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Adjusting Asset Allocation for ESG Preferences

A systematic portfolio construction framework to reflect ESG considerations.

September 2022

EXECUTIVE SUMMARY

Adjusting an asset allocation for environmental, social, and governance (ESG) considerations has become increasingly important in recent years as more investors include these criteria as part of their investment objectives.[1] With this in mind, we have developed an intuitive and transparent framework to evolve a portfolio's asset allocation by explicitly and systematically embedding an investor's ESG preferences.

The outcome is an asset allocation that reflects the investor's preferences with respect to asset classes' ESG risk scores[2] within a risk-aware framework. The flexibility of our process also means that we can customize the asset allocation to each investor's preferences, effectively adding a bespoke ESG overlay to the portfolio.

From a traditional, two-dimensional efficient frontier of return and risk, our process adds a third dimension to asset allocation, seeking to create an efficient surface of return, risk, and ESG.

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Adjusting an asset allocation for environmental, social, and governance (ESG) considerations has become increasingly important, as more and more investors look to include these criteria as part of their investment objectives.

One common approach for embedding ESG in portfolios focuses on evaluating the level of ESG risks and opportunities that characterize issuers of securities and considering ESG factors alongside investment criteria when making investment decisions. ESG integration can span bottom-up security selection decisions within equity and fixed income portfolios, as well as top-down allocation decisions across asset classes.

We have developed an intuitive, systematic, and flexible framework to explicitly embed ESG preferences in asset allocation for investors who include ESG criteria in their investment objectives. The outcome is an asset allocation that systematically reflects the investor's preferences with respect to asset classes' ESG risk scores within a risk-aware framework. The flexibility of our process means we can customize the asset allocation to each investor's preferences, effectively adding a bespoke ESG overlay to the portfolio.

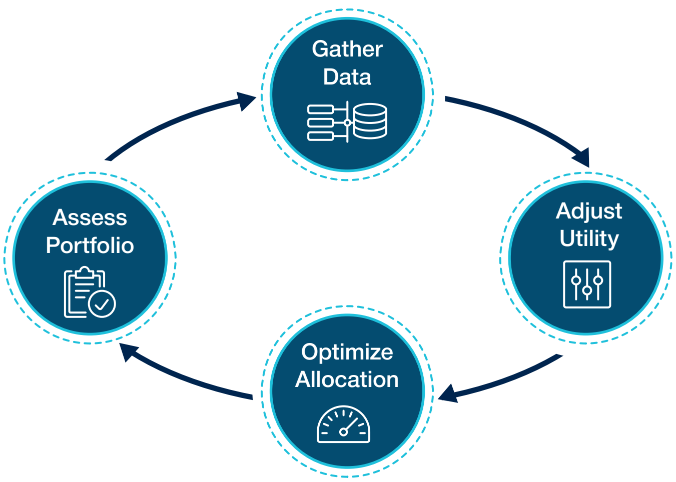
[1] Incorporating ESG factors in asset allocation may lead to suboptimal portfolios from an investment perspective. Therefore, adjusting portfolios for ESG criteria may not be appropriate for all investors, particularly for those who focus exclusively on investment outcomes rather than on ESG preferences in addition.
[2] ESG risk scores can be based on scores from T. Rowe Price's Responsible Investing Indicator Model, the investor's proprietary views, and/or on third-party ratings.

An Intuitive, Systematic, and Flexible Framework

In the following sections, we give an overview of the four-step process: (1) gather data, (2) adjust utility, (3) optimize allocation, and (4) assess portfolio. We intentionally omit technical details and mathematics in this paper, but references to all sources are included in the footnotes for interested readers. Throughout the paper, we use case studies to demonstrate how the process would work in practice with an illustrative asset allocation.

A Process of Adjusting Asset Allocation for ESG Preferences

(Fig. 1) A systematic but flexible framework allows customization for investors



For illustrative purposes only.
Source: T. Rowe Price.

1. Gather Data

Our process begins with collecting the required information to calculate the expected investment results of the portfolio and to form a view on its asset classes' ESG characteristics. The data include both investment criteria and ESG risk scores for the asset classes in the portfolio.

