Summit Strategies Group

Risk Analysis – Committee Report

Howard County Retirement Plans

November 2018

Cognity

Defining "Risk"

Depending on what plans want to accomplish and understand, there are a variety of ways to view and measure risk.

Portfolio risk includes traditional financial risks:

- Principal Risk
- Default Risk
- Liquidity Risk
- Capital Market Risk
- Opportunity Cost

Portfolio risk can also be based upon plan goals:

- To public plans similar to Howard County's, many identify risk as not meeting the actuarial rate of return. This trickle's down to impact:
  - Level of contributions
  - Lack of growth in benefits
  - Funding status of liabilities
- Failure to keep pace with inflation
- Failure to keep pace with peer institutions

***Investment Beliefs**: Koedijk and Slager discuss "risk"*

- While risk diversification is often-times stressed as a key investment belief of pension plans, risk management is underappreciated.
- Risk management is understanding the risks in a portfolio and managing these risks as desired.
- Risks need to be evaluated in terms of consequence and possible occurrence[1].
- Three major risks for pension plans[2]:
  - When the asset benchmark ≠ liability.
  - Tactical decisions that pull the portfolio away from policy.
  - Active management risks.
- It is important to understand which risks are rewarding and which are non-rewarding.
- Committees typically budget risk through asset allocation decisions (policy and tactical) and manager decisions (active/passive).
- "Crises are embedded within our financial system and… [investors] should exercise and train for their regular occurrence."

1. Culp, 2001.
2. Muralidahar and Asad-Syed, 2001.

Investment Risks

- There are various risks in a portfolio that aid in enhancing returns.
- Compensated Risks:
  - **Credit Risk**—As lenders, institutional investors risk loss of capital when borrowers are not able to repay loans.
  - **Interest Rate Risk/Duration**—The value of a fixed income security is directly linked to the absolute level of interest rates.
  - **Illiquidity Risk**—Due to an increased period where an investment must remain "locked-up," investors look for a premium over public investments when investing in private equity and debt.
  - **Leverage**—When an investment manager utilizes leverage, they are able to acquire additional exposure to a desired investment without having to add additional capital. The risk here is the downside scenario when the investment goes down.

When these risks are higher (on a relative basis), investors can expect higher expected returns on their investments (higher yields).

Defining Risk

Absolute Loss Potential		Relative Underperformance Potential
Performance Volatility	**Max Drawdown**	**Relative Performance Volatility**

Performance Volatility

Metric
- Standard Deviation

What It Tells You
- Historical range of periodic performance deviations
  - +/- 1 Std Dev captures 2/3
  - +/- 2 Std Dev captures 95%

Notes
- Most common risk metric
- Does not capture extreme tails

Max Drawdown

Metric
- Expected Tail Loss (ETL)

What It Tells You
- Expected "worst case scenario" periodic return (or $ amount) for an investment

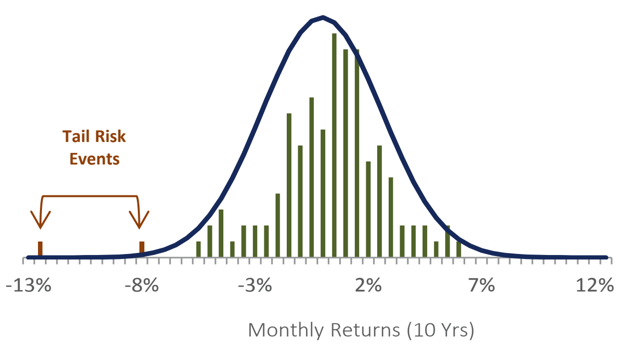
Notes
- ETL is an improvement over standard deviation and VAR
- If the loss is realized, the asset is permanently impaired

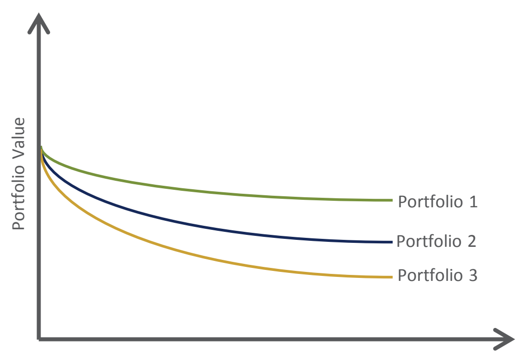
Relative Performance Volatility

Metric
- Tracking Error

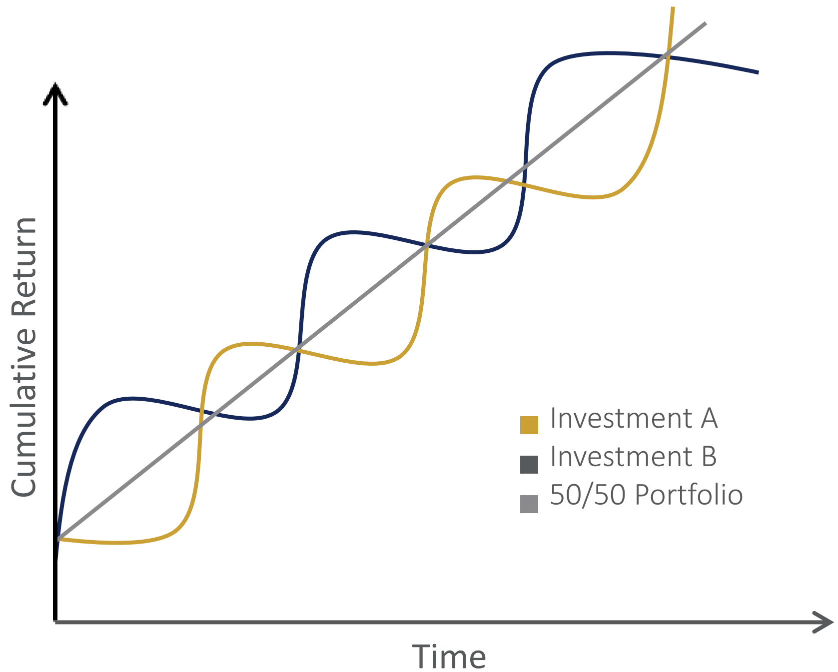
What It Tells You
- Historical range of periodic relative performance deviations vs. a benchmark
  - +/- 1 TE captures 2/3
  - +/- 2 TE captures 95%

