responsible investing (SRI), impact investment, and engagement are typically driven by the wish (or pressure) to avoid negative impact or to have positive impact on the environment or society. Increasingly, there is an argument that there might be purely financial risks associated with not taking environmental, social and governance (ESG) factors into account. Those, however, often take the shape of a "Sword of Damocles"[55] in that they are seen as a threat if and when an ESG-linked disaster occurs. *Geofinancial engineering* turns this argument on its head: it aims to feed real-time information on *occurring* disasters into the heart of the financial markets: The Sword is falling already, and the price effect is happening now – in this instant.

[55] An allegory for a situation which causes a prolonged state of impending doom or misfortune.

Such actionable, real-time information can expose and magnify the risks of fossil fuel assets, helping to reshape how the global financial markets view the future of fossil fuel energy. Instead of valuing such assets as essential core holdings, they could and should be priced as an especially risky financial bet given the overwhelming evidence that extracting and burning fossil fuels warms the planet. Even if the worst impacts of such behaviors are still years or decades in the future, the anticipation of those impacts and the market's (or governments') reaction to them can precipitate financial consequences today. The anticipation (or even merely the anticipation of others' anticipation) of reputational liability, customer preferences, tort liability, unfavorable status with institutional investors, stranded assets, regulation, or any other pressure has the potential to move stock prices within seconds, if the data pipeline exists. The infamous 2010 Flash Crash provides a sobering example of the potential for algorithmic trading to trigger devastating high-speed price movements (U.S. Commodity Futures Trading Commission and U.S. Securities & Exchange Commission 2010). In global energy trading markets, algorithmic trading accounts for about one-third to half of crude oil futures trading, exaggerating price moves and steepening volatility (Piotrowski 2015).

Already, fossil fuel energy markets are vulnerable to shocks in confidence and sudden changes in market perceptions driven by events in both political and natural environments. Heightened concerns about wasted capital, stranded assets, and divestiture are now key factors driving short- and long-term price volatility and directional movements of carbon-intensive assets; also affecting this volatility and directional movement are growing investor concerns about reputational risk, lack of transparency, and the rapidly declining cost of renewable alternatives. This was less true five or ten years ago when, even in the U.S., the fossil fuel industry enjoyed wide bipartisan support and economically viable alternatives were just beginning to emerge. Post-Paris, the pro-fossil-fuel Trump administration is an isolated outlier. In short, the capital markets represent the soft underbelly of the fossil fuel industry. Compounding the risk is the fact that ownership of U.S. oil and gas companies is relatively concentrated. For example, pension funds alone owned 29% of all such companies in 2014 (Shapiro and Pham 2014).

In this context, environmental researchers can spur action by traders and investors that can accelerate shifts in the enormous global capital markets – where approximately $350 billion in equities are traded daily (World Federation of Exchanges 2016). Innovative information technology is creating new opportunities to scale these efforts and increase their potential impact, particularly among hedge funds and algorithmic traders. A key point is that financial self-interest is sufficient to drive the behavior of such large and savvy capital markets players, provided that they either: a) plan on holding their assets for the long-term; or b) expect other market players to do so (and hence that those investors will act on climate risk information by taking information on greenhouse gas emissions into

consideration when buying and selling assets). Evidence also suggests that investor-driven shareholder actions affect corporate behavior. For example, facing pressure from both investors and financial regulators, ExxonMobil recently announced that it might write down one-fifth of its untapped oil reserves (*The Economist* 2016).

With this understanding of how financial markets could significantly affect climate-relevant industrial behaviors, we next consider the data available to track a particularly critical greenhouse gas and link it to individual companies.

Data Availability, attribution and delivery

Venting or burning methane accelerates climate change, the global impacts of which are well known and documented. Venting is particularly problematic because methane is a more potent greenhouse gas than CO_2 and accounts for about third of methane emissions, both in the U.S and globally (Turner et al. 2015; Saunois et al. 2016), Both venting and flaring are also an unproductive waste of a non-renewable resource, with venting leaks posing health challenges for local populations that breathe the fumes.

Attributing these harmful practices to the companies responsible in a way that can affect financial markets requires: 1) spatially and temporally *detecting* where and when such venting and flaring took place; 2) *attributing* events to the companies responsible; and 3) *reporting* data to investors and traders in a format that is timely and actionable. We describe current and future potential to detect, attribute, and report company behavior on climate change to investors.

Detection:

Five types of methane indicators could be measured to convey harmful activity to investors and traders. (These indicators are represented by the purple circles in Figure 8.) Depending on latency and resolution, methane sensing data can provide short- and long-term insights on greenhouse gas emissions, which may be useful to investors and traders in different ways. For instance, consistent venting and flaring suggest harmful long-term behavior and can be determined using less frequent data at lower resolution, while gradual changes in venting and flaring activity suggest either improvements or declines in best practices and intent. Significant short-term changes in venting activity, on the other hand, require high spatial and temporal resolution to capture anomalies, which might be early indicators of large-scale disasters and thus may precipitate major shifts in market sentiment and price. Spatial and temporal resolution in greenhouse gas data are both potentially valuable to traders. If attributable to corporate assets, even low-resolution information that is directly indicative of material behavior is potentially actionable.

Figure 7: Process model for attributing short- and long-term 'Super Emitter' behavior to specific publicly traded companies

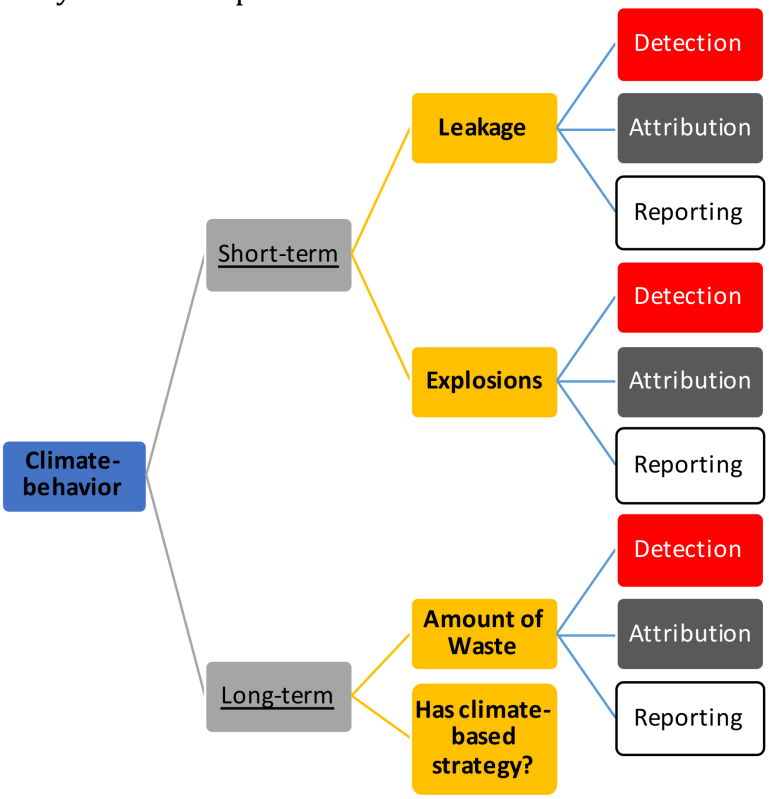
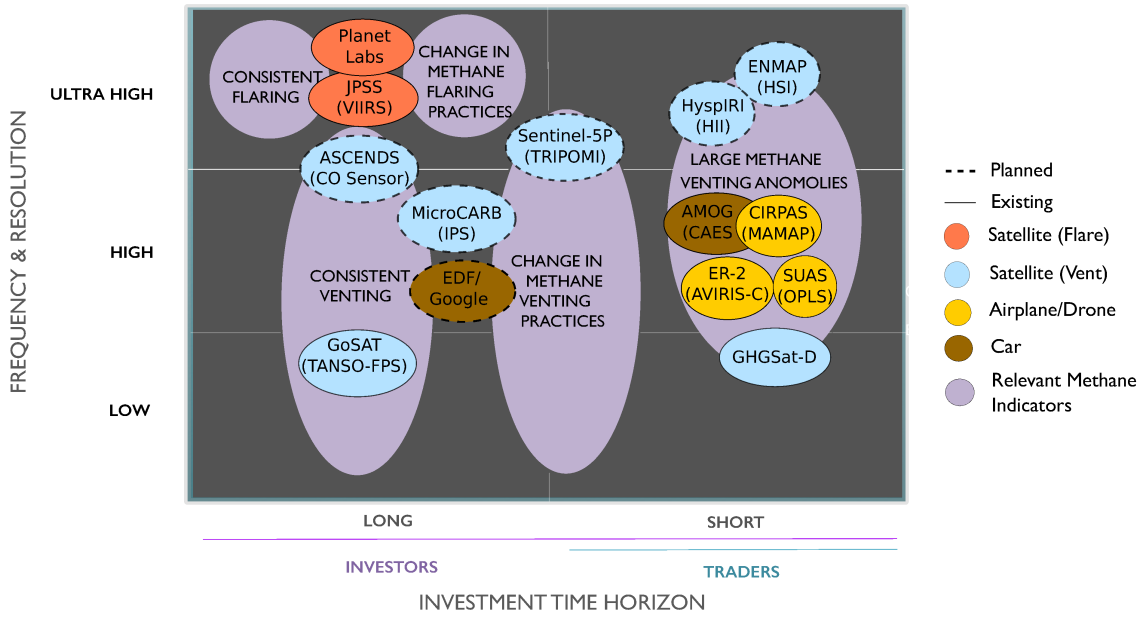


Figure 8: Present and future sensing options for tracking 'Super Emitter' methane flaring and venting.



Several existing remote sensing satellites are currently capable of measuring both methane flares and venting. In particular, the VIIRS satellite can measure flaring at a sufficiently high resolution to track daily changes by flare site and link it directly to the company running the facilities (Elvidge et al. 2013), and private ventures such as Planet Labs satellite constellation can provide even higher resolution data (Planet Labs 2017). Venting is harder to measure since spectrometers must capture the non-visible parts of the spectrum, both using the thermal spectrum (TIR) and short-wavelength infrared (SWIR). Existing satellites, particularly GoSAT (Turner et al. 2015), are capable of measuring at a resolution that can track general trends over time, but none currently in orbit can measure leaks at the temporal/spatial scale and scope necessary to attribute to individual sites. The closest was now-retired EO1 satellite (Figure 1), which was capable of capturing measurements at the required scale – and captured the Aliso Canyon leak (Thompson et al. 2016). But EO1 provided only a small scope where the spectrometer was pointed. A similar "instantaneous field-of-view" (IFOV) satellite was launched in 2016 as a private venture by GHGSat (Germain et al. 2017).

Planned and proposed satellites, particularly the German EnMAP satellite (2019 launch) may for the first time provide a global dataset at the frequency and resolution needed to pinpoint venting emissions by source (Thorpe et al. 2013; Luttenberg and Schaadt 2014;

Tollefson 2016). Local tracking also is available using spectrometers from airplanes and drones, as well as other sensors on ground vehicles (I. Leifer et al. 2013; Gerilowski et al. 2014; Marchese et al. 2015; Perez 2016). Collated together, these sources can be used to build a state-of-the-art, real-time dataset that provides detailed information on all five of these key methane indicators (Brandt et al. 2014; Leifer et al. 2016).

Attribution:

Once data on site-specific emissions is collected, the next step is to attribute the remote sensing methane measurements to the company responsible. The US Energy Information Administration, for instance, provides detailed spatial data on fossil fuel installations and the companies that own them, including stock tickers. By combining these datasets, daily data on facility behavior can be attributed to companies, aggregated, and fed into automated trading systems and/or dashboards, along with conventional financial news and data.[56]

Reporting:

Delivering environmental risk data to investors, human traders, and algorithmic trading systems – in near real-time *before it is generally known* – in a format that seamlessly integrates with their workflow is a way to pull the *geofinancial engineering* lever.

A successful system must create transparency, preferably in near real-time, since knowing about intangible disasters *before others* is what makes the information actionable to hedge fund and algorithmic traders. Knowing first – by a day, an hour or a few hundred milliseconds – can deliver the information advantage they seek. For this reason, we expect that such information would likely be offered on a tiered pricing basis by latency. For example, today high-frequency traders pay very substantial fees for ultra-low latency stock price feeds. By contrast, for the general public such stock price information is typically available for free with a 15-minute lag.

As a case in point, the growing use of Machine Readable News (MRN) as inputs to algorithmic trading systems means that social trends, and even weather events, can have an instantaneous effect on asset prices. Market sentiment exerts a significant influence on investor behavior. Corporate news on select sectors that attract significant media interest

[56] ESG research houses with a specialized climate unit, such as ISS-Ethix, systematically map carbon intense installations (such as factories) and fossil fuel activities to the company level and link them to identifiers of the respective securities. Public data sources – for example, the U.S. Energy Information Administration – also are available for certain industry sectors. (Figure 11) Relatedly, significant efforts are underway by ISS-Ethix, Carbon Delta, Asset-Level Data Initiative and others to map underlying assets to listed companies in order to track "physical" climate risks such as floods, droughts, and storms which might affect company assets and profits.

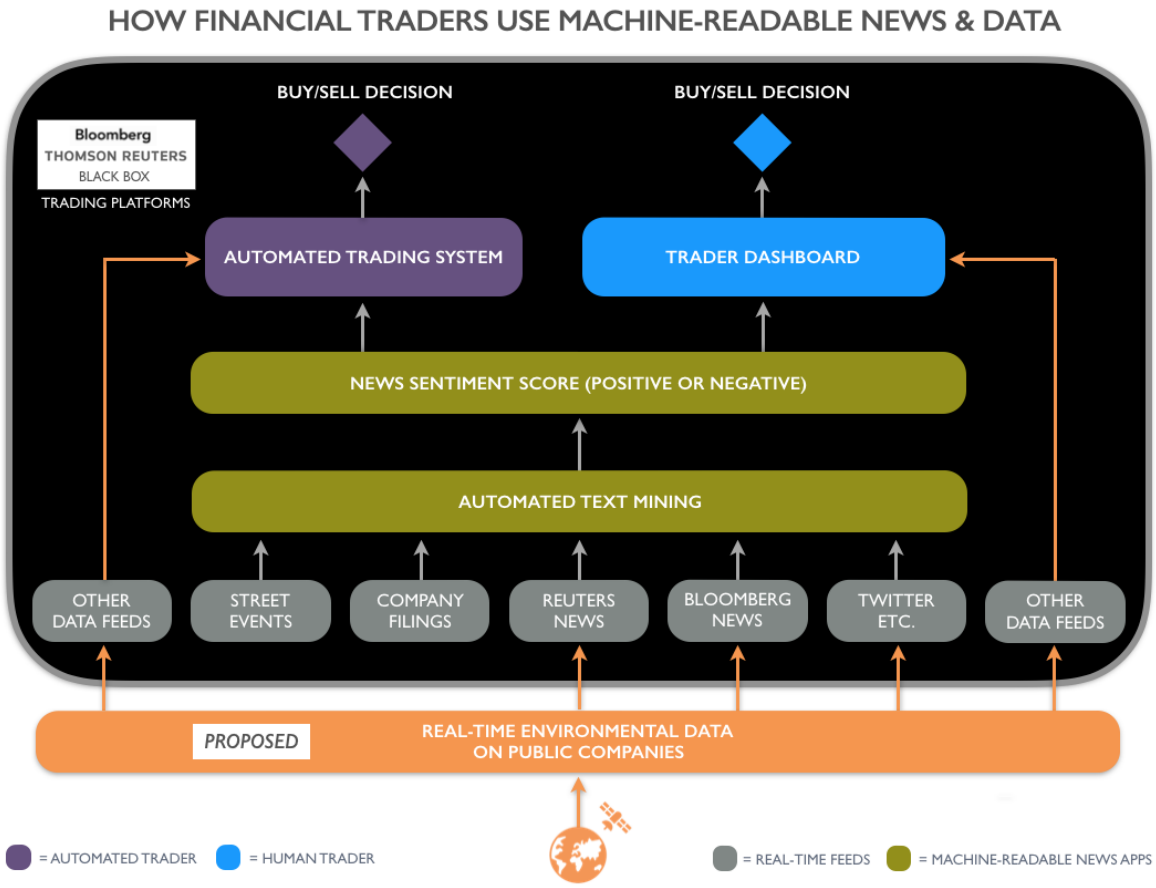
(Depalma 2017), such as the fossil-fuel energy sector, drives market sentiment. In a recent study, for example, abnormal negative stock returns corresponded to news announcements about carbon bubbles, divestment, and related topics. This was especially true for coal companies (Byrd and Cooperman 2016).

Leading financial news providers such as Bloomberg and Thomson Reuters now offer powerful MRN tools that deliver automated sentiment and linguistic analysis on financial news in real-time. Algorithmic trading systems are among the principal users of such tools. Since their trading decisions are often made literally faster than the blink of an eye (less than 300 milliseconds), they use rules-based models with automated circuit breakers – not human traders – to parse and act on new information.

Increasingly, hedge fund and algorithmic strategies seek trading and investment signals from non-traditional sources like social media (Carney 2013) to gain an incremental information advantage. In this context, environmental researchers can trigger shocks in confidence or risk perceptions around investment in fossil fuels or other deleterious behavior. They can do so by delivering timely empirical data and analysis to MRN apps and other analytic tools, amplifying their presence on the financial terminals that drive these apps (Figure 9).

To take advantage of this high-paced financial trader market for methane emissions information, a collator must collect the best available information on methane venting and flaring and translate it into real-time indicators that investors and traders can easily interpret and act upon. We present a step-by-step example in the following section to illustrate how this type of *geofinancial engineering* can work.

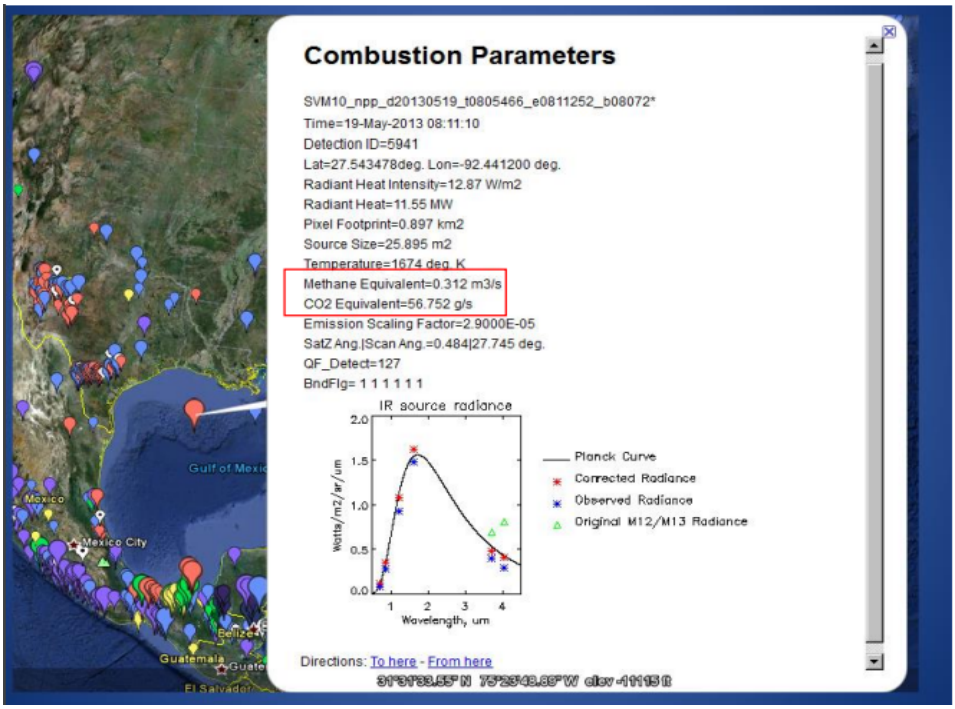
Figure 9: How real-time satellite data on 'Super Emitters' – attributable to specific publicly traded companies – can trigger shocks in confidence or risk perceptions around investment in fossil fuels and/or other deleterious behavior. (Detail of Figure 5)



Hypothetical Case Study: Methane Super Emitter Application

Consider a hypothetical case in which climate-conscious investors care about the rate at which companies are flaring methane, engaging with or divesting from companies with relatively more flaring than their peers. The first step is to *detect* where flaring is happening globally, which requires globally accessible data that captures flaring events at the factory scale. Data from the VIIRS satellite spectrometer has these characteristics and is publicly available daily. Figure 10 shows a screenshot from a presentation by Elvidge et al. (2013) that explains how VIIRS data can be used to calculate daily flares and their respective attributes, including methane emissions and latitude/longitude coordinates.

Figure 10: Methane oil & gas hot spots can be identified by NOAA VIIRS satellite.

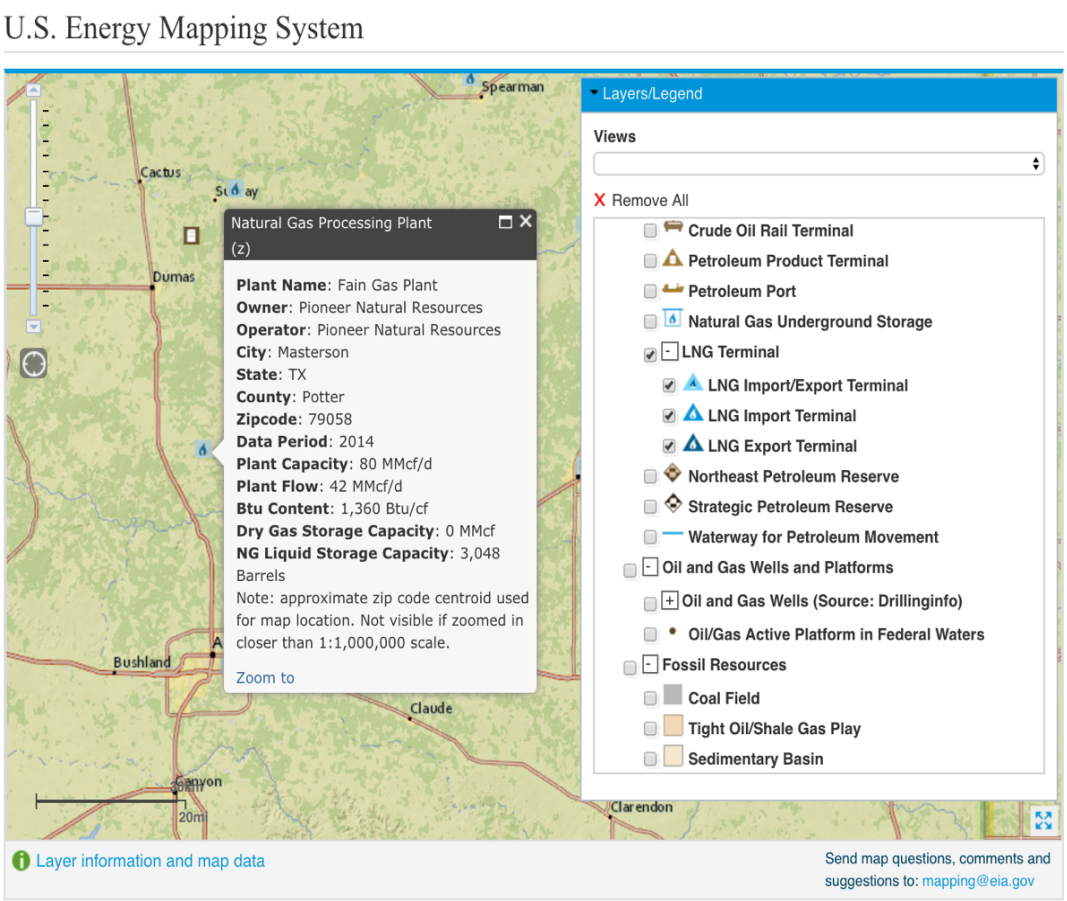


Source: Elvidge et al. (2013)

Next, we need to *attribute* each flare to the facility responsible using spatial coordinates. For the U.S., the Energy Information Agency (EIA) maintains a database with energy-related facilities, which include detailed spatial coordinates as well as company information such as New York Stock Exchange (NYSE) and International Securities Identification Number (ISIN) identifiers (U.S. Energy Information Administration 2017). By overlaying this EIA layer with the VIIRS data, each flaring episode is linked to the company

responsible. Figure 11 is a screenshot of the EIA online tool, showing the information associated with the Fain Gas Plant in Texas. In our hypothetical scenario, if VIIRS detects flares at this site it can be associated with the owner of the plant, Pioneer National Resources, and its stock ticker (PXD) and ISIN (US7237871071). With information on flaring activity per site matched with company identifiers, total flaring activity can be aggregated to calculate behavior across all sites.

Figure 11: Company data associated with Fain Gas Plant in Texas, which, when correlated with VIIRS remote sensing data in our hypothetical example, provides flaring activity per company site.



Source: U.S. Energy Information Administration (2017)

The final step in our hypothetical example is to communicate this flaring activity to investors in an easy to understand manner that can inform their decisions – investment, divestment, or engagement. For instance, real-time daily updates of total GHG emissions from flaring by company can be presented. (Investors would see both flaring indicators from Figure 8: which companies consistently flare the most and which companies have improved or worsened flaring activity over time.) By comparing these data across

companies, investors could decide whether to engage with or to divest from relatively poorly performing companies while perhaps sparing poorly performing companies that are showing improvement in recent weeks and months (suggesting a change in behavior).

While such data may be actionable for investors, they are probably not applicable to hedge funds and algorithmic traders who follow binary buy/sell factors and do not develop views on any given company. For them, we next consider the case of a methane venting "super emitter" disaster such as Aliso Canyon. The EnMAP satellite to be launched in 2019 will have the global coverage and spatial resolution to capture venting incidents such as this every four days. If Aliso Canyon were to happen again in 2020, data from EnMAP cross-referenced with the U.S. EIA information could be fed into trader terminals to alert traders of the increased risk associated with the responsible party, in this case Sempra Energy.

Figure 12 presents a hypothetical *methane risk analyzer* that illustrates how real-time methane risk data on a specific publicly traded company (Sempra Energy) might appear on a climate-agnostic trader's terminal in the near future. Historical time series of past venting anomalies from EnMAP data could be used to estimate a normalized risk score (0-100) from the number of anomalies by company over time. When a new anomaly is detected, this information would be fed into the terminal and immediately affect the risk score, allowing traders to react given the size of the leak, past company behavior, and the risk scores of its peers. Such a dashboard could also include MRN sentiment analysis, tracking of stock price versus methane leaks, and other environmental indicators in real-time, as well as corporate environmental policy scores. Such an app could be programmed to include a notification system that triggers buy/sell trading decisions given pre-selected risk thresholds.

Figure 12: Illustrative example of trader terminal circa 2019 highlighting methane risk for a 'Super Emitter' (Sempra Energy) compared to its peers.

With such a tool, human or automated traders and portfolio managers could use information in several different ways, including:

- Hedge fund and algorithmic trading – Enhance rules-based strategies with automated circuit breakers powered by *methane analyzer* which may anticipate price volatility, sentiment shifts and directional movements based on early indicators of major methane venting anomalies

- Engagement – Trigger efforts by large institutional investors such as pension funds and mutual fund managers to affect directional change at Sempra Energy or its peers via shareholder resolution, proxy votes, disclosures, or other pressures.

Implementation Issues

The examples above highlight a few of the ways *geofinancial engineering* could work, but several key issues are important to consider regardless of the application.

Climate change is a global problem and we live in a global economy. Global data coverage is therefore essential, both for satellite data as well as corresponding company information. Similarly, data resolution must be sufficient to link methane emissions – or other climate-relevant data – to the companies responsible. Moderate confidence levels can still be actionable and better resolution data can increase confidence. Collating data from different sources is another way to increase information reliability, particularly for small, distributed emissions over large areas. For instance, information from short-wavelength (SWIR) spectrometers in the day, thermal (TIR) spectrometers at night, and ground-based sources from airplanes, drones, or cars or stationary remote sensors could improve emissions data confidence in the absence of a "silver bullet" satellite option. A data collation approach may be necessary for spatial information on company assets, connecting multiple data sources (surveys, national accounts, and maps) to improve both accuracy and comprehensiveness. For instance, although attributing emissions to stationary oil and gas assets is fairly straightforward, attributing emissions during the distribution of products is much more difficult (McKain et al. 2015). Similar attribution difficulties may arise for other sectors and GHGs that have spatially distributed emissions as well as asset ownership (for instance livestock and forest products).

Similarly, the temporal dimension of data collection is important. In the case of methane, the more often company venting and flaring is reported the better, as it builds accuracy in readings, allows information to flow to traders more often, and assures that companies cannot easily adjust flaring and venting practices to avoid detection. For instance, satellites that measure methane venting using the short-wavelength infrared (SWIR) spectrometers cannot capture data at night; any venting at this time is undetectable. Similarly, cloudy days can provide an opportunity to flare undetected. And since satellite orbits are predictable, the larger the remote sensing gap, the higher the likelihood that companies can adjust their behavior to exploit those gaps.

For our methane case, VIIRS – with global coverage, a daily time step, and a resolution of 375 m – is sufficient to monitor flaring. Similarly, the planned EnMAP satellite – with global coverage, a four-day time step, and a 12-meter resolution – appears to be the best publicly announced option for venting. Other satellites that can track venting have been proposed, but none are expected to be of the resolution needed for *geofinancial engineering*. (This is particularly true in the U.S. where public funding of such missions is now in question.)

However, the private sector already appears to be filling this gap, and with the potential to do so more quickly and at a lower cost than the public sector. The company GHGSat launched its first satellite last year. It contains both SWIR and TIR spectrometers capable of capturing venting at a 5-meter resolution (Germain et al. 2017). Similar to EO1, however, its IFOV scope does not offer global coverage. Another company, Planet Labs, has launched a constellation of "nanosatellites" capable of capturing ~4-meter resolution images of the entire globe daily. But these satellites track visible and near infrared (NIR) spectrums and not SWIR or TIR. Given the value of improved temporal detail and spatial accuracy, one could imagine a cluster of nano-satellites such as the private Planet Labs data that includes spectrometers similar to those of EnMAP or other proposed satellites. This would take what investors in GHGSat have seen – the value of real-time, accurate information on GHG emissions – to the next level. With such potential coverage, traders could act more confidently and quickly upon information fed into their dashboards (see Figure 12). With the expansion of lower-cost launching options from both governments and private entities, the expense of funding such an effort may fall dramatically in the near future (Vance 2017).

Unintended Consequences and Limitations

Privatizing benefits of greenhouse gas reduction is a key strength of the *geofinancial engineering* approach because it drives uptake in a large and diverse marketplace, and large-scale transformation is necessary to prevent catastrophic climate change. But this trading-based approach to altering corporate behavior may also have side effects, downsides and unintended consequences.

The private option to launch and maintain satellites, for example, raises the issue of information equity. Although emissions reductions provide benefits to everyone globally, the financial benefits from such private information might accrue to only a few. Relatedly, traders and hedge funds might pay high prices to secure access to low latency information on an exclusive basis. That *geofinancial engineering* could incite a kind of data arms race may only intensify the need for capital to secure favorable financial returns.

Second, *geofinancial engineering* may shift influence over the carbon market from well-meaning investors (or policy makers) toward socially indifferent traders with little concern for social benefits or the public good. Finally, significant data penetration could cause political pushback with the potential for new laws or regulations that restrict data collection. This could reduce the amount of information available to us.

We propose a collaborative civic-oriented "open data" approach to mitigate some of these concerns. Given the declining cost of launching satellites, privately-funded consortia consisting of NGOs, academic institutions, foundations, and climate impact-oriented tech firms like Google, Tesla, or SpaceX might make such information publicly available. If

coupled with publicly funded satellite data such as VIIRS – which is already available to all – and a freely-accessible platform such as the one illustrated in Figure 12, then all investors, traders, and stakeholders, regardless of their capital resources, could leverage this information to make environmentally sound decisions.

Another important caveat concerns the efficacy of *geofinancial engineering*. Specifically, the newsworthiness or public perception of certain greenhouse gas emissions may not correlate well with the climate impact of different greenhouse gas sources. For instance, venting is far worse than flaring since unburned methane has higher impacts than burned methane, but flaring means more fire, which could be more "newsworthy" and viewed by traders as more likely to move the short-term market. In other words, information may not move the market for the right reason or may incentivize the wrong things. A focus on traceable venting and flaring events also might draw attention away from more disperse methane venting. This is similar to the differential attention to point-source water pollutants despite the predominance and cumulative impacts of non-point sources. Relatedly, a focus on publicly traded "super emitters" could overlook cumulative venting by numerous, smaller emission sources, as well as the many private and state-owned "super emitters" which are shielded from financial market pressure for transparency and accountability. In the latter case, engagement may be the best and only option.

The *geofinancial engineering* possibilities described in this paper do not include all aspects of climate change risk for corporations, notably those risks from climate change itself. Concern about the risks of extreme heat, drought, and deluge to corporate assets is an additional reason why companies might take action to reduce greenhouse gas emissions. We also assume that a variety of market forces, directly from regulation or indirectly from social awareness and social responsibility, are in place, and might even grow, so that investors and traders can exploit these forces for financial gain. If these forces are not present, the information we suggest collecting and distributing might not affect any change in stock price or corporate behavior.

Conclusions

Climate change as an investment consideration is moving from a responsible investor niche into mainstream concepts of general asset management and institutional investing. This is an important statement by investors, but they still may not reach the critical mass needed to move the needle on a company's market value. The financial market sectors that now generate most of the daily trading volume – hedge funds and algorithmic trading systems – are simply not included in today's considerations. This paper, for the first time, sheds light on a powerful but overlooked driver of capital allocation. We propose a concept in which the underlying mechanics could be utilized to change company behavior – not by the uncertain deployment of ethical arguments, but by linking scientific observations with

likely financial risks and mapping that to hedge fund strategies and trading algorithms in real-time.

The paper suggests two different paradigm shifts.

1) Environmental events including disasters and more routine deleterious behavior of companies negatively impacts the prices of securities. Real-time environmental data from satellites will soon be available in such a standardized and systematic manner that it could be fed into hedge fund strategies and trading algorithms to price such information more quickly and systematically. All that is necessary is a mapping of a measurable event to the investable asset. Given that this is a relatively small hurdle, it is likely that such information will impact trading decisions in the near term.
2) In turn, this means that a proactive use of such information could, at least during a phase of uptake, yield an information advantage that might enable financial outperformance.

The proposed concept of *geofinancial engineering* is the logical progression of financial market participants taking non-financial information into account for their investment decisions or mechanics. Investor consideration of climate change started from an ethical perspective, focusing on the positive or negative impact that an investment can have on the climate and calling on a market participants' responsibility. The investor group that very successfully harnessed and grew this momentum early on – the Principles of Responsible Investing (PRI) group – is now over a decade old. Given the Paris Agreement, in which nearly every country in the world agreed to limit global average warming to well below 2 °C versus pre-industrial levels, the topic of climate change also reached those investors solely focused on risk/return considerations; the implications of the Paris Agreement mean massive transitions of economies, industries, and possibly whole societies.

Since such transitions will impact assets and require financing, they bring new investment risks and investable opportunities. Managing or capturing those risks and opportunities today, however, depends on backward-looking data from annual reports, corporate sustainability reports (CSR), and company communication. While such information helps to understand a company or asset holistically, it does not deliver real-time data that can be used by trading applications. At most, such information is complemented with near real-time information from media and blogs as provided by organizations such as RepRisk. That is, climate-harming events make their way into the financial markets once they have been reported on.

Our proposed concept takes the next step: real-time, satellite-captured information relevant to climate change is linked to specific assets and fed into the financial markets. Such information enables climate-conscious investors to better understand new asset-

specific risks and opportunities in their portfolio. But, critically, it also becomes a tradable signal for hedge funds and algorithmic traders and has the potential to dramatically strengthen the connection between negative climate impacts and market movement.

This "real-time" pricing of externalities can apply to both motivated and climate-agnostic traders and investors as long as there are market signals that impose price penalties on the heightened liabilities of corporations engaging in irresponsible behaviors such as excessive methane venting and flaring. Information on these emissions must be attributable to a particular company and be updated in a regular manner that gives an advantage to those traders with new, updated information. These data do not need to be high-precision if they contain some accurate, and therefore actionable, information.

Further research and initial testing of *geofinancial engineering* is needed to improve information collection, analysis, and dissemination. Investments in improved remote and local sensing options should enhance the ability of markets to respond to real-time information using the *geofinancial engineering* tools. In addition to the methane emissions highlighted here, many of the planned remote sensing projects target other key GHGs (Tollefson 2016), but each gas type requires unique attention to the difficulties in tracking emission sources and confirming company attribution. Careful consideration of the indirect effects of *geofinancial engineering* is also critical, particularly since the social need for greenhouse gas emission reduction is considerable and pressure to take action could and should intensify in the near future.

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A Methodology for Assessment of Corporate Responsibility on Climate Change: A Case Study of the Fossil Energy Industry

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Abstract

Investors are increasingly interested in metrics to evaluate companies' progress on environmental, social, and governance (ESG) initiatives, particularly around climate change, an issue closely tied to long-term global financial stability. We propose a new method to characterize and quantify corporate engagement with climate science and policy. This method builds on past work to define corporate social responsibility and assess corporate behavior specifically around climate change. The metric includes 30 indicators within four broad areas. These are used to measure companies' execution and progress with respect to climate change. The four broad areas are (1) renouncing disinformation on climate science and policy; (2) planning for a carbon-constrained economy; (3) supporting fair and effective climate policies; and (4) fully disclosing climate-related risks. The metric was used to assess and distinguish eight leading fossil fuel companies, and in investor decision making around Barnard College's endowment. The metric is presented in detail along with results for assessing fossil fuel companies. We also discuss the utility and materiality of the metric for asset owners and investment managers, as these groups are increasingly challenged to identify and integrate pertinent ESG data into their policies and processes. With the goal of broad-based application, we address current challenges around practical implementation of the metric, and include suggestions for future enhancements to ensure the continued relevance and replicability of the metric.

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Introduction

Investors are increasingly interested in metrics to evaluate and compare companies' progress on environmental, social, and governance (ESG) initiatives, particularly around climate change, as such evaluation provides an important tool with which to manage their portfolios (Nelson, 2017; Proxy Preview, 2017; ISS, 2016; IFAC, 2012).

Currently, several voluntary climate-related disclosure mechanisms, along with guidance from the U.S. Securities and Exchange Commission (SEC) on climate-related risk reporting, aim to ensure that investors have the access to climate-related disclosures they need to make informed investment decisions. Many companies across sectors, however, provide limited disclosure of their climate-related financial risks and face increasing pressure from both investors and civil society organizations to improve (EIU, 2017; TCFD, 2017; Carlson, Goldman, and Dahl, 2016; Coburn, Salmon, and Grossman, 2012).

Previous metrics have been either broad, covering many ESG issues, or limited in scope and not applicable across different industries. As an example, the CPA-Zicklin Index of Corporate Political Disclosure and Accountability provides an annual ranking of company performance on a host of transparency measures related to political spending (CPA, 2016). Previous attempts to rank company performance on climate-related measures have been limited in scope (Goldman et al., 2014). For example, the Carbon Disclosure Project (CDP), representing over $100 trillion in managed assets, conducts annual questionnaires of companies on climate change and compiles results in its Climate Performance Leadership Index (CDP, 2017). The Science Based Targets Initiative, a collaboration between CDP, the World Resources Institute, the World Wide Fund for Nature, and the United Nations Global Compact, has laid out expectations for, and gathered commitments from, companies regarding reductions in their carbon emissions (Science Based Targets, 2017).

Historically, many companies in carbon-intensive industries have opted out of such voluntary reporting and commitment initiatives. The Oxford Martin Working Principles for Investment in Fossil Fuels provide a framework for engagement between investors and companies that are carbon-intensive or engaged in fossil fuel extraction (Allen et al., 2015). *Investor Expectations for Oil and Gas Companies: Transition to a Lower Carbon Future* provides a basis for investor engagement with the boards and management of oil and gas companies. The report focuses on how companies in this sector are managing risks and developing business strategies to align with the Paris Agreement commitment to keep the increase in global average temperatures well below 2°C above pre-industrial levels (IIGCC, 2016).

Given the far-reaching impact of climate change on long-term financial stability, investors need tools that provide a framework for assessing corporate behavior with regard to climate change. Companies increasingly face financial risks from climate change, including regulatory risk from carbon emission reduction laws, physical risk from the impacts of climate change, and reputational risks from changing public attitudes towards company behavior. Across all economic sectors, the transition to a lower-carbon economy has implications for the global financial system: Models project that climate change will place global financial assets at risk by anywhere from US$2.5 trillion to US$24.2 trillion (Dietz et al., 2016).

On regulatory risk, the international climate agreement reached in Paris in December 2015 has created additional pressure on companies to reduce their emissions in line with the agreement's goal of keeping the increase in global average temperature well below 2°C above pre-industrial levels. Moody's Investor Service warns that as robust carbon pricing policies gain traction they may impose deleterious demand-side costs on oil and gas companies (MIS, 2016). The potential for stranded assets in the form of carbon-intensive investments and reserves is also significant, especially in the fossil energy sector (CTI, 2017).

Left unaddressed, climate change is expected to cause significant physical impacts with serious implications for investors and businesses, including oil and gas companies (Grossman et al., 2012). The year 2016 was the costliest 12 months for natural catastrophes in the last four years, with losses totaling US$175 billion. Climate change is expected to exacerbate existing vulnerabilities to natural disasters (Munich Re, 2016). Extreme heat, sea level rise, and increasingly intense hurricanes affecting the U.S. Gulf Coast and Southeast are projected to pose substantial challenges for oil and gas companies that concentrate production, refining, and transportation infrastructure in these regions (RBP, 2014). Climate-related threats to critical water supplies also contribute material risks for mining, oil, and gas companies (Whelan and Fink, 2016). Company preparation for climate change is closely tied to long-term global financial and stability risk.

On reputational risk, all companies operate with a social license, and companies that fail to act responsibly can lose the public's trust. The experiences of the tobacco and asbestos industries, though different in some respects, suggest that heightened societal awareness and growing public pressure create incentives for companies to accept and act in accordance with their responsibilities to investors and to society (Oreskes and Conway, 2011).

Major fossil energy producers are particularly vulnerable to the aforementioned risks, but their responses have varied. We aim to differentiate between companies in their responses

to climate-related risk. Not only do their products emit greenhouse gases (such as methane and carbon dioxide), but many of these companies have also been politically active on laws or regulations that would reduce emissions of greenhouse gases. In some cases, this involved downplaying or disparaging scientific evidence of the climate risks posed by their products (Mulvey et al., 2015; Goldman et al. 2014). Some fossil energy companies continue to encourage, plan for, and invest in expanded and unabated fossil fuel use – despite knowledge of the adverse climate impacts of their products, and despite having the technical and financial capacity to facilitate the transition to low-carbon energy (Frumhoff, Heede, and Oreskes, 2015).

A number of sources are now suggesting the core dimensions of a metric against which to assess company behavior with respect to climate change. These include previous demands from investors, especially those focused on ESG performance; prior academic literature and policy analyses laying out the responsibilities and performance of companies on climate change-related engagement; and the climate policy guidance established in the Paris Agreement (Frumhoff, Heede, and Oreskes, 2015, UNFCCC, 2015). Here, we aim to equip investors with tools to rigorously assess and compare companies' current performance on climate change-related positions and actions in order to inform decision making.

Methods

We propose a new method to characterize and quantify corporate engagement on climate science and policy. This method builds on prior work to define corporate social responsibility and assess corporate behavior specifically around climate change. It draws on the recommendations of the Financial Stability Board's Task Force on Climate-Related Financial Disclosures (TCFD), the CDP Climate Leadership Index, and the Center for Political Accountability's CPA-Zicklin Index (TCFD, 2017; CDP, 2016; CPA, 2016; Frumhoff et al., 2014; Goldman et al., 2014; Goldman and Rogerson, 2014). It also takes account of the climate goals articulated in the Paris Climate Agreement (UNFCCC, 2015). While these goals reflect commitments by nation-states, they have fundamentally altered the policy and market landscape for businesses. This method may be of particular interest to ESG-oriented investors who are interested in companies that hold consistent, science-based positions on climate change and that engage constructively with the long-term goals of the Paris Agreement.

The metric includes the 30 specific indicators detailed in Table 1. These constitute four areas described below. While most of these indicators are broadly applicable to the assessment of corporate social responsibility on climate change, some are particularly relevant to the fossil fuel sector.

Renouncing Disinformation on Climate Science and Policy

In part, we adapted indicators in this area from consistency and transparency criteria outlined in the *Guide for Responsible Corporate Engagement in Climate Policy*. This was drafted by the United Nations Global Compact, the secretariat of the United Nations Framework Convention on Climate Change, and the United Nations Environment Program, in cooperation with the World Resources Institute (Karbassi et al., 2013). In this area, we assess the scientific accuracy and consistency of companies' direct communications with the public about climate change. This includes both whether they affirm the need for swift and deep reductions in emissions from the burning of fossil fuels and whether they maintain membership or leadership positions in trade associations and industry groups that spread disinformation on climate science or misrepresent the possible effects of climate policies. We also evaluated whether companies have safeguards in place to prevent involvement in future disinformation, and whether they have supported climate-related shareholder resolutions put forward by established networks of socially responsible investors.

Companies affiliate with trade associations and other industry groups for many reasons, independent of their climate position; in some cases it is challenging for companies to sever ties with key associations (Goldman and Rogerson, 2013). The metric thus accounts for the possibility that companies might retain their affiliations but publicly distance themselves from climate disinformation and policy positions.

Planning for a Carbon-constrained Economy

The Science Based Targets Initiative, the Oxford Martin School's Working Principles for Investment in Fossil Fuels, and the long-term temperature targets of the Paris Agreement informed this area (Allen et al., 2015; UNFCCC, 2015; Science Based Targets, n.d.a). We assessed companies' plans through the steps that each one has taken to: (1) align its business model with a carbon-constrained future; (2) disclose long-term and short-term company-wide emissions reduction strategies along with data demonstrating progress towards those goals; and (3) execute reduction plans through concrete actions, thus bolstering the resilience of company business models in a carbon-constrained world.

Supporting Fair and Effective Policies

The indicators in this area incorporate the 2015 CPA-Zicklin Index and the criteria outlined in the *Guide for Responsible Corporate Engagement in Climate Policy* (Center for Political Accountability, 2015; Karbassi et al., 2013). Here we evaluated companies' disclosure,

governance of their political activity in general, and their support for specific U.S. federal policies that would address climate change.

Fully Disclosing Climate Risks

We adapted indicators in this area from *Sustainable Extraction? An Analysis of SEC Disclosure by Major Oil and Gas Companies and Deepwater Drilling Risk* by Ceres and *Carbon Asset Risk: Discussion Framework* from the World Resources Institute and United Nations Environment Program Finance Initiative Portfolio Carbon Initiative (Fulton and Weber, 2015; Coburn, Salmon, and Grossman, 2010). These indicators also note the process undertaken by the TCFD to develop voluntary, consistent, climate-related financial risk disclosures for use by companies in providing information to investors, lenders, insurers, and other stakeholders. In this area, we assessed company disclosure of regulatory risks, physical risks, market and other indirect risks and opportunities, and corporate governance by the board and senior management on climate-related risks.

Table 1 shows the full list of indicators included in the metric.

Table 1: The 30 indicators of the metric to characterize and quantify corporate engagement on climate science and policy[57]

Area	Specific Indicators
Renouncing disinformation on climate science and policy	Accuracy and consistency of public statements on climate science and the consequent need for swift and deep reductions in emissions from the burning of fossil fuels
	Affliations with trade associations and other industry groups that spread climate science disinformation and/or block climate action
	Policy, governance systems, and oversight mechanisms to prevent disinformation
	Support for climate-related shareholder resolutions
Planning for a carbon-constrained economy	Support for the Paris Climate Agreement
	Company-wide commitments and targets to reduce greenhouse gas emissions
	Use of an internal price on carbon in investment decisions
	Commitment and mechanism to measure and reduce carbon intensity of supply chain
	Disclosure of investments in low-carbon technology research and development
	Disclosure of greenhouse gas emissions reduction plans
	Disclosure of how company manages greenhouse gas emissions and associated risks
	Disclosure of greenhouse gas emissions
Supporting fair and effective climate policies	CPA-Zicklin Index of Corporate Political Disclosure and Accountability: Disclosure
	CPA-Zicklin Index of Corporate Political Disclosure and Accountability: Policy
	CPA-Zicklin Index of Corporate Political Disclosure and Accountability: Oversight
	Engagement with Congress on federal climate policies or legislation
	Consistent support for US policy action to reduce emissions
	Engagement with the US Environmental Protection Agency (EPA) on the Clean Power Plan
	Engagement with the EPA on the methane rule
	Company influence through international or national business alliances or initiatives that are supportive of specific climate policies
Fully disclosing climate risks	Disclosure of regulatory risks
	Disclosure of physical risks
	Disclosure of market and other indirect risks and opportunities
	Disclosure of corporate governance on climate-related risks by board and senior management

The proposed metric can be employed using publicly available information, including:

- Company annual reports, proxy statements, sustainability reports, and CDP submissions;
- Company 10-K and 20-F filings with the SEC;
- Company websites and press releases;
- Transcripts and recordings of corporate annual meetings;
- Public statements by company executives;
- The 2015 CPA-Zicklin Index of Corporate Political Disclosure and Accountability;

[57] The area of "Affiliations with trade associations and other industry groups that spread climate science disinformation and/or block climate action" included assessment of seven industry groups, each as their own indicator and scoring.

- Major news sources;
- Third-party websites, such as Sourcewatch from the Center for Media and Democracy, with verification of data.

Specific data sources for each area of the assessment are available online at *http://www.ucsusa.org/sites/default/files/attach/2017/08/Goldman-et-al-2017-Supplementary-Information.pdf*

Scoring

Most metrics work on a five-point scale ranging from "advanced" to "egregious." For some metrics, the scale ranges from "good" to "poor". Scoring bands have been developed in order to determine a company's aggregate score in each area of assessment (Table 2).

Table 2: Scoring Bands for All 30 Indicators

Score	**Definition**	**Points Assigned**
Advanced	Company is demonstrating best practices on this indicator	+2
Good	Company is meeting ESG investor expectations on this indicator	+1
Fair	Company's performance is neither positive nor negative on this indicator	0
Poor	Company is falling short of ESG investor expectations on this indicator	-1
Egregious	Company is acting very irresponsibly on this indicator	-2

Initial Application

The metric assessed and differentiated eight leading fossil fuel companies between January 2015 and May 2016 (Mulvey et al., 2016). Company policies and actions on climate change used to develop the metric fell within this time period; thus, company actions outside of this time period were not accounted for, except in limited cases where indicated when such data were not available.

We chose eight publicly traded fossil energy producing companies to assess the functionality and utility of the metric. The public availability of their data and the high level

of investor interest in fossil energy companies' governance around climate change made these a natural choice. The eight companies included the five largest investor-owned oil and gas companies in terms of cumulative emissions (Chevron, ExxonMobil, BP, Royal Dutch Shell, and ConocoPhillips) and the three largest investor-owned U.S.-based coal companies in terms of cumulative emissions (Peabody Energy, CONSOL Energy, and Arch Coal). These eight companies are among the top fifty investor-owned coal, oil, and natural gas companies. They alone are responsible for nearly 15% of industrial carbon emissions between 1850 and 2010 (Heede, 2014).

