PUBLIC EMPLOYEES
RETIREMENT ASSOCIATION

Date: December 9, 2021
To: PERA Board of Trustees
From: Doug Anderson, Executive Director
Amy Strenge, Policy Coordinator
Subject: Investment Return Assumption

The 2022 legislative session begins Monday, January 3, 2022. The Legislative Commission on Pensions and Retirement (LCPR) is expected to consider the investment return assumption used for the State-wide pension plans. The investment return assumption is currently 7.5 percent. The LCPR is likely to seek PERA's position on this issue. This memo includes information that the Board should consider and staff's recommended position.

*Why is this a 2022 Legislative Issue?*
On June 24, 2021, our actuary, GRS Consulting, provided a report titled "2021 Valuation Interest Rate Assumption". The stated purpose of the report is to comply with Actuarial Standards of Practice and to assist PERA in the selection of appropriate assumptions for funding purposes and Governmental Accounting Standards Board (GASB) Statements No. 67 and 68 reporting.

The key finding of the report is that capital market assumptions have declined significantly. The report stated that "*GRS believes the 7.5% statutory rate is outside of the reasonable range for PERA valuations as of July 1, 2021.*" The report also stated *"We recommend that PERA consider an investment return assumption in the range of 5.71% to 6.61%. Based on the data reviewed, we can support a 7.0% discount rate for the 2021 valuation, but PERA should note that the selection of an investment return assumption near the upper end of this range may not be sustainable."*

In their recently issued July 1, 2021, funding reports, GRS included the comment: ***"In our professional judgment, the statutory investment return assumption of 7.5% used in the report deviates materially from the guidance set forth in Actuarial Standards of Practice No. 27 (ASOP No. 27).*** *In a 2021 analysis of long-term rate of investment return and inflation assumptions, GRS suggested that an investment return assumption in the range of 5.71% to 7.00% would be reasonable for this valuation."*

This means that the use of 7.0 percent would likely only be deemed reasonable by GRS for the 2021 valuation. After which, GRS indicates that 7.0 percent may not be sustainable.

*How did GRS determine their recommendation?*
The range of reasonableness determined by GRS was determined in accordance with established actuarial standards. Where GRS does not have the specific investment forecasting expertise they have relied on 12 reputable firms that do have the expertise. Each investment consulting firm employs a team of specialized experts. The attached report from Wells Fargo titled "2021 Capital Market Assumptions" provides detail on the development of one firm's expectations. The GRS report reflects the consolidated view of numerous experts specializing in many capital market categories.

*How might the GRS recommendation change?*
The GRS recommendation is highly dependent on capital market assumptions from the investment consulting firms. Our understanding is that GRS receives annual updates. Thus new guidance is unlikely before the legislature makes a decision.

An inflation assumption is one component of the GRS investment return assumption recommendation that potentially could change. The assumption in the recommendation is 2.25 percent (note that this is a long-term expectation of annual inflation, not just what is expected this year). If the inflation component is higher it could be used to justify a higher investment return assumption recommendation. However, the inflation component is also part of other assumptions including salary increases and postretirement increase adjustments.

Actuarial Standards call for assumptions to be consistent with one another. As a result, an increase to the inflation assumption for investment returns should only be done in conjunction with a change to the salary increase and postretirement increase assumption. The cost impact of using higher inflation to increase the assumed investment return would be mitigated to some degree by the cost impact of changing the salary increase and postretirement increase assumption.

*Does the GRS recommendation reflect superior asset management?*
The GRS recommendation does not include an increase for investment performance in excess of market norms. The State Board of Investment does have an excellent track record of achieving returns in excess of a composite index. Depending on the look back period, the increase has ranged from zero to 0.2 percent. While these are good results, staff cautions against assuming continued above average management results to justify a rate outside of the GRS recommended range.

*What was selected for June 30, 2021, GASB reporting?*
The selection of the GASB investment return assumption has historically been made by PERA staff. Staff selected 6.5 percent, which is within the GRS range of reasonableness, as the assumption used for the June 30, 2021, GASB reporting.

*How is the rate applicable for July 1, 2022, funding reports determined?*
PERA must provide funding reports using the investment return rate defined by statute. A rate change requires legislative approval. As a result, a statutory rate change included in the 2022 omnibus pension bill would apply to the July 1, 2022, actuarial valuations and all valuations thereafter until the legislature makes another change.

