Vanguard

Strategic Asset Allocation Committee

The role of private equity in a multiasset portfolio

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- Vanguard believes exposure to private equity investments has the potential to enhance long-term returns for investors.
- Private equity should be viewed as a component of the global equity allocation that is accessed through active selection. It requires accepting liquidity and manager idiosyncratic (active) risk.
- Novel enhancements to the Vanguard Asset Allocation Model* (VAAM) provide an initial framework for properly assessing the merits of private equity in diversified, strategic portfolios.
- This memo summarizes the work of Vanguard's Strategic Asset Allocation Committee (SAAC) and is based on research by the firm's Investment Strategy Group and Portfolio Review Department.**

About SAAC

Vanguard's Strategic Asset Allocation Committee (SAAC) is a multiasset oversight committee composed of global investment leaders from across the firm.

The members of SAAC are responsible for the investment methodology behind our single fund solutions, including Vanguard's LifeStrategy® Funds, Target Retirement Funds, Managed Allocation Fund, 529 plans, and model portfolios.

SAAC meets regularly to review its investment methodology, debate investment strategies, and coordinate any changes with Vanguard's Advice Policy Committee, thereby ensuring a consistent approach in our single fund solutions and advice offers.

From left to right: Greg Davis, global chief investment officer; Joseph Davis, committee chair; Roger Aliaga-Díaz, committee vice-chair; Matthew Brancato; Kaitlyn Caughlin; Joel Dickson; Paul Jakubowski; Manish Nagar; Dan Reyes; Qian Wang; Martin Kleppe (non-voting); and Ian Kresnak (non-voting).

* Patent pending.

** The committee acknowledges the contributions of Harshdeep Ahluwalia, Giulio Renzi Ricci, Douglas Grim, and Chris Tidmore from the Investment Strategy Group as well as Francis Kinniry Jr., Cara McCutcheon, and Alex Green from the Portfolio Review Department.

Private equity (PE) offers the potential to enhance returns in long-term, diversified portfolios through exposure to liquidity risk premia and alpha generation. The Strategic Asset Allocation Committee (SAAC) views private equity as a component of the global equity allocation that is accessed through active selection. It involves assistance to companies that are not accessible in public markets. Based on the portfolio analysis and simulations presented, the SAAC believes there is a reasonable basis for the role of PE in strategic, long-term, multiasset portfolios.

A standard approach to assessing an appropriate allocation to PE—or any other asset class in a portfolio—is to use a mean-variance optimization framework. However, such a traditional approach is problematic because of key challenges that PE fund investors face. They include: 1) "smoothed" data (that is, the fact that PE fund values are based on subjective appraisals), 2) illiquidity and portfolio rebalancing issues, and 3) uncertainty in the timing of cash flows (capital calls).

In addition, PE requires the use of active management, which introduces manager idiosyncratic (active) risk into the portfolio. These challenges make it difficult for individual and institutional investors to determine the appropriate exposure to private equity using standard asset allocation models. Portfolio construction frameworks that ignore these key aspects of PE may create challenges from portfolio risk control and fiduciary perspectives.

Vanguard's SAAC approved a series of novel enhancements to VAAM that account for PE's unique characteristics. These enhancements allow investment advisors to recommend an empirical and defendable allocation to PE in strategic portfolios.[1]

De-smoothing

The inherent smoothing effect in PE's appraisal-based valuations biases return data, artificially increasing the Sharpe and information ratios.[2,3] In order to determine the "true" return profile of PE, the SAAC approved the use of a multiple regression "de-smoothing" approach to estimate the volatility of PE returns.

Overview of VAAM:

VAAM is a proprietary tool that takes a multi-dimensional approach to finding the optimal portfolio. Rather than relying exclusively on systematic risk and return, the model incorporates alpha risk—the ex-ante probability of active underperformance—and client's attitude toward it into the optimization process.

VAAM makes allocation decisions among assets under return uncertainty by adopting a utility-based optimization framework that seeks to maximize the expected utility of wealth.

For more details on VAAM, see the paper *Vanguard Asset Allocation Model: An Investment Solution for Active-Passive Portfolios.*

The de-smoothing process involves a two-step, econometric approach to transform the time series from reported returns to an estimate of marked-to-market returns. First, the artificially smooth persistent pattern in appraised PE returns (the high serial correlation in the return series) is removed. Next, the volatility (the variance of the return series) is "scaled" to levels more in line with that of global equity markets. The reason for this is that artificially smooth (too low a variance and too high of an autocorrelation—the latter being a measure of the relationship between a variable's current value and its past values) would cause an over-allocation to PE versus public equities in the model.

