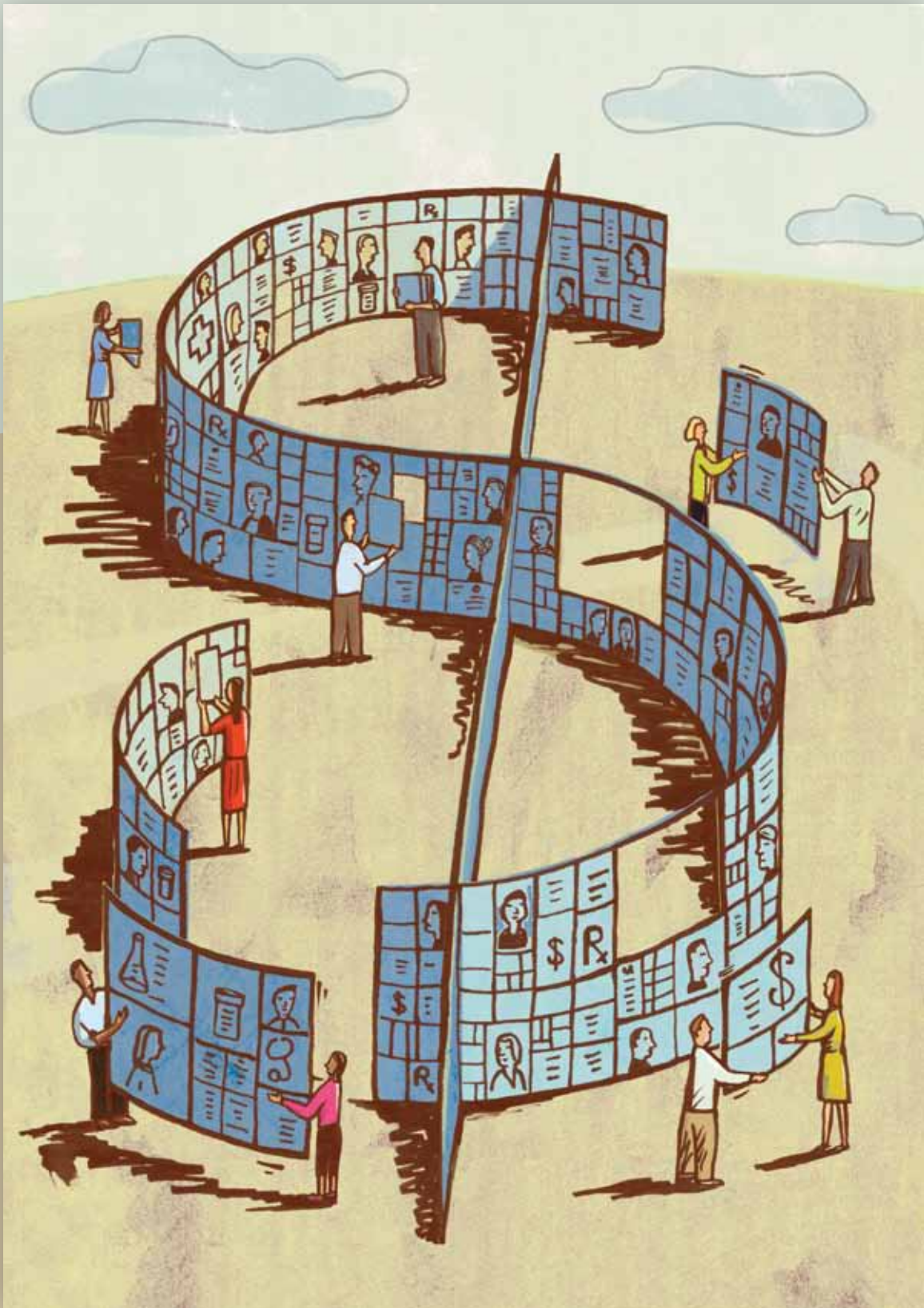




MEASURING THE PERFORMANCE OF MODERN PUBLIC FUNDS INVESTMENT PORTFOLIOS

BY CHRISTOPHER H. DANIEL

The optimal investment of public funds for all types of portfolios and needs is grounded in the principles of safety, liquidity, and return. Governments aim to ensure that their constituent funds are safeguarded, that sufficient cash is on hand to meet obligations, and that cash assets earn a reasonable return. These three strategic principles must work in balance.