*What is the Board's responsibility?*
Board members are fiduciaries per Minnesota Statutes Section 356A.02. As noted in Section 356A.04 Subd 2: "*A fiduciary identified in section 356A.02 shall act in good faith and shall exercise that degree of judgment and care, under the circumstances then prevailing, that persons of prudence, discretion, and intelligence would exercise in the management of their own affairs, not for speculation, considering the probable safety of the plan capital as well as the probable investment return to be derived from the assets.*"

Under the Prudent Person Standard, trustees must use and share the skills they have from their education and prior experience. If trustees are not experts, they must carefully hire, monitor, and evaluate the experts they rely on. If a fiduciary fails to follow the advice of its professional consultants, it must demonstrate an informed, reasonable, and prudent rationale for failing to do so.

*What other standards should the Board consider?*
In December 2019, the Board adopted a Funding Value that "*Assumptions should be based upon the actuary's recommendations made in accordance with Actuarial Standards of Practice. Assumptions should not be changed exclusively for the purpose of achieving benefit or funding motives*."

Although the value does not explicitly state it, a corollary is that an assumption should not be left unchanged exclusively for the purpose of achieving benefit or funding motives. The key implication of this value is for the Board to rely on experts, not stakeholders, for the development and selection of actuarial assumptions.

*What are the Board's risks?*
If the Board does not follow the advice of its experts, particularly if no explanation is provided for that action, it may raise a liability red flag. Potential underfunding of future benefits may implicate the Board's statutory fiduciary duties of prudence and care and increase liability exposure risks. Keeping the assumed rate of return too high can end up benefiting current benefit recipients over future benefit recipients who may need to continue to contribute at elevated rates.

*What is the Executive Director's responsibility?*
The Executive Director for PERA is also a fiduciary, and is subject to the fiduciary standards applicable to the Board members.

In addition to my role as Executive Director, my credentials as an actuary and membership in the American Academy of Actuaries require adherence to the Code of Professional conduct. Precept 1 of the Code states *"An Actuary shall act honestly, with integrity and competence, and in a manner to fulfill the profession's responsibility to the public and to uphold the reputation of the actuarial profession."*

Prior to becoming Executive Director for PERA I worked as a consulting actuary for 28 years. My experience included the development and review of actuarial assumptions. Accordingly, I am familiar with the Actuarial Standards of Practice used to develop assumptions. Given my experience and education, this topic is an area of expertise for me.

*What impact does a lower assumption have on member benefits?*
Most members are not affected by the investment return assumption. However, there are two groups that are impacted:

1. Active members of the General Employees and Correctional Plans that retire early will receive higher benefits if the assumption is lowered. This is due to using a lower rate to determine the actuarial equivalent reduction factor (benefits are reduced less for early retirement). Police & Fire Plan members have fixed early retirement reduction rates and would not be impacted.
2. Members making service purchases would need to pay more for an actuarial equivalent service purchase due to the lower rate.

*What impact does a lower assumption have on contributions to the Plans?*
Employee and employer contribution rates are fixed in statute for the three plans and would not change. However, a supplemental employer contribution to the General Employees Retirement Plan and State contributions to the Police and Fire Plan are dependent on the funding status of each plan:

1. A 1.0 percent employer supplemental contribution to the General Employees Retirement Plan ceases when the Plan reaches 100 percent funded on an actuarial value of assets (AVA) basis. The annual contribution is currently about $65M. As of July 1, 2021, the Plan is 97.9 percent funded on a market value of assets basis using a 7.5 percent assumption. The Plan is 85.3 percent funded on an AVA basis. The AVA funding ratio will increase rapidly as the FY21 returns are recognized over the next four years.
2. Two separate $9M/year State contributions to the Police & Fire Plan cease when the Plan reaches specific funding thresholds. The first $9M stops when the funding ratio on an actuarial value of assets (AVA) basis reaches 100 percent. The AVA funding ratio is currently 92.0 percent. The funding ratio on a market value of assets basis is currently 105.6 percent. The second $9M ceases when **both** the PERA Police & Fire Plan and the MSRS State Patrol plan reach 90 percent funded. The MSRS State Patrol Plan is approximately 94 percent funded now on a market value of assets basis, but less than 90 percent on an AVA basis.

