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ESG INVESTMENT OUTCOMES, PERFORMANCE EVALUATION, AND ATTRIBUTION

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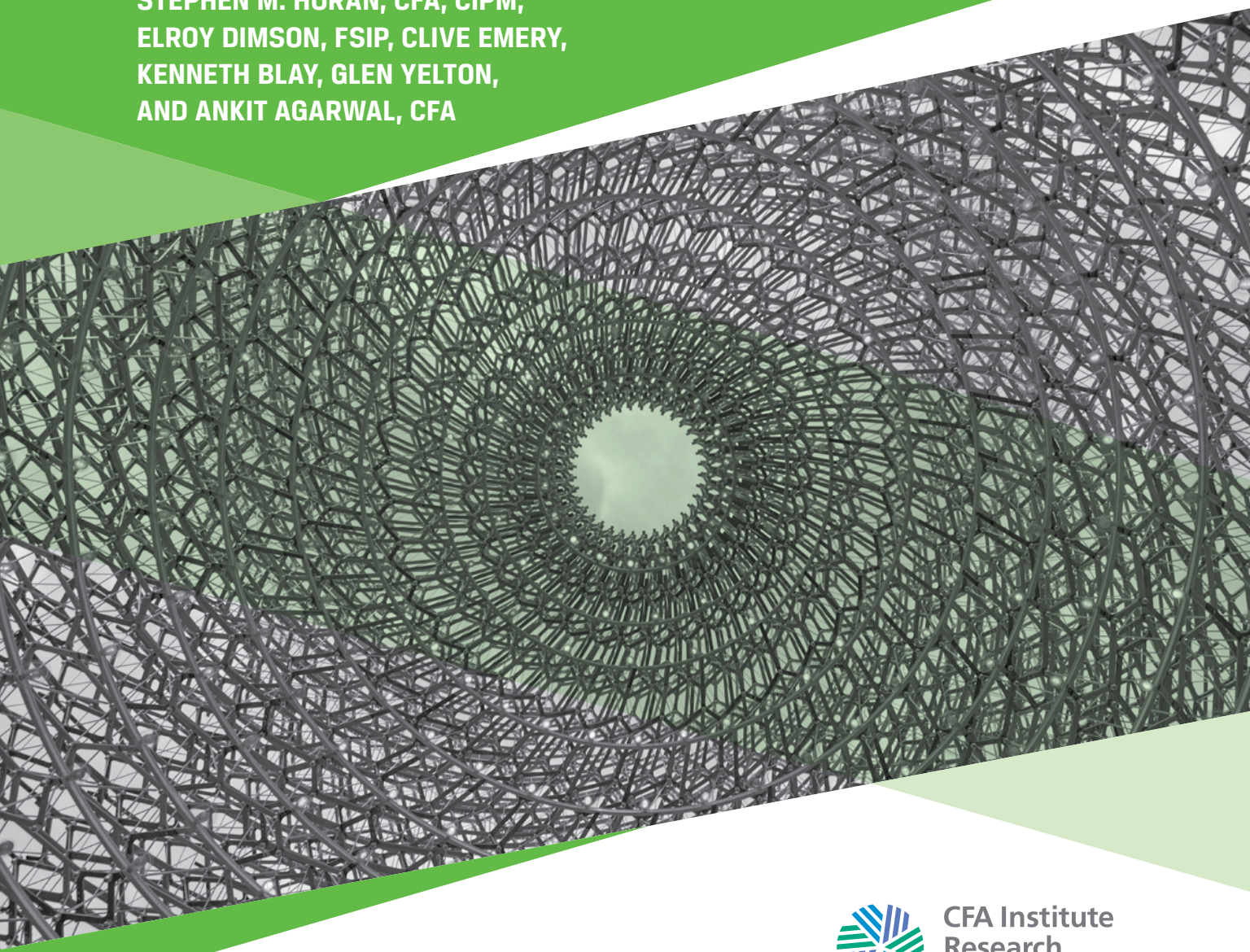

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CFA Institute Research Foundation

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CONTENTS

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ESG INVESTMENT OUTCOMES, PERFORMANCE EVALUATION, AND ATTRIBUTION

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I. INTRODUCTION

The prospect of "doing good while doing well" has become an increasingly enticing proposition for many investors. According to the 2020 Global Sustainable Investment Review, more than one-third (36%), or $35.3 trillion, of all professionally managed assets incorporate environmental, social, and governance (ESG) criteria.[1] Investors might understandably ask if this tectonic shift of assets into ESG funds has decreased carbon emissions, increased human rights, leveled the playing field for under-represented groups, mitigated soil erosion, preserved water purity, or produced whatever outcome investors intended.

Unfortunately, there are few facts to demonstrate these investments are delivering on their promises, at least not on a scale commensurate with the asset flows they have enjoyed. It requires a framework to evaluate portfolio performance and attribute it to specific decisions made by the portfolio manager. Because ESG investors typically have both financial and non-financial investment objectives, a performance evaluation framework must articulate both of these objectives.

Investments should be judged on their outcomes relative to their objectives. Funds aiming to "do good" are no different. Howard-Grenville (2020) noted the dearth of ESG metrics for investing but provided guidance on desirable qualities, including the ability to capture outcomes and impact. Without evidence of the efficacy of ESG investing or the existence of investment objectives against which to judge performance, it is impossible to know the following:

- Are investors with ESG objectives getting what they are paying for?
- Can investors distinguish between good and bad investment managers based on non-financial objectives?
- Can we improve the likelihood investors achieve the results they intend?

These are important questions because if, on the one hand, this colossal allocation of capital produces meaningful environmental or economic results, we will have identified a powerful mechanism to combat potentially existential environmental threats, social injustices, and ethical abuses. If, on the other hand, this massive allocation of investment capital yields little positive impact (or worse, unintended negative consequences), it represents an enormous economic and environmental deadweight loss, the opportunity cost of which is pursuing more effective mechanisms.[2]

This piece develops (1) a practical tool to measure ESG outcomes called an ESG quotient, (2) a performance evaluation tool called R^3, (3) an attribution framework that integrates risk, return, and responsibility, and (4) example applications of each. The remainder of this piece is organized as follows:

- Section II provides additional motivation and context for our inquiry.
- Section III describes the nature of investors with ESG intent and unpacks the salient features of their investment objectives, proposing a spectrum of responsible investing.
- Section IV develops a fund evaluation framework and provides a series of examples.

[1]Global Sustainable Investment Alliance (2021).

[2]We refer to investors allocating capital but not that issuers are ostensibly making their own capital allocation decisions. It is possible, of course, that ESG investing produces positive but unmeasurable impact. In that case, its serendipitous results are based on speculation or hope rather than a balanced consideration of data.

- Section V develops an ESG attribution model and applies it to several hypothetical portfolios.
- Section VI concludes with an overall perspective.

II. THE CHALLENGE OF ESG INVESTING

Bragdon and Marlin (1972) were among the first to empirically examine whether investors must choose between economic value and environmental virtue, finding a positive correlation between pollution control activity indices (a precursor to today's ESG ratings) and profits for 110 virgin paper mills over a five-year period. Since then, a plethora of researchers have set out to determine whether (1) socially responsible firms generate higher financial performance[3] or stock returns,[4] (2) socially responsible funds produce higher risk-adjusted returns,[5] and (3) socially responsible indices outperform conventional indices.[6] The evidence for outperformance is inconclusive.

ESG investing has existed as an investment philosophy in some form for decades. Other aspects of investment management (such as economics, financial reporting, security valuation, and performance evaluation) have evolved over a hundred years. Viewed in this light, ESG investing is still young. As such, there are many issues that must be addressed if investors are to more effectively harness the allocation of capital as a means to drive positive change.

