Dynamic Asset Allocation as a Response to the Limitations of Diversification

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Institutional investors have to meet challenging goals—above all, achieving a high return target with limited drawdown risk. Yet in the current environment, reaching that objective has become increasingly difficult. Today's current climate of financial repression has lowered return expectations across asset classes. In this environment, many institutional investors face a difficult challenge: How can they meet their return objectives without exposing themselves to substantial drawdown risk? To reach their goals, investors may need to increase allocations to return-generating growth assets such as equities, but this also increases risk. Analyzing the typical allocations of pension plan sponsors, the implied capital losses for many pension funds may likely exceed their risk budgets, which could put risk/return objectives in jeopardy. By doing this analysis, plans can revisit their approaches by asking thoughtful questions: What is the investment goal? What are the risk constraints? How can the return objective be met while prudently balancing risk? This paper explores how using risk-mitigation strategies based on dynamic asset allocation may provide investors with a smoother journey toward their goals in a cost-effective way. Implementing such a dynamic approach—with its dual objective of enhanced returns and risk mitigation—aligns directly with the investment beliefs of many plan sponsors.

The Potential Benefits of Dynamic Risk Mitigation

Many risk-management approaches plans commonly employed, including diversification and tail-risk hedging, have major drawbacks. As a result, dynamic asset allocation (DAA) is becoming an increasingly popular technique for achieving plan-level investment goals within the specified risk budget—an approach called "dynamic risk mitigation." By shifting between risk-seeking growth assets and defensive assets, dynamic risk mitigation may help plans meet or exceed long-term return expectations while

minimizing expected drawdown—a philosophy closely aligned with long-term benefit funding and low, stable contribution requirements. Successful design and implementation of dynamic risk mitigation is more demanding relative to other strategies, however its impact on the risk/return profile of the portfolio may also be more rewarding. In the remainder of this paper, we compare commonly used risk-management strategies to dynamic risk mitigation and quantify the benefits of implementing dynamic risk mitigation into a hypothetical pension plan.

Start by Defining The Right Risk Budget

Constructing an investment portfolio and managing it to a specified risk budget are crucial parts of the fiduciary process shared by both staff and fund trustees. Tracking error and standard deviation are abstract ways of quantifying risk that do not communicate true downside-risk potential. Expected dollar loss in an extreme negative market— measured by Value at Risk (VaR) and Conditional Value at Risk (CVaR)—may be more instructive.

As risk can be defined in many ways, a risk budget can be defined by many measures. In general, there are two common methods for defining a risk budget:

- In relative terms versus a benchmark; or
- In absolute terms, measuring the potential change in asset value

The first method measures a portfolio's deviation from its benchmark and is typically expressed as tracking error. Here, risk is not defined in terms of declining portfolio value, but rather as deviating from or trailing its benchmark. While managing an institutional portfolio within a tracking error budget should control large deviations and offer reassurance for the plan's administrators, it does not communicate true downside-risk potential.

In contrast, the second method—the absolute risk-budgeting approach—measures risk in the form of a change in asset value (or funded ratio, in the case of an asset-liability view) and is typically expressed as standard deviation (i.e., volatility). However, standard deviation can only measure the overall dispersion of possible portfolio returns, and it treats positive and negative dispersions equally.

While tracking error and standard deviation are useful—which is clearly why they are the two most popular metrics for measuring risk—they do not easily communicate the true downside risk potential of a portfolio. Instead, defining risk budget as the expected dollar loss in an extreme negative market may be more instructive for decision-makers and stakeholders. This can be assessed with two metrics:

- Value at risk (VaR), which describes the expected loss at a certain point of market severity; and
- Conditional value at risk (CVaR), which states average losses when a specified negative event actually occurs.