*What is the impact of the Board taking no action or advocating for a rate higher than recommend?*

There are several consequences of not changing the assumption to be within the GRS recommendation:

1. The actuarial valuation will continue to include a qualified opinion. GRS indicated that "*Actuarial Standards will require us to include a statement indicating that 'the prescribed assumption significantly conflicts with what, in our professional judgment, would be reasonable*."
2. Rating agencies may consider the lack of action as fiscally irresponsible.
3. Active members that retire early will have benefit reductions greater than what the actuary considers reasonable.
4. Funding commitments from employers and the State that are intended to help the plans reach full funding may end earlier.

*What are the national trends?*

The NASRA issue brief provides a summary of current investment return assumptions and shows the long standing downward trend. Items of note:

1. As of October 2021, the median assumed return is 7.0 percent. Of 131 plans reporting, 35 were more conservative (lower) than 7.0 percent and 58 plans had an assumption that was higher.
2. The reported rates are those currently in effect. Some plans have made a commitment to lowering the rate in the future. Georgia ERS, Nebraska School Retirement System, and three New Jersey plans are currently scheduled to move from above 7.0 percent to 7.0 percent.
3. The assumptions are those adopted by the plan sponsors (the pension boards in most cases) and are not necessarily consistent with the recommendations from their actuaries.

As noted by both GRS and the Horizon Survey of Capital Market Assumptions, the decline in capital market expectations has been fairly significant over the past few years. Many funds are likely to receive recommendations to lower their assumption from current levels. The twenty year trend shown by NASRA of funds reducing their investment return assumption seems likely to continue.

*What are the other Fund's positions?*

The Minnesota State Retirement System (MSRS) took a position to support a 7 percent assumption at their November Board meeting. MSRS also uses GRS as their actuary. The Teachers Retirement Association (TRA) has not yet taken a position.

*What other information informed the staff recommendation?*

1. The GRS June 24, 2021, report titled "*2021 Valuation Interest Rate Assumption*". This report includes GRS recommendations.
2. A copy of PERA's Funding Values, which were established by the Board on December 12, 2019.
3. The Horizon Survey of Capital Market Assumptions, 2021 Edition. This report mirrors the GRS report and contains a survey of expectations from 39 investment advisors.
4. NASRA Issue Brief: Public Pension Plan Investment Return Assumptions that shows the long-term trend towards lower assumptions.
5. Wells Fargo Investment Institute "2021 Capital Market Assumptions, Methodology-The building- block approach". This report helps explain the depth that an investment consultant goes to develop their assumptions.

*What is staff's recommendation?*

Staff recommends that the Board take a position that the investment return assumption effective beginning July 1, 2022, should be within the GRS recommended range at the time the legislature makes their decision. Based on current information staff recommends a specific rate of 6.5 percent. If the GRS recommended range is updated the Board could reconsider their position.

Staff believes that the recommended investment return assumption should be sustainable for future valuations, not just what is deemed acceptable for the July 1, 2022,valuation. Selection of a rate at least somewhat within the range increases the likelihood that the rate will be considered reasonable for more than just one year.

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June 24, 2021

Mr. Doug Anderson, Executive Director
Public Employee Retirement Association of MN
60 Empire Drive, Suite 200
St. Paul, MN 55103

**Re: 2021 Valuation Interest Rate Assumption**

Dear Doug:

We are pleased to present our review of the long-term rate of investment return and inflation assumptions for the Public Employees Retirement Association (PERA). The purpose of this report is to comply with Actuarial Standards of Practice and to assist PERA in the selection of appropriate assumptions for funding purposes and Governmental Accounting Standards Board (GASB) Statements Nos. 67 and 68 reporting. This report should not be relied upon for any purpose other than the purpose described herein.

**Background**

In a 2019 analysis of long-term rate of investment return and inflation assumptions, Gabriel, Roeder, Smith & Company (GRS) suggested that an investment return assumption in the range of 6.80% to 7.74% would be reasonable. This report also concluded that the probability of exceeding a 7.5% assumption over 10 years was only 44%. Please see our report, *General Employees Retirement Plan 4-Year Experience Study*, dated June 27, 2019 for additional information.