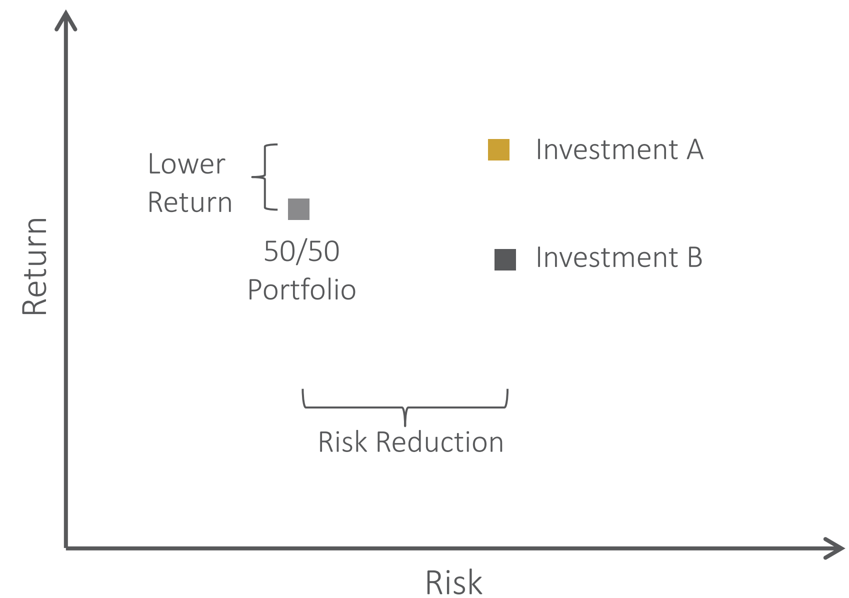
Notes
- Good proxy for the actual experience incurred versus the end result





Diversification



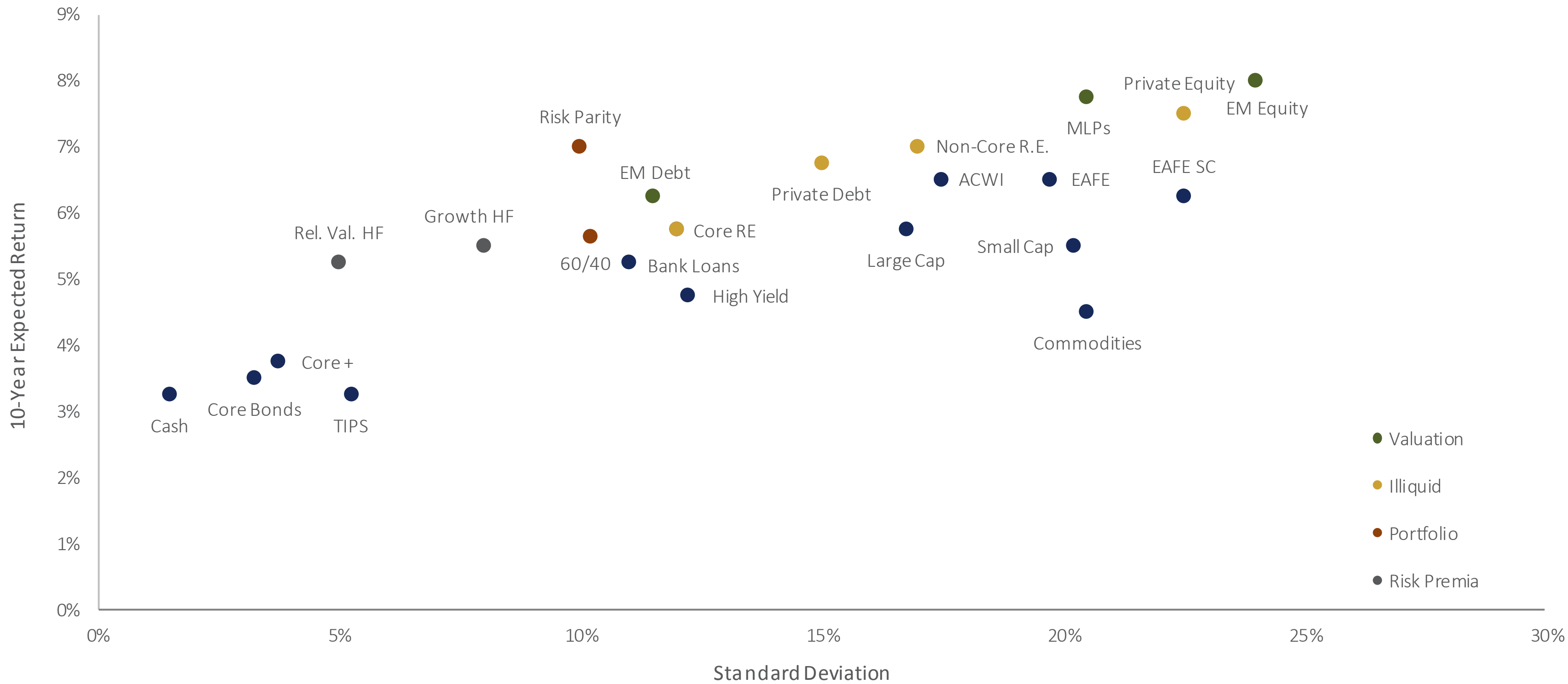


- Combining investments that have positive long-term expected returns, but are not correlated over shorter periods of time can result in a diversification benefit.
- This often provides diversified investors with a "smoother" performance ride.