Some of the most relevant challenges investors face in implementing an ESG investment mandate are listed below.

1. *Hollow Virtue Signaling*—Bebchuk and Tallarita (2021), for example, examined filings of the over 130 U.S. public companies that joined the much-hailed Business Roundtable (BRT) Statement on the Purpose of a Corporation issued in August 2019 that articulated a more expansive view of corporate stakeholders beyond shareholders. A great majority of the signing firms neither mentioned their signatory status in their 2020 proxy statements nor referred to other stakeholders in their corporate governance guidelines. In fact, in response to shareholder proposals regarding the implementation of the BRT Statement during the 2020 or 2021 proxy season, most explicitly stated that their joining the BRT Statement did not require any such changes.
2. *Unintended Consequences*—Firms wishing to reduce their carbon footprint sometimes "divest" high-carbon assets. Often, however, these assets are sold to private entities outside the firm's reporting orbit and therefore are not subject to the ESG reporting requirements or conventions of the carbon-emitting sellers. The issuer has deflated its reported carbon emissions, but the carbon-intensive asset still exists. Worse yet, the new (and perhaps unscrupulous) owner of the high-carbon assets now has end-game incentives to operate myopically, knowing the operating life of the carbon-intensive asset or the ability to operate it without corporate reporting obligations may be limited.

[3]Margolis, Elfenbein, and Walsh (2009); Friede, Busch, and Bassen (2015); Busch and Lewandowski (2018); Eccles, Kastrapeli, and Potter (2017); Giese and Lee (2019).
[4]Krüger (2015); Halbritter and Dorfleitner (2015); El Ghoul and Karoui (2017, 2022).
[5]Renneboog, Ter Horst, and Zhang (2008); El Ghoul and Karoui (2017, 2022).
[6]Schröder (2007); Dimson, Marsh, and Staunton (2020).

Some observers note that the naïve belief that refusing to own carbon-intensive companies slows down emissions has a potential unintended consequence.[7] Governments, which are perhaps better positioned to address market imperfections, such as negative externalities and the tragedy of the commons,[8] may be less likely to act if investors are placated with investment screening as an ESG solution (Darwall 2021, Fama 2020). Alternatively, investing more in oil companies might accelerate transitions because they have the capital, insights, and talent to innovate on ways to replace their core business. Put differently, a key function of capital markets is for owners to influence corporate activities, including those of polluting companies.[9]

3. *Greenwashing*—The *Economist* recently examined the world's 20 biggest ESG funds.[10] On average, they hold investments in 17 fossil-fuel producers, including ExxonMobil, Saudi Aramco, and a Chinese coal-mining company. They also invest in stocks engaged in gambling, alcohol, and tobacco. Gibson-Brandon, Glossner, Krueger, Matos, and Steffen (2021), for example, showed that U.S.-domiciled institutional investors who publicly commit to responsible investing have at best the same or perhaps even lower ESG scores than institutional investors that do not make a public commitment. The Financial Conduct Authority (FCA), the financial services and markets regulator in the U.K., has also noted that portfolio holdings of approved ESG funds are often difficult to reconcile with a fund name or fund objective.

Therefore, investors need a performance evaluation toolkit to determine whether investment managers are delivering on their ESG mandates and at what cost, if any, to risk-adjusted return. Likewise, if presented with a trade-off between risk-adjusted return and some ESG objective, portfolio managers would benefit from knowing what financial trade-offs (if any) investors are willing to make to achieve their ESG goals.

Pedersen, Fitzgibbons, and Pomorski (2021) developed a model of ESG-adjusted efficient frontiers that distinguishes between investor preferences for ESG factors and acknowledges possible financial and non-financial trade-offs. They distinguished between investors who are unaware of ESG factors and those who are aware of them and use them to improve their estimates of risk and expected return. These two classes of investors are like uninformed and informed investors competing to maximize risk-adjusted return (e.g., Sharpe ratio). They also defined a third group of investors that derives non-financial utility from ESG factors, but they left the ESG preference function undefined, which makes the model impossible to implement.

Moreover, Pedersen et al. (2021) presented an ex-ante asset allocation framework. We focus on an ex-post performance evaluation toolkit that allows investors to express their preference for non-financial ESG outcomes and thereby distinguish superior ESG-adjusted investment performance from poor performance and to compare performance across managers. In doing so, it also guides investment managers in making

[7]See, for example, Fancy (2021).

[8]The tragedy of the commons is a concept, originally introduced in 1833 by William Forster Lloyd and later popularized by Garrett Hardin in 1968, that describes a situation in which individuals, each pursuing their own self-interest, share a public resource (also referred to as a *common*). Ultimately, the resource is depleted because no one considered the impact their individual decisions might have on others.

[9]"The EU's Green Rules Will Do Too Little to Tackle Climate Change" (2022).

[10]"Sustainable Finance Is Rife with Greenwash. Time for More Disclosure" (2021).

trade-offs between investors' financial and non-financial objectives. Both are single-period models, however, and as such can be critiqued as incompatible with the long-term nature of ESG investing. Investors can, of course, define the single period over whatever horizon they like, but performance is typically measured over intervals considered short term.

A long-term perspective, however, highlights a fundamental (but underappreciated) aspect of the ESG investment mandate. Specifically, do investors wish to incentivize sustainable behavior by rewarding firms that have "behaved well" in the past and have high ESG scores today with portfolio tilts in their direction? Or do investors wish to incentivize sustainable behavior by forecasting which firms will have tomorrow's high ESG scores based on future "good behavior" or changed behavior and tilt portfolios in their direction? We discuss this long-term aspect of investor objectives in more detail below.

III. THE CENTRALITY OF CLIENT OBJECTIVES

Evaluating any investment strategy involves comparing end results to original ambitions, which are memorialized in client or fund objectives. The Financial Conduct Authority (FCA) has noted the "wide spectrum of ESG and sustainable investment funds, reflecting different objectives, investment strategies and characteristics."[11] Investor interest in ESG investing varies across at least two dimensions—topics and intensity.

The first dimension that characterizes investor objectives is topical. Some investors may wish to emphasize E, S, or G.[12] Alternatively, they may wish to express a range of value across all three categories. Others may wish to emphasize a particular issue within either the E, S, or G area. Climate change takes center stage for many these days, but others are keenly interested in human rights or racial inequity, for example.

An often overlooked but fundamentally important dimension of topic selection is whether investor objectives are to invest in firms that currently score well on some metrics that reflect the values they want to promote or, alternatively, invest in firms likely to transition to a desired future state more fully or more quickly. For example, investors focused on decreasing carbon emissions can invest either in firms that currently report low carbon footprints or in firms expected to cut emissions the most over some period.[13]

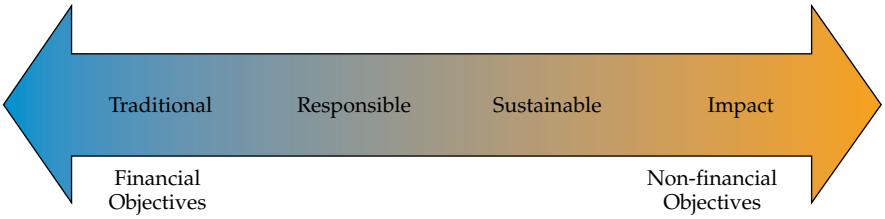
The two approaches are fundamentally different and likely to result in different portfolios and associated benchmarks. This paper abstracts from the specific topic (or combination thereof) and focuses instead on the intensity, or depth of conviction, investors have to achieve a specific ESG outcome.

[11]Financial Conduct Authority letter to authorized fund managers from 19 July 2021.