Exhibit 1 displays the allocation profile and realized risk/return analytics for a hypothetical public plan (PF A) next to two alternative portfolio allocations (PF B and PF C) based on monthly historical index returns between 2000 and 2015. The plan's profile is consistent with the profile of a public plan typically found in today's investment environment:

- Allocation is 60% global equities and 40% US fixed income
- Annualized beta return of 5.23%
- Standard deviation of 9.63%
- 96.5% of the portfolio's 9.63% total risk (volatility) emanates from the public-equity allocation

A close analysis of the VaR and CVaR shown in Exhibit 1 provides detailed information about the loss potential of such a portfolio:

- The one-year VaR at 95% confidence, based on rolling one-year returns amounts to –14.92%. In other words, a fully funded $1 billion fund might expect to lose at least $149.2 million 5% of the time
- The average loss when such an event occurred was 24.5% (one-year CVaR at 95% confidence). This corresponds to a $245 million loss for a $1 billion fund—or a drop of 24.5 percentage points of funded status (assuming a fully funded plan)

With these experiences in mind, what can plan sponsors do to participate in the return potential of risky assets while limiting loss during falling markets?

Diversification is Important but not Sufficient

As one can observe in the prior table, diversification can improve a portfolio's risk/return profile; however, it does not eliminate the need to manage drawdown risk, which to a large degree arises from the equity-risk contribution. Institutional portfolios typically include many asset classes and are well diversified. Yet diversification largely failed in 2008, as asset classes moved in sync, and did not deliver the benefits sponsors expected as risk within these portfolios was not "diversified." In the asset allocation previously discussed, which includes a public equity allocation of 60%, the asset class drives 96.5% of total portfolio risk.

In Pursuit of Greater Diversification

To address both this equity-risk concentration and to lower overall expected risk, institutions accelerated the search for asset diversification. Alternative investments like hedge funds and private equities were the clear beneficiaries of this movement, although increasing exposure to alternatives comes at a price. One issue is the effect on a portfolio's return profile. On average, hedge funds cannot be expected to yield returns as high as equities. Instead, shifting assets from public equities into private equities in order to capture the illiquidity premium can help to maintain or improve the return level of the portfolio while reducing the overall risk as measured by the standard deviation.

Granted, a 10% inclusion of hedge funds and private equity, pro-rata-funded by 4% of the fixed income and by 6% from the equity allocation can, in fact, improve the portfolio's risk adjusted return. Exhibit 1 shows a more diversified hypothetical portfolio (PF B):

- Return increased from 5.23% to 5.45%, while volatility also decreased from 9.63% to 9.29%. As a result, the overall risk/return profile measured by the Sharpe ratio improved from 0.35 to 0.39.

Asset Class	Asset Allocation Weights			Risk Weights		
	PF A	PF B	PF C	PF A	PF B	PF C
Equities	**60%**	**54%**	**48%**	**96.5%**	**90.4%**	**83.4%**
US Large Cap Equities	32%	28.8%	25.6%	44.7%	41.9%	38.6%
International Equities	21%	18.9%	16.8%	37.0%	34.6%	31.9%
Emerging Market Equities	7%	6.3%	5.6%	14.8%	13.9%	12.8%
Fixed Income	**40%**	**36%**	**32%**	**3.5%**	**3.0%**	**2.4%**
US Government Bonds	25%	22.5%	20%	-1.3%	-1.4%	-1.5%
US Corporate Bonds	15%	13.5%	12%	4.8%	4.4%	3.9%
Alternatives	**0%**	**10%**	**20%**	**0%**	**6.6%**	**14.2%**
Private Equity	0%	6%	12%	0%	4.8%	10.4%
Hedge Funds	0%	4%	8%	0%	1.8%	3.8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Risk & Return Analytics	PF A	PF B	PF C
Hypothetical Return (per annum)	5.23%	5.45%	5.68%
Volatility (per annum)	9.63%	9.29%	8.98%
Sharpe Ratio	0.35	0.39	0.43

Value at Risk (1-Year)			
90%-VaR	-7.98%	-8.27%	-8.80%
95%-VaR	-14.92%	-14.76%	-14.58%
99%-VaR	-27.63%	-27.28%	-27.10%

Conditional Value at Risk (1-Year)			
90%-CVaR	-17.62%	-18.04%	-18.47%
95%-CVaR	-24.50%	-24.88%	-25.26%
99%-CVaR	-29.29%	-29.39%	-29.50%

Exhibit 1: Allocation Profile and Realized Risk/Return Analytics of Different Hypothetical Portfolio Allocations
Source: US Equities Large Cap are represented by the S&P 500 Total Return Index, International Equities by the MSCI Daily TR Gross World Ex US Index, Emerging Market Equities by the MSCI Daily TR Gross EM USD Index, US Government Bonds by the JPM US Treasuries Index, US Corporate Bonds by the Barclays US Corporate Index, Private Equity by the Cambridge Associates US Private Equity Index, Hedge Funds by the HFRI Fund of Funds Composite Index. All calculations are based on monthly returns between 01/2000 and 12/2015.