- Over longer periods of time, diversification can result in significant reductions in portfolio risk.
- The consequence of diversification is that you never own enough of the best performing assets, and therefore are susceptible to hindsight bias.

Diversification benefits are only realized if investments are held through their performance cycle.

Risk/Return Relationship—Capital Market Risk

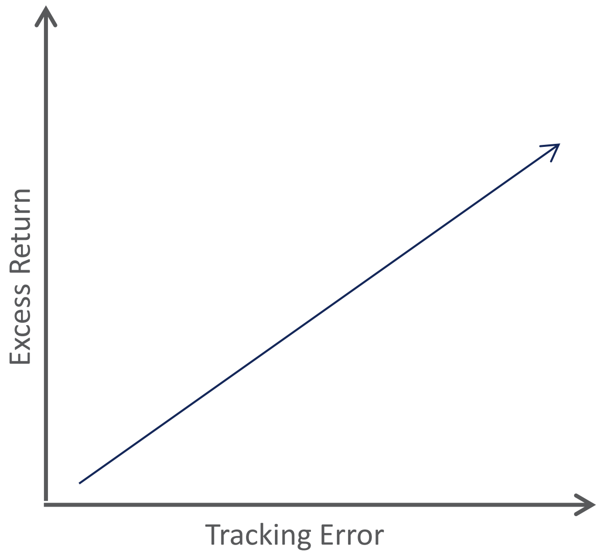


- Capital markets are priced such that investors are rewarded for taking on higher levels of risk. This is intuitive because prices are set by market forces.
- Unfortunately, this means that return seeking investors <u>must</u> take risk.
- Summit's risk management objective is to:
  - Make sure that appropriate return compensation is received for the level of risk taken.
  - Understand and measure the sources of risk – emphasizing diversification.

Note: Returns presented reflect Summit's capital market assumptions as of 9/30/2018, net of fees and volatility.

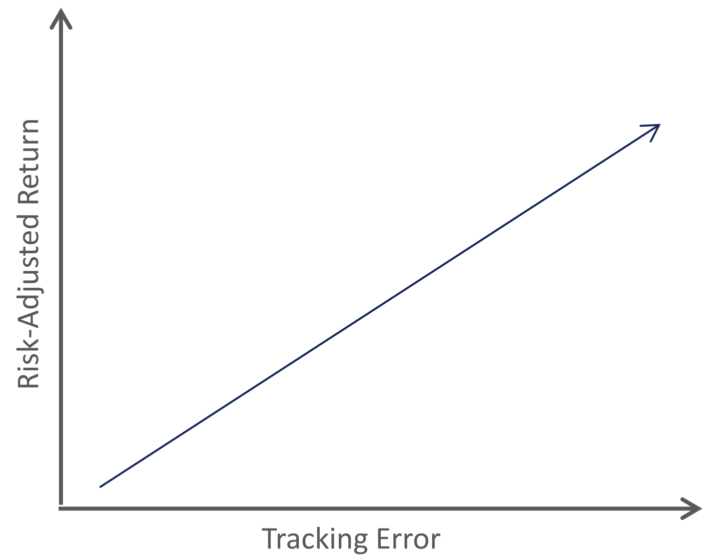
Balancing Excess Return, Risk-Adjusted Return, and Tracking Error

Enhancing Returns



- While it is theoretically possible to generate **excess returns** without taking on tracking error, it is extremely challenging in practice.