Investment Criteria

We believe that the investment criteria needed to formulate an asset allocation are forward-looking capital market assumptions (CMAs), including expected returns, volatility, and correlations of the potential asset classes in the portfolio. If a new asset allocation is designed, it should be based on the investor's CMAs. We produce five-year CMAs on an annual basis[3] across five major currencies—U.S. dollar, euro, British pound, Japanese yen, and Australian dollar. They can be used as a basis for designing an allocation.

Reverse Optimization

Often, rather than starting from an entirely new asset allocation, the aim is to integrate ESG considerations in a portfolio's existing allocation. In this case, we use a mathematical technique to extract the implied expected returns. Reverse optimization—or reverse engineering—turns around the common approach of mean-variance optimization. Instead of starting with a set of expected returns and a covariance matrix and then solving for optimal portfolio weights, the procedure derives the implied returns from a given asset allocation—which is assumed to be efficient—and its covariance matrix, reflecting the expected volatilities and correlations of asset classes. The implied returns are a set of expected returns that, if used with an optimizer, would result in the current asset allocation.

Reverse optimization was first introduced in the 1970s.[4, 5] One challenge of reverse optimization is that there is no one unique set of implied returns. Rather, reverse optimization can extract different sets of implied returns that, when used in the optimization, would lead to the current asset allocation. Some sets of expected returns would compare reasonably with historical performance and reflect current market conditions, while others may not.

To ensure the set of implied returns is intuitive, we apply an additional method that anchors the implied return of one or two asset classes with the CMAs.[6] We use the expected returns from the CMAs for a small number of asset classes to calculate a risk aversion parameter[7] which is then used to calibrate the implied returns of all other asset classes in proportion to the covariance matrix. We can then compare the implied returns with the CMAs to uncover the views embedded in the asset allocation.

The covariance matrix can be estimated using the track record of the investments in the portfolio or by mapping the investments to widely followed indices representing each asset class—for example, MSCI All Country World Index (MSCI ACWI) for global equities and Bloomberg Global Aggregate Index for global fixed income—and using the indices' historical returns. Alternatively, the covariance matrix could reflect expected volatilities and correlations based on the CMAs.

[3] "Capital Market Assumptions Five-Year Perspective 2022," T. Rowe Price. Note, this document is issued annually, with the next publication expected in January 2023. Given our starting point in the case studies included in this paper is an existing asset allocation, the results would not materially change if updated CMAs were to be used.
[4] Sharpe, W. F. (1974) "Imputing Expected Returns from Portfolio Composition," *Journal of Financial and Quantitative Analysis.*
[5] Fisher, L. (1975) "Using Modern Portfolio Theory to Maintain an Efficiently Diversified Portfolio," *Financial Analysts Journal.*
[6] Herold, U. (2005), "Computing implied returns in a meaningful way," *Journal of Asset Management.*
[7] The risk aversion parameter (λ) specifies the relative importance of the two terms of return (μ) and volatility (σ) in the utility (U) function that is the basis for mean-variance optimization. Optimization aims to maximize $U = \mu - \lambda\sigma^2$.

> Our framework can cover any asset class, investment, or active strategy that can be represented by a series of returns and has associated ESG risk scores.
>
> **— Yoram Lustig**
> *Head of Multi-Asset Solutions, EMEA*

There are different ways to estimate a covariance matrix. We typically use monthly total returns over the longest available history since a structural change—over the last 15 to 20 years or so—to estimate forward-looking volatilities (annualized standard deviation) and correlations. We then simply calculate the covariance matrix of the return series. Other methods to determine the covariance matrix could work just as well.

Our approach of adjusting the asset allocation for ESG preferences can also be easily extended to sub-asset classes, such as equity sectors or short duration fixed income, as well as to active investments, such as responsible, sustainable, and impact strategies. Our framework can cover any asset class, investment, or active strategy that can be represented by a series of returns and has associated ESG risk scores.

ESG Risk Scores

The other set of data required for this step of the process is the ESG profile for the asset classes that can be included in the portfolio. ESG ratings are widely used within asset management for this purpose, with a wide array of sources and different methods of calculating them. This variety of approaches means a key challenge with ESG ratings is the low correlation among ratings of different providers.[8] It is important that the selected set of ratings reflects the investor's ESG beliefs and objectives.

