Strategic Long-Term Assumptions: US Perspective
Multi-Asset Solutions

Assumptions Summary

Strategic Long-Term Assumptions: US Perspective 31Dec23

Strategic Long Term Assumptions - Forward Looking Portfolio Return and Risk - Details

Asset Class	Benchmark	Total Return	Total Risk	Sharpe Ratio
US Large Cap Equity	S&P 500 Index	7.2%	15.4%	0.28
US Small Cap Equity	Russell 2000 Index	7.8%	19.8%	0.25
Developed ex-US Large Cap Equity	MSCI EAFE Index	6.5%	13.9%	0.26
Emerging Markets Equity	MSCI Emerging Market Index	8.0%	19.1%	0.26
US TIPS Fixed Income (Series-L)	Bloomberg US Treasury Inflation-Protected Securities (TIPS) Index (Series-L)	4.8%	6.1%	0.31
US Government Long (10+Y) Fixed Income	Bloomberg US Long Government Index	5.2%	12.2%	0.18
US Aggregate Fixed Income	Bloomberg US Aggregate Index	4.3%	4.3%	0.31
US Corporate Fixed Income	Bloomberg US Corporate Index	5.1%	6.1%	0.35
US Corporate High Yield Fixed Income	Bloomberg US Corporate High Yield Index	5.5%	8.7%	0.29
Global ex-US Government Fixed Income (JPM)	JPMorgan GBI Global ex-US Index	3.9%	3.5%	0.27
Emerging Markets Debt	JPM EMBI+ Index	5.7%	8.6%	0.32
US Public Real Estate	Wilshire REIT Index	8.3%	20.8%	0.26
US Private Real Estate	Private Real Estate is modeled using unlevered public real estate and fixed income, adjusted for illiquidity	8.6%	16.5%	0.34
Broad Private Equity Portfolio	Modeled as a customized blend of Venture Capital, Large US Buyout, Small US Buyout, European Buyout, Distressed, Emerging, and Secondaries sectors.	11.8%	20.7%	0.43
Hedge Funds	Modeled as a customized blend of Event Driven, Relative Value, Equity Long/Short, and Tactical Trading Hedge Funds	6.1%	5.5%	0.57
Commodities	S&P GSCI Index	5.2%	21.3%	0.11

The long-term risk-free rate is assumed to be 2.95% herein. Risk Free Rate is calculated as Multi-Asset Solutions's forward looking expected return on cash.
US Private Real Estate, Broad Private Equity Portfolio and Hedge Funds are assumed to be actively managed. All other asset classes are passively managed.
Emerging Markets Equity is assumed to be unhedged. All other indices are hedged.
See Glossary for additional definitions.

Our long-term horizon is ten years. Expected returns are estimates of hypothetical average returns of economic asset classes derived from statistical models. There can be no assurance that these returns can be achieved. Actual returns are likely to vary. Please see additional disclosures. Alpha and tracking error assumptions reflect Multi-Asset Solutions' estimates for above-average active managers and are based on a historical study of the net-of-fee results of active management. Strategic long-term assumptions are subject to high levels of uncertainty regarding future economic and market factors that may affect future performance. They are hypothetical indications of a broad range of possible returns. All numbers reflect Multi-Asset Solutions' strategic assumptions as of 31Dec23. Please see additional disclosures. The returns presented herein are gross and do not reflect the deduction of investment advisory fees, which will reduce returns.

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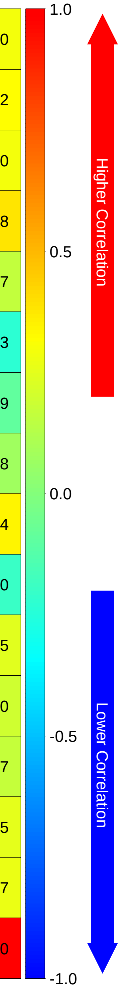
31Dec23

