MEKETA

Risk budgeting primer

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For CIOs, investment staff, and trustees tasked with assessing the risk of a capital pool, risk budgeting provides a structured approach. This practice involves setting a "budget" for risk and then allocating and monitoring that risk across the portfolio. Unlike traditional capital allocation, which focuses on distributing capital across asset classes, risk budgeting emphasizes the allocation of risk itself.[1]

Risk budgeting can be applied at the total portfolio level or at the asset class level. There are two types of risk budgets. The first involves determining the contribution to the overall level of risk. The second, more common, approach looks at how much a portfolio contributes to risk relative to a benchmark. This specific method, known as "active risk budgeting," guides portfolio decisions by incorporating a benchmark or index as a point of comparison.[2] Through this approach, investors may be able to better manage active risk within their portfolios, helping to steer portfolio construction.

This paper focuses on risk budgeting at the active risk level, examining how active risk is allocated and managed within a portfolio. We will explore the concept of active risk, why it exists in portfolios, and the expected outcomes for investors based on different levels of active risk exposure.

Key takeaways

- Risk budgeting is a portfolio management and monitoring technique that forces investors to explicitly consider where risk is coming from and the expected compensation from that risk.
- While risk budgeting can be applied at both absolute and benchmark-relative levels, the majority of implementations and discussions on this topic (including this paper) relate to benchmark-relative measures (i.e., active risk budgeting).
- Risk budgeting uses similar inputs/calculations as those used when examining a total portfolio and its corresponding risk/return attributes, but it shifts the lens to active risk/return.
- Risk budgeting is most appropriate for asset classes that are liquid and that have implementable benchmarks (i.e., opportunity cost). It becomes far more challenging when it includes private markets.
- Active risk/return can be driven by multiple factors (e.g., allocation decisions, manager/security selection decisions, etc.), and risk budgeting allows investors to better decompose its sources.
- Risk budgeting may improve the ability of those overseeing portfolios to understand what drove active risk historically, as well as for those same investors to develop more refined expectations for where forward-looking risks, and thus excess returns, may come from.

[1] We use the terms capital allocation and asset allocation interchangeably throughout this document.

[2] Active risk refers to the variation between a portfolio and its benchmark. It is also commonly referred to (and measured) as tracking error.

Risk budgeting

Risk budgeting typically refers to the concept of managing a portfolio based on how asset classes and strategies contribute to a target level of (or budget for) risk. That is, it focuses on how risk is allocated rather than (or in addition to) how assets/capital is allocated. The inputs/calculations for these measures are similar to what is used in traditional portfolio optimization (i.e., mean-variance optimization) in that expected returns, volatilities, and correlations are needed. Importantly, the concept of risk budgeting may be applied at two levels.

The market return (i.e., asset allocation) level refers to the risk that is generated from investing in capital markets. An investor's policy allocation to different asset classes serves as a prudent foundation for measuring its market risk.[3] Figure 1 illustrates how a sample portfolio may be viewed from an asset allocation standpoint as well as from a risk standpoint.

[3] A "policy allocation" refers to the target asset allocation that is typically specified in an investor's statement of investment policy (or equivalent).

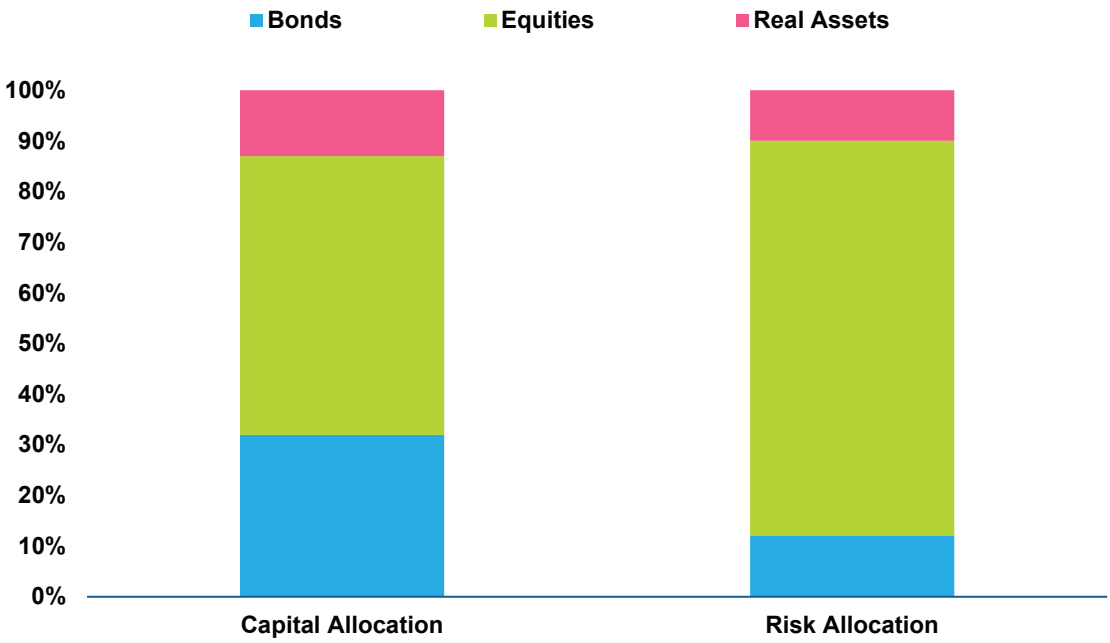

FIGURE 1
Example of Capital vs. Risk Allocation

Source: Based on Meketa's 2024 capital markets expectations. The risk allocation in this chart reflects contribution to total fund volatility.

When viewed under this lens, an investor can examine what strategic asset classes are responsible for what percentage of variation in the overall portfolio. Given this information, an investor may choose to alter the capital allocations to the various asset classes in order to modify their corresponding risk contributions. For example, a "risk parity" portfolio construction approach represents a relative extreme where each class contributes equally to the overall portfolio risk level.

The active risk (i.e., excess return) level refers to the variation between a portfolio and its benchmark. Variations in returns versus a benchmark can occur due to two different drivers:

1) allocations to alternative market risks or "out-of-benchmark" exposures (i.e., betas), commonly referred to as allocation risk, and 2) manager selection decisions, commonly referred to as manager or selection risk. These concepts can also be applied to a specific manager and their out-of-benchmark securities (allocation) and security selection (selection risk).