As a fundamental, bottom-up, research-led investment manager, we believe on-the-ground, granular insights on ESG considerations are vital. Therefore, we opt to generate ESG risk scores for asset classes by aggregating our ESG views on the constituent securities and sovereign issuers of each investment strategy, or a selected index representing each asset class.

Responsible Investing Indicator Model (RIIM)

For this task, we use our proprietary Responsible Investing Indicator Models.[9] The models systematically and proactively screen the responsible investing (RI) profile of investments, flagging any elevated RI risks and identifying investments with positive RI characteristics. Akin to investment risk, a higher ESG score indicates a more negative ESG rating, while a lower ESG score indicates a more positive ESG rating.[10]

RIIM produces scores for each of the three pillars of ESG—environmental, social, and governance. Instead of utilizing aggregate ESG risk scores,[11] we can focus on specific environmental, social, or governance aspects in building the overall scores for asset classes. Disaggregating the ratings allows us to consider the elements within ESG that are the more relevant for each investor or strategy. For example, climate risk is one of the biggest challenges for humanity. As such, many investors may wish to place greater emphasis on the "E" risk scores in building their portfolios.

Averaging ESG risk scores of individual constituencies could also lead to misleading results. For example, portfolio A includes 50% in a stock with an ESG risk score of 0 and 50% in another stock with an ESG risk score of 1.0. Portfolio A's average ESG risk score is 0.5. Portfolio B holds a single stock with an ESG risk score of 0.5. The average ESG risk score of the two portfolios is 0.5, apparently having the same level of ESG risk. However, portfolio A is far riskier because one of its holdings is red-flagged. Nevertheless, in the case of asset classes, the large number of constituencies mitigates the shortcomings of ESG score averaging.[12]

[8] Berg, F; Koelbel, J; Rigobon, R. (2019), "Aggregate Confusion: The Divergence of ESG Ratings," SSRN.
[9] "2021 ESG Investing Annual Report: How ESG impacts our investment decisions," T. Rowe Price.
[10] We color-code investments as green, amber, or red based on their ESG risk scores. Green—low score of 0 to 0.49—has a relative positive ESG rating, red—high score of 0.75 to 1.0—has a relative negative rating, and amber—medium score of 0.50 to 0.74—has a relative neutral rating. Note: this differs slightly from the RIIM score methodology from T. Rowe Price's Responsible Investing team, which attributes ESG ratings of low/medium/high flags.
[11] For purposes of the multi-asset team's framework, analysis, and this paper, we use the term ESG risk score.
[12] To overcome gaps in ESG coverage (i.e., the index includes unrated securities), we normalize the score using the formula:
Average ESG risk score = sum (security weight * security ESG risk score)/sum (security weights), where securities are rated with an ESG risk score.

> One advantage of our model is that we use it across equity and fixed income investments, allowing the consistent comparison of ratings across asset classes based on a single source of ESG risk scores.
>
> **— Robert Panariello**
> *Associate Director of Research, Multi-Asset*

One advantage of our model is that we use it across equity and fixed income investments, allowing the consistent comparison of ratings across asset classes based on a single source of ESG risk scores. Another advantage is that we have invested years in developing RIIM and fully integrating it within our equity and fixed income investment processes, where it combines both quantitative elements and qualitative insight.

We believe that it reliably captures the ESG risk of securities and issuers. Nevertheless, our flexible framework allows the use of any third party source of ESG risk scores or ratings.

Case Study

To demonstrate our process, we have applied it to an illustrative 60% equity and 40% fixed income strategic asset allocation (SAA). We have intentionally included asset classes with hypothetical green, amber, and red ESG risk scores.

Table 1 includes the data we gathered: the asset classes, the indices representing some of them, the current strategic allocations, the volatility of excess return, the implied excess returns, and the ESG risk scores.[13] The generic equity asset and generic fixed income asset could be any investment. We assume one has equity characteristics and the other has fixed income characteristics. Later, we apply different extreme ESG risk scores—0.40 and 0.80—for each to illustrate how the framework treats green and red assets.