In particular, our report contained the following statement: "In our opinion, the assumed rate of return of 7.50% is a reasonable assumption based on this analysis. PERA should note that the investment return assumption must be reviewed each year for reasonability based on actuarial standards. A rate near the median, such as 7.0%, would be more likely to be sustainable for a longer period. If in a future year the assumption is deemed unreasonable, we would need to qualify our report and we would not be able to use the assumption in the GASB calculations."

The assumed rate, which is mandated by Minnesota Statutes, was changed from 8.0% to 7.5% during the 2018 legislative session. This rate was at the upper end of the reasonable range at that time.

If an assumption is deemed unreasonable based on current information, we will have to “qualify” the work that we do for PERA. We will still comply with statutes and produce the valuation based upon 7.5%, but Actuarial Standards will require us to include a statement indicating that “the prescribed assumption significantly conflicts with what, in our professional judgment, would be reasonable.”

On the following pages, we present information that leads us to conclude that 7.5% is outside of a reasonable range as of July 1, 2021.

**Actuarial Standards of Practice**

The relevant Actuarial Standard of Practice (ASOP) for economic assumptions is ASOP No. 27, Selection of Economic Assumptions for Measuring Pension Obligations[1]. Under ASOP No. 27, Section 3.6, an economic assumption is reasonable if it has the following characteristics:

- It is appropriate for the purpose of the measurement;
- It reflects the actuary's professional judgment;
- It takes into account current and historical data that is relevant to selecting the assumption for the measurement date, to the extent such relevant data is reasonably available;
- It reflects the actuary's estimate of future experience, the actuary's observation of the estimates inherent in market data (if any), or a combination thereof; and
- It is expected to have no significant bias (i.e., it is not significantly optimistic or pessimistic), except when provisions for adverse deviation or plan provisions that are difficult to measure are included (as discussed in Section 3.5.1) or when alternative assumptions are used for the assessment of risk, in accordance with ASOP No. 51, *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*.

**Inflation**

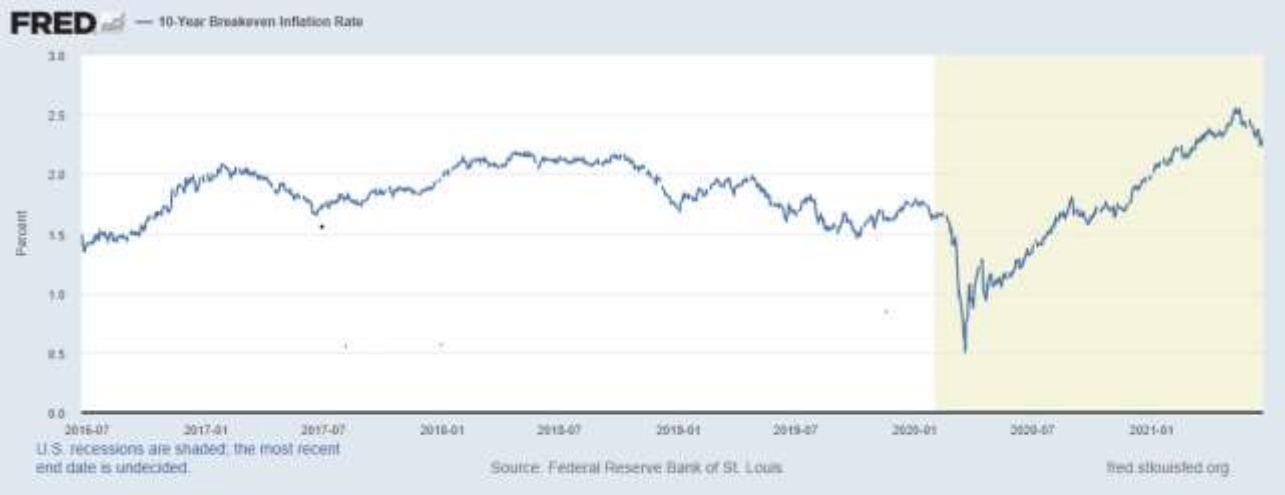
The long-term inflation assumption is a building block for the remaining economic assumptions. The PERA Board and the Legislative Commission on Pensions and Retirement (LCPR) approved a change in the inflation assumption, from 2.50% to 2.25%, effective for the actuarial valuations as of July 1, 2020.