[12]The Securities and Exchange Commission (2021) in the U.S. attempted to define ESG investment funds in an investor bulletin, noting that "an ESG fund portfolio might include securities selected in each of the three [E, S, and G] categories—or in just one or two of the categories. A fund's portfolio might also include securities that don't fit any of the ESG categories, particularly if it is a fund that considers other investment methodologies consistent with the fund's investment objectives." Such a description highlights the breadth and lack of specificity of the ESG or sustainability monikers.

[13]"Low carbon" is simply a specific example of an ESG objective. The concept can be applied to any ESG objective or set of objectives.

FIGURE 1. SPECTRUM OF ESG/SUSTAINABLE INVESTING



Source: Horan, Dimson, Emery, Blay, and Yelton (2022).

ESG Intensity

Horan, Dimson, Emery, Blay, and Yelton (2022) presented a model for the second dimension—the degree of interest or commitment an investor has for ESG/sustainable investing (**Figure 1**). It ranges from disinterest (characterized by an exclusive focus on traditional financial objectives) to a singular, perhaps exclusive, focus on a specific impact (characterized by intentional proxy voting, company engagement, and active ownership).[14]

Between those extremes, investors may have ESG investment ambitions but are unwilling to trade off risk-adjusted returns. For example, some investors may have non-financial objectives and want their investment manager to act on them if, and only if, there are no trade-offs with financial objectives. As a result, they may be unconcerned about whether the fund's portfolio holdings are materially different from an otherwise identical portfolio with only financial objectives. Others are willing to make return trade-offs to varying degrees. Willingness to balance financial and non-financial goals is a key element in this categorization scheme, and we refer to this continuum as "intensity."

The categories in Figure 1—Traditional, Responsible, Sustainable, and Impact—are informed by a variety of standard-setting bodies that have noted the varying degrees of responsible investing. The precise nomenclature is unimportant. Rather, investors can identify where their investment objectives lie on the spectrum by identifying the amount of risk-adjusted return they are willing to sacrifice for a given ESG outcome. We denote this willingness to pay as λ.

ESG Investing for Financial versus Non-Financial Gain

The investment policy statement (IPS) articulates a client's investment objectives (i.e., return requirements and risk tolerances) and investment constraints. Forty years ago, when responsible investing focused on exclusions, client objectives were expressed in the investment policy statement as a constraint to avoid holdings associated with South Africa, gambling, alcohol, or firearms. In fact, ESG considerations were relegated to the residual bin of investment constraints, called "unique circumstances" (Maginn, Tuttle, Pinto, and McLeavey 2007; Byrne and Smudde 2019).

ESG investing is no longer "unique." It is ubiquitous and central to what some investors want to

[14]In fact, these impact characteristics can be considered a spectrum of investor engagement or stewardship on the right-hand side of the spectrum in Figure 1.

achieve.[15] It has effectively been elevated from a residual investment constraint to a primary investment objective. If ESG considerations are to be elevated to an investment objective alongside return and risk, it must *differentiate between ESG factors that increase risk-adjusted expected returns and those that do not.*

ESG factors may or may not lead to better risk-adjusted returns. Corporate governance has long been studied as possibly leading to either better financial performance (e.g., corporate outcomes), increased risk-adjusted investment returns, or both.[16] Social and environmental factors may also lead to higher profits, valuations, and/or excess returns.[17]

Selecting investments on ESG factors for financial gain, however, is no different from fundamental investing, which has enjoyed the analytical attention of practitioners and academics for nearly a hundred years, dating back at least to Benjamin Graham and David Dodd (1934). Traditional investors would select investments and portfolios on ESG factors expected to have positive financial implications regardless of their non-financial utility. These financial gains are already reflected in a portfolio's traditional measures of risk-adjusted return (Sharpe ratio, Jensen's alpha, maximum drawdown, etc.).

Selecting investments for non-financial gain, however, is fundamentally different. The industry has yet to coalesce around measures that capture the non-financial benefits of ESG factors. However, drawing a *clear conceptual distinction between ESG factors expected to produce financial gains and those that do not* is a necessary requisite for investors to weigh the trade-offs, if any, between the two. We therefore define ESG factors as those intended for non-financial gain.

IV. ESG-ADJUSTED PORTFOLIO EVALUATION—R^3

The Pedersen, Fitzgibbons, and Pomorski (2021) model of ESG-adjusted efficient frontiers distinguishes between investor preferences for ESG factors and acknowledges possible financial and non-financial trade-offs. It does not, however, specify an ESG preference function without which an investor has no way of evaluating an investment manager's ESG-adjusted performance. We use the intensity preference for ESG outcomes to quantify the amount of risk-adjusted return, if any, they are willing sacrifice for a specific ESG outcome. It leads to a portfolio performance metric that incorporates the three Rs—risk, return, and responsibility—which we colloquially refer to as R^3.

A hallmark of a strong performance evaluation framework is that it be specified in advance and commonly agreed upon by client and manager to properly set expectations. That is a challenging proposition in today's nebulous ESG environment, but the following performance evaluation framework is designed to make that easier.

[15]Although a minority of investors and assets are committed to an ESG primary investment strategy, many more integrate ESG strategies into their investment program.

[16]Gompers, Ishii, and Metrick (2003) provided a good example of both. Becht, Bolton, and Röell (2003); Denis, McConnell, Ovtchinnikov, and Yu (2003); and Claessens and Yurtoglu (2013) offered surveys of academic studies on the link between corporate governance and firm value.

[17]Eichholtz, Kok, and Quigley (2010), for example, showed that "green buildings" command higher rents and selling prices than otherwise identical buildings. Although some of the price premium can be attributed to energy savings, higher rents suggest the label itself affects perceptions in the marketplace.

FIGURE 2. CAPITAL MARKET LINE

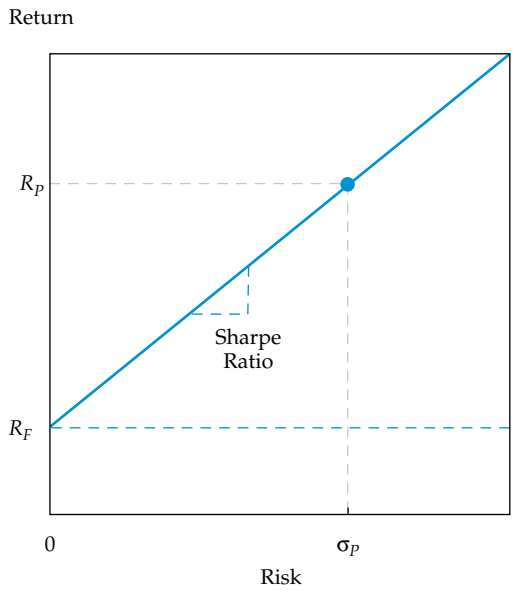
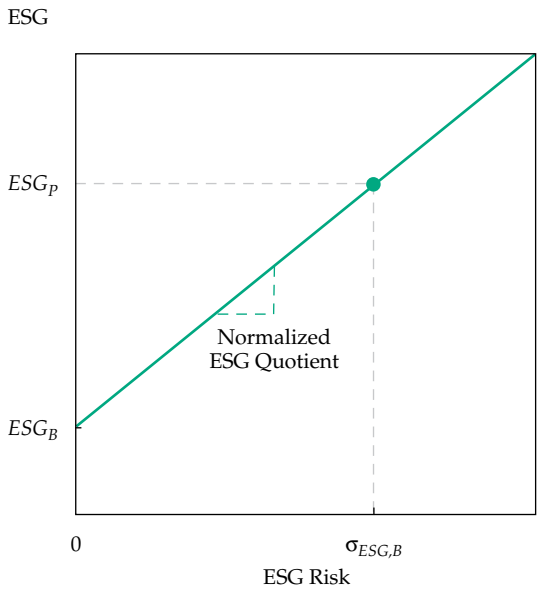


FIGURE 3. NORMALIZED ESG QUOTIENT



The Sharpe ratio is a traditional risk-adjusted performance measure.[18]

$$\text{Sharpe ratio} = \frac{R_P - R_F}{\sigma_P}, \tag{1}$$

where R_P is the return to the portfolio, R_F is the risk-free rate, and σ_P is the standard deviation of returns for portfolio P. **Figure 2** reminds us that the Sharpe ratio is the slope of the capital market line (CML), which imposes a penalty on the excess return (i.e., $R_P - R_F$) for accepting investment risk above and beyond the risk-free benchmark.

