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REVERSE ASSET ALLOCATION: ALTERNATIVES AT THE CORE

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By P. Brett Hammond

INTRODUCTION

Institutional investors have shown an increasing interest in alternative asset classes—including private equity, venture capital, real estate, commodities, hedge funds, and others—due to their strong performance and low correlations with traditional assets. In addition, diminished expectations for returns from traditional assets have made alternative assets even more attractive.

The inclusion of alternatives in formal asset allocation models, however, can make these models highly sensitive to small changes in a portfolio's allocations. Moreover, because most alternatives do not have long track records, some institutions may be unsure how to predict the risk/return behavior of these investments in a traditional asset allocation model.

A new approach—"reverse asset allocation"—addresses these challenges by taking into account the special characteristics of alternative assets. Unlike traditional asset allocation, which, to produce the bulk of overall return, puts equities at the core of the portfolio and then, to limit risk and improve efficiency, adds bonds plus alternatives, reverse asset allocation does the opposite. It begins by finding the expected return from a desired allocation to a core group of alternative assets, and then adds bonds and equities as the completion elements, to achieve the overall desired portfolio characteristics.

The rationale for reversing the usual approach is based on the notion that alternatives offer an opportunity to obtain asset-based return alpha with low correlation to traditional asset classes while limiting risk.

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THE CHALLENGES OF USING ALTERNATIVES IN A TRADITIONAL MODEL

A central issue for institutions that wish to include alternatives in portfolio construction is how much uncertainty should be assigned to risk/return data for the purposes of modeling. Changes in returns, volatilities, and covariances can affect portfolio allocations to any asset class, so the use of sophisticated autoregression, Bayesian, and even resampling techniques may not always provide a clear view of expected values for alternative assets.

The increase in the number of asset classes to be considered can also affect confidence in the results. With only a few asset classes, portfolio optimization modeling is fairly straightforward and stable, especially when there is high confidence in the expected returns of each asset class. On the other hand, as asset classes proliferate and the number of inputs increases, results become less predictable. The inclusion or exclusion of a single asset class, or a change in that asset's inputs, could have unanticipated effects on the allocation assignments—not just for one asset class, but for many.

Specific examples can help illustrate the issues of predictability and stability. Exhibit 1 shows a matrix of correlations among traditional and alternative asset classes. Using an optimizer and different combinations of assets from Exhibit 1, it is possible to model various efficient portfolios as shown in Exhibit 2. Each of these portfolios lies on its own efficient frontier constructed by optimizing across the assets listed in the portfolio. These portfolios have the same overall volatility (standard deviation = 11.17%) but different Sharpe ratios and portfolio betas.

Portfolio A is one of two baseline portfolios shown in Exhibit 2. This portfolio combines traditional assets such as U.S. equities, U.S. bonds, and cash. Note that the portfolio's overall expected return of 5.85% is low in comparison with actual historical returns over much of the 20th century, when equities averaged closer to 11% and bonds about 6% [Ibbotson]. Returns and other results listed for any portfolio