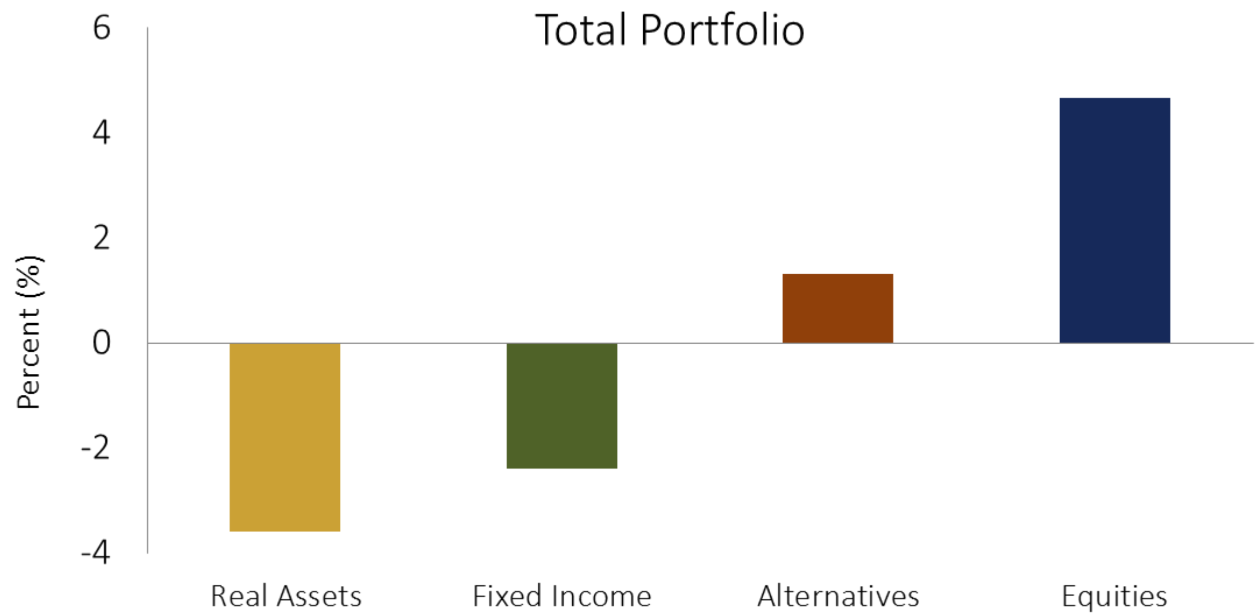
Improving Efficiency



- Increasing portfolio **efficiency** through diversification means that returns will, by design, be different.
- This adds tracking error to the portfolio.

- When designing a portfolio, relative risk should be categorized and managed based on objective.
- Examples:
  - Risk parity is expected to provide higher risk-adjusted returns, but increases tracking error.
  - Overweight to emerging markets is expected to provide excess returns, but increases tracking error.

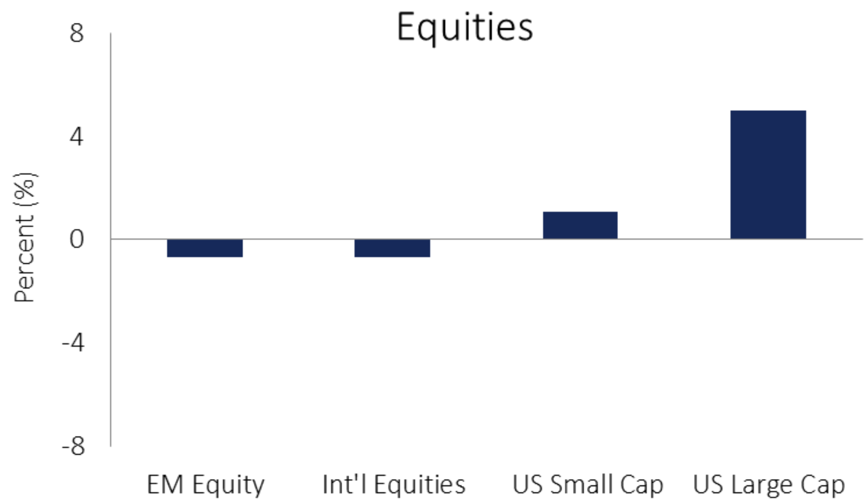
Strategy vs. Policy Portfolio Weights

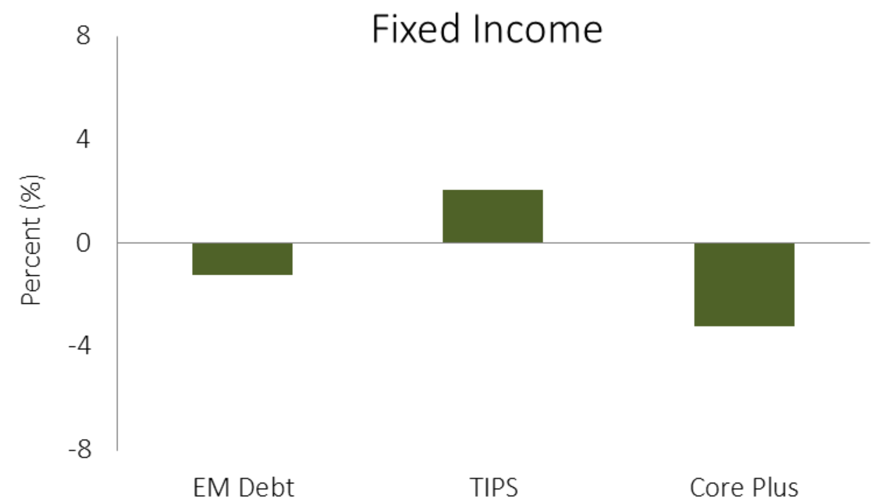


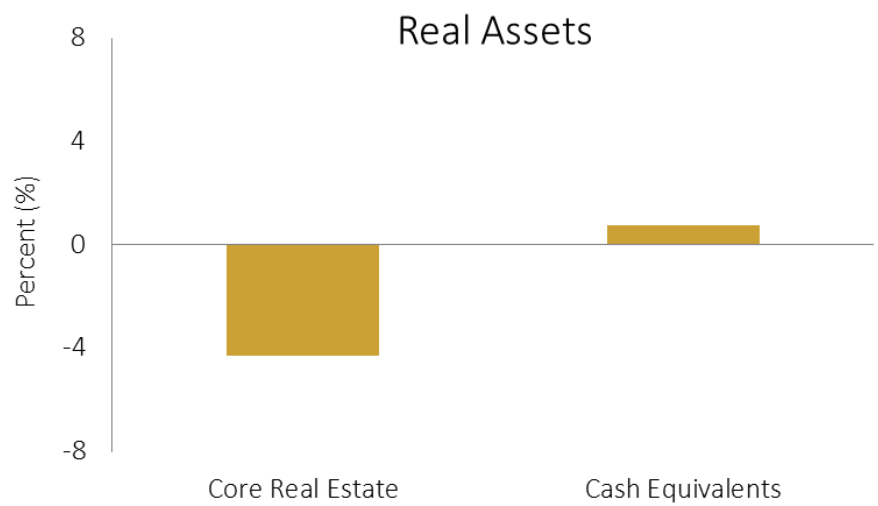
	Policy	Actual Strategy	Actual Strategy vs. Policy
Equities	**40.0**	**44.7**	**4.7**
US Large Cap	15.0	20.0	5.0
US Small Cap	5.0	6.0	1.0
Int'l Equities	13.0	12.3	-0.7
EM Equity	7.0	6.3	-0.7
Fixed Income	**30.0**	**27.6**	**-2.4**
Core Plus	25.0	21.8	-3.2
EM Debt	5.0	3.8	-1.2
TIPS	0.0	2.1	2.1
Real Assets	**7.5**	**3.9**	**-3.6**
Core Real Estate	7.5	3.2	-4.3
Cash Equivalents	0.0	0.7	0.7
Alternatives	**22.5**	**23.8**	**1.3**
Private Equity	10.0	12.4	2.4
Hedge Funds	12.5	11.4	-1.1