[18]There are dozens of other performance measures designed to measure different things and adapt to various investment settings. The Sharpe ratio is rarely used to evaluate performance in private equity, for example, because illiquidity biases the measure of standard deviation downward. Since-inception internal rate of return (SI-IRR) is a generally accepted alternative in that setting. That said, our framework can accommodate most any pre-ESG measure of performance.

The Sharpe ratio captures risk and return but not ESG factors. In a similar fashion, an investor with ESG intent may desire a portfolio with a superior ESG characteristic relative to a particular benchmark and may wish to evaluate the manager's performance on this dimension with a normalized ESG quotient. CFA Institute defines a portfolio-level ESG characteristic as "any measure, or metric, that describes a certain ESG characteristic of the portfolio. A portfolio-level ESG characteristic can be an aggregate measure of the underlying holdings (e.g., asset-weighted carbon intensity) or a measure that is relevant only at the portfolio level (e.g., 85% of assets are invested in green bonds)."[19]

In **Figure 3**, ESG_P is a portfolio-level ESG score according to some pre-determined and mutually agreed-upon metric, ESG_B is the benchmark ESG score according to the same metric,

[19]CFA Institute (2021).

and $\sigma_{ESG,B}$ is the standard deviation of ESG scores across the benchmark constituent components. We can define the slope as the ESG quotient, which is the performance component that captures the third R—responsibility:

$$\text{ESG quotient} = \frac{ESG_P - ESG_B}{\sigma_{ESG,B}}. \quad (2)$$

The denominator, $\sigma_{ESG,B}$, deserves special attention. Unlike the standard deviation of portfolio returns (σ_P) in the Sharpe ratio, which imposes a penalty for risk as σ_P, the standard deviation of ESG scores across the benchmark ($\sigma_{ESG,B}$) is not a risk measure and is not endogenous. It normalizes deviations from the mean, creating a standard normal distribution, $N(0,1)$, to make the portfolio ESG score, ESG_P, comparable across benchmarks with different ESG dispersion.

For example, portfolios A and B may both have an average ESG score 20% above the average for their respective benchmarks. If portfolio A's ESG benchmark has a standard deviation of 10% and portfolio B's benchmark has a standard deviation of 40%, portfolio A has outperformed portfolio B on an ESG basis. Both portfolio ESG scores are 20% above the benchmark, but portfolio A's differential is two standard deviations above the mean rather than a half standard deviation above the mean. In other words, portfolio A has a better signal-to-noise ratio. More generally, portfolios drawing from the same investable universe and having larger (positive) deviations from the mean will have a more positive (negative) slope, or ESG quotient. Investors can therefore use the ESG quotient to compare ESG performance across managers independent of risk-adjusted return.

One might also like to see a model that expresses ESG per unit of portfolio variance attributed to ESG. Relating ESG to traditional measures of risk conflates the financial and non-financial, however. Portfolio variance is meaningful only to the extent investors value financial performance. If, in the extreme, investors value only ESG (which they can specify with λ), portfolio variance is irrelevant.

Assume the investor and portfolio manager agree to evaluate fund performance using a simple Sharpe ratio, which captures two of the three Rs—risk and return. If, however, they agree to evaluate performance on the basis of responsibility as well, the ESG quotient both articulates the investor's ESG objective and can be scaled to quantify the amount of Sharpe ratio, if any, investors are willing to sacrifice to realize their ESG ambitions. The result can be termed the R^3, which reflects all three components—risk, return, and responsibility:

$$R^3 = \frac{R_P - R_F}{\sigma_P} + \lambda\left[\frac{ESG_P - ESG_B}{\sigma_{ESG,B}}\right], \quad (3)$$

where λ is a scaling (or intensity) factor that represents the weight an investor assigns to the ESG quotient based on his or her preferences. As we discuss in more detail below, λ functions as the following:

1. A parameter in client investment objectives that conveys to the investment manager the importance the client places on ESG considerations. The greater the intensity factor, λ, the greater the importance of ESG outcomes and the greater the willingness to trade financial gain for non-financial gain, if necessary.

2. A parameter in the performance evaluation metric, which derives directly from client objectives. The greater the intensity factor, λ, the greater the weight placed on non-financial outcomes relative to financial outcomes.

3. A standardized parameter to compare R^3 across managers.

Investors' ESG intensity is a measure of their willingness to make trade-offs between financial and non-financial outcomes. It aligns with the willingness-to-pay (WTP) trade-off that Barber, Morse, and Yasuda (2021) documented among impact venture capital investors willing to accept 2.5 to 3.7 percentage points lower IRRs in exchange for meeting their dual objectives.

The further to the right on the intensity scale in Figure 1, the higher the scaling factor and the greater the WTP. A "traditional" investor, for example, on the continuum represented in Figure 1 would assign no weight or intensity to the ESG quotient ($\lambda_{Trad} = 0$), in which case the investment manager is evaluated purely on risk-adjusted returns.

A "sustainable" investor on that continuum might be willing to make financial trade-offs for ESG gain and assign a moderately positive weight with $\lambda_{Sust} > 0$ because the ESG intensity and WTP are higher. An "impact" investor might be willing to make even greater financial trade-offs for non-financial gain and assign more intensity yet, such that $\lambda_{Impact} > \lambda_{Sust}$.[20]

The intensity factor, λ, is in some ways analogous to an investor's risk-aversion parameter in a mean–variance optimization (MVO) utility function derived from a goals-based life balance sheet. Assets on the left-hand side are represented in the normal way, but some goals on the right-hand side are listed as desired ESG outcomes. Although some authors have demonstrated how it can be meaningfully and practically estimated (Wilcox, Horvitz, and DiBartolomeo 2006; Horan and Johnson 2014), advisers rarely use it in practice. As a normalized deviation from the mean, the ESG quotient provides a powerfully intuitive interpretation for the scaling factor that can be used in practice.

This approach makes no assumptions about the relationship, if any, between ESG and risk-adjusted returns. Specifically, it does not presume a higher ESG quotient is associated with a lower Sharpe ratio.[21] However, the scaling factor, λ, does provide a mechanism to measure a client's willingness to pay (WTP) should a trade-off between financial and non-financial outcomes exist or become necessary.

For example, an investor willing to accept a 0.10 lower Sharpe ratio in exchange for a portfolio ESG one standard deviation above the benchmark would express her ESG intensity, λ, as 0.10. An investor willing to accept a 0.20 lower Sharpe ratio in exchange for the same one standard deviation of ESG outperformance is expressing his λ to be 0.20, and so on. Financial markets may not require that trade-off, but λ provides guidance to the portfolio manager about how to evaluate trade-offs should they exist.

Hypothetical Examples

Consider three investors—Brown, Yellow, and Green—evaluating the investment performance of three investment managers: Angel Partners, Climate Capital, and Devil Ltd. Investor Brown places no emphasis on ESG investing ($\lambda = 0$). In **Table 1**, Investor Yellow is willing to trade off 0.50 units of Sharpe ratio for a portfolio

[20]In theory, an investor with nefarious ESG intent could assign $\lambda < 0$, but that is unlikely. The more likely scenario is that of an investor interested in, say, "sin" investments, believing they are undervalued and offer a superior risk-adjusted return. In that case, the investor's interest in poor ESG scores is purely a consequence of pursuing financial gain—a means to an end rather than an end unto itself—in which case the R^3 performance evaluation would assume $\lambda = 0$.