For the indicator "Company Affiliation with Trade Associations and Industry Groups Involved in Disinformation," we included seven major US industry groups and trade associations: American Coalition for Clean Coal Electricity, American Legislative Exchange Council, American Petroleum Institute, National Association of Manufacturers, National Mining Association, U.S. Chamber of Commerce, and Western States Petroleum Association. These seven groups were chosen because they suit the eight sample companies and because of their past engagement around climate-related policies (Mulvey et al., 2015, Goldman and Rogerson, 2014; Brulle, 2013).

Leaders at all eight companies were given an opportunity to clarify their positions and actions on climate change. The authors had conversations with BP, Peabody Energy, and Shell. These companies provided relevant source material for consideration in the assessment. Arch Coal, ConocoPhillips, and CONSOL Energy acknowledged Mulvey et al. (2016)'s request for information and provided no substantive reply in advance of publication. ConocoPhillips subsequently commented in detail and has engaged in dialog with the authors regarding the findings. Chevron and ExxonMobil sent electronic messages confirming receipt of the questionnaire but did not respond despite several attempts on the part of the research team for follow-up communication.

Results

Results indicate that, in terms of engagement around climate change, the eight companies assessed here can do more to distance themselves from the spread of climate disinformation and to engage productively in policy discussions (Tables 3 and 4). However, some companies have made more progress than others, as detailed below.

Table 3. Metric Scores for Eight Fossil Energy Companies[58]

		Arch Coal	BP	Chevron	ConocoPhillips	CONSOL Energy	ExxonMobil	Peabody Energy	Royal Dutch Shell
Renouncing disinformation on climate science and policy	Accuracy and consistency of public statements on climate science and the consequent need for swift and deep reductions in emissions from the burning of fossil fuels	0	1	-1	0	-1	-2	0	2
	Affliations with trade associations and other industry groups that spread climate science disinformation and/or block climate action	-3	-5	-7	-6	-3	-9	-5	-4
	Policy, governance systems, and oversight mechanisms to prevent disinformation	-1	-1	-1	-1	-1	-1	-1	-1
	Support for climate-related shareholder resolutions	0	1	-2	-2	-1	-2	0	1
	AREA SCORE	**-4**	**-4**	**-11**	**-9**	**-6**	**-14**	**-6**	**-2**
Planning for a carbon-constrained economy	Support for the Paris Climate Agreement	-1	0	-1	-1	-1	-1	-1	0
	Company-wide commitments and targets to reduce greenhouse gas emissions	-2	-2	-1	-1	-2	-2	-2	-1
	Use of an internal price on carbon in investment decisions	-2	0	-1	-1	-2	-1	-2	0
	Commitment and mechanism to measure and reduce carbon intensity of supply chain	-1	0	-1	-1	-1	-1	-1	0
	Disclosure of investments in low-carbon technology research and development	-1	0	-1	-1	-1	-1	-1	0
	Disclosure of greenhouse gas emissions reduction plans	-1	-1	-1	-1	-1	-1	-1	-1
	Disclosure of how company manages greenhouse gas emissions and associated risks	-1	-1	0	0	0	0	-1	0
	Disclosure of greenhouse gas emissions	-2	0	0	1	0	0	-1	1
	AREA SCORE	**-11**	**-4**	**-6**	**-5**	**-8**	**-7**	**-10**	**-1**
Supporting fair and effective climate policies	CPA-Zicklin Index of Corporate Political Disclosure and Accountability: Disclosure	-2	0	0	1	-2	-1	1	0
	CPA-Zicklin Index of Corporate Political Disclosure and Accountability: Policy	-2	2	2	2	0	2	0	2
	CPA-Zicklin Index of Corporate Political Disclosure and Accountability: Oversight	-2	-1	1	2	0	0	0	-1
	Engagement with Congress on federal climate policies or legislation	0	0	0	0	0	0	0	0
	Consistent support for US policy action to reduce emissions	-1	0	-1	-1	-1	0	-2	0
	Engagement with the US Environmental Protection Agency (EPA) on the Clean Power Plan	-1	0	0	0	-1	-1	-2	0
	Engagement with the EPA on the methane rule	0	1	-1	-1	-1	0	0	0
	Company influence through international or national business alliances or initiatives that are supportive of specific climate policies	0	1	0	0	0	0	0	1
	AREA SCORE	**-8**	**3**	**1**	**3**	**-5**	**0**	**-3**	**2**
Fully disclosing climate risks	Disclosure of regulatory risks	1	1	1	1	1	-1	0	-1
	Disclosure of physical risks	-1	-1	-1	1	-1	0	-2	-1
	Disclosure of market and other indirect risks and opportunities	-1	0	0	0	0	0	-1	0
	Disclosure of corporate governance on climate-related risks by board and senior management	-2	-2	-2	0	-2	-2	-2	-1
	AREA SCORE	**-3**	**-2**	**-2**	**2**	**-2**	**-3**	**-5**	**-3**

[58] Scores for the indicator "Affiliations with trade associations and other industry groups that spread climate science disinformation and/or block climate action" range from a possible -10 to 10 because seven industry groups (five relevant to each company) were each assessed on a -2 to 2 scale.

Table 4. Scoring Key

	Advanced	Good	Fair	Poor	Egregious
Renouncing disinformation on climate science and policy	+10 to +15	+4 to +9	(-3) to +3	(-9) to (-4)	(-15) to (-10)
Fully disclosing climate risks	+6 to +8	+3 to +5	(-2) to +2	(-5) to (-3)	(-8) to (-6)
Supporting fair and effective climate policies	+9 to +14	+3 to +8	(-2) to +2	(-8) to (-3)	(-14) to (-9)
Planning for a carbon-constrained economy	+8 to +12	+3 to +7	(-2) to +2	(-7) to (-3)	(-12) to (-8)

Companies scored from "egregious" to "fair" on "Renouncing disinformation on climate science and policy," indicating that the eight companies assessed could do more to distance themselves from the spread of climate disinformation. Scores in this area came predominantly from one indicator: company membership in trade associations observed to misrepresent climate science and/or the implications of climate policies and the failure to publicly distance themselves from such messaging.

In the area of "Planning for a carbon-constrained economy," the three coal companies assessed (Arch Coal, CONSOL Energy, and Peabody Energy) received a score of "egregious." Among the oil and gas companies, only Shell scored a "fair." The results indicate that companies can improve their planning for a carbon-free future by, for example, cutting emissions from their operations and ending the practice of flaring natural gas. To score higher in this area, companies can update their business models to reflect the risks of unabated fossil fuel burning and the importance – even necessity – of national and international policies limiting carbon emissions. Central to such a business plan, fossil fuel companies should map their 20-year plans to ensure that society achieves a carbon-free clean-energy future.

Currently, many fossil fuel companies promote business scenarios that would result in emissions far in excess of those allowed under the international climate goals (BP PLC, 2016; ExxonMobil Corporation, 2016c; Royal Dutch Shell PLC, 2016b). As both domestic

and international actors whose products and core businesses directly and substantially contribute to global climate change, fossil energy companies could demonstrate a level of ambition similar to that shown by countries in the Paris Climate Agreement. They could clarify the paths they plan to take to reduce emissions in service of the Paris global temperature goals; such steps would improve their scores in this metric.

BP and ConocoPhillips scored a "good" in the area of "Supporting fair and effective climate policies." All other companies scored "fair" or "poor." To improve scores in this area, fossil energy companies could identify and publicly support policies that will reduce emissions significantly enough to mitigate the worst effects of global warming. These policies include things like cap and trade, renewable energy standards, renewable fuel standards, and direct regulation of emissions. Such policy support is especially important for fossil fuel producers, as these companies have a unique responsibility and opportunity to engage constructively in conversations about policy solutions to limit carbon emissions. While companies may disagree on the merits of a specific policy proposal under discussion, the onus is on the company to present and advocate for a specific, viable alternative that would result in equivalent or greater emissions reductions.

Finally, in the area of "Fully disclosing climate risks," companies scored from "poor" to "fair," with all eight companies in positions to improve disclosure under existing climate risk disclosure requirements. By law, fossil fuel companies that are publicly traded in the United States are required in their annual SEC filings to discuss risks that might materially affect their business. However, compliance with this guidance is not consistent. While most of the companies in our sample reported on regulatory risks related to climate change, none were yet providing sufficient information to investors about physical and operational risks, or market risks and opportunities for their businesses. Only Shell included disclosures about corporate governance on climate-related issues in its SEC filings, mentioning climate change as one of the topics discussed by its board Committee on Corporate and Social Responsibility. But these disclosures provided no details on how the committee manages the company's climate-related risks and opportunities.[59]

59 Detailed scoring results can be found online at http://www.ucsusa.org/sites/default/files/attach/2017/08/Goldman-et-al-2017-Supplementary-Information.pdf

Discussion

The metric presented here provides a quantitative baseline against which to measure company and industry-wide progress toward societal expectations on climate responsibility. Such assessments can be useful for investors, policymakers, the media, and the public.

Barnard College Endowment Decision

In 2016, Barnard College launched a Presidential Task Force to Examine Divestment. In its report, the Task Force recommended that Barnard establish meaningful distinctions among fossil fuel producers, with the goal of divesting from those that "deny climate science or otherwise seek to thwart efforts to mitigate the impact of climate change." Partially motivating this recommendation was the view that such distinctions would provide "incentives for firms to bring their pronouncements and actions into better alignment with the available scientific evidence" (Sethi, Pfirman, and Goldmark, 2017). Furthermore, the approach was viewed as being closely connected with a fundamental component of Barnard's academic mission – the principle of scientific integrity.

The Task Force recognized, however, that the College faces several challenges in implementing the proposal, including defining climate-denying behaviors and monitoring firms on an ongoing basis. A key turning point in the College's consideration of alternative approaches was the publication of Mulvey et al. (2016), which provided a framework for differentiation and a proof-of-concept. A report from Columbia University's Advisory Committee on Socially Responsible Investing that argued for an approach based on "standing up for science" also influenced the Task Force (ACSRI, 2015). In particular, the Committee advocated divestment from firms that have sought to obstruct honest debate on the causes and consequences of climate change through "word" or "deed." Using these documents as a foundation, the Task Force developed possible criteria against which to screen fossil energy companies, recognizing that implementation required expanding analysis beyond the eight initial companies examined by Mulvey et al. (2016). Barnard's Board of Trustees voted in March 2017 to accept the recommendations of the Task Force, noting that the college will "distinguish between companies based on their behavior and willingness to transition to a cleaner economy" (McDonald, 2017). Other colleges and universities have expressed interest in this approach to fossil fuel divestment, but the unavailability of a published, continually updated, expanded analysis of companies is a significant constraint on further adoption.

Future Applications

This metric enables asset owners and investment managers to make distinctions between companies along a continuum of behavior. The fiduciary requirement of returning value to shareholders does not absolve corporations of other legal and ethical responsibilities relating to their products (Shue, 2017). One could argue further that, in order to maximize shareholder value and minimize financial stability risk over the long-term, it is incumbent on company management to have in place a culture of corporate accountability and responsibility related to climate change. This is particularly important in the fossil fuel industry.

Metrics like the one presented here can also be useful in a legal context. One approach to holding corporations accountable for the harm of their products, when used as intended, is to pursue legal remedies. The attorneys general of New York and Massachusetts, for example, are investigating whether ExxonMobil violated any laws in misleading shareholders and consumers about the realities and risks of climate change. Other states or nations considering legal approaches to holding fossil fuel companies accountable for climate responsibilities might inform their investigation with metric-driven comparisons of company actions.

The research presented here could be replicated on a regular basis to encourage and assess improvements in companies' climate-related performance. It could also be expanded so that investors can evaluate a broader list of companies. While eight companies were chosen for inclusion in Mulvey et al. (2016), this publicly available methodology could be used to assess additional fossil energy companies. It would take considerable effort, however, to compare all 200 fossil fuel companies that are currently the focus of divestment campaigns (350.org, 2017). Additional resources and capacity would be required to assess companies not listed on U.S. exchanges and companies that report in languages other than English. Furthermore, to support broad-based adoption of the metric, it may be necessary to refine some of the indicators to facilitate cross-border comparability, further emphasize materiality, and ensure the repeatability of evaluation.

In addition to potential application to divestment decisions, this research could inform investor behavior through shareholder engagement with companies about specific climate-related positions and actions. For instance, an investor may consider the metric when evaluating and analyzing certain proxy votes. As proxy voting and shareholder activism successes increase, we believe that they will become a more powerful tool for asset owners. Further downstream, publicity of the metric could also impact companies' reputations, adversely affecting stock prices and profitability – both areas of keen focus for investors.

While most of these indicators are broadly applicable to the assessment of corporate social responsibility on climate change, some are specifically designed around the fossil fuel sector. With appropriate modification to some indicators, the metric could also be adapted to compare companies in other carbon-intensive industries. In addition, the area labeled "support fair and effective climate policies" in this methodology focuses primarily on companies' actions to influence U.S. federal climate policies. Future analyses could assess major company support for or opposition to selected state climate policies, policies in other countries or regions, or international agreements.

Mulvey et al. (2016) focused on the responsibilities of fossil fuel producers with respect to climate change, and should not be construed as a rating of any company's overall corporate responsibility. The operations of these eight corporations – most of them transnational – affect a host of issues, including human rights, worker rights, public health, and the environment. In many cases, other organizations and communities in the United States, and internationally, are engaging with these fossil fuel producers and working to hold them accountable for negative impacts on people and the planet (CHRB, 2017).

Further, this methodology is inhibited by a lack of corporate and political transparency. Limited and patchy disclosure requirements restrict the amount of information that is publicly available about companies' political activities, particularly around payments to third-party groups like trade associations, think tanks, and research organizations. The eight companies assessed in Mulvey et al. (2016) reported spending more than $42 million on federal lobbying in 2015, and $7.5 million in campaign contributions in the 2015-2016 election cycle (Senate Office of Public Records, 2016; CRP, 2016). However, federal filings do not require disclosure of positions companies take on specific legislative proposals or the amount spent to lobby for or against them. Moreover, there is no requirement for companies to disclose their indirect political contributions or so-called "dark money" – funds given anonymously to nonprofit organizations that often spend significant amounts to influence elections.

Recent heightened monitoring of companies' climate-related positions and actions by the public, investors, and policymakers is creating demand for greater transparency. We are witnessing significant amounts of pressure on companies as a result of increasing investor awareness of the effects of climate change on long-term profitability and stability. Disclosure of climate-related risks has become an expectation of mainstream investors.[60] Such developments and increased demands could substantially improve future iterations of this study, or others, if more public information is available. For example, as overt

[60] Consider the unprecedented majority shareholder votes calling on ExxonMobil and Occidental Petroleum to report annually on how they will ensure that their businesses remain resilient in (1) the face of climate change policies and (2) technological advances designed to limit global temperature increase to well below 2° Celsius (Mufson, 2017).

disinformation on climate science by companies and their trade associations becomes less acceptable, criteria in the area of "Renouncing disinformation on climate science and policy" may evolve. In addition, the TCFD is now promulgating internationally developed and vetted standards for disclosure of climate-related financial risks; indicators in this study could be updated accordingly (TCFD, 2017).

Conclusion

The metric presented here is a model for assessing company positions and actions on climate science and policy. As a case study, we assessed eight fossil energy companies using 30 indicators. The companies did not meet the expectations laid out by this metric, indicating the potential for improvement across the fossil energy industry when it comes to climate science and policy engagement. Specifically, results of this study indicate that fossil energy companies could take the following actions to improve their climate responsibility:

- Renounce disinformation on climate science and policy;
- Plan for a carbon-free world, developing business models that are consistent with keeping warming well below a 2°C increase above pre-industrial levels;
- Support climate policies to reduce emissions of greenhouse gases;
- Fully disclose the financial and physical risks climate change poses to their business operations;
- Break from climate-denying trade associations and industry-affiliated groups, or publicly commit to work within these groups to change their climate-related policies and actions;
- Disclose all climate-relevant information, including greenhouse emissions, climate-related business risks, direct and indirect political spending, payments to trade associations and industry groups active on climate issues, and climate-related lobbying;
- Make company-specific commitments to contribute to global goals to limit warming; and
- Be consistent, specific, and transparent about the need for U.S. and international policies to reduce emissions of greenhouse gases.

Barnard College used this metric to inform responsible investment decisions in their endowment. The metric has potential to be used for other industries and expanded to include other indicators spanning different time periods. As investors become increasingly interested in company performance and risks related to climate change, demands for such a metric are likely to grow.

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Appendix

An Appendix can be found at *http://www.ucsusa.org/sites/default/files/attach/2017/08/Goldman-et-al-2017-Supplementary-Information.pdf*

Proposing Constant Currency as a Revenue-Based Denominator to Measure Greenhouse Gas Intensity: A Case Study from the Industrial Gases Sector.

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Abstract

Many investors believe that corporate sustainability offers insight into operational excellence, innovativeness, and long-term shareholder growth. Such investors are looking for a means to separate firms that are making a positive environmental, social, and governance (ESG) contribution from those that are not.

This paper presents observations from employees of one company, Praxair, in a small and fairly homogenous industry subsector, industrial gases (IG). Many ESG investors focus on energy and greenhouse gases (GHG), a material issue for the energy-intensive IG sector. The paper explores challenges for investors who seek to understand and benchmark corporate GHG performance in relation to financial performance.

The paper briefly discusses current ESG investor practices in constructing numerators and denominators for reporting GHG intensity. For the numerator, the authors outline some issues within the emerging practice of summing Scopes 1 & 2 GHG emissions. For the denominator, the authors focus on the preferred investor practice of using revenue to normalize company GHG performance. For multinational firms, a denominator of reported revenue against GHG emissions can produce results that reflect currency fluctuations rather than GHG performance. For Praxair specifically, there is a 22% difference in its reported 2016 GHG intensity depending on the revenue denominator used. The authors argue that reported revenue as a denominator can lead to incorrect conclusions for investors and that constant currency is a more helpful denominator.

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The opinions expressed in this article are those of the authors, are theirs alone, and do not reflect the opinions of any of their employer or any organization which they are associated. Such employers and organizations are not responsible for the accuracy of any of the information supplied in this article.

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Introduction

Concern over climate change among socially responsible investors makes greenhouse gas emissions an important filter in investment screening. To help develop these filters, environment, social, and governance (ESG) analysts often use the following metric to determine greenhouse gas (GHG) intensity:

$$GHG\ Intensity = GHG\ Emissions\ (Scope\ 1 + Scope\ 2) Total\ Reported\ Sales\ Revenues$$

Scope 1 emissions refer to those for which the company is directly responsible. Scope 2 emissions are indirect – if a company uses electricity, for instance, then the greenhouse gases emitted in the generation of that electricity are the Scope 1 emissions of the utility company, and the Scope 2 emissions of the user.

This standard assessment of greenhouse gas emissions per unit of revenue can generate misleading conclusions about a company's environmental standing. Using the industrial gases subsector as its case study, this article shows that the denominator of this equation is especially problematic. Using the industrial gases subsector as its case study, this article explores the challenges presented with this calculation. After background on industrial gases (IG), this article briefly outlines concerns with the numerator of this equation and then turns to its principal focus on challenges in using revenues in the denominator.

A note is in order about methodology. This paper presents research and observations from employees of one company, Praxair. Like many companies, Praxair engages in multiple conversations with its investors and ESG investors, who use their own proprietary research or the research of third-party ESG analyst services to which they subscribe.

For the authors, as industry insiders, some investor conclusions about relative company GHG intensity in the chemicals (and IG) sectors did not conform to what we know of business and operational conditions. Several investors made the same observation, and asked us if we could provide an explanation. This paper was produced in response to their questions and presented to various ESG analysts during 2016-2017. It is offered here as a small empirical contribution to an important dialogue.

Industrial Gases

The industrial gases subsector produces both atmospheric and process gases that are used for industrial and commercial applications. Praxair, based in the U.S., is one of four major

firms in this area. The other three are based in the U.S., France, and, Germany.[61] These companies produce two types of gases using two different processes. The business models of all four companies are fairly homogenous.

Atmospheric gases are made by separating air into oxygen, argon, and nitrogen in a process powered by electricity. When that electricity comes from fossil fuels, it generates Scope 2 GHG emissions. *Process gases* are made for the most part through steam methane reforming. This uses natural gas (CH4) and steam (H2O) to make hydrogen; it releases Scope 1 GHGs as a byproduct.

The production of industrial gases is energy intensive. Three of the companies benchmarked in this paper devoted at least 25-30% of their total 2015 operational spend on energy.[62] Industrial gases companies therefore have strong incentives to promote energy efficiency.

At the same time, many industrial gas applications help reduce the environmental footprint of the customer or end-user. For example, Praxair has shown that using oxygen, an atmospheric gas, to improve combustion efficiency in steelmaking avoids more indirect GHG emission than are emitted over the entirety of Praxair's air separation activity. In the case of process gases, hydrogen is used to make ultra-low sulfur diesel fuel, which helps oil refiners meet air quality limits set by the U.S. Clean Air Act. When trucks are fitted with diesel particulate filters, as is now mandated for new trucks in the U.S., the combination of hydrogen and these filters eliminates black carbon emissions from tailpipes. These avoided GHG emissions add up to five times more than the emissions produced by Praxair's hydrogen production. Peer companies make similar claims.[63]

ESG Metrics

Derek Bingham of Goldman Sachs GS SUSTAIN Research points out in a recent report that there are still no broadly accepted standards for ESG data comparable to those that exist for financial reporting. In this context, inconsistent and idiosyncratic metrics proliferate: his team counted 400-800 individual ESG metrics in the databases they reviewed.[64] There

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[61] In June 2017, Praxair and Linde, a German peer company, signed a Business Combination Agreement to work towards a merger of equals. See http://praxairlindemerger.praxair.com/

[62] CDP 2016 Climate Change Responses – Question 11.1, responses for all companies available at www.cdproject.net. Though 2016 results were not available at time of writing, they are not likely to change the comments herein.

[63] Avoided GHG emissions are reported in in *Air Liquide 2016 Reference Document* page 89; *Air Products 2016 Sustainability Report* (2015 data) page 6; *Linde Corporate Responsibility Report 2016*, page 2; *Air Products 2016 Sustainability Report* (2015 data) page 6; *Praxair 2016 Sustainable Value Report* page 5

[64] Derek Bingham, of Goldman Sachs Research/ GS SUSTAIN, interview with Jake Siewert, Goldman Sachs Global Head of Corporate Communications, Podcast May 2 Episode 63: "The Metrics that Matter. A

is some progress being made as many in the ESG community use materiality assessments to narrow these metrics to a smaller list of key performance metrics (KPIs) that are material to a specific industry. For example, carbon intensity is a material issue in resource-intensive sectors but may not be in a bank.

Less progress has been made in standardizing key metrics. The Sustainability Accounting Standards Board (SASB) has contributed value in this area, which is discussed below.[65] This paper describes the range of measures used to calculate carbon intensity, and the implications for investors.

Constructing a Numerator

A full corporate GHG emissions statement includes direct emissions (Scope 1), indirect emissions (Scope 2), and other upstream and downstream emissions (Scope 3). Although an understanding of all Scopes is needed to develop a full picture of a company's GHG impacts, most investors simply sum Scopes 1 and 2. This despite the fact that each Scope has a distinctive calculation methodology: Scope 1 GHG emissions can be attributed fairly directly to specific sources and assigned carbon dioxide equivalence values. Scope 2 emissions are measured less precisely.

Take the case of electricity generation, a common source of Scope 2 emissions. This can be calculated from the known fossil/non-fossil fuel mix of the utility provider. This ratio can fluctuate during the year (a utility may be able to draw on wind power more in some seasons than others) and generally changes over time. Sometimes these records can be obtained, although not normally in real-time, so corporate Scope 2 GHG reporting tends to use aggregation: reporting companies infer generalized "emissions factors" (EFs). In the U.S., these EFs are created and published for each state. Some countries create them for sub-national regions. But most countries use a country-level average EF that is periodically updated. This presents an obvious challenge: regional differences in Scope 2 emissions are erased with country-level EFs. For instance, a firm sourcing electricity from Quebec, where hydropower dominates, will overestimate its Scope 2 emissions by using a country-level rather than a provincial-level EF. A reporting firm may disclose this information, but its significance may be lost once it is baked into additional calculations layered on afterward.

In addition to the relative imprecision of Scope 2 measurement, summing Scopes 1 and 2 creates a number of challenges for investors. First, it masks the relative contribution and sources of each. In industrial gases companies, for example, hydrogen production accounts

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'Mainstream' Approach to ESG." They asked (1) what matters to operations? (materiality), (2) what data are available, (3) Historical relationships with stock data, LT (3-5 years)

[65] SASB, Sustainability Accounting Standards Board, Standards, see footnote67

for most Scope 1 emissions through steam methane reforming. Atmospheric gas production generates most Scope 2 emissions through the use of electricity. A summed GHG footprint on its own provides investors insight into neither different sources of value and related GHG emissions nor how these change over time in response to business strategies or market conditions. (Incorporating Scope 3 emissions makes this challenge even greater.)[66]

Second, regulators tend to focus on Scope 1 GHG emissions, with Scope 2 not at risk of direct regulatory action. When Scopes 1 and 2 are combined, an investor might inflate the apparent regulatory risk while being unable to pinpoint the sources of that risk. This issue is addressed in the Sustainability Accounting Standards Board (SASB) Standard for the Chemical Sector, RT0101 (Provisional Standard, March 2015). Their GHG Accounting Metric is the annual metric tons of gross CO2 equivalent of global Scope 1 emissions that are covered under a regulatory program.[67] Even though the SASB standards are designed as a basis for SEC filings – and therefore for investor use – this is not the standard metric used among ESG investors to measure corporate carbon emissions in the chemicals and IG sectors.

Third, in terms of national or global accounting, Scope 2 emissions are by definition the Scope 1 emissions of another entity – usually a utility company. In a perfect world where all GHG emissions were properly attributed to their sources, the summing of a company's Scopes 1 and 2 GHG emissions would thus constitute "double counting."

Despite these challenges, many ESG investors use the formula above to construct the numerator in normalizing a company's GHG footprint. Companies in the STOXX Low Carbon family of indices for example, "are selected based on their Carbon Intensity Data (Scope 1 + Scope 2 Greenhouse Gas emissions (GHG) / Revenue ($million))."[68] The STOXX family includes the STOXX Global Climate Change Leaders Index, co-developed with the

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[66] See "Exploring the materiality of ESG data," *Environmental Finance.* Winter 2016. Pp 10-17. An important discussion of challenges in establishing product intensity for multiple products and/or activities is provided in Bartley, Jon, Frank Buckless, Y.S. Al Chen, Stephen Harvey, D. Scott Showalter, and Gilroy Zuckerman. "How Widely Used Sustainability Metrics Distort Actual Performance—And a Solution to This All-Too-Common Problem." Environmental Quality Management, Volume 24, Number 4, Summer 2015.

[67] SASB, Sustainability Accounting Standard – Resource Transformation – Chemicals (Provisional Standard, March 2015, page 10. The Standard can be downloaded from: https://www.sasb.org/standards/download/resource-transformation-standards-download/. The Standard requires disclosure of the percentage of an entity's emissions that are covered under a regulatory program, such as the European Union Emissions Trading Scheme (EU ETS), Western Climate Initiative (WCI), California Cap-and-Trade (California Global Warming Solutions Act), or other regulatory programs. It includes regulatory programs like cap-and-trade schemes and carbon tax/fee systems and excludes emissions covered under voluntary trading systems and disclosure-based regulations (e.g., the U.S. Environmental Protection Agency (EPA) mandatory reporting rule).

[68] STOXX® INDEX METHODOLOGY GUIDE (PORTFOLIO BASED INDICES), March 2017. Viewed July 21 2017, page 117.

Carbon Disclosure Project (CDP). Other ESG analysts who use a combined Scope 1 & 2 normalized against revenue include Goldman Sachs GS SUSTAIN, MSCI, and Vigeo-EIRIS.[69] Similarly, the Task Force on Climate-related Financial Disclosures (June 2017) weights corporate Scopes 1 and 2 emissions in relation to revenue and/or market capitalization.[70] The Task Force's preferred system is a "weighted average carbon intensity metric," which is calculated as:

$$\sum_{n}^{i}\left(\frac{\text{current value of investment}_i}{\text{current portfolio value}} * \frac{\text{issuer's Scope 1 and Scope 2 GHG emissions}_i}{\text{issuer's \$M revenue}_i}\right)$$

A variant is offered in the April 2017 report from Goldman Sachs, *The PM's Guide to the ESG Revolution,* which uses two GHG metrics as the basis for their subsequent calculations: total CO2 and CO2 equivalents (CO2-e); and Total Scope 1 GHG emissions. (Both numbers are then normalized by USD revenue.)[71] Having laid out a few of the challenges with the establishment of a numerator that sums Scope 1 and 2 emissions, we will move on to the main focus of this paper: the selection of a denominator, and particularly revenue as a denominator.

Constructing a Denominator

Various denominators have been proposed to measure GHG performance, from sales/revenue to product volumes to employee headcount. Most energy intensive companies, including Praxair, prefer a denominator of product intensity, as this is how operations are managed. (It should be noted that there is no agreed standard to measure or report product intensity.) However, investor criteria – reliable publicly available data that allow for cross-sector comparisons – invariably lead them to use revenue as a denominator in the measurement of GHG performance.

Revenue as a Denominator

ESG investors seek to use extra-financial, non-financial, or, in this case, GHG metrics in the same way that they use financial information. To normalize information and make comparisons, they need a denominator that is easily available in public materials and consistent across industry sectors. Through annual filings and investor presentations, a

[69] MSCI and Vigeo-EIRIS Questionnaires are in the possession of the authors. Goldman Sachs Equity Research April 2017: The PM's Guide to the ESG Revolution: From an article of faith to a mainstream investment tool, downloaded 8.12.17.

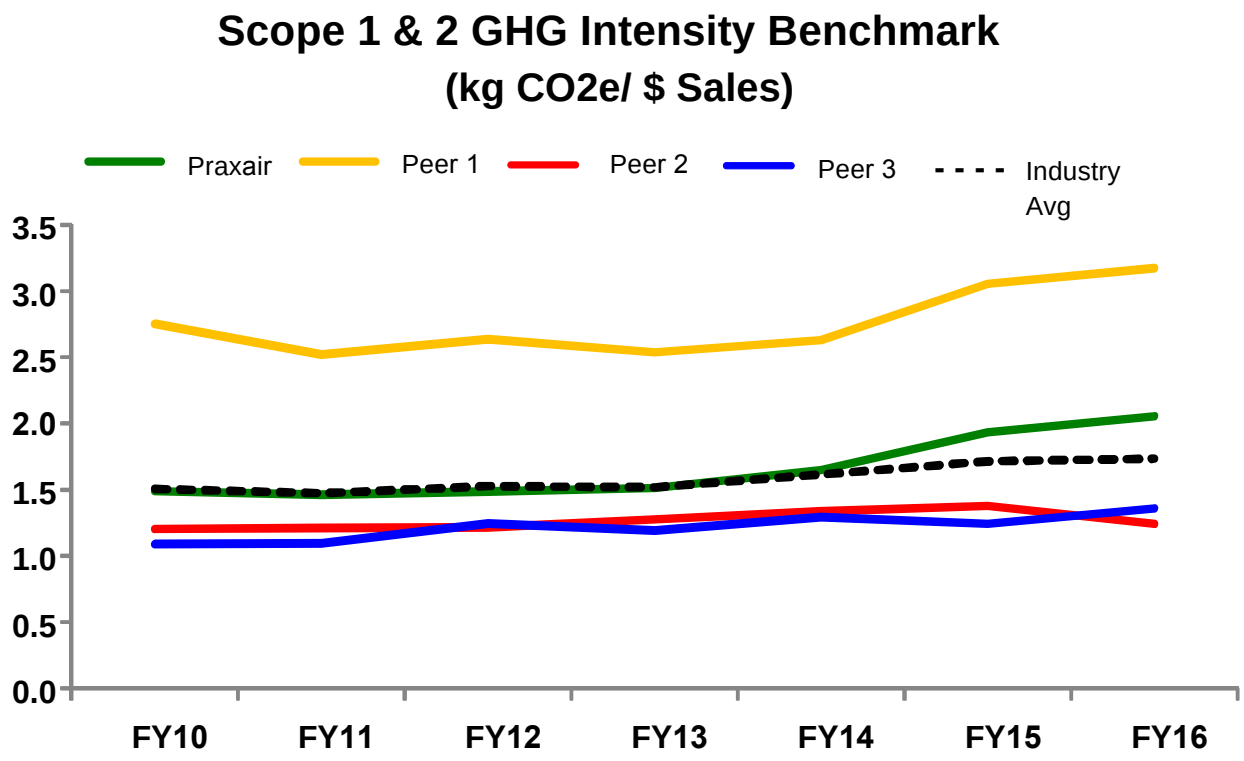
[70] Recommendations of the Task Force on Climate-Related Disclosures 2017, Table 2 page 44. https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Report-062817.pdf.

[71] Goldman Sachs Equity Research April 2017: *The PM's Guide to the ESG Revolution, op cit.*

range of financial information is disclosed that meets investor requirements for normalizing ESG data; reported revenue is one. By applying the same calculation to the same data from publicly available sources for all four major industrial gases companies, we found that the use of revenue can produce misleading conclusions about GHG intensity.

We started by benchmarking the GHG intensity of the four major global industrial gases companies as the sum of Scopes 1 and 2 against reported revenue. Figure 1 provides the results. The data indicates that "Peer 1" is the most GHG intensive, which is to be expected because it has the largest hydrogen business. It then shows Praxair tracks at industry average and lower than "Peer 2" and "Peer 3" until 2014, after which it shows a significantly higher GHG intensity. Using this methodology, an investor might assume that Praxair's GHG intensity was increasing compared to Peers 2 and 3 and the industry average; and that Peer 2 had taken specific steps to improve its GHG intensity. In fact, this variation was created by non-operational differences.

Figure 1: Industrial Gases Companies Scopes 1 & 2 GHG Intensity Based on Total Reported Sales Revenues, 2010 – 2016



The Importance of Constant Currency

The next adjustment we considered was foreign exchange (FX). We should note here that the RobecoSAM Corporate Sustainability Assessment, which publishes the RobecoSAM Dow Jones Sustainability Indices, invites companies to define a denominator for evaluating eco-efficiency with product volumes, reported revenue, or constant currency. They prefer a denominator of constant currency (foreign exchange adjusted) revenues if possible, as they eliminate the effect of fluctuations in foreign exchange rates and are thus a better indicator of business performance."[72] The argument we present below provides empirical support for this RobecoSAM observation. We do note that investors using the RobecoSAM conclusions for relative company environmental performance, which are available on Bloomberg terminals, may not know which decision a firm made on this issue.

All four industrial gases companies have currency exposure, which has had significant impact on revenues in recent years. Such exposure can significantly increase or decrease reported sales revenues when local currencies are translated to their functional reporting currency. Using reported revenue as a denominator for multinational firms therefore distorts the energy and/or GHG intensity calculations.

A further complication is that different companies usually have different FX exposures. All four industrial gases companies discussed the risk from currency exposure in their 2016 annual filings.[73] Compared with peers, Praxair has a much larger business in Brazil, which has suffered from considerable FX depreciation since FY15. In fact, FX reduced Praxair's reported sales by 10% in FY15 and another 3% in FY16 on year-over-year basis (see Figure 2).

This distortion can be removed by adjusting the FX impact and referring to the sales variance data published in company earnings call presentations and annual reports. This will reveal the extent to which FX contributed to yearly sales variation. To complete this task, we set up a base year to exclude FX impact going forward. In this analysis, our base year is FY10. We started from FY10 sales revenues and extrapolated sales in FY11 to FY16 using the following formula:

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[72] This is provided within the RobecoSAM Corporate Sustainability Assessment CSA questionnaire, "Normalization Factors." The citation is from the 2017 questionnaire, in the possession of the authors. A sample questionnaire can be downloaded from: http://www.robecosam.com/en/sustainability-insights/about-sustainability/corporate-sustainability-assessment/sample-questionnaire.jsp. Investors using RobecoSAM CSA results for corporate benchmarking may not have insight into what denominator individual firms selected.

[73] FX exposure was reported as relevant in the 2016 Annual Filings of all four industrial gases companies: Air Liquide 2016 Reference Document page 34; Air Products 2016 Annual Report page 25; Linde 2016 Financial Report page 51; Praxair 2016 Annual Report page 18.

$$Ex\ FX\ Sales\ Yn+1 = Ex\ FX\ Sales\ Yn \times (1 + Ex\ FX\ Growth\ Gn+1)$$

Figure 2: Praxair Adjusted Sales Revenues ex-FX, 2010 - 2016

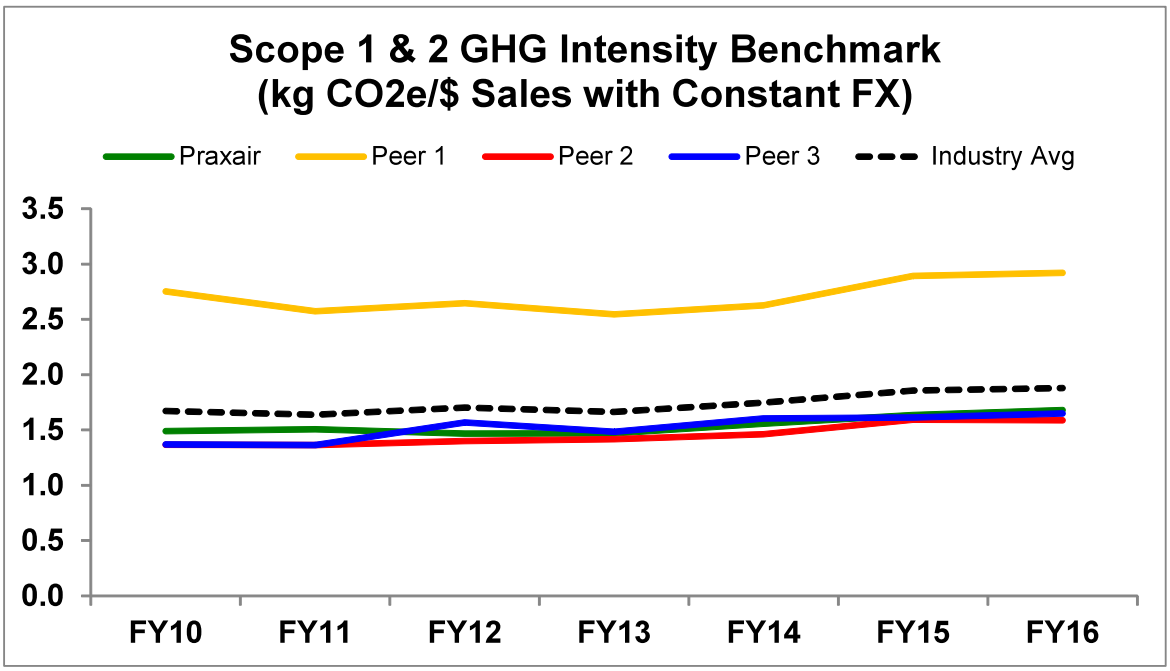
Unit: $ MM	2010	2011	2012	2013	2014	2015	2016
Praxair Sales	**10,116**	**11,252**	**11,224**	**11,925**	**12,273**	**10,776**	**10,534**
Volume	*9%*	*6%*	*2%*	*3%*	*3%*	*-2%*	*0%*
Price	*0%*	*2%*	*2%*	*2%*	*2%*	*1%*	*1%*
Cost Pass-through	*1%*	*1%*	*-1%*	*0%*	*0%*	*-2%*	*-1%*
Currency	*2%*	*3%*	*-4%*	*-2%*	*-3%*	*-10%*	*-3%*
Acquisition/Divestitures	*1%*	*-1%*	*1%*	*3%*	*1%*	*1%*	*1%*
Growth (ex. FX)	***11%***	***8%***	***4%***	***8%***	***6%***	***-2%***	***1%***
Praxair Sales (ex FX, 2010 Base)	**10,116**	**10,925**	**11,362**	**12,271**	**13,008**	**12,747**	**12,875**

If repeated for all the industrial gases companies, we will have constant FX sales (FY10 base) and the revised GHG intensity calculation would look as follows:

$$GHG\ Intensity\ r2 = \frac{GHG\ Emissions\ (Scope\ 1 + Scope\ 2)}{Sales\ Revenues\ Constant\ FX}$$

Figure 3 applies this methodology to all four companies and shows a truer benchmark comparison of GHG intensity between industrial gases companies. This methodology concludes that Praxair's GHG intensity 2010-2016 is on par with European peers, and below the industry average.

Figure 3: Industrial Gases Companies GHG Intensity Based on Adjusted Constant FX Sales Revenues, 2010 - 2016



To double check: if we only look at GHG emissions growth (Figure 4), Praxair has been consistent with the trend observed in the industry. This confirms that the adjusted GHG intensity metric better reflects Praxair's real performance in GHG emissions.

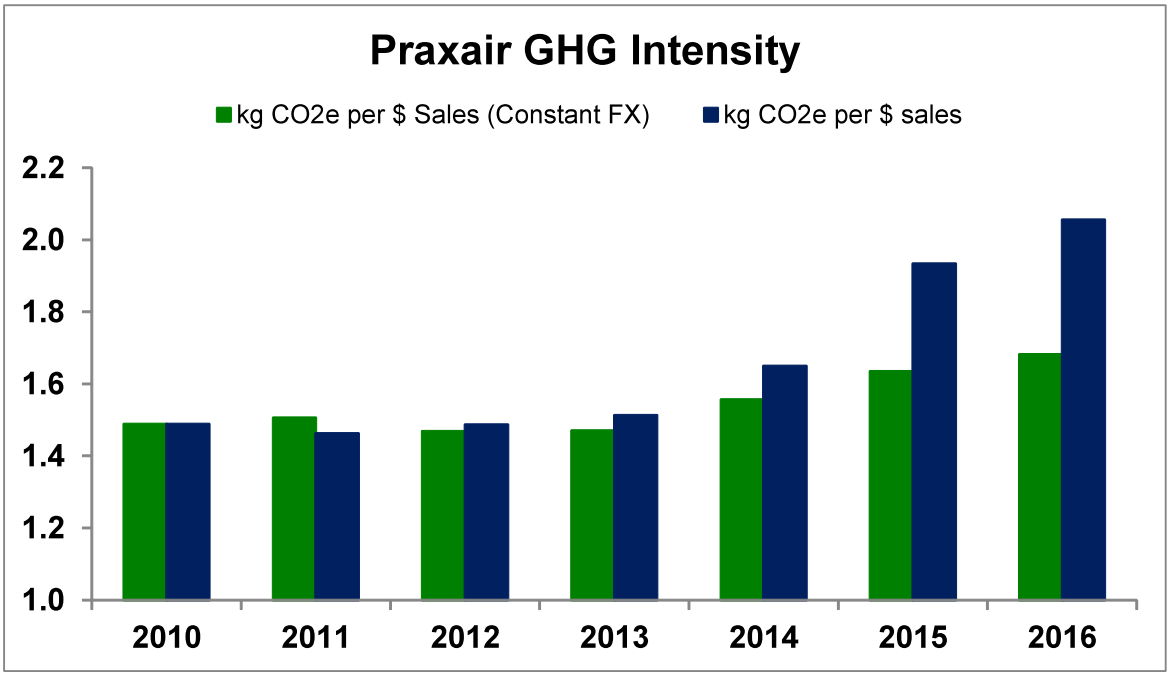
Figure 4: Praxair & IG Industry Scope 1 & 2 GHG Emissions ('000 MT CO2e)

Scope 1 & 2	FY10	FY11	FY12	FY13	FY14	FY15	FY16	CAGR
Praxair	15,060	16,454	16,684	18,035	20,245	20,839	21,649	6%
IG Industry	72,667	77,368	84,132	87,822	95,369	101,331	102,906	6%

Conclusion

Relating GHG intensity and revenue can be done in various ways depending on how revenue is counted in the denominator. Different methodologies can produce materially different conclusions. Figure 5 shows that Praxair's GHG intensity was inflated by significantly lower reported sales in FY15 and FY16 due to currency headwinds, not a change in GHG intensity. All peer company GHG intensity results were affected positively or negatively, and to a greater or lesser extent, by this factor. For Praxair, the difference in GHG intensity between the two methodologies is 22% for 2016.

Figure 5: Praxair GHG Intensity – Comparing Results Reported Against Revenue or Constant Currency, 2010 - 2016



These variations in results derive from different methodologies that relate to business conditions, not underlying GHG performance. Investors are skilled at understanding the complexities of financial accounting and routinely look "beneath" reported revenue at issues such as the business model of each company, its business lines and product mix, the geographies in which it operates, and its current financial challenges and opportunities, including FX. This same attention to detail is needed in order to accurately understand GHG performance.

Like financial information, ESG data and metrics are complex. Moreover, ESG metrics have different accounting methodologies that are not easy to align with the methodologies of financial accounting. Investors seeking to benchmark GHG performance might find it useful to consider how to develop financial denominators that provide more reliable insight into GHG performance.

There is a new level of interest from investors to integrate environmental, social, and governance factors into their investment process. This focus is putting unprecedented pressure on ESG information to reflect corporate performance. However, ESG accounting is an emerging field and protocols are still evolving. This applies to the construction of numerators and denominators to evaluate GHG performance, and likely several other ESG metrics.

It is essential that ESG investors remain sensitive to potential distortions in GHG performance trends when normalizing against reported revenue. Our proposal to consider "constant currency" as a denominator will require agreement between users and investors on methodologies and standards to use. This finding for GHG intensity reporting for four multinational firms in one industry subsector is likely to be true for other environmental – and possibly other ESG– data that is normalized against reported revenue.

Investor's Guide to Understanding Corporate Sustainability Performance Metrics: Beware of Flawed Metrics

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Abstract

Investor interest in and demand for sustainability information is increasing. This growing interest is due to evidence that corporate sustainability practices enhance corporate financial performance. Paralleling this increased interest by investors, the Sustainability Accounting Standards Board (SASB) has concluded that the quality of information disclosures is lacking. This paper supports these views by illustrating the wide variety of circumstances under which companies, by failing to consider confounding factors, normalize sustainability metrics results that report flawed measures of efficiency improvements. The authors demonstrate that reliable and accurate measurement of a company's improved environmental efficiency can be obtained only by the application of a flexible budgeting methodology. A flexible budgeting approach isolates the results of a company's initiatives so that measures of improvement are not distorted by confounding factors. We provide examples demonstrating how the application of flexible budgeting avoids this problem and provides more accurate reporting than traditional average-intensity measures. This paper also offers a series of questions that investors can ask to determine the nature and extent of flexible budgeting used in sustainability metrics reporting. An understanding of the flexible budgeting method allows investors to ask appropriate questions and engage in informative discussion with management. Such dialog can help overcome many of the distortions that arise in reporting sustainability performance and improve investor decision making.

Introduction

Investor interest in and demand for sustainability information is increasing, as evidenced by several trends. First, the U.S. Social Investment Forum Foundation (SIF) reported that U.S. sustainable, responsible, and impact (SRI) investing grew from $6.57 trillion at the start of 2014 to $8.72 trillion at the start of 2016, an increase of 33 percent. One out of every five dollars under professional management now follows SRI strategies (U.S. SIF Foundation, 2016). During this period the World Health Organization also reported that investors increasingly strive to incorporate climate change in their portfolios, from both moral and long-term economic value perspectives (World Health Organization, 2015). Supporting this increased interest requires specific environmental, social, and governance (ESG) information. This need for additional information is supported by a recent study published by the Principles for Responsible Investment Association titled, "Shifting Perceptions: ESG, Credit Risk and Risk." The report concludes that, "Credit Rating Agencies are increasingly researching ESG topics beyond traditional rating analysis. This is contributing to the development of evaluation tools and deeper understanding of the issues at stake" (PRI 2017).

Observing this increased interest, the Sustainability Accounting Standards Board (SASB)[74], established in 2011, concluded in its initial report on the state of sustainability reporting that "in today's rapidly changing business climate, investors are increasingly looking beyond financial statements for a more complete picture of a company's ability to create value over the long term. For example, in response to a recent effort by the U.S. Securities and Exchange Commission (SEC) to modernize its disclosure requirements, investors made a resounding call for improved sustainability disclosure" (SASB 2016).

What has led to this increased interest? In addition to the important direct benefits of improved corporate sustainability, operating sustainably enhances corporate financial performance. Harvard Business School researchers examining an 18-year period concluded that, "the High Sustainability firms outperformed the Low Sustainability ones in terms of both stock market and accounting measures while the market did not actually expect this outperformance" (Eccles 2014).

[74] The mission of the SASB "is to develop and disseminate sustainability accounting standards that help public corporations disclose material information useful to investors. That mission is accomplished through a rigorous process that includes evidence-based research and broad, balanced stakeholder participation." SASB Standards are designed for inclusion in SEC filings as a vehicle to improve sustainability communications and open a dialogue between companies and investors.

Motivation for Developing Reliable Sustainability Metrics

Although companies in their SEC filings have begun to address a growing number of sustainability factors that have impacted – or are likely to impact – their financial condition and operational results, the SASB has said that the quality of these disclosures is lacking. This puts investors at a disadvantage when it comes to fully understanding their risk exposures. In its 2016 State of Disclosure report, SASB notes that,

> Investors and their portfolio companies have become increasingly aware of the link between sustainability factors and business outcomes. For example, increased energy efficiency can lead to operational cost savings; effective resource management can reduce input price volatility and the risk of supply disruptions; and stronger data security practices can mitigate the risk of fines, litigation, and reputational harm, while also lowering a firm's cost of capital [SASB 2016].

However, investors should ask if companies are using relevant metrics to measure and report their sustainability performance. Many companies, for example, currently disclose intensity measures like changes in the average pounds of waste per unit of production as a proxy for reporting their efficiency and communicating sustainability improvements. The use of these intensity measures to evaluate efficiency improvement can mislead management and investors into believing a company's policies are achieving desired efficiency improvements when, in fact, they are not. A long list of confounding events can render the change in average intensity, however carefully reported, useless as a measure of efficiency improvement. Fortunately, the application of flexible budgeting provides a solution, allowing companies to more accurately measure changes in their overall corporate efficiency. The remainder of this paper will explore how the application of this well-known and widely used managerial finance methodology can improve the accuracy of reported sustainability measures.

Analysis

Starting in 2012, based on research funded by the Institute of Management Accountants, we published a series of papers in ESG and management journals demonstrating that reliable and accurate measurement of a company's improved environmental efficiency can be obtained only by the application of a flexible budgeting methodology. These papers illustrated the variety of circumstances under which normalized sustainability metrics, such as waste per unit of production, report flawed measures of efficiency improvements achieved over time. While it is true that efficiency improvements impact average intensity, there are significant confounding factors that also impact average intensity, occluding its

usefulness as a measure of improved efficiency. These confounding factors include (1) shifts in product mix; (2) outsourcing and insourcing of operations; (3) acquisition and divestitures; and (4) facility utilization.

A flexible budgeting approach isolates the results of a company's sustainability initiatives so that measures of improvement are not distorted by confounding factors. Corporations already use flexible budgeting to measure financial performance. Applying the same methodology to sustainability measurements can improve managerial decision making and provide stakeholders with more useful information about corporate sustainability performance.

Explanation of Flexible Budgeting

Financial managers routinely use flexible budgeting to analyze cost variances due to the dynamic nature of business along with other confounding factors beyond their control. Corporate management develops a flexible budget that can be tailored to any level of activity within an expected range – that is, the relevant range. A flexible budget thus enables managers to make accurate performance evaluations when their business activities exceed or fall short of expectations. This process requires comparing actual costs to a flexible-budget forecast of costs at the new level of production.