The total return that a portfolio generates is a combination of these two levels of risk. That is, a portfolio's performance equates to the returns provided by the market(s) in which it is invested (i.e., betas) in addition to how the portfolio is invested relative to the market (i.e., alpha). The first of these can be referred to as policy return, as it relates to the return that is due to the asset allocation targets the investor has adopted at the investment policy level. The latter can be considered an implementation return as it is driven by how the investor implements the stated policy, including differences from policy benchmarks at the manager or asset class level.

Risk and active risk

Risk means different things to different people, including various participants in the investment community. To understand risk budgeting, it makes sense to start by defining "risk" as it is used in a risk budgeting context.

It is common for investors to examine multiple metrics of risk, partly because no single risk measure captures the whole picture that investors face. At the portfolio level, risk measures might include volatility, maximum drawdown (i.e., the maximum cumulative loss from a peak to a trough), and the probability of not achieving a target rate of return.

Volatility

Volatility is perhaps the most commonly used single metric for measuring risk (and budgets thereof). This is partly because it is easily quantifiable. It also serves as a reasonable proxy for many other risk measures (i.e., a portfolio with higher volatility will typically have higher levels for other risk metrics). Moreover, when certain assumptions are made (e.g., normal distributions), calculations of volatility and corresponding risk budgets/levels are relatively simple.

Volatility measures the variability of returns around an average. Hence volatility includes above-average returns as well as below-average returns. That is, it measures dispersion of outcomes, not just negative outcomes. The higher the volatility, the greater the variation around the midpoint.

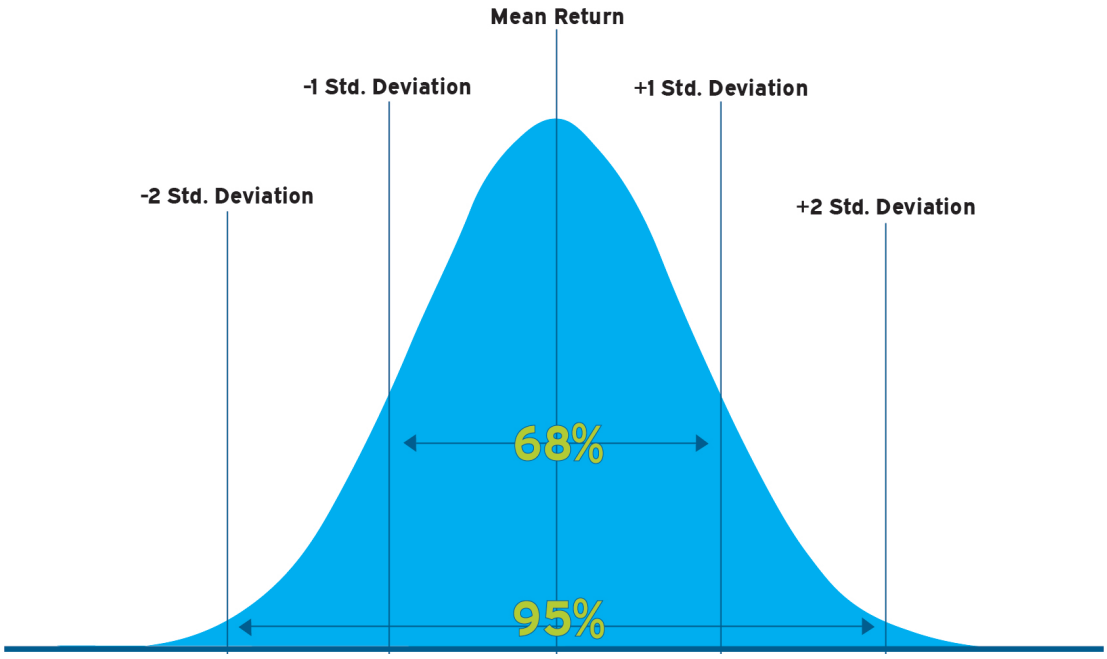

FIGURE 2
Distribution of Returns for a "Normal" Curve

Source: Meketa Investment Group, 2024.

For modeling purposes, returns are sometimes assumed to follow a "normal distribution" as shown by the "bell curve" (see Figure 2). Volatility is usually measured using a statistical concept known as a standard deviation. Under a normal distribution of returns, about two-thirds of returns fall within one standard deviation above or below the average, and 95% of returns fall within two standard deviations from the average.

Tracking error (aka, active risk)

Tracking error (also commonly referred to as active risk) measures the variation between a portfolio and its benchmark. Specifically, tracking error is measured by calculating the standard deviation of excess returns for a portfolio versus its benchmark.

For a portfolio that perfectly replicates its benchmark, the tracking error will be zero;[4] the more a portfolio deviates from its benchmark, the greater the tracking error will be. The higher the tracking error, the greater the potential for positive and negative excess returns (see Figure 3 for an example of what tracking error can look like in terms of relative returns).

[4] In reality, even passive strategies exhibit a modest amount of tracking error due to real world frictions that are not present in hypothetical benchmark/index calculations. For example, the tracking error figures for passive equity mandates may be under 10 basis points but as high as 50 basis points or more for certain hard-to-trade markets (e.g., emerging market equities).