Using the process of reverse optimization, the implied excess returns are derived based on the covariance matrix, with the expected excess returns of global equity and fixed income calibrated to our five-year CMAs. The starting point could be a blank sheet of paper or any portfolio as long as we can determine its asset allocation and estimated covariance matrix.

Data Gathered for a Strategic Asset Allocation

(Table 1)

Asset Class	Index	Current Allocation (%)	Volatility of Excess Return (%)	Implied Excess Return (%)	ESG Risk Score
Global Equity	MSCI ACWI	55.0	15.0	5.0	0.60
Global Fixed Income	Bloomberg Global Aggregate Index	35.0	3.0	-0.5	0.60
Generic Equity Asset*	–	5.0	13.0	3.2	0.40 or 0.80
Generic Fixed Income Asset*	–	5.0	4.0	0.0	0.40 or 0.80
Total Portfolio		**100**	**8.8**	**2.7**	**0.60**

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The volatilities and the covariance matrix used are hypothetical. Implied excess returns are based on the covariance matrix. Excess return is above cash.
Green ESG risk score 0 to 0.49, amber score 0.50 to 0.74, red score 0.75 to 1.0.

*The generic equity asset and the generic fixed income asset have similar hypothetical characteristics as those of equity and fixed income asset classes, respectively. The characteristics are volatility (e.g., relatively higher for the generic equity asset and relatively lower for the generic fixed income asset) and correlations (e.g., relatively higher with global equity for the generic equity asset and relatively higher with global fixed income for the generic fixed income asset). The implied returns for the generic equity asset and generic fixed income asset are derived from the reverse optimization.

Source: T. Rowe Price.

[13] The ESG risk scores are hypothetical for illustrative purposes only and are not based on our RIIM or on actual holdings within the indices representing the asset classes. The basis for the hypothetical ESG risk scores are low (0.40) for a green asset, high (0.80) for a red asset, and amber (0.60) for a neutral asset.

2. Adjust Utility

Armed with the data, the second step of our process adjusts the portfolio's expected utility for ESG factors based on the investor's preferences.

Utility is a measure of the benefit each investor derives from an investment. It helps assess the risk/return trade-off between expected return and risk. It is a function of the investment's expected return (reward) less expected investment risk calibrated to the investor's risk aversion.

Calibrating to Investor ESG Preferences

In our approach, we add a third variable to the utility function: ESG risk scores calibrated to the investor's preferences to ESG factors via an ESG preference parameter.[14] Utility now reflects not only the expected returns and investment risks of asset classes, but also the investor's sensitivity to their ESG risk.

In the context of the model, the utility function translates the portfolio's objective into a utility score that is consistent with the investor's attitude toward investment risk and ESG risk. In effect, the utility function applies a penalty for higher expected investment risk and ESG risk that is dependent on the investor's risk aversion and sensitivity to ESG factors. For any given set of returns, the more averse to investment risk and sensitive to ESG the investor is, the higher the applied penalty will be. The higher the penalty, the more conservative the resulting portfolio will be.

Our framework does not directly modify the expected returns and/or volatilities (risk) of asset classes based on ESG ratings—a topic that is still under research.[15] However, in practice, adjusting utility for ESG factors may have a similar impact to adjusting the expected return and risk characteristics of asset classes.

For example, assuming an ESG preference parameter of 0.5 and an asset's ESG risk score of 0.8, incorporating ESG preferences has the same effect of subtracting 0.4% (0.5 x 0.8) from the expected return of this red-rated asset. The equivalent return penalty for a green-rated asset with an ESG score of 0.2, on the other hand, would be only 0.1% (0.5 x 0.2).

Similarly, adjusting utility for ESG factors could have a similar effect as adjusting upward the expected volatility of an asset class that has an overall red rating, reflecting the wider range of possible outcomes for such assets as markets' views on ESG risks evolve.

3. Optimize Allocation

The third step of the process optimizes the asset allocation using the ESG-adjusted expected utility to derive the ESG-adjusted asset allocation.