Sustainability managers can apply the same methodology to isolate the cause(s) of changes in sustainability, and to take corrective actions when indicated. For example, resource consumption and waste generation contain fixed components that are independent of changes in facility utilization, and variable components that are dependent on the level of facility utilization. Using the flexible budgeting method, Bartley, et al. (2017) demonstrate how to accurately isolate the change in efficiency by excluding confounding factors. Recognizing that many investors may not understand flexible budgeting, we offer an example that illustrates how to apply the methodology to measure environmental efficiency improvement in water usage (an environmental aspect) when a company experiences changes in product demand and associated production. We look specifically at water usage.

Assume Glacier Brewing has two products, Beer Rocky and Beer Icy, and that they measure production in barrels (BBL). During the production process, Beer Icy consumes more water (936 gallons per BBL) than Beer Rocky (260 gallons per BBL). Glacier Brewing proudly reports that it achieved a significant reduction in the average water intensity of its beer operations from 395.2 gallons per BBL of output in year 1 to 330.7 gallons in year 2 (a 16.3% reduction). We will now analyze the facts.

In year 1, Glacier Brewing produced 1,600 BBL of Beer Rocky, using 416,000 gallons of water for a water intensity rate of 260 gallons per BBL of output (416,000/1,600). For its Beer Icy, Glacier Brewing consumed 374,400 gallons of water to produce 400 BBL. Thereby, a total of 790,400 gallons of water were consumed in year 1, producing a product mix of 1,600 BBL of Beer Rocky and 400 BBL of Beer Icy. Note that Beer Rocky consumes much less water than Beer Icy (water intensity of 260 gallons per unit of output versus 936 gallons).

In year 2, Glacier Brewing reported Beer Rocky sales growth and, thus, a corresponding increase in production to 2,140 BBL using a total of 556,400 gallons of water. In contrast, Beer Icy suffered a 37.5% sales reduction with only 250 BBL produced and sold. With this shift of product mix, one needs to inquire whether Glacier Brewing's 16.3% reduction in average water intensity (from 395.2 gallons of output per BBL to 330.7 gallons) reflects a true improvement in the company's water efficiency.

Using the flexible budgeting approach, it is estimated that Glacier Brewing would consume 790,400 gallons of water, assuming no change in efficiency: 556,400 gallons (2,140*260) for Beer Rocky and 234,000 gallons (250*936) for Beer Icy. Table 1 shows these estimates match actual water consumption reported by Glacier Brewing. The flexible budgeting method correctly demonstrates that no efficiency improvements occurred for Beer Rocky, Beer Icy, or for the total water used by the company. The method instead connects the reduction in average water intensity to the shift from a high water-intensity product to a low water-intensity product. Conversely, the flexible budgeting method can help Glacier Brewing's management understand and explain an adverse change of average water intensity when there is a shift of product mix from a low-intensity product to a high-intensity product. The example in Table 2 shows a 35.1% increase in average water intensity that is due solely to a decrease in sales of Beer Rocky and an increase in Beer Icy; the company as a whole experienced no change in water efficiency.

TABLE 1							
Glacier Brewing	Year 1			Year 2			
	Production BBL	Actual water used, Gal	Rate Gal/BBL	Production BBL	Actual water used, Gal	Flexible Budget, Gal	Efficiency Improvement
Beer Rocky	1,600	416,000	260	2,140	556,400	556,400	
Beer Icy	400	374,400	936	250	234,000	234,000	
Total	2,000	790,400		2,390	790,400	790,400	0.0%
Average Intensity		395.2			330.7		
Shift from HIGH intensity to LOW intensity product.							

TABLE 2							
Glacier Brewing	Year 1			Year 2			
	Production BBL	Actual water used, Gal	Rate Gal/BBL	Production BBL	Actual water used, Gal	Flexible Budget, Gal	Efficiency Improvement
Beer Rocky	1,600	416,000	260	880	556,400	228,800	
Beer Icy	400	374,400	936	600	234,000	561,600	
Total	2,000	790,400		1,480	790,400	790,400	0.0%
Average Intensity		395.2			534.1		
Shift from LOW intensity to HIGH intensity product.							

Questions Investors Should Ask

Increasingly, investors seek information about a company's aspiration to engage in sustainability, its approach, program goals, and focuses. Companies need to report policies and guidelines that reflect how their sustainability programs align with the values contained in mission and vision statements. These policies and guidelines provide investors information about the key entity-level controls that are embedded in the organization's operations. Investors should identify sustainability efforts that are the focus of the company's investment strategies. Does management set clear targets for specific environmental aspects, such as reducing greenhouse gas (GHG) emissions, energy use, fuel use, water use, and solid and liquid waste generation?

The CFA Institute advises investors to systematically consider ESG issues in order to make better-informed investment decisions.

To effectively monitor a company's ESG issues, investors should know:

- How does the company measure related investments' ability to improve sustainability performance?
- Do sustainability managers use metrics that accurately reflect the corporation's performance in managing resources and reducing waste?

To evaluate a company's continuing effort in its sustainability program, investors should know:

- What metrics are employed by management to report their ESG program performance over time?

- Does management understand the fallacy of using the average intensity as a measure of efficiency?
- How do sustainability managers identify the drivers of change in average intensity?

To actively engage management and influence their practices regarding ESG performance evaluation, investors should know:

- How confident are sustainability managers in assessing the reported efficiency improvements of the sustainability-related investments?
- Is the company's management aware of issues related to measuring the actual efficiency of its sustainability program?
- Does the company's measurement of progress align with a flexible budgeting process? If not, how would implementing a flexible budgeting approach change the understanding of performance?

Sustainability Report Transparency

In addition to reporting totals for sustainability aspects, most companies disclose an average intensity metric as a measure of efficiency. Reported average intensity is calculated as the total amount of resources consumed or waste generated divided by a relevant operating parameter. Common operating parameters include the company's total revenue or productive output. Examples include tons of CO_2 or gallons of water per dollar of revenue. Some managers and investors, in turn, use the reported average intensities to rank companies' environmental productivity within their respective industry sector (SASB Q4, 2016). However, Bartley, et al. (2017) illustrate that "[a] verage intensity is most useful in providing perspective on an industry sector's resource consumption and waste production relative to other sectors." Its use in comparing companies within an industry sector is more limited because of differences in the scope of activities and sourcing policies among the companies. Investors should ask companies to isolate their actual sustainability program efficiency improvements by excluding other factors that contribute to the change in average intensity. The flexible budgeting methodology helps investors identify several essential questions that need to be addressed in quantitative analyses and by probing management. A few of these are discussed below.

Change in Product or Service Mix. Has the company identified the impact of acquisitions and divestitures on its product mix and its measures of efficiency? How does the company's reporting system consolidate its environmental efficiency performance information across all its products and services; and has the company assessed the impact of product mix changes on average intensity measurements? As shown in Tables 1 and 2, if the relative

mix of product or service activities changes, a company's overall average intensity will not accurately reflect the change in sustainability-related efficiencies.

Change in Facility Utilization. How have market conditions affected the company's facility utilization? And if facility utilization has changed, does the company track both fixed and variable components of resource consumption and waste generation? If not, an increase (or decrease) in facility utilization will reduce (or increase) the allocated fixed components of sustainability attached to each unit of production. In turn, this will reduce (or increase) average intensities in a way unrelated to any real change in sustainability efficiencies.

Outsourcing and In-sourcing Changes. How does the company measure and isolate the impact of changes in outsourcing and in-sourcing activities on average sustainability intensity measurements? For example, if a water-intensive manufacturing step is outsourced while final production remains within the company, the average intensity will decrease because water usage on-site decreases while production remains the same. Does a change in average intensity result from nothing more than a change in what is being included or excluded in the numerator, the denominator, or both?

Conclusion

Reed, et al. (2016) challenged "[a]sset owners and managers [to] think more critically about how to incorporate climate data into their investment decision making." Further, a study by the consulting group EY and the Boston College Center for Corporate Citizenship reports that two of the primary challenges to sustainability reporting are accuracy and/or completeness of data (EY 2016). Investors want to actively engage company management to influence their practices regarding ESG performance evaluation; the focus of this engagement is often on evaluating how accurately sustainability managers report and assess efficiency improvements resulting from changes in operations and sustainability-related investments.

To assess a company's continuing efforts in advancing its sustainability program, investors should request that companies provide more robust and accurate measures of sustainability performance. In doing so, they need to probe companies to learn the efficacy of metrics employed by management to report ESG performance over time. Flexible budgeting provides more accurate insights into published sustainability results, and investors should determine if it is being used to accurately communicate a company's sustainability performance.

To properly adjust for confounding factors, this paper provides a series of questions that investors can ask to determine the nature and extent of flexible budgeting used in the

reporting of sustainability metrics. An understanding of the flexible budgeting method allows investors to ask appropriate questions and engage in informative discussion with management. It also helps to overcome many of the distortions that arise in reporting sustainability performance, in turn improving investor decision making.

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Missing Metrics that Matter to Investors: How Companies Can Develop ESG Financial Value Creation Metrics

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Abstract

Investment in companies that leverage superior environmental, social, and governance (ESG) performance to enhance financial results would increase if mainstream investors could discern whether companies' ESG strategies help, hurt, or have minimal impact on financial performance. We propose ESG value creation metrics that indicate the impacts of a company's ESG strategy on line items in its financial statements, and thus the strategy's impacts on earnings, cash flow, and value. By clarifying the causal connection between a company's ESG and financial performance, ESG value creation metrics provide investors, senior executives, directors, and other decisionmakers with better information about how much value a company's ESG strategy creates. We also propose a three-step process through which companies can design an effective ESG strategy and value creation metrics.

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Introduction

Environmental, social, and governance (ESG) investing has become an important strategic concern among investors, corporate executives, and boards. While formal estimates vary, the size of the ESG investment market probably falls between three and 22 percent of assets under management (Lubin & Esty, 2014; Lubin & Krosinsky, 2013; Voorhes & Humphreys, 2017). This figure depends on the definition of ESG that is used (see Eccles & Kastrapeli, 2017 for a typology of ESG investing definitions). Growing investor demand and changes in client demographics suggest greater future attention to ESG. In a recent survey, 85% of professional asset managers who considered ESG in their investment analysis and portfolio construction had done so in response to client demand (Voorhes & Humphreys, 2017). Millennials, who are twice as likely to seek investments consistent with their environmental and social values (Morgan Stanley, 2017), will fuel the ESG investing market as they age and accumulate wealth.

As the ESG investment market has grown, the focus has shifted away from investors who screen companies to align with their moral values, even at the expense of potential returns, and toward investors seeking ESG-conscious investments that don't sacrifice financial returns. Between 2014 and 2016, investments that explicitly considered ESG opportunities and risks in their decision-making process grew by 23% per year, while investments that merely screened on ESG criteria declined by 20% per year (Global Sustainable Investment Alliance, 2017). The future is one in which investors will increasingly allocate capital toward companies that demonstrate strong ESG practices linked to increased financial returns.

Professional investors have already begun to adjust to these trends and many indicate that they intend to in the future. While only 16% of North American institutional asset managers have a specific ESG allocation, 52% expected ESG considerations to become a bigger investment priority within the next three years, according to a 2016 study by the asset management firm AB (Giuliano, 2016). When asked what would accelerate their consideration of ESG factors, 68% wanted a "demonstrated link between ESG and financial performance." In other words, the dearth of quality information about causal connections between ESG and financial performance is restricting both the flow of capital into companies that leverage ESG activities to increase their value and the rate of ESG investment growth.

There appears to be no shortage of data measuring companies' ESG performance. An industry of NGOs and commercial data services produces an array of measures across a range of ESG domains (Esty & Cort, 2017). Governance metrics address how the company's board oversees management, strategy, and risk, as well as management's control over the

business and relationships with its stakeholders. For the most part, traditional social and environmental metrics are designed to measure the societal value – beyond economic growth and jobs – that companies produce. However, traditional ESG metrics are less useful for investors whose primary need is to determine if a company's ESG performance increases, decreases, or has minimal impact on its current and future financial performance. Although companies' senior executives are in the best position to evaluate the strategic importance of ESG activities and produce credible metrics that indicate their connection to financial performance, few are currently doing so. A 2017 global study indicates that 92% of investors "want companies to identify and report on the material ESG issues they believe affect financial performance" (Eccles & Kastrapeli, 2017).

We propose guidelines to help companies design financially relevant ESG metrics; that is, a small number of meaningful measures that signal to investors how a company's ESG strategy affects its financial performance. From this foundation, investors can evaluate opportunities and compare companies. By clarifying the causal connection between a company's ESG strategy and its financial performance, ESG value creation metrics serve to improve the efficiency of resource flows. They provide investors, senior executives, board members, and other decision-makers with better information about how much value a company's ESG practices create. By bringing ESG metrics to the attention of senior executives and directors, and by integrating expertise from across and beyond the company to define accretive ESG strategies, the metrics development process may reveal new pathways to enhance financial performance.

The Need for ESG Value Creation Metrics

Companies' ESG strategies have the potential to improve or harm their financial performance depending on factors like management quality and strategy and operational, industry, and institutional context (Esty & Cort, 2017; Khan, Serafeim, & Yoon, 2016). Some academic research finds that ESG performance is positively correlated with financial performance, perhaps through superior management skills (Orlitzky, Schmidt, & Rynes, 2003) or more proactive risk management (Godfrey, Merrill, & Hansen, 2009). Anecdotally, research shows cases where companies strategically leverage their ESG performance to increase financial returns (see Reinhardt, 2000). More recent research suggests that companies' superior ESG performance can generate financial value under certain circumstances, but a host of confounding factors prevents clear conclusions (Endrikat, Guenther, & Hoppe, 2014). Of course, stronger ESG performance does not always produce financial results, and recent investment industry studies have shown little to no difference in risk-weighted returns between ESG-weighted and traditional portfolios (O'Brien, Liao, & Campagna, 2017).

A Brief History of ESG Metrics

ESG metrics have proliferated over the past several decades (Eccles, Serafeim, & Krzus, 2011). ESG measures gained international prominence in the 1960s and 1970s, as NGOs and social activists highlighted perceived corporate ESG failures. This raised awareness of social and environmental issues and pressured companies to improve performance in these areas. To protect their reputations, some companies reacted by putting in place ESG activities that addressed activist concerns, providing ESG metrics to signal performance improvements. As interest grew among NGOs, activists, and even governments, companies expanded the scope of their ESG activities and metrics.

Over time, some mainstream investors began to perceive that better ESG performance signals lower-risk investments (Ioannou & Serafeim, 2015). Some company executives also realized that applying an ESG lens across their operations and industry value chains could help them identify and capture value. Investment advisory organizations began to produce more comprehensive ESG metrics for the mainstream investor community. These wide-ranging ESG measures were, and are, constructed from many sources, including corporate disclosures, government data, media reports, NGO analyses, and correspondence with company management. Meanwhile, more companies have been producing their own ESG reports, increasingly guided by standardization initiatives such as the Global Reporting Initiative (GRI), Sustainability Accounting Standards Board (SASB), and International Integrated Reporting Council (IIRC). These initiatives seek to improve comparability of traditional ESG factors across firms and identify which have the greatest financial impact within industries. On the whole, however, today's metrics were designed to measure externalities – the impact of companies' ESG activities on society at large.

The Current Landscape

How mainstream investors currently use ESG metrics reflects this history. For the most part, ESG activities are perceived as a way to protect company value. Mainstream investors have primarily used ESG metrics as indicators of risk, highlighting governance weaknesses and the potential environmental and social controversies that can arise from governance failures (Khan et al., 2016). Because they were not designed to measure financial value, ESG metrics have proven ill-suited to helping investors discern the financial impact of companies' ESG performance (Esty & Cort, 2017).

Absent compelling evidence to the contrary, many investors are skeptical of the potential value and strategic importance of companies' ESG activities, which appear peripheral to core business operations and strategy. Meanwhile, the costs of a company's ESG practices are often readily apparent to outside observers; potential financial benefits tend to be less

obvious. The result is that investors who primarily seek to maximize financial returns, but would consider ESG performance if they could, face a situation akin to a "lemons market" (Akerlof, 1970): the seller is more informed about the quality of a product than potential buyers. Without credible verification of the seller's claims on the attributes that matter to the buyer, the buyer is reluctant to make a purchase, fearing that the product touted as high-quality is in fact low-quality. Likewise, when investors cannot distinguish which companies use their ESG practices to create value, they are unable to incorporate a company's ESG performance into their investment decision-making processes. Thus, investors who would prefer to invest in ESG-conscious companies, all other things equal, are unable to do so because they cannot discern if ESG practices will help, hurt, or have minimal impact on their financial performance.

A Solution in Better Data

Better data can solve this lemons-market problem. Certificates of authenticity allow antique collectors to purchase with greater confidence; taster ratings help wine enthusiasts anticipate the quality of a bottle before they buy. In the same way, credible metrics that reflect how a company's ESG activities contribute to financial value can help mainstream investors identify those companies that fall within their investment mandates. Such metrics can unlock pent-up investor demand for ESG-conscious investments that do not sacrifice, and indeed increase, financial performance.

Mainstream investors want ESG metrics suited to investment decision-making purposes. To be useful to investors, metrics must be specific to the company under consideration and present a causal, predictive, and transparent connection between ESG performance and financial performance. Thus, they must be carefully attuned to measure what matters within the context of each company's unique business strategy, customer value proposition, industry and market dynamics, competitive positioning, and core competencies. Finally, metrics must move towards standardization and be amenable to integration into investors' proprietary analytical models to allow comparison across companies and within companies over time. What companies need is better guidance on how to produce credible ESG metrics that investors can use.

ESG Value Creation Metrics

To help investors identify companies executing ESG strategies that create financial and broader societal value, we propose an investor-oriented conceptual framework and methodology for producing company-specific ESG value creation metrics. As the name implies, ESG value creation metrics measure the contribution of a company's ESG strategy to its financial value; they identify the causal links between ESG and financial performance.

Investors can use ESG value creation metrics to evaluate which companies are executing ESG strategies that enhance financial performance, while companies can use them to more credibly communicate the financial value of their ESG strategies. Finally, the process of designing these metrics helps guide senior executives toward a more strategic approach to ESG value creation; it provides them with practical tools to set goals, define the combined ESG and business initiatives required to achieve them, and monitor and manage their companies' ESG and financial performance.

To be useful to the investment community, the measures we propose are grounded in the terminology, tools, and processes used by asset managers in their decision making, particularly those routinely used when analyzing companies' standard financial statements. This means focusing ESG metrics around activities that impact earnings (Lubin & Esty, 2014; Lubin & Krosinsky, 2013) and cash flow. In some cases, value-creating activities have a clear and direct causal link to earnings and cash flows. For example, an increase in sales generated by acquiring new customers is captured directly by the revenue line of the financial statements. In other cases, the mechanism by which an activity drives value is less direct and more difficult to measure. In labor-intensive industries, the energy and commitment employees bring to their work can be an important labor-cost driver, even if causal effects on value may not appear on the surface to be directly linked to financial results. Implementing a system of metrics for both the direct and indirect drivers of value can make cash flow forecasts more precise and allow senior executives to forecast the financial impact of new activities whose value might otherwise be difficult to evaluate. Robert Kaplan and David Norton's *Balanced Scorecard* (1996) presents a comprehensive and systematic strategy for identifying value drivers, implementing programs to improve them, and establishing metrics to track and manage them for success.

ESG value creation metrics track how a company's ESG strategy impacts drivers of cash flows, in particular by measuring the associated direct and indirect impact on revenue and cost. A company's ability to generate financial returns from its ESG strategy hinges on how well it advances the company's strategic and financial objectives. For example, a U.S. based food-products company whose growth strategy revolves around penetrating the European food service market may choose a non-GMO sourcing strategy to help it grow revenue. This same strategy of procuring potentially higher cost non-GMO ingredients may be revenue neutral for a company with a growth strategy focused on emerging markets, and therefore detrimental to cash flow and value creation.

Tracking direct and indirect indicators that contribute to financial returns over time is particularly useful for demonstrating causal impacts. When properly designed and implemented, these ESG value creation metrics can be used to quantify the impact of the of a company's ESG strategy on its intrinsic value.

We propose a three-step process for designing value creation metrics around those activities that maximize the strategic and financial returns of ESG investments. This process can be incorporated into ongoing business strategy, financial planning and reporting, and performance management processes. Required for implementation are: senior executive leadership with the strategic perspective and stature to execute company-wide initiatives; a cross-functional team that integrates a range of financial and operating experience; and the necessary oversight required for material information disclosures. Inputs to this process must come from across the company because ESG value may be generated in multiple areas of the business. Input should also come from outside the company because identification of some ESG value creation opportunities require perspectives from beyond the company.

Step 1: Identifying Company ESG Strategy As a Source of Value Creation

The first step is to develop an ESG strategy that identifies value creating opportunities, upside potential, and downside risks across the entirety of the company's operations and industry value chain (Lubin & Krosinsky, 2013). An effective ESG value creation strategy articulates the prioritized set of integrated ESG and core business activities, tailored to the company's unique business objectives and circumstances, that have the greatest potential to increase value through revenue growth, sustained cost reduction, and increased productivity (Lubin & Esty, 2014). The ESG strategy then lays out specific goals and milestones, along with the interlinked ESG and business initiatives, timeline, and responsibilities required to achieve them. An ESG strategy to expand sales per customer, increase customer retention, and capture price premia for differentiated goods may focus on environmental and social attributes that matter most to current and potential customers. In manufacturing industries, an ESG strategy that increases value through procurement cost-savings may favor ESG activities that increase efficiency and reduce waste. In service industries, an ESG strategy focused on energy efficiency in office buildings may have minimal financial impact.

Step 2: Quantifying Operational Value Outcomes

The second step follows processes similar to those that corporate finance departments use to allocate capital, corporate strategy departments use to evaluate new businesses, and some investors use to value companies. It also may serve as a mechanism to identify the granular components of ESG value that map to emerging SASB guidelines (SASB, 2017) and the United Nations Principles of Responsible Investing investor communications toolkit (Lubin & Krosinsky, 2013).

The process identifies the direct and indirect mechanisms by which the major initiatives encompassed by a company's ESG strategy create financial value. It pinpoints the pathway by which each initiative moves a driver of cash flow, and then measures that change. This process systematically identifies the impact on each line item of the forecasted financial statements that, in aggregate, drive operating cash flows and intrinsic value, starting with revenue and moving through the income statement, balance sheet, and statement of cash flows. The process of developing ESG value creation metrics can identify new or under-recognized sources of value and enable deeper insight into risk management. The measures may also be subjected to best practice quantitative and qualitative scenario planning and sensitivity testing to estimate potentially material upside and downside risks to earnings, cash flows, and value.

ESG value creation metrics must be measureable in practice and mindful of implementation factors, such as possible process and information technology changes, employee time, and expense. In some cases, proxy measures may be more practical. While time-series metrics are often helpful for estimating cause and effect, surveys and qualitative data, from focus groups say, can also provide predictive value.

A few simple examples can illustrate how ESG value creation metrics connect to companies' financial statements at the operational level:

- A company looking to increase revenue might target consumers who consider ESG performance as a purchasing differentiator. A direct revenue metric for this strategy might assess the size and amount of ESG-conscious customer purchases before and after a sustained marketing and brand-building effort. Indirect metrics could assess these customers' attitudes toward the company and their purchasing plans.
- Another ESG strategy could look to lower the cost of goods sold by improving visibility, control, and collaboration within a supply chain. Measurement of lower input costs would be relatively straightforward.

- Finally, an ESG strategy might reduce selling, general, and administrative expenses by encouraging video conferencing to reduce greenhouse gas emissions. A metric for this program could assess employee travel and entertainment expenses for company meetings.

Step 3: Selecting ESG Value Creation Metrics

The third step is for senior executives to identify and sum up the value indicated by all operating level ESG metrics; evaluate the ESG strategy's aggregate effect on financial performance; and decide which small number of meaningful metrics, if any, to disclose. These few metrics should aim to convey the overall impact of the company's ESG strategy on financial performance and health, such as those that signal the contribution of ESG to revenue growth rate and margin expansion (Lubin & Esty, 2014; Lubin & Krosinsky, 2013) and the primary initiatives that drive that impact. While these factors differ between industries and by company, metrics should be built up in a granular manner and designed with an eye toward standardization and comparability. Finally, the selected metrics should be structured to fit the company's senior executive responsibilities, governance obligations, and the legal ramifications of disclosure.

ESG value creation metrics can help improve forecasts for financial statement line items and provide additional perspective on the health of the company. Because these adjustments flow through to financial ratios such as gross, operating, and net income margins, earnings growth rates, and return on capital employed, they can help investors differentiate a company that has implemented a value creating ESG strategy from comparable companies that haven't.

To illustrate ESG value creation metrics, and our framework for developing them, we describe how a major retail clothing company may construct them. The company seeks to increase financial performance primarily by acquiring new customers and reducing high employee turnover. Its ESG strategy advances these goals with an initiative designed to increase workforce engagement and simultaneously equip employees to attract new customers. The initiative provides opportunities for employees to participate in ESG activities carefully selected to resonate most with the company's customers and employees, such as ensuring ethical working conditions in the supply chain, using environmentally friendly raw materials, and promoting workplace recycling.

The company designs the employee engagement program to produce two main causal pathways to financial value. First, it seeks to increase revenue by attracting customers who prefer to purchase from ESG-conscious companies. Employees who personally participate

in the company's ESG programs are likely to demonstrate conviction in the company's ESG accomplishments, and thus convey credibility to potential customers. Second, encouraging employees to participate in workplace activities that align with their own values and having coworkers, managers, and senior executives participate along with them is expected to improve employees' pride in and commitment to their company. More engaged employees can lower labor costs through improved recruitment, retention, and productivity (Harter, Schmidt, & Hayes, 2002). This is particularly valuable in an industry with high labor costs and turnover rates.

Table 1 illustrates a potential approach to measure the value created by some elements of the clothing retailer's employee engagement initiative. The first column provides examples of line items from the company's profit and loss statement that drive earnings and cash. In practice, these can be broken into more specific line items, such as costs of labor or talent acquisition. The second and third columns represent the driver of the financial line item that the ESG strategy changes, and the mechanisms that cause that change. The last column provides potential ESG value creation metrics that the clothing retailer could implement at the operational level for its ESG workforce engagement initiative. Note the intent of this proposed class of value creation metrics is to complement metrics that capture the broader societal benefits of the company's ESG initiatives. (While such benefits can be important, approaches to measuring and reporting them have been developed elsewhere, as discussed above).

Table 1: Operational ESG Value Creation Metrics at a Clothing Retailer

Driver of increased earnings, cash flow and value	Driver of financial statement line item	ESG causal impact on driver of financial statement line item	Operational ESG value creation metrics
Increased revenue	Increased number of customers	Increased customer awareness of company's ESG leadership Increased front-line sales personnel promoting company's ESG accomplishments	Number of new customers citing company's ESG leadership for making purchase (customer surveys) Frequency and level of employee comfort discussing company's ESG accomplishments with potential customers (employee surveys)
Reduced costs	Reduced cost of employee turnover	Reduced turnover rate of ESG engaged workforce	ESG-engaged employee turnover rate versus average (employee surveys) Level of workforce pride, commitment to company, and job satisfaction due to company's ESG performance (employee surveys)

Evaluating the company's operational level metrics can help the company identify if, where, and how its ESG strategy creates value. It may choose to disclose a small number of higher-order metrics to guide investor communications, such as those that signal ESG-driven

increases in operating profit margins and revenue growth (Lubin & Esty, 2014; Lubin & Krosinsky, 2013). In the case above, measures may indicate a sustained reduction in employee turnover within two to three years, which could have meaningful financial impact in an industry characterized by high turnover rates. They may also indicate competitive advantage in attracting customers, particularly millennials, who are critical to the financial performance and health of most retailers.

Conclusion

ESG value creation metrics provide evidence of the causal pathways through which companies' ESG strategies impact their financial performance. While existing metrics indicate performance along dimensions with no explicit link to financial outcomes, ESG value creation metrics are company-specific, driven by company strategy, and causally indicate future financial performance. These metrics are more credible to investors and thus help solve the lemons-market problem between investors and companies.

ESG value creation metrics are based on standard measurement approaches for showing the direct and indirect causal connections between companies' strategic programs and important cash flow drivers. Companies develop these metrics through established strategic planning processes with executive management and board oversight. ESG value creation metrics are functionally similar to other data that investors use to evaluate investment options, enabling ready integration into proprietary analytical models. Armed with ESG value creation metrics, investors can unlock capital resources otherwise sitting on the sidelines by incorporating companies' ESG strategies and associated financial impacts into their investment evaluation processes. In other words, for mainstream investors, the process for evaluating investments along ESG criteria will start to look like the process for evaluating investments along most other criteria.

Along with ESG value creation metrics, the strategic planning process for developing them can be valuable for companies. Fostering investor interest and attention in ESG as a value driver elevates ESG performance to a matter of strategic importance among senior executives and directors. Companies are more likely to systematically identify and potentially uncover unexpected sources of value. These metrics can improve the efficiency of resource flows by providing investors and senior executives better information about value created by companies' ESG strategies. In the end, by identifying the financial returns of an ESG strategy, ESG value creation metrics help investors and companies maximize both ESG and financial performance.

Mainstream investors have an important opportunity to do well by doing good. By engaging with management around ESG value creation metrics, investors encourage management to take a more strategic approach to ESG; investors, meanwhile, are able to

make more informed decisions on allocating capital to those companies that are poised to produce both financial and broader societal value. And, for society at large, ESG value creation metrics, and the process for constructing them, serve to help the investor and business community expand economic prosperity, enhance corporate governance and increase positive environmental and social externalities.

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Do Corporate Controversies Help or Hurt Performance? A Study of Three Portfolio Strategies

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Abstract

Industry researchers and practitioners have become increasingly sophisticated in determining how integrating best-in-class environmental, social, and governance (ESG) signals can impact portfolio exposures to traditional financial factors with an aim to reduce portfolio risk and produce higher risk-adjusted returns over the medium- to long-term. Similarly, the broad effects of excluding entire business lines, typical of the more traditional values-aligned socially responsible portfolio, are also generally understood. However, little research has been done on the performance implications of exclusions based on alleged corporate wrongdoing, though such exclusions are common. In this study, we investigate the risk and return impact of excluding companies involved in events negatively impacting stakeholders, testing three model portfolios with increasingly stringent criteria. Our universe for analysis consists of constituents of the MSCI World Index, which represent ~1,600 large- and mid-cap public companies in developed markets, over the sample period February 2007 through June 2017. We found that exclusions of the worst types of corporate wrongdoing had a mildly positive effect on returns but that, beyond this, as exclusions increased, so did tracking error. Returns were also negatively impacted by more sweeping exclusions. For a given level of severity, larger companies had lower stock-specific returns on average than their smaller peers. The smallest stocks with alleged wrongdoing outperformed the average MSCI World stocks of similar size, indicating that over this period smaller companies were not penalized in their stock price by the occurrence of moderate or even severe events.

Introduction

In recent years, institutional investors have increasingly directed capital to investments that take into account environmental, social, and governance (ESG) factors.[75] The dominant practices in ESG investing have typically fallen along two lines. The more traditional approach tries to align a portfolio with investors' ethical or social values by excluding companies whose business model or behavior contravene those professed values. To achieve values-alignment, portfolios are typically constructed to exclude companies involved in certain lines of business (e.g. tobacco or controversial weapons) or that have faced serious allegations of wrongdoing (e.g. human rights violations or environmental degradation). A more recent approach takes a risk or performance focus and aims to improve a portfolio's long-term risk-adjusted returns by integrating select ESG factors that could impact the risks and opportunities of portfolio companies. To achieve better long-term returns, investors typically use ESG signals in portfolio construction that are specifically aimed at capturing industry best-in-class performers, such as industry-relative ESG ratings.

Industry researchers and practitioners have become increasingly sophisticated about how integrating best-in-class ESG signals can impact portfolio exposures to traditional financial factors, such as value, quality, or volatility (e.g. Northern Trust, 2016; Melas et al., 2016). There is also a growing body of research suggesting that integrating ESG factors has historically reduced portfolio risk and produced higher risk-adjusted returns over the medium- to long-term (e.g. Nagy et al., 2016; Dunn et al., 2017; Chaudhry, 2016; Hitchens et al., 2015). Similarly, the broad effects of excluding entire business lines, typical of values-alignment methods, are also generally understood, inasmuch as this approach often leads to notable industry skews and, depending on the scope of exclusion, may hurt performance (e.g. Kacperczyk and Hong, 2009); at minimum, no performance gain is expected.

Less is known about the performance implications of incorporating exclusions based on alleged wrongdoing, though this approach is commonly deployed in real-world portfolios that profess to invest with ESG principles. In contrast to the more straightforward "best-in-class" and industry- or business-line exclusions, investors' aims for excluding companies implicated in alleged wrongdoing are often less straightforward. There are three main rationales, and individual investors often cite more than one in choosing to exclude alleged corporate wrongdoers from their investments:

1. Ethical reasons – An unwillingness to hold stocks in companies whose behavior crosses non-negotiable ethical lines.

[75] For example, signatories to the United Nations Principles for Responsible Investments has grown to number over 1,700 institutions, accounting for over US$90 trillion in assets. https://www.unpri.org/

2. Reputational risk – Concerns that holding stocks of alleged wrongdoers could harm the investor's reputation or raise uncomfortable questions from stakeholders.
3. Performance risk – A belief that companies facing allegations of serious wrongdoing may experience prolonged poor performance following the allegations and/or that such allegations indicate underlying problems at the company.

This multiplicity of rationales is driven in part by the fact that "alleged wrongdoing" comes in many flavors. These are event-based incidents, some of which may be more directly financial, such as accounting irregularities, paying bribes, or major product recalls. But often the financial impact of these events is either uncertain in scope or negligible in relation to the size of a company. Examples include labor disputes, health and safety problems, and toxic spills. The severity of wrongdoing varies as well, with a range of possible negative impacts on stakeholders. Finally, not all allegations of wrongdoing receive equal public attention or elicit equal public backlash, which could also influence the effects on a company's financials (Kölbel et al., 2017).

Companies are not a uniform category either: some may be better equipped to manage controversial events, or certain types of controversial events, than others. For example, smaller companies could have fewer resources or less capacity than larger ones to absorb negative fallout. Or, conversely, smaller companies may not attract as much public or stakeholder attention to controversial incidents as larger ones, thereby avoiding potential costs to rectify the situation or rebuild their reputation.

From the perspective of portfolio construction and performance, if the exclusion of companies involved in alleged wrongdoing is more akin to making ethics-based exclusions, or is done largely to protect the investor's reputation, we might anticipate a negative performance impact. (Though if we assume that such events are largely idiosyncratic we would not expect to see the sector biases introduced by business activity exclusions.) On the other hand, if wrongdoing presents a risk that weighs on a company's financial prospects, we would expect to see some positive portfolio performance effects from excluding such companies.

To date little research has been done to disaggregate the effects of wrongdoing-based exclusions on portfolio performance over time and to understand how these exclusions contribute to under- or out-performance.

In this paper we investigate three main questions:

1. To what extent do exclusions that are highly company specific and event-based impact the sector, country, and factor/style skews of a portfolio, i.e. result in unintended bets?

2. To what extent do these effects change with the severity of the wrongdoing?

3. Does size matter to how companies financially weather an incident of wrongdoing?

To investigate these questions, we analyzed the effects of excluding increasingly large selections of stocks based on the severity of wrongdoing in which they had been implicated. We found that exclusion of a small number of stocks involved in the most severe events had a moderately positive effect on portfolio returns over our sample period. Increasing the number of stocks excluded – expanding to include implications in less severe wrongdoing – quickly increased tracking error and led to a number of unintended systematic bets and deterioration of realized active returns. In an analysis of stock-specific performance among excluded companies, we found that smaller companies accused of wrongdoing tended to have more positive returns over the study period than larger companies with the same level of alleged wrongdoing. This suggests that smaller firms may have paid a smaller performance penalty when they got into trouble.

Data and Methods

To study the effect of excluding corporate wrongdoers, we constructed three model portfolios. We began with simple market cap-weighted portfolios based on the MSCI World Index. To each portfolio we then applied increasingly stringent exclusion criteria based on severity of wrongdoing. For this we used the MSCI ESG Controversies research. Our analysis focuses on risk and return aspects of these exclusion-based portfolios from February 2007 through June 2017.[76]

Data

MSCI ESG Controversies research defines a controversy as an incident or ongoing situation in which a company faces allegations of negatively impacting stakeholders[77] via some type of wrongdoing. While public data and media reporting are essential sources of information, the aim of ESG Controversies research is to objectively assess the severity of the negative impact of each event or situation, rather than the extent of negative press attention or public opprobrium. As such, no distinction is made in the data between incidents with

[76] Exclusions were updated monthly based on the most recent controversy scores

[77] Depending on the nature of the controversy, relevant stakeholders may include customers, workers, communities, the environment, shareholders, or society at large. See Appendix 1 for the full list of controversy categories.

equivalent negative impact on stakeholders even if the reach or volume of reporting on those incidents is dramatically different. The emphasis of the research methodology is on accurately assessing the on-the-ground impact of the event. In addition to the sources of information that are monitored, the research process entails that companies are provided the opportunity to review controversies cases attributed to them and to provide factual updates related to each incident.

Controversies are classified as "Very Severe," "Severe," "Moderate," or "Minor" according to a rules-based matrix that gauges two dimensions of each case: the scale of the negative impact (e.g. number of injuries, size of geographic area affected, etc.) and nature of the negative impact (e.g. death or irreparable damage versus minor procedural failing, etc.). The severity assessment is accompanied by an assessment of whether the case is ongoing or concluded, and whether it represents a structural failing at the company. A 0-9 score is derived formulaically from these factors with the score of 10 being reserved for instances where there is no wrongdoing alleged. A company's overall score, which we used as the exclusion criteria in portfolio construction, is determined by its most severe case. The overall score for a company is hence driven by the lowest score associated with any case and is not affected by multiple cases of varying severity (see Appendix 1 for the category list).

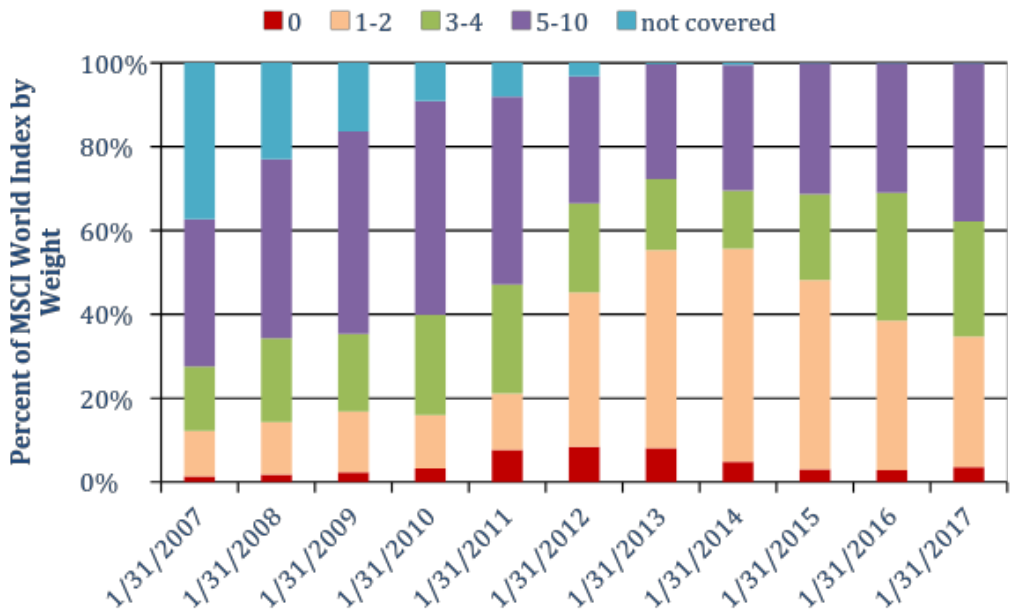
Sources are monitored continuously and consist of government databases (e.g. U.S. Environmental Protection Agency, Food & Drug Administration, and equivalent agencies in other countries), NGOs (e.g. Amnesty International, Natural Resources Defense Council), and thousands of news media sources in several languages spanning the globe, all of them vetted for reliability. Controversies are logged and assessed when they first appear in any of the monitored public information sources. They are subsequently updated as additional information becomes available. They can remain active for several years depending on how they develop and whether and how they are resolved. The intent of the data set is to identify and track situations where wrongdoing is alleged and then provide an objective and consistent assessment of how serious the negative impact is.

New information about an instance of alleged wrongdoing may result in a change in the assessment and consequently the score. If the death toll in a factory accident grows larger in the days or weeks following the initial report of the event, the severity assessment could be changed, for example, from Moderate to Severe. Similarly, new information indicating high-level executive involvement in a controversy could shift the assessment. And finally, as lawsuits are settled or situations resolved, the status of a case may change from ongoing to concluded, also affecting the score. Changes in the scores are published daily.

Figure 1 shows the weight of various score segments in the MSCI World Index over the study period. The most severe cases represented less than 10% of the index market

capitalization throughout the sample period, hitting a peak around 2012 and 2013. Expanding the criteria to more moderate cases (represented by scores of 0-4) captures a much larger portion of the universe: starting with roughly 30% weight, this group also reached a peak in 2012 around 70%.

Figure 1: Weight Distribution of MSCI World Index Controversy Scores, February 2007-June 2017



Increasing coverage of the MSCI World Index over the 2007-2012 period caused these shifts in score distribution. As companies with no controversy scores were added to coverage, some of them began to appear in groups identified for exclusion in this study. In the later years of the study period, wider availability of information and increased methodological formalization also contributed to shifts in score distributions.

Model Portfolios

We constructed three controversy groups, starting by identifying companies with the most extreme ESG controversies in the MSCI World Index and successively adding stocks implicated in less severe events. We created the corresponding three model portfolios by excluding these groups from the MSCI World Index to test the effect of such exclusions at varying thresholds. We rebalanced the portfolios monthly, excluding newly disqualified stocks and re-adding any that became qualified due to controversy case updates, as well as

adjusting for MSCI World Index quarterly rebalances. Monthly portfolio rebalancing is a common practice among investors applying exclusion rules. Between the time required for MSCI ESG Controversies to assess a new event and the monthly rebalancing frequency, the portfolios were unlikely to capture any instantaneous stock price movements when a new incident was reported publicly. A newly disqualified stock could potentially remain in the portfolio for almost a month; likewise, newly qualifying stocks could remain excluded during the same timeframe. The performance effects captured by our analysis would typically be over a longer time period.

Portfolio 1: World ex Worst

In the first model portfolio we took a very conservative approach to the screening process, maximizing the remaining opportunity set by excluding only a small set of companies that were involved in the worst types of alleged wrongdoing – typically either massive scandals or incidents representing gross violations of global norms around human rights, environmental protection, and so on. These corresponded to companies with an ESG Controversies score of 0 and assessment of "Very Severe."

The investment hypothesis behind this approach would be that allegations of corporate bad behavior are so common as to be expected and that only a handful of truly egregious cases would noticeably impact financials or draw public attention sufficient to hurt the investor. From an ethical standpoint, the position of this approach would be one of compliance with minimal standards, such as those set out by the United Nations Global Compact.[78]

Examples of companies excluded from this portfolio at various points throughout our sample period:

- Tokyo Electric Power (Tepco): Tepco was assessed "Very Severe" for environmental, community, and workforce impacts following the devastation of its Fukushima nuclear power facility in 2011. As of end of June 2017, the workforce case had been upgraded because the company addressed working conditions with excessive radiation exposure. The environmental case remained "Very Severe" as the area surrounding the nuclear facility remained environmentally damaged and 1,500 spent nuclear fuel rods continued to threaten further radiation leaks. The community impact case also remained "Very Severe" as the area surrounding the facility was still unsafe to inhabit. More than 2,000 people died early deaths either from radiation exposures or other impacts associated with trauma and evacuation.

[78] https://www.unglobalcompact.org/what-is-gc/mission/principles

- BP PLC: BP was assessed "Very Severe" in 2010 after the Deepwater Horizon oil spill in the Gulf of Mexico, which followed years of inadequate safety management. The spill released 3.2 million barrels of oil into the Gulf over 87 days before it was stopped, constituting the largest offshore oil spill in U.S. history. The case was upgraded in 2016 after a U.S. federal judge approved a US$20 billion settlement that provided adequate funding for the remaining cleanup; the company had already completed substantial cleanup activities and settled with thousands of government and business entities.

Portfolio 2: World ex Severe

In the World ex Severe model portfolio, we excluded the most egregious cases ("Worst") plus an additional set of companies facing incidents or allegations of wrongdoing more serious than most. These exclusions corresponded to companies with an MSCI ESG Controversies score of 0-2.

The investment hypothesis behind this approach would be that headline risk matters in any serious case of alleged wrongdoing, but that garden-variety negative news is still just noise. From an ethical or reputational perspective, this approach would represent a compromise: an attempt to maintain a reasonable opportunity set while avoiding association with any significant wrongdoing.

In addition to the stocks with "Very Severe" cases excluded in the World ex Worst portfolio, examples of companies excluded from the World ex Severe portfolio at various points throughout our sample period include:

- Carnival Corp.: In addition to being excluded from 2012-2015 with a score of 0 related to a cruise ship crash that killed 32 people, Carnival was excluded from the ex-Severe portfolio again in late 2016 with a "Severe" case upon pleading guilty to criminal charges that it intentionally used bypass equipment to illegally discharge waste into the sea off the U.S. and UK coasts over the course of ten years.

- Rio Tinto PLC: Rio Tinto has long been assessed "Severe" in connection with its 40% ownership stake in the Grasberg Mine in Papua, Indonesia. (Freeport-McMoran owns the other 60% and has been assessed "Very Severe" because of its direct controlling relationship with the mine. It was likewise excluded from this portfolio.) The mine, through its financial support for Indonesian security forces, is alleged to be complicit in killings, torture, rape, and other human rights violations. Rio Tinto is also assessed "Severe" for the exceptional environmental damage inflicted by the riverine tailings disposal (RTD) used by the Grasberg mine (Freeport-McMoran is again assessed "Very Severe" for this case.)

Portfolio 3: World ex Moderate

Finally, to test the effects of extensive wrongdoing-based exclusions, we constructed the World ex Moderate portfolio, which excluded all of the companies excluded by the World ex Severe portfolio plus companies implicated in what might be thought of as garden-variety negative incidents or allegations regarding environmental, social, or governance issues. These exclusions corresponded to companies with MSCI ESG Controversies scores of 0-4.

The investment hypothesis behind this approach would be that any such incident could have the potential for negative financial impacts or be indicative of poor management. From an ethical perspective, an investor seeking to hold only "good" companies that avoid trouble might apply such a broad-brush approach.

In addition to the companies excluded because of "Very Severe" and "Severe" events, the World ex Moderate portfolio also excluded companies with allegations of "Moderate" wrongdoing such as:

- Alphabet: The company formerly known as Google has been implicated in numerous "Moderate" cases in the last few years. These include allegations of anti-competitive behavior dating back to at least 2011, typically alleging that the company has privileged its own services in search results; numerous allegations of privacy and data security violations related to data tracking as well as security flaws; allegations that the company has paid its female employees substantially less than male employees; and numerous allegations of tax evasion in several jurisdictions.

- Marks and Spencer Group: M&S has faced "Moderate" allegations related to working conditions in its supply chain. There were recent allegations of poor working conditions for Syrian refugees in Turkish garment factories supplying the company as well as older allegations regarding working conditions in supplier factors in Cambodia and Bangladesh.

Controversy Group Characteristics

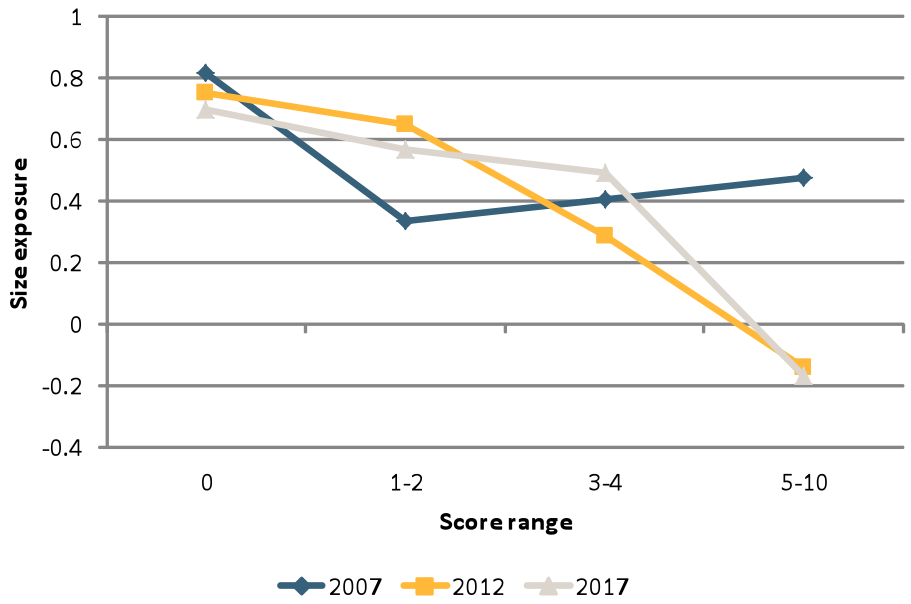
In the following section, we briefly look at some characteristics of these groups.

First, we find a link between the size of the company and the probability of being implicated in a more or less severe event.

Figure 2 plots the size exposure[79] of groups of stocks against the MSCI ESG Controversies scores, showing the ranges used in the construction of the model portfolios. Larger stocks tended to be implicated in more severe wrongdoing, and as the case severity decreased, the size of the corresponding companies also decreased. This may be because larger companies have more capacity to do damage via a larger footprint or because incidents involving larger companies are more likely to be reported.

Figure 2: Size Exposures of Stocks Against Controversy Score Ranges

Size exposure is a z-score. That is, it expresses how many standard deviations away the company's market capitalization is from the weighted average. The weighted average market capitalization of MSCI World Index constituents at the end of June 2017 was approximately $118 bn, and the standard deviation was approximately $50 bn.



Second, we analyzed potential linkages between alleged wrongdoing and sector. Tables 1-3 describe the composition of the excluded group of companies for each of the three portfolios, by year.

[79]We use the Global Total Market Equity Model to calculate portfolio exposures. The Size exposure of the model is directly related to the size of the company, more positive values corresponding to larger companies.

Table 1: Sector Distribution of "Worst" Companies

For each year, the chart shows the fraction of companies in each sector among all the excluded companies. The average proportion of each sector among the entire MSCI World Index is displayed at the bottom; these ratios remained roughly stable from year to year.

year	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financials	IT	Telecom	Utilities	Total %	Total Number
2007	16.7%			33.3%	50.0%						100%	6
2008	11.1%		11.1%	22.2%	55.6%						100%	9
2009	11.1%	11.1%	22.2%		44.4%		11.1%				100%	9
2010	7.1%	21.4%	21.4%	7.1%	28.6%	14.3%					100%	14
2011	20.0%	24.0%	12.0%	4.0%	16.0%	12.0%	4.0%	8.0%			100%	25
2012	20.7%	24.1%	10.3%	10.3%	10.3%	10.3%	3.4%	6.9%		3.4%	100%	29
2013	23.3%	23.3%	10.0%	16.7%	6.7%	10.0%	6.7%			3.3%	100%	30
2014	36.4%	22.7%	4.5%	13.6%	4.5%	13.6%				4.5%	100%	22
2015	31.6%	36.8%		15.8%	5.3%					10.5%	100%	19
2016	28.6%	33.3%	4.8%	19.0%	4.8%					9.5%	100%	21
2017	26.3%	26.3%	5.3%	21.1%	5.3%		5.3%			10.5%	100%	19
Average over time	**21.2%**	**20.3%**	**9.2%**	**14.8%**	**21.0%**	**5.5%**	**2.8%**	**1.4%**	**0.0%**	**3.8%**	100%	18
MSCI World average	**6.7%**	**8.9%**	**16.1%**	**15.6%**	**7.4%**	**7.2%**	**20.9%**	**9.4%**	**2.8%**	**5.0%**	100%	1693

As evident in Table 1, "Very Severe" cases did not occur in all sectors equally during the study period. They historically occurred more frequently in sectors whose operations had the most intensive effects on the environment and surrounding communities – namely Energy and Materials. Consumer Staples occurred frequently too, given product safety issues. No "Very Severe" cases occurred in the Telecom sector. The IT and Financials sectors were less frequently implicated.