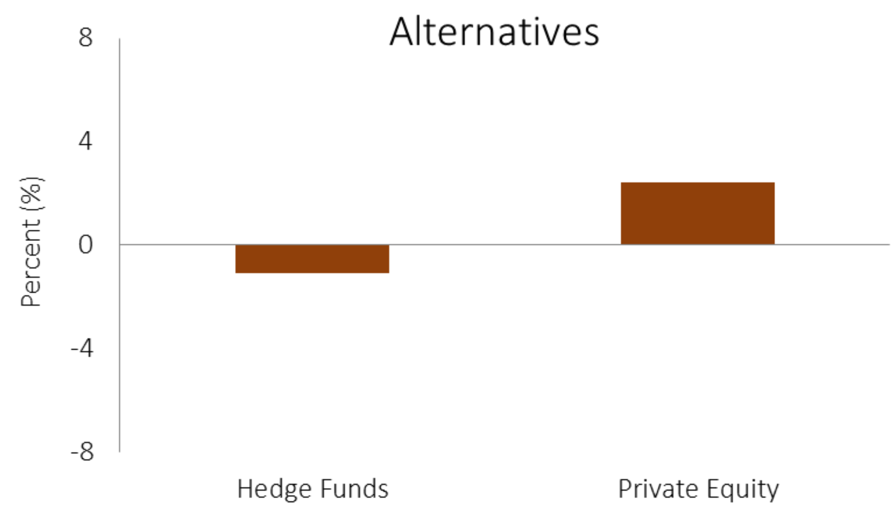
Note: Policy and strategy weights presented are as of 9/30/2018.

Strategy vs. Policy Weights Detail





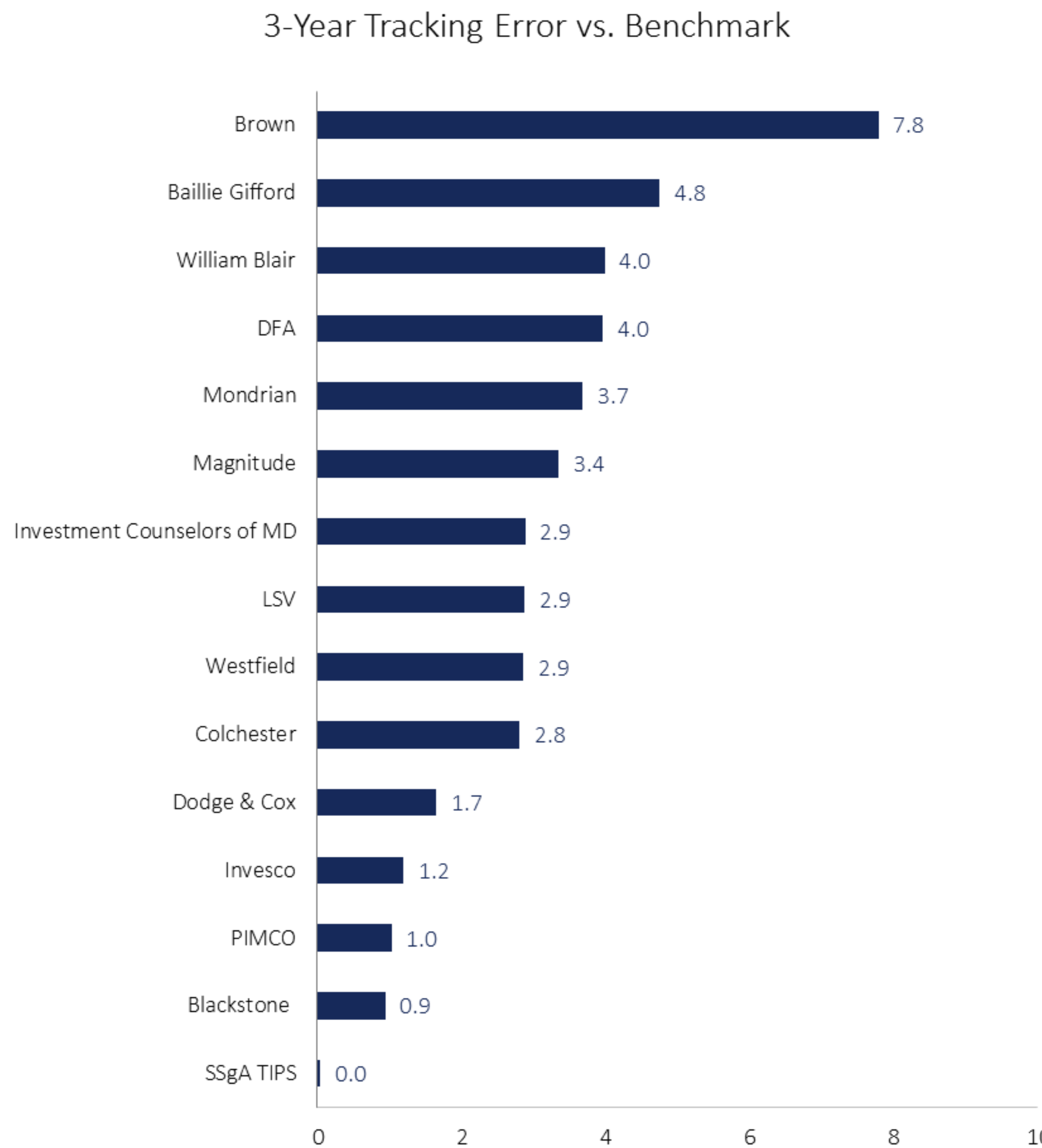




Note: Policy and strategy weights presented are as of 9/30/2018.