- One-year VaR marginally changed to -14.76%, while the one-year CVaR actually worsened from -24.50% to -24.88%.

While the average variation of returns, measured by the portfolio standard deviation marginally improved, downside risk, measured by VaR and CVaR was not meaningfully impacted. Further increasing the allocation to alternative assets by doubling its exposure does not change the picture. Exhibit 1 shows this as the third hypothetical allocation (PF C):

- Return increased to 5.68%, while volatility further fell to 8.98% resulting in a higher Sharpe ratio.
- One-year VaR again marginally improved to -14.58% , while the one-year CVaR further dropped to -25.26%.

The main reason these alternative assets classes did not impact downside risk was their lack of diversification in times of market stress. The equity-risk concentration in all three allocation profiles, indicated by the risk weights, is still dominated by public equities. In times of market stress, when correlations among asset classes tend to increase, alternative assets may behave similar to public equities and should not be expected to mitigate the portfolio's downside risk. In fact, the lack of diversification by hedge funds and private equity during the global financial crisis actually led to an increase of "fat tail" risks demonstrated by an increase of the CVaR in PF B and PF C. While alternative asset classes might reduce the average risk measured by portfolio volatility, the downside risk measured by VaR and CVaR were not.

From Static Diversification to Dynamic Diversification

Among more active approaches used to manage the equity-risk contribution, dynamic asset allocation (DAA) strategies distinguish themselves by balancing between downside protection and upside participation. The two significant drawdowns of the past 16 years—the 2000 dot-com collapse and the 2007–2008 financial crisis—have reminded investors that risk management

should be a top priority for two main reasons:

- To ensure a smoother ride toward investment goals while experiencing less drawdown risk.
- To gain by not losing and avoid the need to compensate for severe losses, while achieving solid upside participation in strong markets.

Diversification is a critical component of any investment process but, as illustrated above, diversification alone is not sufficient. As a result, many investors have started taking a more active approach to managing downside risk. For example, strategies that address equity tail risk—so-called "tail-risk hedging strategies"—gained attention after 2008, although many sponsors find them ill-suited to long-term allocations. They are expensive and come with a high opportunity cost: buying drawdown protection through put options can easily cost a few percentage points year after year.

Some investors have turned to tactical asset allocation (TAA) to improve the risk/return profile of their portfolios. Like diversification, TAA-strategies can have a positive impact. However, their primary objective is delivering "alpha" rather meeting a return target with minimal risk, which makes them more suitable as an active investment strategy rather than a portfolio-level tool for managing downside.

Dynamic risk mitigation is designed to deliver an asymmetric return profile with the goal of meeting or exceeding the return of the plan's strategic asset allocation in the long run, while minimizing the expected drawdown in the short term. Such a dynamic risk-mitigation approach is strongly aligned with the overall plan-level objectives and therefore suitable for larger scale implementation. To achieve both of the desired goals of a typical institutional investor—drawdown protection and upside participation—an efficient use of DAA must simultaneously target two dimensions: the return relative to the strategic asset allocation (SAA) benchmark and the risk budget. To accomplish this, the DAA-approach needs to capture medium-term trends across asset classes, and combine both pro-cyclical and anti-cyclical components. The use of a well-designed trend or momentum model is an intelligent way to approach active asset allocation. By eliminating the need to forecast future asset-class returns, it is possible to simply position portfolios in light of current market conditions. Within each liquid asset class of the SAA, there are four observable "modes":

- positive trend (normal up-mode);
- negative trend (normal down-mode);
- excessive positive trend (excessive up-mode); and
- excessive negative trend (excessive down-mode).