Table 2: Sector Distribution of "Severe or Worse" Companies

For each year, the chart shows the fraction of companies in each sector among all the excluded companies. The average proportion of each sector among the entire MSCI World Index is displayed at the bottom; these ratios remain roughly stable from year to year.

year	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financials	IT	Telecom	Utilities	Total %	Total Number
2007	6.7%	4.1%	15.0%	21.2%	10.9%	2.1%	25.4%	9.8%		4.7%	100%	193
2008	7.9%	4.6%	16.2%	20.8%	12.0%	2.3%	22.7%	8.8%		4.6%	100%	216
2009	10.9%	6.3%	17.6%	17.2%	9.0%	3.2%	22.6%	9.5%		3.6%	100%	221
2010	11.9%	8.6%	21.3%	13.1%	9.4%	4.5%	19.7%	7.8%		3.7%	100%	244
2011	10.4%	8.4%	22.8%	13.6%	9.6%	5.6%	19.6%	6.8%	0.4%	2.8%	100%	250
2012	8.1%	13.8%	18.8%	10.8%	8.5%	10.4%	10.4%	8.8%	2.7%	7.7%	100%	260
2013	8.6%	11.3%	20.6%	14.5%	11.3%	8.3%	12.3%	6.4%	1.7%	5.1%	100%	408
2014	11.8%	10.5%	16.5%	12.5%	12.0%	8.8%	13.5%	4.8%	2.5%	7.0%	100%	399
2015	11.3%	12.2%	14.5%	12.8%	13.6%	9.3%	13.6%	4.1%	2.9%	5.8%	100%	345
2016	8.4%	10.5%	15.5%	16.2%	15.2%	10.8%	12.5%	2.0%	2.7%	6.1%	100%	296
2017	7.4%	13.2%	13.6%	13.6%	14.5%	12.4%	14.5%	2.5%	2.5%	5.8%	100%	242
Average over time	9.4%	9.4%	17.5%	15.1%	11.5%	7.1%	17.0%	6.5%	1.4%	5.2%	100%	279
MSCI World average	6.7%	8.9%	16.1%	15.6%	7.4%	7.2%	20.9%	9.4%	2.8%	5.0%	100%	1693

Including less severe events, (score 0-2) leads to a more even distribution by sector. The Energy and Consumer Staples sectors were still overrepresented among "Severe" events, whereas the Telecom and IT sectors were the most underrepresented.

Table 3: Sector Distribution of "Moderate or Worse" Companies

For each year, the chart shows the fraction of companies in each sector among all the excluded companies. The average proportion of each sector among the entire MSCI World Index is displayed at the bottom; these ratios remain roughly stable from year to year.

year	Energy	Materials	Industrials	Consumer Discretionary	Consumer Staples	Health Care	Financials	IT	Telecom	Utilities	Total %	Total Number
2007	7.2%	14.4%	16.8%	18.1%	8.7%	5.2%	17.1%	7.4%	0.2%	5.0%	100%	404
2008	8.6%	14.2%	18.0%	17.4%	9.4%	5.2%	15.7%	6.4%	0.4%	4.7%	100%	466
2009	8.7%	11.0%	18.4%	17.2%	8.9%	4.9%	17.2%	8.1%	0.4%	5.3%	100%	472
2010	9.3%	10.8%	20.8%	14.2%	9.0%	5.9%	17.2%	6.8%	0.3%	5.7%	100%	592
2011	9.8%	11.2%	20.7%	14.4%	9.5%	5.8%	17.4%	6.2%	0.5%	4.7%	100%	634
2012	9.3%	13.0%	17.7%	14.2%	8.2%	8.2%	12.1%	6.7%	3.9%	6.8%	100%	571
2013	8.7%	11.4%	18.5%	15.5%	10.2%	8.6%	12.0%	5.2%	2.9%	7.2%	100%	699
2014	11.6%	9.4%	16.9%	15.3%	11.4%	7.6%	13.1%	4.5%	2.9%	7.4%	100%	649
2015	12.0%	10.0%	16.7%	14.9%	10.6%	8.1%	13.2%	4.8%	3.1%	6.6%	100%	651
2016	9.3%	10.5%	16.1%	16.3%	11.0%	9.0%	14.8%	4.0%	3.0%	6.1%	100%	657
2017	5.4%	10.5%	15.9%	17.3%	11.3%	9.6%	14.6%	6.9%	3.6%	4.9%	100%	533
Average over time	**9.1%**	**11.5%**	**17.9%**	**15.9%**	**9.8%**	**7.1%**	**14.9%**	**6.1%**	**1.9%**	**5.9%**	100%	575
MSCI World average	**6.7%**	**8.9%**	**16.1%**	**15.6%**	**7.4%**	**7.2%**	**20.9%**	**9.4%**	**2.8%**	**5.0%**	100%	1693

Finally, if we take into account "Moderate" and worse events (score 0-4), the distribution again becomes more uneven. The Energy sector remained the most overrepresented, and the IT sector was the most underrepresented relative to its representation among index constituents.

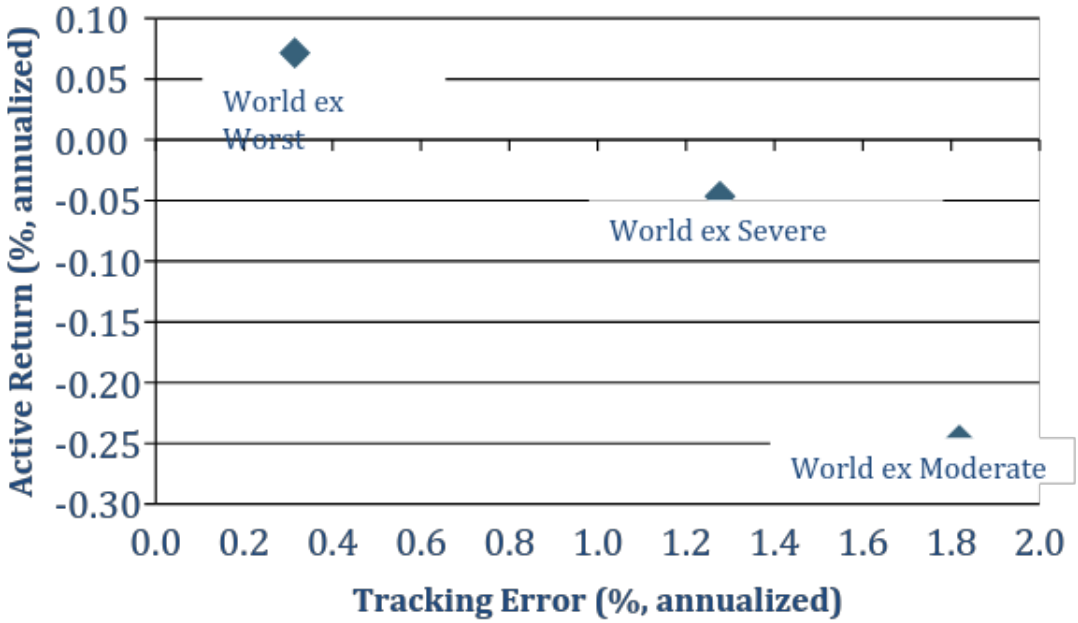
Overall, we see that, historically, certain sectors were overrepresented among companies with alleged wrongdoings, even though the controversy analysis process included no explicit sector biases. This indicates that certain sectors may have been more inclined by their nature to undertake activities with potential harmful impacts on the environment, stakeholders, or public at large – especially for very severe cases. The investment implication is that even if controversy-focused investors do not have a sector-based exclusion approach in mind at the outset, the portfolio they build can nevertheless end up having a sector tilt.

Exclusion Effects

Our analysis focuses on risk and return aspects of these exclusion-based portfolios from February 2007 through June 2017. First, at the high level, we look at the relationship between the tracking error and the active return relative to the MSCI World Index. Not surprisingly, the realized tracking error increased with the weight of excluded stocks, from 0.3% for the World ex Worst portfolio to 1.8% for the World ex Moderate portfolio. Second, we found that the exclusion of the most severe controversies led to a mild outperformance of the portfolio, but screening out more moderate infractions put a drag on performance.

Figure 3: Tracking Error and Active Return of Model Portfolios Relative to MSCI World, Feb 2007 – June 2017

These results reflect monthly rebalancing of the portfolios to exclude newly disqualified stocks and include newly qualified stocks.



What drove the differences in portfolio returns? As Table 4 shows, returns can come from two sources: either systematic tilts or asset-specific contributions.

Table 4: High-level Performance Attribution of Screened Portfolios, Feb 2007 – June 2017

Return Source (%)	World ex Worst	World ex Severe	World ex Moderate
Total Active	**0.07**	**-0.05**	**-0.25**
Style	0.01	0.03	0.04
Industry	0.03	0.07	-0.03
Country	0.00	-0.04	-0.01
Currency	0.00	-0.13	-0.12
Specific	0.03	0.03	-0.13

Systematic Effects

We look at some of the systematic effects in the most risky portfolio: World ex Moderate. Style exposures provide a good illustration of the unintended bets that a portfolio can take after excluding a large number of stocks. In this particular case, the resulting contributions were positive overall, but further analysis reveals that many of the style factor bets actually detracted from performance. On the plus side, after exclusion, there was a pronounced tilt towards the smaller companies in the benchmark universe (cf. **Figure 2** and Table 5). This is visible in the positive Mid Capitalization and negative Size exposures, which resulted in a 26 bps positive contribution. The lower Residual Volatility of the portfolio also added 18 bps to return. The portfolio was also somewhat tilted towards higher price momentum stocks, which added 20 bps.

Offsetting the positive contributions, the portfolio had a tilt toward lower dividend yield, lower investment quality, and higher liquidity stocks, which collectively subtracted 35 bps from performance overall. The total contribution from style factors reached 4 bps.

Table 5: Style factor contributions to the World ex Moderate Portfolio Active Performance Relative to MSCI World, Feb 2007 – June 2017

World ex Moderate	Average active exposure	Annualized Contribution
Momentum	0.02	0.20%
Mid Capitalization	0.23	0.18%
Residual Volatility	-0.05	0.18%
Size	-0.30	0.06%
Growth	0.06	0.04%
Long-Term Reversal	-0.03	0.03%
Earnings Variability	0.02	-0.01%
Earnings Quality	-0.06	-0.03%
Profitability	-0.01	-0.03%
Book-to-Price	-0.04	-0.05%
Beta	0.02	-0.05%
Leverage	-0.02	-0.05%
Earnings Yield	-0.11	-0.07%
Dividend Yield	-0.11	-0.10%
Investment Quality	-0.07	-0.10%
Liquidity	0.10	-0.15%

Unintended currency bets also collectively detracted 13 bps from the World ex Moderate portfolio's performance, and, as such, were responsible for half of the underperformance. As Table 6 shows, the portfolio had a small positive tilt on the Japanese Yen, which alone was responsible for a 17 bps drag on portfolio performance. Other currency tilts had much smaller individual effects.

Table 6: Top/bottom Three Currency Factor Contributions to the World ex Moderate Portfolio Active Performance Relative to MSCI World, Feb 2007 – June 2017

World ex Moderate	Average active exposure	Annualized Contribution
Japan	0.05	-0.17%
United States	-0.07	-0.06%
Sweden	0.01	-0.01%
Switzerland	-0.01	0.02%
Hong Kong	0.01	0.02%
Australia	0.01	0.08%

Again, based on these historical observations, we can draw similar conclusions: the portfolios created by excluding controversial stocks did not target any style or country bias, but ended up having them nevertheless, with important contributions sometimes arising from them.

Stock-Specific Effects

Besides systematic effects, stock-specific contributions can also be an important part of portfolio performance. As Table 4 shows, while net stock-specific contributions for the full ten-year period were mildly positive when excluding only the most severe cases of alleged wrongdoing, they deteriorated as exclusions were extended to include less-severe events.

At first glance, this indicates that, historically, stocks with the most severe cases underperformed their peers, but stocks with a lower level of severity rather, were outperformers. However, this conclusion demands more nuanced consideration, as the effect of monthly rebalancing is not clearly visible. It is possible that both gross and less-severe alleged wrongdoing tended to cause negative price effects, with the effects from more serious cases lasting longer. If that were true, the negative price impact of very severe

cases can be more easily avoided in portfolios with monthly rebalancing, whereas a more frequent – and also more costly – rebalancing maybe needed to avoid the negative price effect of less severe cases. Further research is needed to shed more light on this question.

So far, we have been talking about the three groups of excluded companies as if they formed a homogeneous entity. But was the stock price reaction uniform among stocks with similar level of controversies, or was there something differentiating them?

Figure 4: Average Stock-specific Return Contribution Relative to Size for Companies with Events of the Same Severity

The chart illustrates the relationship between size and stock specific returns for companies involved in negative incidents of the same severity for the period Feb 2007 – June 2017. All stocks meeting criteria for exclusion from the World ex Severe and World ex Moderate portfolios were sorted monthly by Size exposure and divided into four equally weighted quartile sample portfolios whose performance is evaluated over the sample period.

Size exposure is a z-score. That is, it expresses how many standard deviations away the company's market capitalization is from the weighted average. The weighted average market capitalization of MSCI World Index constituents at the end of June 2017 was approximately $118 bn, and the standard deviation was approximately $50 bn.

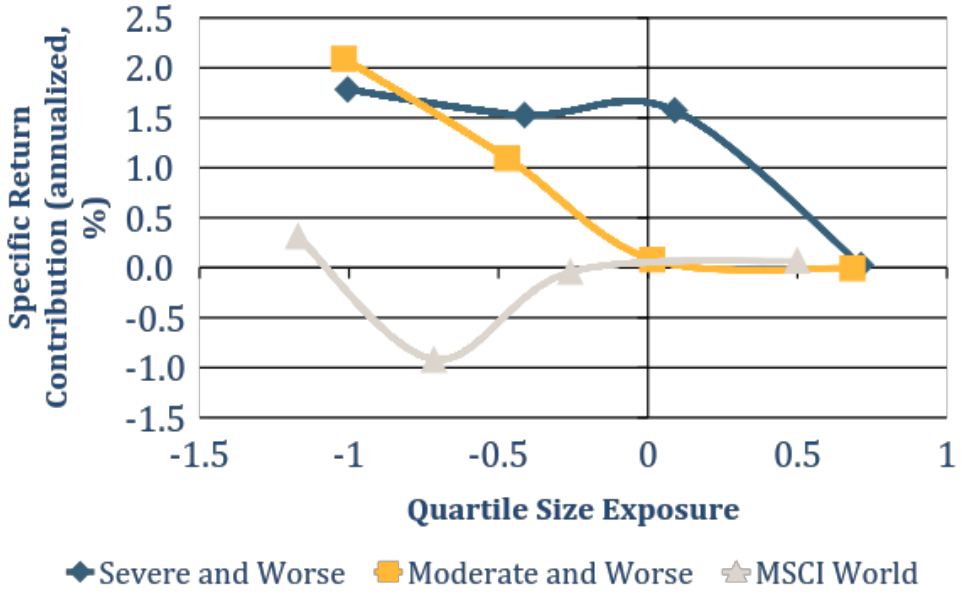


Figure 4 reveals an interesting trend. For a given level of severity, larger companies had lower stock-specific returns on average than their smaller peers. The smallest stocks with alleged wrongdoing outperformed the average MSCI World stocks of similar size, indicating that, over this period, smaller companies were not penalized in their stock price by the occurrence of moderate, or even severe, events.

The finding that large companies seem to be penalized by the market more than small companies for alleged wrongdoing could be due to a number of factors. One reason could be that market reactions to these incidents are mediated through media coverage, and media treatment of larger companies may differ from coverage of smaller companies. Previous research focused purely on the intensity and reach of media coverage, as opposed to the nature and impact of the incidents themselves. This suggests that media of greater reach had a larger negative financial impact (Kölbel et al., 2017). It is possible that for an incident of given severity or "true" on-the-ground impact on stakeholders, larger companies may attract more media coverage from outlets with greater reach; even fairly serious issues associated with smaller companies may not result in much press.

Another reason could be that companies of different size may have different reputations for corporate social responsibility (CSR). Previous research has suggested that CSR activities may act as a protective shield, or a form of insurance, against shocks from negative events. Following this line of argument, companies with stronger CSR reputation would be better positioned to absorb negative events (Godfrey, 2005; Godfrey et al., 2009). The prevailing research has suggested, however, that larger companies rather than smaller companies tend to undertake more CSR activities of the variety that academic researchers have used in these studies. Hence, our findings would run counter to this line of reasoning.

Research indicating that companies with both the strongest CSR reputations and weakest CSR reputations tended to attract greater media scrutiny suggests a more nuanced explanation (Luo et al., 2012). It is possible that larger companies occupy both ends of the spectrum: they have more resources to invest in enhancing their CSR reputation and have larger footprints that can lead to larger negative impacts. Occupying the extreme ends of CSR reputation could mean that they attract more intensive and wider media coverage when negative events occur.

The current dataset measures the level of impact or harm to stakeholders of each single incident, rather than the level or nature of media attention to any given incident. Further studies would first need to establish the relationship between an incident and its media coverage, and then between how differences in coverage might mediate how incidents translate into market reactions.

Conclusion

Our findings suggest a number of practical implications for investors.

Exclusions based on alleged wrongdoing are a blunt instrument. As our exclusion criteria became more stringent, portfolio tracking error increased without necessarily leading to outperformance. Unintended systematic bets and negative stock-specific contributions seemingly caused this. However, our analysis indicates that excluding only a handful of the worst offenders did not significantly impact the model portfolios' risk or returns.

Our analysis also suggests that events with severe negative stakeholder impacts may not (or may not always) hurt a company's returns. While existing literature would suggest that larger companies with greater resources to manage stakeholder relationships could better absorb negative events, our findings suggest otherwise. In fact, larger companies seemed to suffer more than smaller companies from involvement in incidents with negative stakeholder impact. It is possible that the negativity of media coverage rather than the negativity of the actual impact more directly affects company returns.

As indicated in the introduction, institutional investors have varied, and sometimes multiple, reasons for excluding corporate wrongdoers from their portfolios. They may implement this type of exclusion in order to: (1) withhold capital from companies that contravene their ethical standards or established global norms; (2) protect the investor's own reputation by avoiding investments associated with corporate wrongdoing; and/or (3) mitigate financial risks that may result from corporate wrongdoing, such as penalties or revenue loss.

For investors that aim to meet a minimal ethical standard, our analysis indicates that excluding only the worst offenders from a portfolio would allow them to meet this objective while retaining close to the full market opportunity set. As of May 2017, holding a hypothetical MSCI World ex Worst portfolio would mean that investors would avoid stocks like Freeport-McMoran, BHP Billiton, and Saipem, which violated the Global Compact on issues ranging from environmental pollution to community destruction to large scale corruption.

For investors that aim to protect their reputations, excluding the worst offenders is a critical starting point, as these companies are associated with the most severe negative stakeholder impacts. Such a portfolio, however, would still contain companies implicated in "Severe" controversies. Carnival and Rio Tinto, for example, remained in the World ex Worst portfolio. Investors with higher reputational sensitivities should be aware that excluding a broader set of companies implicated in less-severe controversies did appear to incur a cost in both unintended bets and stock-specific returns. It bears noting that for investors with higher reputational sensitivities, the proliferation of information and news

alert functionalities may seem to suit the purposes of avoiding association with poor press coverage. However, implementing exclusions based on the growing flow of news could quickly increase portfolio tracking error, as well as run the risk of excluding both false positives (negative news event that later prove to have no grounding) and false negatives (incidents that do not initially attract press coverage but in fact have large negative stakeholder impact).

Finally, for investors who aim to mitigate financial risks, our analysis suggests that purely excluding corporate wrongdoers is too blunt an approach. While allegations of corporate wrongdoing may sometimes connect to negative reputational and financial impact, the relationship does not appear to be universal. Company size, type of controversy (labor rights versus toxic spills versus bribery), and nature of media coverage may all play mediating effects that are not well understood. Additionally, allegations of wrongdoing are single events and ignore the industry and organizational contexts that can differentiate companies' capacity to rectify the negative stakeholder impact or mitigate the financial impact. A more holistic view of companies' risk management capacity is likely more effective for capturing potential financial impact from single negative events.

As allocations to ESG-related investments continue to grow, investors have become increasingly sophisticated, differentiated, and nuanced in the objectives they aim to achieve and the tools they use to implement their objectives. This study contributes to the growing literature on the performance implications of integrating ESG factors in portfolio construction. Whereas industry research in recent years has focused on taking a risk-based approach to integrating ESG factors, no research to date has explored the performance implications of the widely used approach in portfolio construction of excluding stocks implicated in harming stakeholders. This paper makes a first attempt to understand whether the implications of controversies-based exclusions are more akin to ethically based exclusions or to risk-based approaches. Our findings suggest the former. Investors should be cautious about making exclusions beyond the handful of worst offenders, given the potential impact on portfolio performance from unintended bets and uncontrolled stock-specific impacts.

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Appendix 1: List of MSCI ESG Controversies Categories

Sub-Pillar	PERFORMANCE INDICATORS
ENVIRONMENT	• Biodiversity & Land Use • Toxic Emissions & Waste • Energy & Climate Change • Water Stress • Operational Waste (Non-Hazardous) • Supply Chain Management • Other
CUSTOMERS	• Anticompetitive Practices • Customer Relations • Privacy & Data Security • Marketing & Advertising • Product Safety & Quality • Other
HUMAN RIGHTS & COMMUNITY	• Impact on Local Communities • Human Rights Concerns • Civil Liberties • Other
LABOR RIGHTS & SUPPLY CHAIN	• Labor Management Relations • Health & Safety • Collective Bargaining & Union • Discrimination & Workforce Diversity • Child Labor • Supply Chain Labor Standards • Other
GOVERNANCE	• Bribery & Fraud • Governance Structures • Controversial Investments • Other

Environment

Biodiversity & Land Use: This indicator measures the severity of controversies related to a company's use or management of natural resources where there is an alleged or anticipated negative impact on the environment, especially in ecologically sensitive areas. Topics covered under this indicator include issues such as species loss, reduction in biodiversity, habitat damage, depletion of or competition for natural resources, loss of economic value (for example, in fisheries or tourism), as well as post-consumer waste issues. Biodiversity impacts primarily caused by toxic releases are captured under the Toxic Emissions & Waste key performance indicator (KPI). Competition for water resources and controversies regarding water usage are captured under the Water Stress KPI. When there is a substantial impact on a local community that results from an environmental controversy classified under Biodiversity & Land Use, an additional controversy case is logged and assessed under the Impact on Communities KPI in the Human Rights & Communities sub-pillar; the assessment in that case is based on the impact on the community rather than the environmental impact.

Toxic Emissions & Waste: This indicator measures the severity of controversies related to a firm's operational non-GHG emissions or releases to land, air, and/or water. This includes controversies related to accidental spills or releases as well as the environmental impacts of standard operational emissions, whether within or in exceedance of levels allowed by permit. When there is a substantial impact on a local community that results from an environmental controversy classified under Toxic Emissions & Waste, an additional

controversy case is logged and assessed under the Impact on Communities KPI in the Human Rights & Communities sub-pillar; the assessment in that case is based on the impact on the community rather than the environmental impact.

Energy & Climate Change: This indicator measures the severity of controversies related to a firm's climate change and energy-related impacts. Issues covered include, for example, lawsuits over a company's alleged contribution to climate change, public controversy or criticism of a company's contribution to climate change, or status as an exceptionally large emitter of GHGs, as well as resistance to calls for improvement.

Water Stress: This indicator measures the severity of controversies related to a firm's water management practices. Issues covered include, for example, ecological damage resulting from water withdrawals, depletion of water resources for other users, and regulatory action or community disputes regarding the company's water usage. This indicator does not capture water pollution cases, which are covered under the Toxic Emissions & Waste KPI. When there is a substantial economic impact on a local community that results from an environmental controversy classified under Water Stress, an additional controversy case is logged and assessed under the Impact on Communities KPI in the Human Rights & Communities sub-pillar; the assessment in that case is based on the impact on the community rather than the environmental impact.

Operational Waste (Non-Hazardous): This indicator measures the severity of controversies related to the impact of a firm's non-hazardous, non-toxic operational waste, meaning waste, emissions, or effluents produced through normal operations and/or as part of the production of a product. Controversies related to toxic and hazardous waste emitted to air, land, or water are captured under the Toxic Emissions & Waste KPI. Controversies related to post-consumer waste are captured under Biodiversity & Land Use.

Supply Chain Management: This indicator measures controversies related to the sourcing raw materials or other inputs that have a substantial negative environmental impact. Issues covered include, for example, degradation of natural resources through use of raw materials that are resource intensive and/or waste intensive, including tropical hardwoods, palm oil, or unsustainable fisheries.

Other: This indicator measures any environmental issues that fall outside of the more targeted indicators listed above.

Social: Customers

Anticompetitive Practices: This indicator measures the severity of controversies related to a firm's anti-competitive business practices. Topics covered include, for example, price fixing, collusion, bid rigging, and predatory pricing. Business-to-business claims are generally not covered unless a regulator joins the suit. Likewise, standard pre-merger regulatory inquiries are not considered controversial.

Marketing & Advertising: This indicator measures the severity of controversies related to a firm's marketing and advertising practices. Topics covered include, for example, false or deceptive marketing or advertising, marketing of products for off-label uses, and controversies regarding the marketing of products to children or other vulnerable populations, labeling controversies, and spam or ad-ware. Controversies about known product safety issues are covered under the Product Safety & Quality KPI.

Product Safety & Quality: This indicator measures the severity of controversies related to the quality and/or safety of a firm's products and services. Topics covered include, for example, food safety, controversial media content, product recalls, service disruptions, and the use of chemicals of concern in products.

Customer Relations: This indicator measures the severity of controversies related to how a firm treats its customers or potential customers. Topics covered include, for example, fraudulent or improper billing, excessive or hidden fees, predatory financial products, and restricted or discriminatory access to products or services.

Privacy & Data Security: This indicator measures the severity of controversies related to a firm's privacy and data security practices. Issues covered include, for example, controversial legal uses of personal data,

security breaches, regulatory action against the company related to these, and changes to a company's policies or practices that erode customer privacy. Privacy issues affecting employees are captured under the Labor Management KPI in the Labor & Supply Chain sub-pillar. Government surveillance and related issues are captured under the Civil Liberties KPI in the Human Rights & Communities sub-pillar.

Other: This indicator measures any customer issues that fall outside of the more targeted indicators listed above.

Social: Human Rights & Community

Impact on Communities: This indicator measures the severity of controversies related to a firm's interactions with communities in which it does business. Topics covered include, for example, land use disputes, negative economic impacts resulting from environmental damage or the presence of company operations, disputes over access to economic opportunities or jobs, impacts of facility closures, and disputes over access to clean water, clean air, or other natural resources. Controversies that are primarily about environmental impact are classified under the appropriate Environment pillar KPI (e.g. Biodiversity & Land Use, Toxic Emissions & Waste). A case in which there are substantial environmental impacts in addition to community impacts may be logged and assessed under and environmental KPI as well as under Impact on Communities.

Civil Liberties: This indicator measures the severity of controversies related to the impact of a firm's operations on civil liberties. Topics covered include, for example, cooperation with repressive governments requiring censorship, conducting surveillance, or limitations on other civil liberties such as freedom of movement and freedom of the press. Violations of customer privacy are captured under the Privacy & Data Security KPI in the Customers sub-pillar. Violations of employee privacy are captured under the Labor Management Relations KPI in the Labor & Supply Chain sub-pillar.

Human Rights Concerns: This indicator measures the severity of controversies related to the impact of a firm's operations on human rights. Topics covered include, for example, complicity in killings, physical abuse, displacement, or other rights violations, as well as complicity with such actions by governments or other parties.

Other: This indicator measures any human rights or community issues that fall outside of the more targeted indicators listed above,

Social: Labor Rights & Supply Chain

Labor Management Relations: This indicator measures the severity of controversies related to a firm's labor-management relations. Topics covered include, for example, instances of wrongful termination, reductions in benefits, mistreatment of either employees or contractors, controversial workforce reductions, controversies over wages and hours, employee privacy issues, and forced labor.

Health & Safety: This indicator measures the severity of controversies related to the health and safety of a firm's employees, temps and contractors, and franchisee employees. Topics covered include, for example, on the job accidents, injuries, and fatalities, mental health issues, as well as kidnappings and physical harm experienced by employees in the field. This KPI does not cover health and safety issues in the traditional supply chain, for example in supplier factories; those issues are captured under the Supply Chain Labor Standards KPI.

Collective Bargaining & Union: This indicator measures the severity of controversies related to a firm's union relations practices. Topics covered include, for example, anti-union activities, efforts to prevent non-unionized employees from unionizing, strikes, lock-outs, and the use of replacement workers, acrimonious contract negotiations, and controversies regarding alleged breaches of union contracts. Organized strikes by non-unionized employees are also captured here. Union issues in the supply chain are captured under the

Supply Chain Labor Standards KPI. Health and safety issues raised by a union but not primarily about the company's relationship with the union are captured under the Health & Safety KPI.

Discrimination & Workforce Diversity: This indicator measures the severity of controversies related to a firm's workforce diversity, including its own employees as well as temporary employees, contractors, and franchisee employees. Topics covered include, for example, allegations of discrimination on the basis of sex, race, ethnicity, or other characteristic. Discrimination at supplier facilities is captured under the Supply Chain Labor Standards KPI. Discrimination on the basis of unionization or union sympathies is captured under the Collective Bargaining & Unions KPI.

Child Labor: This indicator measures the severity of child labor controversies in a firm's own operations or its supply chain. Topics covered include allegations that the company has used underage workers or that underage workers are present at supplier facilities.

Supply Chain Labor Standards: This indicator measures the severity of controversies related to workers in a firm's supply chain. Topics covered include, for example, allegations of unsafe working conditions, inadequate pay, excessive working hours or overtime, union issues at supplier facilities, the use of forced labor or prison labor by suppliers, and discrimination. Underage labor in supplier operations is captured under the Child Labor KPI.

Other: This indicator measures any labor issues that fall outside of the more targeted indicators listed above.

Governance

Bribery & Fraud: This indicator measures the severity of controversies related to a firm's business ethics practices. Topics covered include, for example, bribery, insider trading, money laundering, tax evasion or avoidance, violations of government sanctions, and accounting irregularities.

Governance Structures: This indicator measures the severity of controversies related to a firm's corporate governance practices. Topics covered include, for example, shareholder or board-level objections to pay practices and governance structures and shareholder resolutions seeking change to governance practices, as well as conflicts of interest, unethical behavior, or misrepresentation of, or lack of qualifications on the part of directors or senior executives.

Controversial Investments: This indicator measures the severity of controversies related to the social and environmental impact of a firm's lending, underwriting, and financing activities. Topics covered include, for example, financing projects that are controversial because of their actual or anticipated environmental or social impact, as well as criticism of mining companies, real estate investment trusts, and similar companies that receive royalties or own shares in a particular project that they neither own or operate.

Other: This indicator measures any governance issues that fall outside of the more targeted indicators listed above.

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Performance and Impact: Can ESG Equity Portfolios Generate Healthier Financial Returns?

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Abstract

Investors have yet to aggressively integrate environmental, social, and governance (ESG) factors into portfolio construction due in part to concerns about data quality and availability along with uncertainty around how integration might affect returns. A chief obstacle to overcoming these concerns is the abundance of ESG indicators with a paucity of data-fill. In order to test the hypothesis that using ESG criteria for security selection need not be detrimental to returns, we review which ESG performance metrics are disclosed by a critical threshold of mid- and large-cap companies in relevant sectors. We then use this data to rate firms from the S&P 500. This information is used to construct ESG portfolios and test their performance against a market capitalization weighted benchmark. We then review how investors can reduce their investable universe by a random factor and still outperform the market capitalization weighted benchmark, using non-market capitalization weighting schemes. Finally, we field test this hypothesis with a live risk-weighted ESG portfolio and test its performance against a market capitalization weighted benchmark. The results demonstrate it is not necessary for an ESG factor to have predictive power over future security prices in order to be applied in a fiduciary compliant context.

With proper portfolio construction, investors can align their capital with their values, whether around ESG, gender, faith, or something else.

Introduction

While an increasing number of investment managers are incorporating sustainability criteria into portfolio construction, most are not. The integration of environmental, social, and governance (ESG) data has challenged many portfolio managers for at least three, sometimes overlapping reasons. First, the data are incomplete and inaccurate, with diminishing corporate transparency in mid-cap and small public companies, as well as emerging and frontier markets. This data paucity, along with the reality that ESG data sources don't always agree on the underlying facts, has been an obstacle to adoption (Montiel et al., 2014). Second, while simple exclusionary values (screens) provide comfort to clients who wish to avoid sectors of the economy they abhor, some portfolio managers believe any reduction in an investable universe increases risk of benchmark under-performance, despite a large body of research that has found this not to be the case (Friede, Busch, and Bassen, 2015). Third, portfolio managers have varying views on materiality. Previous research (Khan, Serafeim, and Yoon, 2015) showed that companies with good ratings on material sustainability issues outperformed companies with bad ratings over long time frames. At the same time, companies with good ratings on immaterial sustainability issues did not outperform companies with bad ratings on these issues.

For portfolio managers focused on short-term returns, issues around data quality, availability, materiality, and diversification taken together have given ample reasons to avoid inclusion of ESG inputs. Despite these barriers, Amel-Zadeh and Serafeim (2017) find a growing number of investors who seek to use ESG inputs linked to financial performance.

In this paper we review ESG data that investors can use to group companies based on whether they align or do not align with a specific values-based preference. We then demonstrate how ESG factor integration is no better or worse than random security selection, which academic research has shown can lead to benchmark outperformance when combined with risk-efficient weighting. We then review a field test of this approach in the U.S. Equities (large-cap) market with a live product. The clear implication of this study extends beyond ESG, to a broader field of values-aligned investing.

State of the Data

This paper reviews ESG data from four categories: raw, public data disclosed by companies; transparent thematic ratings from issue-focused nonprofits; revenue segmentation techniques to map the percent of revenues companies own from products or services that serve a green or sustainable development theme; and nascent big-data attempts that sift through online media mentions of companies.

Raw Data Publicly Disclosed

While some of the major data providers, such as Bloomberg and Thomson Reuters, count over 400 ESG indicators, the vast majority of these are not reported by over 95% of mid- and large-cap companies, which limits their practical application. (It is worth noting that there are numerous initiatives to narrow down the ocean of ESG indicators and make a smaller, more relevant, and usable set. See World Federation of Exchanges, 2015; London Stock Exchange Group, 2017; SASB, 2015; Morgan Stanley, 2015.) In fact, for the 2014 performance year, we were only able to identify 24 indicators related to performance – not policy – that were reported on by at least 10% of mid- and large-cap companies as of December 31, 2016. Up to 20 of these indicators (depending on the industry) are included in the Corporate Citizenship Score used in this paper to split companies into values-aligned and non-aligned segments (see Table 1).[80]

Table 1: Corporate Citizenship Factors to Generate Company ESG Scores
(based on percentile ranking compared to industry peers)

Key Performance Indicators	Methodology
Energy Intensity	Revenue (converted to USD using **PPP exchange rate**) / (Energy use – **renewable energy use)**
Carbon Intensity	Revenue (converted to USD using **PPP exchange rate**) / GHG emissions: scope 1 & 2
Water Intensity	Revenue (converted to USD using **PPP exchange rate**) / Water use
Waste Intensity	Revenue (converted to USD using **PPP exchange rate**) / Non-recycled or reused waste generated
Innovation Capacity	R&D expenses / revenue – three year trailing
Percentage Tax Paid	Cash tax amount paid / EBITDA – five year trailing
CEO-Average Employee Pay	CEO compensation / average employee compensation
Pension Fund Status	75% (total DB and DC employer contributions/ FTE employees percentile-ranked against peers) + 1/4 (fair value of DB plan assets/FTE employees percentile-ranked - (1-(fair value of DB plan assets/liability percentile-ranked)
Safety Performance	Fatalities and lost time incidents

[80] The four factors that met the 10% reporting threshold in at least one industry but are not included in our scoring are: certified palm oil as a percentage of total palm oil produced/used/processed; fleet average fuel efficiency; percent power asset financing for renewable energy; and total amount of corporate or group donations/community investments made to registered not-for-profit organizations.

Employee Turnover	Number of departures / average total employees
Leadership Diversity	Female representation on board of directors, executive management team, and existence of a female CEO
Clean Capitalism Pay Link	Mechanisms that link senior executive pay to clean capitalism targets
Supplier score	▪ The company's largest supplier as determined by Bloomberg ▪ Largest supplier will be scored using the same new methodology for the 2017 Global 100 minus the "Supplier score" KPI.
Clean Air Productivity score	▪ Revenue (converted to USD using PPP exchange rate) / VOC emissions (25%) ▪ Revenue (converted to USD using PPP exchange rate) / Nox emissions (25%) ▪ Revenue (converted to USD using PPP exchange rate) / Sox emissions (25%) ▪ Revenue (converted to USD using PPP exchange rate) / Particulate matter emissions (25%)

Of these 20 indicators, some have nearly 100% disclosure because they are part of regulatory disclosures – percent female board directors and cash taxes paid as percentage of EBITDA, for instance. The majority of the indicators, however, fall within the domain of voluntary disclosures. For the past five years, the annual State of Sustainability Disclosure Report published by Corporate Knights and Aviva has tracked mid- and large-cap company disclosure of seven indicators. These indicators achieve at least a 10% report rate for the majority of industries (Corporate Knights & Aviva, 2016). But as Figure 1 and Table 2 illustrate, with the exception of payroll, fewer than half of mid- and large-cap firms across most sectors voluntarily disclose information on these seven indicators.

Figure 1: The seven sustainability indicators: disclosure by mid- and large-cap companies and as a percentage of the total number of large companies (2014 performance year). Source: Corporate Knights and Aviva, 2016

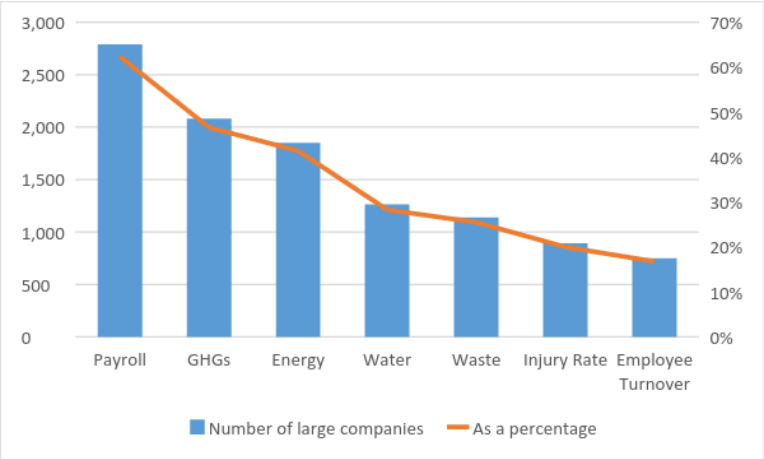


Table 2: Disclosure rate by Global Industry Classification Standard (GICS) sector, 2014. Dark grey cells imply worst disclosure rates, light grey imply best disclosure rates. Source: Corporate Knights and Aviva 2016

GICS Sector	Energy	GHGs	Water	Waste	Employee turnover	Injury rate	Payroll
Consumer Discretionary	38%	46%	24%	22%	11%	13%	61%
Consumer Staples	52%	51%	34%	32%	18%	27%	70%
Energy	37%	44%	33%	26%	20%	30%	44%
Financials	35%	30%	22%	19%	17%	12%	64%
Health Care	40%	31%	28%	26%	11%	20%	55%
Industrials	46%	52%	31%	28%	15%	23%	74%
Information Technology	38%	45%	22%	22%	12%	13%	46%
Materials	**56%**	**57%**	**46%**	**42%**	26%	**40%**	70%
Telecommunication Services	52%	55%	29%	30%	**34%**	29%	**80%**
Utilities	44%	51%	39%	32%	25%	27%	66%

Despite limited disclosure rates for any particular performance indicator, it is still possible to design a rules-based rating system rooted in these indicators that identifies which companies are lagging and which are leading; this scoring also takes into account firm size and industry type. In this paper, our Corporate Citizenship Score awards a zero to firms that do not disclose relevant indicators.

Thematic Ratings by Issue-focused Nonprofits

Complementing the raw indicators publicly disclosed by companies is an emerging ecosystem of transparent, thematic ratings produced by issue-focused nonprofits. In addition to Just Capital (2017), which rates 1,000 American companies on a range of indicators intended to reflect American values, we identified 12 nonprofit efforts to rate companies on a particular theme. Each of these ratings uses a replicable methodology. The ratings range from how well pharmaceutical companies are providing access to medicine in developing countries to percent of capital expenditure on projects that are likely to be stranded assets in a world that adheres to the commitments of the Paris Accord. (See Table 3 for a detailed description of each rating.)

Table 3: Nonprofit Thematic Ratings

Ranking Topic	Ranking Source and Details
Access to Medicine score	The Index analyzes 20 of the world's largest research-based pharmaceutical companies on how they make medicines, vaccines, and diagnostics more accessible in low- and middle-income countries.
Access To Nutrition Score	The Access to Nutrition Index (ATNI) is founded on the premise that food & beverage manufacturers can greatly contribute to addressing poor nutrition and related diseases. By assessing and ranking the world's largest manufacturers on their nutrition-related commitments, practices, and performance globally, ATNI aims to encourage companies to: Increase consumer access to nutritious and affordable foods and beverages through actions related to product formulation, pricing, and distribution; and Responsibly exercise their influence on consumer choice and behavior through actions in areas such as marketing, labeling and promoting healthy diets, and active lifestyles.
Animal Welfare	The Business Benchmark for Animal Welfare assesses how the world's leading food companies are managing risks and opportunities associated with farm animal welfare. It has established itself as a catalyst for influencing change in corporate practices on animal welfare management and reporting.
Percent of Upstream Capex Outside 2-degree Celsius budget (% band)	This new analysis provides a way of understanding whether the supply options of the largest publicly traded oil and gas producers are aligned with demand levels consistent with a 2-degree Celsius (2D) carbon budget. By allocating the carbon budget to potential oil and gas projects using the economic logic of a carbon supply cost curve, it is possible to identify which companies have the highest exposure to potential capital expenditure (capex) to 2025. This report provides a snapshot of the potentially unneeded capex spend for 69 global oil and gas companies, highlighting for the first time the wide-ranging degree of exposure amongst companies in the sector.
Corporate Human Rights Benchmark	The Benchmark ranks 98 of the world's largest publicly traded companies, from three at-risk sectors, on human rights performance.
Forest 500	The Forest 500 is the world's first rainforest rating agency. It identifies and ranks the most influential companies, financial institutions, and governments in the race towards a deforestation-free global economy. By objectively identifying and ranking the 500 powerbrokers that have large-scale influence

	over forest risk commodity supply chains, the Forest 500 holds companies, financial institutions, and governments accountable for their actions. The results and insights from the Forest 500 indicate shortcomings and gaps in powerbrokers' commitments, highlighting where greater action is required to achieve overarching deforestation commitments. Specifically, the Forest 500 assesses 250 companies, 150 investors and lenders, 50 jurisdictions, and 50 other powerbrokers, each selected based on their exposure to forest risk commodity supply chains.
Sustainable Fishing	The "Carting Away the Oceans" report evaluates and ranks major grocery stores on their commitments to sustainable seafood.
Human Rights Campaign (Equality)	Human Rights Campaign Foundation's 2017 Corporate Equality Index is the national benchmarking tool on corporate policies and practices pertinent to lesbian, gay, bisexual, and transgender employees.
InfluenceMap Performance	The rankings measure how a corporation or trade association behaves towards 2-degree Celsius aligned climate and energy policies. For corporations, the score (from A to F) can be viewed as an indicator of readiness for a transition to low-carbon policy globally.
KnowTheChain	In 2016, KnowTheChain benchmarked 60 large global companies on their efforts to address forced labor and human trafficking in their supply chains. Companies came from three sectors: information & technology communication, food & beverage, and apparel & footwear.
Sustainable Cotton	Rank a Brand scored company performance across three areas: policy, sourcing and use, and traceability. Most points were available for sourcing and use with companies assessed according to volumes used from Better Cotton, Cotton made in Africa, Organic, and Fairtrade – the four standards judged to be sustainable for this research.
Sustainable Palm oil	WWF Palm Oil Buyer Score Card evaluates major retailers, consumer goods manufacturers, and food service companies from the US, Canada, Europe, Australia, Japan, and India to see what percent of their palm oil is sourced sustainably.

The advantage of these ratings is that credible actors present them using transparent methodologies endorsed by institutional investors. The coverage is not universal, nor is it intended to be; rather, these thematic ratings focus on the biggest, most relevant companies. While these ratings do not help ESG-oriented investors determine the suitability of unrated smaller companies in a relevant sector, they can be used with some confidence to identify the relative merit of rated large actors.

Revenue-exposure Ratings

For most large, publicly traded equities, there are private databases that offer revenue exposure (by percentage) to climate-related or sustainable development goals. These databases include but are not limited to Bloomberg's New Energy Revenue Exposure field, MSCI's green revenue metrics and SDG revenue metrics, and FTSE-Russell's Environmental Markets and Low Carbon Economy database. A related product is the oekom Sustainability Solutions Assessment, which documents the extent to which companies further or hinder the attainment of the UN Sustainable Development Goals, or individual sustainability topics, through their products and services.

In addition to these private ratings, investors can also invent their own or use non-proprietary taxonomies for sustainable development or clean energy themes. These can be matched to segmented revenue databases like Factset Revere, Thomson Reuters, or Bloomberg to generate thematic revenue exposure scores.

Big Data

Big data offers the promise of factoring in real-time ESG information, which none of the above sources can do. We reviewed three notable efforts on this front represented by RepRisk, Arabesque S-Ray, and TruValue. RepRisk synthesizes data from media, stakeholders, and other public sources external to the company to produce daily data feeds on a range of themes and specific to one company. Arabesque S-Ray combines over 200 ESG metrics with news signals from over 50,000 sources across 15 languages to rate companies on human rights, labor rights, the environment, and anti-corruption. They also provide an industry-specific assessment of companies' performance on financially material sustainability criteria. TruValue's Insight360 data feed provides investors with daily updates and analyses on ESG-related issues for select public companies and industries.

We find the approaches used by RepRisk, Arabesque S-Ray, and TruValue to be a useful first-cut to help investors identify where companies sit on a particular set of values, but independent human review is still advisable before acting on these signals. Over time, advances in artificial intelligence and machine learning may obviate this need. Until then,

the challenges of issues related to discerning credible news from "fake news," detecting sponsored content, or parsing a product or company's incidental or direct relevance to a mention on the Internet inhibit the reliability of these feeds.

In this section we have reviewed four types of data sources: raw data reported by companies, thematic ratings by non-profits, revenue exposure, and real-time ratings powered by big data scrubbed from the internet.

For the purpose of this paper we used elements of the first three data types to split 500 U.S. large-cap firms into an ESG aligned list and an ESG non-aligned list. The client mandate in this instance was to avoid companies that derive revenue from tobacco (>5 percent), thermal coal (>30 percent), and weapons (>50%). The mandate also stipulated inclusion of best-in-class and exclusion of worst-in-class firms. A worst-in-class company from one of the nonprofit thematic ratings (see Table 3) was automatically classified as non-aligned. The remaining securities – generally more than 90% of the starting universe – were scored on three equally weighted factors: percent female board directors, overall corporate citizenship score (see Table 1), and percent exposure to new energy sources (BNEF New Energy Exposure). The companies with composite scores in the top half remained eligible for the portfolio.

After ESG scoring was complete, ~200 of the original SP500 remained eligible for inclusion.

A Theory on Why ESG Factors Aren't Prejudicial to Performance

A combination of ESG indicators can be used to create a scoring function, S, as long as the function results in an ordered set of stocks and the top N can be retained. Most investors would be fearful of doing this as it is akin to a random selection of securities from the portfolio. However, Arnott et al. (2013) show that a series of equally weighted random portfolios of 30 stocks (sampled from the benchmark) outperform the same cap-weighted benchmark over a 40-year period. The implication for investment managers is that buying firms assigned any ESG metric – a lower carbon footprint, for instance – can be done in a fiduciary-compliant manner provided the weights are chosen to maximize some risk-to-return goal. For factors assumed to influence security prices, Amenc, Goltz, and Lodh (2012) create reduced-universe portfolios based on variables such as market cap. These portfolios achieve a superior result compared to the market capitalization weighted benchmark in all cases except one: high volatility stocks weighted to reduce portfolio volatility. By using a risk-to-return weighting scheme these techniques result in greater risk-adjusted performance relative to the market capitalization weighted benchmark – findings that were borne out by Balkissoon and Heaps (2014) when using carbon efficiency scores to create carbon-reduced portfolios. Amenc and Shirbini (2012) show how market

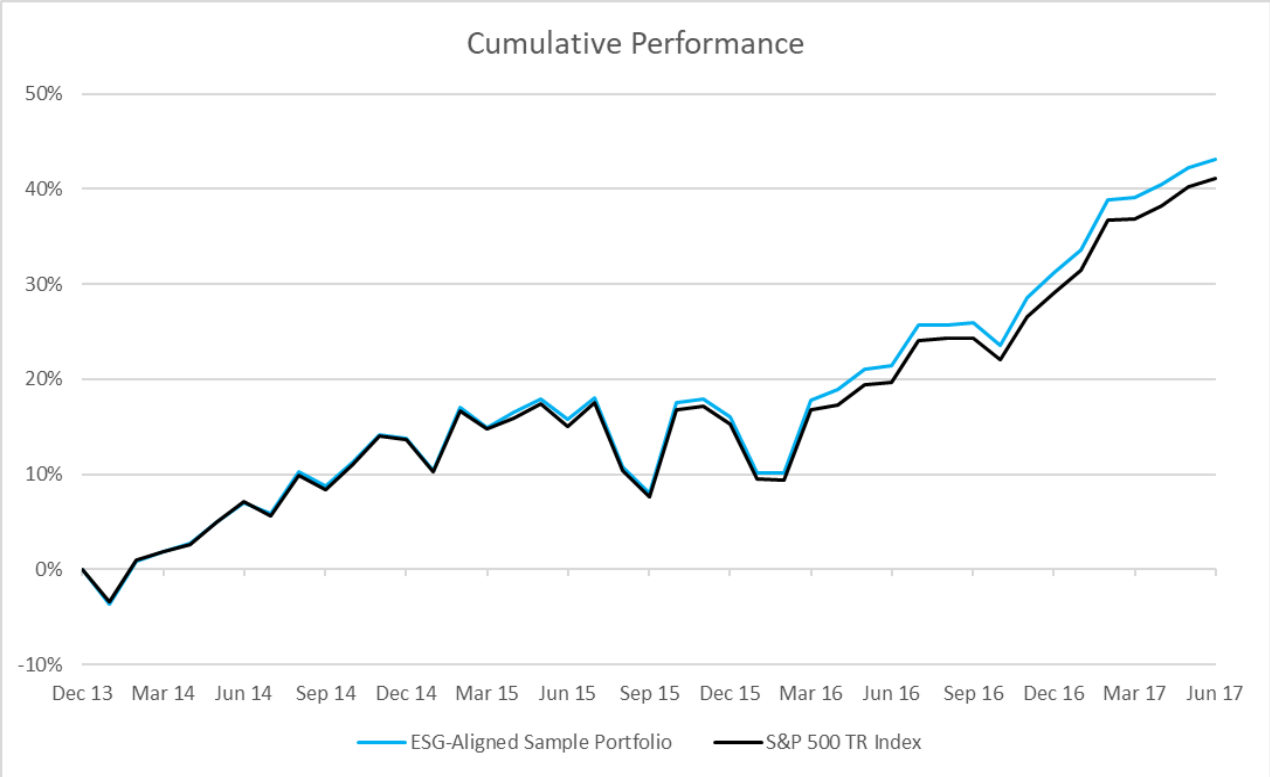
capitalization inefficiencies are compounded in a reduced investable universe (ESG screens), which furthers the case for weighting in an ESG-reduced universe.