The two key assumptions behind this methodology are that true unsmoothed private equity returns should, at minimum, exhibit similar serial correlation and volatility characteristics to those of their public equity counterparts.

1 For more detail on Vanguard's approach to private equity, see the Vanguard research paper by Aliaga-Díaz et al. (2020), *The Role of Private Equity in Strategic Portfolios.*

2 The information ratio is a measure of portfolio manager skill. It is equal to the excess return of the portfolio over the benchmark divided by tracking error (or the standard deviation of fund return minus benchmark return).

3 See Couts, Gonçalves, and Rossi (2020), Unsmoothing Returns of Illiquid Funds. *USC Lusk Center of Real Estate Working Paper Series*, available at: https://lusk.usc.edu/research/working-papers/unsmoothing-returns-illiquid-funds.

As **Figure 1** shows, this approach provides a return series that preserves the average return of PE while providing more economically sensible (marked-to-market) volatility and covariance estimations (covariance is a measure of how two variables change in relation to one another).

Liquidity and rebalancing issues

Most portfolio construction frameworks, such as mean-variance optimization or ad hoc allocations, implicitly assume continuous and costless rebalancing. The illiquid nature of PE makes this assumption impractical. Moreover, sticking to a naïve continuous rebalancing assumption could cause investors to overallocate to PE, significantly altering the risk-return profile of the portfolio in unintended ways.

To address this, the research team built a capability into VAAM to account for the fact that, unlike liquid assets, PE cannot be regularly rebalanced back to target asset allocation.

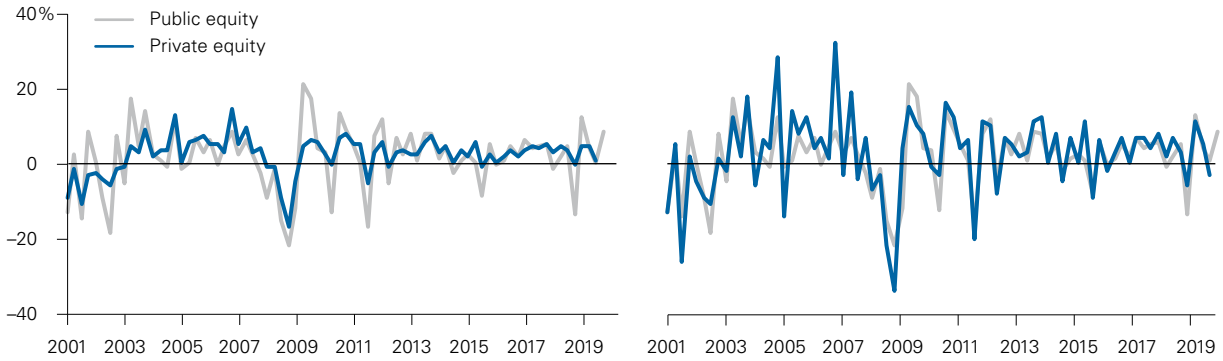
Mathematically, the change in VAAM's portfolio simulation core consists of letting the illiquid asset portfolio weights drift until new cash flow comes in or out of the portfolio (capital calls or distributions) or, if there are no more cash flows, to the end of the investment horizon.

Accounting for this rebalancing friction leads to a different optimal allocation to private equity. This rebalance feature yields a number of important benefits. Most important, it provides a more accurate representation of the risk-return trade-offs of portfolio optimization, including the possibility

Figure 1. "Unsmoothing" private equity returns results in a more realistic economic return profile

a. As-reported private equity returns, 2001–3Q2019

b. Adjusted private equity returns, 2001–3Q2019



c. Summary statistics

	Public equity	Private equity (as reported)	Private equity (adjusted)
Volatility	16.6%	10.7%	22.6%
Autocorrelation	0.02	0.45	0.00
Annual average return	7.2%	11.0%	11.0%

Notes: The time series of private equity returns is based on global, pooled quarterly net returns to limited partners for venture capital and buyout direct funds from the Burgiss Manager Universe for the period December 31, 2001, to September 30, 2019. The public equity returns are based on the MSCI All Country World Index. The modified Dietz returns produced by Burgiss are unsmoothed using a Geltner (1993) method, which allows us to remove first-order autocorrelation from the return series to create the adjusted results.

Sources: Vanguard calculations, based on data from Burgiss and Morningstar, Inc.

for PE allocations to depart from intended target levels under certain market scenarios. It also allows for the derivation of key portfolio analytics from VAAM, such as the probability of breaching an investor's maximum private equity threshold at any point.