EXHIBIT 1: ASSET CLASS CORRELATIONS

	U.S. Equity	International Equity	Emerging Mkt Equity	Absolute Return	Equity Hedge Funds	Venture Capital	Private Equity	REITs	Real Estate	Commodities	U.S. Bonds Govt	U.S. Bonds All	U.S. Bonds TIPS	Cash
U.S. Equity	1.00	0.65	0.45	0.50	0.85	0.35	0.70	0.55	0.10	-0.25	0.35	0.30	0.35	0.35
International Equity	0.65	1.00	0.60	0.55	0.55	0.30	0.60	0.40	0.15	-0.10	0.20	0.20	0.20	0.20
Emerging Mkt Equity	0.45	0.60	1.00	0.50	0.65	0.35	0.30	0.20	-0.30	-0.05	-0.20	-0.15	-0.10	0.00
Absolute Return	0.50	0.55	0.50	1.00	0.65	0.10	0.35	0.55	-0.05	-0.05	0.10	0.15	0.15	0.20
Equity Hedge Funds	0.85	0.55	0.65	0.65	1.00	0.50	0.60	0.50	0.00	-0.05	0.10	0.15	0.25	0.35
Venture Capital	0.35	0.30	0.35	0.10	0.50	1.00	0.65	-0.05	0.15	0.20	-0.30	-0.25	-0.15	0.05
Private Equity	0.70	0.60	0.30	0.35	0.60	0.65	1.00	0.20	0.20	-0.05	-0.15	-0.10	0.05	0.25
REITs	0.55	0.40	0.20	0.55	0.50	-0.05	0.20	1.00	0.00	-0.20	0.35	0.30	0.30	0.20
Real Estate	0.10	0.15	-0.30	-0.05	0.00	0.15	0.20	0.00	1.00	-0.05	0.00	0.00	0.20	0.40
Commodities	-0.25	-0.10	-0.05	-0.05	-0.05	0.20	-0.05	-0.20	-0.05	1.00	-0.20	-0.10	-0.20	-0.20
U.S. Bonds Govt	0.35	0.20	-0.20	0.10	0.10	-0.30	-0.15	0.35	0.00	-0.20	1.00	1.00	0.75	0.50
U.S. Bonds All	0.30	0.20	-0.15	0.15	0.15	-0.25	-0.10	0.30	0.00	-0.10	1.00	1.00	0.75	0.45
U.S. Bonds TIPS	0.35	0.20	-0.10	0.15	0.25	-0.15	0.05	0.30	0.20	-0.20	0.75	0.75	1.00	0.75
Cash	0.35	0.20	0.00	0.20	0.35	0.05	0.25	0.20	0.40	-0.20	0.50	0.45	0.75	1.00

These estimates, which are drawn from Leibowitz and Bova (2004), are used for illustration only and may or may not reflect current expectations for any or all asset classes. Source: Morgan Stanley Research

should be used for comparison purposes only, because all portfolios are based on the same assumptions and inputs. Individual portfolio returns and other results are unlikely to match actual future results.

Next, international equities are added to this mix, as shown in Portfolio B. Not surprisingly, the optimizer allocates a significant proportion of assets (about 40% of all equities and 18% of the total portfolio) to international equities. Overall, Portfolio B shows that a mix of 63% equities and 37% U.S. bonds (very close to the 60/40 mix of baseline Portfolio A) would have an expected return of nearly 6%, a Sharpe ratio of 0.53, and a beta in relation to U.S. equities of 0.64. Exhibit 3 illustrates the shift from Portfolio A to Portfolio B on the efficient frontier chart.

What happens when alternative assets are added to the mix? In the case of Portfolio C, an efficient portfolio with a volatility of 11.17% allocates only 10% of its assets to equities —all of it to emerging markets—and none to U.S. bonds. In contrast, there are large allocations to real estate, real estate investment trusts (REITs), and venture capital, with additional commitments to commodities and private equity.

Portfolio C's beta is 0.44—below the 0.65 beta of Portfolio A. Although Portfolio C's overall expected return and Sharpe ratio are attractive when compared with those of other portfolios, the model's almost complete reliance on alternative asset classes is based on inputs (i.e., expected asset class returns) that may or may not be borne out in the future.

To illustrate the change from Portfolio B to Portfolio C, Exhibit 4 shows the complete set of asset classes. Portfolio C is allowed to include alternatives, and therefore in Exhibit 4 it lies on a new efficient frontier above Portfolio B.

As previously noted, when starting with a baseline portfolio containing a small number of fairly well-defined assets, adding (or taking away) one asset class is relatively straightforward. However, if the allocation process begins with a much larger number of asset classes, the effect of adding or removing an asset class may not be obvious.