The goal of asset allocation is to maximize expected utility,[16] where the utility now considers ESG factors. Maximizing expected utility to set an efficient asset allocation is supported by compelling evidence for its benefits over standard mean-variance optimization.[17] When optimizing, we often use robust techniques in aiming to minimize the optimizer's sensitivity to even small changes to inputs.[18]

One challenge is to determine each investor's ESG preference parameter. To calibrate the ESG preference parameter to any type of utility function, non-parametric return distribution, and level of portfolio optimization complexity (e.g., multi-asset optimization with constraints), research[19] proposes the efficient frontier approach. This method creates multiple optimal portfolios using a fairly wide range of initial risk tolerance and ESG preference parameters. Because the optimization uses three dimensions of return, investment risk (e.g. volatility), and ESG risk, rather than the traditional two of return and investment risk, the efficient frontier becomes a three-dimensional efficient surface—as illustrated in Figure 2.

[14]The utility function: $U = \mu - \lambda\sigma^2 - gESG$; where U is utility, μ is expected return, λ is risk aversion parameter, σ^2 is volatility, g is ESG preference parameter, and ESG is ESG risk score.

[15]For a review of industry research on the correlation between ESG ratings and equity returns, please refer to Belsom, T. (2021) "ESG factors and equity returns—a review of recent industry research," PRI (Principles for Responsible Investment).

[16]Sharpe, W. F. (2007) "Expected Utility Asset Allocation," *Financial Analysts Journal*.

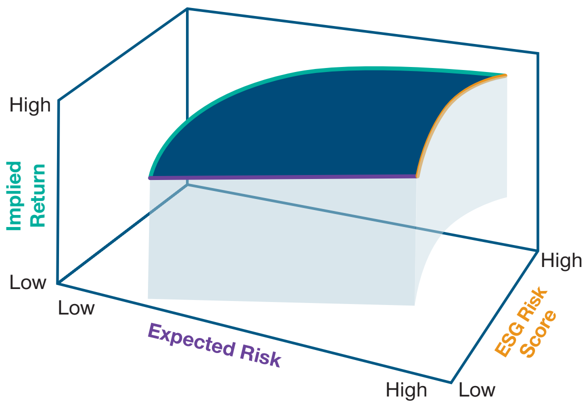
[17]Adler, T., Kritzman M. (2007) "Mean-Variance Versus Full-Scale Optimization: In and Out of Sample," *Journal of Asset Management.*

[18]Using techniques of robust optimization (e.g., resampling, inclusion of higher moments), we aim to alleviate parameter uncertainty.

[19]Liu, S., Xu, R. (2010) "The Effects of Risk Aversion on Optimization," MSCI Barra Research Paper No. 2010-06.

Illustrative "Efficient Surface"

(Fig. 2) Incorporating investor ESG preferences adds a third dimension to traditional asset allocation.



For illustrative purposes only.

Source: T. Rowe Price. The three dimensions of the efficient surface are implied return per annum, expected risk, and ESG risk score. Typically, the higher the expected risk and/or ESG risk score, the higher the implied return. This is because under the process of maximizing utility, expected return needs to overcome both expected investment risk and ESG risk score. This does not necessarily mean that higher or lower ESG risk scores mean higher or lower implied returns.

Investors would identify those portfolios that meet their preferences on the surface based on a set of return and investment risk statistics (e.g., expected return, volatility, Sharpe ratio, maximum drawdown, CVaR,[20] and so on) and ESG risk scores while adjusting the implied ESG preference parameter until the optimal portfolio statistics converge to the desired set of portfolio return, risk, and ESG metrics.

> The investor can apply constraints to ESG characteristics during the optimization process in a similar manner to setting desired levels of expected return or volatility.
>
> **— Shannon Toy**
> *Investment Analyst, Multi-Asset*

The investor can apply constraints to ESG characteristics during the optimization process in a similar manner to setting desired levels of expected return or volatility. For example, the investor may specify an exclusionary preference of no asset classes with an overall red rating in the allocation or a maximum ESG risk score for the portfolio. The framework allows the investors to change the set of constraints and experiment possible results under each one.