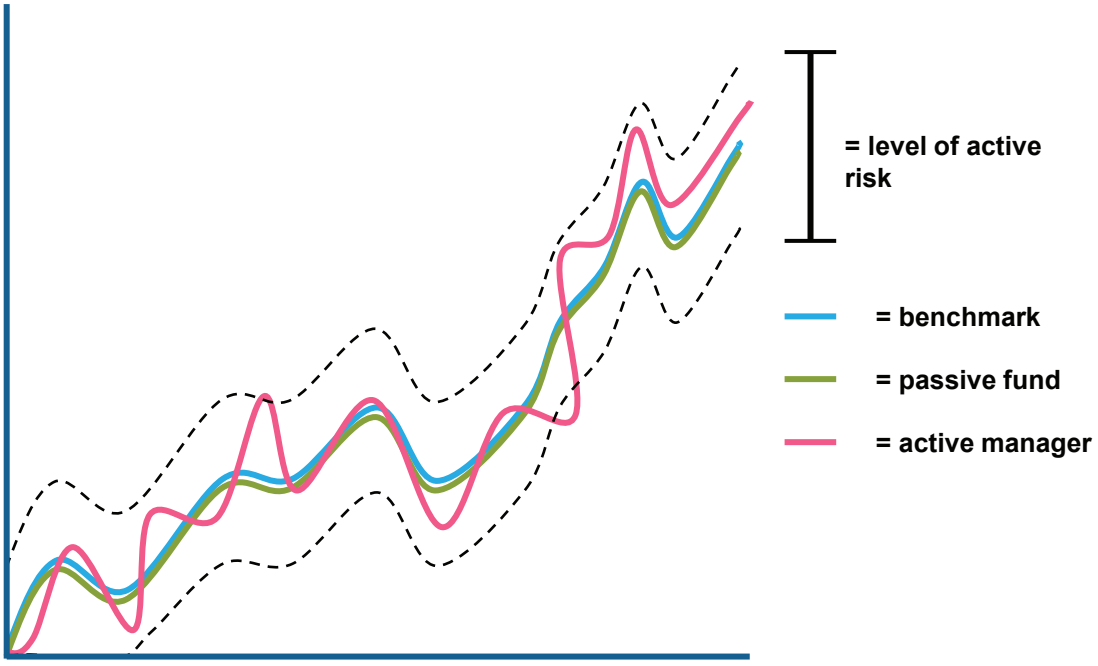

FIGURE 3
Example Growth of $1

Source: Meketa Investment Group, 2024.

Tracking error is most commonly used for public market asset classes, where benchmarks are more readily available and typically are fully investible or more easily replicated. While some active managers may manage their strategies to a specific tracking error target or range, for others, the level of tracking error may simply be a byproduct of their approach. This is one challenge that investors face when developing active risk budgets at the asset class/composite level – what assumptions should be used for active risk/return/correlation and how confident are they in their consistency?

Just as an investor may be willing to accept a higher level of risk in the hope of achieving higher returns, an investor may be willing to accept a higher level of active risk in the hope of generating higher relative returns. Specifically, for an investor to add value above a benchmark, their portfolio must differ from the benchmark. A portfolio that is different than its benchmark produces a different return pattern. A different return pattern is tracking error. Hence, tracking error is generated by holding positions differently than a given benchmark. These differences can be the result of holding different weights or different securities (i.e., out-of-benchmark) altogether.

Tracking error can occur at different levels in an investor's portfolio. For example, tracking error can be measured for individual managers relative to their respective benchmarks. It can also be measured at the asset class level, whereby a group of portfolios are compared to an asset class benchmark. And it can even be measured at the total portfolio level, whereby the performance of the combined multi-asset class portfolio is measured against a policy benchmark (see Figure 4 for examples).

Importantly, these mechanisms are additive. Changes at the manager level can impact the asset class level tracking error which, in turn, can impact the total portfolio tracking error.

Levels of Tracking Error	Sources of Tracking Error
Individual Manager vs. Benchmark Ex: foreign equity manager vs. MSCI ACWI ex-US	Different portfolio weights of individual securities compared to the benchmark. Example: higher allocation to Taiwan Semiconductor, lower allocation to financial sector or Japan, allocation to non-benchmark securities (e.g., small cap stocks).
Asset Class vs. Asset Class Benchmark Ex: US Equity vs. Russell 3000	→ Changes to manager/strategy weights. → Increase/decrease to passive mandates.
Actual Portfolio vs. Policy Benchmark	→ Over/under allocation to asset classes compared to policy. → Incorporation of strategies that are not held in the policy portfolio/benchmark.

FIGURE 4
Examples of Tracking Error at Different Levels of a Portfolio

Source: Meketa Investment Group, 2024.

Because tracking error can be measured at these different levels, risk budgeting can also occur at each of these levels. In practice, the operational difficulty in developing risk budgets tends to increase in a similar order as presented in the table above. That is, setting active risk/return assumptions or constraints at an individual manager level is relatively straightforward, whereas there are far more considerations to account for at the total portfolio level.

How much tracking error is normal?

Different types of strategies and asset classes will have varying levels of tracking error. As noted previously, the higher the tracking error, the higher the expected difference relative to the benchmark.

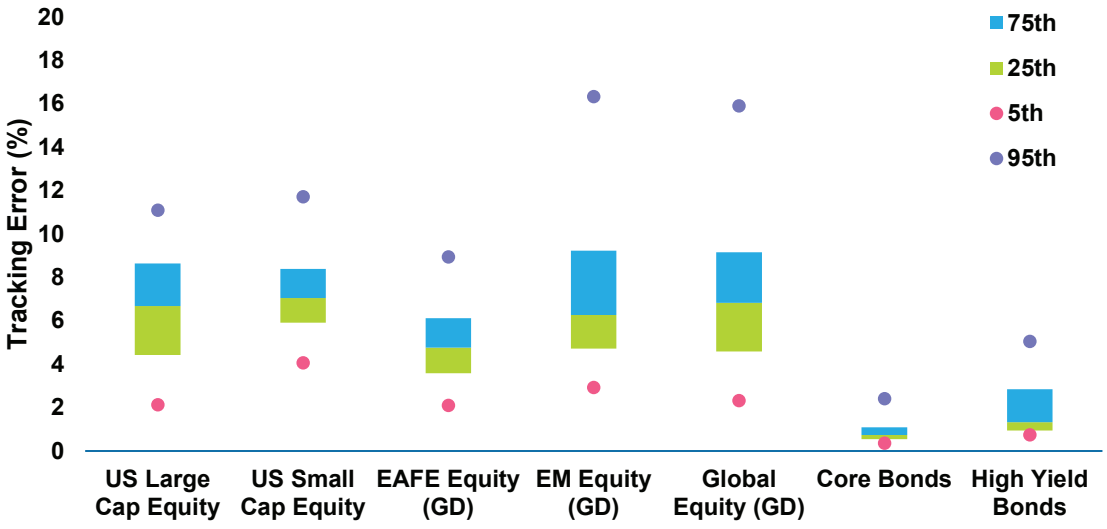

FIGURE 5
Trailing 10-Year Tracking Error for Active Managers by Asset Class

Source: eVestment, as of June 30, 2024. Analysis includes only actively managed strategies. It includes "dead" funds for the period they were live. Benchmarks used were the S&P 500, the Russell 2000, MSCI EAFE, MSCI EM, MSCI ACWI, Bloomberg US Aggregate, and Bloomberg US Corporate High Yield.

Figure 5 shows historical tracking error for actively managed strategies in various public market asset classes by percentile rankings. Tracking error is typically larger for equity than for fixed income strategies. Among the equity strategies shown, US small cap has exhibited the highest median tracking error at nearly 7%. However, there has been a much greater dispersion in tracking error in global equity and especially emerging market equity strategies. For example, a global equity manager at the top 75th percentile of tracking error would have exhibited tracking error of slightly more than 8%, while a manager at the bottom 25th percentile would have exhibited only half as much tracking error, at just over 4%.