EXHIBIT 2: EFFICIENT PORTFOLIOS A,B,C

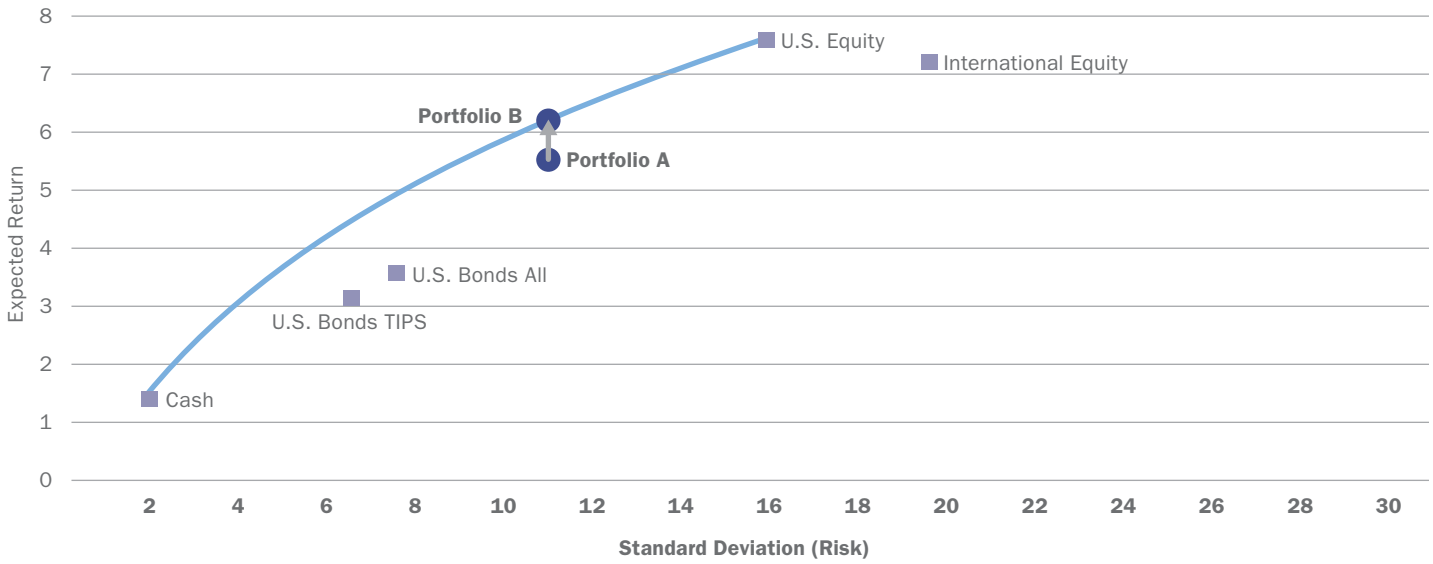
	A	B	C
U.S. Equity	60	45	0
International Equity	–	18	0
Emerging Mkt Equity	–	–	10
Absolute Return	–	–	0
Equity Hedge Funds	–	–	0
Venture Capital	–	–	24
Private Equity	–	–	8
REITs	–	–	31
Real Estate	–	–	20
Commodities	–	–	7
U.S. Bonds All	40	37	0
Cash	0	0	0
Expected Return*	5.85	5.95	8.19
Beta-Based Structural Alpha	0.67	0.88	4.30
Standard Deviation	11.17	11.17	11.17
Sharpe Ratio	0.52	0.53	0.73
Beta	0.65	0.64	0.44

* Expected returns are calculated using mean-variance analysis. Optimizer results involving alternative assets may be highly sensitive to changes in the input assumptions.

In cases where zero appears for an asset class, the model was allowed to consider the asset, but the efficient portfolio assigned a zero weight to it. In cases where no number appears, it means the model was not allowed to consider the asset in the optimization.