The four modes are the reflection of behavioral patterns of market participants described by well-researched and prominent asset pricing theories of Barberis, Shleifer, Vishny [1998], Daniel, Hirshleifer, Subrahmanyam [1998] and Hong, Stein [1999]. The response function to these four modes shows both a pro- and anti-cyclical element. With its pro-cyclical element, a DAA-approach can take advantage of the tendency for markets to exhibit trends over time due to the typical under-reaction of market participants. At the same time, market participants occasionally over-react, leading to mean reversion of trends. These reversals can be identified by the systematic anti-cyclical process element. A DAA-approach would reduce the active weight in an asset class as the trend becomes excessively positive, while an excessive negative trend would trigger asset class re-entry to capture the mean-reversion potential.

The dynamic approach employs a portfolio structure based on the plan's strategic asset allocation in order to incorporate the unique market cycles of each sub-asset class that is designed to improve diversification and risk-mitigation potential. For example, if non-US equity is experiencing a negative trend, a DAA-approach may underweight relative to the strategic allocation. The dynamic approach seeks to capture the risk premia of a policy benchmark while also actively managing exposures when markets are under stress as a way to mitigate downside risks.

Dynamic Asset Allocation in Action

We are able to illustrate this concept using the global 60/40 strategic asset allocation outlined in Exhibit 1 (PF A) and a rules-based simulation setup outlined in Exhibit 2. The table illustrates the asset classes, the SAA weights, their minimum and maximum weights in the simulation, and the index used. The simulation results are gross of management fees and net of transaction costs. Equity is the main risk-contributing asset class; therefore, risk mitigation occurs by cutting the weight from 60% potentially down to 20%, while return enhancement is made possible by increasing the weight from 60% potentially up to 80%.

The 2:1 ratio between the de-risk range and up-risk range reflects the intended asymmetric return profile. These guidelines will ultimately determine the level of expected excess return, drawdown and tracking error; as such, understanding how these measures interact is vital to setting appropriate expectations.

The benefit of dynamic asset allocation is apparent in both absolute and relative risk-return measures. In the comparison shown in Exhibit 3, the dynamic approach could have added 234 basis points (bps) of annualized excess return for 373 bps annualized tracking error, an information ratio of 0.63 and a meaningful improvement in Sharpe ratio. While comparing the annualized volatility of DAA with SAA (8.53% vs. 9.63%), both approaches indicate a rather similar risk profile. The true impact of DAA becomes apparent when comparing downside risk figures VaR and CVaR. Furthermore, going beyond VaR and CVaR by simply comparing the worst realized 12-month returns, DAA delivered risk mitigation with approximately one-third less downside.

While comparing typical performance and risk analytics of the DAA-approach vs. the strategic asset allocation, one might conclude the outperformance of 2.34% is mainly due to risk mitigation. Further insight into the outperformance pattern and its persistency give the below two graphical evaluations.

The left chart of exhibit 4 uses a technique of Fung, Hsieh [1997], segmenting the rolling 12-month average SAA returns into quintiles and comparing average returns with the DAA-strategy returns in these quintiles allows for a more robust return comparison over five different market environments. Based on the average quintile returns, the DAA-strategy yields outperformance on average in all five quintiles. This aggregated

Asset Class	SAA	Min	Max	Index Used for Simulation
Equities	**60%**	**10%**	**80%**	
US Equities Large cap	30%	10%	65%	S&P 500 Total Return Index
International Equities	21%	5%	35%	MSCI Daily TR Gross World Ex US Index
Emerging Market Equities	7%	0%	15%	MSCI Daily TR Gross EM USD Index
Fixed Income	**40%**	**20%**	**80%**	
US Government Bonds	25%	10%	80%	JPM US Treasuries Index
US Corporate Bonds	15%	0%	40%	Barclays US Corporate Index
Oppurtunistic Assets	**0%**	**0%**	**20%**	
US REITs	0%	0%	10%	FTSE E/N All Equity REIT Total Return Index
Commodities	0%	0%	10%	Bloomberg Commodity Total Return Index
US Equities Small Cap	0%	0%	10%	Russell 2000 Total Return Index
Emerging Market Debt	0%	0%	10%	JPM Emerging Markets Bond Index
US High Yield	0%	0%	10%	iBoxx LiquidHigh Yield Index
US TIPS	0%	0%	10%	Barclays US Treasuries Inflation Linked Index
Cash	**0%**	**0%**	**60%**	