In practice, we would start with a small ESG preference parameter. We expect that the resulting asset allocation would have relatively modest changes compared with the initial allocation produced without ESG inputs. That would give the investor an initial sense of how the ESG preference parameter changes the allocations. The magnitude of the ESG preference parameter should depend on the sensitivity of the investor to ESG factors and on the level of confidence in the framework. The impact on the resulting asset allocation could be made larger or smaller depending on the size of the parameter.

With the original asset allocation as a starting point, the framework considers the relative risk introduced by integrating ESG and its potential rewards or costs. It is simple to compare the expected return and risk of the initial and final asset allocations and calculate the tracking error between the two. For investors with liabilities, the process allows the reflection of ESG within a liability-aware framework.

[20] The conditional value at risk (CVaR), also known as the expected shortfall, is a risk assessment measure that quantifies the amount of tail risk an investment portfolio has. CVaR is derived by taking a weighted average of the "extreme" losses in the tail of the distribution of possible returns, beyond the value at risk (VaR) cutoff point. Conditional value at risk is used in portfolio optimization for effective risk management.

Case Study

Going back to the illustrative SAA, Table 2 shows the optimization results of asset allocations across a range of different ESG preference parameters under Scenario I, with a green ESG risk score of 0.40 for the generic equity asset and a red ESG risk score of 0.80 for the generic fixed income asset.[21] Table 3 compares the optimization results with the existing neutral allocation (ESG preference of zero).

Table 4 switches the ESG risk scores of the two generic assets under Scenario II, making the equity generic asset red and the generic fixed income asset green. Table 5 compares the results of Scenario II with the existing SAA.

Under Scenario I, where the green, generic, equity-like asset has a higher implied return than the red, generic, fixed income-like asset, the optimization process nearly fully disinvests from the red asset with an ESG preference parameter of 3 while maintaining a steady Sharpe ratio. Under Scenario II, where the red asset has higher implied return than the green asset, the optimizer needs to get to an ESG preference parameter of 5 to disinvest from the red asset nearly completely.

In our case study, the optimizer can maintain steady return and risk characteristics for the asset allocations while reducing the allocation to the red asset because of the availability of suitable substitute assets to compensate for this. Without such substitutable assets, increasing the ESG preference parameter may result in suboptimal portfolios from an investment perspective—a lower Sharpe ratio.

Scenario I

(Table 2) Adjusting the asset allocation for ESG preferences

		ESG PREFERENCE PARAMETER						
Asset Class	**ESG Risk Score**	**0 (Neutral)**	**1**	**2**	**3**	**4**	**5**	**6**
Global Equity	0.60	55.0%	54.6%	54.1%	53.7%	53.1%	52.4%	51.7%
Global Fixed Income	0.60	35.0%	36.2%	37.4%	38.6%	38.4%	38.1%	37.9%
Green Equity Asset	0.40	5.0%	5.9%	6.7%	7.6%	8.5%	9.5%	10.4%
Red Fixed Income Asset	0.80	5.0%	3.3%	1.7%	0.1%	0.0%	0.0%	0.0%
	ESG Risk Score	0.600	0.595	0.590	0.585	0.583	0.581	0.579
	Volatility (Annualized)	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%
	CVaR (95%)	-15.4%	-15.4%	-15.4%	-15.4%	-15.4%	-15.4%	-15.4%
	Tracking Error (Annualized)	–	0.1%	0.2%	0.3%	0.4%	0.5%	0.5%
	Implied Excess Return (per Annum)	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
	Sharpe Ratio	0.31	0.31	0.31	0.31	0.31	0.31	0.31
	Turnover	0%	2%	4%	6%	7%	8%	8%

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Green ESG risk score 0 to 0.49, amber score 0.50 to 0.74, red score 0.75 to 1.0. The CVaR and tracking error calculations are based on normal distribution and are estimations because implied returns are not necessarily equal to expected returns. The implied returns are a set of expected returns that, if used with an optimizer, would result in the current asset allocation. The results shown are the change in the hypothetical portfolio's asset allocation and the resulting portfolio's ESG risk scores given changes in ESG Preference Parameters while the desired return, volatility, sharpe ratio and CVaR are fixed/static. ESG Preference Parameters between 0 to 6 shows the neutral allocation and the respective allocation under the given ESG Preference Parameter. Implied excess returns are returns in excess of cash. The ESG risk scores are hypothetical for illustrative purposes only and are not based on our RIIM or on actual holdings within the indices representing the asset classes.
Source: T. Rowe Price.