[21]By contrast, the Sharpe ratio and most other performance measures assume a specific link between risk and return.

TABLE 1. NINE HYPOTHETICAL EXAMPLES OF R^3

		Investor Brown	Investor Yellow	Investor Green
ESG intensity		0.00	0.50	1.00
Angel Partners				
Sharpe ratio	0.20			
ESG quotient	1.25			
R^3		0.20	0.83	1.45
Climate Capital				
Sharpe ratio	0.50			
ESG quotient	0.75			
R^3		0.50	0.88	1.25
Devil Ltd.				
Sharpe ratio	0.70			
ESG quotient	0.00			
R^3		0.70	0.70	0.70

constructed with an ESG score one standard deviation above the mean ($\lambda = 0.50$). Investor Green is more intense and would be indifferent between portfolios with a Sharpe ratio of zero or one if the latter had an ESG score one standard deviation above the mean ($\lambda = 1$). Angel Partners has mediocre traditional risk-adjusted investment performance but superior ESG performance. Devil Ltd. produces the opposite outcome, and Climate Capital performs in between them on both dimensions.

Although each investment manager produces the same financial and non-financial results for all their investors, each investor evaluates them differently. Investor Green prefers Angel Partners, which delivers inferior traditional risk-adjusted performance but compensates with superior ESG performance. Placing no value on ESG outcomes, Investor Brown evaluates Devil Ltd. as superior. Investor Yellow balances the financial and non-financial outcomes differently and evaluates Climate Capital as the superior manager.

It becomes obvious that investment managers cannot know if they are ingratiating to or alienating themselves from investors with their investment decisions without knowing their investors' relative preference for financial and non-financial outcomes.

It may be difficult for investors to express their preferences in terms of standard deviation. Quartiles, however, are commonly used to rank managers. The upper quartile of a normal distribution is $\sqrt{2}$, or 1.41, standard deviations away from the mean, according to Chebyshev's theorem.[22] By choosing an intensity factor

[22]Chebyshev's theorem states that the maximum proportion of observations that are more than k standard deviations from the mean is $1/k^2$. The minimum proportion of observations that are within k standard deviations from the mean is $1—1/k^2$. When $k = \sqrt{2}$ standard deviations,

of λ = 1, Investor Green is implicitly willing to accept a portfolio with a 1.41 lower Sharpe ratio for a portfolio with an ESG score landing just inside the upper quartile.

Investor Yellow is relatively less interested in ESG outcomes and by choosing λ = 0.5 prefers instead to sacrifice no more than 0.70 (i.e., 0.5 × 1.41) of Sharpe ratio for a portfolio landing in the upper quartile of ESG outcomes. Investors uncomfortable with that trade-off may choose λ = 0.2 if they are only willing to give up 0.28 (i.e., 0.2 × 1.41) of Sharpe ratio for landing in the upper quartile of ESG scores.

Investment managers can use this information to make decisions. Those with clients like Investor Brown know to make no financial trade-offs for any amount of ESG gain. Those with clients like Investor Yellow know to pursue investments that increase the ESG quotient so long as it sacrifices no more than 0.50 of Sharpe ratio per standard deviation of improvement. Those with clients like Investor Green know to sacrifice as much as 1.0 Sharpe ratio per standard deviation of improvement.

Advantages and Disadvantages

R^3 is an ad hoc construct. One can conceive of others. And it is not a model of general equilibrium. This ad hoc approach presents both advantages and disadvantages. As an ad hoc measure, however, it is not unique among popular portfolio evaluation metrics, such as the Sortino ratio, Calmar ratio, Sterling ratio, total-value to paid-in (TVPI) ratio, distribution to paid-in (DPI) ratio, residual value to paid-in (RVPI) ratio, or public market equivalent (PME). R^3 does not dictate a trade-off between financial and non-financial performance but, rather, lets investors specify it themselves. It is a tool therefore to help articulate investment objectives and measure performance against those objectives.

Another disadvantage is that this framework measures the ESG score at a point in time. This allows investment managers to window dress their portfolio with high ESG holdings when the score is being measured, which we address later.

Because of these limitations, R^3 is not a model. It is a tool. It will take some time for the industry to converge on an accepted model of general equilibrium that incorporates ESG factors. Until then, R^3 is a flexible tool that can be useful for some investors but most certainly not all.

One advantage of R^3 is that it treats the financial and non-financial components independently. It derives from the notion of distinguishing between ESG factors that increase risk-adjusted return and those that do not. ESG factors producing only non-financial gain are reflected in the second term. Although ESG factors producing financial gain are reflected in both terms, their impact on the second term is determined by the investor's chosen intensity.

Another advantage to this approach is that it is intuitive. It offers a framework for investors to articulate their objectives and provides clarity for advisers to understand investor intent. These features combine to allow the adviser to lead the client in a product discussion without the quagmire of an ethical discussion. Providing the investor and adviser with a flexible tool to articulate their investment objectives in this way with some specificity is a major practical advance.

Another advantage is that it generalizes to any measure of risk-adjusted performance, such as

the maximum proportion of observations that fall outside $\sqrt{2}$ standard deviations and the minimum proportion of observations that fall inside are both 50%. Because the inner two quartiles of a ranking represent 50% of the distribution, the upper quartile breakpoint is $\sqrt{2}$, or ≈1.41, standard deviations away from the mean.

Jensen's alpha, or any agreed-upon ESG metric however narrowly or broadly defined, such as carbon emissions or ESG rating. Importantly, however, an ESG intensity factor, λ, that properly adjusts the Sharpe ratio will be improper for other measures of risk-adjusted performance, such as Jensen's alpha or the Treynor ratio. So, care must be taken to interpret and choose them accordingly.

An ESG Metric for Transition

One version of greenwashing is the possibility of window dressing—that is, loading a portfolio with highly rated ESG firms at the end of a reporting period to mimic a "green" portfolio despite financial performance being driven by "brown" holdings preceding the end of the reporting period. In the extreme, a fund manager could own the worst offenders for 364 days of the year and still rate well, which is obviously not the intent of the benchmarking.

Fund managers genuinely emphasizing today's low emitters will struggle to ever increase their allocation to high-emitting sectors even if they are the ones cutting emissions the most because ESG_P is a point-in-time measure of today's virtue rather than tomorrow's transition.

The distinction between investing/divesting in firms that are currently sustainable/unsustainable (either relative to a specific industry or the market portfolio) versus firms that are likely to make the largest strides in transitioning to a sustainable profile is critical to choosing an appropriate ESG metric. Net-zero methodologies are an example of the latter. An industry-wide approach has been to reduce portfolio carbon exposure by 30% from a base year (2019) and commit to a 7% per annum reduction thereafter at the portfolio level; that is, $ESG_{P,t}/ESG_{P,t-1} - 1 > 7\%$. This approach seems sensible at first glance but sets perverse incentives that will not support real-world change.

Funds can set their 2019 benchmark year as one with large exposures to the high-carbon-emitting sectors and simply reduce their exposure to these sectors over time to ensure a mathematical reduction in overall portfolio exposure. It is not a real-world solution, because although it reduces portfolio exposure to carbon, not owning an asset does not mean the carbon is not being produced. Moreover, it encourages owning companies with the lowest emissions (e.g., technology versus petroleum) rather than companies that will reduce emissions the most.