GFOA's best practices recommend that governments develop expected outcomes for their public funds investment programs. This article provides an overview of how best to develop benchmarking and performance measurements for types of investment funds used by governments.

THE TWO-PORTFOLIO APPROACH

The default public funds investment approach is often to establish separate cash/investment accounts for each primary type of governmental fund. In most cases this practice isn't required, and it results in inefficient investment management. Instead, a government can commingle its cash into an investment portfolio, leaving it to accounting staff to track the governmental fund cash balances. This approach permits the investment manager to strategically invest cash in accordance with two primary mandates, liquidity assurance and risk-managed return enhancement.

The two-portfolio approach can help ensure sufficient liquidity and a risk tolerance-based foundation, while managing the investment program as a value-added business unit.

Investing for Cash Flow/Liquidity Needs. A government can ensure liquidity and an understanding of cash flow needs to meet obligations by creating a liquidity portfolio and setting aside an amount equal to the government's expected net drawdown over the operating cycle, plus a cushion of an additional 10 to 20 percent. (See Exhibit 1 for an example of fund balance analysis.) Although the primary focus of this portfolio should be cash placement in stable-value instruments that offer immediate or T+1 cash conversion to meet near-term obligations, basic risk and return objectives for liquidity money should be established as well. These can be couched in terms of collateral requirements, placement

concentration limits, short-term Treasury performance benchmarks, and others.

Intermediate-Term Investing. The residual and typically larger portfolio, often referred to as the core investment portfolio, can be managed more like an intermediate-term investment pool, notwithstanding statutory constraints and the overriding realization that core funds remain a contingent source of cash should liquidity portfolio funds be insufficient. To that end, and given that every investment opportunity carries some level of risk, public funds performance measures must be calculated and stated on a risk-adjusted basis. Let's briefly discuss the risk components, then the return measures, followed by how to combine these concepts and then compare them to a yardstick (benchmark) so we'll know if we're performing well or not.

Defining Risk (Safety). Let's define and briefly discuss the most prominent types of risk the public funds investment manager will encounter:

■ **Total Risk.** The total of all sub-risks encountered. It's represented statistically as standard deviation, or the square root of variability (variance) based on the assumption of a normal distribution of returns. Total risk is best managed by a strategic asset allocation approach, whereby the investable sectors or asset classes are "optimized" to create an "efficient frontier" of portfolios that provide the asset mix most likely to earn the highest return for the level

of total risk assumed — or, alternatively, offer the lowest total risk portfolio for the desired return.

■ **Interest-Rate Risk.** The exposure of fixed-income portfolios to changes in market value based on the movement of market interest rates. This risk is best managed using duration targets.

■ **Credit Risk.** The likelihood that a fixed-income investment will default due to inability of the issuer to pay principal and interest. Credit analysis and some level of investment in "risk free" Treasury and similar, yet not risk-free sectors such as U.S. Agency securities is helpful in mitigating this risk.

■ **Systematic Risk.** This is the non-diversifiable risk of the investable markets, although it is typically referenced