Implementation vs. Strategy

Manager	Benchmark
Brown	Russell 2000 Growth
Baillie Gifford	MSCI EAFE (Net)
William Blair	Russell 2500 Growth
DFA	MSCI Emerging Markets (Net)
Mondrian	MSCI EAFE (Net)
Magnitude	HFRI FOF: Conservative
Investment Counselors of MD	Russell 2000 Value
LSV	Russell 1000 Value
Westfield	Russell 1000 Growth
Colchester	JPM GBI EM Global Diversified
Dodge & Cox	Barclays Aggregate
Invesco	S&P 500
PIMCO	Barclays Aggregate
Blackstone	HFRI FOF: Conservative
SSgA TIPS	Barclays TIPS

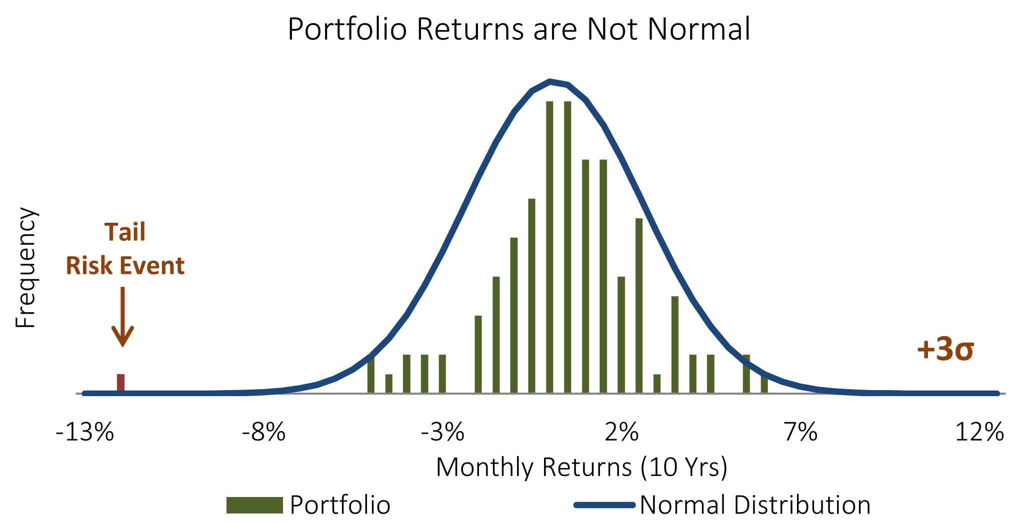


Note The data presented above includes every manager shown except real estate and private equity managers.

Tail Risk

Tail risk measures the potential losses (and gains) that result from non-normal return distributions.

In a normal distribution, 99.97% of portfolio returns are assumed to be within +/-3 standard deviations of the mean.



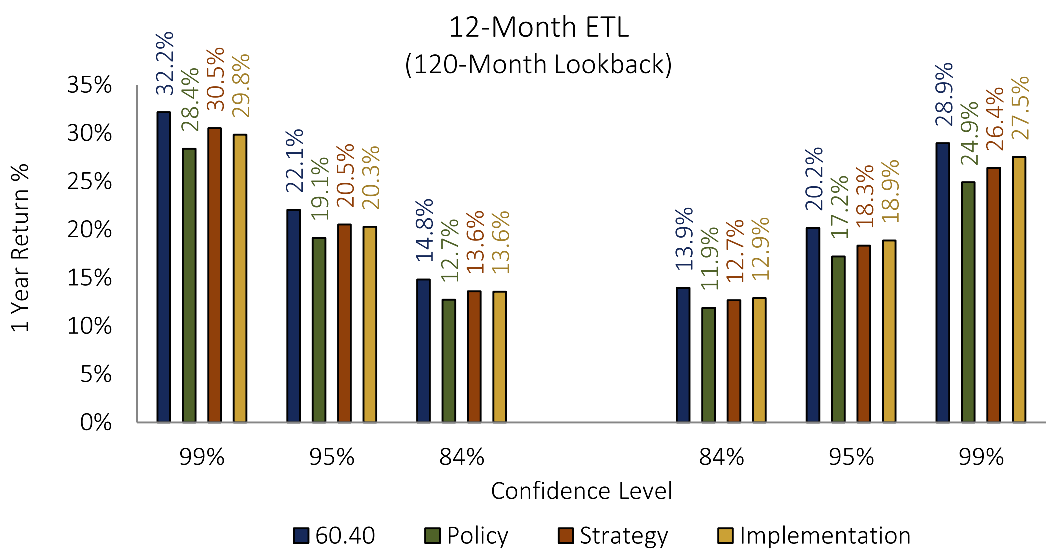
Realized portfolio return distributions may be far from "normal," however.

Expected Tail Loss (ETL) is the average expected loss at a given level of confidence.