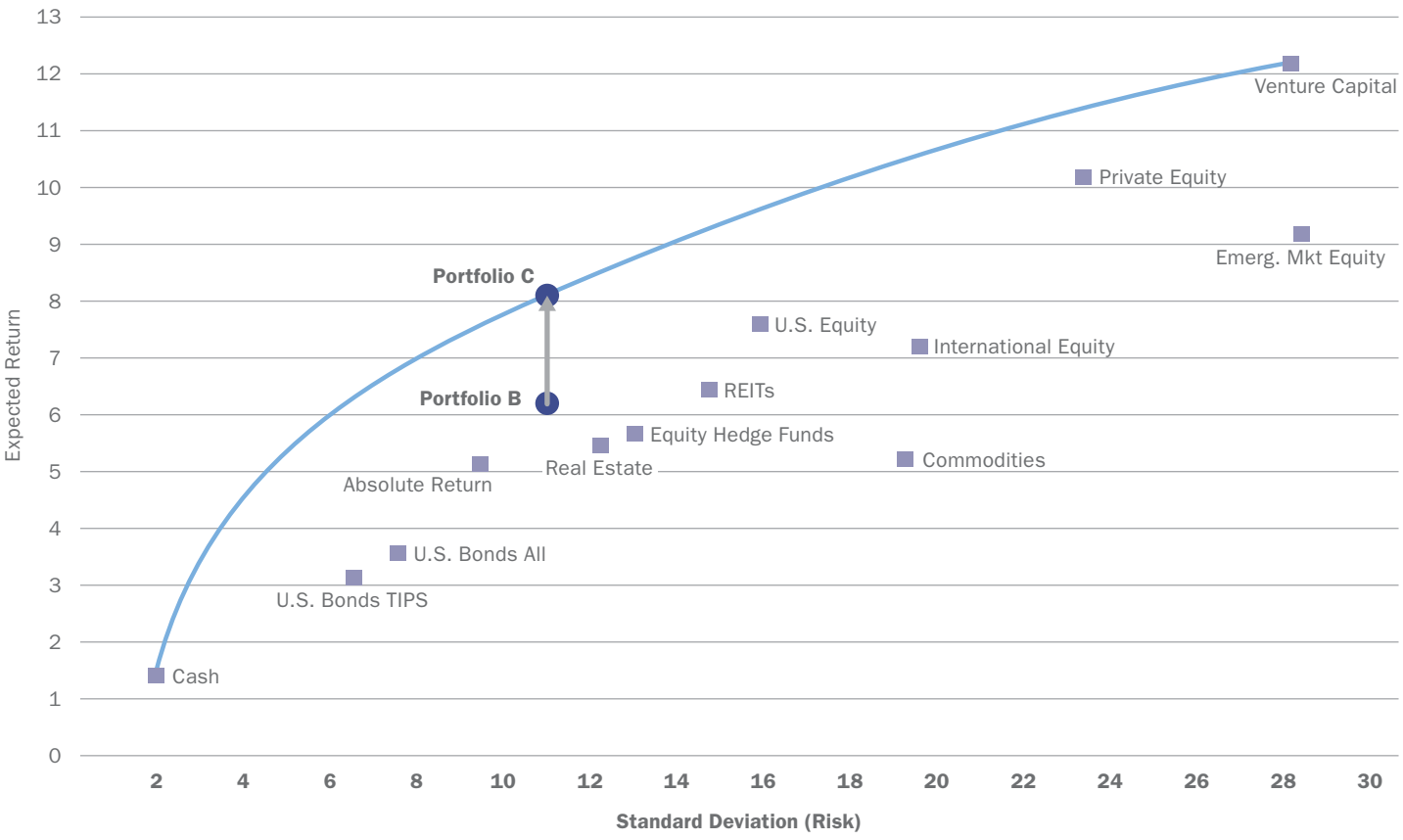
Source: TIAA-CREF Asset Management

EXHIBIT 3: EFFICIENT FRONTIER WITH BASIC ASSET CLASSES (PORTFOLIO B)



Source: TIAA-CREF Asset Management

EXHIBIT 4: EFFICIENT FRONTIER WITH FULL RANGE OF ASSET CLASSES (PORTFOLIO C)



Source: TIAA-CREF Asset Management

Even if there is a high degree of confidence in the stability of the inputs and in the modeling, it may not always be possible—or desirable—to gain access to alternative assets in the proportions indicated by a formal model. Recall that Portfolio C assigns just under 25% of its total assets to venture capital, more than 30% to REITs, and nothing to equity or hedge funds.

These recommended allocations could easily give an investment committee heartburn, because the institution may not wish to make such deep commitments to some alternative assets while leaving out others altogether.

Or, in the case of small and mid-size institutions, the investment staff may not be able to gain sufficient access to high-quality managers or other resources to build confidence in the expected returns.

In other words, no institution can afford to be overly model-driven, especially when including illiquid and uncertain submarkets such as those typified by many alternative assets. Thus, a model that optimizes all asset classes together or adds new asset classes one-by-one to the mix may not provide an institution with sufficient confidence in the stability of its overall portfolio.