Exhibit 2: Simulation Parameters for a Hypothetical DAA Portfolio Between 01/2001 and 12/2015
Source: Allianz Global Investors

Absolute Performance & Risk	DAA	SAA
Hypothetical Return (per annum)	7.57%	5.23%
Volatility (per annum)	8.53%	9.63%
Sharpe Ratio	0.67	0.35
95%-VaR	-6.27%	-14.92%
95%-CVaR	-15.13	-24.50%
Minimum 12-month return	-20.98%	-30.83%
Relative Performance & Risk		
Hypothetical Outperformance (per annum)		2.34%
Tracking Error (per annum)		3.73%
Information Ratio		0.63

Exhibit 3: Analytical Simulation Results of Historical Backtest
Source: Allianz Global Investors

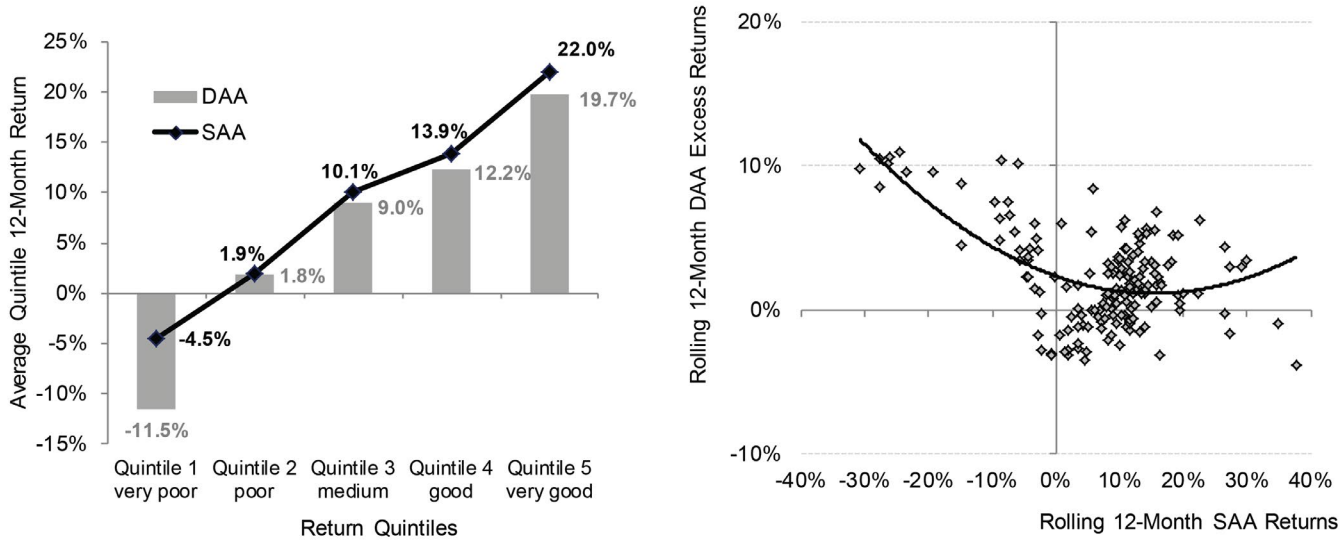

Exhibit 4: Comparing Return Outcomes of a Hypothetical DAA Portfolio Relative to SAA
Source: Allianz Global Investors

relative performance pattern reflects the objective of the DAA-approach: providing outperformance due to risk mitigation in sustainable negative markets and return enhancement in positive trending markets. By design, the degree of outperformance is greater in negative SAA-return scenarios due to the asymmetric asset class ranges, de-risking the equity exposure twice as much as up-risking. What is the trade-off for receiving the aggregated outperformance pattern outlined in the quintile chart? The investor must be willing to accept dispersion of short-term active returns including periods where the strategy lags its static reference benchmark, as indicated by 3.73% tracking error. Following Moskowitz, Ooi, Pedersen [2012], the scatterplot of all 168 rolling 12-month DAA excess returns is illustrated in the right chart of Exhibit 4, visualizing a momentum smile effect. Here, the strategy underperformed in 44 periods, typically during volatile sideways-equity markets with weak or no clear trend where the active allocation strategy accrues volatility costs. Both the quintile chart and the momentum smile reflect the desired convex payoff profile or skewed smile: due to the asymmetric allocation leeway, the DAA-approach is aiming for a stronger degree of risk mitigation in severe down markets than the correspondent degree of return enhancement in the same size substantial up markets.