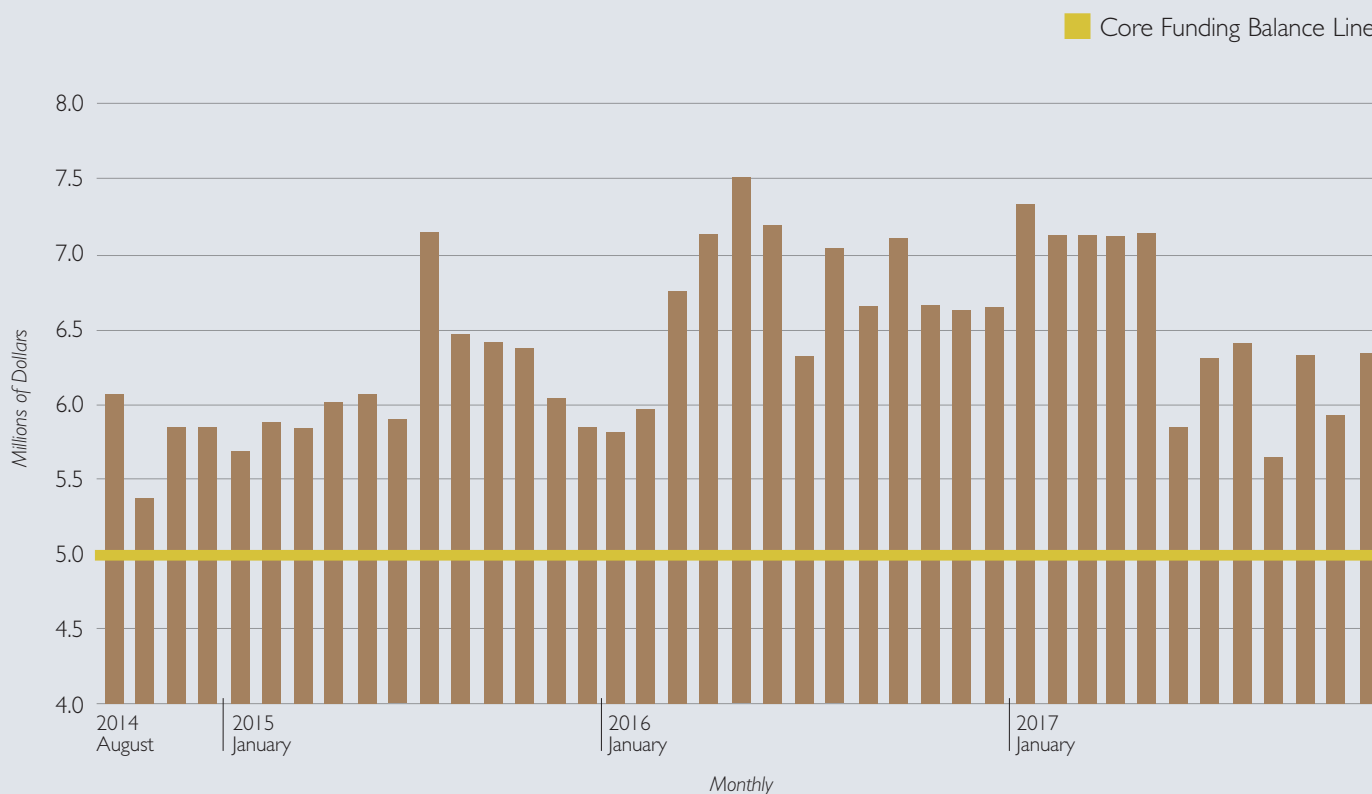
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Exhibit I: Example of Fund Balance Analysis

Annual Historical Summary

	Fiscal Year	
	2016	2017
Average Balance	\$649,825,251	\$684,376,674
Maximum Balance	\$752,303,160	\$734,493,610
Minimum Balance	\$581,605,250	\$586,365,723
Variance High to Low	\$170,697,910	\$148,127,887
Core Fund Size	\$500,00,000	
Average TTL Fund Previous Year	\$684,376,674	
	Liquidity Range	
	Average Liquidity Difference	Low High
	\$184,376,674	\$86,365,723 \$234,493,610

Historical Total Fund Balances



in regard to equity portfolios. Its inverse, non-systematic (idiosyncratic) risk — often referred to as concentration risk — can be eliminated through proper diversification of issuers, sectors, and asset classes. Systematic risk is managed via risk tolerance determination, asset class optimization, and tactical asset allocation.

To create a “safety-based” public funds investment program, the government must determine its risk tolerance and govern the program based on the target total risk (standard deviation) and interest rate risk (duration) it’s willing to gain exposure to. Risk tolerance is typically determined by administering an assessment questionnaire to the investment

oversight committee. The responses to the questions (some of which may be qualitative in nature) are compiled and, using algorithms, are converted to the target total risk and duration metrics. These measures create the government's safety requirement, so it can then turn to return optimization within these parameters.

Defining Return. The most prominent return measures for governmental portfolios are yield and total return.

Liquidity Portfolio Return. Yield is a suitable measure for measuring liquidity portfolio performance, since instruments in this portfolio are of very short duration and thus have little market value fluctuation. There are many definitions of yield, including yield to maturity, yield to call, book yield, and market yield. Generally speaking, yield is calculated as interest income divided by average portfolio balance.

Core Portfolio Return. Investment yield alone is not sufficient for assessing risk and performance for the core investment portfolio performance measurement. Investment yield, as described above, measures the interest income that a portfolio generates during a given period and is useful for budgeting purposes, but overall is unreliable for decision making and assessing the risk and return characteristics of the portfolio.

Total Return. Total return should be used to measure performance of the core investment portfolio. It takes into account market value changes as well interest income. As such, it measures the true economic value of the results and portfolio level. It's calculated as: (interest income +/- gain/loss on investment value)/average market value of portfolio.