REVERSE ASSET ALLOCATION: A CONCEPTUAL SHIFT WITH PRACTICAL IMPLICATIONS

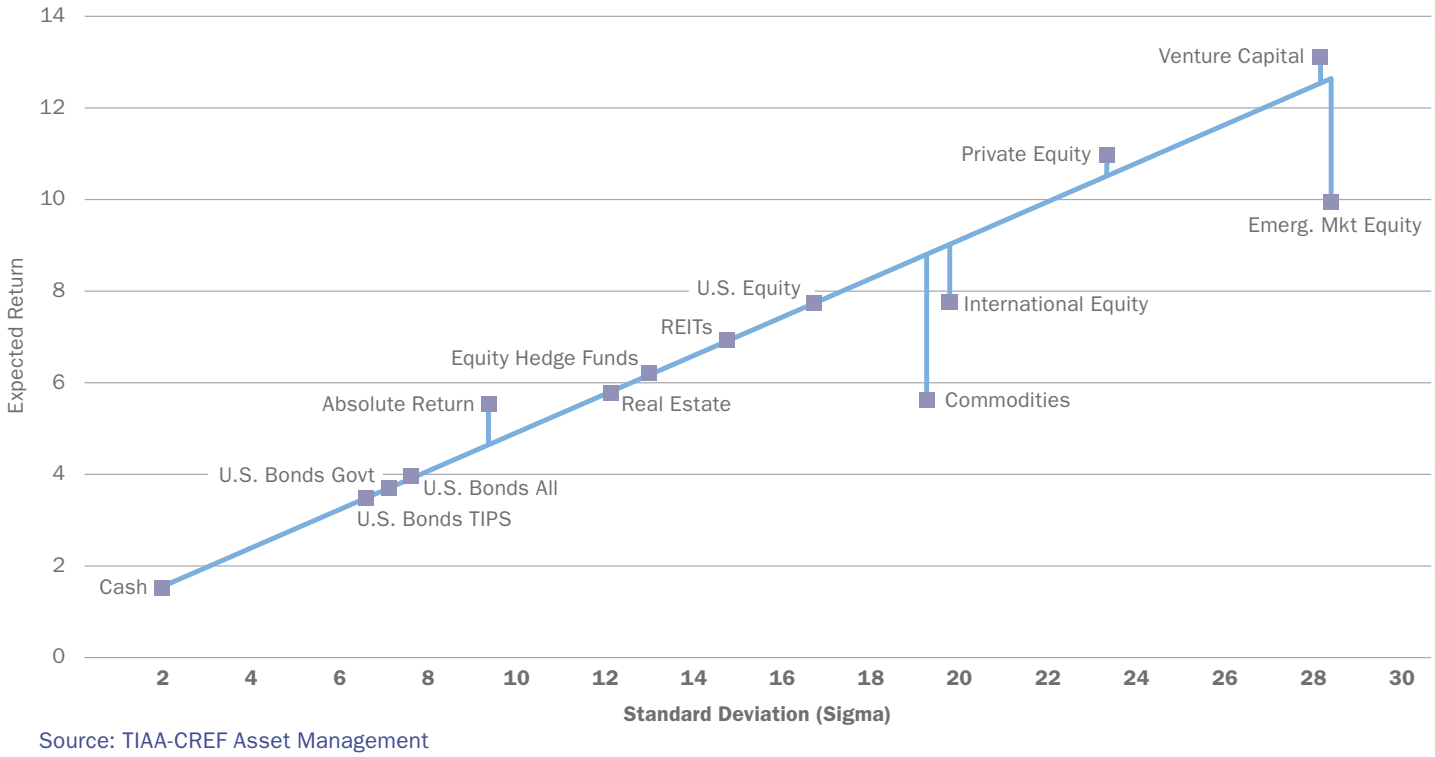
Reverse asset allocation involves three steps:

1. making a conceptual shift that reverses the role of alternative assets in a diversified portfolio;

2. setting targets or upper limits for allocations to alternative assets; and

3. using traditional asset classes (equities and fixed income) to control overall expected portfolio volatility.

EXHIBIT 5: EXPECTED RETURNS AND THE SIGMA LINE



Source: TIAA-CREF Asset Management

Step 1: Making a conceptual shift.
Rather than thinking of alternatives as asset classes that should be *added* to an already existing portfolio of traditional equity and fixed-income assets, the institution can view alternatives as the core assets to which equities and fixed income are added to achieve or *complete* the desired overall set of portfolio characteristics (e.g., expected risk and return). This conceptual shift can be justified based on the understanding that alternatives provide the potential for an asset-based return alpha with low correlation to traditional asset classes.