Expanding beyond carbon-reduced portfolios, we analyzed the impact on portfolio performance of ESG factors representing good corporate citizenship. Good corporate citizens are companies that score in the top half on the composite of metrics outlined in Table 1. These companies are considered ESG-aligned.

In order to determine the value of a broad portfolio of ESG-aligned companies, we analyzed the members of the S&P 500 Index. For each consecutive January 1st starting in 2014, the holdings of the index were divided into ESG-aligned and non-aligned companies. We readjusted the percentage of the basket after eliminating the non-aligned firms, yielding a new weight to reflect the percentage share within the ESG-aligned group. This sample portfolio is rebalanced each January 1st and the constituent holdings drift in weight between these rebalances. The performance of the sample portfolio would likely improve with quarterly rebalancing.

The sample portfolio provides a remarkably similar return and risk profile to the S&P 500 TR Index (SP500TR). Although the sample portfolio outperformed from January 1, 2014 through June 30, 2017, the annualized amount was minimal, at 0.46%. The sample portfolio and the SP500TR are correlated 0.9982 and the tracking error was small, at 0.65%.

Figure 2: Cumulative performance of ESG-aligned sample portfolio compared to S&P 500 TR Index.

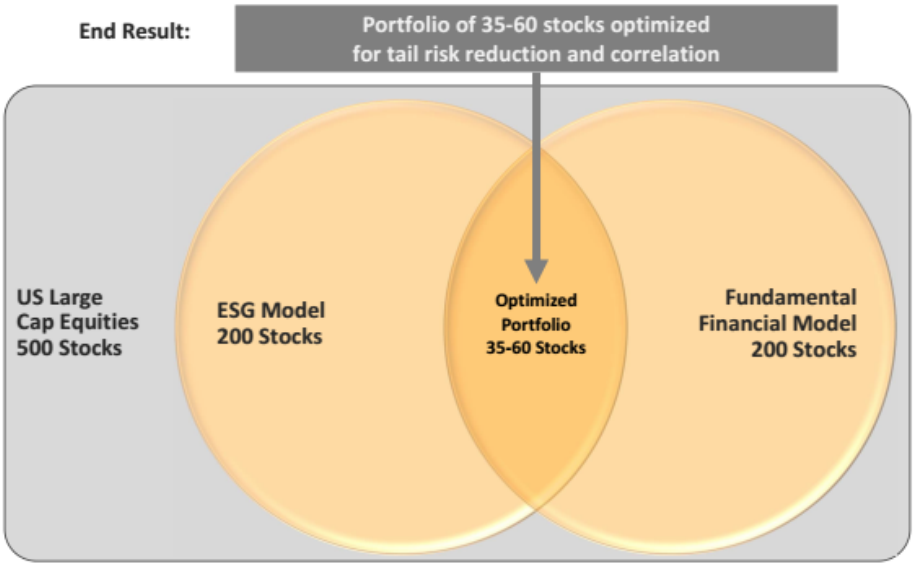


Further, the distribution of returns of the sample portfolio was quite similar to that of the SP500TR. The skewness of the sample portfolio for the period was 0.1653 and the SP500TR was 0.1338. The kurtosis of the sample portfolio for the period was 3.535 and the SP500TR was 3.364. The closeness of the two distributions shows that the sample portfolio exhibits extremely similar risk profiles. These analyses clearly demonstrate how splitting a portfolio based on ESG factors is akin to random selection.

Putting the Theory into Practice

When deploying this technique, given a preference or scoring function, S, any series of ESG indicators with coverage for the variables of interest can be used as long as that function can create an ordered set of securities. With an ordered set of securities we can cut a benchmark in half, effectively randomly sampling the securities that are preferred by the investor. We then intersect this set with securities from a predictive model based on standard fundamental ratios. Finally, we optimize this set to maximize diversification and reduce tail risk as shown in Figure 3.

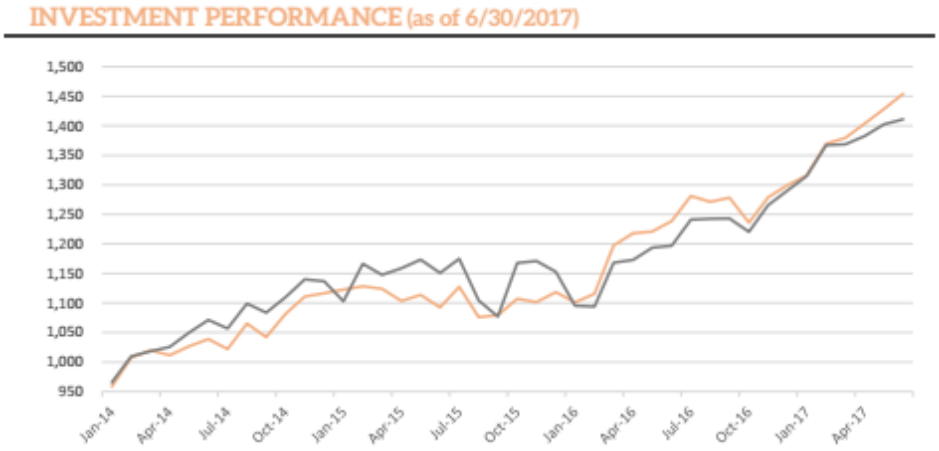
Figure 3: Optimization Venn Diagram of ESG Integration.
Source: Stance Capital, 2017



This process allows us to switch out any ESG screen or model and intersect with any source of alpha, edge, or manager edge, similar to the way value managers or fundamental managers have their picks. The only requirement is that the manager has sufficient breadth in his edge and can identify a large enough candidate pool.

Figure 4: Investment Performance of ESG+Fundamentals+Efficient Weighting vs. Benchmark. Source: Stance Capital, 2017

		Last 3 months	YTD	Last 1 year	Last 2 years	Last 3 years	ITD
	Stance Equity (Net)	5.44%	11.91%	17.37%	33.09%	40.01%	45.42%
	S&P 500 TR	3.09%	9.34%	17.90%	22.60%	31.70%	41.10%



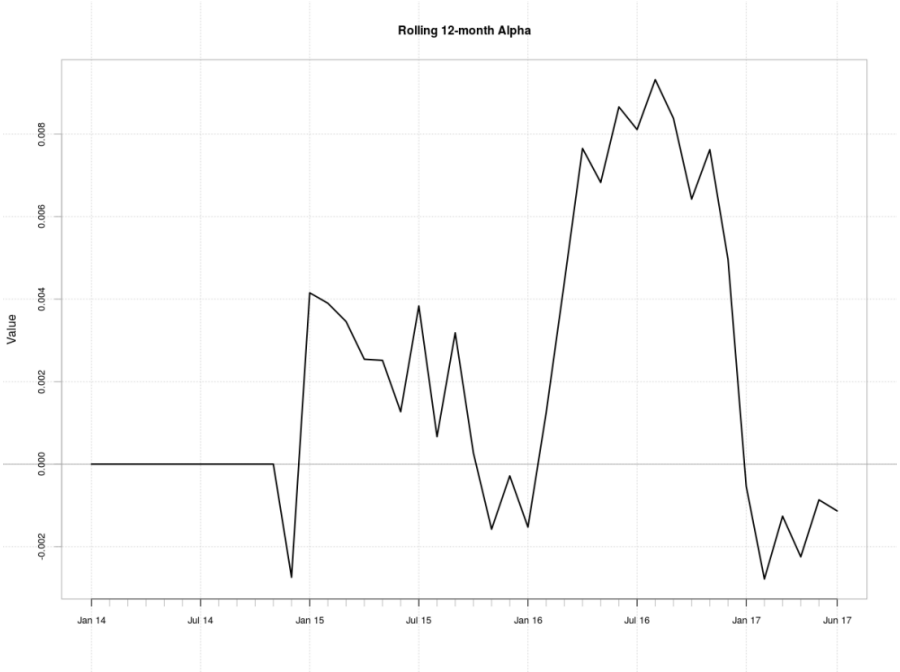
As shown in Figure 4 and Table 4, our cumulative performance net of fees has been better than benchmark SP500TR. However, given our lower level of risk, this product offers superior risk-adjusted performance when compared to the benchmark.

Table 4: Investment Performance of ESG+Fundamentals+Efficient Weighting vs. Benchmark. Source: Stance Capital, 2017

	Stance Equity	S7P 500 TR
Cumulative Return	45.42%	41.10%
Annualized Return	11.29%	10.34%
Standard Deviation	8.37%	10.10%
Sharpe	1.35	1.02
Alpha	4.51%	0.00%
Beta	0.64	1.00
Treynor	17.57%	10.34%
Max Drawdown	4.61%	8.36%
Up Capture	81.7%	100.00%
Down Capture	51.22%	100.00%
R-Squared Adjusted	59.23%	100.00%
Correlation	0.78	1.00
Downside Deviation	2.37%	2.83%
Value at Risk	-2.99%	-3.74%
Sortino	72.91%	54.89%

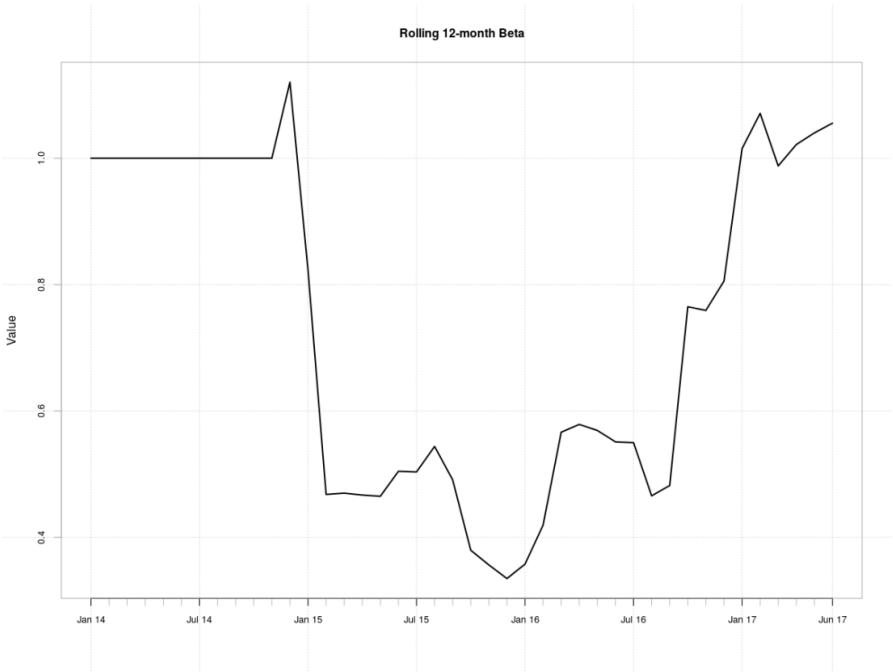
Looking at the rolling alpha in Table 4 – single factor vs. the SP500 – we see how the product generates positive alpha in most periods net of fees.

Figure 5: Monthly alpha of the portfolio vs. the benchmark S&P500



Looking at the rolling beta in Figure 6 – single factor vs. the SP500 – the ESG portfolio has run a lower beta for most of the period.

Figure 6: Rolling 12 Month Beta of the portfolio relative to the S&P 500



Finally, we perform Fama-French Regression in order to identify if our outperformance is due to manager skill or some other factor (Table 5).

Table 5: Fama-French Regression of the portfolio vs. the Fama-French Factors

	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.0049690906	0.0025231995	1.9693609836	0.0562343451
Mkt.RF	0.0060868267	0.0008425365	7.2244068435	1.22482436163804 E-008
SMB	0.0002779498	0.0010044042	0.276731006	0.7834863845
HML	-0.0010309457	0.0009493289	-1.0859731058	0.284332129

We see that the alpha is significant at the 10% level and the most significant factor in explaining our returns is the market risk premium; firm-size premium and value factors are not useful.

We see an alpha that is slightly significant at 10%, which may be an artifact of our low sample size or potential over-fit from the other two factors, firm-size premium and value premium. However our single-factor alpha is significant at the 5 percent level. We have back tested portfolios using gender diversity, carbon, water, and, as long as the weighting is optimized using non-market capitalization schemes, investors can expect outperformance in the long-term.

Conclusion

With over 1,750 signatories from 50 countries representing $70 trillion aligned around the Principles for Responsible Investment, ESG investment portfolios are on the rise and likely here to stay. That said, considering the scope and scale of ESG, it is surprising that its value appears to be both misunderstood and poorly positioned. Our view is that good ESG behavior (around material issues) is a proxy for good management – that is all. Other variables (including cost) being equal, most investors would rather invest in a well-managed company, as doing so will likely mitigate future tail risk and further position the investment for long-term out-performance.

But portfolio managers are largely incentivized (compensated) for near-term results, and, given it's not clear that ESG considerations will provide an immediate performance edge,

managers that don't buy into the benefits of ESG are not being penalized for their point of view. Nor do they fully understand the potential of ESG.

The ESG screen and split-field test presented in this paper demonstrates the ability to generate compelling risk-adjusted and absolute outperformance using ESG criteria. Given the limited role ESG selection criteria has played in the performance of our use case, we were able to model similar risk-adjusted and absolute benchmark outperformance across a range of values-based strategies. These include: gender, faith, and low carbon. As long as ESG criteria mimics random security selection, ESG factors can be used to split an investable universe, which can be expected to outperform the benchmark when combined with fundamental value screens and risk-efficient weighting.

This is a powerful result as it allows portfolio managers to create portfolios that take into account the preferences of their clients while also being able to generate excess after-fee returns. These results imply that if investment managers can provide non-financial utility in the form of better ESG impact for their clients, ESG investing is no longer a question of "why," but "why not."

This study adds to the growing body of work around the value of ESG integration. Specifically, we demonstrate the potential for ESG outperformance while placing ESG factor integration within the context of its utility: the ability to align capital with values without sacrificing performance. Values, importantly, need not be limited to ESG, but can include any ethical preferences.

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Measurement and the Circulation of Risk in Green Bonds

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Abstract

Since their invention in 2007, green bonds have become a key mechanism by which money is channeled into environmentally beneficial projects. However, questions about what, exactly, is "green" about green bonds remain open. This lack of consensus represents one of the major obstacles to continuing to scale green debt. To explore the challenges of ascertaining and communicating potential environmental benefits, this article explores the range of institutions involved in the origination and distribution of green bonds. It does so by conceiving of the connections between these institutions through the communication of risks, both financial and environmental, as the infrastructure of green bonds. The relative complexity of this infrastructure compared to that of "vanilla" debt, owing to the added nodes of environmental risk, is a core challenge. The article includes a visualization of this infrastructure of risk that demonstrates moments in which risk is originated, combined, partitioned, and held. The paper concludes with brief reflections on the utility of conceiving of the green debt value chain as the infrastructure of paired environmental-financial risk.

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Introduction

Green bonds have emerged over the last decade as a key financial mechanism for channeling investment into climate change mitigation and adaptation. From their creation by the European Investment Bank in 2007 until 2014, green bonds were a niche financial product issued primarily by multilateral development banks to support green lending programs. Early green bonds lacked standardization and wider awareness, inhibiting widespread uptake. However, the asset class has enjoyed explosive growth over the last three years as corporates, municipalities, and now sovereign issuers have begun issuing debt with an explicitly "green" label. This shift has channeled substantial capital into environmentally inflected projects, particularly around renewable energy and energy efficiency. Issuance surged to roughly US$80 billion in 2016 (Thomson-Reuters 2017).

While recent growth in green bonds has been impressive, some observers fear the asset class is entering a "valley of death" (Lazarova 2016), as investors with an appetite for green debt become satiated. There is also a concern that metrics for communicating "greenness" – both environmental benefits and the risk that those benefits will not be achieved – are not sufficiently developed or standardized to scale the market as its proponents envision. One way this challenge to scale manifests is uneven use of green bonds across different jurisdictions and industries. This unevenness is due, in part, to variations in pre-and-post-issuance reporting of intended/actual use of either proceeds or environmental benefits achieved. This means that various actors throughout the investment process don't necessarily receive sufficient information on the environmental risks that are commodified in green bonds (see Tripathy, 2017).

This paper examines how risks, both environmental and financial, are quantified, communicated, combined, and distributed throughout the green bond value chain, focusing especially on environmental certification and credit ratings as twinned practices of risk evaluation. It contrasts the degree to which these evaluation practices are commensurable, and so intelligible, to different actors throughout the value chain. To demonstrate the way that financial and environmental risks are originated, partitioned, distributed, and held, the article offers a visual schematic of risk creation and transfer over the life of a green bond. The schematic highlights the moments at which environmental and financial risk diverge or must be sutured together. These moments represent opportunities to commodify these increasingly inseparable risks in a financial form. They also complicate matters for buyers who are unused to evaluating environmental criteria or who face regulatory definitions of fiduciary responsibility that make the incorporation of ESG criteria into investment decisions challenging.

Conceptually, the article starts with the supposition that all financial products represent quantified and priced risk, partitioned and rendered fungible through specific practices up and down the value chain (Dean 1998). That risk is then communicated through key indicators. It is transferred to others by public reporting on the "green" components of a given bond and contractual arrangements, from standard underwriting and bookrunning to post-issuance green auditing. These social artifacts and their practice comprise the infrastructure of risk in green debt: environmental risks are packaged with financial risks in any given green bond, creating different practices whereby risk is transferred to different sets of actors.

The construction of this risk infrastructure is both the primary opportunity and challenge for the growth of the green bond market. The quantification and communication of financial risk through pricing in debt are thoroughly mature and widely agreed upon practices, signaled most explicitly by credit ratings. While green bonds are generally used to fund specific projects or types of projects, the risk of default is (for the most part[81]) based on the full balance sheet of the issuer (Cochu et. al 2016). This makes the evaluation of financial risk relatively simple for buyers of that debt, and hence straightforward to manage.

However, the evaluation of environmental risks in green bonds, both material and reputational, remains an evolving set of practices. There is no consensus on the best way to ascertain the possibility that green goals will not be met. Nor are there agreed upon sanctions in the event of "green default" – there is not even agreement on whether there should be formal sanctions at all. Various standards bodies, financiers, and governments have devised systems for assessing the environmental bonafides of an issuer's approach to green debt, resulting in a fragmented landscape of risk evaluation practices, and hence an incomplete infrastructure of risk origination, distribution, and management. Environmental standards also differ widely across jurisdictions. Even reporting within the same standards regime may be irregular depending on the detail available through audit reports. The communication and distribution of environmental (and twinned environmental/financial) risk may therefore not be uniform even where one might expect convergence.

While understandable in a new asset class, the lack of harmonization is a problem for some issuers, as it imposes transaction costs beyond simply the money needed to verify a green bond. In turn, this limits the number of entities who label their debt, and so slows the

[81] Other kinds of debt that are not based on the issuer's entire balance sheet, including asset-backed securities, are becoming increasingly common.

overall pace of market development, including standardization of metrics. Much of this challenge is rooted in the integration of risk into green bonds.

The Intricate Practices of Risk Integration

I argue that the evolution of climate bonds exemplifies the challenge of folding two different kinds of risk into new debt products: both the commodification of financial risk and the risk of failing to achieve environmental objectives. Because green bonds are both a relatively well understood debt instrument and an environmental derivative at the same time, the challenge of rendering them a standard and standardized asset class turns on the numerous steps of risk origination, transfer, and holding (Tripathy 2017).

Simply put, green bonds are conventional debt instruments used to finance environmentally friendly projects. These projects are often explicitly tied to climate mitigation or adaptation, but there are seemingly limitless possibilities for environmental application. This basic premise is why green bonds have potential to be a critical asset class for financing green transitions: they are familiar to the investment world.

The origination and trading of debt instruments is among the most foundational financial practices in the modern economy. Global outstanding debt hovers around US$100 trillion – the largest reliably quantifiable asset class in the world. As supporters of green bonds are keen to point out, capturing just a fraction of this debt with a few tweaks to current practices could address the myriad environmental funding gaps (e.g. renewable energy, urban infrastructure, or even biodiversity conservation). In contrast with many of the exotic environmental derivatives that proliferated since the 1980s, such as carbon markets or wetlands banking, green bonds can be easily explained to investors. Nor do they hinge on key politically-defined metrics (e.g. additionality), making them less prone to regulatory capture (Drew and Drew 2010). But despite their relative simplicity, green debt is more involved than conventional "vanilla" bonds.

Green bonds foreground environmental benefits, which is both the premise of the asset *and* the primary challenge to scale. Making the "green" risks embodied in each bond easily intelligible and subject to evaluation in the same way as financial risks requires new metrics. Thus, risk evaluations must be developed that are simple enough for integration into fixed-income managers' matrices but detailed enough to satisfy environmental campaigners, government regulators, and financial industry backers. On the one hand, if the links between a bond and environmental benefit appear tenuous to investors, then the potential for perceived greenwashing looms large. This does reputational damage not only to the issuer, but also the environmental verifiers and auditors, the underwriter(s), and the holders of the debt. It also damages the reputation of labeled green debt as a whole,

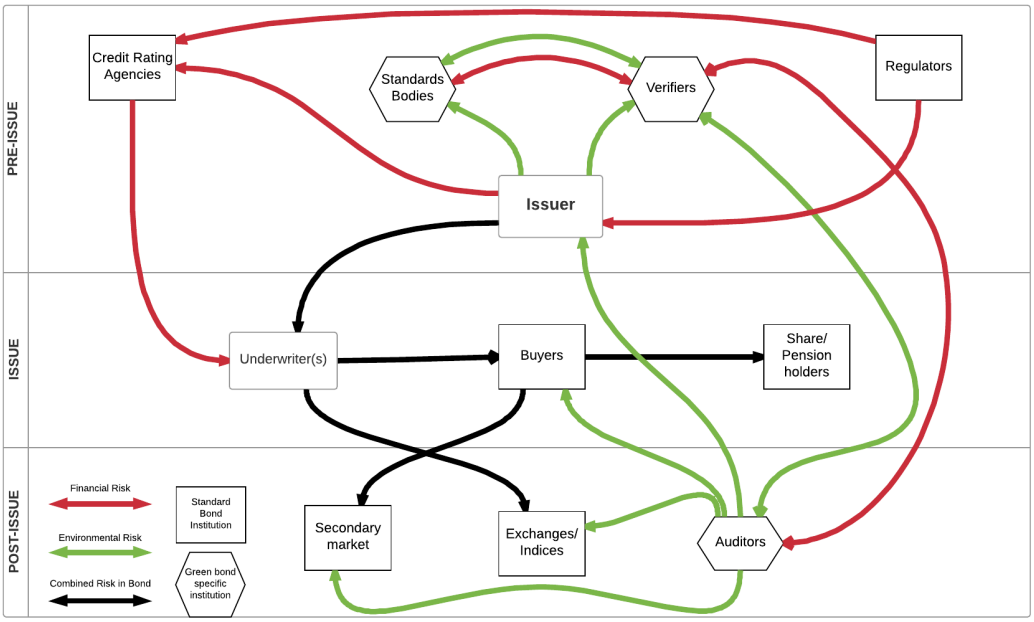
potentially hindering further scale-up.[82] On the other hand, if reporting standards are perceived as onerous – and in the absence of any aggressive regulation – issuers will forego the transaction costs of green labeling and potential purchasers will stick with easily intelligible, but perhaps environmentally harmful, vanilla debt. This disconnect has led some issuers that might be expected to issue green debt to forego the label (e.g. Danish utilities). The issuer avoids added transaction costs this way and trusts that environmentally conscious buyers will proactively seek appropriate opportunities.

I explore what we might think of as the constitution of green bonds as an asset class that packages environmental and financial risk together in a particular way. The *raison d'etre* of these practices, like environmental assessment methodologies, pricing structures, and secondary market indices, is to facilitate the origination, commingling, holding, and trading of environmental and financial risk. The commodification of risks is conducted through these practices with the goal of realizing financial returns while simultaneously rectifying environmental crises. That is, green bonds represent a (largely) private sector endeavor to come to terms with the historical tendency to treat nature as a free gift to capital by pricing environmental risk into existing financial products. I consider how this risk infrastructure is constructed in rather abstract financial space. I also look at how this market and its infrastructure conceptualize and circulate risks through two evaluation practices – environmental certification and credit rating.

The importance of metrics cannot be overstated in the development and future growth of green bonds. After all, how do we know something is "green," especially when the disparate bits that comprise that something become fungible, commodified representations of financial risk that represent everything from thermal power sulfur scrubbers in China to energy efficient housing retrofits in Sweden? Figure 1 presents a visual schematic of the moments when risks, both environmental and financial, are formally communicated through the various actors in the development, issuance, and circulation of a green bond. While not exhaustive, it highlights the diversity of actors for whom any given metric or reporting mechanism must be intelligible, as well as the sheer volume of extra connections required when making debt green. So, with that motivation in mind, we move to the nuts and bolts of suturing environmental and financial risk together in a green bond, how that risk is represented, and the challenges to circulating those risks.

[82] All that fallout can occur from *perceptions*, to say nothing of the lack of regulatory enforcement mechanisms in the case of actual "green default."

Figure 1. Risk transfer in green bond investment chain



A Brief History of Green Bonds

The European Investment Bank (EIB), the EU's multilateral development bank, issued the first labeled green bond in 2007 as a "Climate Awareness Bond." The bank was raising capital to lend to member states in both the EU and Africa; these states were pursuing low-carbon investments. As the initial offering in the green bonds space, there were no definitive rules for what constituted "greenness," so the EIB made up its own.

Ten years later, there is still no standard for what constitutes greenness. Any debt issuer can label their bond offering green regardless of what it ultimately finances. While standards, rules, and norms have proliferated, their application remains uneven, both conceptually and spatially. Risks of greenwashing stalk the asset class and contribute to many of the decisions and developments in the market. Financiers who have a genuine interest in facilitating "the great transition" build self-governance mechanisms into green bond infrastructure to insure the bona fides of a given bond. These assurance mechanisms are to mitigate the risk that proceeds of green debt will be spent on something considered "un-green," thereby doing reputational damage to the issuer and the nascent asset class as a whole.

After that initial issuance by the EIB, the green bond market developed slowly, driven largely by multilateral lenders like the EIB and the World Bank. The promise of green bonds was still novel and unproven, investors were largely unaware of them, and pricing remained unclear. For instance, should the incorporation of poorly understood

environmental risks entail higher rates, or should the altruistic intentions of the bond create a discount (Petrova 2016)? This question remains largely unresolved.

Growth began to accelerate in 2014, when sub-sovereign issuers, particularly US municipalities and European provinces, began issuing highly rated debt to finance municipal infrastructure projects tied to climate change. These bonds were joined by corporate issuance – especially banks' – as the market matured and standards and metrics for determining what constitutes green developed. For a time, the global distribution of debt issuance was largely confined to the US and Europe, where the lion's share of the proceeds was also spent. This has recently changed, as China, India, Mexico, Poland, Indonesia, and a raft of other countries and entities have begun offering labeled green debt (CBI 2017).

Nowhere is this more pronounced than in China, which went from close to zero green debt to being the leader in issuance in 2016, largely because of regulation and government encouragement. Of the roughly US$80 billion issued globally in 2016, China raised more than US$23 billion by various state-backed banks (Thomson-Reuters 2017; see also Zhou 2017). Another recent development that bears mentioning is the growth of green bond indices, which each have their own criteria for inclusion. These demonstrate the degree to which green bonds have moved from an experimental to a mainstream financial product. They also play a central role in determining which standards issuers adhere to, and hence the route that risks take in their commodification (Macpherson 2017).

Green bonds today generally adhere to a standardized definition of both environmental commitment and transparency, assuring investors that their commitments will be, or were, met. A bond can be aligned to five primary standards, ranging from the Climate Bonds Initiative's in-house definition, which is the most rigorous and requires the highest level of transparency, to rules recently issued by the Chinese investment authorities. The most widespread standard in use is the Green Bonds Principles, coordinated by the International Capital Markets Association. These principles are becoming the de facto baseline standard for bonds issued in North America and Europe. Adherence to them is the primary criterion for inclusion on a small but growing number of green bond indices compiled by market service providers and exchanges, including Bloomberg and the London Stock Exchange.

The growth of these indices is critical for the development of green bonds as an asset class. It demonstrates that serious institutions take them seriously. More important, it facilitates trading in secondary markets by significantly reducing transaction costs for secondary market participants.[83] As in all environmental markets that promote the exchange of

[83] These indices relieve buyers of the need to conduct detailed environmental due diligence. They lower transaction costs and thus encourage further issuance by allowing purchasers to apply their standard financial analysis with minimal complications from additional green risk metrics.

environmental benefit quantified into a security with a specific price, secondary market liquidity is a critical factor for the development of the asset class. For green bonds specifically, this means the possibility of bond traders who hold debt for short periods participating in trades. However, this also requires that issuances be large enough that secondary trading will always be available, anecdotally above US$500 million.

Infrastructure of Green Bond Risk

Building on this background, I turn to explore the infrastructure and commodification of risk in the green bonds asset class. By infrastructure of risk, I mean the pathways by which risks, both environmental and financial, are originated, partitioned, distributed, and held from top to tail in the green bonds market. It has only become possible in the last two years to speak of green bonds as having an infrastructure. In this time, the asset class has solidified and key path dependencies evolved through the development of standards and a sufficient volume of deals; patterns have become identifiable. The path dependencies that we see largely follow the established route of risk origination, transfer, and holding in existing types of debt. But the network possesses new nodes owing to the inclusion of environmental risk – for example, green standards bodies and environmental auditors.

The environmental risks under consideration are not, for the most part, immediate threats to property and life. Instead, to date, 95% of green bonds have been issued to fund climate mitigation through energy efficiency, renewables, or public transport (CBI 2017). As a result, the risks distributed through green bond infrastructure are primarily reputational, in the event the projects financed by a given bond fail to deliver. To illustrate this, I will work through an idealized green bond, highlighting the moments where risk is originated, partitioned, distributed, and held by different actors. The network these actors comprise forms the infrastructure of the green bond market, in conjunction with material methods of assessment, like forms for validating the green credentials of an issuer or financial statements for determining creditworthiness of borrowers.

The first step in issuing a green bond is for an issuer to identify either an existing set of assets or future assets to finance. These assets must be, in some way, associated with greenness. The Climate Bond Standards identify six classes of environmental concern a bond can finance, from low carbon buildings to water conservation. Other standards are broader in their definitions: the Green Bonds Principals has 37 categories for eligible project types, all with their own construction and delivery risks. The issuer must also draft a set of criteria and assurance mechanisms to affirm the funds raised through the green bond will not finance "brown," or environmentally damaging, projects – a first hedge on environmental risk. A verifier – either one of the big four, or a specialized environmental auditor, such as CICERO – then signs off on the protocol.

The audit presents the first moment of environmental risk origination, partition, and transfer, as some of the environmental risk is passed from issuer to verifier; verifiers are then exposed to reputational damage if the issuer does not live up to its environmental commitments. To minimize risk, the verifier evaluates the green assurances of the issuer. It is increasingly common, and also best practice, to release this evaluation publicly. This marks another potential moment of risk distribution, as prospective buyers of green debt use these verification statements to evaluate the environmental risk of a particular bond.

Sharing risk through environmental disclosure, even using a standardized, easily understood metric, does not necessarily reduce risk. Rather, it can spread the risk by increasing the likelihood of circulation, with more buyers willing to accept the green risks. If an issuer fails to disclose their green certification, however, they acquire additional financial risk as their debt may be excluded from listing on secondary markets or indices that ESG-oriented investors follow. Non-disclosure is also off-putting to primary market buyers in many jurisdictions, which reduces demand. The quality of public risk assessments as it relates to verification also remains uneven. KPMG often offers a one-page statement certifying that they find an issuers' approach to environmental/financial management sufficient. CICERO, meanwhile, provides an in-depth exploration of the framework and representative projects the bond will (re)finance, along with a grade for the approach on a continuous, color-coded scale. As such, picking different verifiers carries a distinct set of conjoined financial-environmental risks.

Simultaneous with or just after verification, a potential bond can be assessed for compliance with one of the green bond standards. Some standards are more narrowly focused on carbon reductions, while others are tailored to local concerns, like urban air pollution for those originating in China. Each standard also has different requirements for ex-anti and ex-post reporting of green credentials. These are explicitly environmental, *not financial*, standards. The financial rating of green bonds and borrowers is left to the existing credit rating agencies. This allows environmental standards bodies to partially divest themselves of risks (and potential financial liabilities), which are instead held by groups like Moody's and S&P. In an interesting development, credit rating agencies themselves are beginning to offer environmental ratings of bonds, which, while separate from their financial rating systems, more directly tether the two forms of risk in a single corporate actor and in the performance of the bond (Moody's Investor Services 2016).

Once issuers have identified projects for (re)financing and adopted and verified a framework, they contract with one or several underwriting banks. These are typically major investment banks that operate in the jurisdiction where target buyers are located and hold significant balances in the relevant currency. As in all bond issuance, this contract represents a significant – if not *the most* significant – moment in both risk origination and distribution. The underwriter(s) becomes the temporary holder of the full debt load;

assumes the responsibility for pricing the debt (in conjunction with the rating agencies) and finding buyers; and, in the event the entire debt offering does not sell, promises to buy the unsold portion of claims to that debt. The packaging of financial debt and environmental risk through practices of evaluation and pricing represents the moment when these risks coalesce into a commodified form. From here, the commodity can begin to circulate, spreading risk to new nodes.

After underwriting, the financial risk embodied in the bond is distributed to buyers. The environmental and financial risk becomes partitioned more broadly as institutional purchasers, in effect, distribute the conjoined risk across shareholders or pension members. Thus far in the short history of green bonds, a relatively small group of investors has been particularly keen on green bonds: institutional purchasers who have a CSR or ESG mandate, sovereign funds, and investment banks with dedicated ESG (or even green bond) funds. Fixed-income institutional purchasers tend to have very low financial risk tolerance, which manifests in avoidance of environmental/reputation risks that have little historical performance data. With every green bond issuance, however, comes new data that can be used to evaluate the environmental risk commodified in green bonds. This facilitates the further commodification of risk by making it easier for risk-averse investors to purchase green debt, demonstrating increased demand, prompting further issuances.

Described as a virtuous circle by the Climate Bonds Initiative, such a progression turns on the propagation and consolidation of data practices (CBI 2017). Herein lies the rub: there is currently a tradeoff with sharing information about conjoined environmental/financial risk to spur new investor involvement. On the one hand, simple reporting that can be integrated into existing spreadsheets may appeal to fixed income investors with limited capacity to evaluate green bona fides. On the other hand, simplified reporting will miss out on nuanced information that is critical for building confidence in the asset class's capacity to deliver real environmental benefit. This data relationship, perhaps more than any in the green bonds investment chain, lies at the crux of both the promise of green bonds but also of metrological challenges associated with scale-up.

The fiduciary responsibility to provide the highest rates of return at the highest level of certainty (as in the case of pension fund managers) emerges as a key issue at this point. For example, many US and European based pension funds are only authorized to invest in AA/AAA rated securities. Debt issued in Global South countries or by corporates based in those countries, with lower or no credit rating, is therefore off limits. Even though data associated with green bonds in the Global South is often more robust than in the North, this prohibition restricts the types of commodified risk that can flow to some institutional purchasers. Further, a quirk in US tax law exempts US-based investors' returns on municipal debt from capital gains tax, fundamentally shaping the geography of risk circulation in the municipal bond market. Domestic investors and traders hold a huge

proportion of US municipal debt at a discount, inhibiting US municipal green debt (and its risks) from circulating more broadly despite the generally high quality of data associated with this debt. At the same time, many institutional investors are highly risk-averse, with limited capacity to evaluate environmental risk, or even to report on environmental risk provided by pre-issuance validators. This means that European pensions, which have been granted more license than many of their US counterparts to pursue environmentally beneficial investment, may be shut out of the US municipal market, though it is the largest in the world and has massive climate-related infrastructure needs (ASCE 2017). These are only two of the legal quirks that restrict the circulation of risk in fragmented global markets – restrictions that cannot be solved by better reporting, but only legal revision.

The final phase of risk communication and circulation is the secondary market, where claims on already existing debt are traded. Prior to this stage, most aspects of a transaction that packages environmental and financial risk together are bespoke, contractual arrangements, from issuer-verifier relationships to prior agreements between book-runners and buyers to purchase debt pre-issuance. As noted above, indices and exchanges are enrolled at this stage to facilitate liquid electronic trading, where risk assessment techniques of the various standards bodies reach back to the initial practices of risk origination and partition. Indices and exchanges ranging from Bloomberg to the Luxembourg Bourse require adherence to standardized criteria around reporting and use of proceeds to be considered for inclusion, so issuers and underwriters seeking to facilitate trades on secondary markets are nudged to comply with standards adopted by these bodies. Listing on secondary markets is often important for the purchasers of initial debt offerings because it offers an exit strategy. This relationship is the clearest example of how the various parts of the infrastructure of risk in green bonds connect to one another. It also illustrates one of the key challenges the asset class has faced: it requires the full investment chain to coalesce around practices that allow environmental and financial risk to be jointly commodified and circulated on global capital markets that have little experience reorienting their risk assessment practices to incorporate environmental risk.

Conclusion

By thinking of financial products as individual packages of commodified risk, we can identify the moments and practices by which that risk is rendered tradeable on capital markets. This approach is particularly useful for thinking about green bonds, which seek to combine both environmental and financial risk into a single product. The commodification of financial risk is well-trod ground, and the practices for its expression are thoroughly mature. This is not true of environmental risk. Consensuses on best practices for the types of environmental data and sharing of that data in the creation of green bonds are beginning to emerge, but remain fragmented. Moreover, it is not merely disparate data practices or lack of agreement on what constitutes greenness that impede the further growth of green

bond issuance. Regulatory hurdles, such as narrow definitions of fiduciary responsibility, limit some in the green bond investment chain from acting on less environmentally damaging activities. The development of metrics that communicate the benefits of green debt offerings and are satisfactory and actionable to all actors in the investment chain, as well as outside observers, will be necessary to facilitate growth of the market. More important, this development will ensure that environmental goals are achieved.

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ESG and the Stock-Picker's Dilemma

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Abstract

One of the greatest challenges that public equities investors face to integrating environmental, social, and governance (ESG) data into their decision making is the lack of proof that real – not hypothetical – investment strategies can use ESG factors to enhance performance. This is an important challenge to overcome for "ESG" and "impact" investors, but also for mainstream investors who need clarity on the practical performance of companies and investment managers who claim to incorporate ESG goals into their strategies. We posit that ESG information can provide an investment edge, but current techniques that seek to provide proof of this assertion focus on *systematic risk*, or beta factors. In contrast, we look at this topic predominantly from the perspective of *idiosyncratic risk*: can one use ESG information to identify exceptional companies that produce investment returns above what can be explained by market risk factors? This article summarizes some of the challenges that researchers have confronted in their analyses of systematic ESG risk. It then presents a framework for how to use ESG information to support fundamental research. If more investors are willing to view ESG information in this light – as a key ingredient in investment decision making rather than the source of a persistent, quantifiable investment rule – we believe they will come to recognize its value.

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The Search for an ESG Investment Edge

For decades, investors and academics have contested the merits of considering environmental, social, and governance (ESG) factors in investment decision making. Hundreds of academic studies and thousands of media commentaries have taken different angles on this issue, with the conversation centered on one key question: Does the incorporation of ESG factors in portfolios help, hurt, or do nothing to returns?

We are surprised neither about the longevity of this debate nor the lack of a satisfying conclusion. To be sure, a variety of challenges to ESG data provision and utility afflict the field, some of them highlighted in this issue of the *Journal.* In this article we briefly summarize some of those issues. But the subject on-hand is more fundamental: the question itself.

In our view, the ESG investing debate has centered on *beta,* or *systematic,* risk*.* Many studies have asked whether ESG metrics are statistically significant as a factor in market or portfolio returns. Defining the question in this way is appealing: it demands a definitive yes-or-no answer. Moreover, it offers the potential to add value in the way that more traditional, factor-based investment approaches do; it appeals to strategies centered around the "classic" factors of value, growth, quality, size, style, and so on. In a world increasingly enamored of "strategic beta" and, more recently, "smart beta" solutions, investors believe they can manage portfolios vis-à-vis these types of market risk factors (Mainie, 2015). Can we also generate predictable utility from managing portfolios around an "ESG factor?" As evidenced by the ongoing debate, some believe we already can, and others believe we will never be able to.

Alongside the "ESG factor" debates, it is important to remember that established factors, like value or momentum, do not produce consistent value in and of themselves. Some traditional investment factors (size, value) have stood the test of time even as we learned to identify more than one factor – the market factor – that can drive returns. (This work builds on the Capital Asset Pricing Model developed in the 1960s.) Multi-factor models, of course, are not held to an expectation that "buy and hold" will lead to outperformance. To expect attractive returns with factor-based portfolios, a good deal of skill is required. Managers must build models that identify significant factor correlations, tilt portfolios toward "good" factors and avoid or hedge away "bad" ones, and maintain the desired factor exposures over time. Moreover, they must understand that the correlation of traditional factors with performance outcomes (such as portfolio returns and volatility) is highly sensitive to market conditions and the exact time-periods reviewed (Podkaminer, 2013).

In contrast, the absolute nature of the debate over ESG factors is hard to ignore. Many academic and industry studies are determined to identify ESG factors that correlate with portfolio risks and returns. The methods for doing this involve very large data sets that build broad, hypothetical portfolios and back-test them over long periods of time to determine correlations that may define systematic, or beta, risk factors. While these efforts are valuable – they may eventually lead to well-defined ESG factors that resonate with economic principles – it is easy to forget that they cannot prove whether "ESG investing" can be a source of market-independent returns, or alpha. The debated methods can only discern pervasive factors that affect a large proportion of securities, or beta.

Using ESG Information to Drive Alpha

The conviction that investors can use ESG information to drive alpha arises from our experience in managing *idiosyncratic risk*. We do not use ESG research to produce a systematic filter, or a set of rules, for our portfolios. Instead, we use it to identify exceptional companies that we believe will produce investment returns beyond what can be explained by market risk factors. We have found that this approach can, in fact, drive alpha over time. Unfortunately, this approach is not easily tested by statistical studies. As is typical for fundamental stock pickers, we apply information – ESG-related or otherwise – to an investment process that is as qualitative as it is quantitative; it is a process ultimately driven by human decisions. While we think our approach contributes to attractive risk-adjusted returns, we frankly acknowledge our inability to offer statistical proof of its validity.

To be clear, we do not suggest a "right" or "wrong" way to use ESG information in investing. We simply want to highlight an approach that does not use quantitative rules or lend itself to consistent statistical evaluation. It is up to investment managers and, ultimately, their clients whether they seek investment exposures that are systematic (beta exposure) or idiosyncratic (alpha exposure). Moreover, we welcome further academic discussion on the use of ESG information to produce idiosyncratic results. More focus from the academic community on this approach may reveal better ways to test and show its value.

Background

As most readers are likely aware, the academic and investment communities have long debated whether ESG factors positively, negatively, or neutrally influence portfolio performance. In studying the characteristics of socially responsible indices, some researchers have found high correlations with conventional indices (Statman, 2006).

Acknowledging this result, select studies take the middle road, claiming investors are no worse off employing ESG screens because they "do not forego a lot of opportunities, but they also do not financially benefit from their screening activities" (Dam and Scholtens, 2015).

Researchers have also investigated the contrast between "socially responsible" and its presumed opposite, "vice" investing.[84] One study concluded that investors "pay a financial cost in abstaining from [sin] stocks" (Hong, 2009). Another study found that by eliminating the worst ESG offenders the resulting hypothetical portfolios have greater downside protection (Hoepner, 2013). Yet another study found that firms with superior performance on sustainability issues outperform firms with inferior performance on material sustainability issues (Khan, et al., 2015). The United Nations Environment Program published a helpful review of key academic and broker reports on responsible investment and performance (UNEP, 2007). Of the 20 academic studies referenced, half reported a positive effect of ESG factors on portfolio performance, three reported negative effects, and the rest were neutral. Of the 10 investment-broker reports reviewed, three were positive and the rest were neutral. Finally, a growing number of meta-analyses conclude that incorporating ESG issues into investment decision making generates better returns than comparable non-ESG strategies (Clark, et al., 2015).

In short, anyone seeking answers in this debate faces a tangled web of information. Multiple studies over many years have offered high-quality analyses, but have led to varying conclusions that cloud the issue rather than providing clarity. There are many challenges to finding definitive causality between ESG data and financial performance. To name a few:

- Companies are not required to provide audited data relevant to many ESG metrics.
- Ratings frameworks created by firms like MSCI, Eikon, and Sustainalytics, among others, have made admirable progress in recent years. The same is true of research, education, and engagement programs from Ceres, the Global Reporting Initiative, the Sustainability Accounting Standards Board, and others. There is nonetheless little to no standardization in how companies report ESG data.
- Research firms lack standardization on the ESG issues they cover and the systems they use to quantify those issues into a score or rating for a company (Bose and Springsteel, 2017).

[84] "Socially responsible investing," by some definitions, requires the avoidance of "sin" stocks – typically alcohol, tobacco, firearms, gaming, adult entertainment, and the like. Similarly, some ESG ratings criteria assign low ESG scores to companies engaged in these business activities, leading many "ESG" investors to avoid those low-scoring companies altogether. "Vice" investing, on the other hand, seeks out rather than avoids exposure to such sin stocks, or ESG risks.

- Definitions of "sustainability," or what constitutes a valid ESG metric, remain ambiguous (Esty and Cort, 2017) – not to mention potentially controversial and politically charged.
- Inconsistencies in ESG data may be exacerbated among small- and medium-sized companies that do not have the resources required to complete ESG analyst surveys and publish sustainability reports (Douglas, 2017).
- In many cases, there are several degrees of separation between ESG factors and financial performance. Though a relationship may exist it can be difficult to show correlation through the noise.

Stock-pickers and the Challenge of ESG Quantification

As an exercise to supplement this paper, we sought to understand what sort of correlation we could find between ESG ratings data on our portfolio companies with the returns that those companies produced over the past five years. The results are not statistically significant for a variety of reasons, but we thought some of our observations were worth noting.

We took information from six leading ESG rating systems and attempted to level-set the various scores on a one-to-ten scale, with 10 being the highest ESG score and one being the lowest. We found a wide dispersion of results. The difference between the "best" and "worst" ESG score for the average company in our portfolio was 4.6. In other words, a typical company would receive a score of, say, 7.5 from one ESG rating firm (in the top quartile), while another firm would rate that same company with a 3 (in the bottom one-third). The different focuses of each ESG ratings provider primarily drove the dispersion: some prioritize climate risk, others focus exclusively on governance issues, and so forth. We did not find statistically significant correlations between trailing returns and any of the ESG ratings, either.

We want to reemphasize that this data would not hold up to academic scrutiny. Because we invest in a concentrated portfolio it is hard to find statistical significance in our relatively small sample. Thus, our own portfolio surely has little comparability to other actively managed funds that incorporate ESG considerations. Yet we agree with scores of fund managers who shared with the U.S. Forum for Sustainable and Responsible Investment that expectation of stronger financial performance is a top reason for incorporating ESG into the investment process (US SIF, 2016).

As active managers[85] that are more focused on alpha than beta, even well-defined, statistically valid, and perfectly clairvoyant ESG metrics would not help much with our primary task: diving deep on individual companies and finding the select few that are poised to produce exceptional long-term business results.

This has little to do with ESG data specifically; *no* screening approach is very helpful for bottom-up investors. If we run screens for metrics that are arguably associated with high quality – return on equity, earnings variability, historical earnings per share growth – we will at best get a list of companies to *start* looking at more deeply. These metrics alone do not reveal if a company has high barriers to entry, enjoys persistent drivers of growth, or has a resilient business model supported by a forward-looking management team that understands the company's long-term sustainability risks and opportunities and is investing in those opportunities. Such success factors are difficult to quantify and not very amenable to statistical analyses. Nevertheless, active managers of concentrated portfolios need an ESG framework that is unconstrained by the challenges identified by many analyses and summarized in the previous section of this article.

Sustainable Business Advantages: A Company-level Research Model

Personally, we rely on an approach that eschews general rules and instead focuses on how the ESG attributes and strategies of a specific company are likely to impact its business results over time.

In academic terms, we want to manage and master *idiosyncratic risk,* and seek results through return streams that are not correlated with the broad market. In more pragmatic terms, we are looking for exceptional companies that have the potential to thrive in many different market or economic scenarios.

Additionally, we look for information gaps to gain perspective on a company's prospects that we believe we observe more clearly than does the rest of the market. As long-term investors, we look for companies that will thrive in the physical, social, and economic reality that exists today and is likely to develop over time. In our view, responsible companies understand and manage their long-term sustainability risks, while truly exceptional management teams see the *opportunity* in sustainability, not just the risk. These teams find ways to address sustainability challenges for their own company and their customers in a way that drives growth, profitability, and market share. Finding these companies before the market understands their potential has been a consistent source of alpha for us.

[85] Managers who maintain concentrated portfolios with high active share compared to their benchmarks.

There are many ways to think about sustainability as part of a stock-picking exercise; we comment on our own approach. We use the term "sustainable business advantage," or SBA, to describe the characteristics in a company's business strategy that can drive shareholder value through sustainability. Specifically, we look for companies that can produce at least one of three distinct *financial* outcomes with these advantages:

- First, they accelerate revenue growth by offering a "sustainability-critical" product or service. These help customers reduce the cost of doing business by saving energy, water, and other resources.

- Second, they lower their own costs materially, thereby improving margins, by becoming productivity leaders through innovative manufacturing, distribution, or other strategies.

- Third, they increase customer loyalty, enhance their brand, and attract and retain top talent because their sustainability strategies are a differentiator. This way they grow their market share.

Companies with great fundamentals and the potential to drive the above outcomes through sustainable business advantages are the companies that we want to own.

Table 1 illustrates how our approach is distinct from one focused on ESG metrics, scores, and rankings. We look at various sectors and the challenges that companies face in those sectors. But rather than focusing on how companies avoid risk we are interested in how companies embrace and capitalize on the opportunities produced by sustainability challenges. We also note that positive sustainability strategies are a requirement for finding great companies, but the sustainable business advantages (or any other ESG attributes) are a means, not an end. Our end-goal is to invest in fundamentally strong companies that will outperform over time. One of our methods for doing this is to find companies using sustainability strategies to add value for shareholders.