Optimization. Before return is assessed, a government must construct the core portfolio in a way that tries to ensure that it is risk/return "efficient." That is, based on the government's risk tolerance ("safety" proxy), the sectors are allocated in a manner that allows the government to reasonably pursue the highest available return and measure it. This approach is called "strategic asset allocation," which allows us to formulate the following:

- A custom benchmark.
- A basis for seeking to outperform the benchmark with our risk parameters.
- A de-emphasis of security selection in favor of asset class/sector allocation.

THE OPTIMIZATION PROCESS

While an in-depth discussion of portfolio optimization is beyond the scope of this article, an overview provides a framework for core portfolio return measurement, appraisal, and attribution.

One of the primary benefits of holding all cash assets that aren't required for immediate liquidity needs in a core investment portfolio is the ability to create an efficient portfolio. An efficient portfolio offers the highest return for a given risk exposure. To determine the array of efficient portfolios, the government determines its permissible asset classes or sectors and then chooses an index to represent each of them. Fixed-income index data for a variety of maturity buckets is available from Merrill Lynch, Barclays, and others. An example of a government's asset class universe is shown here:

- 1- to 5-year U.S. Treasuries
- 1- to 5-year U.S. bullet agencies
- 1- to 5-year municipals
- 1- to 5-year A — AAA U.S. corporates
- 1- to 5-year Treasury Inflation-Protected Securities (TIPS)

A government would obtain historical data (i.e., daily, monthly, or quarterly) for these sectors for a representative historical period, perhaps adjusting the data for outliers or the manager's own capital markets expectations. The required elements are:

- Total return.
- Total risk (standard deviation).
- Correlations between each asset class.

The correlation coefficients are the keys to the ability to combine riskier stand-alone sectors like corporates and municipals with "full faith and credit" Treasuries and GSE assets to generate higher returns while maintaining low risk. The correlation coefficients of a given fixed-income sector with other sectors, which range from -1 to +1, should be low (i.e., less than 0.75) or negative for the proposed sector to provide diversification benefits. Otherwise, the sector should be excluded from the portfolio. (See Exhibit 2 for a correlation matrix.)

Once the sectors/classes to be included in the portfolio are determined, the optimization algorithm will compute and graphically plot a line representing all efficient portfolios (total return is the Y axis standard deviation is the X axis;

Exhibit 2: Correlation Matrix

Time Period: 6/2002 -12/2007

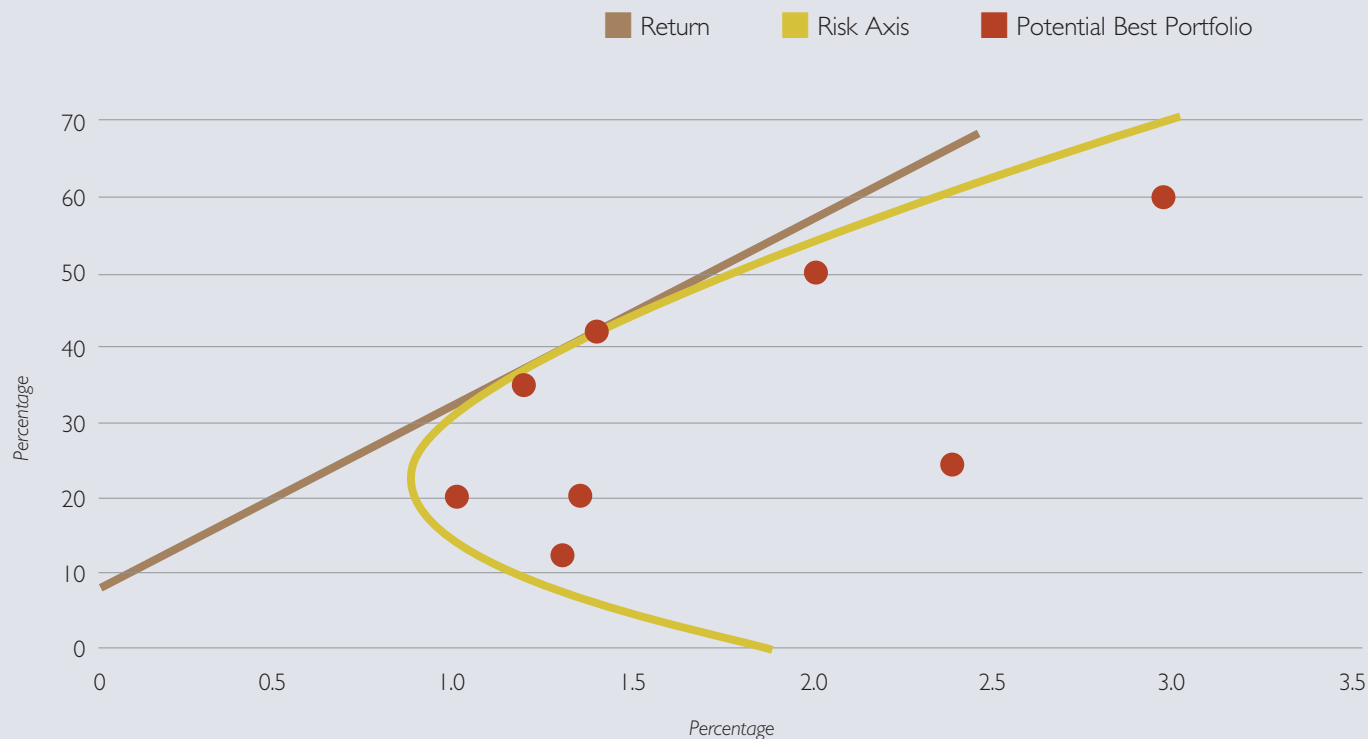
Asset Class	I-5 Year				
	U.S. Treasuries	Agency Bullets	U.S. Treasury TIPS	Year Municipals	AAA-A Corporates
U.S. Treasuries (I-5 year)	1.000				
Agency Bullets (I-5 year)	0.919	1.000			
U.S. Treasury TIPS (I-5 year)	0.507	0.562	1.000		
Municipals (I-5 year)	0.390	0.410	0.463	1.000	
AAA-A Corporates (I-5 year)	0.650	0.716	0.688	0.561	1.000