An alternative to this blunt and ineffective portfolio measure is ΔESG, which measures year-on-year change for each of the current holdings. By measuring year-on-year change at the security level $\left(\Delta ESG = w_i \sum_{i=1}^{n} ESG_{i,t} / ESG_{i,t-1} - 1 \right)$ rather than the portfolio level $(ESG_{P,t}/ESG_{P,t-1} - 1)$, ΔESG mitigates the disadvantage of the ESG score being a single point-in-time measure that captures real-world change over the time period rather than how the portfolio has changed over that time.

This approach can be refined further to address the potential of window dressing the portfolio with high ΔESG holdings at the end of an evaluation period by further weighting the holdings by the duration of time, d_i, for every holding during the entirety of the evaluation period, not just those holding at the end of the evaluation period, such that $\Delta ESG = w_i d_i \sum_{i=1}^{n} ESG_{i,t} / ESG_{i,t-1} - 1$.

So, this performance evaluation framework accommodates either ESG levels or ESG change without necessarily making a case for which objective is better. An investor wishing to invest

in transition or change would simply substitute a transition measure, ΔESG, as the measure of non-financial performance, such that

$$R^3 \text{ change} = \frac{R_P - R_F}{\sigma_P} + \lambda \left[\frac{\Delta ESG_P - \Delta ESG_B}{\sigma_{\Delta ESG,B}} \right]. \quad (4)$$

V. ESG PERFORMANCE ATTRIBUTION

How a portfolio achieves its ESG quotient is just as important as the ESG quotient itself because portfolio managers can game the metric with simple and blunt approaches that can mathematically produce a higher ESG_P but have no real-world positive impact. So, we also develop an ESG attribution model that distinguishes between managers who report positive ESG scores through industry avoidance (e.g., sector allocation) versus those who selected the most sustainable firms within an industry (e.g., security selection). It is a crucial step to meaningfully compare performance of different fund managers across all three dimensions, increase investment stewardship, and improve real-world outcomes.

A simple tactic to deliver a low-carbon portfolio relative to the market is to exclude high-emitting sectors or companies—often petroleum and coal. It can have a dramatic impact on the portfolio's carbon footprint relative to a benchmark that includes them. A fund could allocate to the highest emitters in every other sector but exclude a few high-emitting sectors and appear to be excellent relative to the traditional benchmark.

A fund that adopts a systematic strategy of selecting companies within each industry that are moving more decisively or quickly to net zero relative to their industry peers but includes oil and gas companies is likely to have a lower ESG quotient than an exclusionary fund, but which is better? Some may want an exclusionary approach, but then a benchmark that also excludes the same sectors should be used to judge the ESG quotient.

Alternatively, a flattering ESG score may result from a large weight in one or two very "green" companies. Attribution models can identify the source of ESG performance, so investors can determine if the realized ESG integration strategy is consistent with their objectives and the fund's mandate.

This dilemma reinforces the importance of both benchmark selection and an attribution model.

The aim here is to establish better ways to attribute the ESG outcome—stock selection, sector selection, or asset allocation.

Brinson and Fachler (1985) and Brinson, Hood, and Beebower (1986) developed a model that isolates the sources of effects by comparing the effects of variously constructed portfolios. We can use the Brinson model framework to decompose the difference in ESG scores between the portfolio and its benchmark into its principal components.[23]

Asset Allocation

To identify the ESG contribution from allocating assets to various sectors, for example, an ESG performance attribution model creates a shadow portfolio, $ESG_{P,A}$, that applies the portfolio weight in sector i to the benchmark ESG score for sector i, such that

$$ESG_{P,A} = \sum_{i=1}^{n} w_i ESG_{B,i}, \quad (5)$$

[23]Kritzman (2006) and Ibbotson (2010) have separately critiqued the Brinson et al. models for determining attribution assuming that the alternative to the portfolio was being entirely uninvested rather than invested in the benchmark. Our model compares portfolio ESG to that of the benchmark.

where w_i is the portfolio weight on sector i and $ESG_{B,i}$ is the benchmark ESG score in sector i. This notional $ESG_{P,A}$ portfolio has a hypothetical ESG score that would have been delivered had the manager chosen average-ESG-score firms within a sector and varied only sector weights. The asset groupings here need not be defined by sector. They could be broken down by industry or some other descriptor provided the weights sum to one. The contribution of this asset allocation to ESG performance, A, is given by the difference between the notional fund ESG score and the benchmark ESG score:

$$A = ESG_{P,A} - ESG_B = \sum_{i=1}^{n} w_i ESG_{B,i} - \sum_{i=1}^{n} v_i ESG_{B,i} = \sum_{i=1}^{n} (w_i - v_i) ESG_{B,i}, \quad (6)$$

where v_i is the benchmark weight of sector i. The individual sector contributions, $(w_i - v_i)$ $ESG_{B,i}$, represent the impact of veering from benchmark sector weightings and sum to equal the contribution to ESG performance from sector selection or asset allocation.

This approach allows investors or consultants to (i) quantify the portion of relative ESG score performance driven by sector selection overall, (ii) identify sector overweights/underweights responsible for that variance, and (iii) suggest sectors where ESG performance metrics may have been artificially manipulated. These quantities can then be compared to the fund's investment strategy to determine if ESG performance is driven by investment strategy, style drift, manipulation, or luck.

Security Selection

To determine how security selection within each sector grouping contributes to relative ESG score performance, we create another shadow portfolio, $ESG_{P,S}$, that assumes the portfolio sector weights equal benchmark sector weights, but the ESG score for that sector is determined by the portfolio rather than the benchmark:

$$ESG_{P,S} = \sum_{i=1}^{n} v_i ESG_{P,i}, \quad (7)$$

where $ESG_{P,i}$ is the portfolio ESG score in sector i. In a similar fashion, the contribution of security selection, S, to ESG performance is given by the difference between the shadow fund ESG score and the benchmark ESG score:

$$S = ESG_{P,S} - ESG_B = \sum_{i=1}^{n} v_i ESG_{P,i} - \sum_{i=1}^{n} v_i ESG_{B,i} = \sum_{i=1}^{n} v_i (ESG_{P,i} - ESG_{B,i}). \quad (8)$$

Again, the individual sector contributions, $v_i(ESG_{P,i} - ESG_{B,i})$, represent the impact of choosing "green" firms within an industry or sector and sum to equal the contribution to ESG performance from security selection. Investors and consultants can then (i) quantify the fund's relative ESG performance driven by security selection generally, (ii) identify sector(s) in which security selection is(are) responsible for that variance, and (iii) suggest sectors where ESG performance metrics may have been artificially manipulated. These quantities can then be compared to the fund's investment strategy to determine if ESG performance is driven by the strategy, style drift, manipulation, or luck.

Interaction

Importantly, the contribution of asset allocation and security selection to ESG performance do not fully account for the difference in ESG score between the portfolio and the benchmark. In other words,

$$\begin{gathered} A + S \\ (ESG_{P,A} - ESG_B) + (ESG_{P,S} - ESG_B) \\ ESG_{P,A} + ESG_{P,S} - 2ESG_B \neq ESG_P - ESG_B. \end{gathered} \quad (9)$$

The interaction between asset allocation and security selection accounts for the difference and can be expressed as

$$I = \sum_{i=1}^{n}(w_i - v_i)(ESG_{P,i} - ESG_{B,i}) = \sum_{i=1}^{n} I_i, \quad (10)$$

where I_i represents the contribution of sector i's interaction to ESG performance. Interaction contributes positively to ESG performance when a manager overweights (underweights) sectors in which portfolio firms are more (less) "green" than sector peers. Conversely, interaction would contribute negatively to ESG performance when a manager overweights (underweights) sectors in which portfolio firms also move more (less) decisively or quickly to net zero relative to their sector peers.

This expression can help isolate whether ESG performance is attributable to a stock selection in an overweighted industry, which sheds light on whether the ESG performance is attributable to luck, skill, or metric manipulation.