Table 1. Sample Framework for Capitalizing on Sustainable Business Advantages

Potential Risks	Sectors	Investment Challenge	Sustainable Business Advantage	Shareholder Value
Data Center Energy Use, Power Quality and Cost	Information Technology, Financials	Finding fundamentally strong companies that capitalize on these types of opportunities	Optimize hardware, software & energy = Reduced capex & opex	*Cost reduction*
Commodity price volatility, cyclicality	Industrials, Basic Materials		Reduce energy, water, labor, resource use for customers = persistent and compelling customer value proposition	*Revenue growth*
Brand reputation, changing customer preferences	Consumer, Health Care		Ethical, healthy, clean-label products = customer trust, loyalty	*Enhanced franchise value*

One example we can readily situate in the chart from Table 1 is ARM Holdings. ARM Holdings is a UK-based leader in low-power microprocessors. (It is now a part of Softbank.) Their commitment to power efficiency and a streamlined chip design was established in the early days of the company's founding in 1990. This enabled them to eventually build the low-power, low-cost chips that mobile lifestyles rely on. Nearly all smartphones today have at least one ARM-designed chip (Hern, 2015). Power efficiency and performance have become top concerns in the semiconductor design process given the goal of increasing computational performance per watt and per dollar. ARM's commitment to power efficiency along with a sleek, simple, and effective chip design is their sustainable business advantage. This has been a powerful driver of revenue growth. Creating more resource-efficient data centers is a similar market challenge that appears ripe for sustainable business advantage. This would respond to the demand for digital services in emerging markets, the growth of the cloud in established markets, and the need to store and access huge quantities of data from the Internet of Things. Cavium, a U.S.-based provider of high-end integrated processors, has licensed ARM's designs for greater efficiency and functionality in the server market. By improving on standard, inefficient methods, Cavium extends ARM's original sustainable business advantages into functions beyond mobile devices.

Does an investment in a company with sustainable business advantages guarantee returns? Of course not. Will it automatically lose money? Of course not. We want to reiterate that our investment in these companies is based on a business case, not a sustainability case. It is admirable that ARM-based chips consume less energy; we invested because those attributes have helped ARM acquire new customers and dominate an industry. Will Cavium

succeed over a long period of time? It may, but it won't be exclusively because of its energy-efficient value proposition. Cavium also needs make great capital allocation decisions and provide customers with speed and functionality in order to topple big incumbents.

Many ESG metrics, scores, and rankings focus on data pertaining to a company's production efficiencies, carbon footprint, and water usage. Translating these metrics into shareholder value is not straightforward. Nor are the examples we offered ideal, as ARM and Cavium outsource their manufacturing. Yet far from debating the validity of ESG metrics, we have conviction that ESG information is valuable to our fundamental thesis. Yes, we used ESG data in both of these cases to inform our investment decision, but we do not build portfolios based on ESG factors alone. The way to make money on companies with great ESG characteristics is to *first* invest in fundamentally strong companies. ESG information helps with broader due diligence, providing insight into a company's sustainability strategies alongside their fundamental strengths, the competitive environment, and, of course, stock valuation at the time of buy or sell decisions.

Broader Application and Paths for Future Research

We have not identified ESG attributes among our portfolio companies that consistently help us pre-select portfolio candidates for strong future performance. Each company and situation is unique.

To be sure, our industry's ability to understand and deliver alpha – whether ESG-related or not – is incomplete. For example, one study revealed that beta is often confounded with alpha, and this can mistakenly attribute outperformance to the value-add of an active manager rather than market risk premia (Bender, 2014). But we need not wait for more studies offering statistical validity or categorical proof of how ESG can provide investment alpha *or* beta. Instead, we call on practitioners, in collaboration with industry and academic researchers, to continue to extend the applications and results of incorporating ESG information into investment decision making.

We believe that the academic community is far more qualified than we are to sort through the publicly traded universe and find common identifiable elements among companies with compelling sustainable business advantages. We very much hope to see more studies in the future with this sort of focus.

We offer an analogy to William Sharpe's argument for why managers should understand and utilize factor models:

> While the relative importance of various factors changes over time, as do the preferences of investors, we need not completely abandon a valuable framework within which we can approach investment decisions methodically. We have developed a useful set of tools and should certainly continue to develop them. Meanwhile, we can use the tools we have, as long as we use them intelligently, cautiously, and humbly [Sharpe, 1984, as quoted by The Research Foundation of the Institute of Chartered Financial Analysts in 1994].

The above statement could apply as much to the study of ESG factors that are pervasive (beta) as it could to the study of ESG factors that are particular to a company's business model (alpha). Indeed, creating and testing frameworks of customized ESG strategies may be a fruitful path to understanding how these strategies can ultimately affect shareholder value. Michael Porter has published an extension of his seminal work on competitive advantages by looking at social influences of company competitiveness (Porter, 2006). Company case studies and practitioner-oriented books provide an outlook on the business case for corporate environmental strategies (Esty, 2009). Other authors focus on the nuances of managing corporate sustainability investments in contexts that may not yield immediate returns but that are of strategic concern as companies navigate environmental risks and opportunities that reveal themselves over time (Henderson, 2015). And one of the authors on this paper has offered a combination of quantitative measures and qualitative evidence that can be combined and mined to create company-specific sustainability models for empirical testing (Funk, 2003).

As a final note, we acknowledge that investors look for different outcomes from sustainable investing. Some want to achieve impact; others want to align their portfolio with their values; others simply want to gather better information to drive better decisions. These are all worthy goals and, we believe, all achievable. Our comments in this article specifically refer to the use of sustainable investment principles to drive better returns. In our experience, there is no silver bullet proving companies with a certain quantifiable attribute persistently achieve positive investment results. However, we strongly encourage practitioners to accept the worth of ESG research as independent from a search for a quantifiable ESG screen applied categorically across an investable universe. Information about a company's sustainability strategies and practices can be used to improve fundamental investment decisions. ESG research does not by itself ensure investment gains or losses, but when combined with additional due diligence it can inform better investment decisions.

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Sustainable Investing and Bond Returns

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Abstract

We investigate the link between environmental, social, and governance (ESG) ratings and corporate bond performance. We constructed broadly diversified portfolios designed to track the Bloomberg Barclays US Investment-Grade Corporate Bond Index through matching characteristics (sector, quality, duration). We imposed on these portfolios either a positive or negative tilt to different ESG factors. We find that a positive tilt to ESG factors resulted in a small but steady performance advantage. No evidence of a negative performance impact was found. ESG attributes did not significantly affect the price of corporate bonds. No evidence was found that the performance advantage was due to a change in relative valuation over the study period. When applying separate tilts to E, S, and G scores, the positive effect was strongest with a positive tilt to governance and weakest with a tilt to social. Issuers with high governance scores experienced lower incidence of downgrades by credit rating agencies. Broadly similar results were observed using ratings from the two ESG providers considered in this report despite significant differences in their methodologies.

Introduction

Sustainable investing, in which environmental, social, and governance (ESG) issues are incorporated into the investment process, is increasingly gaining a foothold in mainstream financial markets.

For some of the most committed investors, the knowledge that their funds are being invested to support their values is so important that they would accept a lower return to assure this end. A much larger group would be happy to support these values, but only when convinced that there is limited negative impact on returns. Finally, if consideration of ESG principles can actually help to improve portfolio performance – as many adherents claim – then it would be hard to justify any resistance to their adoption. The relationship between ESG characteristics and performance is therefore of primary importance.

Focus on Credit Market

In the absence of much research into the impact of ESG values on the credit markets, Barclays Research has conducted a new study to determine the nature of the relationship between bond performance and ESG issues. We focused on the credit markets for several reasons.

An increasingly large number of bond investors are interested in ESG investing. The relationship between sustainability and portfolio performance, though, has been researched far less in the credit market than in equity. Institutional investors also dominate credit investing, including pension funds, which are leading the trend for sustainable returns. Bonds represent a substantial percentage of these assets.

Finally, corporate bonds are complex: they combine exposure to interest rates and credit spread, so allocations along both dimensions influence risk and performance. Unintended biases can therefore easily appear when overweighting one bond relative to another. To aid bond managers in evaluating the potential performance effect of integrating ESG data into their portfolio construction, we knew it was important to carefully avoid systematic risk exposures.

What This Report Covers

We begin with a short overview of what drives ESG investing and the rapid rise in its popularity over the last decade. We then investigate the impact that increasing ESG awareness has had on different groups of financial market participants, including asset owners, asset managers, corporate managers and regulators.

The second section addresses ESG ratings. Many market participants rely on independent providers of ESG scores and ratings in their investment decisions. In fact, we rely on them ourselves when we quantify the performance impact of ESG-motivated investment decisions. We therefore try to understand them better: what exactly do the scores measure and how are they constructed? We describe the approaches followed by two major ESG metrics providers – MSCI and Sustainalytics – and investigate the relationships between different metrics. How do these scores relate to more traditional credit ratings, or to corporate bond spreads? How stable are the scores over time? We investigate these questions in the context of the US investment-grade credit market.

Finally, we perform a detailed analysis of the relationship between ESG scores and corporate bond performance. We construct bond portfolios with high-ESG and low-ESG alignment. These are carefully designed to track the index by controlling for the non-ESG factors known to affect bond returns. We find that high-ESG-aligned portfolios tend to outperform, and we try to understand why.

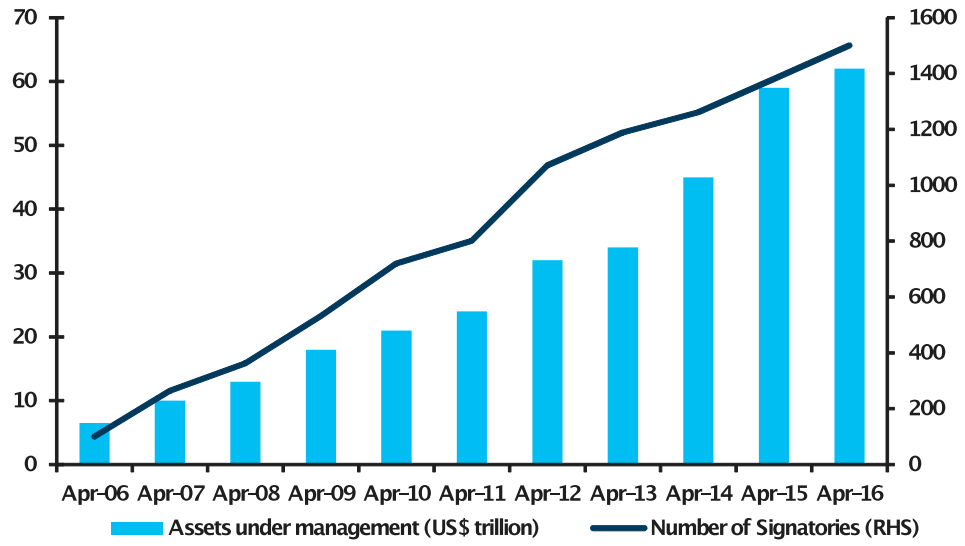
What is ESG Investing?

Responsible investing goes by many different names and definitions, but can be broadly described as expanding the objectives of an investment process beyond pure financial considerations to reflect investors' values and beliefs such that their holdings positively affect the community and broader ecosystem.

In order to measure the sustainability of investments, a widely accepted set of metrics has evolved, known as environmental, social, and governance (ESG) scores. In addition to the traditional objective of delivering financial returns, ESG investing enables investors to structure portfolios aligned with their values.

While not new, responsible investing has gathered momentum and taken on broader significance in the past ten years. The United Nations, for example, supported the launch of six Principles for Responsible Investing in 2006 to incorporate sustainability into investment practice. Collectively known as UN PRI, it has since attracted nearly 1,500 signatories, collectively controlling over $60 trillion of assets under management. The steady increase in the number of UN PRI signatories is shown in Figure 1.

Figure 1. Number of UN PRI Signatories and their total Assets Under Management



Source: UN PRI

The widespread adoption of ESG investing has come hand-in-hand with a subtle but critical change in emphasis. The early charge was led by ethically motivated investors, while most institutional investors looked on from the sidelines, concerned about the potential negative impact on portfolio returns. The key to gaining traction was in reversing the perceived effect on performance. Today, it is no longer assumed that "doing the right thing" will place a drag on portfolio returns; rather, it is seen as prudent to avoid investing in companies that have a detrimental impact on the world, as their business practices may be forced to change. ESG ratings providers thus emphasize that their ratings measure the risks of negative events stemming from poor ESG behavior.

The recent expansion of ESG investing

Figure 2 summarizes ten significant ways in which the industry has changed in recent years. These developments, taken together, lead to a single inescapable conclusion: the trend towards sustainable investing is not just a passing fad, but a movement that has brought, and will continue to bring, fundamental and sweeping changes to the investment landscape.

Figure 2. From Fringe to Mainstream: Changes in the ESG Investment Landscape at a Glance

Yesterday	Today
Negative screening of "sin" industries	Positive screening based on ESG characteristics
Hiring of specialist ESG teams	ESG issues integrated in investment decisions
Investors sign up to the UN PRI	PRI Signatories report on ESG implementation
Asset managers offer specialist socially responsible investment mandates	Asset owners embrace responsible investing
Regulation is at best indifferent to ESG investing	Regulation is supportive of ESG issues
Limited offering of ESG-related indices	Broader offering of ESG indices; launch of thematic ETFs; ESG metrics incorporated in "smart beta" strategies
Emergence of specialist providers of ESG analysis	An industry of ESG data providers is growing fast and consolidating
Limited ESG data disclosure by corporations	Corporations develop a Corporate Social Responsibility (CSR) agenda
ESG data hard to collect	ESG data broadly available. Push for mandatory reporting
Active engagement limited to governance and proxy voting	Active engagement covers all E, S, and G dimensions

Source: Barclays Research

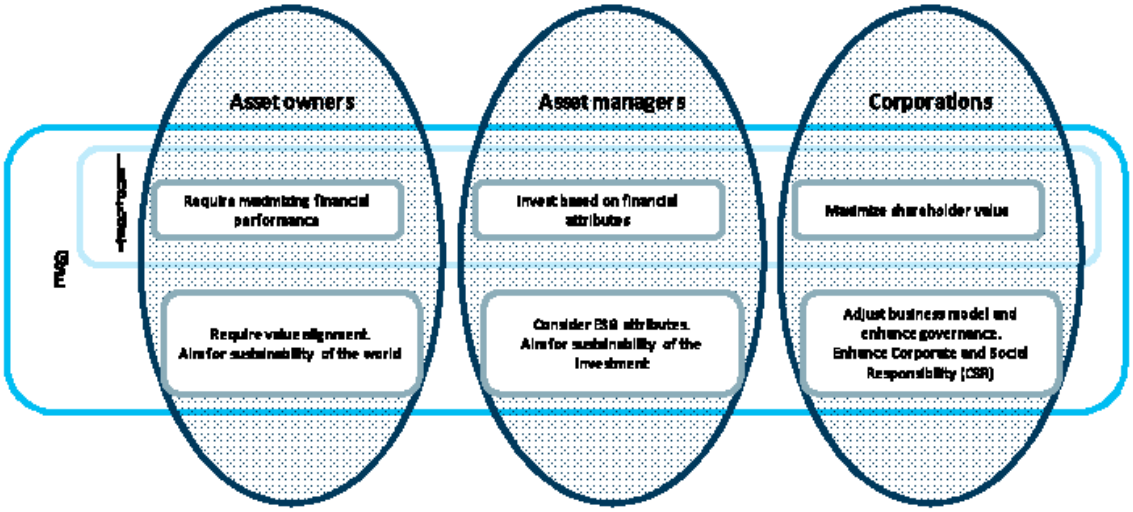
These changes can potentially lead to incremental costs to asset owners and asset managers, as well as corporations: commitment to ESG values and related reporting and analysis take time and resources to implement. This raises a host of questions for asset owners and managers:

- Many institutional asset managers have created specialist ESG teams. Is all this justified, or should such expertise just be embedded in traditional fundamental investment analysis with a long horizon perspective?
- Can a focus on ESG issues distract the investment focus away from return maximization?
- In particular, could the increased emphasis on ESG ratings encourage mutual fund managers to make their funds attractive to investors by increasing the weight of high ESG-rated securities with insufficient consideration of financial risk and return?
- Can the increasing scrutiny and reporting burden that comes with ESG alignment deter private companies from going public, or even encourage public corporations to go private? ESG ratings are generally published for publicly listed companies although corporate bonds can be issued by both public and private firms. A trend towards private ownership could limit the ESG rated investment universe of asset managers.

What is Unique about ESG Investing?

ESG investing has different implications for asset owners and asset managers: individual asset owners want to make the world a better place by allocating resources to responsible companies while maintaining financial performance. Asset managers acting on behalf of these investors want to be seen as ESG-compliant in order to attract assets, but also need to deliver financial performance in order to retain those assets. As shown in Figure 3, ESG investing expands the relationships among asset owners, asset managers, and corporations.

Figure 3. ESG investing expands the relationship among asset owners, asset managers, and corporations.



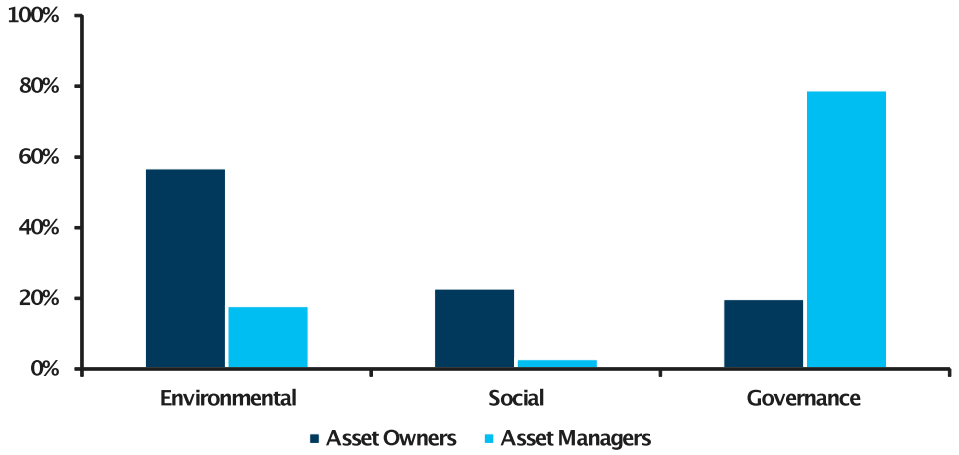
Source: Barclays Research

The three individual ESG elements differ in nature. Governance is an indication of how well governed a corporation is and the extent to which the primacy of shareholder interest is ensured. It can be seen as a measure of management quality. By contrast, the environment and social variables capture the risk and opportunities that are often specific to the industry and the activities of a company.

While many investors agree that governance is linked to performance, there is not as much consensus on the importance of environment and social attributes; their link to future performance is indirect. A Barclays survey of large asset managers in 2016 found their views on the importance of E, S, and G diverged dramatically from asset owners' views (see Figure 4).

The fact is there may not yet be enough evidence of a relationship between these metrics and performance. Relying on ESG metrics therefore could be seen as an act of faith that desirable corporate behavior should be beneficial to investors over the long run. The business of ESG measurement has emerged, in part, to help produce this evidence and lay an empirical foundation for this faith.

Figure 4. Which one of E, S, or G is most important to asset owners, and to asset managers?



Source: Barclays Research. Barclays survey of large fixed income managers (2016)

The Role of ESG Ratings

Once investors have decided to incorporate ESG-related considerations into their investment process, how do they proceed? The systematic consideration of a catalog of environmental, social, and governance issues for every company in the investment universe is complex.

One approach is to leave the process to asset managers that specialize in ESG investing. Another is to structure a mandate more formally, with quantitative metrics to express the investment goals and constraints. An ESG-specific benchmark could be specified rather than a more traditional one. In any case, the asset manager will need to report periodically to the asset owner on how the portfolio is positioned relative to ESG issues. For all of the above, asset managers and asset owners often rely on third-party ESG ratings, in the same way that credit ratings from rating agencies are pivotal to bond portfolios.

Several ESG data providers have emerged in the past two decades dedicated to helping investors identify companies that follow better and worse practices in different ESG areas. This relatively new industry is still fragmented by product area and geography, but it is experiencing consolidation. Only a handful of providers claim to offer comprehensive coverage across all three ESG dimensions and across geographies. In addition to specialist providers, large data vendors such as Bloomberg and FTSE are entering this market.

ESG ratings are used in various ways. They may be used to screen potential investments, and can be integrated into investment decision processes and portfolio analysis. They form the basis for the design of benchmark indices in both equity and debt markets (for example, Bloomberg Barclays MSCI sustainability indices). They can be used in the design of ESG-

targeted investment products and strategies, such as low carbon or ethical mandates. Some ESG-rating companies have also expanded coverage to sovereign issuers and to investment funds, in addition to individual corporations. In a recent development, Morningstar (in partnership with Sustainalytics) and MSCI have both started providing ESG rankings of mutual funds, based on aggregated scores of the companies comprising each fund's holdings.

According to an annual industry survey by Independent Research in Responsible Investment, the top two providers of independent ESG research and rankings are MSCI ESG Research and Sustainalytics. Another important provider, Institutional Shareholder Services (ISS) has a 30-year history of focusing on corporate governance issues, with expertise in law, accounting, and compensation. ISS was part of MSCI until 2014; it only recently expanded its services to cover a full range of ESG issues.

How Are ESG Ratings Formed?

While there are similarities between ESG research and ratings providers, each has its own methodology. ESG ratings are based on a multi-criteria scoring of individual corporations based on a large set of factors or metrics across all three E, S, and G dimensions.

The ranking process begins in a bottom-up manner. Within each of the three main dimensions, dozens of specific categories of risk are assessed, and each company is scored on its exposure to that category of risk and the steps it has taken to mitigate it.

Global warming may be the "poster child" of sustainable investing, but it is far from the only issue considered. In fact, ESG ratings reflect a broad range of considerations within each of the three categories. Ratings providers have a detailed hierarchy of sub-categories and specific issues that are used to arrive at numeric scores for each company. Figure 5 offers a small sampling of the more detailed sets of issues examined by ESG ratings providers.

Figure 5. Sample Issues Considered in Forming ESG Scores

Environment	**Social**	**Governance**
Carbon Emissions	Labor Management	Corporate Governance
Energy Efficiency	Diversity and Discrimination	Business Ethics
Natural Resource Use	Working Conditions	Anti-Competitive Practices
Hazardous Waste Management	Employee Safety	Corruption and Instability
Recycled Material Use	Product Safety	Anti-Bribery Policy
Clean Technology	Fair Trade Products	Anti-Money Laundering Policy
Green Buildings	Advertising Ethics	Compensation Disclosure
Biodiversity Programs	Human Rights Policy	Gender Diversity of Board

Source: MSCI ESG Research, Sustainalytics, Barclays Research

In each category, the assignment of a numerical score to a company may require the synthesis of quantitative and qualitative information from multiple sources. Among the information sources and questions evaluated in a given area are:

- Quantitative ESG data disclosed by a company regarding its own activities
- Estimates of ESG data from third-party sources
- Level of self-disclosure
- How exposed is the company to significant risks in this area?

- How much has been done to manage such risks?
- Has the company been involved in controversial incidents on this topic? What happened?
- Is there a formal program in place to manage this issue company-wide?
- Is the company well placed to capitalize on opportunities in this area?

ESG score providers combine information from all of these sources and calculate fine-grained scores for each individual metric on an absolute basis. These are then aggregated up to overall scores for each of the three pillars (E, S, and G), and from there to an overall ESG score, as a weighted average of the granular scores. This weighting is another key element in the aggregation process. A given corporation may be involved in many different businesses and geographies, each bringing different exposure to ESG issues. Similarly, the relative importance of each metric may vary substantially by industry or country.

To meet this challenge, ESG ranking firms have developed schemes for assigning different sets of weights to underlying risk factors for each industry and company. Thus, while an overall environment ranking will be provided for any firm, these scores will mean something distinct in each case, whether covering a bank, a pharmaceutical firm, an oil company, and so on; the environment score will also form a different percentage of the overall ESG score. For example, the environment score has a relatively small weight in the combined ESG score of banks, but a large weight in the ESG rating of energy companies.

Both the selection of the underlying metrics that are evaluated and the weights assigned to these metrics change over time, reflecting industry developments and evolving beliefs regarding corporate "best practice."

ESG rating firms' research contains two kinds of rankings: relative and absolute. The most fine-grained metrics are typically absolute scores, or raw scores, which allow comparison between any two companies across the board. Conversely, the highest-level ESG ratings are based on rankings relative to a peer group in the same industry. Rating comparisons are most useful for firms within the same peer group; a comparison of the overall ESG scores of companies in different industries is much less meaningful. In this sense, ESG ratings are very different than credit ratings, which rank the credit-worthiness of firms in all industries on a common scale.

And while ESG ratings across firms are often in rough agreement, there are differences in the different providers' methodologies at every level:

- Selection of the detailed list of low-level factors in each category

- Assignment of raw factor scores: how much emphasis is placed on the different types of information available? How much of a penalty is assigned to companies that do not disclose information or do not maintain formal ESG-focused programs?
- What parts of the ratings process are purely formula-driven, and where is there room for an analyst to apply subjective judgment?
- Assignment of weights to different factors for each industry. Must these be constant across an industry, or can a given firm be assigned different weights to respect its mix of businesses?
- To what peer group should each firm be compared to convert absolute scores to relative ones?

Due to these differences in approach, it is not surprising that different ratings providers can at times disagree in their assessment of a company.

Properties of ESG Ratings

To what extent are individual E, S, and G scores from the same provider correlated with each other? For example, is a company with a high governance score likely to also have high environment or social scores? Our analysis of the ratings on corporate bond issuers from both providers we analyzed shows that all of these correlations are low (near zero for MSCI and about 30% for Sustainalytics). This means that individual E, S, and G scores carry different information, complementing each other to help form a holistic description of non-financial information and risk.

Do different providers of ESG ratings tend to reach similar conclusions? As a lot of the analysis done by each provider is based on publicly accessible data sources, and on the information put forward by the rated companies, one could expect the qualitative rankings of different companies to be comparable. However, as discussed, the differences in the way the data are processed, analyzed, and presented can lead to very different results.

In practice, we observe that MSCI and Sustainalytics ratings often disagree with each other. When measuring the relationship between ESG ratings of the two providers, we find positive but low correlations across all three dimensions, as well as for the composite rating. This is not surprising, given the differences in methodology described above.

Thus, ESG ratings should not be considered as a simple commodity; the ratings from different providers carry different information and can potentially suggest different portfolio management decisions. This makes it all the more surprising that our analysis seems to arrive at similar conclusions using ESG ratings from either provider – as we shall

soon see – in terms of both the relationship with credit ratings and the performance implications.

The Relationship between ESG Scores and Credit Ratings

Although it uses non-financial information, ESG scoring aims to evaluate companies based on long-term risks and opportunities. On the face of it, it should therefore have similarities with credit analysis, which measures a corporation's risk of default.

If that is the case, bonds with high ESG scores are more likely to have a high credit quality and therefore trade at a lower yield spread to government bonds. This would also mean that filtering an investment or index universe simply to exclude low-ESG bonds could automatically translate into a systematic bias to less risky, lower yielding securities and may therefore lead to lower returns over time.

To find out whether focusing on ESG issues can translate into a quality or spread bias, we consider a broad universe of corporate bonds and investigate whether different sets of bonds, grouped by ESG scores, have different properties. Our universe is the Bloomberg Barclays US Corporate Investment-Grade Index, a popular benchmark for institutional asset managers investing in the U.S. credit market. In April 2016, this index included 5,675 bonds from 761 different issuers. We only consider bonds with ESG scores from both MSCI and Sustainalytics, reducing the sample size by about 10%.

We sort bonds by ESG score and group them into three equal size buckets: low, medium, and high ESG. We report the average characteristics of the three portfolios in Figure 6. This figure contains two sets of data: one sorted according to MSCI scores and the other using Sustainalytics ESG data. In both cases, spreads decrease steadily with increasing ESG score; the average spread of high-ESG bonds was 38bp lower than that of the low-ESG portfolio using MSCI data and 35bp lower for Sustainalytics.

To measure the difference in quality, we transform the traditional letter ratings from credit rating agencies into a number (higher for lower quality and lower for higher quality) and then average the numeric ratings. The difference in average rating between high and low ESG buckets corresponds to a one-notch change in credit rating, from A2 to A3.

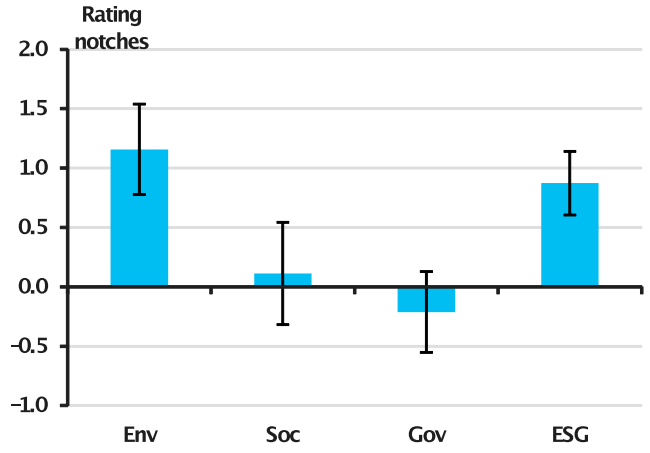
Figure 6. Average Characteristics of Bonds in Different Tiers of ESG Scores (August 2009 to April 2016)

	MSCI				Sustainalytics			
	Low	Medium	High	High – Low	Low	Medium	High	High – Low
Average ESG Score	2.6	4.9	7.7	5.1	51	60	70	18
Spread over Treasury Bonds (bp)	172	154	134	–38	173	157	138	–35
Rating Quality	A3	A3	A2		A3	A3	A2	
Rating Quality Number	8.2	8	7.3	–0.9	8.4	7.9	7.3	–1.1

Source: MSCI ESG Research, Sustainalytics, Barclays Research

This analysis was repeated each month from August 2009 to April 2016. In Figures 7 and 8, in addition to the average number of notches by which the high-ESG bonds were more highly rated than their low-ESG peers, we show error bars indicating the variation in these numbers over time. We see that the difference in credit ratings between high-G and low-G bonds were not significantly different from zero, while high and low overall ESG scores led to about a one-notch difference using data from either MSCI or Sustainalytics. The two sets of results differ most with respect to S scores.

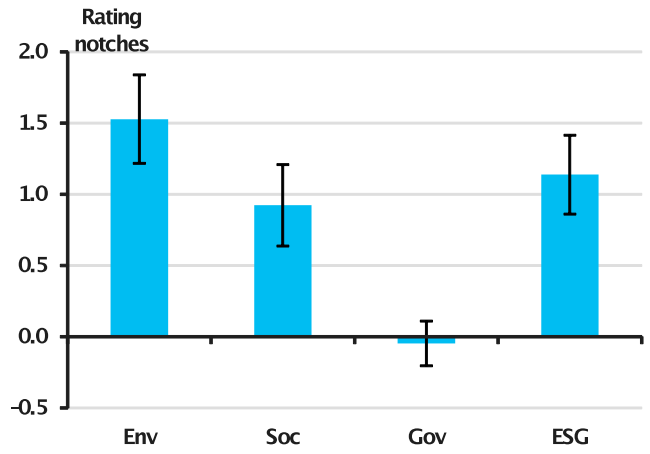
Figure 7. Average difference in credit rating between top and bottom tier of ESG rating – MSCI



Source: MSCI ESG Research, Barclays Research

Note: Error bars indicate one standard deviation above and below the average

Figure 8. Average difference in credit rating between top and bottom tier of ESG rating – Sustainalytics



Source: Sustainalytics, Barclays Research

Note: Error bars indicate one standard deviation above and below the average

How should we interpret these results? Does it make sense that having a good environmental record should have a clear impact on credit ratings while good governance does not? An alternative explanation might be that issuers with higher credit quality (and stronger balance sheets) are better able to comply with environmental constraints than those with lower credit quality, which are likely to have higher leverage and tighter financial constraints.

In any case, investors should be careful when using ESG data in their portfolio construction to avoid unintentional biases in allocation and risk profile. Just overweighting companies with better ESG scores can result in lower yields and, consequently, lower returns.

Are ESG Ratings Stable?

For investors considering full integration of ESG factors into the investment process, the stability of these ratings is an important consideration. Frequent changes in scores could potentially lead to excess turnover in investor portfolios, as well as less predictable risk exposures. This would be particularly difficult for credit portfolio managers, given the liquidity environment; secondary liquidity in the corporate bond market has deteriorated markedly since the financial crisis of 2008, forcing credit investors to adopt a long horizon by default.

Our data analysis reveals that for both MSCI and Sustainalytics, ESG scores are stable. A company that has a high ESG rating is likely to retain a high ESG rating on a one-year

horizon. Similarly, a low ESG rating today is a strong predictor of a low ESG rating one year forward.

For example, Figure 9 shows that for both providers, a top-tier ESG company has more than an 80% probability of remaining in the top tier a year later. Thus, there is little reason to fear that the adoption of ESG criteria would become a cause of excessive portfolio turnover.

Figure 9. How Likely is an ESG Rating to Change Over a Year? Transition Frequencies across ESG Tiers on a One-Year Horizon (August 2009 to April 2016)

		MSCI				Sustainalytics		
		at end of period				at end of period		
		Low	Medium	High		Low	Medium	High
at start of period	Low	73%	24%	3%	Low	84%	15%	1%
	Medium	22%	60%	18%	Medium	13%	73%	15%
	High	2%	17%	81%	High	0%	13%	87%

Source: MSCI ESG Research, Sustainalytics, Barclays Research

How Do ESG Ratings Affect Corporate Bond Performance?

Does the incorporation of environmental, social, and governance criteria in the investment process improve or hurt the financial performance of a bond portfolio?

Many studies have been published to try to establish an empirical link between ESG attributes and financial performance. A recent survey article on this body of research (Friede 2015) summarizes the results from 60 distinct review studies, covering 2,200 primary studies. The authors emphasize the difficulties in trying to generalize over many different studies, each of which may focus on a different aspect of ESG criteria in a different market, geography, or industry. Nonetheless, the survey reports that about half of the published studies show a positive link between corporate social responsibility and corporate financial performance, while less than 10% report a negative link.

There is a key distinction between an ESG approach based on negative screening by industry and one based on relative comparisons of the firms in each industry. For example, an investor using a negative screen may choose to exclude coal-mining companies from its investment universe. Another may use ESG ratings to rank coal-mining companies and choose to invest in the ones that have the best overall ranking within the sector. In the first case, if coal-mining companies outperform the market then the investment portfolio may lag a broad market index. In the second approach, the portfolio is neutral with regard to the

systematic sector exposure, but favors companies with better ESG policies, as these are considered to be less likely to suffer from the risks inherent in the industry.

Examples of both negative and positive screening can be found within the range of Bloomberg Barclays MSCI ESG bond indices. The Socially Responsible Investing (SRI) corporate bond index is based on negative screening and excludes companies involved in industries such as tobacco, alcohol, gambling, adult entertainment, nuclear power, genetically modified organisms, stem cell research, firearms, and weapon systems. By contrast, the Sustainability index uses a best-in-class approach based on ESG ratings to choose the best-rated subset of index bonds within each industry.

In earlier research (Polbennikov 2016), we analyzed the historical returns of both indices relative to the Bloomberg Barclays US Corporate IG Index. While they underperformed in terms of nominal returns, some of that underperformance was traced to systematic biases unrelated to ESG criteria. Once these biases were corrected, we found that the return impact due specifically to the ESG tilt in security selection was positive for the Sustainability index but negative for SRI. We concluded that the wholesale exclusion of industries from the investment universe, while it may be desirable based on ethical considerations, is not justified based on purely financial criteria.

Our Methodology: Objectively Measuring ESG Impact on Performance

For insight into the impact of ESG-related practices on corporate bond portfolios, we applied an ESG tilt in security selection within each industry. Can such an approach improve portfolio performance over the long term?

To measure the effect of ESG investing on credit portfolio performance in an objective manner, it is important to isolate the ESG effect from all other possible sources of risk. To do this, we constructed pairs of portfolios that differed drastically in their ESG scores, but whose risk profiles were nearly identical across important dimensions of risk for corporate bonds. We then measured and compared the performance of these portfolios over time.

The core of our portfolio construction technique is a mechanism for building well-diversified portfolios of bonds designed to track a benchmark – in this case, the Bloomberg Barclays US Corporate Investment-Grade Index. We applied a simple model that constrains the portfolio to remain neutral to the benchmark along multiple risk dimensions that could arise from differences in yield, maturity, credit quality, or sector allocation. In addition, limits on concentration ensured that the tracking portfolios were highly diversified.

Many such portfolios could be created; in our procedure, the model was run once to find the portfolio with the highest possible average ESG score that meets these constraints and once to find the one with the lowest ESG score. The two tracking portfolios were

reconstructed on a monthly basis, coordinated with the monthly index rebalancing, to ensure that they kept pace with any changes in the structure of the corporate bond market. Both tracked the index quite well, experiencing the same broad rallies and declines as the benchmark, so that monthly tracking error volatility was low. The key question is whether substantial differences arose over time between the average returns of the two portfolios.

The difference between the high- and low-ESG tracking portfolios can be interpreted as an ESG factor: the return contribution associated with systematically favoring high over low ESG corporate bonds while keeping everything else equal. This approach does not automatically exclude any issuer or any industry sector, no matter how controversial it might be.

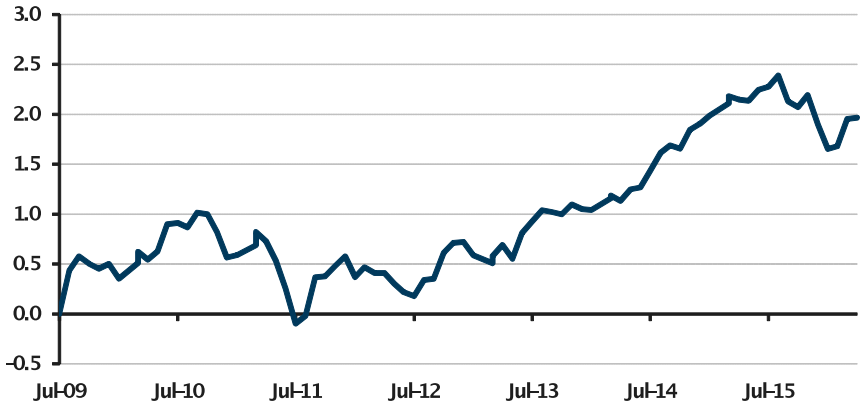
In addition to pairs of portfolios with the minimum and maximum overall ESG rating, we also created portfolio pairs that accentuate differences in individual E, S, and G scores, to try to observe which one of these three pillars is most related to performance. All of these studies were carried out twice, using ESG ratings from MSCI and Sustainalytics.

Our Findings

Most portfolio pairs (high-ESG minus low-ESG portfolios) delivered a positive return, indicating a generally positive return premium for the "ESG factor" in corporate bond markets.

Figure 10 shows the cumulative excess returns of the high-ESG over the low-ESG portfolios from August 2009 to April 2016. The time window of the analysis is limited by the availability of historical ESG data from the two providers considered. For this pair of portfolios, the cumulative outperformance was almost 2% over the past seven years.

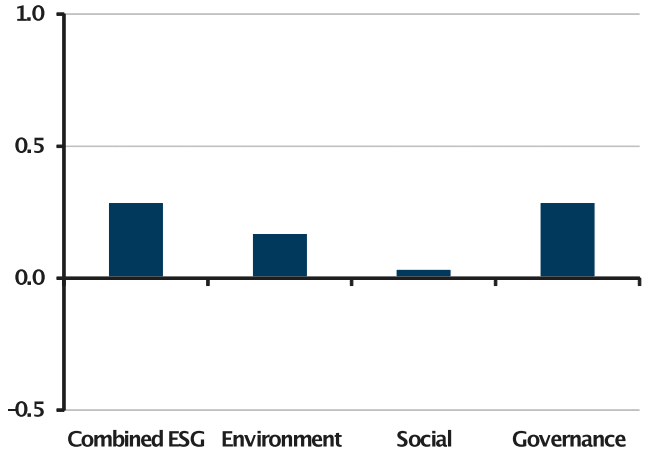
Figure 10. Cumulative Return (%) of a Portfolio with High ESG Rating over a Portfolio with Low ESG Rating using Sustainalytics ESG scores



Source: Sustainalytics, Barclays Research

Figures 11 and 12 summarize the returns of various simulated portfolio pairs, based on both MSCI and Sustainalytics data. For each one of these two providers, we construct four portfolio pairs to measure the performance associated with the combined ESG factor, as well as the environmental, social, and governance pillars taken in isolation. The average return differences reported in Figures 11 and 12 represent the difference in performance between high and low ESG-score portfolios. For both providers, the combined ESG rating has been associated with incremental returns over the past seven years. The return differences between the high and the low ESG portfolios are small (0.42%/y in one case and 0.29%/y in the other), but positive.

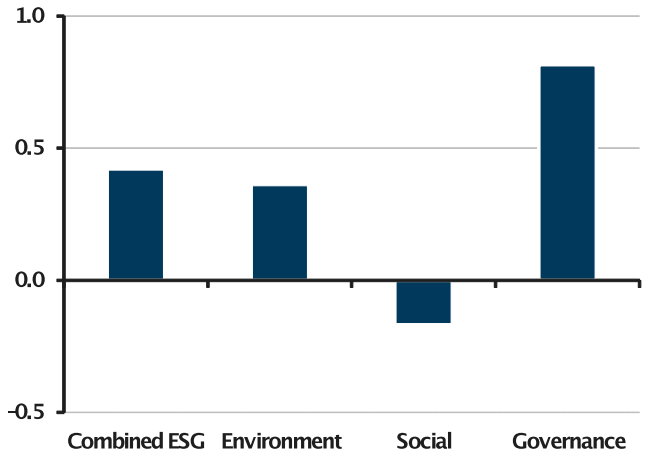
Figure 11. Return difference (%/year) between portfolios with high and low scores for ESG provider Sustainalytics



Source: Sustainalytics, Barclays Research

Note: Sustainalytics' governance pillar measures governance of sustainability issues. The firm has a separate corporate governance rating that is not represented in this study.

Figure 12. Return difference (%/year) between portfolios with high and low scores for ESG provider MSCI

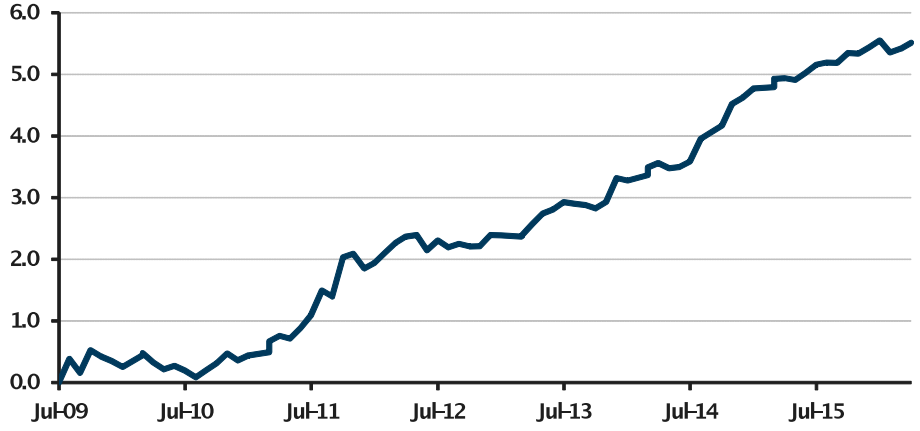


Source: MSCI ESG Research, Barclays Research

It is striking that despite different approaches to evaluating bond issuers, a similar pattern is observed for both providers: Governance has the strongest link with performance and social the weakest (even slightly negative). Environment is in between. The intuition of portfolio managers that governance is more important to portfolio risk and return than the other two dimensions of ESG (as seen in Figure 4) is validated in this analysis.

The message conveyed by this analysis is that incorporating an ESG tilt in an investment-grade credit portfolio is not detrimental to returns, but can be beneficial. This is particularly true for governance, which may indeed be a reflection of management quality that, over a long horizon, can be beneficial to bondholders of a corporation. In the example shown in Figure 13, the return associated with governance is high – 5.5% of cumulative outperformance – and persistent over seven years.

Figure 13. Cumulative return (%) of a portfolio with high governance score over a portfolio with a low governance score (using MSCI ESG scores)



Source: MSCI ESG Research, Barclays Research

No Evidence of "Systematic Richening" of High ESG Bonds

It is possible that, as a result of the increased popularity of ESG investing, portfolio flows from issuers with poor ESG attributes to those with high ESG scores have resulted in the systematic richening of high ESG bonds (and cheapening of low ESG bonds). If that is the case, the returns observed in our analysis should be considered as transient and possibly not representative of future market conditions.

If such a systematic ESG-based repricing of bonds happened in the past few years, it should be visible in bond valuations, particularly in spreads over Treasuries. However, issuers with high ESG scores could also have tighter spreads for unrelated reasons – they could be tilted towards higher credit ratings or specific industries, for example. We use statistical analysis to measure the extent to which there is a systematic ESG-specific spread premium that would cause the spreads of high-ESG corporate bonds to be higher or lower than those of their peers after controlling for sector, quality, and duration. We repeated this analysis each month and observed both the average results over our study period and the changes that were observed in the interim. We then calculated a crude estimate of the impact that these observed spread differences might have had on portfolio returns.

We found no evidence of a systematic tightening of high-ESG bonds relative to the broader market; in fact, if anything, we found the opposite. Results of the statistical analysis had low significance in many months, indicating that the market was largely pricing corporate bonds based on sector, quality, and duration, with little or no systematic preference for ESG bonds. As shown in Figure 14, using overall ESG scores from both MSCI and Sustainalytics as the ranking variable, a small negative spread premium was detected at the start of the

period, indicating that high-ESG bonds were more expensive than their low-ESG peers. However, by the end of the study, this reverted to a small positive number.

Figure 14. Implied Returns from Changes to ESG Spread Premium

		MSCI	Sustainalytics
ESG Spread Premium (bp)	Beginning of period (August 2009)	−5.3	−1.0
	End of period (April 2016)	0.8	2.9
	Average (Aug 2009 – Apr 2016)	−3.7	1.5
	Cumulative Change (Beg to End)	6.1	3.8
Implied Return Advantage of High-ESG Bonds (%/yr)	Carry	−0.04%	0.01%
	Price return from ESG spread premium trend	−0.06%	−0.04%
	Total Return	−0.10%	−0.02%

Source: MSCI ESG Research, Sustainalytics, Barclays Research

The effect of this premium on returns would be two-fold. First, over the long-term, high-ESG bonds should earn a carry advantage equal to the spread, which for the MSCI rankings came to an estimated -0.04%/year. Second, if the spread widened by 6 basis points over the course of the seven years of the study period – representing roughly 1 bp/year – this should translate into an estimated underperformance of about -0.10%/year. For Sustainalytics ratings, the performance difference was estimated at -0.02%/year. Thus, if there was a systematic effect of ESG ratings on pricing, the small changes to this number should have caused a small underperformance for high-ESG bonds over the study period. We can thus rule out the possibility that the outperformance of high-ESG portfolios described above was due to a systematic richening of ESG bonds; and there is therefore no reason to expect this outperformance to be reversed.

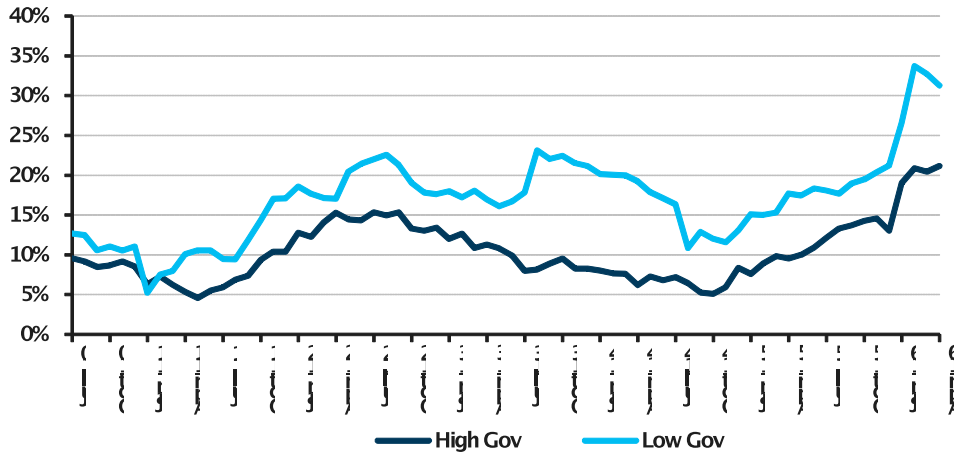
What Is the Reason for High-ESG Outperformance?

If there was no systematic richening of bonds with good ESG rankings, what has made them outperform? One interpretation could be that poor ESG rankings relate to risks of various types of adverse events that could negatively impact companies' fortunes and that, even over the relatively short time period we have investigated, our high-ESG portfolios experienced fewer such events than the low-ESG portfolios. Unfortunately, we do not have the data to document this effect. However, we know that in bond markets, negative changes to a company's outlook are often associated with a downgrade in credit ratings, as well as negative returns. Do we find that high ESG scores are associated with a lower rate of subsequent downgrades?

To test this, we partitioned our bond universe into two groups – above and below the median ESG scores – and observed the number and magnitude of downgrades in each set. This allowed us to report an annual "downgrade notch rate" capturing both the frequency

and intensity of downgrades. (For example, if 10% of the issuers in a given group experience one-notch downgrades and another 3% have two-notch downgrades, the downgrade notch rate for the year would be 16%.) We compared these downgrade rates for bonds scoring high and low in different ESG categories according to the two providers; the most striking difference in the two groups was observed using governance scores. As shown in Figure 15, bonds with low governance scores from MSCI experienced a consistently higher rate of subsequent downgrades than those with high scores throughout our study period.

Figure 15. 12-month Rolling Average Number of Downgrade Notches per Issuer per Year for Bonds with High and Low Governance Scores



Source: MSCI ESG Research, Barclays Research

Conclusion

All indications are that the trend towards sustainable investing is not only becoming more sophisticated but also gaining widespread acceptance. ESG has become an increasingly popular framework for measuring and managing assets in a way that resonates with the values and beliefs held by many asset owners. ESG investing is now becoming embedded in the investment process of many institutional investors.

While evaluating an investment across environment, social, and governance dimensions was once a demanding task, a number of service providers have emerged that offer ESG scores derived using non-financial metrics of corporate performance.

Our research into the impact of ESG on the performance of U.S. investment-grade corporate bonds in the past seven years shows that portfolios that maximize ESG scores while controlling for other risk factors outperform the index, and that ESG-minimized portfolios underperform. The effect was most pronounced for the governance tilt and least

pronounced for the social tilt. Favoring issuers with strong environmental or social ratings has not been detrimental to bond returns. These conclusions hold using ESG ratings data from two different ratings providers, despite significant differences between the two ratings methodologies.

In many publicly quoted companies, corporate decision-makers have been forced to balance the long-term best interests of their firms against relentless investor pressure for short-term earnings growth. The growth of the sustainable investing movement can help redress the balance. As ESG considerations play out over a long horizon, and as they increasingly become a priority for company managers, they may help alleviate the pressure for short-termism and, rather, encourage a focus on long-term value creation – to the mutual benefit of the firm, its investors, and the world at large.