The amount of tracking error that can be expected for a strategy can also often depend on how actively managed and concentrated the strategy is. At one end of the spectrum, passive (i.e., index fund) managers exhibit almost no tracking error as they seek to closely replicate their benchmark. The more actively managed a strategy is relative to its benchmark, the higher the likely tracking error.

Asset class tracking error

The tracking error of an asset class portfolio can be attributed to the contributions that individual managers make to it, in terms of both their individual tracking error and their weight in the portfolio. As noted above, passive managers contribute almost nothing to overall tracking error, even if they have a large allocation given their typically low tracking error versus their benchmark. Importantly, it is not a matter of simply summing up the individual weights and tracking errors. This is because the managers' tracking errors may not be perfectly correlated with each other. Some active managers may even serve to reduce tracking error at the asset class level because their tracking error is negatively correlated with that of the rest of the portfolio (see Figure 6).

Manager	Portfolio Weight (%)	Tracking Error (%)	Contribution to Asset Class Tracking Error (%)
Passive Manager	71.1	0.04	0.024
Factor-based Manager	22.0	2.61	0.722
Active Manager	1.0	4.08	0.006
Active Manager	0.6	6.66	0.020
Active Manager	1.2	4.07	0.007
Active Manager	0.6	10.36	-0.008
Active Manager	0.9	7.12	0.040
Active Manager	0.8	8.30	0.007
Active Manager	0.8	7.54	0.008
Active Manager	1.0	7.03	-0.005
Total	100		0.81

FIGURE 6
Example of Tracking Error at the Manager/Asset Class Level

Source: Meketa Investment Group, 2024.

Tracking error at the total portfolio level

These same dynamics come into play at the total portfolio level. However, there is one additional element that may contribute to tracking error at this level - differences between an investor's policy targets and its actual allocation may result in tracking error. In the example in Figure 7, the investor is experiencing 33 basis points of tracking error at the total portfolio level because of differences between policy and actual allocations. Specifically in this example, the tracking error is largely due to the investor being underweight their private credit target and overweight their real estate target.

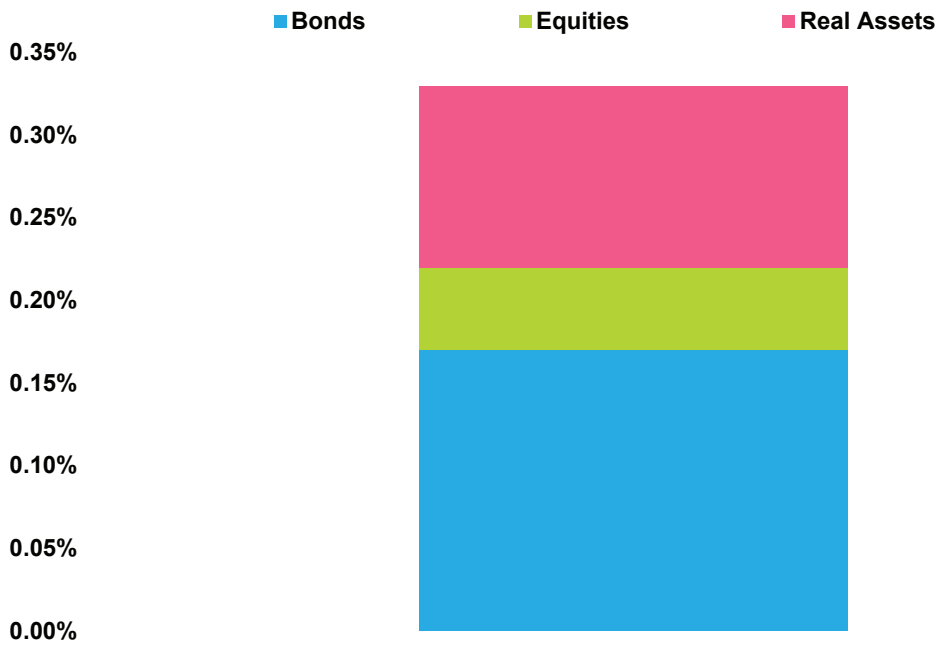

FIGURE 7
Example of Contribution to Tracking Error Based on Asset Allocation

Source: Meketa Investment Group, 2024.

Benchmark risk

Tracking error is a relative measure – it is calculated relative to a benchmark return. Given its relative nature, selection and understanding of the benchmark is vital. Adopting well-defined policy benchmarks is a critical first step. Appropriate benchmarks should be in place for each level at which performance (and tracking error) is being measured. This includes individual managers, the asset class, and the total portfolio.

While tracking error sources can be additive at the manager level, it can also be partially offsetting at the asset class or total portfolio level. This is partly because the benchmarks for individual managers may not roll-up perfectly at each level. For example, an emerging markets equity manager may increase tracking error versus an emerging markets index by owning developed markets stocks in their portfolio. However, if this manager is one of several/many in a broader global equity portfolio, these developed market holdings are unlikely to contribute much if anything to tracking error versus the global equity benchmark.

Variability in tracking error

As noted earlier, tracking error is calculated by taking the standard deviation of excess returns relative to a benchmark. Just as there is cyclicality in market returns, there can be cyclicality in excess returns. Therefore, tracking error may increase or decrease dramatically due to what is happening in the market. For example, tracking error spiked for many strategies in the first half of 2020 due to the outbreak of the COVID pandemic and the ensuing market volatility (see Figure 8 below). In some cases, it remained elevated or even continued to increase. This highlights the importance of evaluating tracking error over multiple periods rather than relying on a snapshot of a single point in time, as the latter approach may omit valuable information.