Source: Bloomberg, LP

see Exhibit 3). Based on its previously determined total risk target (i.e., 1.5 percent), the government finds the point on the line (the efficient frontier) directly above that target. That point offers a mix of assets offering the highest return

for that risk tolerance. This mix is the strategic allocation, or custom benchmark portfolio. The government can either adopt this strategic mix as its portfolio or, based on short-term capital markets expectations of market inefficiencies, slightly

Exhibit 3: Example Efficient Frontier Graph



change the asset mix to try to outperform the benchmark. As stated previously, this approach seeks to enhance returns by managing systematic risk, or market risk, at the sector level. Managing the asset mix and duration is easier and less intensive than a security selection focus.

To develop risk bands for tactical asset allocation (TAA), overlay a range of permissible mixes for each asset class. (See Exhibit 4).

BENCHMARKING AND PERFORMANCE ADEQUACY

Measuring portfolio risk and return results against appropriate market benchmarks is a technique for verifying that all investment objectives are being met and that portfolio investment returns are appropriate for the risk incurred. Comparing return to a proper benchmark or index is the preferred means for assessing performance relative to risk and investment objectives.

GFOA recommends that government investors assess their investment portfolios for performance and risk by comparing portfolio return to carefully selected benchmarks.

Any achieved return that is much greater or much less than that of the benchmark should be analyzed, since significant deviations between the return measurement and the bench-

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mark often correlate to the portfolio risk profile. To provide a valid reference for comparison of an entity's investment portfolio, select a benchmark that closely resembles policy constraints and management practice in terms of duration, maturity range, security types, sector allocations and credit quality.

The selected benchmark should be:

- **Unambiguous.** The names and weights of securities that constitute a benchmark should be clearly defined.
- **Investable.** The benchmark should contain securities that an investor can purchase in the market or easily replicate.
- **Measurable.** The benchmark's return should be calculated regularly.
- **Accountable.** Manager should be accountable for performance versus the benchmark.
- **Specified in Advance.** The benchmark should be adopted before undertaking the evaluation.
- **Reflective of Current Investment Opinions.** The manager must have knowledge of the securities in the benchmark.
- **Appropriate.** It should have a composition that is similar to the portfolio holdings.

The benchmark will typically be a widely recognized security or index, or the government may choose to use a customized benchmark consisting of a blend of measurable indexes, as described in the Optimization Process section above. The key is that performance must be compared with a relevant measure.

Liquidity Portfolio Benchmarking. For the liquidity portfolio, the public funds manager may use a global benchmark such as the 1-year Treasury bill yield for the measurement period.