In addition, there is a second challenge associated with the illiquidity of PE. Unlike public equities, private equity lacks a deep secondary market. To address the resulting material liquidity constraint faced by PE investors, VAAM has a built-in valuation adjustment feature that allows the user to specify a penalty, or discounting factor, to apply to private equity wealth in the portfolio at the end of the investment horizon (for example, ten years). This allows private wealth to be fairly traded and compared with public liquid assets when making portfolio decisions using utility-based optimization.

Practically speaking, the more realistic rebalancing assumption combined with the built-in liquidity valuation adjustment make PE a smaller portion of the overall equity exposure in the portfolio in comparison to standard models of asset allocation.

Accounting for cash-flow uncertainty

Another unique challenge that PE investors face is uncertainty about the timing and magnitude of cash inflows and outflows, because these are controlled by the PE manager(s). Unexpected fund distributions and capital calls can have a significant impact on the risk of the portfolio over time. To address this, functionality is built into VAAM to explicitly model PE fund cash flows and their inherent level of uncertainty in a multi-asset framework.

VAAM-based allocations for PE

Based on the team's estimated excess return over global public equity of 400 basis points and volatility of excess return on a desmoothed marked-to-market basis of 13.2%, VAAM generated recommended allocations for different investor risk-aversion profiles.

Figure 2 shows optimal multiasset portfolios and PE allocations for three different active risk-aversion levels—low, medium, and extremely high. The inner rings show the total portfolio allocation to different asset categories (public equity, fixed income, private equity) and the outer rings show the portion allocated to private equity out of the total allocation to global equities. These outputs are in line with our expectations—in a 70/30 policy portfolio, PE allocations increase substantially with the degree of active risk tolerance. Such allocations account for 3% (for the highest active risk aversion) to 36% (for the lowest active risk aversion) of the total portfolio and 4% to 46% of the broad equity allocation with a buy-and-hold assumption.

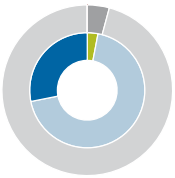
It should be noted that the allocations in Figure 2 are based on specific, hypothetical assumptions for private equity and passive and active risk aversion and are agnostic to other investor-specific risk tolerances. The optimal allocation for a client will vary based on custom assumptions and risk preferences. SAAC does not endorse a single PE recommendation for all investors. Vanguard's Advice Policy Committee is responsible for setting client risk tolerance, investment-policy guardrails, and other constraints within an advice context that will ultimately determine all VAAM-based PE allocations for advised portfolios on a case-by-case basis.

Where we go from here

The unique characteristics of PE present a set of complex challenges to ordinary portfolio construction frameworks. The novel approaches outlined in this memo have been incorporated into our proprietary VAAM framework. While the SAAC believes that this is a rigorous and robust methodology, we remain committed to continuous enhancements using the latest technologies and innovative techniques while staying true to our time-tested principles for asset allocation.

Figure 2: VAAM-derived private equity allocations for a 70/30 policy portfolio

With an illiquidity-constrained rebalancing assumption

Active risk aversion	Portfolio		Metrics	
Lower	46% Private equity share of total equity 54% Public equity share of total equity 36% Private equity 43% Public equity 21% Fixed income		Total equity PE share of total equity PE share of portfolio Expected return Expected volatility	79% 46 36 7.3 14.4
Medium	30% Private equity share of total equity 70% Public equity share of total equity 23% Private equity 54% Public equity 23% Fixed income		Total equity PE share of total equity PE share of portfolio Expected return Expected volatility	77% 30 23 6.8 13.3
Very high	4% Private equity share of total equity 96% Public equity share of total equity 3% Private equity 69% Public equity 28% Fixed income		Total equity PE share of total equity PE share of portfolio Expected return Expected volatility	72% 4 3 5.4 11.6

Notes: "PE" refers to private equity. Expected return and expected volatility are median values from a distribution of 10,000 simulations. Portfolios have been optimized over a ten-year investment horizon. Passive risk aversion in VAAM was set to a level consistent with a 70/30 policy, fully liquid portfolio. The following constraints apply: non-U.S. bonds, up to 50% of total (noncredit) bonds; total credit bonds, up to 50% of total fixed income (bonds and credit bonds); intermediate-term U.S. credit bonds, up to 60% of total credit bonds; short-term U.S. credit bonds, up to 60% of total credit bonds. For these case studies, we assume that the only sub-asset class in the portfolio with active investments is private equity. The inner ring shows the total portfolio allocation to each asset category. The outer ring shows the portion allocated to private equity out of the total allocation to global equities. The optimized weights for intermediate-term U.S. credit bonds, short-term U.S. credit bonds, and international bonds (hedged) have been aggregated in the fixed income class.