In summary, a portfolio's relative ESG performance can be expressed as the sum of asset allocation, security selection, and the interaction between them, or

$$ESG_P - ESG_B = A + S + I. \quad (11)$$

Better appreciation of how ESG performance is delivered and ensuring that a relevant benchmark is used to judge this delivery are key steps to improve the real-world outcomes that funds are purporting to deliver and will help to eradicate some "shortcuts," such as sector exclusions, overallocating to a few stocks or sectors, or window dressing.

VI. R^3 PERFORMANCE EVALUATION AND ESG ATTRIBUTION EXAMPLE

The R^3 metric can be used as either a portfolio construction tool (e.g., greater ex-ante preference for high-ESG-score holdings when λ is high) or a performance evaluation tool (e.g., ex-post evaluation of the trade-off of financial and non-financial gains). It can also be a tool for measuring utility if a utility function includes both the Sharpe ratio and an ESG metric. In this section, we illustrate its use as an ESG-adjusted performance evaluation and ESG attribution tool with examples that demonstrate the interpretation of the ESG quotient and how it can be affected by some example ESG strategies.

As presented in Horan, Dimson, Emery, and Blay (forthcoming 2022), we constructed a 33-stock-based portfolio from the MSCI All-Country World Index (ACWI), a large- and mid-capitalization index of 2,966 stocks in 23 developed markets and 25 developing markets, over the three-year period ending 31 October 2021. We selected carbon intensity as the ESG metric because it is the focus of much attention, is quantifiable, and is commonly reported. Specifically, we ranked by carbon intensity defined as Scope 1 and Scope 2 emissions (in metric tons) per USD sale (in millions). As mentioned before, the investor's chosen ESG metric can be environmental, social, or governance related. Alternatively, it can be specific or broad within one of those categories or across it.

The 33-stock portfolio was constructed by randomly selecting three stocks from each of the 11 sectors—one stock each from the top decile, the bottom decile, and near the median.[24]

[24]We exercised some discretion in selecting within the top and bottom deciles to avoid emerging market and

The resulting 33-stock portfolio, weighted by market capitalization, is intended to represent a hypothetical "ESG neutral" investment portfolio (see **Table 2**).

Table 3 reports descriptive statistics for the carbon intensity metric. Its distribution has a very high standard deviation and is highly skewed. The mean, for example, is ten times the median. As a result, we transform the ESG score with the natural log, which brings the mean and median in close proximity to each other and significantly reduces skew and kurtosis. It remains a figure, however, in which a *lower* score is more desirable from an environmental perspective than a higher score. So, we will adjust our interpretation of the results accordingly.

ESG metrics and their associated ESG quotients may or may not be normally distributed. The natural log transformation may or may not be appropriate for other ESG metrics. Transformations that mitigate the influence of higher moments, however, can easily reduce the challenges posed by higher moments in a practical way until a more theoretical approach is agreed upon and may even enable their development. It is possible to make such a transformation because the ESG quotient is not tied to a general equilibrium asset pricing model.

The 33-stock portfolio constructed in this manner without regard for ESG attributes (called the ESG neutral portfolio) has a poor ESG profile relative to the broad market MSCI AWCI benchmark index. The weighted average of the natural log of carbon intensity of each of the portfolio's holdings is 3.66, compared to the 2.90 for the MSCI AWCI broad market index. The main culprit is the 16.34% allocation to Berkshire Hathaway, whose combination of large weight and relatively high carbon footprint accounts for about a quarter of the portfolio's carbon footprint (0.917 out of 3.66).

We designed three hypothetical ESG strategies to the 33-stock ESG neutral portfolio to improve upon its ESG profile and R^3 score—all based on some exclusion method, including the following:

1. **Ex-Chevron:** Divesting the single largest and most carbon-intensive energy producer
2. **Ex-Energy:** Divesting the entire energy sector, which is a pure ESG asset allocation play
3. **ESG Stock Picker:** Divesting the most carbon-intensive holding within each of the eleven sectors

These stylized portfolios will illustrate the impact on R^3 performance and ESG attribution.

Table 4 lists the ESG scores for the MSCI ACWI benchmark, the ESG neutral portfolio, and the three ESG strategies. Because a lower ESG score is associated with lower carbon intensity, we multiply through by negative one when calculating the ESG quotient in Panel A and the performance attribution statistics in Panel B.

As referenced above, the difference between the ESG score for the ESG neutral portfolio and the benchmark is 0.755, which, according to the ESG quotient, is 0.37 standard deviations worse than the benchmark.[25] The ex-Chevron portfolio improves upon the ESG neutral score by 0.30 and narrows the difference to 0.22 standard deviations represented by its ESG quotient.

small stock biases. We also ensured the inclusion of a large petroleum company (in this case, Chevron) to illustrate the impact of a single stock exclusion.

[25]One can also consider the 33-stock portfolio as an ESG neutral strategy against which to compare the ESG strategies (e.g., Horan, Dimson, Emery, and Blay, forthcoming 2022), and the interpretation remains robust.

TABLE 2. HYPOTHETICAL ESG NEUTRAL PORTFOLIO

GICS Sector	Holding	Weight	Carbon Intensity (ESG)	$\ln(ESG_t)$
Communication Services	Auto Trader Group PLC	0.42%	0.90	−0.11
	Cable One Inc.	0.49%	19.00	2.94
	Orange Polska SA	0.12%	139.00	4.93
Consumer Discretionary	Flutter Entertainment	1.07%	1.70	0.53
	Dollarama Inc.	0.59%	27.50	3.31
	Carnival Corp.	0.78%	517.20	6.25
Consumer Staples	Lawson Inc.	0.22%	4.10	1.41
	Coca-Cola Company	10.26%	48.30	3.88
	Kimberly Clark de Mexico	0.11%	313.70	5.75
Energy	Schlumberger NV	1.82%	69.30	4.24
	Cenovus Energy Inc.	1.08%	565.40	6.34
	Chevron Corp.	9.86%	613.90	6.42
Financials	PICC Property & Casualty	0.27%	0.10	−2.30
	Bank of Montreal	3.04%	3.60	1.28
	Berkshire Hathaway Inc.	16.34%	274.60	5.62
Health Care	Humana Inc.	2.44%	0.90	−0.11
	Merck & Co. Inc.	8.57%	23.60	3.16
	Lonza Group AG	2.71%	270.20	5.60
Industrials	Toyota Tsusho Corp.	0.70%	2.00	0.69
	Caterpillar Inc.	4.74%	36.40	3.59
	Singapore Airlines Ltd.	0.48%	1,453.90	7.28
Information Technology	PayPal Holdings Inc.	9.84%	1.20	0.18
	Oracle Corp.	11.24%	15.10	2.71
	ON Semiconductor Corp.	1.20%	556.50	6.32
Materials	Johnson Matthey	0.24%	19.90	2.99
	Grupo Mexico SAB de CV	1.47%	494.30	6.20
	PT Semen Indonesia (Persero)	0.15%	10,995.10	9.31
Real Estate	Prologis Inc.	5.05%	1.30	0.26
	Swiss Prime Site AG	0.32%	34.20	3.53
	Digital Realty Trust Inc.	2.16%	767.90	6.64
Utilities	ENN Energy Holdings Ltd.	0.96%	26.10	3.26
	Fortum Oyj	1.15%	821.10	6.71
	Huaneng Power International	0.10%	13,505.40	9.51

Sources: MSCI; Invesco; Horan, Dimson, Emery, and Blay (forthcoming 2022).

TABLE 3. DESCRIPTIVE STATISTICS FOR CARBON INTENSITY ESG SCORE

	Carbon Intensity (ESG)	ln(ESG_t)
Mean	309.18	3.58
Median	30.60	3.42
Standard Deviation	1,152.20	2.04
Skewness	8.66	0.26
Kurtosis	98.21	−0.04
Minimum	0.10	−2.30
Maximum	20,439.30	9.93

Source: Invesco.