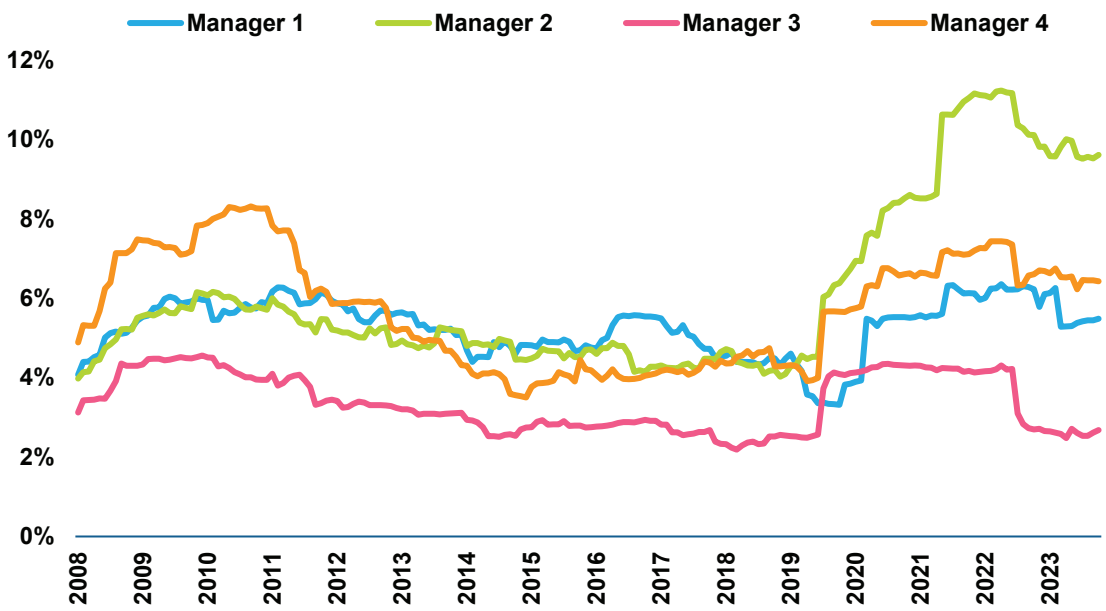

FIGURE 8
Rolling 36-month Tracking Error Example

Source: Meketa Investment Group, 2024.

Time horizon for tracking error

Like most other financial metrics, tracking error reflects a snapshot in time. And the level of tracking error that is observed can vary with the period being observed. While the measurement period can vary, the trailing 36 months is a common horizon for measuring tracking error.

The amount of expected tracking error tends to be highest over a short time horizon. Conversely, the longer the horizon, the smaller the amount of (annualized) tracking error (see Figure 9). Hence tracking error can have a much larger impact on returns in a single year.

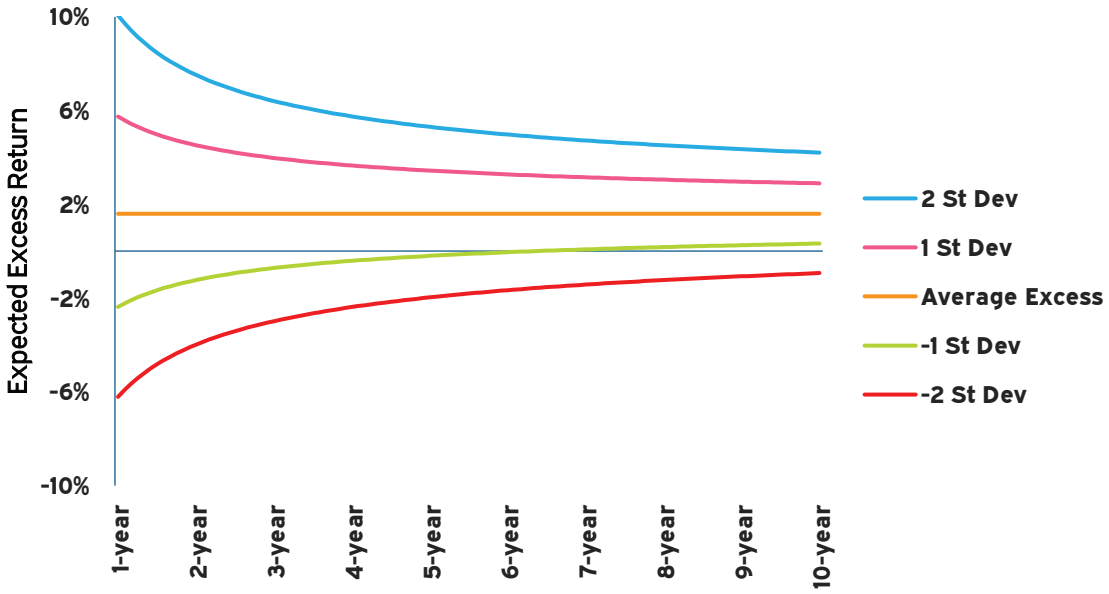

FIGURE 9
Example Tracking Error Horizon with 1.6% Excess Return and 4% Tracking Error

Source: Meketa Investment Group, 2024

Note: Annualized returns for periods greater than one year.

Understanding risk budgets

As implemented by most institutional investors, risk budgeting is the process of setting a target, or budget, for the level of tracking error, and then allocating active risk within that risk budget to produce returns in excess of benchmark. Put differently, it is an approach for finding the most efficient way to target alpha for an accepted level of tracking error. The incorporation of active risk budgets explicitly forces investors to think about the risk/return tradeoff in portfolio construction when utilizing strategies that differ from the benchmark in any way.

Active risk budgeting implementation

The first step in implementing a risk budget is for the investor to decide where they want to use a risk budget. For example, they must choose if they want to set it for a single asset class (e.g., US equities), for multiple asset classes (e.g., public equities), and/or at the total plan level.

Next, the investor should determine what the total risk budget should be for the areas where they have decided to use a risk budget. Specifically, they must decide what the tracking error target will be. This should be based on a balance of: 1) how willing (and by how much) the investor is to see their portfolio underperform, and 2) the target for outperformance. It effectively means setting a target (or tolerance amount) for how different the investor is willing to be from their benchmarks, knowing that outperforming any index requires looking different than that index (i.e., there will be tracking error). Put differently, it quantifies how much leeway the governing body (e.g., a Board of Trustees) is willing to give the investment staff, advisor, and/or managers in order for them to potentially outperform. Those who are responsible for implementation must then determine the expected payoff for that tracking error, which is commonly calculated as an information ratio.[5] As Figure 10 illustrates, the higher the tracking error, the higher the potential for outperformance, but also the higher potential for underperformance in any given year.

[5] The information ratio is calculated by dividing the excess return by tracking error.

Tracking Error (%)	95th (%)	75th (%)	Expected (%)	25th (%)	5th (%)
0.5	-0.8	-0.3	0.0	0.3	0.8
1.0	-1.6	-0.7	0.0	0.7	1.7
1.5	-2.4	-1.0	0.0	1.0	2.5
2.0	-3.3	-1.4	0.0	1.4	3.3
2.5	-4.1	-1.7	0.0	1.7	4.2

FIGURE 10
Expected Annual Relative Performance (Alpha) Based on Tracking Error

Source: Meketa Investment Group. Active risk level (left column) is the expected tracking error of an active strategy. The expected relative performance per percentile assumes a normal distribution of relative returns per level of active risk/tracking error and an information ratio of 1.0.