How to Make Static Portfolios Dynamic

In order to take full advantage of the DAA-approach when integrating it into a strategic allocation, plan sponsors should consider a total-portfolio view toward sizing the dynamic asset allocation and analyzing its impact. An investor can blend the dynamic allocation into the overall portfolio to create an asymmetric return profile for the total plan. By starting from the SAA weights, the dynamic approach targets at least the expected plan return while ensuring that short-term return deviations (tracking error) remain limited.

The first step involves carving out an equivalent proportion of liquid assets within the SAA, such that the remainder still reflects the composition of the SAA. The second step invests these assets using the dynamic approach, and the third step blends the dynamic segment back into the overall portfolio to observe its impact. To determine the most efficient size for the dynamic allocation segment, the dynamic allocation may be calibrated to achieve a specific outcome, or it may be driven by a statistical constraint. An outcome-oriented approach targets the degree of desired return enhancement or drawdown mitigation compared with the policy benchmark. A statistical constraint might define overall asset-class deviation versus the policy benchmark, or the tracking error compared to the current rebalancing policy. Exhibit 5 illustrates various blends between a DAA-approach and an SAA-based policy portfolio.

An outcome-oriented approach to finding the appropriate size for active allocation within an overall portfolio begins with quantifying the expected compound return and return distribution of the policy benchmark. Due to the equity risk concentration and large drawdown potential in most client portfolios, risk mitigation is generally the target outcome. To that end, it is important to note that dynamic asset allocation's asymmetric return compared with a plan sponsor's benchmark can enable risk mitigation without sacrificing the long-term expected return—the unpleasant tradeoff typically required of other risk-mitigating concepts. With the previously specified DAA-approach, the 2:1 de-risk to up-risk ratio means risk mitigation's positive effects on a total plan could accrue at a faster rate than return enhancement, as seen in Exhibit 5. In this backtested scenario, a 10% allocation to dynamic allocation improved the worst 12-month return by 0.95% while improving the long-term assumed return from 5.23% to 5.56%. As the example shows, an allocation to the DAA-approach linearly indicates both effects: short-term drawdown reduction and long-term return enhancement.

Absolute Analytics	SAA	DAA	10% Blend	20% Blend	30% Blend	40% Blend
Hypothetical Return (per annum)	5.23%	7.57%	5.46%	5.69%	5.93%	6.16%
Volatility (per annum)	9.63%	8.53%	9.46%	9.31%	9.16%	9.03%
Sharpe Ratio	0..35	0.67	0.38	0.41	0.45	0.48
Minimum 12-month return	-30.83%	-20.98%	-29.88%	-28.93%	-27.96%	-26.99
Relative Analytics						
Hypothetical Outperformance (per annum)		2.34%	0.23%	0.47%	0.70%	0.94%
Tracking Error (per annum)		3.73%	0.37%	0.75%	1.12%	1.49%

Exhibit 5: Blending Dynamic into Static and its Impacts on the Portfolio
Source: Allianz Global Investors

How to Size the Dynamic Slice

Clearly, despite the long-term horizon of institutional investors, minimizing short-term drawdown in such a way has merit for a variety of reasons—including peer-relative comparisons, board/staff evaluation periods and managing a negative cash flow portfolio. As a result, a plan sponsor seeking to reduce a portfolio's expected drawdown, or seeking to identify a new source of return without adding volatility, may use the sensitivity data shown in Exhibit 6 to target specific outcomes.