Core Portfolio Benchmarking. For the core investment portfolio, factors such as target duration and the mix of asset classes and sectors in the portfolio must be considered. For example, if the portfolio is primarily a very short-term Treasury/agency mix, a 0- to 3-year agency/Treasury index may be appropriate. Alternatively, for a strategic asset alloca-

Exhibit 4: Example Risk Bands for Tactical Asset Allocation

Asset Class	Target Allocation	Permissible Range
		Percentage
U.S. Treasuries (1-5 years)	10	0-20
Agency Bullets (1-5 years)	45	30-50
U.S. Treasury TIPS (1-5 years)	5	0-10
Municipals (1-5 years)	15	5-25
AAA-A Corporates (1-5 years)	25	5-25
TOTAL ALLOCATION	100	

tion approach, a custom benchmark will be more appropriate. Consult with your advisory sources to determine the best fit.

Risk-Adjusted Performance. As stated earlier, measuring portfolio performance on an absolute return basis is insufficient, as it doesn’t take into account the level of risk assumed to achieve the results. Total return for the core portfolio, as well as for the benchmark and any other comparative results, should be measured on a risk-adjusted basis. A simple yet very informative statistic for assessing risk-adjusted return is the Sharpe ratio. The formula is: (Portfolio return — risk-free rate)/portfolio standard deviation. (See Exhibit 5.)

The Sharpe ratio can be interpreted as “units of risk-exposed return per unit of total risk assumed.” The higher the Sharpe ratio, the better the portfolio’s risk-adjusted return. Note that the manager can use a proxy such as the 90-day T-bill as the risk-free rate. Given two portfolios with an identical rate of return, the one that assumes the lower risk to achieve that

Exhibit 5: Example Analysis of Sharpe Ratio Comparisons

Time Period: 6/30-2016-12/31/2017
.50 percent risk free

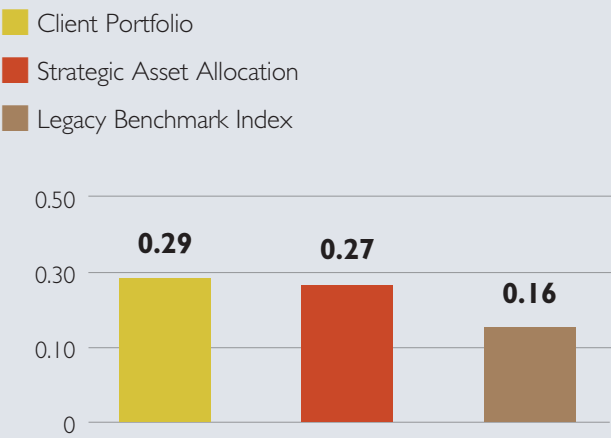


Exhibit 6: Example of Ongoing Tracking of Past Strategy to New Strategic Asset Allocation Models

	Time Period			
	7/31/2014-12/31/2017	7/31/2014-12/31/2017	7/31/2014-12/31/2017	7/31/2014-12/31/2017
	Total Periodic Return	Annualized Return	Invested Amount	Total Dollar Return
Tactical Allocation (Five Asset Classes)	4.11%	1.19%	\$500,000,000	\$20,570,000
BA/ML 0-3 Treasury Index	1.98%	0.57%	\$500,000,000	\$9,875,000
TOTAL VALUE ADDED				\$10,695,000

Source: Benchmark Asset Allocation Comparison TAA to a Historical Benchmark

return will have a higher Sharpe ratio. This concept ties back to the concept of portfolio optimization, which is a highly recommended exercise. Again, a properly conducted optimization will yield an “efficient frontier” of portfolios that will offer the highest return for a given level of risk assumed, or, alternatively, the lowest risk for a given return target.

Value Proposition of Strategy Change. As the government moves from a legacy investment strategy focused on credit risk aversion and a heavily subordinated view toward return, compare and contrast current performance to that of the legacy approach (see Exhibit 6). A straightforward and materially accurate way to do this is to compare current performance to that of the legacy benchmark (i.e., a 0- to 3-year Treasury index) on both an absolute and risk-adjusted

(Sharpe) basis. Framing the return differential on a dollar value-added basis is a great way to highlight the additional value the current strategy brings to the government.

CONCLUSIONS

Although liquidity and safety are cornerstones of a public funds investment program, constituent funds deserve optimal deployment. Balancing return on investment with safety and liquidity is essential. Properly measuring return on a risk-adjusted basis and comparing it with an appropriate benchmark helps to ensure public funds are efficiently invested. ■

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