For example, it is typical to see tracking error targets for institutional investors of 1-3% for public equity portfolios.[6] This likely implies an alpha target of 25 to 75 basis points per annum, depending on how confident the investor is in their (and/or their managers') ability to produce above-median performance, and by how much.[7] Given that estimates of active risk tend to be unstable, it is common for investors to set a target range rather than or in addition to an active risk target.

Arguably, asset classes that an investor deems more "efficient" (i.e., harder to consistently produce alpha at scale) should receive lower active risk budgets. Less efficient asset classes (e.g., those with a high dispersion of relative returns) should receive larger risk budgets, which likely means greater use of active management or other active implementation strategies, such as overlays or portable alpha. It is this recognition that supports the idea of risk budgets: those in charge of implementing the portfolio on a day-to-day basis can take more/less risk in targeted areas and thus tailor the overall tracking error expectation of the overall portfolio in a deliberate manner.

Once the risk budget is set, the investor can then choose from a theoretically infinite combination of strategies to achieve the desired budget. Of note, this includes estimating how much a given strategy will contribute to the risk budget. Estimating the future amount of active risk includes projecting: 1) the amount of active risk being taken on by individual managers, and 2) how much each of these is related to the other. Traditionally, investors have used historical tracking error to estimate future tracking error. For institutional investors, this is an ongoing area of research and effort as risk budgets may be monitored on both ex-ante and ex-post bases.

Figure 11 below shows an example of two different ways to construct a portfolio with a target tracking error of 2%. Each option uses the same managers, including both active and passive strategies, but in different weights.

[6] Based on Meketa's experience with and observation of large public plans who have set a risk budget.

[7] In this case, we are assuming that active management would perform in the top 35th to 45th percentiles. See the appendix for an explanation of how different levels of tracking error and percentiles translate to alpha targets.

A risk budgeting exercise such as this can be very helpful for portfolio construction, helping the investor to decide how many managers, what kinds of managers (e.g., active versus passive), and which managers to include in their portfolio.

Manager	Tracking Error (%)	Option 1: Portfolio Weight (%)	Option 2: Portfolio Weight (%)	Option 1: Contribution to Tracking Error (%)	Option 2: Contribution to Tracking Error (%)
Passive Manager	0.1	15	25	0.014	0.024
Passive Manager	0.2	5	0	0.011	0.000
Active Manager	4.1	10	12	0.185	0.221
Active Manager	6.7	10	8	0.536	0.429
Active Manager	5.8	10	11	0.261	0.287
Active Manager	10.4	10	7	-0.134	-0.094
Active Manager	7.1	10	11	0.443	0.488
Active Manager	8.3	10	8	0.332	0.266
Active Manager	7.5	10	10	0.473	0.473
Active Manager	7.9	10	8	-0.056	-0.045
TOTAL		100	100	2.06	2.05

FIGURE 11
Examples of 2% Tracking Error Portfolio

Source: Meketa Investment Group, 2024.

Monitoring

Finally, the risk budgeting process should include an oversight framework for measuring, monitoring, and reporting on active risk. These frameworks can provide increased visibility into the sources of risk and returns generated from active management across the total portfolio, which should contribute to a more robust risk management process and deliberate approach to portfolio construction and rebalancing. An investor can build internal and/or use external risk models and tools for the measuring and monitoring process.

Ideally, any variances relative to a benchmark should be intentional, with the goal of maximizing risk-adjusted excess return. Likewise, unintentional deviations from the benchmark (e.g., due to unknown factor exposures) should be monitored and addressed.

The monitoring process should involve continual evaluation of active risk in the various investments and at the portfolio level as market conditions change. While a modest amount of drift is normal, a significant deviation in the level of active risk from its target risk budget could be cause for action, including rebalancing the portfolio.

Challenges of risk budgeting

Risk budgeting is not without its challenges. The choice for the "lookback window" (i.e., the interval of measurement for active risk) will affect estimates for tracking error (and the related covariances) at the individual portfolio and asset class level. As noted earlier, these relationships tend to vary based on portfolio composition and market trends. For example, when volatility spikes, as it did in 2020, strict adherence to an interval that emphasizes more recent performance could result in estimated tracking error being far outside the target range for active risk. Time horizon also matters when considering the minimum length of track record necessary for modeling active management strategies. Moreover, intramarket dynamics, such as individual stock correlations, can materially impact both ex-ante and ex-post tracking error metrics.

Risk budgeting becomes far more challenging when it includes private markets. Because of the nature in which these assets are valued, which may include a lag in pricing relative to public markets and typically a smoothed return profile, measures of tracking error are strained, at best. Comparing private markets to a public market benchmark (which is valued daily) further complicates the active risk budgeting process. These are known and accepted challenges of private markets investing, and it may mean that investors need to examine other tools for monitoring risks rather than realized performance and tracking error figures.

Benefits of risk budgeting

A risk budgeting program is intended to compel investors to be deliberate about the utilization of risk to enhance returns. A well-managed program should result in the more efficient use of active management. Moreover, it forces those in charge of implementation (e.g., investment staff with delegated authority) to create explicit expectations for the employed managers (and/or internal management) as well an awareness of where commonalities among managers exist (e.g., active returns across equity managers as well as active returns across managers in different asset classes, such as between high yield and public equities). Likewise, it should reduce unintentional risk exposures and concentrate efforts on areas of opportunity that pose a higher probability of excess return. Risk budgeting is meant to ensure that active risk is being spent in a manner commensurate with the anticipated return.

Monitoring active risk without a risk budget

One step that several institutional investors have taken is to construct an active risk monitoring program without adopting a formal active risk budget. The goal of such a program is to have a better grasp of how their total fund moves with the market, by systematically tracking the performance of all investments relative to their benchmarks.

In such a program, the investment advisor or staff can track manager and asset class level risk and return data.

Such a program provides detail and visibility of the sources of risk and return in the portfolio, and it allows for aggregation and evaluation at the asset class, and even total portfolio level. This may serve as the initial phase of a risk budgeting program, as it begins to introduce the vernacular and concepts of risk budgeting to the overarching decision makers.