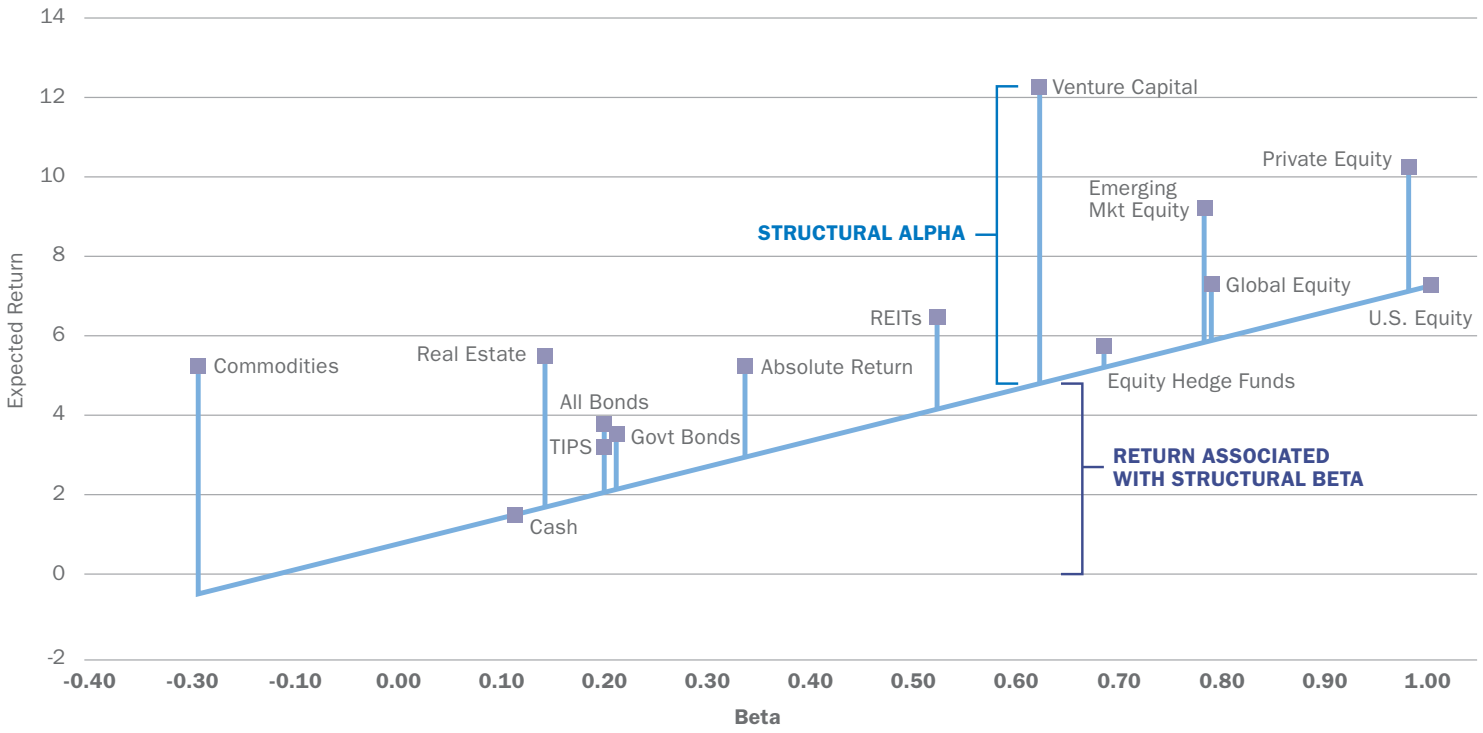
Consider the expected asset returns and volatilities plotted in Exhibit 5, along with a line connecting cash and U.S. equities. Not surprisingly, most asset classes lie very close to the line, reflecting the well-accepted wisdom that the overall market is relatively efficient—i.e., that an asset class that offers the opportunity for additional return will also entail a proportional amount of additional risk.

In this framework, it is not possible over the long run to achieve a return/risk tradeoff much above the line at the asset-class level. Instead, modern portfolio theory calls for the formation of a portfolio of assets that have low correlations or covariances, an action that will push the portfolio risk and return above and/or to the left of the line.

But what happens when the same asset classes are revisited from a different perspective? In Exhibit 6, the vertical axis still represents the expected rate of return, but the horizontal axis now measures the *beta* of each asset class—rather than the standard deviation (expected volatility), as is typically the case.

Beta is usually understood as a measure of an asset's volatility relative to the volatility of U.S. equities as a whole. In other words, for any change in the return of U.S. equities, how much will the other asset's return change? In Exhibit 6, all of the asset class returns lie above the equity-cash beta line. For any asset class, the distance from the horizontal axis to the line represents the return due to what can be called a *structural* beta for that asset class. In turn, the distance above the line represents a beta-based *structural* alpha that potentially could be achieved by investing in that asset class instead of in equities [Leibowitz 2005, Leibowitz and Bova 2004].