[21]We use integer numbers to represent the ESG preference parameter. The actual parameters used in the optimization: 0 = 0, 1 = 0.25, 2 = 0.5, 3 = 0.75, 4 = 1, 5 = 1.25, 6 = 1.5.

Scenario I

(Table 3) ESG-adjusted asset allocations compared with the existing asset allocation

		ESG PREFERENCE PARAMETER						
Asset Class	ESG Risk Score	0 (Neutral)	1	2	3	4	5	6
Global Equity	0.60	55.0%	-0.4%	-0.9%	-1.3%	-1.9%	-2.6%	-3.3%
Global Fixed Income	0.60	35.0%	1.2%	2.4%	3.6%	3.4%	3.1%	2.9%
Green Equity Asset	0.40	5.0%	0.9%	1.7%	2.6%	3.5%	4.5%	5.4%
Red Fixed Income Asset	0.80	5.0%	-1.7%	-3.3%	-4.9%	-5.0%	-5.0%	-5.0%
	ESG Risk Score	0.600	-0.005	-0.010	-0.015	-0.017	-0.019	-0.021
	Volatility (Annualized)	8.8%	–	–	–	–	–	–
	CVaR (95%)	-15.4%	–	–	–	–	–	–
	Tracking Error (Annualized)	–	0.1%	0.2%	0.3%	0.4%	0.5%	0.5%
	Implied Excess Return (per Annum)	2.7%	–	–	–	–	–	–
	Sharpe Ratio	0.31	–	–	–	–	–	–

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Scenario II

(Table 4) Adjusting the asset allocation for ESG preferences

		ESG PREFERENCE PARAMETER						
Asset Class	ESG Risk Score	0 (Neutral)	1	2	3	4	5	6
Global Equity	0.60	55.0%	55.4%	55.9%	56.4%	56.8%	57.3%	57.1%
Global Fixed Income	0.60	35.0%	33.9%	32.7%	31.5%	30.3%	29.1%	26.7%
Red Equity Asset	0.80	5.0%	4.1%	3.2%	2.2%	1.3%	0.3%	0.0%
Green Fixed Income Asset	0.40	5.0%	6.6%	8.2%	9.9%	11.6%	13.4%	16.1%
ESG Risk Score		0.600	0.595	0.590	0.585	0.579	0.574	0.568
Volatility (Annualized)		8.8%	8.8%	8.8%	8.8%	8.8%	8.8%	8.8%
CVaR (95%)		-15.4%	-15.4%	-15.4%	-15.4%	-15.4%	-15.4%	-15.4%
Tracking Error (Annualized)		–	0.1%	0.2%	0.3%	0.4%	0.5%	0.6%
Implied Excess Return (per Annum)		2.7%	2.7%	2.7%	2.7%	2.7%	2.7%	2.7%
Sharpe Ratio		0.31	0.31	0.31	0.31	0.31	0.31	0.31
Turnover		–	2%	4%	6%	8%	11%	13%

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Green ESG risk score 0 to 0.49, amber score 0.50 to 0.74, red score 0.75 to 1.0. The CVaR and tracking error calculations are based on normal distribution and are estimations because implied returns are not necessarily equal to expected returns. The implied returns are a set of expected returns that, if used with an optimizer, would result in the current asset allocation. The results shown are the change in the hypothetical portfolio's asset allocation and the resulting portfolio's ESG risk scores given changes in ESG Preference Parameters while the desired return, volatility, sharpe ratio and CVaR are fixed/static. ESG Preference Parameters between 0 to 6 shows the neutral allocation and the respective allocation under the given ESG Preference Parameter. Implied excess returns are returns in excess of cash. The ESG risk scores are hypothetical for illustrative purposes only and are not based on our RIIM or on actual holdings within the indices representing the asset classes.