Total Correlation by Assets / Strategic Long-Term Assumptions

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 US Large Cap Equity	1.00	0.88	0.85	0.73	0.28	0.05	0.26	0.44	0.68	0.18	0.59	0.70	0.64	0.85	0.53	0.30
2 US Small Cap Equity	0.88	1.00	0.79	0.69	0.19	-0.04	0.17	0.36	0.68	0.09	0.52	0.72	0.64	0.81	0.52	0.32
3 Developed ex-US Large Cap Equity	0.85	0.79	1.00	0.72	0.10	-0.09	0.10	0.33	0.66	0.05	0.54	0.60	0.54	0.80	0.51	0.30
4 Emerging Markets Equity	0.73	0.69	0.72	1.00	0.28	0.00	0.23	0.45	0.67	0.05	0.64	0.56	0.52	0.69	0.47	0.38
5 US TIPS Fixed Income (Series-L)	0.28	0.19	0.10	0.28	1.00	0.68	0.80	0.74	0.37	0.61	0.58	0.38	0.41	0.19	0.22	0.17
6 US Government Long (10+Y) Fixed Income	0.05	-0.04	-0.09	0.00	0.68	1.00	0.89	0.67	0.00	0.77	0.37	0.20	0.25	0.03	0.04	-0.23
7 US Aggregate Fixed Income	0.26	0.17	0.10	0.23	0.80	0.89	1.00	0.88	0.30	0.79	0.60	0.37	0.41	0.20	0.17	-0.09
8 US Corporate Fixed Income	0.44	0.36	0.33	0.45	0.74	0.67	0.88	1.00	0.60	0.66	0.76	0.50	0.54	0.37	0.32	0.08
9 US Corporate High Yield Fixed Income	0.68	0.68	0.66	0.67	0.37	0.00	0.30	0.60	1.00	0.14	0.72	0.65	0.61	0.59	0.45	0.34
10 Global ex-US Government Fixed Income (JPM)	0.18	0.09	0.05	0.05	0.61	0.77	0.79	0.66	0.14	1.00	0.42	0.29	0.32	0.14	0.10	-0.20
11 Emerging Markets Debt	0.59	0.52	0.54	0.64	0.58	0.37	0.60	0.76	0.72	0.42	1.00	0.58	0.58	0.53	0.38	0.25
12 US Public Real Estate	0.70	0.72	0.60	0.56	0.38	0.20	0.37	0.50	0.65	0.29	0.58	1.00	0.90	0.61	0.45	0.20
13 US Private Real Estate	0.64	0.64	0.54	0.52	0.41	0.25	0.41	0.54	0.61	0.32	0.58	0.90	1.00	0.60	0.41	0.17
14 Broad Private Equity Portfolio	0.85	0.81	0.80	0.69	0.19	0.03	0.20	0.37	0.59	0.14	0.53	0.61	0.60	1.00	0.47	0.25
15 Hedge Funds	0.53	0.52	0.51	0.47	0.22	0.04	0.17	0.32	0.45	0.10	0.38	0.45	0.41	0.47	1.00	0.27
16 Commodities	0.30	0.32	0.30	0.38	0.17	-0.23	-0.09	0.08	0.34	-0.20	0.25	0.20	0.17	0.25	0.27	1.00



Alpha and tracking error assumptions reflect Multi-Asset Solutions' estimates for above-average active managers and are based on a historical study of the net-of-fee results of active management. Strategic long-term assumptions are subject to high levels of uncertainty regarding future economic and market factors that may affect future performance. They are hypothetical indications of a broad range of possible returns. All numbers reflect Multi-Asset Solutions' strategic assumptions as of 31Dec23. Please see additional disclosures. Past correlations are not indicative of future correlations, which may vary.

Assumptions Methodology

We believe there are three potential sources of expected total return

Risk-Free Rate	Expected returns on Cash	
Passive Excess Returns (Beta)	Expected returns from markets in excess of Risk Free Rate	**Expected Total Return**
Active Returns (Alpha)	Expected excess return from skilled management	

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Calculating the Covariance Matrix

- We use total return data, sampled monthly, to estimate the volatility and correlation of excess returns for all the underlying asset classes.
- To reflect a specific investment horizon, we specify a decay rate parameter. This parameter adjusts the weight placed on more recent data and is used to adjust for time-varying volatility and correlation. For long-horizon problems (e.g., strategic asset allocation), we prefer to use a very low decay rate, such that the weight given on 20-year old data is half the weight given on the most current data.
- Next, we align all data to a common window by truncating the longer time series and using a factor model to backfill the shorter time series.
- We then calculate the covariance matrix of the aligned data.
- Finally we use the same factor model to adjust the results by incorporating information available in data dating back to 1980.