We examined the capital market assumption sets for twelve investment consulting firms. The average assumption for inflation was 2.19%, with a range of 1.92% to 3.10%.

The 2020 Social Security Trustees report uses 2.4% as the long-range intermediate price inflation assumption. The low-cost assumption is 3.0%, and the high-cost assumption is 1.8%. (The Social Security program benefits from high inflation through faster earnings and revenue growth.) The long-term intermediate assumption has decreased since 2013, from 2.8% to 2.4%.

[1] *This ASOP was recently revised by the Actuarial Standards Board. The new version is effective August 1, 2021. The discussion here is based on the new version.*

The following chart from the Federal Reserve Bank of St. Louis shows a 5-year history of the 10-year breakeven inflation rate. The breakeven inflation rate represents a measure of expected inflation derived from 10-Year Treasury Constant Maturity Securities and 10-Year Treasury Inflation-Indexed Constant Maturity Securities. The latest value implies what market participants expect inflation to be in the next 10 years, on average. The chart shows an upward trend over the last 15 months, peaking at approximately 2.5% in May 2021, and declining to 2.25% on June 21, 2021.




Based on the data presented, GRS believes the 2.25% inflation assumption is within the reasonable range for valuations as of July 1, 2021.

**Long-Term Rate of Return on Investments**

For purposes of budgeting contributions and measuring liabilities for public employee retirement systems, the assumed rate of investment return is used as the discount rate to determine the present value of a system's pension obligations. For most valuations, an actuarial investment return assumption based on expected future experience is a single estimate for all years and, therefore, implicitly assumes that returns above and below expectations will average out over time. In other words, the expected risk premium is reflected in the assumed rate of investment return in advance of being earned, while the investment risk (i.e., volatility) is not reflected until actual experience emerges with each valuation.

The analysis of the investment return assumption in this report is based on forward-looking measures of expected investment return outcomes for the asset classes in the System's current investment policy. For purposes of this analysis, we have analyzed the System's investment policy with the capital market assumptions from twelve nationally recognized investment firms.

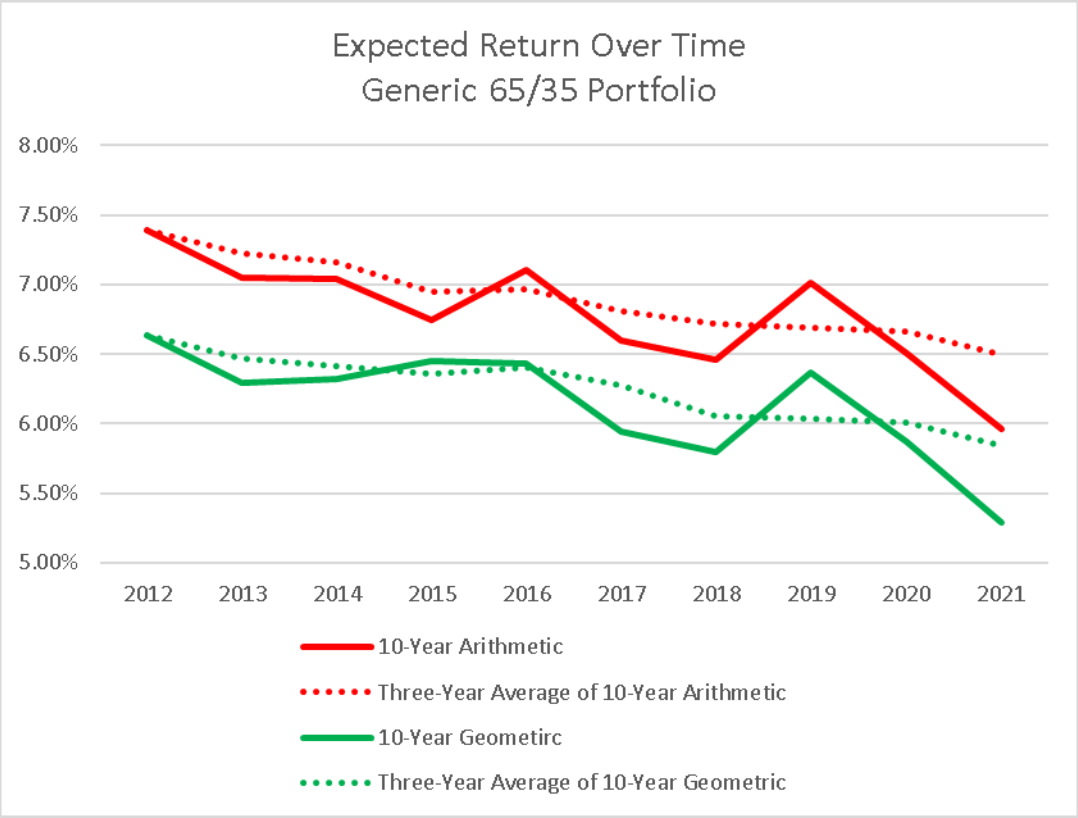
Our analysis is based on the GRS 2021 Capital Market Assumption Modeler (CMAM[2]). Because GRS is a benefits consulting firm and does not develop or maintain its own capital market expectations, we request and monitor forward-looking expectations developed by several major investment firms. We update our CMAM on an annual basis. The capital market assumptions in the 2021 CMAM are from the following investment firms (in alphabetical order): Aon Hewitt, Blackrock, BNY Mellon, Callan, Cambridge, JPMorgan, Meketa, Mercer, NEPC, RVK, Verus, and Wilshire. We believe that the benefit of performing this analysis using multiple investment firms is to recognize the uncertain nature of the items affecting the selection of the investment return assumption. While there may be differences in asset classes, investment horizons, inflation assumptions, treatment of investment expenses, etc., we have attempted to align the various assumption sets from the different investment firms to be as consistent as possible. In some cases, we have made minor adjustments or assumptions to align the various assumption sets with our model.