Source: Vanguard calculations, using asset-return projections from the VCMM as of December 31, 2019, in U.S. dollars.

IMPORTANT: The projections and other information generated by the VCMM regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. Distribution of return outcomes from VCMM are derived from 10,000 simulations for each modeled asset class. Simulations are as of December 3, 2019. Results from the model may vary with each use and over time. For more, please see important information on page 7.

Additional perspectives from the SAAC

A primary responsibility of the SAAC is to oversee the policy allocation of Vanguard's suite of multiasset portfolios, including a formal annual review. The SAAC has also been tasked with establishing the investment methodology and portfolio construction approaches that are most appropriate for various objectives. Since its founding in 2013, the SAAC has held research meetings to discuss investment topics, seeking the best outcomes for our clients through constant debate. These meetings, often showcasing the latest research by Vanguard's Investment Strategy Group, have centered on a wide range of subjects. A summary of past topics is provided below.

2013
- Hedging currency exposure in a multiasset portfolio
- Role of commodity futures
- Minimum-volatility equity strategies

2014
- Equity home bias by country
- Glide-path construction methodology
- Inflation protection

2015
- Approaches to retirement income
- Factors and strategic asset allocation
- Fixed income glide-path allocations

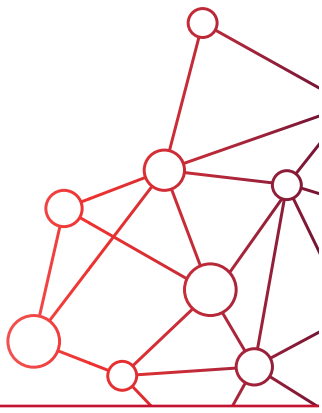
2016
- Time-varying risk premia and asset allocation
- Expansion of the Vanguard Capital Markets Model
- Inflation-hedging strategies over multiyear horizons

2017
- Long-run equilibrium risk-free rates and the equity risk premia
- Diversified versus concentrated active equity portfolios
- Global methodology for non-market-cap-weighted ETF model portfolios

2018
- Role of private real estate in portfolios
- Vanguard Life-Cycle Model (VLCM) and glide-path outcomes
- Inflation protection in a 529 college savings plan

2019
- Vanguard Asset Allocation Model (VAAM) and optimal allocations to active and passive strategies
- VAAM-based investment methodology for ETF-model portfolios
- Return-targeting and time-varying asset allocation

2020
- VLCM-derived glide paths for 529 college savings plans
- Role of private equity in multiasset portfolios *(more details in this memo)*



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All investing is subject to risk, including the possible loss of the money you invest. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. Diversification does not ensure a profit or protect against a loss.

Private investments involve a high degree of risk and therefore should be undertaken only by prospective investors capable of evaluating and bearing the risks such an investment represents. Investors in private equity generally must meet certain minimum financial qualifications that may make it unsuitable for specific market participants.

IMPORTANT INFORMATION ABOUT THE VCMM: The projections and other information generated by the Vanguard Capital Markets Model regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results, and are not guarantees of future results. VCMM results will vary with each use and over time.

The VCMM projections are based on a statistical analysis of historical data. Future returns may behave differently from the historical patterns captured in the VCMM. More important, the VCMM may be underestimating extreme negative scenarios unobserved in the historical period on which the model estimation is based.

The Vanguard Capital Markets Model® is a proprietary financial simulation tool developed and maintained by Vanguard's primary investment research and advice teams. The model forecasts distributions of future returns for a wide array of broad asset classes. Those asset classes include U.S. and international equity markets, several maturities of the U.S. Treasury and corporate fixed income markets, international fixed income markets, U.S. money markets, commodities, and certain alternative investment strategies. The theoretical and empirical foundation for the Vanguard Capital Markets Model is that the returns of various asset classes reflect the compensation investors require for bearing different types of systematic risk (beta). At the core of the model are estimates of the dynamic statistical relationship between risk factors and asset returns, obtained from statistical analysis based on available monthly financial and economic data from as early as 1960. Using a system of estimated equations, the model then applies a Monte Carlo simulation method to project the estimated interrelationships among risk factors and asset classes as well as uncertainty and randomness over time. The model generates a large set of simulated outcomes for each asset class over several time horizons. Forecasts are obtained by computing measures of central tendency in these simulations. Results produced by the tool will vary with each use and over time.

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