Deriving Expected Passive Excess Returns

- Expected Passive Excess Returns are derived using a risk-based model
- The Capital Asset Pricing Model (CAPM) states that the excess return on an asset can be derived using the beta of that asset to the market, and the expected excess return on the market portfolio: $\pi = \lambda \Sigma \omega$,
  where π is the vector of excess returns for all asset classes, λ is the risk aversion parameter, Σ is the covariance matrix, and ω is the vector of market portfolio weights
- We set λ such that the expected excess return on the S&P 500 from USD Perspective is 4.25%, following a decision by MAS Investing Core Working Group. Its decision is based on the interpretation of current and historical equity prices, corporate earnings (both realized and estimated) as well as economic growth and real rate assumptions
- We also enhance this model by using MAS Model Portfolio instead of market portfolio. In MAS Model Portfolio, we overweight exposures which we believe have a potential to deliver a higher risk adjusted return relative to that implied by the traditional CAPM model

These examples are for illustrative purposes only and are not actual results. If any assumptions used do not prove to be true, results may vary substantially.

Modeling Hedge Funds

- Main Hedge Fund sectors include:
  - Relative Value
  - Event Driven
  - Equity Long/Short
  - Tactical Trading
- For each strategy we determine the following risk and return characteristics[1]
  - Market exposure, which we estimate by regressing hedge fund index data on a set of market factors, including: market cap, rates, convexity, credit, etc
  - Residual volatility from the regression analysis to represent each sector's tracking error, scaled up to account for the concentration of a hedge fund of funds portfolio compared to the broad index
  - Conservative estimates of the information ratios
- Our assumptions for Hedge Funds use weightings based on where we see opportunities for alpha

(1) See "Active Risk Budgeting in Action: Understanding Hedge Fund Performance" (MAS Strategic Research, May 2004), which is available upon request.
These examples are for illustrative purposes only and are not actual results. If any assumptions used do not prove to be true, results may vary substantially.

Modeling Private Equity

- We decompose Private Equity in the same way as other investments[1]
  - Exposure to a suitably chosen equity index
  - Alpha component
- Private Equity can be further broken down into sub-sectors, and we model each sub-sector based on a similar approach. These sub-sectors include:
  - Venture Capital
  - Large US Buyout
  - Small US Buyout
  - European Buyout
- For each Private Equity sector, we make the following assumptions
  - Market exposure to an equity index, adjusted for leverage, fees and carry
  - Relatively high tracking error
- Our assumptions for Private Equity are based on a customized blend of these sectors

(1) See "Active Risk Budgeting in Action: Assesing Risk and Return in Private Equity" (MAS Strategic Research, April 2005), which is available upon request
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Glossary

Investment Terminology

Expected Total Return: The long-term expected total return (annualized) of an asset or portfolio inclusive of income and capital gains. Let R be the annualized expected return, the expected value of $1 invested today in T years is $(1+R)^T.

Expected Total Risk: The forward-looking expected standard deviation of total return (annualized).

Expected Total Sharpe Ratio: A measure of the risk-adjusted return of an asset or portfolio, equal to the ratio of (i) expected total return in excess of the risk free rate divided by (ii) the expected total risk.

Expected Passive Excess Return: The forward-looking long-term expected total return of an investment benchmark in excess of the risk free rate (annualized).

Passive Risk: The forward-looking expected standard deviation of the total return of an investment benchmark (annualized).

Sharpe Ratio: A measure of the risk-adjusted passive return of an investment benchmark, equal to the ratio of (i) the passive excess return divided by (ii) the passive risk.

Alpha: The forward-looking expected excess return over an investment benchmark (annualized) due to active management of an asset or portfolio, net of management fees, for an above-average active manager.

Tracking Error: The forward-looking expected standard deviation of alpha (annualized).

Information Ratio: A measure of manager skill, equal to the ratio of (i) alpha divided by (ii) the tracking error.

Capital Asset Pricing Model: A model to determine the expected return of an asset based on the expected return of the market and the asset's sensitivity to the market risk.

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Effect of fees on performance:
The following table provides a simplified example of the effect of management and incentive fees on portfolio returns. For example, assume a portfolio has a steady investment return, gross of fees, of 0.5% per month and total management fees of 0.1042% per month of the market value of the portfolio on the last day of the month and incentive fees of 5% of net profits. Management fees and incentive fees are deducted from the market value of the portfolio on that day. There are no cash flows during the period. The table shows that, assuming that other factors such as investment return and fees remain constant, the difference increases due to the compounding effect over time. Of course, the magnitude of the difference between gross-of-fee and net-of-fee returns will depend on a variety of factors, and the example has been intentionally simplified.

Period	Gross Return	Net Return	Differential
1 year	6.17%	4.61%	1.56%
2 years	12.72%	9.43%	3.29%
10 years	81.94%	56.89%	25.05%

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