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Appendix A: A Brief Glossary of ESG Terms

As the perception of ESG has changed over the past decade, the jargon used to describe the industry has evolved in step, developing more terms that have positive connotations regarding performance. In the brief (and certainly incomplete) glossary below, we attempt to summarize the industry jargon.

Terms for the Industry as a Whole

Responsible investing (RI): Investing based on criteria that are not purely financial, in order to support positive effects on society and avoid negative ones. This is a blanket term intended to encompass the items detailed below.

Socially responsible investing (SRI): Investing based amongst others on social criteria, for example by avoiding controversial industries such as tobacco, alcohol or gambling.

ESG: The environmental, social and governance metrics that investors apply to measure the sustainability of their investments. These factors are:

Environmental: Issues connected to global warming, energy usage, pollution and the like.

Social: factors such as how a company treats its workers, health and safety considerations, and community outreach.

Governance: a focus on topics including business ethics, board structure and independence, executive compensation policies and accounting.

ESG investing: Incorporates measurable criteria to compare investments across the three broad categories of Environment, Social, and Governance. ESG metrics provide measurable attributes of a corporation that may be used in many forms of responsible investing. Note that Governance is distinct in nature from Environment and Social attributes, and that investors may have their own priority ranking of the various categories. "ESG investing" has become synonymous with "sustainable investing."

Sustainable investing: Ensures that an investment will preserve its value over time. In the case of a corporation, ensuring that it has the capacity to endure and can keep operating over a long period. In this view, ESG factors serve to highlight exposures to risks that could derail a company over the

long term. A poor environmental record may make a firm vulnerable to legal action or regulatory penalties; mistreatment of workers may lead to high turnover, low productivity, or poor quality work; poor corporate governance can give management wrong incentives or increase the likelihood of accounting irregularities. By extension, a sustainable investment should not be detrimental to the broad ecosystem in which it operates. So sustainability can been seen at two levels: sustainability of the investment and sustainability of the world.

Ethical investing: Ensures that specific ethical or religious considerations are taken into account when choosing investments. This is very similar to Socially Responsible Investing and generally involves exclusion of controversial industries. The "ethical investing" term has been used more widely in the UK.

Impact investing: Investments that consider social or environmental benefits alongside financial return. Impact investors may be willing to earn below-market returns in order to help finance causes they deem worthy. This may be seen as an alternative to dividing assets among investment funds seeking to maximize financial performance and philanthropic activities for social benefit and no financial return. By directing a larger fund base to address both issues simultaneously, a larger net impact might be achieved. An example of impact investing is investing in green bonds, whose proceeds have clear net environmental benefit and comply with standards called Green Bond Principles.

Sustainable and responsible investing (SRI): Used as an umbrella term for all of the above by industry associations. This – the second definition of SRI – seems to be the preferred term accepted by industry organizations because it is broader in scope and places greater emphasis on issues that are financially material to investors.

Ways to Incorporate ESG Goals in a Portfolio

Negative screening: Excluding specific companies or industries that are considered to be particularly objectionable from the investment universe of a portfolio. For example, Bloomberg Barclays MSCI Socially Responsible (SRI) Indices apply a negative screen to existing Bloomberg Barclays indices to exclude issuers involved in activities that are in conflict with investment policies, values, or social norms, such as tobacco, alcohol, nuclear power and weapon manufacturing.

Positive screening: Selecting a portfolio of companies with desirable characteristics to form an investment universe or a benchmark index. For example, the STOXX Global ESG Leaders equity index offers a representation of the leading global companies in terms of environmental, social and governance criteria, based on ESG indicators provided by Sustainalytics.

ESG integration: The inclusion of ESG metrics in all aspects of the investment process, such as security valuation, the formation of expected returns, risk analysis and portfolio construction.

Corporate engagement: The process by which investors actively seek to influence corporations with a view to addressing ESG shortcomings and to encourage better practice. An active ownership culture – also called stewardship – among shareholders can help promote more sustainable and

responsible business practices. Most corporate engagement relates to governance issues, as this is where the relationship between investors and corporate management can be anchored in existing accounting, financial and legal frameworks.

The ESG Rating and Ranking Industry: Vice or Virtue in the Adoption of Responsible Investment?

Stephanie Mooij

Stephanie Mooij is a third-year DPhil candidate at the Smith School of Enterprise and the Environment, University of Oxford, whose thesis is about identifying obstacles in the investment chain when it comes to ESG integration. Stephanie has two years of work experience at Ownership Capital, a long-horizon equity manager based in Amsterdam. This investment fund is a spin-out of PGGM's successful responsible equity strategy. This concentrated fund unlocks value (ESG or other) by engaging as an owner of the companies they invest in ("Ownership Investing"). Moreover, the company analysis is fundamental and ESG is completely integrated at every level. She has also completed an equity valuation internship at Duff & Phelps and a private equity internship at GIMV. Her degree is a MSc in Finance & Investments (Cum Laude and Honours) from Erasmus University in the Netherlands.

Abstract

The industry related to environmental, social, and governance (ESG) initiatives has grown tremendously in the last decades. Many organizations in this sector serve as intermediaries between companies and their investors, with billions of dollars in capital allocated based on the judgment of these intermediaries. Much academic research is also rooted in their work. Regardless of its widespread use, little is known about how this industry arose and what precise role it serves. The multitude of initiatives and lack of convergence raise questions on whether the industry's costs outweigh its benefits. This paper uses the Industry Life Cycle Model to investigate 218 ESG initiatives and illustrate that the ESG industry is maturing. It draws upon interviews conducted with its users to strengthen this finding. The paper concludes that reporting fatigue, a lack of convergence, and the (sometimes) poor information quality along with lack of transparency have made the industry more vice than virtue in the adoption of responsible investment.

Acknowledgments

This paper is based on 45 interviews conducted with asset owners, asset managers, and companies based in the UK, the Netherlands, and Germany. Although the respondents remain anonymous throughout the paper, I would like to extend my gratitude to them for taking part and for providing me with invaluable insights. Moreover, I would like to thank Gordon Clark and Colin Mayer for the fruitful discussions, helpful feedback, and support.

Emergence of an Industry

Many environmental, social, and governance (ESG) rating agencies and related initiatives emerged in response to the rising popularity of responsible investment. These groups assess corporations on their ESG performance (Fowler and Hope, 2007; Sadoswki et al., 2010; Scalet and Kelly, 2010). Besides ESG ratings, there are also about 500 rankings (Branding Institute, 2016), 170 indices (Lydenberg and White, 2015), 100+ awards, and at least 120 voluntary standards (Bowen, 2014). On top of that, there are think thanks, institutions, and other associations with their own interpretations of how to understand the relationship between companies and their ESG performance (Vandekerckhove et al., 2012).

Companies have come a long way in their ESG disclosure, but this topic is haunted by a lack of standards, training, and consensus. The information therefore cannot be used for comparison and is difficult for investors to interpret. (Hockerts and Moir, 2004; Juravle and Lewis, 2008; Munro, 2015; Ransome and Sampford, 2013; Searcy and Buslovich, 2014; Searcy and Elkhawas, 2012). ESG initiatives aim to sort this information for practitioner use. Unfortunately, they vary widely, conditional on the audience that they are looking to serve and the criteria that they take into account (Charles J Fombrun, 1998; Gladman, 2015; Scalet and Kelly, 2010; Sonnenfeld, 2004). Given ESG initiatives are an important intermediary between companies and asset managers (AMs), the quality of information is imperative to understanding impediments to responsible investment in the investment chain.

Some of these intermediaries simply send the companies they are assessing verification requests based on public information, but many rating agencies require more involvement from companies. This can include questionnaires, interviews, or even on-site visits (Schaefer, 2005). The *Rate the Raters* initiative by SustainAbility finds that, out of 108 organizations, about 60% rely completely or partially on information submitted by companies (Sadoswki et al., 2010). Amid this process, one concern is that there are too many, and often duplicative, questionnaires; much of the information asked for is already public (Searcy and Elkhawas, 2012). Many companies use half of a full-time post to simply respond to surveys (Oekom et al., 2013). This investment provides larger companies with an unfair advantage and helps them stand out for the wrong reason: ticking all the right boxes (Chatterji et al., 2009; Hanson, 2015; Searcy and Elkhawas, 2012). This is not surprising, as ESG rating organizations often state that the goal of their work is to support implementation of the UN Principles for Responsible Investment (PRI). In other words, many ratings are intended to tick boxes rather than increase shareholder value.

To make matters worse, recent academic evidence finds low correlation between different ESG ratings. This sheds doubt on the reliability of ESG scores (Chatterji et al., 2015;

Dorfleitner et al., 2015). Even when Chatterji et al. (2015) adjust the ratings for what raters say they are trying to measure, convergence did not improve by much. According to the authors, this means that most rating agencies have substantial measurement error when trying to capture similar ESG concepts. (That Volkswagen was announced industry leader in the Dow Jones Sustainability Index (DJSI) minutes before the emissions scandal broke does not help the case for ESG rating agencies.) This is all unsurprising, though, given there are no rules guiding the development of these metrics, nor is there general agreement on how to measure ESG (Dillenburg et al., 2003; Dorfleitner et al., 2015).

The large number of ESG initiatives along with their questionable reliability raises questions about the role of the industry. It is thus important to take stock of this new industry – to investigate its status and analyze its role as an intermediary. Two motivations drive this effort.

1. Scholars and practitioners (AMs) rely on ESG initiatives as a proxy for ESG performance, often not knowing that there is little agreement between different initiatives. This calls into question the validity of academic studies that have used these ratings (Igalens and Gond, 2005). Moreover, though the lack of agreement is difficult for AMs to observe (Chatterji et al., 2015), these large investors rely on it to help distinguish ''responsible'' from ''irresponsible'' companies. They use this tool to allocate billions of dollars in capital.
2. Responding to all ESG-related inquiries uses companies' time, and is therefore costly. If the conclusions of these ESG initiatives are not accurate, companies would be better off taking care of matters more urgent and relevant than reporting. As previously mentioned, these ESG agencies are an important intermediary between companies and investors. This means that they are a vital piece of the puzzle in investigating the adoption of responsible investment.

To address these concerns, we must understand the status of the industry and what precise role it serves. Specifically, are these ESG ratings and rankings a vice or a virtue in the development of responsible investment? The following paper probes this question. Through research and interviews with companies, asset owners (AOs), and AMs, the article explores the concerns mentioned above.[86]

I commence with a discussion of theories to analyze industry development. I then proceed with an overview of the research methods, after which I use the Industry Life Cycle Analysis (ILCA) to assess the stage of development of the ESG-initiative industry. I then provide an overview of the industry as well as some of its milestones. Although this

[86] I conducted interviews in the UK, the Netherlands, and Germany, with a total of 45 respondents. Appendix 2 provides more information on the sample and questions pertaining to this paper.

overview only scratches the surface, it appears to be the most comprehensive one in the literature. Afterwards, I provide a comparison to the credit rating industry as well as a brief overview of product innovation in the industry. From there I provide the results of interviews with companies, AMs, and AOs, along with a discussion of the findings. These results are used to answer the pressing question on whether the industry is a vice or a virtue in the development of responsible investment.

Defining an ESG initiative

Due to the many different types of ESG initiatives, it is important that I describe what I mean when using this term. Scalet and Kelly (2010) define a rating agency as: "Any organization that rates or assesses corporations according to a standard of social and environmental performance that is at least in part based on non-financial data." Much like ratings, indices can also serve as a framework or basis for investment products and as benchmarks for assessing investment performance (Grayson and Nelson, 2013; Lydenberg and White, 2015; Oh et al., 2013). These indices are often built on ESG ratings, as are awards and rankings.

When using the term ESG initiative I refer to the above organizations, but also to others that focus on ESG or have launched an ESG-related product. Examples are corporate social responsibility (CSR) research agencies or shareholder services. These players influence the ESG discourse by, for example, publishing pieces such as "Behind the Brands," by Oxfam. Appendix 1 lists all 218 initiatives investigated – a first attempt to shed light on the ESG-initiative industry's status and role.

The Industry Life Cycle Model

Scholars have come up with many different models to predict the changes that occur from the birth to the decline of an industry (Abernathy and Utterback, 1978; Adner and Levinthal, 2001; Deans et al., 2002; Porter, 1980; Utterback and Abernathy, 1975). Michael Porter introduced one of the more widely known theories in 1980: the Industry Life Cycle Analysis (ILCA). His model predicts that industry growth generally follows an S-shaped curve, from introduction to growth, then maturity, and finally decline. The phase that an industry is in has important implications for firm strategy. Product innovation, for example, can further increase the growth or stall the decline (Porter, 1998). Organizations should thus make understanding where they fall in the cycle the cornerstone of their long-term plan (Deans et al., 2002).

The ILCA is helpful when attempting to explain industry changes simply by looking at technological developments. The early stage of the ILCA is characterized by ambiguity, as little is known about the product features desired by the buyer (Klepper and Graddy, 1990). The duration of the total cycle depends on many factors, like barriers to entry and

the ease with which the product can be copied. If the product takes off, more players will enter the market to take advantage of its popularity. This reduction of uncertainty may lead to new entrants, including more established firms (Porter, 1998). As the number of users grows and eventually levels off, companies have to adjust accordingly by first improving quality and then enhancing the product and expanding capacity (Mirva Peltoniemi, 2011). At some point, there will be a decline in the number of market players as the industry starts to consolidate. Product obsolescence or a fundamental change in technology can trigger this leveling off; this may signal the start of a new product cycle (Audretsch and Feldman, 1996; Klepper and Graddy, 1990; Porter, 1980).

Several factors influence the rate at which an industry goes through these phases. First, there is the complexity of the product's technology, as simple products mature faster; they may be adopted more quickly and are easily imitated, which reduces barriers to entry. Second, diversity in buyers' preferences hampers the emergence of a dominant design, which may lengthen the time it takes to reach maturity (Klepper and Graddy, 1990). However, some products do not have a dominant design as customers value a wide range of choice (McAfee, 2002). These customers become more knowledgeable – and often more demanding – as the industry matures; they may require complementary products, customization, or improved performance (Porter, 1998, 1980). Customers may also express preference for bundling or unbundling of certain features. This tendency to offer packages is explained by economies of scale rather than transaction costs, and it can encourage synergies as a firm is likely bound together by several capabilities (Langlois and Robertson, 2002).

The ILCA is an effective tool to better understand how a new industry – ESG initiatives, in this case – has developed. Moreover, if we know what cycle the industry is in, we can gain insight into firm strategy and get an idea of where the industry is going. The next section provides an ILCA of the ESG-initiative industry, followed by a detailed description of the milestones in its development.

Research Methods

I used two methods to investigate the role of the ESG-initiative industry and whether it is an impediment to responsible investment.

Desk Research

I compiled and sorted information on the ESG-initiative industry to provide a comprehensive overview (see Appendix 1). This overview is not meant to be exhaustive, as there are countless initiatives involved with ESG. I gathered existing initiatives through extensive searches, reports of companies, and some existing overviews. I collected the description, country of origin, launch date, target market, and methodology of each

initiative and then divided these into seven categories: awards, ratings, rankings, index, research, shareholder services, and other initiatives. Initiatives that focused more on rating countries were excluded, as were those that appeared to be inactive. Whenever possible, I used books or papers from around an initiative's launch to piece together information. In the rare cases when a launch date was not given, I emailed the organizations in question or estimated a date.

Based on this overview, I used the ILCA to analyze the development of this new industry. As discussed in the previous section, this helps to reveal the current state of the industry and where it is going. By counting the number of initiatives each year and correcting for acquisitions, we can graph the trend in the ESG-initiatives industry. If the trend is leveling off, we might conclude that the industry is mature and that adjustments in quality of ESG products or initiatives should be expected. However, if the number of players is declining, the industry is in the decline phase, which could indicate obsolescence or a fundamental change.

Field Research

I conducted semi-structured interviews with select companies, AMs, and AOs (see Appendix 2 for details). Semi-structured interviews provide sufficient focus to address the research questions while leaving flexibility for participants to contribute unique insights (Galletta, 2013). The interviews followed the "close dialogue" approach, as proposed by Clark (1998). These interviews were a form of a "bilateral engagement," rather than a one-way street (Clark and Monk, 2017). Predefined questions guided the interview through an iterative method that shuttled between theory and empirical evidence. Although close dialogue may not be the most conventional method, it is necessary in this case to better understand organizational beliefs and behavior. Instead of taking for granted the world of existing theories, this method offers the opportunity to reconstruct and enhance our current understanding. Close dialogue helps us think outside of the box and promote conceptual and theoretical innovation (Clark, 2007, 1998b).

Company respondents were selected by means of a Bloomberg Screening across the UK, Germany, and the Netherlands. The sample selection for the AMs and AOs required a PRI transparency document, as this helps to prepare for the interviews and fill in missing information. The selected respondents were approached via LinkedIn or email, with a short description of the study. I offered anonymity to maximize the likelihood of obtaining unique insights. I conducted several interviews face-to-face to establish rapport and to acquire further potential interview participants. Given that respondents tend to speak more freely without recording, I mainly took notes. Those were immediately analyzed, coded, and compared with the help of NVivo software.

Although there are many advantages to computer-aided analysis – more explicit rules and higher coder reliability in applying those rules – there are also many drawbacks. One is that the data reduction method omits details from the collected data, reducing the richness of collected information. Other drawbacks relate to the reliability and validity of coding; a computer can apply explicit rules over and over, but if definitions or wording are ambiguous then it will not measure the intended construct (Drisko, 2015; Weber, 1990). Given these drawbacks (but mainly to prevent the loss of data richness), I used NVivo as a tool to sort themes and look at the data from different angles.

The Evolution of ESG Initiatives

I identified 218 ESG initiatives and their launch dates through Google searches, company websites, and interviews.[87] Although sales numbers were not available, the new entrants each year were studied to gain some insight. Specifically, the launch date refers to when the ESG-related product or service is launched. Where this is not available, it refers to the organization that launched it. In ~5% of the cases, this date may be slightly off; it is not always indicated and some initiatives are rather small and have not left much of a trace.

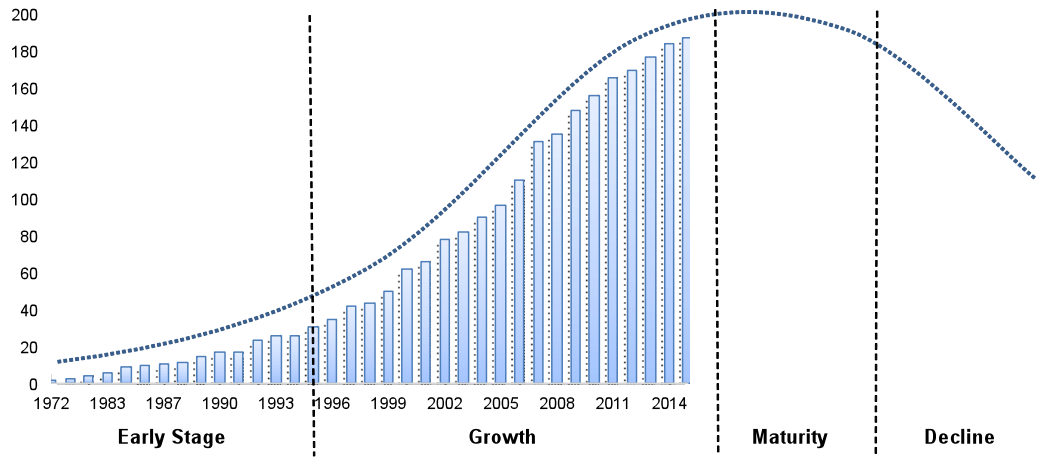
As Figure 1 demonstrates, the ESG initiative industry is transitioning from the *growth* phase to *maturity*. The rate of market entrants is slowing and their number is closer to the number of exiting companies. This normally signals when organizations shift focus from improving the product and introducing new variants to enhancing the process and expanding their capacity (McAfee, 2002; Mirva Peltoniemi, 2011). Many players in this industry already scaled during the growth phase, as coverage is one of the most important criteria for buyers. In fact, about 15 acquisitions took place from 1999 to 2002 and many partnerships formed between organizations in the ESG database. This was done to either boost coverage or to expand the number of products offered. At this point, a few players dominate the market and large companies may continue to form alliances with peers as they find new ways to grow their core business in an established industry (Deans et al., 2002). Difficulty maintaining market share and profit levels characterize the *maturity* phase, as competition is high and most potential customers have already bought the product (Porter, 1998, 1980).

Although the products launched by the ESG-initiative industry are not complex in nature, diversity in buyers' preference has probably hindered the development of a dominant design. As previously described, ESG suffers a lack of standardization and consensus. This has given rise to a multitude of responsible investment strategies and created room for a

[87] The database I use here does not list all products separately. KLD, for example, launched the Domino 400 Social index in 1990. This is the first social investment benchmark, but they launched their rating product shortly thereafter, in 1991. The launch of their rating was thus more of a product expansion than a separate initiative, which is why they are listed together and only counted once as an index starting in 1990.

variety of ESG products – likely one of the reasons that the industry has not matured faster. Moreover, as detailed below, product innovations have taken place that reached a wide variety of buyers and boosted the adoption of ESG initiatives, thus stalling the decline phase and further supporting growth.

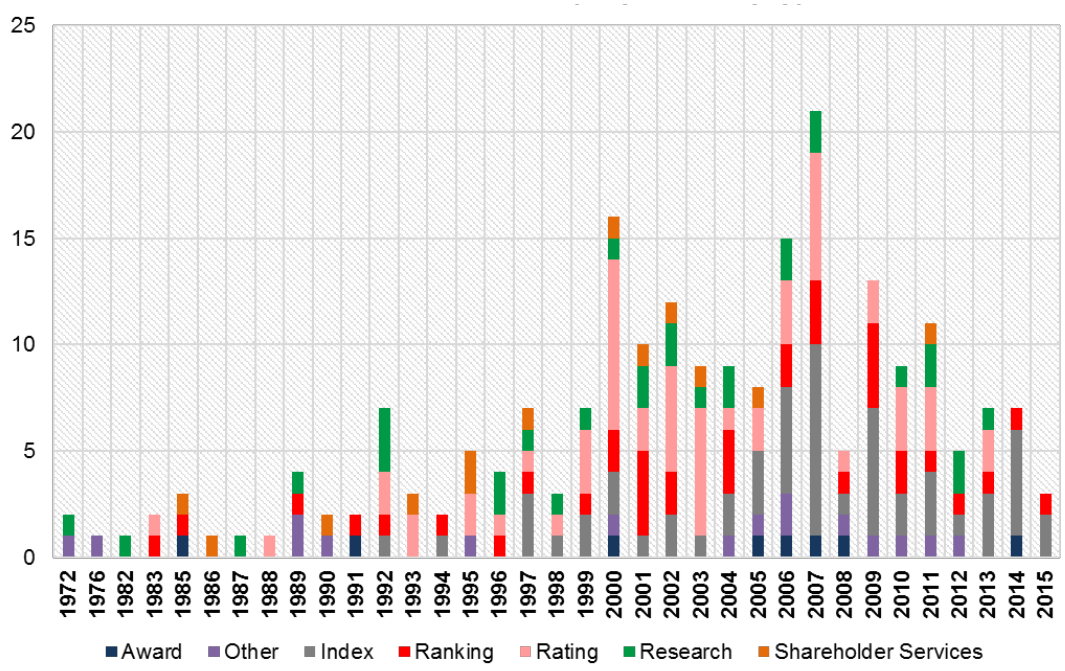
Figure 1: Industry lifecycle analysis of ESG ratings, rankings, and other initiatives



Milestones in the Development of ESG Initiatives

Figure 2 shows the first products that were launched and how the offerings have evolved. The U.S. and the UK support most ESG initiatives in the database, followed by Germany, France, and Switzerland. I've listed milestones during the development of these initiatives below, with the introduction of new ESG products discussed in the following section. The database does not include sell-side research on ESG. While this does reflect an increase in demand on the investor side, the ESG offering as part of their overall product portfolio is negligible.

Figure 2: ESG initiatives launched per year and by type



1960s and 1970s. Although there were small waves of interest in the social conduct of corporations before the 1960s, that is when interest in its measurement really started. The Council on Economic Priorities launched in 1969 to track corporate and government behaviour; they released a series of publications profiling U.S. corporations and their environmental and hiring practices. Due to the inherent subjectivity of the process, they decided not to rate companies. Milestones in the 1970s were the launch of the Investor Responsibility Research Center (IRRC) and the Interfaith Center on Corporate Responsibility (ICCR), both established in 1972. The latter comprised the first religious investors to file proxy resolutions with social and environmental themes. Of course, proxy voting and corporate governance inclusion goes back much further (e.g., Gilbert brothers in 1932), but these initiatives were formed specifically to help institutional investors as demand for responsible investment products and consultancy grew. The Sullivan Principles, introduced in 1976, also gained a lot of traction. These Principles were launched to help fight the Apartheid regime. Companies voluntarily subscribing to the Sullivan Principles were monitored and rated on compliance. This approach gained significant momentum in the 1980s and prompted debate (Lydenberg et al., 1986; Lydenberg and Paul, 1992). It also laid the foundation for the commercial rating models that exist today.

1980s and 1990s. *Fortune* launched the first corporate ranking, "America's Most Admired Companies," in 1983. This marked the start of the ranking industry and also, incidentally,

the rating industry, with the introduction of the now well-known rating company EIRIS. EIRIS started out as a foundation, helping churches and charities incorporate their ethical principles into their investment allocation decisions. Demand for ESG focus from institutional investors drove them to launch a rating service. As mentioned earlier, KLD was a pioneer with the launch of the Domini 400 Social index in 1990 (now MSCI KLD 400 Social). However, they gained more popularity when they launched their rating product in 1991. At the time, there was no benchmark in place for investors who screened their portfolios based on ESG indicators. This was exactly the motivation for constructing this index as Kinder, Lydenberg, and Domini applied different sets of screens to the S&P 500 (Domini et al., 1992). The rating product behind the index construction was launched a year later and became very well known. They became part of RiskMetrics in 2009 and MSCI acquired RiskMetrics in 2010.

2000 until present. The year 2000 saw a lot of ESG "newcomers" on the scene, notably UN Global Compact 100 and Governance Metrics International. The former became an input for many ESG screening tools and the latter was the predecessor to GMI Ratings, a well-known rating agency that has been part of MSCI ESG since 2014. The ESG initiatives had to professionalize their products to stay afloat and expand their coverage to compete for customers. Most acquisitions took place from 1999 to 2002. Increasing coverage through acquisitions or partnerships helped scale up without having to duplicate the costs involved with data gathering and analysis (Crockett, 2003).

By 2000, the first ESG research teams formed at HSBC – the first firm to offer this in Europe and only the second in the world. This move encouraged mainstream investors to push ESG forward. Led by the demand of institutional investors, quite a few of the established brokerage houses were offering ESG research by 2005 (de Graaf and Haigh, 2011). Soon, different and more technologically savvy products emerged, aimed at carbon screening and other portfolio analytics for institutional investors. As previously mentioned, innovations such as these can boost adoption among users and stall the decline in the ILCA. RepRisk, for example, launched a web-based tool in 2006 that enables investors to screen the media for ESG risks. Although products have changed over the years, the issues in rating systems today do not differ widely from those raised in the 1960s and 1970s. What does differ is how issues are put on the agenda. For example, instead of calling for increased regulation, companies are now expected to make voluntary changes to stay ahead of the pack.

Comparison with the Credit Rating Industry

ESG ratings have some similarities to credit rating agencies. They both mold assessments into easy-to-use numerical scores or letter grades. And both often use public input information, with the intermediary not solving information asymmetries. I follow the argument that Rhee (2015) makes about credit rating agencies having a sorting function:

instead of *producing* information, ESG agencies *process* a large volume of information. This facilitates more efficient ESG screening.

Another similarity between ESG and credit rating agencies is the shifted focus from initial development stages centered on research. The credit rating industry has its roots in 1841, when a merchant started gathering and selling information on the creditworthiness of companies in the U.S. He had been collecting this information on his own clients and spotted a gap in the market. The first commercial rating book was published in 1857 and Moody's Investors Service joined in 1909 with their bond ratings. About 10 years later, U.S state and local government bonds were rated. ESG ratings differ in that they are unsolicited and paid for by the users. The exception is a few companies that offer ratings to companies for a fee. This kind of service is more of an assessment and consultancy designed to help companies improve their rating.

Credit ratings help reduce regulatory costs and send signals to investors about the quality of securities (Jeon and Lovo, 2013). In 1936, the Comptroller of the Currency prohibited national banks from investing in bonds that were not investment grade. In case of doubt about the rating, it had to be guaranteed by at least two rating agencies. Later, in 1975, the SEC stepped in to introduce Nationally Recognized Statistical Ratings Organizations (NRSROs). This way, only long-recognized ratings were relevant for SEC regulations and both smaller and new ratings were excluded (Coffee, 2006; Sylla, 2002). Although ESG ratings differ from the regulated credit rating industry, some of the AMs have adopted ESG ratings in a similar way. They opt for the established rating agencies and subscribe to more than one provider. In cases of extreme discrepancy between ratings, they dig deeper. This is especially helpful for larger holdings, as a small error on behalf of one rating agency may result in significant capital reallocation.

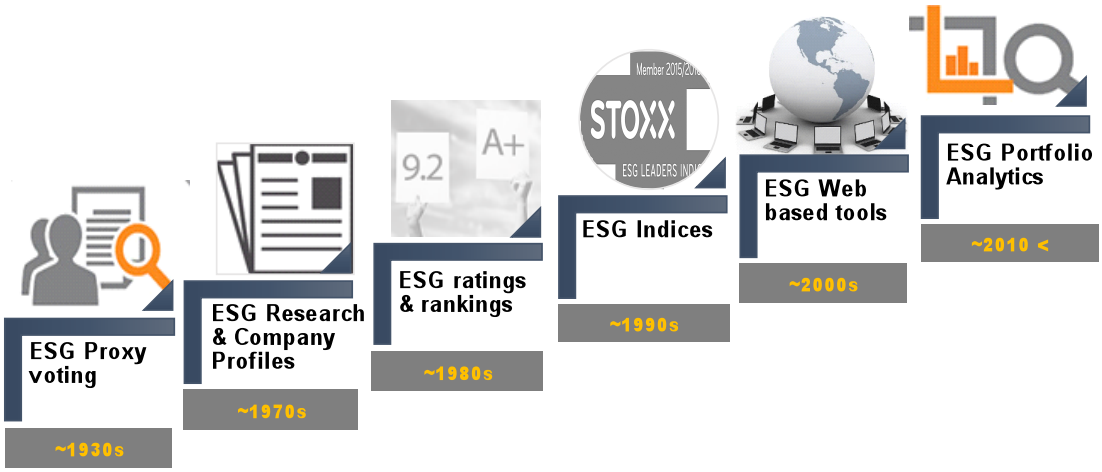
Product Development and Complementarity

ESG products have progressed through several phases. Although most organizations started out with a single product, they gradually expanded to become a one-stop-shop for investors' ESG needs. Figure 3 reviews approximately when different types of products entered the scene. It must be noted that proxy voting has been around for a long time, but the service for institutional investors really started with the IRRC in 1972.

Lack of consensus and a range of different ESG strategies bring about diversity in buyer preferences, likely contributing to the industry's slow maturation (Klepper and Graddy, 1990). Most ESG initiatives have a large assortment of products to cater to the range of ESG strategies employed by investors. As seen in Figure 3, in-depth ESG research and proxy research have been around for decades. These products are still used by some fundamental investors. Other investors need tools to scan many companies and to screen out those that

are ''irresponsible'' based on a set of exclusion criteria. Yet others need an index or screening tool tot comply with clients' request for a low-carbon portfolio. AOs are under more pressure than ever to know what they own; portfolio analytics can be a helpful tool.

Figure 3: ESG Product development phases



Results and discussion

The results of interviews, by subject, are detailed below. It is important to note that the interviews were focused primarily on those ESG initiatives that need information from companies, such as rating agencies, awards, rankings, and indices. The interviews were conducted with 20 companies, 15 AMs, and 10 AOs in the UK, the Netherlands, and Germany. The response rate was 45%. More details on the interviews and the respondents can be found in Appendix 2.

Companies

Companies on average receive roughly 30 requests a year from ESG agencies. This is likely an underestimate since invitations to participate are sent to disparate departments. Despite uncertainty, it is clear that the range of requests varies widely and companies without an ESG reporting function may split these requests between different roles. The number of annual requests is three times greater than what oekom found (2013). This may be due to the fact that the companies in my sample are larger than the companies surveyed by oekom. It may also be due to growth of the industry and the methodological inclusion of rankings and other initiatives.

More than half of companies doubt the value of responding to every request, as the work already requires at least half of a full-time job to fulfil. This includes a few respondents who stated that the industry does have value but has become too unwieldy. Those respondents who think the industry has value all seem to have an advanced filtering system in place to minimize reporting fatigue.

Nevertheless, many respondents still try to fill out as many requests as they can. They want to be helpful and transparent. Some even responded to requests despite describing the scores as "nonsense." Reputation is another important driver for respondents. Not filling out a questionnaire may give the impression that they have something to hide. Respondents expressed concern the number of agencies and requests makes prioritization difficult, although nearly all respondents agreed that CSR awards are not a priority. While useful for marketing, these are not as important or credible as ratings or rankings. (Many awards have even lost credibility by requesting sponsorship fees.)

Some companies prioritize based on credibility. MSCI, Sustainalytics, and oekom are the most credible organizations based on my interviews. The Carbon Disclosure Project (CDP) and DJSI were also frequently mentioned, as was the Dutch Transparency Benchmark for Dutch companies. (These last two are also sources of frustration.) In general, established raters are preferred over newcomers, indicating that there is not much room for new entrants. Few companies maintain a materiality approach by which they select those ratings and rankings most relevant to them. Some companies simply respond to those agencies requested by shareholders or to those with a big audience. Some players, such as CDP, Sustainalytics, and DJSI have been clever about reaching a wider audience and distribute their data via the Bloomberg terminal.

For some companies, ratings and rankings have become a benchmark that generates competition with peers. Many companies use these ratings to measure their progress. These effects are especially helpful for internal ''sustainability people'' who are trying to gain support for certain ESG projects. To them, these questionnaires have become a proxy for investor demand. More than one respondent claimed that it really helps to get their superiors to sign off on certain projects. It also helps companies to understand the areas in which they need to be more transparent and it provides them with insight into trending topics and potential points of improvement.

More than half of respondents complained about the time required to fill out non-comparable but overlapping or irrelevant questions – time that could be used to make actual progress with their ESG journey. The methodologies are complex and there is a lack of harmony. This is reason for concern given the number of surveys. Some respondents stated that ratings and rankings have become an obsession for companies and that one can score high by simply ticking the right boxes: "Practice makes perfect" also goes for filling

out questionnaires. The DJSI, especially, was mentioned as a frustrating process – both lengthy, and demanding of expertise from different departments. It can take more than 30 employees and 1,000 hours to respond to. On top of that, payment is often required to get feedback. Opinion is divided, though, as some also find it helpful to see what questions are on the agenda and to get an impression of how they measure up. Few use the DJSI as a management tool or link it to compensation, but most respond to it because it reaches a big audience. CDP was also frequently mentioned, but in a more positive light, as the initiative is more transparent.

Companies believe that ratings and rankings should focus on material and relevant issues. They must be transparent both with methodology and assessment. The matter in which companies are assessed is often not straightforward. Some respondents described receiving inconsistent assessments between years. They also said that it would be helpful if these initiatives shared data, as this would minimize reporting fatigue and inconsistencies. Another suggestion was that they improve their follow-up – sometimes a 6-month wait for an outcome – and be more considerate toward companies in general.

In sum, ESG initiatives can help companies understand what is expected of them. They can help sustainability-focused employees get internal approval for their projects and create a sense of urgency. Finally, they are useful for benchmarking and tracking progress. The downsides include irrelevance or immateriality as well as the sheer number of ESG initiatives. They take too much time and questions are overlapping but different. Companies that excel at filling out the questionnaire can improve their score without changing practices. The exercise then becomes more about ticking the right boxes as opposed to making the right improvement. Lastly, many ESG initiatives do not conduct assessments transparently.

Asset Managers

Due to the sheer number of companies that must be screened, AMs often use external parties with extensive ESG coverage. This is why many rating agencies scaled through acquisitions or partnerships. Lack of time, expertise, or analysts, makes it infeasible for investors to do ESG research. It is more efficient to simply subscribe to an ESG rating agency. This is in-line with other research that finds investors resource-constrained (van Duuren et al., 2015): They often have many stocks to cover and use ESG as a screening tool to identify their investable universe. This means that stocks may automatically be cut from a portfolio when an ESG score is downgraded.

Although not everyone is aware of the recent evidence on the lack of correlation between ESG ratings, AMs are not surprised to learn of it. Some have already discovered errors in ratings and try to be mindful when choosing one. Some state that, although far from

perfect, ESG ratings currently offer the best approach given the sheer number of stocks covered. Others subscribe to several different rating agencies to deal with discrepancies. Although costly, this provides them with different viewpoints and avoids putting all eggs in one basket. Large discrepancies between scores can be investigated, which is more efficient than considering every single company in the portfolio. Some combine many providers including RepRisk, Trucost, Sustainalytics, and MSCI.

MSCI and Sustainalytics are the preferred providers and many respondents described these rating agencies as complementary. A few respondents said MSCI is known for governance (due to the GMI acquisition) while Sustainalytics is stronger in environmental and social analysis. Both players have extensive coverage. The choice of provider may also be due to a fund's history. (MSCI is often in place as the benchmark.) As discussed earlier, this ''one-stop-shop'' model is practical for the users of ESG data. In addition to these kinds of rating providers, respondents often use a RepRisk "overlay" to track reputational aspects.

Overall, the reliance on rating agencies is more pronounced than that found by van Duuren et al. (2015) in their survey among 100 fund managers. These investors indicate that they mainly use ESG rating agencies for red-flagging and managing risks. According to the interviews I conducted, many investors rely on rating agencies for ESG expertise and efficiency. Although not always clearly indicated, many AMs use the scores to identify the ''most responsible'' companies – a screening method that assumes these ratings are a good proxy for ESG performance. AMs allocate capital based on these ratings, though many know that it is not a perfect solution. Respondents questioned the quality of the data and had difficulty quantifying certain information. However, they also stated that this is the best approach available and that rating quality has been improving over the last few years. Other AMs do not find the scores useful and use the narrative included in company profiles to feed investment decision making. They find it helpful to have different viewpoints and to outsource the collection of ESG information.

Asset Owners

Approximately 70% of AOs have no preference whether AMs do their own ESG research or outsource it. Most do not think it is their job to tell AMs how to make investment decisions. The respondents did agree that blindly relying on ratings is not a good idea, and that ratings are useful for gathering different viewpoints and supporting thought and discussion throughout the investment decision-making process. AOs also acknowledge that portfolios are on average quite large, making subscriptions to ESG rating agencies efficient and likely the best available approach. They were generally not aware of the low correlation between ESG scores, but nor were many surprised.

Except for one respondent, AOs do not tend to use ESG scores to evaluate or compensate their AMs. Some do use the scores to get input for review talks: This makes it easier to have some input for discussion with their AMs, as ESG is a broad concept. AOs use the narrative to read up on their portfolio and to ''know what they own'' and challenge AMs. Respondents stated that they do not take specific action based on these reports, but merely use them for review purposes. Sometimes trustees want to see how the portfolio compares to the benchmark on ESG criteria. One of the AOs started using ESG ratings in a similar way to credit ratings: they defined an investable universe for their AMs according to a pre-determined threshold.

Discussion

The initiatives described in this paper have experienced tremendous growth. Companies use ESG ratings to benchmark their efforts, customers use them to identify ''good'' employers or buy ''better'' products, investors use them to identify more ''responsible'' investments, and academics use them to investigate the financial value of ESG. However, some recent evidence has shed doubt on the reliability of ESG initiatives – somewhat unsurprising since we have not agreed on what indicators matter and materiality differs for every company. It is also not surprising that once so many indicators are aggregated, the final score becomes a noisy proxy for ESG. The lack of consensus and understanding of what ESG entails is precisely what has made many of these initiatives popular.

There is no doubt that some of these initiatives have supported the development of responsible investment, evidenced by the role of the ICCR in the South Africa Divestment Campaign (MacLeod, 2014; Shapiro, 1992). To this date, ESG-related initiatives can play an important role as watchdogs; consider Amnesty International's recent investigation into the supply chain of multinationals like Unilever (Amnesty International, 2016). According to Waddock (2008), some of these initiatives serve as a voluntary responsibility assurance system. They give an "independent" perspective on how a given company is upholding their social contract, and thus serve as a monitor. This exerts some degree of normative pressure on companies and can help change dominant conventions (Sun et al., 2011).

Some company respondents also suggested that ESG ratings help to get certain topics on the agenda by creating a sense of urgency. Because sustainability managers are not often in a room with investors, they tend to use these initiatives as a proxy for investor demand, which helps to convince their superiors to take action. The finding that companies barely talk to their investors about ESG is interesting, as this further underlines the role of the ESG-initiative industry as an intermediary and emphasizes the need to better understand this industry.

Given resource constraints and a lack of understanding, investors will likely continue to use this intermediary. A handful has transitioned from scores to narrative, using their investment skills to interpret investment implications. For AOs, this can be helpful preparation for a review meeting with their AMs, as they often do not have the skills or time to do ESG research in-house. (Nearly all AOs indicate that they do not expect AMs to do this in-house.) Given portfolios often comprise hundreds of stocks (or more), ESG scores remain the most efficient way to screen them. It is therefore important that AMs thoroughly understand the rating methods they choose (Chatterji et al., 2015; Delmas et al., 2013). Some interview respondents subscribe to more than one rating agency to avoid major errors. This solution, though, can be quite costly and still may not provide an accurate proxy for ESG. At some point, it may be more cost-efficient to train employees in ESG analysis and have more all-around analysts on the investment team. With regard to academic use, it may be better to break scores into component parts for a less noisy proxy; this could help reveal financial relevance of individual indicators.

Even though the industry serves a purpose, the accuracy of this proxy for ESG performance is questionable, with no consensus on what it means. Several other concerns are equally problematic. First, there is the time that companies must put into ratings questionnaires. Based on interviews, it appears that reporting fatigue is close to a peak; respondents are frustrated. Some made it clear that they will soon start to implement a strict filter. One idea from Schaefer (2005) is that rating agencies should lower transaction costs of processing ESG data for companies. Respondents that do have a filter or priority system have a clear preference for more established players. This means that smaller rating agencies will have to exclusively deal with public information once excluded. They will thus become even more likely to be shaken out or acquired. This supports findings in the ILCA and shows that the industry is reaching maturity.

Another problem is that most of the reported ESG data are not audited and reliability is debatable, at best (Eccles et al., 2015). The same is true of the input information. This lack of reliability and convergence in findings adds to the confusion that surrounds this topic. Additionally, due to the proprietary nature of methodologies it is difficult for ESG initiatives to be fully transparent. From my interviews, it seems that this is especially problematic with rankings like the Transparency Benchmark or Corporate Knights – and even the DJSI, to some extent. This only adds to frustration as companies put in an effort and are then left in the dark as to how they received a certain score. In some cases, as with the DJSI, companies can find out how to improve their performance for a fee of roughly EUR50,000. Although a clever way to make money, this does not help the credibility of the DJSI and makes companies question the value of responding.

There are a few rating agencies that appear to offer high-quality data. According to company respondents, the most credible ratings/rankings are MSCI ESG, Sustainalytics, and the DJSI. Other favorable mentions were oekom and the CDP. Although companies mentioned the DJSI frequently, it was also a source of frustration. What is more, investors did not mention the DJSI at all. For them, the leading providers were MSCI and Sustainalytics. They sometimes mentioned Trucost, CDP, and RepRisk. This is not fully in line with other research, which also mentions ASSET4 and EIRIS (now VIGEOEIRIS) as leading ESG providers (Dorfleitner et al., 2015; Sustainable Insight Capital Management, 2016). No interview subjects mentioned these players.

Conclusion

The ESG-initiative industry has become an important intermediary between companies and their investors. Though recent evidence along with the sheer number of initiatives have cast doubt on the value of this industry, billions of dollars in capital are allocated based on these tools and companies spend at least half of a full-time job responding to requests from ESG ratings agencies. Given the implications for the adoption of responsible investment, it is crucial to develop an understanding of this industry. Namely, is the ESG-initiative industry a vice or a virtue in the development of responsible investment? To answer this question, I investigated 218 ESG initiatives and analyzed the industry with ILCA. I also explored the role of ESG initiatives by conducting 45 interviews. The respondents were AOs, AMs, and companies located in the Netherlands, the UK, and Germany (see Appendix 2).

In weighing the pros and cons, my findings indicate that the ESG-initiative industry is an impediment to the adoption of responsible investment. The industry has helped boost the adoption by exerting normative pressure on companies, exposing them to ESG-related discourse, and serving as a monitor. There is also, currently, not a more efficient way to screen on ESG criteria. The problem is that there are simply too many rating agencies and their judgement is questionable. Looking at the 218 initiatives in the database I compiled, the obstacles named by interview respondents, the academic evidence that casts doubts on the accuracy of ESG ratings, and the fact that Volkswagen was announced an industry leader just prior to the emissions scandal makes it clear that this market is not functioning.

The ESG-initiatives industry is now at a crossroads: the number of ratings, rankings, and indices spread more confusion and reporting fatigue than they spread benefits. For some companies in my sample, the time has come to be more selective, as much of the rating industry is little more than a nuisance. Those who have a filtering approach in place must reinforce their focus on the established and credible agencies. This is bad news for newcomers. As evidenced by the ILCA, the growth in new entrants is already stabilizing and the industry is likely to transition to maturity in the next few years. More partnerships

and acquisitions are expected, which is good news for companies suffering from reporting fatigue. It would also help if more users became aware of the flaws inherent in ratings/rankings and if companies published evidence on how much time this industry requires. This would exert more pressure on ESG initiatives to be transparent, build credibility, and even collaborate by producing a standardized question list. Initiatives such as the Global Initiative for Sustainable Ratings (GISR) help to set some minimum standards and encourage best practices (Makower, 2013). They have also previously organized training on ESG ratings for companies; it might be helpful if they continue to offer this type of education.

At the end of the day, investors will rely on the expertise of the ESG industry. Even if they have the skills to do ESG analysis, portfolios are simply too large. This know-how will take another few years to become mainstream, given that ESG has not yet been integrated into the curricula of most business schools and industry certification bodies (Krosinsky, 2015). Companies may be better off talking to their investors about what information matters to them; they can more effectively focus their efforts if they are on the same page. This point is worth emphasizing, as many people are under the impression that investors use ESG scores without knowing which ones, how to do it, or how much time this requires. As an alternative to spreading thin, companies could respond only to those initiatives that align with their goals and industry type: heavy water users can, for example, participate in CDP's water program. A couple of respondents already use this approach. They said that this focus frees time and helps them to work toward their goals more effectively.

The findings in this paper have important implications for scholars and practitioners alike. The overview in Appendix 1 and in-depth discussion demonstrate that the ESG-initiative industry has become a web of confusion. It is important that users are aware of the pitfalls of this proxy and that they proceed with caution. Besides acknowledging its limitations, scholars may also be better off researching individual indicators as opposed to aggregated scores. This can reduce the noise and subjective weights in their search for financial significance. It is also important for companies to establish a strategy to deal with the workload. Being on the same page with investors is one way to do this. Asset managers should also be careful of the extent to which they rely on the ESG rating industry. Crosschecking with a second provider may be helpful if there is no way around the scores. Asset owners should also make sure they are on the same page as their AMs. It may not help for AOs to identify an investable universe based on these scores or to evaluate their AMs with the ratings. Rather, clearly communicating objectives and goals regarding ESG is useful, as is regular and challenging discussion with AMs. It is important to note that the noise, or disconnect, between investors and companies may be the tip of the iceberg. The fact that companies do not tend to talk to their investors about ESG hints at a large misalignment in the investment chain.

One limitation of this paper is that I investigate several parties in the investment chain, which makes the sample of respondents rather small. Future endeavors could focus on a larger number of interviews. It would also be interesting to obtain data on the response rate of ESG initiatives. If this has declined over time, it would support the findings of this paper. Getting an ESG rater's opinion on this would also provide a useful angle. Other projects could look at the influence on a company's share price once they stop responding to a major rating agency, or once they are de-listed from the DJSI. There is some research on this already (see Cellier and Chollet, 2015), but our understanding of this industry and its impact is unsatisfactory. This is especially true given the size of the industry and its role as an intermediary between companies and investors. After all, they are our point of reference in allocating substantial capital to ''responsible'' companies. On top of that, sustainability managers need to invest approximately half a full-time job in taking part.

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Appendix 1 ESG initiatives

This appendix contains an overview of the 218 ESG initiatives that are investigated. They were collected by means of google search, interviews, existing reports/literature and company reports. They were then divided into 7 different categories:

1. ESG Awards – 8 observations
2. ESG Indices – 57 observations
3. ESG Rankings – 38 observations
4. ESG Ratings – 57 observations
5. ESG Research – 27 observations
6. Shareholder services – 15 observations
7. Other initiatives – 16 observations

It must be noted that there can be overlap between the categories, but the ESG organizations are categorized according to their main focus.