Source: T. Rowe Price.

Scenario II

(Table 5) ESG-adjusted asset allocations compared with the existing asset allocation

		ESG PREFERENCE PARAMETER						
Asset Class	**ESG Risk Score**	**0 (Neutral)**	**1**	**2**	**3**	**4**	**5**	**6**
Global Equity	0.60	55.0%	0.4%	0.9%	1.4%	1.8%	2.3%	2.1%
Global Fixed Income	0.60	35.0%	-1.1%	-2.3%	-3.5%	-4.7%	-5.9%	-8.3%
Red Equity Asset	0.80	5.0%	-0.9%	-1.8%	-2.8%	-3.7%	-4.7%	-5.0%
Green Fixed Income Asset	0.40	5.0%	1.6%	3.2%	4.9%	6.6%	8.4%	11.1%
	ESG Risk Score	0.600	-0.005	-0.010	-0.015	-0.021	-0.026	-0.032
	Volatility (Annualized)	8.8%	–	–	–	–	–	–
	CVaR (95%)	-15.4%	–	–	–	–	–	–
	Tracking Error (Annualized)	–	0.1%	0.2%	0.3%	0.4%	0.5%	0.5%
	Implied Excess Return (per Annum)	2.7%	–	–	–	–	–	–
	Sharpe Ratio	0.31	–	–	–	–	–	–

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Source: T. Rowe Price.

The framework allows us to readily calculate the expected impact of adjusting the asset allocation for ESG. For example, because the framework is anchored to the existing asset allocation, it allows us to calculate the tracking error relative to the initial neutral allocation and the turnover depending on the ESG preference parameter.

A topic for a future paper is new measures of relative risk and risk-adjusted return (Sharpe ratio) considering not only investment risk (volatility) but also ESG risk (ESG risk scores).

4. Assess Portfolio

The fourth and final step of our process is assessing the results and using judgment to arrive at the final asset allocation.

The investor can choose whether to implement one of the optimized asset allocations as is or use it only as guidance. We believe a quantitative, systematic process is a helpful guide. However, the investor should apply common sense to ensure that the results of the quantitative model are intuitive and pragmatic. Our framework should help the investor to make informed decisions about adjusting their asset allocation for ESG preferences and to quantify the impact of doing so.

The investor can go back to the previous steps, change the ESG preference parameter, apply different sets of constraints, and change the ESG risk scores of asset classes to experience how changing the inputs changes the output.

Adjusting for Future Trajectory Potential

For example, one consideration is the potential evolution and momentum of ESG risk scores. Here, investors could consider whether they believe that the ESG risk score of an asset class may change in the future. Take emerging markets equity, for instance. While its score may be amber, China—the largest constituent country within the MSCI Emerging Markets Index—is making efforts to transition to a greener economy. We can apply discretion, and, instead of penalizing the asset class for its current relatively high ESG risk score, we can consider the potential future trajectory and decrease the score. We can then optimize the portfolio to evaluate how a modified risk score impacted the allocations.

Time horizon is another important consideration. The framework is agnostic of time horizon, as CMAs with different time horizons could be used. For SAA purposes, time horizon should be long term (e.g., five to 10 years), while for tactical asset allocation (TAA) purposes, the time horizon should be short term (e.g., six to 18 months). One caveat is that trends such as climate change, social justice, and corporate governance are all likely to unfold over a longer time horizon and may not fit the typical shorter investment horizon of TAA.

Conclusion

Accounting for ESG considerations in asset allocation has become increasingly important to investors. We have developed a flexible framework to systematically incorporate ESG risks in the asset allocation. Our framework allows investors to adjust the expected utility of asset classes in line with their preferences and sensitivity to the ESG risk of investments. Effectively, our approach adds a third dimension to a two-dimensional asset allocation—from return/risk to return/risk/ESG.

We believe our approach is intuitive and based on rigorous processes that investors may use in constructing multi-asset portfolios. Transparently adjusting the expected utility and translating it to potential adjustment to key assumptions used in asset allocation allows the rationale for such changes to be discussed, justified, and debated in a way that is linked to the broader economic or market-based methods used to formulate CMAs.

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