Finally, most institutional investors already have certain policies in place that inherently drive tracking error expectations. For example, explicit targets for passive management, policy target ranges, and individual manager guidelines, among others, will naturally impact experienced and expected tracking error metrics. For investors who are open to exploring risk budgeting for the first time, it is best to begin with existing policies and examine their impacts (even at a high level) on potential risk budget considerations.

Summary

Risk budgeting is the practice of setting a "budget" for risk and allocating it across a portfolio. For most portfolios, this term is used when examining and managing active risk (i.e., tracking error), although it is also commonly explored when making asset allocation decisions in order to improve awareness of major portfolio drivers. Institutional investors use risk budgets to be thoughtful about taking active risk at different levels of their portfolio. Implementing a risk budget provides a risk-based framework for managing the expected excess returns of active strategies.

The primary challenge of risk budgeting is its operational difficulty. Calculating risk budgets requires extensive data, statistical analysis, and robust assumptions when incorporating forward-looking metrics. And while risk budgets may be relatively easy to calculate, determining how the risk budgets vary with changes in the underlying portfolios and market trends can be tricky.

Risk budgeting complements asset allocation through its focus on how risk is allocated across investments in a portfolio. Risk budgeting's primary benefit is that it can result in the efficient use of active management.

Appendix

Systematic risk vs active risk

Investing involves accepting risk in the anticipation of being compensated for those risks. Most of the risk in, and return for, an institutional investor's portfolio will result from macro/systematic risks (i.e., betas). Conversely, active risk will contribute only a very small amount to overall risk.

The strategic asset allocation decision will be the primary determinant of which risks an investor is willing to accept. This decision tends to be made infrequently, anywhere from once per annum to once every three to five years for institutional investors. And changes tend to be modest.

By contrast, the active risk decision is focused on optimizing active management, a process that tends to involve far more frequent feedback loops. It is the area where investors often hope to add value (alpha), in addition to the systematic risk (i.e., beta) they are accepting.

Tracking error, percentiles and alpha targets

The table in Figure 12 shows alpha expectations at different levels of tracking error and percentiles. This table (and traditional risk budgeting) is based on the assumption of a normal distribution.[8]

Tracking Error	45th Percentile	40th Percentile	35th Percentile	30th Percentile	25th Percentile	20th Percentile	16th Percentile
0.5	0.07	0.13	0.20	0.26	0.34	0.42	0.50
1.0	0.13	0.25	0.39	0.52	0.67	0.84	1.00
1.5	0.20	0.38	0.59	0.78	1.01	1.26	1.50
2.0	0.26	0.50	0.78	1.04	1.34	1.68	2.00
2.5	0.33	0.63	0.98	1.30	1.68	2.10	2.50
3.0	0.39	0.75	1.17	1.56	2.01	2.52	3.00

[8] The assumption of a normal distribution of outcomes allows an investor to use a standard z-score. In this case, we are assuming an information ratio of 1.0.

FIGURE 12
Expected Annual Outperformance Based on Tracking Error Percentiles

Source: Meketa Investment Group, 2024.

To examine the relationship, consider the options available to an investor who wants to target 50 bp of alpha. If they are only willing to tolerate tracking error of 0.5%, then they have to presume their active management activities will consistently land in the top 16th percentile. If they are willing to tolerate tracking error of 1.0%, then active management in the top 30th percentile is required. If they are willing to tolerate tracking error of 1.5%, then active management in the top 37th percentile is necessary. If they are willing to tolerate tracking error of 2.0%, then active management in the top 40th percentile is needed. If they are willing to tolerate tracking error of 2.5%, then active management in the top 42nd percentile is required.

Differences in Tracking Error by Asset Class

The level of tracking error that can be expected varies both with the time period being measured and the asset class. The tables below (see Figure 13-15) provide historical tracking error over three different time periods for seven public market asset classes where the use of actively managed strategies is common.

Note that these tables likely exaggerate the amount of tracking error an investor would experience, depending on the number and type of strategies they utilize. This is because it represents "raw" data that has not been filtered for strategy, and it does not account for how the strategies interact with (and may offset) each other in a broader portfolio.[9] When viewed in isolation, a given manager may have a meaningful tracking error to the asset class's benchmark. However, the purpose of risk budgeting is to examine what the combination of managers might mean for the asset class's tracking error.

[9] For example, the US Large Cap Equity universe in eVestment contains growth, value, min vol, 130/30, and a few other categories. Strategies with known style differences compared to standard benchmarks will inherently exhibit significant tracking errors to the benchmarks that are typically used at the asset class level.

Percentile	US Lagre Cap Equity	US Small Cap Equity	EAFE Equity	EM Equity	Global Equity	Core Bonds	High Yield Bonds
95th	9.13	10.87	7.99	18.43	13.96	2.07	4.44
75th	6.77	8.17	5.83	7.97	8.22	1.32	2.65
50th	5.40	6.79	4.61	5.70	5.88	0.95	1.62
25th	3.96	5.65	3.40	4.28	4.13	0.67	1.26
5th	2.28	4.03	2.13	2.83	2.18	0.43	0.94
Average Number of Funds	837	465	282	327	965	202	188

FIGURE 13
Trailing 10-Year Tracking Error for Active Managers by Asset Class

Source: eVestment, as of June 30, 2024. Analysis includes only actively managed strategies. It includes "dead" funds for the period they were live. Benchmarks used were the S&P 500, the Russell 2000, MSCI EAFE, MSCI EM, MSCI ACWI, Bloomberg US Aggregate, and Bloomberg US Corporate High Yield.

Percentile	US Lagre Cap Equity	US Small Cap Equity	EAFE Equity	EM Equity	Global Equity	Core Bonds	High Yield Bonds
95th	11.28	13.36	9.95	17.90	16.27	2.98	5.28
75th	8.25	9.57	6.60	9.20	9.06	1.74	2.88
50th	6.48	8.05	5.38	6.50	6.84	1.24	1.71
25th	4.50	6.59	3.81	4.58	4.64	0.84	1.23
5th	2.26	4.65	2.28	2.98	2.28	0.51	0.89
Average Number of Funds	970	531	363	459	1384	222	223

FIGURE 14
Trailing 5-Year Tracking Error for Active Managers by Asset Class

Source: eVestment, as of June 30, 2024. Analysis includes only actively managed strategies. It includes "dead" funds for the period they were live. Benchmarks used were the S&P 500, the Russell 2000, MSCI EAFE, MSCI EM, MSCI ACWI, Bloomberg US Aggregate, and Bloomberg US Corporate High Yield.