Each investment firm provided capital market assumptions over an investment horizon of approximately 10 years. Although investment firms often refer to this period as "short-term" it is important to remember that 10 years is actually a very long time. In fact, the duration of the liabilities of the State Employees Retirement Fund is 11 years. Therefore, returns during the next 10 years will affect the plans funding materially. (The duration of the present value of future benefits may be used to approximate the sensitivity to a 1% change in the assumed rate of return. For example, duration of 10 indicates that the present value of future benefits would increase approximately 10% if the assumed rate of return were lowered 1%.) A subset of six investment firms provided capital market expectations over a longer horizon, varying between 20 and 30 years. For purposes of this report, the analysis is generally based on the 10-year expectations provided by the investment firms.

Over the years, we have observed a general decreasing trend in capital market expectations. However, we have also observed that some of the investment firms' assumption sets are dependent on the market conditions at the time they are developed and consequently may be sensitive to short-term market fluctuations. Some expectations are contrarian – meaning that when the market is high, future expectations are lowered and when the market is low, future expectations are raised. The amount of these fluctuations as they appear in the year-to-year capital market assumptions varies between the various investment firms.

Each year, the GRS CMAM reflects the most up-to-date information at the time the data was collected (typically reflecting the firms' expectations at the beginning of the calendar year). The results of the 2021 survey were generally lower capital market assumptions than 2020 for most asset classes, in some cases substantially lower. This is perhaps due in part to the decrease in bond yields in 2020 to record lows and the high stock market at the end of 2020 (resulting in the contrarian expectation of lower future stock market returns). Looking back to 2019, return expectations were somewhat higher than prior years for some survey participants, perhaps in part due to an increase in bond yields and a decrease in the stock market at the end of 2018. If we consider the three-year average of return expectations, the general decreasing trend is more apparent and the short-term fluctuations are diminished. The chart below illustrates the volatility from year to year from past CMAMs with a generic 65/35 asset allocation. The general declining trend is illustrated with the three-year average of CMAM returns.

[2] *Issued 2021-05-04.*




To the best of our ability, we have adapted the System's investment policy to fit with the investment firms' assumptions adjusting for these known differences in assumptions and methodology. The asset classes in the system's investment allocation often do not exactly align with the asset classes of all investment firms in the survey. This may require us to make approximations which can introduce some subjectivity into the process. In the following charts, to the extent possible all returns are net of passive investment expenses and have no assumption for excess manager performance (alpha) in excess of active management fees.