EXHIBIT 6: STRUCTURAL ALPHAS AND THE BETA LINE



Source: TIAA-CREF Asset Management

For example, of a total expected return for venture capital of about 12%, the lower bracket shows just over 4% associated with the asset's beta, and the upper bracket shows a beta-based structural alpha of just under 8%. The structural alphas and betas for each asset class are shown in Exhibit 6. Using this information, an institution could construct model portfolios using these asset classes to determine the total portfolio's expected return.

This approach highlights an important element in the attractiveness of alternative assets. Despite the uncertainty associated with the future behavior of alternatives, the existence of beta-based structural alphas for these asset classes suggests that exposure to them can add risk-adjusted value to an institutional portfolio.

The existence of structural alpha may be due to illiquidity, imperfect information, asset accessibility, and other systematic factors. Note that these structural, asset-class alphas are different from any additional alpha that might be added through an active manager's selection of individual securities, sectors, or styles. (This distinction does not address the debate about whether, in the case of some alternative investments, the investor receives, instead of an alpha, a disguised or hidden beta-based return.)

For example, the summary numbers previously shown in Exhibit 2 reflect the effects of the individual structural asset-class alphas and betas on each portfolio. In essence, each *portfolio* has its own beta and beta-based structural alpha, reflecting the structural betas and structural alphas of the assets that the portfolio contains. Note that Portfolio C has an attractive portfolio-level alpha but is less "stock-like" in its behavior (i.e., it has lower beta) than Portfolios A and B.

From a practical standpoint, if the possibility of obtaining structural alpha is attractive, then an institution may wish to start its portfolio construction process by selecting a desired set of alternative assets with a beta-based structural alpha target in mind and then using equities and fixed income to complete the portfolio to meet portfolio beta and other overall risk guidelines. (Of course, in addition to structural alpha, an institution could also look to its investment managers to add active alpha in one or more asset classes. In combining structural and active alpha approaches, however, an institution must be vigilant to ensure that active managers do not deliberately or inadvertently raise the beta of the asset class or the portfolio.)

The special characteristics of alternatives—especially their lower liquidity and behavioral unpredictability relative to traditional assets—suggest the need for limits in implementing a structural alpha approach. For example, given the illiquidity of many alternative assets, an institution will be less able to rely on alternatives for shorter-term income or cash flow needs. Setting appropriate targets that reflect these characteristics is the second step in the reverse asset allocation process.

Step 2: Setting targets or upper limits for alternatives. Limits should be established for alternatives as a whole and for each asset class within the alternative category. For example, an institution might assign an overall target or limit to the institution's commitment to alternatives, one that balances investment return with other needs. An overall target that falls anywhere between 20% and 60% of the portfolio could be appropriate, depending on the institution's previous experience with alternatives, the market outlook, the nature of each asset class to be included, the institution's assessment of uncertainty and risk, income needs, and other liability considerations.

In addition to an overall target, the institution may set targets or limits for individual alternative asset classes. Regardless of the allocation that a formal optimization model might assign to an individual asset class, the issues of illiquidity and uncertainty may preclude excessive exposure to any one alternative asset. For example, without limits on individual asset classes, if an institution were to instruct the optimizer to assign between 20% and 60% to alternatives using the assets shown in Exhibit 1, the resulting portfolio would allocate nearly all of this to venture capital (which has an alpha of 7.47 and a beta of 0.59).

To prevent such an outsized allocation, a general rule might limit any one alternative to not more than 5% or 10% of the portfolio's total assets. Another possibility would be for the investment committee and chief investment officer to assess and assign a separate target for each individual asset class. The objective would not be to assign precise numbers for risk and return to each individual alternative asset class for the purposes of portfolio optimization. Instead, the institution could set some targets for individual assets and

an overall target allocation for alternatives in general. The overall target would be the bundle of alternatives that form the core of the institutional portfolio.

Step 3: Using traditional assets as completion elements. The reverse asset allocation process is completed by adding equities and fixed income to control overall expected portfolio volatility. This step involves considerable analysis, but a simplified example shows how the addition of equities and fixed income to the bundle of core alternatives affects the portfolio's expected standard deviation and beta.