Percentile	US Lagre Cap Equity	US Small Cap Equity	EAFE Equity	EM Equity	Global Equity	Core Bonds	High Yield Bonds
95th	11.10	11.70	8.93	16.32	15.89	2.41	5.04
75th	8.64	8.39	6.13	9.23	9.15	1.09	2.85
50th	6.68	7.06	4.76	6.28	6.82	0.75	1.32
25th	4.42	5.92	3.59	4.72	4.58	0.55	0.95
5th	2.12	4.05	2.09	2.92	2.31	0.36	0.74
Average Number of Funds	1020	552	394	516	1576	232	232

FIGURE 15
Trailing 3-Year Tracking Error for Active Managers by Asset Class

Source: eVestment, as of June 30, 2024. Analysis includes only actively managed strategies. It includes "dead" funds for the period they were live. Benchmarks used were the S&P 500, the Russell 2000, MSCI EAFE, MSCI EM, MSCI ACWI, Bloomberg US Aggregate, and Bloomberg US Corporate High Yield.

Risk Budgeting Case Study

The amount of tracking error in a portfolio can vary substantially by asset class, as well as by the composition of the asset class (see Figure 16 below). Investors who are unaccustomed to risk budgeting may not know what a reasonable expectation is for tracking error in their portfolio. We have found that some investors are surprised by the amount of tracking error when they measure it for the first time.

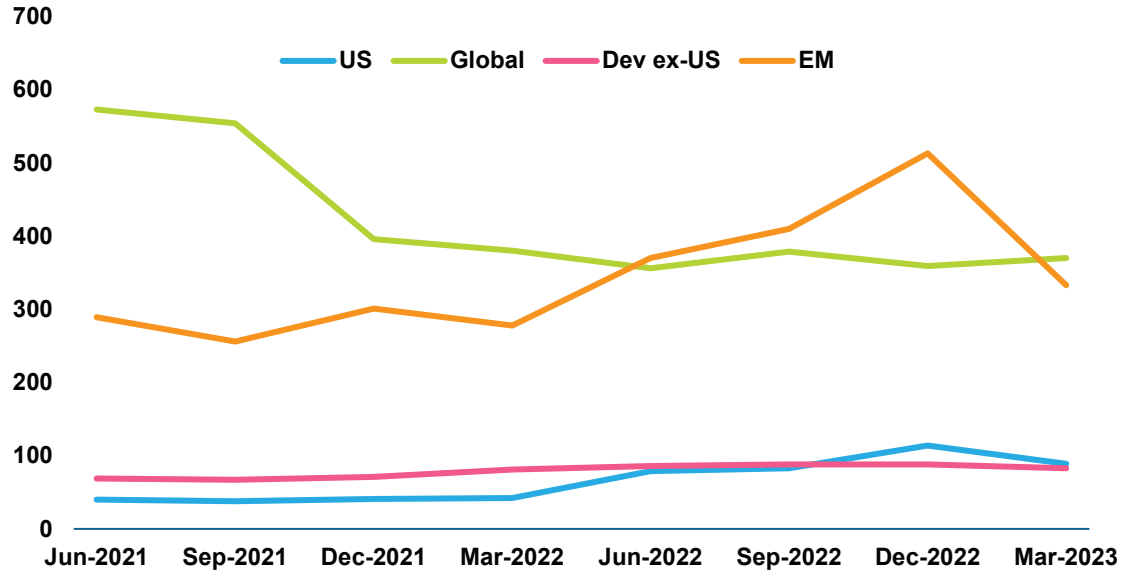

FIGURE 16
Tracking Error for Illustrative Equity Portfolios at the Asset Class Level

Source: Source: Meketa Investment Group, 2024.

For this investor, their global equity and emerging market equity portfolios have exhibited the highest tracking error historically. These two asset classes have also exhibited the greatest variability in tracking error. In this investor's case, this is in part due to the mix of active and passive strategies within these asset classes (e.g., greater allocation to passive management in US and developed foreign equities).

The level of excess return (as measured by the asset class portfolio relative to its benchmark) has tended to resemble the level of tracking error (see Figure 17). For example, the excess return for the US equity portfolio, while negative, has averaged around -1%. This corresponds with the 1% tracking error for US equities. By contrast, global equities have exhibited a much higher tracking error, and hence have experienced a much higher amplitude of excess returns (in this case, positive). In mathematical terms, it would be unusual to see the absolute value of the excess return for an asset class substantially above the tracking error for that asset class.

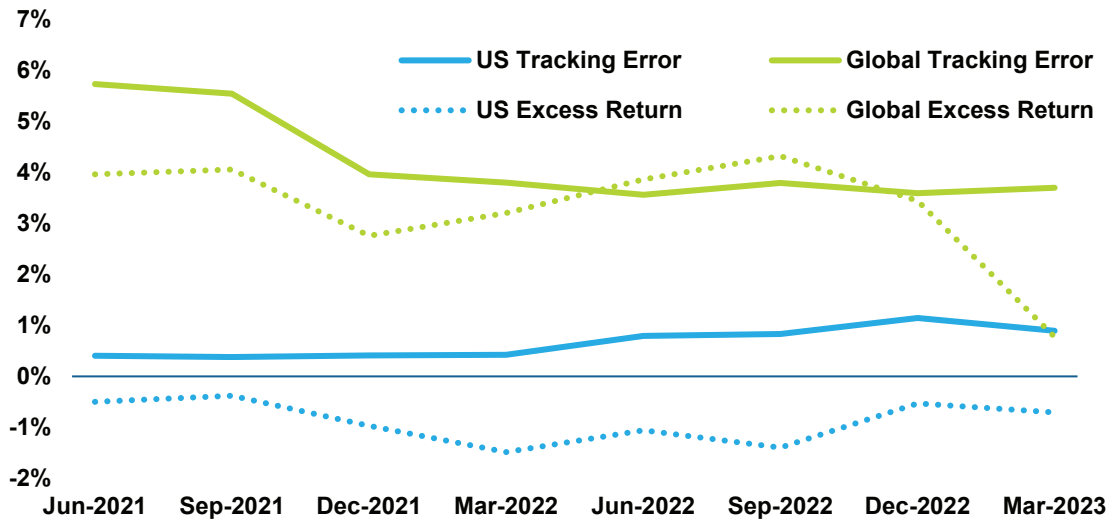

FIGURE 17
Tracking Error vs Excess Return for Illustrative Equity Portfolios

Source: Source: Meketa Investment Group, 2024.

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