For purposes of this analysis, we have reviewed the following asset mix based on the Minnesota State Board of Investment (SBI) Combined Funds Policy Target in the SBI's Performance Report as of March 31, 2021:

| Asset Class | Asset Allocation |
|---|---|
| Public Equity | 50% |
| Fixed Income | 25 |
| Private Markets | 25 |

Additionally, the following background information was provided by the SBI regarding the actual asset allocation as of March 31, 2021. SBI staff provided assurances that no significant changes in asset allocation are expected and that these are appropriate to use going forward.

| Asset Class | Asset Allocation |
|---|---|
| Domestic Equity | 33.1% |
| International Equity | 16.4% |
| Global Equity | 1.3% |
| Core/Core Plus Fixed Income | 5.2% |
| Return Seeking Fixed Income | 4.1% |
| Treasury Protection | 8.8% |
| Laddered Bond plus Cash | 5.4% |
| Real Estate | 1.4% |
| Private Equity | 10.2% |
| Private Credit | 1.1% |
| Real Assets | 2.1% |
| Distressed/Opportunistic | 1.5% |
| Large Cap Stocks (uninvested private market allocation) | 9.4% |

The arithmetic expected return developed from this detailed actual asset allocation is shown in the table on the following page. The CMAM begins with the nominal expected return from each Capital Market Assumption (CMA) set (column 2), takes out each CMA's price inflation assumption (column 3) to arrive at the real return (column 4). We then incorporate the current price inflation assumption of 2.25% (column 5) to get the adjusted nominal return (column 6). Investment expenses not already netted out of the return and/or administrative expenses paid out of trust assets which are not reflected in the employer contributions (column 7) are netted out of the return. The final arithmetic expected return is shown in column 8. We believe that this is reasonable provided that the current price inflation assumption does not differ materially from the assumptions used by the investment firms. Note that the arithmetic return is in general higher than the median return due to the compounding effect of random returns. In general, the difference between the arithmetic and median return will be larger for larger standard deviation of returns. We have shown the standard deviation of returns as the investment risk in column 9.

The average arithmetic return and standard deviation from the last three years of CMAMs are shown at the bottom of the table for reference.

ASOP No. 27, Section 3.6.2, states that "[d]ue to the uncertain nature of the items for which assumptions are selected, the actuary may consider several different assumptions reasonable for a given measurement. Different actuaries will apply different professional judgment and may choose different reasonable assumptions. As a result, a range of reasonable assumptions may develop, both for an individual actuary and across actuarial practice." This range of different expectations from the CMAs is evident from the summaries we show from our CMAM.

| GRS 2021 CMAM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Capital Market Assumption Set (CMA) | CMA Expected Nominal Return | CMA Inflation Assumption | Expected Real Return (2)–(3) | Actuary Inflation Assumption | Expected Nominal Return (4)+(5) | Plan Incurred Administrative Expenses | Expected Nominal Return Net of Expenses (6)-(7) | Standard Deviation of Expected Return (1-Year) |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| 1 | 5.95% | 2.15% | 3.80% | 2.25% | 6.05% | 0.00% | 6.05% | 13.80% |
| 2 | 6.17% | 2.21% | 3.96% | 2.25% | 6.21% | 0.00% | 6.21% | 14.32% |
| 3 | 6.38% | 2.34% | 4.04% | 2.25% | 6.29% | 0.00% | 6.29% | 14.62% |
| 4 | 5.81% | 2.01% | 3.80% | 2.25% | 6.05% | 0.00% | 6.05% | 12.35% |
| 5 | 5.97% | 2.00% | 3.97% | 2.25% | 6.22% | 0.00% | 6.22% | 12.98% |
| 6 | 6.25% | 2.00% | 4.25% | 2.25% | 6.50% | 0.00% | 6.50% | 13.95% |
| 7 | 6.33% | 2.00% | 4.33% | 2.25% | 6.58% | 0.00% | 6.58% | 13.86% |
| 8 | 6.79% | 2.40% | 4.39% | 2.25% | 6.64% | 0.00% | 6.64% | 13.75% |
| 9 | 6.60% | 2.11% | 4.50% | 2.25% | 6.75% | 0.00% | 6.75% | 14.10% |
| 10 | 6.98% | 2.01% | 4.97% | 2.25% | 7.22% | 0.00% | 7.22% | 14.52% |
| 11 | 8.12% | 3.10% | 5.02% | 2.25% | 7.27% | 0.00% | 7.27% | 14.89% |
| 12 | 7.17% | 1.92% | 5.25% | 2.25% | 7.50% | 0.00% | 7.50% | 13.30% |
| **Average** | **6.54%** | **2.19%** | **4.36%** | **2.25%** | **6.61%** | **0.00%** | **6.61%** | **13.87%** |
| | | | | | **Average from last 3 CMAMs** | | **7.05%** | **13.62%** |