Organization	ESG Award
World Environment Center	World Environment Center Gold Medal for International Corporate Achievement in Sustainable Development
Institute of Directors	Golden Peacock Awards
US Chamber of Commerce Business Civic Leadership Center (BCLC)	Corporate Citizenship Awards
The PR News Group at Access Intelligence	PR News CSR Awards
Ethical team limited	International Green Awards
Terrapinn	Vaccine Industry Excellence Awards
The Ethical Corporation (FC Business Intelligence)	Ethical Corporation Responsible Business Awards
Effie Worldwide	Positive Change Effie Award

Organization	ESG Index
KLD (Kinder, Lydenberg, Domini)	KLD (Kinder, Lydenberg, Domini)
WM Company	Ex-vices Index
Citizens Fund	Citizens Index
ECPI	ECPI
Ethical Screening	Ethical Screening
Oeko Invest	Nature Equity Index
NPI	NPI Social Index
Robeco & Dow Jones	Dow Jones Sustainability Indexes &

	Sustainability Year Book
Wespac Investment Management	Westpac-Monash Eco-Index
Calvert	Calvert Responsible Index Series
UN Global Compact	UN Global Compact 100
FTSE	FTSE4Good Index Series
Business in the Community (BITC)	CR Index and the Community Mark
Forum Ethibel	Ethibel Sustainability Indices & excellence label
Kempen SNS	Kempen SNS Smaller Europe SRI Index
Bloomberg	Bloomberg new energy finance indices
Johannesburg Stock Exchange	JSE Socially Responsible Investment Index (SRI)
HypoVereinsbank Nachhaltigkeits Index	HypoVereinsbank Nachhaltigkeits Index
Tel-Aviv Stock Exchange - (TA) and Maala	Maala CSR Index
VINIS Gesellschaft für nachhaltigen Vermögensaufbau und Innovation "	Vonix Index
BBGI Group	BBGI Group Indices
Cleantech Group (CTG)	Cleantech Indices
International Securities Exchange Holdings	ISE Global Wind Energy Index
Shenzen Stock Exchange (SZSE)	CORP Governance Index
WilderShares	Progressive Energy Index
BÖAG Börsen AG	Sustainability Index
Boston College Center for Corporate Citizenship	Reputation Institute CSR Index
Deutsche Börse Group	Dax Global Sarasin Sustainability Indexes
Goldman Sachs	GS SUSTAIN Focus List
HSBC	HSBC Global Climate Change Index
Landesbank Baden-Württemberg (LBBW)	Nachhaltigkeit Strategie Index
MSCI	MSCI Indices
Solactive	Solactive
Thomson Reuters	Thomson Reuters Corporate Sustainability Indices.
S&P	S&P Carbon Efficient Index
Indonesia Stock Exchange	KEHAIT SRI Index
Korea Exchange	Governance & SRI Eco Index
Nasdaq	The NASDAQ OMX CRD Global Sustainability Index
Shanghai Stock Exchange	Shanghai Stock Exchange Indices
Walmart	Wal-Mart Sustainability Index
Wiener Börse AG	The CEERIUS (CEE Responsible

	Investment Universe)
BM&FBOVESPA	Carbon Efficient Index (ICO2)
Hong Kong Quality Assurance Agency	Hang Seng Corporate Sustainability Index Series
Bolsa Mexicana de Valores (Mexican Exchange)	BMV Sustainability Index
Hawkamah	ESG Index
STOXX	STOXX Global ESG leaders (Broad Indices)
Ethinvest	Ethinvest Environmental Index
ERI	ERI Scientific Beta
Euronext	Euronext Vigeo Indices
Rhein Asset Management	Deutschland Ethik 30 Aktienindex
Borsa Istanbul A.S	BIST Sustainability Index.
"Environmental Investment Organization"	ET Index
Finvex Group	Finvex Group
Fossil Free Indexes	Fossil Free Indexes
SIX Swiss Exchange	SIX Swiss Exchange Sustainability 25 Index
Etho Capital	Etho Capital index
Nataxis	Natixis Climate Optimum Prospective Index

Organization	ESG Ranking
Fortune (Time Inc.)	Fortune 100 Best Companies to Work For and Most Admired Companies
Working Mother Magazine	Working Mother ranking
Universum	Universum - ranking
Equal Opportunity Magazine	Equal Opportunity's Top 50 Employers
Great Place to Work®	Great Place to Work®
Computerworld ranking	100 Best Places to Work in IT
The Brand Keys	Customer Loyalty Engagement Index
LATINA Style	Latina style 50
CR Magazine	100 Best Corporate Citizens
DiversityBusiness.com	America's Top 50 Organizations for Multicultural Business Opportunities
DiversityInc	DiversityInc's Top 50 Companies for Diversity
AARP	Best Employers for Workers over 50
Mediacorp Canada	Mediacorp Canada rankings
National Association for Female Executives (NAFE)	Top 50 companies for Executive Women

Sunday Times	Best Companies to Work for
Corporate Knights	Global 100
Human Rights Campaign	Corporate Equality Index
Political Economy Research Institute (University of Massachusetts)	Toxic air polluters
PROhumana Foundation	PROHumana ranking
Stonewall	Top 100 employers
Transparantie Benchmark	Transparantie Benchmark
CRD Analytics	Smart View™
Diversity MBA Magazine	50 Out Front for Diversity Leadership
Ethisphere	Ethisphere World's Most Ethical Companies
Forbes	Forbes' 100 Most Trustworthy Companies
Glassdoor	Top 50 Best Places to Work
Access to Medicine	Access to Medicines Index
Greenpeace	Greenpeace Cool IT Leaderboard
Management Today	Britain's Most Admired Companies
Newsweek	Newsweek Green Rankings
Rank a Brand	rankabrand.com
Interbrand	Best Global Green Brands
Pride in Diversity	Pride in Diversity - ranking
Access to Seeds Foundation	Access to Seeds Index
Points of Light & Bloomberg	Civic 50
Access to Nutrition Foundation	Access to Nutrition Foundation ranking
Channel NewsAsia	Sustainability Ranking
Ranking Digital Rights	Corporate Accountability Index

Organization	ESG Rating
Experts in Responsible Investment Solutions (EIRIS)	Company ratings
Innovest	Innovest
Jantzi research	Jantzi research
BMJ ratings	BMJ ratings
oekom	oekom Corporate Ratings
Eco-Frontier	Eco-Frontier
Inrate	Inrate Sustainability Assessments
Safety and Environmental Risk Management Agency (SERM)	Safety and Environmental Risk Management Agency (SERM)
Arese	Arese
Reinhard Friesenbichler Unternehmensberatung Management Consulting (rfu)	rfu Sustainability model
The Good Bankers	The Good Bankers

Corporate Monitor	Rating
RepuTex	RepuTex Sustainability / ESG Ratings
The Corporate Library	The Corporate Library
Center for Australian Ethical Research (CAER)	Center for Australian Ethical Research (CAER)
Ecovalores	Ecovalores
Etikanalytikerna (Global Ethical Standard)	Etikanalytikerna (Global Ethical Standard)
Governance Metrics International	Governance Metrics International
Scoris	Scoris
SIRIS	SIRIS
Stock at Stake	Stock at Stake
Sustainable Investment Research Institute (SIRI)	Sustainable Investment Research Institute (SIRI)
BHF-BANK	BHF-BANK
Covalence	Covalence
Avanzi	Avanzi SRI Research
Carbon Disclosure Project (CDP)	CDP Ratings & Indices
Dutch Sustainability Research (DSR)	Dutch Sustainability Research (DSR)
Thomson Reuters	ASSET4 ESG Ratings
Vigeo	Vigeo Ratings
CoreRatings	CoreRatings
DNV GL	Tomorrow's Value Rating
EthiFinance	EthiFinance
Standard Ethics	Standard Ethics
Züricher Kantonalbank	Züricher Kantonalbank
Management and Excellence Ratings (M&E)	Management and Excellence Ratings (M&E)
ASI	ASI
SolAbility	SolAbility
B Lab	B Ratings System (B Corporation)
Greeneye	Greeneye
HIP Investor	HIP Impact Ratings
Climate Counts	Company Scorecards
CSRHUB	CSRHUB Ratings
EcoVadis	EcoVadis Supplier Sustainability ratings
KO-CSR	KO-CSR
Solaron	Solaron
Underwriters Laboratories	GoodGuide rating
Sustainalytics	Sustainalytics
Bloomberg	Bloomberg ESG data
Responsible Research and CSR Asia	Asian Sustainability Rating
Gender Diversity Directory	2020 Women on Boards
GMI Ratings	GMI Ratings
MSCI	MSCI ESG Research
Champlain Research	Champlain Research
Frontis	Frontis Governance Rating Report

FTSE	FTSE4Good ESG ratings
Sustainability intelligence	Hidden Champion Rating
TruValue Labs	Insight360

Organization	ESG Research
Investor Responsibility Research Center (IRRC)	Investor Responsibility Research Center (IRRC)
Co-op America	Co-op America
British Ethical Consumer Research Association (ECRA)	Corporate Critic
EthicScan Canada Ltd.	EthicScan Canada Ltd.
Fundación Ecología y Desarrollo - ECODES	Fundación Ecología y Desarrollo - ECODES
Institut für markt umwelt gesellschaft (Imug)	Imug
Centre français d'information sur les entreprises (CFIE)	Centre français d'information sur les entreprises (CFIE)
Forum for the future	Forum for the future
RepRisk	RepRisk
Ethix SRI Advisors	Ethix SRI Advisors
Trucost	Trucost
IW Financial	IW Financial
Verisk Maplecroft	Verisk Maplecroft Sustainability Performance Benchmark (MSPB)
Regnan	Regnan
SynTao	Syn Tao
Global Footprint Network	Global Footprint Network
Source-Asia	Source-Asia
The Centre for Sustainable Organizations.	True Sustainability Index
South Pole Group	South Pole Group
Sustinvest	Sustinvest
The Climate Registry	The Climate Registry
P&G Scorecard	"P&G Supplier Environmental Sustainability
DZ Bank AG Deutsche Zentral-Genossenschaftsbank	Sustainability research
Sustainability Partners Inc.	Sustainability Partners Inc.
SD-M	SD-KPIs
Transparency International	Transparency in corporate reporting ranking
Oxfam International	Behind the Brand

Organization	Shareholder Service
Institutional Shareholder Services (ISS)	Institutional Shareholder Services (ISS)
Pensions & Investments Research Consultants Ltd. (PIRC)	Risk Rating

Deminor Rating	Deminor Rating
Global Engagement Services (GES)	Global Engagement Services (GES)
Corporate Governance International (CGI)	Corporate Governance International (CGI)
Manifest	Manifest
Proxinvest	Proxinvest
Ethos Foundation	Ethos Services
Proxy Australia	Proxy Australia
The Expert Corporate Governance Service (ECGS)	The Expert Corporate Governance Service (ECGS)
Shareholder support	Shareholder support
Glass Lewis (Glass Lewis is a portfolio company of the Ontario Teachers' Pension Plan Board ("OTPP") and Alberta Investment Management Corp. ("AIMCo")	Glass Lewis
IVOX GmbH	IVOX GmbH
zRating	zRating
Institutional Shareholder Services (ISS)	Institutional Shareholder Services (ISS)
Pensions & Investments Research Consultants Ltd. (PIRC)	Risk Rating
Deminor Rating	Deminor Rating
Global Engagement Services (GES)	Global Engagement Services (GES)

Organizations and initiatives included under "other initiatives"	
The Interfaith Center on Corporate Responsibility (ICCR)	The Interfaith Center on Corporate Responsibility
Sullivan Principles	Sullivan Principles
Ceres	Ceres
Ethical Investors	Ethical investors
Centre Info	Centre Info
VBDO	VBDO
Forética	Forética
The Prince's Accounting for Sustainability Project	The Prince's Accounting for Sustainability Project
Shareaction	Shareaction
Eumedion	Eumedion
Diversum	Diversum Label & Ratings
The Water Footprint Network	The Water Footprint Network
Conflict Risk Network	Conflict Risk Network
Plastics Disclosure Project (PDP)	Plastics Disclosure Project (PDP)
German Council for Sustainable Development	The Sustainability Code
CAMRA Data Services	CAMRADATA ESG reporting

Appendix 2 Interviews

The interviews were conducted with 3 Dutch, 3 German and 4 UK Asset Owners. The majority has more than EUR 30 billion AUM. They were asked the following questions, relating to the ESG initiative industry;

Questions for Asset Owners	Type
• Do you prefer external or internal ESG research (or don't know)	Categorical
If so, why?	Open
• Do you evaluate your asset managers based on ESG ratings?	Yes/No
• Why and how did you choose your provider?	Open
• Are you aware of academic research on the low correlation between ratings?	Yes/No

Additionally, 15 interviews were conducted with Asset Managers. Of those, 6 are Dutch, 4 are German, and 5 are located in the UK. They are all among the 400 largest in the world by AUM, according to IPE[88]. The following questions relating to the ESG initiative industry were asked;

Questions for Asset Managers	Type
• Do you do the ESG research yourself?	Yes/No
If so, by the same person?	Yes/No
If not, why don't you conduct it internally?	Open
• Which research provider? How did you choose?	Open
• Are you aware of academic research on the low correlation between ratings?	Yes/No
• Do you look at why ratings have changed before you adjust your investment accordingly?	Yes/No
• Do you make use of any other ESG initiatives, such as rankings? Why and how does this work exactly?	Open

On the company level, 20 organizations were interviewed. Of those, 8 companies have their headquarters in the UK, 7 in the Netherlands and 5 in Germany. These companies are all listed and about half have market cap between EUR 1 billion and 20 billion. Only a quarter has a market cap of more than EUR 50 billion. Different sectors are included such as food staples, retail, chemicals, and technology. The financial sector is not included. The following questions relating to the ESG initiative industry were asked;

Questions for companies	Type
• Do you receive requests from ESG (ratings/rankings/awards/	Yes/No
If so how many?	Numerical
• How do you prioritize and how long does it take you?	Open

[88] https://hub.ipe.com/top-400/total-global-aum-table-2016/10007066.article

• Why do you respond?	Open
• Do you see any added value from these ESG initiatives/Important to score high?	Yes/No
Please explain?	Open
• Do you think it is important to be part of an ESG ranking index?	Yes/No
Please explain	Open
• Do you ever receive negative comments from the investment community if you don't verify or correct your rating?	Yes/No
• Do you ever receive positive comments if you increase your rating or become part of a ranking/index?	Yes/No
• Do you use these ratings for internal evaluation (do you subscribe to any)?	Yes/No
• Do you feel pressured by any of these ESG initiatives?	Yes/No
• Do you keep an eye on the ratings or awards of your competitors?	Yes/No
• Do you also apply to awards/certification?	Yes/No
If so, how do you prioritize?	Open

BOOK REVIEW

Sustainable Investing: Revolutions in Theory and Practice

edited by Cary Krosinsky and Sophie Purdom, by Sarah Cleveland

Sarah Cleveland
Sarah Cleveland has been an independent investment consultant since 2011, working with organizations on addressing sustainability in the investment process. She works on research, strategy, and education projects. Previously Sarah advised institutional investors on investment strategy, implementation, and ongoing monitoring. As senior consultant working at Towers Watson Investment Services and Rogerscasey, Sarah consulted with a broad spectrum of asset owners such as endowments, foundations, as well as corporate and public retirement plans. She has been involved in economic research and financial services for over 20 years, and active in the sustainable investment field since 2003.

Introduction

Editors Cary Krosinsky and Sophie Purdom published the book *Sustainable Investing: Revolutions in Theory and Practice* at a critical moment. We need the book's positive message and urgent call to action. We need its central emphasis on systemic and network solutions that move beyond "business as usual" in the financial world. While isolated approaches to systemic issues are necessary, they are not sufficient to address significant headwinds like climate change. With more than 30 short chapters authored by specialists covering a wide range of subjects, this book offers practitioners and students of sustainable investing a helpful new resource. (It's worth noting that climate change is a consistent theme throughout and the reader is presumed to be familiar with environmental, social, and governance (ESG) issues and investing.)

As Krosinsky says in the Introduction, he intends the book to "mark the turning" of sustainable investment. He believes we are in a moment when conversation and action around ESG issues is shifting from the negative to the positive – from a focus on the bad things that companies do to the successful and innovative solutions that companies are implementing. We are near a "sustainable investing tipping point," he says, which, if expanded and practiced at scale, has potential to provide systemic solutions to environmental and social issues. We now have case studies to demonstrate sustainable investment solutions that are outperforming benchmarks and traditional approaches. Why not leverage these positive solutions as a new target to which we direct capital?

Krosinsky has written extensively on sustainable investing and I applaud him for taking the opportunity to incorporate his experience as both a practitioner and a teacher. (He has lectured at Brown and Yale Universities.) Coeditor Sophie Purdom is a recent graduate of Brown who shares her experience advancing sustainable investing through the student-led Brown Investment Fund; it's inspiring to see the passion and beliefs of a new generation of sustainable investors.

Synopsis

The editors set the stage in the book's first section, "How." They differentiate approaches to sustainable investing – among them values-focused, values-driven, community, impact, thematic, ESG integration, and engagement/advocacy – and they debunk the conviction that impact investing implies lower financial returns. I appreciate that they acknowledge the breadth of approaches and the variability of outcomes, including as they relate to performance. They also demonstrate the power of "the networked solution" through climate finance and the Paris Agreement, and attempt to add up global assets and account for the "value of everything."

In Part II, Krosinsky and Purdom shift to "systems and systemic solutions." Krosinsky describes our fight against climate change as "the Manhattan project of our time" – an endeavor that requires collaboration between investors, policymakers, and companies. We cannot sustain infinite growth within a finite planet, but we lack a constraining loop to counterbalance pushes for unconstrained growth. This second section also includes a framework to help investors create a climate change strategy across asset classes while highlighting significant data challenges that hinder investors' ability to make informed decisions. Three asset managers contribute unique perspectives on this issue by describing their own sustainable investment strategies: focusing on water as the primary consideration for investment; employing a multi-factor ESG model with Warren Buffet's value approach; and using Carbon Impact Analytics to measure carbon at the portfolio level.

The second half of the book, Part III, is dedicated to "The Next Frontier." This section begins with a look at how to address major areas of fossil fuel consumption that are ongoing sources of greenhouse gas emissions. Solutions involve renewable energy financing, disruptive technologies like driverless cars, sustainable real estate, infrastructure funding, and accounting for regional differences (e.g., China, India, Japan) and the primary owners of fossil fuel reserves (i.e., state-owned enterprises). Several countries have "soft regulation," like stewardship codes, that requires investors to state their approach to sustainable investment. In the U.S., shareholder engagement and advocacy are often used to influence a company's behavior. A few authors investigate new business models like "conscious capitalism," value drivers (linking sustainability to product/service growth), and shared ownership (Sharia). Krosinsky coauthors a chapter on the future of innovation in which he looks at efficiencies gained by business structures such as closed loop processes, shared resources (e.g., cloud computing), and biomimicry, as well as financial innovation (e.g., infrastructure finance and Public-Private Partnerships). The final chapter presents an overview of the Principles for Responsible Investment, an initiative launched by the United Nations and now led by industry. Writing in the conclusion, Krosinsky and Purdom draw on insights from Krosinsky's students to argue that climate change and workplace conditions are the two most urgent issues for sustainable investing.

A Few Observations

In some ways, I found the book rich in content; in other ways, given the breadth of topics included, it only scratches the surface. For example, Chapter 7 proposes a thorough practical framework for developing an investor's climate change strategy. In select other chapters, asset managers profile their strategies, and practitioners provide in-depth views into sustainable real estate and infrastructure. On the other hand, the book encompasses everything from the unknown of disruptive technologies to geographical influences and new business models. I appreciate the editors' willingness to stake a claim for moving

forward without a perfect solution. They also do not dismiss the difficulties of implementing systemic solutions, which take a concerted effort by policymakers, investors, companies, countries – all of us.

At times, the book's flow was choppy – chapters tend to stand on their own – but this didn't detract from the overall message as long as I remembered to take a big-picture view. For example, an extensive discussion on data challenges follows a chapter on why divestment is a thoughtful outcome. The connection may seem elusive until you consider that greenhouse gas emissions data are *voluntarily* reported and investors are making portfolio allocation decisions, including divestment, based on these data.

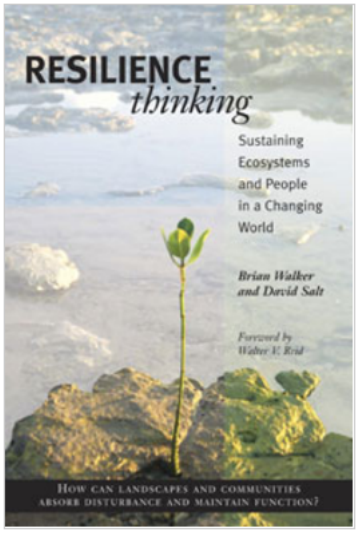
Conclusion

When I initially read the book's subtitle, *Revolutions in Theory and Practice*, I pushed back: is this really revolutionary? In short, yes. If you consider the current structure of our financial system, theories such as a circular economy are way out there. Are capital markets and sustainable investing going to "save" us from ourselves? Unlikely, but worth a try. As they say, the alternative – our current path – isn't so hopeful.

Many of us working in the sustainable investing community live in a bubble. We are too often the majority of attendees at our industry conferences. We know that "business as usual" is not going to change without ideas leaving the echo chamber. *Sustainable Investing: Revolutions in Theory and Practice* does a respectable job of trying to encourage just this flight, to push ideas beyond the bubble with a sense of urgency and possibility and help both mainstream and sustainable investors realize that they have the same objectives. After all, sustainability and finance are interdependent. To have both success and impact as investors requires a business case for sustainability and a sustainability lens for finance. Such convergence will help us avoid environmental and social crises. I long for the day when we are beyond terms like "sustainable investing" and when we are all considered smart investors for directing capital to systemic solutions. Hopefully this will be the focus of a sequel to *Sustainable Investing*.

BOOK REVIEW

Resilience Thinking: Sustaining Ecosystems and People in a Changing World **by Brian H. Walker and David Salt; Island Press, 2006, 192 pp., $28 (paperback), 2012 (E-book edition), $27.99**



https://islandpress.org/book/resilience-thinking

Reviewed by Richa Agarwal, CEO, Global Shokunin and Christina Valauri, Sr. Strategic Business Adviser, Global Shokunin

… "Why is it that, despite our best intentions, some of the world's most productive landscapes and many of our best-loved ecosystems are in trouble?" The question is expanded through the course of the book to include social systems, business enterprises, and social-ecological systems. …

Resilience Thinking offers a different way of understanding the world and provides a new yet practical guide to understanding resource-management within complex and dynamic ecosystems that view human and natural systems as interwoven entities, continually adapting through cycles of change. The lessons from this book are applicable to any investor seeking to understand natural resource scarcity, and the implications for companies and organizations grappling with the challenge.

Resilience Thinking outlines the impact of an expanding human population and associated consumption and depletion of finite resources such as water and agricultural land, and offers an updated perspective and approach on sustaining eco-systems. The genesis of this book was the research of an association called the Resilience Alliance (RA), an international network of organizations and individuals involved in the multidisciplinary aspects of ecological, social, and economic research that formed in 1999. The members of the Research Alliance collaborate across disciplines to advance the understanding and practical application of resilience methodology, adaptive capacity, and transformation of the dynamic aspects of societies and ecosystems (www.resalliance.org). The mission of Resilience Alliance network is twofold, both the development of science and communication of that science. Over three decades of research undertaken through this

network has resulted in the development of a new paradigm for understanding and managing the environment referred to as “resilience thinking.”

The shrinking world is stretched to capacity

The book beams a spotlight on a serious issue facing our global community - “the world is shrinking: the human population is growing while its resource base declines.” Increasingly, the capacity of ecosystems to sustain our planet's well being are being dangerously stressed, and the world is facing a broad range of serious and worsening resources issues. Undoubtedly, the human species is living beyond its means and human-demand has far exceeded the earth’s capacity to supply. Population growth is now expanding by approximately 75 million per year and the United Nations projects the global human population at 8 billion in 2025.

Moreover, the solutions put forth to address the impact of this systemic stress are largely "more of the same", and are the very protocols that contributed to this situation in the first place. To be clear, the impact of resource consumption associated with the expansion of the human population continues to have devastating and long reaching consequences given current institutionalized resource management strategies. Approximately 85% of agricultural land has areas of degradation due to a myriad of factors such as soil erosion, and rising salt levels, while water consumption levels continue largely unchecked expected to lead to an estimated 50% of the world population living in water-stressed river basins by 2025.

Another way in which our world is shrinking is in loss of biodiversity - reducing the variety of species, the genes they contain, and the ecosystems that comprise them, ultimately limiting our options. A good case in point is the importance of genetic diversity in agriculture and our vulnerability to pathogens and increased risks to our food supply as industry focuses on fewer and fewer animal and plant species, selecting for easily managed, bigger, faster-growing species (Heal et al. 2004).

In *Resilience Thinking,* scientist Brian Walker and science writer David Salt provide a conceptual overview along with five real-world case studies to illustrate the positive impact of an innovative approach to resource management. They begin by asking, "Why is it that, despite our best intentions, some of the world's most productive landscapes and many of our best-loved ecosystems are in trouble?" The question is expanded through the course of the book to include social systems, business enterprises, and social-ecological systems.

Resilience Thinking - a new paradigm in resource management:

So, what exactly is "**resilience thinking**"? Simply stated, "resilience thinking" offers a different way of understanding the world and a new approach to managing resources. Through this insightful book, the authors provide a practical guide to understanding eco-systems in an ever-changing world and a new approach to resource-management within complex and dynamic ecosystems. This approach views human and natural systems as interwoven entities continually adapting through cycles of change, and it endeavors to evaluate the qualities of a social-ecological system that must be maintained, or enhanced to achieve sustainability.

The authors explain the key principles of resilience without oversimplification, building on the extensive data and case studies undertaken through the Research Alliance. The book endeavors to communicate to a broad audience perspective, offering insights and a framework of the emerging field of "resilience thinking." The authors point out that concepts of resilience have been around for decades and it is only recently that an interdisciplinary approach has been taken by researchers from well-known organizations such as the Resilience Alliance and the Santa Fe Institute, given the urgency of the situation.

Many underlying causes are contributors to the decline of the earth's resource base:

Walker and Salt stress that there are a broad spectrum of underlying causes contributing to the decline of the earth's resource base. They have grouped these causative factors into three categories: **"no choice"** category which relates to problems associated with large populations coupled with poverty where it is a matter of survival; **"willful"** resource degradation due to a short-term exploitative approach to produce and consume with disregard for the future; and **"ignorance and misunderstanding"** where despite enormous funds being invested to understand and achieve sustainability in an ecosystem the data shows otherwise. Author's Walker and Salt emphasize, "it isn't just the amount of knowledge - details about species and ecosystems - it's also the kind of knowledge. It's the way we conceive of resource systems and people as part of them. The way we currently use and manage these systems is no longer working, and yet what we hear most of the time is that the solution lies in more of the same."

The book focuses on the third driver of unsustainability, claiming that the first driver (poverty) can only be resolved by addressing the other two drivers. The second driver (willful consumption) is revisited in the final chapter to be addressed/resolved through the expanded influence of resilience **thinking** when solving real world social-ecological system problems.

"Optimization" a legacy management approach yielding less than optimum results:

Current **"best practice"** in resource management is based on a legacy approach referred to as the **"optimization"** of the delivery of products (goods or services). The optimization approach aims to achieve and sustain an optimal state, with the goal of delivering a maximum sustained benefit. This is sometimes referred to as a **"maximum sustainable yield"** or **"optimal sustainable yield paradigm."** Practitioners of the optimization approach construct models that generally assume the optimal state may vary under different conditions, and work to find the optimal path to achieve the maximum sustainable yield for that system. But there is a significant drawback of the "best-practice" optimization approach because it ignores the dynamic nature of social-ecological systems where change is not "incremental and linear (cause - and - effect changes)."

Walker and Salt make a strong point that "while minor changes are often incremental and linear, the really significant ones are usually lurching and nonlinear - like mouse plagues in Australian wheat crops, insect pest outbreaks in forests in North America, and the sudden change from a clean, clear lake to one dominated by an algal bloom." The authors underscore the paradox that exists between **"optimization"** and the resulting "**efficiency,"** because optimization is applied to a narrow range of values and a specific set of interests. The focus on optimization and the resulting efficiency certainly can lead to the "elimination of redundancies - keeping only those things that are directly and immediately beneficial" but inevitably leads to unwanted outcomes such as lack of diversification. This can render a system vulnerable, as it does not have a diversified pool of solutions to draw from in case of an external system shock or an extreme event.

Another negative outcome of optimization is the compression of the time horizons of resource management programs to a couple of decades - which are more aligned with the timeframes for most commercial investments. Moreover, the authors state that optimization "demotes unquantifiable and unmarked values, such as the life support, regenerative, and cleansing services that nature provides (collectively known as 'ecosystem services') that do not have property rights or are publicly owned do not generate wealth, gain little support, even if they involve a critical ecosystem." And lastly, the "optimization best -practice" approach does not account for the complexity of social - ecological systems.

Walker and Salt stress that "the ruling paradigm - that we can optimize components of a system in isolation of the rest of the system - is proving inadequate to deal with the dynamic complexity of the real world. Sustainable solutions to our growing resource problems need to look beyond a "**business as usual**" approach." They believe that optimization and greater efficiency cannot solve resource problems over the long term because it creates the risk of vulnerability to changes in the environment that shuts down

options. Applying resilient thinking strategies can offer constructive alternatives that provide greater optionality and long-term sustainability.

Three step approaches to "resilience thinking":

A three-step approach outlined in the book provides a framework for applying resilience thinking: establishing the foundation; outlining the essential elements of the research approach; and exploring the application of resilience thinking to real world challenges.

"Step one" of Resilience thinking applies a comprehensive view that humans are an integral component of a complex system within nature, referred to as social-ecological system. Within these adaptive systems, resilience is the key to the sustainability unlike traditional resource management approaches that utilize a compartmentalized **"command-and control"** approach.

Step two outlines the two key themes that underpin resilience thinking: "Thresholds" and "Adaptive cycles." The **thresholds concept** outlines the social-ecological system changes that cross a threshold and begin to manifest different structures and feedbacks between its components otherwise referred to as a **"regime shift."** The **adaptive cycle** addresses the system's dynamic nature - how the social-ecological system changes over time in terms of four phases: rapid growth, conservation, release, and reorganization.

"Step three" examines the application of resilient thinking to the real world and how resilience thinking can be applied to the various components of a socio-ecological system such as its operations, cost, policy and management. An approach can be formulated using the principles of resilience thinking to offer resource management solutions in creating social-ecological systems that facilitate continued functionality, while implementing positive changes that work in concert with the changing nature of the respective regions.

A system as a "call in the basin" & adaptive cycles:

The authors use a ball in a basin as a metaphor for a system seeking equilibrium. The ball wants to drop to the bottom of the basin but the shape of the system is constantly changing. Therefore, the question arises about the extreme changes in a system that can lead to the ball falling out of the basin. This is described as a threshold event or a system change that is irreversible and fundamentally changes the nature of the system such as the eutrophication of a lake leading to massive algae growth and the decline of all marine life. As we noted earlier, the **adaptive cycle** comprises the four phases of a social-ecological system: rapid growth, conservation, release, and restructure.

The early or growth phase is where a system experiences **rapid growth** and exploits as many resources as available, much like the explosive growth of a successful early stage company. Within eco-systems, these tend to be weeds as they thrive in cleared lands. In the **conservation** phase, the ecological systems increase in biomass like companies specializing or reaching economies of scale. During this phase, the growth rate may slow down, efficiencies increase, and flexibility may decline. An example is the application of JIT systems approach where efficiency is high but the system is vulnerable to changes in supply. In an ecological system, this phase can often be characterized by loss of diversity of species, as species are cultivated for specific characteristics.

The **release** phase can happen suddenly and systems that stay in the conservation phase are more vulnerable to shocks. A company or an entire industry may be derailed to the emergence of a new technology. An ecological system may be vulnerable to extreme weather events or a specific disease type that can completely decimate specialized species.

In the **reorganization** phase, the system may be thrown into chaos due to shocks from the preceding phases. New opportunities can emerge creating favorable conditions for a different species that may become invasive cycling the system into a new and disruptive growth phase. New players may take over existing structures due to emerging opportunities or fractures within the system. The ability of an ecological system to overcome these changes without reaching a system threshold that fundamentally changes the nature of the system is characterized as its **resiliency**.

Real world case studies illustrate the effectiveness of the "resilience thinking" in resource management - "creating space":

Five western hemisphere case studies illustrate the effectiveness of resilience thinking when applied to real-world circumstance and the value it provides in assessing the factors underlying the changes in social-ecological systems. You may be wondering as we did, why Walker and Salt choose only western hemisphere regions? The authors explain that these regions have varying levels and types of populations engaged in different enterprises coping with a range of different challenges. What is consistent among these five regions is that each is faced with the issue of managing their natural resource and social challenges that have serious implications for their inhabitants and surrounding regions. Lastly, each region has been well studied by the Resilience Alliance at the time of the book's release.

These scenarios serve as examples of **threshold** change and the lack of **resilience** due to lack of knowledge and misguided efforts in addressing long-term ecological sustainability. The findings of the case studies establish that the current "optimization/business as usual" approach in resource management aka selectively increasing efficiency, increase control over change, and reducing waste to optimize the systems we manage, which they contend

has only made the situation worse. They believe that each of these five regions have many potential pathways, and emphatically point out that "being more efficient, or extracting greater profit are constraining the future options of the people living in them". They emphasize the need to create more options, and advocate for the utilization of a resilience framework to "create more space."

1. The **Florida Everglades** has suffered a loss of its natural habitat, declining water quality, which has resulted in a new eco-system dominated by the invasive cattail vegetation, leading to a loss in biodiversity. "Creating space requires releasing the legislative gridlock to enable a partial reestablishment of natural flood regimes for critical processes and a focus on ways to minimize phosphorus inflows."
2. In **Australia, in the Goulburn-Broken Catchment**, the time has passed for relying on adaptive capacity, as the area has witnessed an increase in level of saline groundwater, threatening the entire agriculture sector. "The social-ecological system has crossed a hydrological threshold into a new regime, creating space in this situation requires transformation…. requiring the people of this region to reinvent their social-ecological system. They need to find a new way to make a living."
3. The **Caribbean** coral reefs have seen a 90% decline over the last 30 years, leading to a loss in the tourism-dependent economy. "Creating space in the Caribbean involves the restitution of several functional groups of organisms to allow the coral reefs to regenerate." The challenge lies in the social system of the Caribbean, which has limited resources and lacks the necessary coordination and thus adaptability to execute an effective program to restore the reef system.
4. In **Wisconsin**, the **Northern Highlands Lake District (NHLD)** is under massive stress from the increasing population and human activity. Creating space may be possible as a range of local stakeholders are exploring options, enhancing adaptability, building networks, enhancing diversity, while avoiding the need for transformation and thus changing the trajectory of the NHLD.
5. In **Sweden**, the **Kristianstad** region's water quality and biodiversity have experienced significant decline, and constant conservation efforts are needed to prevent further damage. The residents of this region had a very clear vision of what they wanted and needed - higher adaptability of the social domain, which was developed through leadership and social networks that allowed for new forms of experimentation.

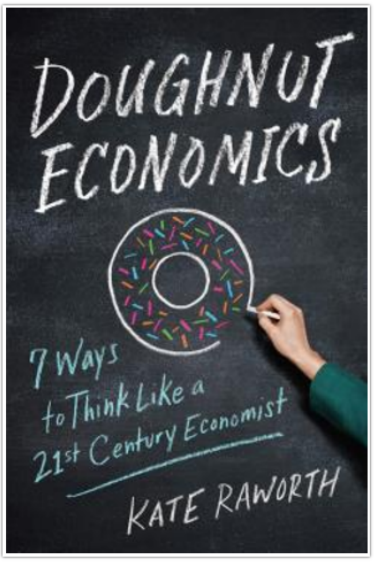
Resilience thinking is a work in progress

Walker and Salt state that "by focusing on the resilience of a social-ecological system you create space for safe changes in the ecosystem because the system can absorb more shocks and disturbances without crossing a threshold into a new regime. A resilient system has

the capacity to change as the world changes while still maintaining its functionality. Resilient systems are forgiving of management mistakes and miscalculations." The authors point out that although they have chosen case studies at a regional level, resilience thinking principles can be can be scaled to social-ecological systems at all levels, including national and global scales. (Tainter 1998; Diamond 2005). A much broader range of Research Alliance case studies can now be found at: https://www.resalliance.org/key-concepts

Emphasizing the importance of the broader themes that underpin the framework of resilience, which revolves around humans coexisting with linked social and ecological systems, resilience thinking is a work in progress and to be successful it must be applied at the local level. These systems "are complex adaptive systems, and attempts to control or optimize selective parts of these systems without consideration of the corresponding responses within the broader system are fraught with risk. Resilience thinking moves us to a holistic approach and the authors stress that it is not a panacea for all the world's problems, it does provide a foundation for achieving sustainable patterns of resource use." They invite the readers to send their suggestions and offer a list of what they believe a resilient world would value.

BOOK REVIEW



***Doughnut Economics*; Chelsea Green Publishing, 2017, 320 pp., $21 (hardcover)**

http://www.chelseagreen.com/doughnut-economics

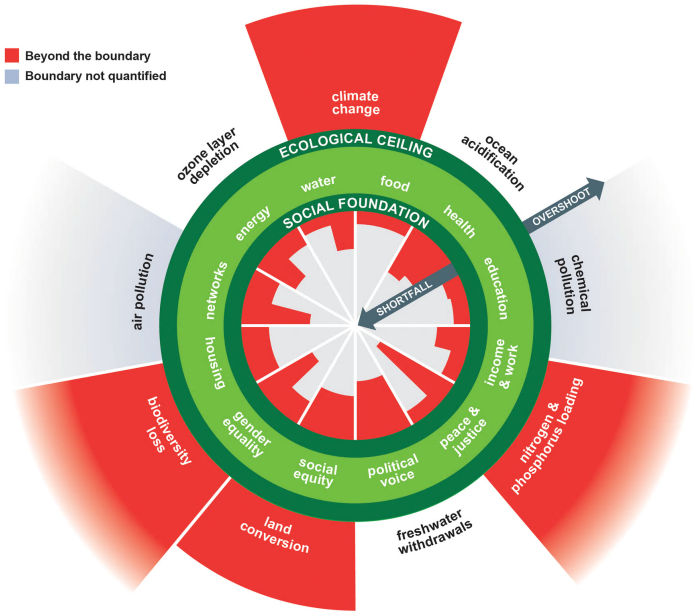
Reviewed by Alex Bernhardt, Principal, US Responsible Investment Leader, Mercer

… There is much to be said for the practicality of this framework from the standpoint of global policymakers and their economic advisors. And it is not hard to see its appeal for impact investors either…

An array of alternative economic theories is vying for attention on bookshelves today. The list of adjectives describing the economic approach of each theory is long and includes: behavioral, sustainable, regenerative, adaptive, resilient, low-growth, no-growth, long-term, circular, feminist, sacred, ecological, and even just 'new.' So if this is the first you are hearing of "Doughnut Economics" a bit of skepticism is understandably warranted.

However, after only a short investigation it should become clear that the book does not mean to address our modern eating habits (at least not directly); rather it contains an excoriating critique of neoclassical economic theory and proposes a compelling and elegant alternative to the growth-at-any-costs mentality pervading political-economic thinking and practice today. Author Kate Raworth argues convincingly that this mentality has led to increasingly severe environmental degradation and social inequity rendering it unsustainable, and that the so-called "free market" is not equipped to solve these problems independently. She argues that environmental and social issues are not "peripheral" but of "critical concern" and only currently deemed as "external costs" because "we've made no provision for them in our economic thinking."

Raworth does not charge into this scrum lightly; according to her, confronting the current hegemony of economic theory is absolutely necessary if we are going to render our current political-economic systems sustainable since "economics is the mother tongue of public policy, the language of public life and the mindset that shapes society." The "doughnut" which she prescribes as a solution is a straightforward visual guide to 21st century economic thinking. Stated simply it argues for the economy to operate within the "safe and just" space between an ecological ceiling and a social foundation.



Raworth quantifies the ecological boundaries using science-based targets. For instance, the planetary boundary for climate change is determined to be 350 parts per million (ppm) of CO2 in the atmosphere, the scientifically agreed "safe" level of atmospheric CO2 concentration. As we are currently past 400 ppm, and climbing, the red bar for this particular earth system indicates overshoot.

The social indicators are more illustrative insofar as they are not scientifically but rather ethically based. However, this does not give them any less credence. For instance the indicator used for food is the percentage of the global population which is malnourished (11%) with the threshold for this indicator appropriately being set at 0%.

There is much to be said for the practicality of this framework from the standpoint of global policymakers and their economic advisors. And it is not hard to see its appeal for impact investors either; if an investment serves to increase the portion of the population living in substandard housing or to increase the amount of fertilizer being used by farmers and running off into streams then the doughnut suggests the investment should be foregone. While the visual of the doughnut is by far the most compelling takeaway of the book, this isn't to say the remainder of the text is unworthy of a read. To the contrary, it is rife with interesting and rarely told anecdotes about the history and development of modern economic theory and practice which should prompt readers of many different persuasions to pause and examine their assumptions about the "dismal science" and its influence on investment decisions and outcomes.

Some of the most interesting historical observations include:

- Sir Isaac Newton, whose physics spawned "physics envy" among many an economist, fell victim to market exuberance leading up to the collapse of the South Sea bubble and lost a small fortune in the process. The deep irony of this occurrence is difficult to miss – economists, in their deep desire to be treated as scientists, overlooked the capacity for human beings to act irrationally; a fact not lost on Sir Isaac who once said "I can calculate the motions of the heavenly bodies, but not the madness of the people."
- Adam Smith moved back in with his mother to complete the *Wealth of Nations*. She cooked, cleaned and did his laundry while he hammered away at his manuscript. Yet, despite her obvious contribution to her son's work, she got not so much as a mention in the final publication – not in the liner notes or by inference in its influential economic theories. To this day unpaid caregiving remains a social necessity which mainstream economics ignores. But if this labor were to be fully valued at market prices it would represent an astounding sum without even considering its "intangible" social benefits.
- The board game *Monopoly* was originally created by Elizabeth Magie with two sets of rules. The first set of rules – 'Prosperity' – outlined a collaborative object whereby the game was won once the player with the least starting capital had doubled their money and the utilities were jointly owned. Only the second set of 'Monopolist' rules survives today. Imagine the influence this ubiquitous game might have had on the young minds of yesteryear if the Prosperity rules had survived?
- Simon Kuznets, the Nobel Prize-winning inventor of Gross Domestic Product (GDP) warned in presenting the results of his work to the U.S. congress in 1934 that the "the welfare of a nation can scarcely be inferred from a measurement of national income." Many years later he elaborated further and said "goals for more growth should specify more growth of what and for what."[1] These footnotes to Kuznet's great contribution have been all but lost in political-economic decision making since, which speaks to the seductiveness of relying on a single, simple progress indicator.

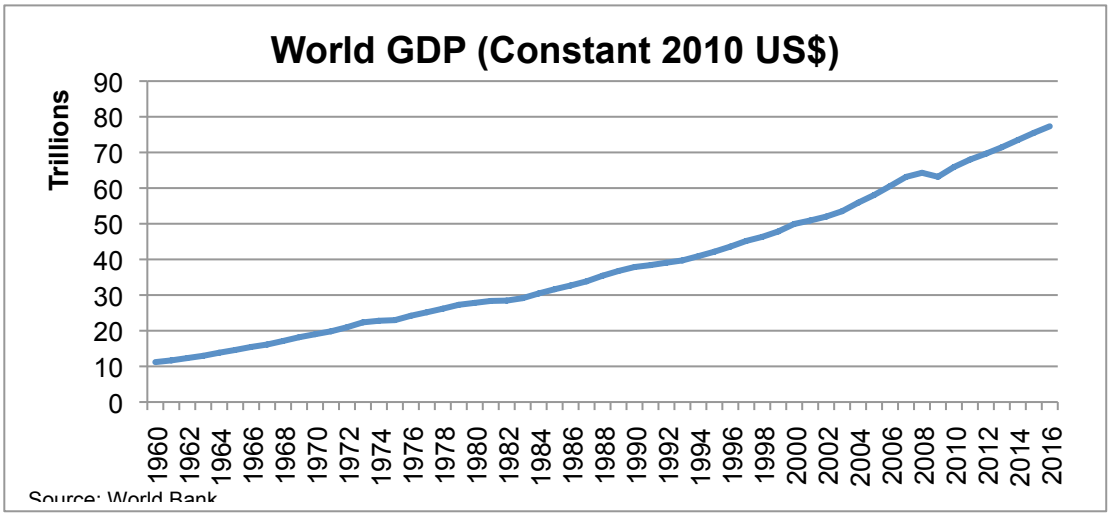
Leaving GDP Behind

Having learned from her study of history, Raworth's doughnut notably ignores Gross Domestic Product (GDP) altogether. In fact the only doughnut indicator involving monetary or other traditional economic measures of any kind is the indicator related to "income and work" and in this context the focus is not on growth but rather on poverty alleviation, job access and equity.

[1] Simon Kuznets in: (1962) *The New Republic* Vol. 147. p. 29

Indeed it is the conspicuous lack of focus on economic growth – or GDP at all – which is the primary underpinning of Raworth's revolutionary economic thesis. While she does fully describe "seven ways to think like a 21st century economist", the two of the seven which really resonate (and are most likely to rankle free-market purists) are her suggestions that: we change the goal of economic policy decisions from a unilateral focus on growth to a focus on outcomes which support planetary and human well-being (#1); and that we seek to be agnostic about growth (#7).

The doughnut is meant to be a tool to enable #1 and it succeeds in conveying its message in a powerfully direct way. However, in questioning the growth imperative Raworth pushes up against a great many preconceptions we all may hold (including readers of the *Journal of Environmental Investing*!) about growth as a necessary condition for healthy economies, individual wealth creation and positive investment results. After all, even the Sustainable Development Goals (SDGs) include economic growth as an explicit aim[2] and for the last 60+ years GDP has only ever increased (with the brief exception of the financial crisis), lifting millions out of poverty in the developing world in the process.



But what if this assumption is wrong? What if growth is not a precondition for economic (or social or environmental) well-being? Based on the current state of the doughnut, with red bars protruding sharply through its ceiling and floor, the track-record of our global growth-based economy has been pretty poor when it comes to finding solutions to problems related to ecology or equity. Intuitively it would seem that the inverse may be true – in order to solve these problems we need to curb economic growth and focus instead on what matters.

Based on the historically low growth rates of developed economies in recent years and increasingly pessimistic long-term growth projections by economists it appears the

[2] e.g. SDG #8 – Decent Work and Economic Growth: https://sustainabledevelopment.un.org/sdg8

decision to switch to a low- or no-growth economy may be made for us. In which case, irrespective of policymakers' stance towards the environment or society, investors better be prepared to answer the above questions and a few others, such as: how exactly does economic growth affect investment returns across asset classes? Are these relationships fixed or fluid? If economic growth is a precondition for high investment returns how in a low- or no-growth economy can retirement goals be met, educations be funded, insurance claims be paid and bank loans be financed?

Raworth spends due time exploring whether "green growth" is possible and concludes that the answer to this question is irrelevant; in her compelling theoretical economic framework GDP growth is a second-order outcome which is unrelated to the primary goals of planetary and human wellbeing. However, Raworth's exploration and explanation of the potential impacts of growth agnosticism on investment outcomes is unfortunately lacking in detail. She ignores an abundant research base describing the influence of macroeconomic variables on investment risk and return[3] and only mentions institutional investors (pensions specifically) in the context of their potential interest in Evergreen Direct Investing (EDI), a concept espoused by John Fullerton and the Capital Institute[4]. While EDI may well be a useful tool for investors to capture long-term predictable return streams and address principal-agent issues brought about by time horizon differentials in the investment value circle, this solution alone can hardly be considered a means for pension schemes to meet their return objectives and improve liability funding ratios.

The social crisis of pension underfunding is no small matter which slower economic growth could exacerbate. Recent estimates by the World Economic Forum place the retirement savings gap at $70 trillion in eight major developed and developing countries and project this gap will increase to $400 trillion by 2050 based on current trends. While this estimate already presumes "equities are expected to perform ~5% below historic averages and bond returns are expected to be ~3% lower" [5], a switch to doughnut thinking and action might further amplify this return deficiency.

On the other hand, a true doughnut economy may, through its heightened focus on issues related to equity, serve to improve the strength of public social safety nets and alter

[3] See for example http://people.hss.caltech.edu/~bcornell/PUBLICATIONS/2010%20Cornell%20-%20Equity%20Growth%20and%20Equity%20Investing.pdf which finds: "The long-run performance of equity investments is fundamentally linked to growth in earnings. Earnings growth, in turn, depends on growth in real GDP. This article demonstrates that both theoretical research and empirical research in development economics suggest relatively strict limits on future growth. In particular, real GDP growth in excess of 3 percent in the long run is highly unlikely in the developed world. In light of ongoing dilution in earnings per share, this finding implies that investors should anticipate real returns on U.S. common stocks to average no more than about 4–5 percent in real terms."

[4] http://capitalinstitute.org/wp-content/uploads/2014/09/EDI-CAPITALINSTITUTE.pdf

[5] http://www3.weforum.org/docs/WEF_White_Paper_We_Will_Live_to_100.pdf

working definitions of retirement[6] thereby alleviating some savings pressure. It would be useful to better understand the potential dynamics of these countervailing forces as they could have significant and lasting impacts on asset-liability management and related long-term investment decisions, but to gain this understanding interested readers will need to look elsewhere.

Embracing Systems Thinking

In addition to her growth challenge, Raworth's urging of economists to "get savvy with systems" (#4) may be of particular relevance to "universal owners" such as large pensions. She contends that dominant economic models do not adequately consider systemic risk, an insufficiency which stems from "ECON 101" where the Circular Flow diagram of money moving through the economy is inevitably drawn and taught; this visual was so pervasive and affecting it was even physically built as a board with various tanks attached and water passing between them to represent monetary flows[7]. Yet in constructing this model its designers treated the economy more or less as a closed loop between households and businesses – with occasional allowance for the role of government – and failed to notice the economy's reliance on natural materials (which derive their energy ultimately from the sun) or to account for non-market-based goods/services (which have tremendous value even if not monetized).

Raworth argues that the economy is not linear, mechanical and predictable and it cannot be summed up in the prevailing macroeconomic theory of market equilibrium. Instead we need to let go of controls that aim to pull markets back into an imaginary state of equilibrium and instead adopt an approach more consistent with the natural world which acknowledges the interplay between stocks and flows but also the existence of feedback loops and delays. An increasing focus on approaches to understanding complexity through system dynamics would help economists and investors to better understand key hubs and leverage points in the financial system which could lead to contagion or collapse.

This line of thinking has begun to take hold in investments with industry leaders like Andrew Lo[8] and Richard Bookstaber[9] articulating potential alternatives to the Efficient Market Hypothesis and embracing complexity. A number of sophisticated institutional investors are additionally confronting the systemic risk posed by climate change head on by taking specific measures to expand their governance, risk assessment and risk management protocols to render their portfolios more resilient to a potential low carbon

[6] See page 10 of: https://www.mercer.com/content/dam/mercer/attachments/private/glb-2017-bold-ideas-for-mending-the-longterm-savings-gap.pdf
[7] https://en.wikipedia.org/wiki/MONIAC
[8] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=728864
[9] https://seekingalpha.com/article/4068311-bookstaber-end-theory

economic transition[10]. While these advances are not discussed directly in Doughnut Economics they are nevertheless included by inference.

All told Raworth proposes few practical solutions for investors, yet, this shortcoming aside, she tells a captivating story (which is saying a lot for a book essentially about economic theory) and proposes an astute and potentially revolutionary challenge to dominant modes of practice in the economic discipline. Simply by questioning the necessity of GDP growth Raworth raises a number of important questions with significant potential ramifications which economists and investors alike ought to take seriously. The book serves as a timely reminder that economic theory underpins our policy and investment decisions and current interpretations and applications of this theory should not be taken for granted.

Acknowledgements: Thanks to Jillian Reid, Divyesh Hindocha, Phil Edwards and Jane Ambachtsheer of Mercer for their thoughtful editorial input.

[10] http://investorsonclimatechange.org/

JEI THE JOURNAL OF ENVIRONMENTAL INVESTING
VOLUME 8, NUMBER 1, 2017

This special issue of the *Journal of Environmental Investing* marks our 8th year of publication and provides for the first time a comprehensive review of the **state of Environmental/Social/Governance (ESG) data and metrics**. With two leading Yale Professors, Dan Esty and Todd Cort, as guest editors, this issue offers a sweeping perspective on the analytic underpinnings—present and future—of sustainable investing.

While still a nascent field, every fund manager now knows that he or she must be in the sustainable investing game. The race is on to develop the best investment tools and processes that will allow investors, who have wide ranging sustainability interests, to steer their portfolios into better alignment with their values.

In addition to bringing a degree of academic rigor and systematic analysis to the realm of sustainability data, this special issue helps to blaze the trail towards the next generation of ESG metrics. The articles cover a great deal of ground—and will be an invaluable resource for investors, fund managers, data providers, academics, environmental advocates, and others interested in sustainable investing. As a group, the articles highlight the weaknesses in the existing data sets, spell out opportunities for improved ESG metrics, and signal to policy makers where government intervention may be required to deliver an ESG data framework that is more carefully constructed, methodologically consistent, trusted, and capable of directing capital flows toward more sustainable enterprises.

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