The most intuitive statistical method for targeting these outcomes simply uses deviations in asset allocation compared with the policy benchmark. Blending different percentages of the dynamic asset allocation strategy with a static benchmark creates an implied asset-class-deviation table. For example, using the dynamic asset ranges described previously, 10% of liquid assets allocated to the dynamic strategy realizes only 10% of its total impact. The dynamic asset ranges allow an up-risking by 20 percentage points and de-risking by 40 percentage points around the strategic equity exposure of 60%, therefore a 10% allocation

Rebalancing Policy		Dynamic Blend		Implied Equity Ranges	
Asset Class Range	Tracking Error	Weight	Tracking Error	Up	Down
2.5%	0.42%	10%	0.37%	+2%	-4%
5.0%	**0.84%**	**20%**	**0.74%**	**+4%**	**-8%**
7.5%	1.26%	30%	1.11%	+6%	-12%
10.0%	1.68%	40%	1.48%	+8%	-16%

Exhibit 6: Designing the Hypothetical Blend Between the Static and Dynamic Portions of the SAA
Source: Allianz Global Investors

translates into 10% of this dynamic allocation range, i.e., +2% and -4% maximum asset-class ranges in the overall portfolio. For many plans, these are within the range of a rebalancing policy, so implementation would require limited policy-level considerations.

Another statistical approach to finding the appropriate size for dynamic allocation examines the tracking error that dynamic exposure would introduce. The rebalancing policy or active risk budget defines the acceptable drift from policy weights, which equates to an implicit tracking error. This active risk is typically unaddressed by active management and, therefore, most portfolio-level tracking error is not compensated with expected excess return or risk mitigation. Using dynamic asset allocation could redeploy this unused active risk budget for both return enhancement and risk mitigation in order to potentially improve the overall portfolio.

An example of how to redeploy unused active risk budget by staying within tracking-error ranges can be seen in Exhibit 6. It compares the implicit tracking-error budget of rebalancing policy equity ranges with the corresponding dynamic exposure weight producing similar tracking error. A rebalancing policy allowing a +/- 5% equity range means that a plan can expect 0.84% tracking error relative to its policy benchmark. Yet equipping a portfolio with a 20% exposure to dynamic allocation stays within this tracking-error-budget as it introduces just 0.74% portfolio-level tracking error. As the tracking error from rebalancing policy and dynamic blend scales linearly with the asset class ranges and dynamic weights respectively, any idle tracking error budget of a rebalancing policy can be employed by implementing the tracking-error equivalent DAA-component.

Clearly, there are different ways to consider the size of a dynamic allocation blend. Whatever decision is made, the larger the allocation to the dynamic asset category, the greater its effects. These effects can be expressed in multiple terms as a function of:

- the degree of desired return enhancement;
- the degree of desired risk mitigation;
- the desired allocation range to be introduced to the static SAA weights; and
- tracking-error-neutral sizing in relation to a portfolio's current rebalancing policy.

Dynamic Asset Allocation as a Toolkit

The objective of delivering excess return while minimizing downside risk aligns with the philosophy statement of most institutional plan sponsors. However, many approaches commonly used to deliver this goal fell short in one dimension. Dynamic asset allocation offers investors a unique toolkit designed to achieving these objectives and potentially improving distribution of plan returns over time. Its customized implementation structure and asset class parameters enable any institution to become dynamic to help more efficiently utilize an existing risk budget to attain the goals of risk mitigation and return enhancement.

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Mr. Zimmerer is a senior product specialist and a director with Allianz Global Investors, which he joined in 2014. As a member of the Multi Asset US team, he is responsible for articulating the philosophy and process of the firm's dynamic multi-asset strategies to clients and external audiences; he also provides insights to the advisor and consultant community on the impact of market conditions on portfolio decisions. Earlier with the firm, Mr. Zimmerer was a portfolio manager with Allianz in Munich and Frankfurt, where he developed quantitative investment strategies and managed bond and CPPI portfolios. He has 19 years of investment-industry experience. Before, Mr. Zimmerer was a professor of finance and investments at the University of Applied Science in Ansbach, Germany, and served as senior consultant for a German-based consulting firm, advising institutional investors. He has an M.B.A. in economics and finance and a Ph.D. in econometrics from the University of Regensburg, Germany.

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