Policy: 25% Bloomberg Barclays Aggregate, 15% S&P 500, 13% MSCI EAFE, 12.5% HFRI FOF Conservative, 10.0% Private Equity, 7.0% MSCI Emerging Markets, 7.5% NCRIEF Property Index, 5.0% Russell 2500, 5.0% JPM GBI-EM Global Diversified

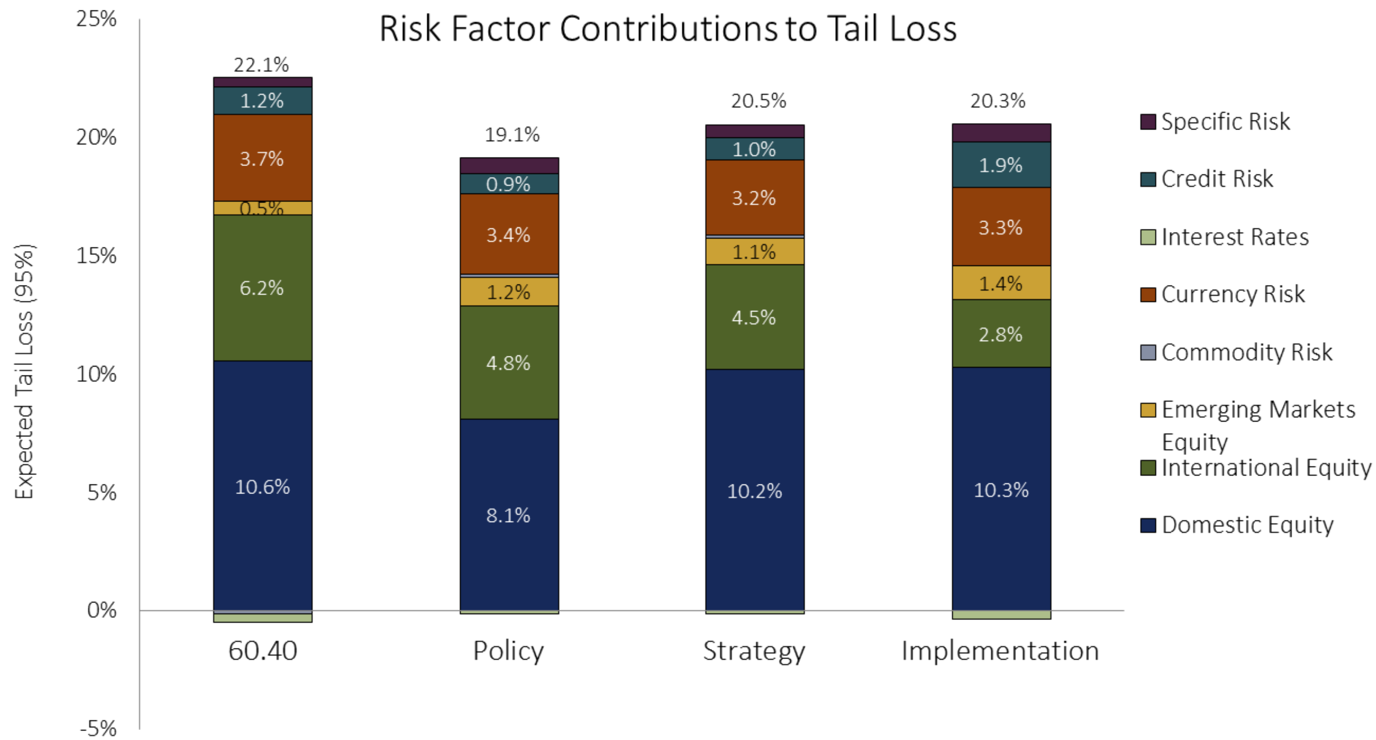
Strategy: Portfolio Benchmarks

Implementation: Actual Portfolio



Factor Analysis

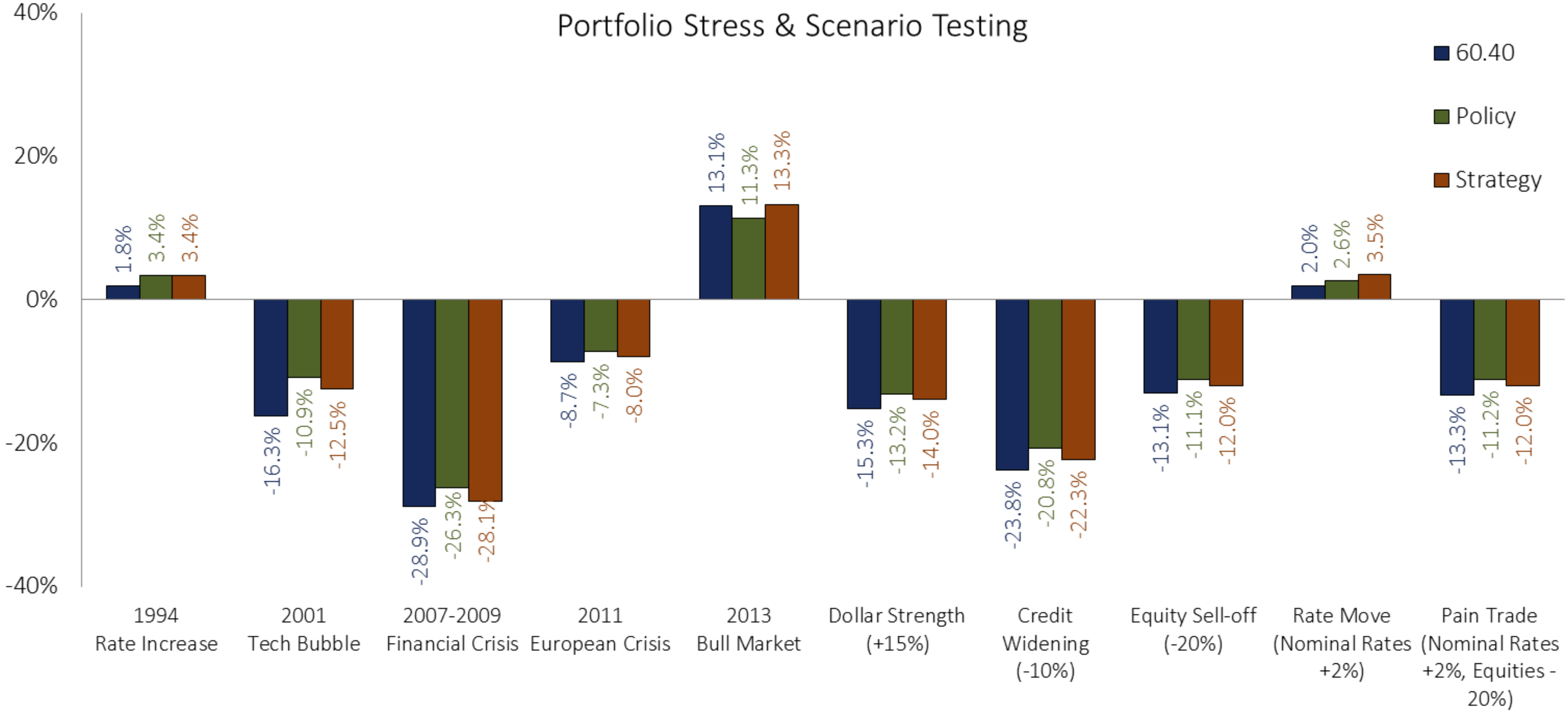
Factor Analysis identifies the factors that are contributing to tail losses.