To do this, Exhibit 7 shows three broad types of portfolios. The first two are Portfolios B (traditional asset classes) and C (traditional asset classes plus alternatives). The third type is represented by Portfolios D through G, which hold multiple alternative asset classes in equal weights along with varying combinations of traditional assets.

Note that in Portfolio C, the optimizer chooses only alternative asset classes, despite the availability of traditional assets. In Portfolio B, the structural alpha is a modest 0.88, and the portfolio beta is 0.64. In Portfolio C, the structural alpha climbs to an impressive 4.30, but the portfolio beta drops to 0.44, well below the level that many institutions would consider acceptable. Moreover, Portfolio C contains no traditional asset classes. It is quite possible that, in the current environment, some actual institutional portfolios resemble Portfolio C, but it is unlikely that many institutions could tolerate the exclusion of traditional fixed income or equities from their long-term allocations altogether.

EXHIBIT 7: EFFICIENT PORTFOLIOS B–G*

	B	C	D	E	F	G
U.S. Equity	45	0	40	37	34	30
International Equity	18	0	12	10	8	5
Emerging Mkt Equity	–	10	3.75	5	6.25	7.50
Absolute Return	–	0	3.75	5	6.25	7.50
Equity Hedge Funds	–	0	3.75	5	6.25	7.50
Venture Capital	–	24	3.75	5	6.25	7.50
Private Equity	–	8	3.75	5	6.25	7.50
REITs	–	31	3.75	5	6.25	7.50
Real Estate	–	20	3.75	5	6.25	7.50
Commodities	–	7	3.75	5	6.25	7.50
U.S. Bonds All	37	0	18	13	9	5
Cash	0	0	0	0	0	0
Expected Return	5.95	8.19	6.69	6.89	7.07	7.23
Beta-Based Structural Alpha	0.88	4.30	1.56	1.80	2.05	2.31
Standard Deviation	11.17	11.17	11.17	11.17	11.17	11.17
Sharpe Ratio	0.53	0.73	0.60	0.62	0.63	0.65
Beta	0.64	0.44	0.65	0.64	0.63	0.61

* **PORTFOLIO COMPOSITION:**
- **B** U.S. Equities, International Equities, U.S. Bonds, Cash
- **C** All Asset Classes
- **D** 30% to Alternatives
- **E** 40% to Alternatives
- **F** 50% to Alternatives
- **G** 60% to Alternatives

Some allocations may not add up to 100% due to rounding. Source: TIAA-CREF Asset Management

Allocations such as those shown in Portfolios D through G, however, provide scenarios that are potentially more realistic for an institutional investor. For example, Portfolio G, which assigns 60% of its total assets to alternatives, offers an extremely favorable picture. Relative to Portfolio E, Portfolio G has a lower beta, higher structural alpha, higher Sharpe ratio and higher expected return. Portfolio G's characteristics are also an improvement over their counterparts in the traditional Portfolio B. Despite the attractive characteristics of Portfolio G, a cautionary question for any institution is whether a commitment of 60% to alternative assets is appropriate.

Depending on the desired target allocation to alternatives as a whole, an institution could work its way through some of the uncertainties about contemporary asset behavior and formulate defensible portfolios by using Portfolios D–G or variations on them.

CONCLUSION

These illustrations of institutional asset allocation, while highly stylized and overly simple, show how an institution could construct defensible portfolios with attractive expected return and risk characteristics using alternative assets.

The steps of the reverse asset allocation process described in this paper acknowledge both the attractiveness of alternative assets and the degree of unpredictability associated with using alternatives in an asset allocation framework. The attractiveness lies in the potential for obtaining a beta-based structural alpha from alternative asset classes and in the relatively low correlations between alternative and traditional asset classes. These factors allow an institution to make an allocation to alternatives while retaining a commitment to equities and fixed income.

There are at least two practical implications of using such an approach to formulate a portfolio. One, it provides a rationale and a process for including alternatives in institutional portfolios. Two, and perhaps more important, it suggests a quantitative and nonquantitative logic for limiting or targeting the use of alternatives to reflect both the level of experience of these assets and some of their special characteristics (e.g., relative illiquidity). Reverse asset allocation is a unique approach for institutions seeking ways to direct a commitment to alternative assets in order to gain broader exposure while limiting risk.

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730 Third Avenue
New York, NY 10017-3206
(212) 490-9000 Ext. 7183
www.tcasset.com

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