Excluding the entire energy sector improves ESG performance further for a 0.40 raw difference in ln(ESG) and an ESG quotient of −0.20. This portfolio still has a poorer carbon footprint than the benchmark index.

The more elaborate strategy of excluding the highest emitters from each of the eleven sectors dramatically improves ESG performance and increases the ESG score 0.22 standard deviations above the benchmark. That these simple strategies all fall well within one standard deviation of the mean illustrates the difficulty of building a portfolio with an ESG metric one standard deviation away from the mean, especially when the standard deviation is so large.

The Sharpe ratios for the MSCI ACWI benchmark and ESG strategies were computed using three years of performance data for the period ending 31 October 2021. Because this was a very good time period for equity investments, they are relatively high. We can nonetheless calculate R^3 for each portfolio and gauge the ostensible improvement over the ESG neutral strategy.

R^3 for the benchmark index equals the Sharpe ratio by definition because the ESG score for the portfolio and benchmark are identical.

TABLE 4. ESG PERFORMANCE EVALUATION FOR FOUR STYLIZED ESG STRATEGIES USING THE MSCI ACWI AS THE BENCHMARK

	MSCI ACWI	ESG Neutral	Ex-Chevron	Ex-Energy	Stock Picker
A. Portfolio statistics					
ESG_p	2.90	3.66	3.36	3.30	2.45
ESG quotient	—	−0.37	−0.22	−0.20	0.22
Sharpe ratio (3-year)	0.95	1.08	1.22	1.31	1.31
B. R^3 ESG performance evaluation					
R^3 (λ = 0.25)	0.95	0.98	1.16	1.26	1.37
R^3 (λ = 0.50)	0.95	0.89	1.11	1.21	1.42
R^3 (λ = 0.75)	0.95	0.80	1.05	1.16	1.48
R^3 (λ = 1.00)	0.95	0.71	1.00	1.11	1.53
R^3 (λ = 1.25)	0.95	0.61	0.94	1.07	1.59

Source: Invesco.

Investors expressing a positive preference for ESG attributes ($\lambda > 0$) see the ESG-adjusted performance increase for each of the increasingly ESG-intensive strategies (i.e., moving from left to right in Table 4). It results from improvements in both financial performance and nonfinancial performance.

Within a particular ESG strategy, though, ESG-adjusted performance as measured by R^3 for both the ESG neutral portfolio and the first two ESG strategies decreases with investor ESG intensity because ESG scores for these portfolios are inferior to the benchmark. Placing greater emphasis on this inferior ESG performance decreases R^3. For example, the ex-Chevron strategy has a Sharpe ratio of 1.22. Because its ESG score is below the benchmark, however, R^3 drops to 0.94 depending on investor intensity.

In contrast, R^3 increases with λ for the stock picker strategy because its ESG quotient is positive, or 0.22 standard deviations above the mean of the benchmark. The favorable ESG profile becomes more valuable as the investor intensity increases. The variation of R^3 across different levels of λ implies that although the metric can create consistent decisions at the client level (or at least clients with the same λ), one cannot compare across different clients. Implementing it at the investment fund level would require λ to be specified as part of the investment mandate and hence implicitly adopted by fund investors.

Table 5 presents the performance attribution of the three ESG strategies. The portfolio selected without regard for ESG attributes weighted carbon-intensive sectors more heavily than the benchmark, so the influence of asset allocation (A) accounts for nearly a third of the ESG score differential (i.e., –0.214 of –0.755). Security selection accounts for half of the ESG differential (i.e., –0.376 of –0.755). So, the ESG neutral stock selection process tended to pick relatively carbon-intensive securities within sectors.

The ex-Chevron strategy shows up as improved asset allocation (A) because de-selecting this holding greatly reduces the weight of the entire energy sector from 12.8% to 3.2%. As a result, the asset allocation effect is much larger than the security selection effect. The negative interaction effect (I) indicates that the portfolio is still holding greater carbon-intensive assets relative to each asset's sector for the most carbon-intensive sectors.

The ex-energy strategy predictably shows an even stronger asset allocation effect, but no improvement in either security selection or interaction. Excluding an entire sector is a significant asset allocation decision. The stock

TABLE 5. ESG PERFORMANCE ATTRIBUTION FOR FOUR STYLIZED ESG STRATEGIES USING THE MSCI ACWI AS THE BENCHMARK

	ESG Neutral	Ex-Chevron	Ex-Energy	Stock Picker
Asset Allocation (A)	–0.214	0.133	0.251	–0.186
Security Selection (S)	–0.376	–0.339	–0.382	0.654
Interaction (I)	–0.165	–0.247	–0.266	–0.016
$ESG_P - ESG_B$	–0.755	–0.453	–0.397	0.452

Source: Invesco.

picker strategy, which excludes the brownest holding within each sector, shows a dramatic improvement in security selection (*S*). The magnitude is large enough to turn the ESG quotient positive, making this strategy desirable for an ESG investor relative to the others.

The investor can compare the ESG attribution to the stated strategy to determine if the ESG performance is consistent with the investment mandate.

VII. CONCLUSION

ESG investing is riddled with challenges of measurement, impact, and the law of unintended consequences. Solving these problems will take many years. If investment professionals are to be accountable for fulfilling non-financial objectives, those objectives must be communicated and codified. "Doing good" is an insufficient directive. The more clarity and specificity investors can provide, the more effective the investment industry can be in fulfilling their aims.

Financial advisers and portfolio managers have a duty to guide investors in articulating their ESG intent with well-structured frameworks that outline relevant trade-offs. Constructs such as the "intensity factor" and the R^3 performance metric can be useful tools in that endeavor. Portfolio managers can then use them to inform investment decisions aligned with investor objectives.

Horan et al. (2022) outlined desirable qualities for ESG reporting metrics, but much work remains to be done to produce data investors and managers can use to evaluate and attribute performance. Also, the industry should coalesce around a classification scheme for investor objectives; without such a scheme, everything else has limited value. We have proposed one, but others have made their own contributions. A common and defining feature across many of them is a measure of ESG "intensity" that reflects an investor's willingness to make financial/non-financial trade-offs. Setting a serviceable investor objective framework will help investors state their intentions and help advisers solicit them.

The ESG attribution model in this brief is modeled after traditional and accepted performance attribution models. It is, however, unidimensional. ESG investing is inherently multi-dimensional. So, it requires a methodology to summarize multiple variables into a single measure. An alternative approach for future authors to develop is a multi-dimensional performance attribution model that eliminates the need for aggregation.

Investor objectives are paramount. Integrating them into the investment management process is critical if we are to claim the high ground of an investment profession because they represent the North Star to guide investment activity, fund analysis, performance measurement, performance evaluation, and fund reporting. All investors are heterogeneous. We must accommodate the spectrum and diversity of sustainable investment intent in our methods. Necessary ingredients to disciplined sustainable investment that we highlight here are as follows:

1. Clear investment objectives
2. Investment outcomes that are
    a. Measurable
    b. Reflective of real-world impact
    c. Aligned with investor objectives
3. Portfolio reporting that is
    a. Clear
    b. Concise
    c. Aligned with investor objectives

None of these elements is unique to ESG investing. They apply to any fiduciary investment activity. In that sense, ESG investment is no different. The quagmire ensues when objectives are amorphous and ill-defined or when outcomes are poorly measured and unaligned with those objectives.

Doing good while doing well is here to stay. If the investment industry fails to tackle sustainable investing with the same rigor applied to traditional investing over the last hundred years, it will wither from the plague of unfulfilled expectations. If, however, we can apply structure to this endeavor, we will have advanced investors' ability to actually do good while doing well.

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