Strategic asset allocation and implementation have a higher expected tail loss due to increased exposure to equity risk.

- **Equity Risk**—Measures the portfolio's exposure to changes in equity market values. Equity risk can take the form of US equity risk, International equity risk, and Emerging Market equity risk.
- **Commodity Risk**—Measures the portfolio's exposure to changes in the price of commodities (agriculture, energy, precious metals, industrial metals, etc.).
- **Currency Risk**—Measures the portfolio's exposure to changes in exchange rates. When international currencies depreciate relative to the dollar, international asset returns will be lower (all else equal).
- **Credit Risk**—Measures the portfolio's exposure to changes in credit spreads.
- **Specific Risk**—Measures the portfolio's exposure to risks that are "specific" to an asset, and can be diversified away.

Scenario Analysis / Stress Testing



Note: Allocations are as of 9/30/2018, manager returns are backfilled with strategy composites, and simulations are calculated on a 120-month lookback utilizing exponentially weighted moving averages.

Total Portfolio Tracking Error Versus Policy

Total Tracking Error Versus Policy	0.97%
Equity	0.61%
Fixed Income	0.23%
Real Assets	0.09%
Alternatives	0.04%

40%	Overweight/Underweight, Off-Benchmark Assets
60%	Active Management

- Expected tracking error between the total portfolio performance and Policy can be decomposed at various levels.
  - The equity assets primarily drive the tracking error.
    - The asset allocation decisions (overweight/underweight and off-benchmark assets) compared to the policy is 40% of the portfolio's tracking error.
    - Managers provide 60%.

Note: Allocations are as of 09/30/2018. Investment manager returns are backfilled with strategy composites. Tracking error is calculated based on a 36-month lookback utilizing classical factor correlations.

Total Portfolio Tracking Error Vs. Policy Detail

	Equity	Fixed Income	Alternatives
	vs. Equity Policy	vs. Fixed Income Policy	vs. Alternatives Policy
Total Tracking Error	1.5%	2.8%	1.9%
	% of Total	% of Total	% of Total
Allocations	28%	42%	94%
Active Management	78%	58%	6%

Manager Buckets	Tracking Error (%)
DFA	26%
LSV	15%
Mondrian	13%
Baillie Gifford	12%
Other	34%

Manager	Tracking Error (%)
D&C	60%
PIMCO	25%
SSgA	15%
Colchester	0%

Manager	Tracking Error (%)
Magnitude	46%
Blackstone	54%

Note: Allocations are as of 09/30/2018. Investment manager returns are backfilled with strategy composites. Tracking error is calculated based on a 36-month lookback utilizing classical factor correlations. Real assets were modeled against NCREIF.

Glossary

- Currency Risk
  - Measures the portfolio's exposure to changes in exchange rates. When international currencies depreciate relative to the dollar, international asset returns will be lower (all else equal). Currency risk increases as the allocation to (unhedged) international assets increases.
- Equity Risk
  - Measures the portfolio's exposure to changes in equity market values. Equity risk can take the form of US equity risk, International equity risk, and Emerging Market equity risk.
- Interest Rate Risk
  - Measures the portfolio's exposure to unexpected changes in the term structure of interest rates. Interest rate risk is highest for long duration fixed income assets.
- Commodity Risk
  - Measures the portfolio's exposure to changes in the price of commodities (agriculture, energy, precious metals, industrial metals, etc.).
- Inflation Risk
  - Measures the portfolio's exposure to changes to inflation expectations. Inflation risk exposure is highest for nominal fixed income assets.
- Credit Risk
  - Measures the portfolio's exposure to downgrades and defaults in fixed income assets. Credit risk exposure increases as corporate fixed income quality declines.
- Specific Risk
  - Measures the portfolio's exposure to risks that are "specific" to an asset, and can be diversified away.

Disclosures

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