The average expected nominal return from column 8 is 6.61%. This is the return that is "expected' each year. However, the average volatility of return, the standard deviation, is 13.87%. Volatility drags down the cumulative return over time -- losses hurt more than gains help. Although the expected return, in this case 6.61%, can be considered a reasonable assumption, we prefer the median return (see page 8) over time, because it adjusts the cumulative expectation for volatility.

Next, we compare the probabilities of achieving returns over a 10-year horizon. We compute the 40th, 50th, and 60th percentiles of returns as well as the probability of achieving the current assumption of 7.50% over a 10-year horizon. These estimates are based on the assumption that the distribution of returns for the next 10 years is the same each year. The average median return from the last three years of CMAMs is shown at the bottom of the table for reference.

| GRS 2021 CMAM | | | | | | |
|---|---|---|---|---|---|---|
| Capital Market Assumption Set (CMA) | Distribution of 10-Year Average Geometric Net Nominal Return | | | Probability of Exceeding | Probability of Exceeding | Probability of Exceeding |
| | 40th | 50th | 60th | 7.50% | 7.25% | 7.00% |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1 | 4.08% | 5.16% | 6.26% | 29.57% | 31.56% | 33.61% |
| 2 | 4.13% | 5.25% | 6.39% | 30.94% | 32.90% | 34.91% |
| 3 | 4.14% | 5.29% | 6.46% | 31.60% | 33.54% | 35.53% |
| 4 | 4.36% | 5.34% | 6.32% | 28.99% | 31.20% | 33.48% |
| 5 | 4.41% | 5.43% | 6.47% | 30.70% | 32.85% | 35.07% |
| 6 | 4.50% | 5.60% | 6.71% | 33.26% | 35.34% | 37.46% |
| 7 | 4.60% | 5.69% | 6.79% | 33.89% | 36.00% | 38.15% |
| 8 | 4.69% | 5.77% | 6.86% | 34.45% | 36.59% | 38.77% |
| 9 | 4.72% | 5.83% | 6.95% | 35.29% | 37.39% | 39.54% |
| 10 | 5.11% | 6.25% | 7.40% | 39.17% | 41.29% | 43.43% |
| 11 | 5.09% | 6.26% | 7.44% | 39.50% | 41.56% | 43.66% |
| 12 | 5.64% | 6.69% | 7.74% | 42.26% | 44.61% | 46.99% |
| **Average** | **4.62%** | **5.71%** | **6.82%** | **34.14%** | **36.24%** | **38.38%** |
| **Average from last 3 CMAMs** | | **6.19%** | | | | |

The 50th percentile return is also related to the geometric average return. The geometric average of a sequence of returns over a number of years is the compound average of those returns over the number of years compounded. As the number of years in the geometric average increase and if the distributions of returns each year are independent and identically distributed, then the geometric average will converge to the median return. The median return may be considered a reasonable rate of return for purposes of the valuation. The average of 50th percentile returns is 5.71% per year.

Column 5 of table 2 shows the estimated probability of achieving the 7.50% assumed rate of return over a 10-year period. The average probability of achieving 7.50% over 10 years is 34%.

In summary, a reasonable range for the assumed rate of return based solely on the current CMAM's 10-year investment horizon is between the median of 5.71% and the (arithmetic) nominal expected return of 6.61%. Returns outside that range are not necessarily unreasonable, but a separate justification may be needed. We think that an assumption up to 7% can, in fact, be deemed reasonable for the July 1, 2021 valuation, as the discussion below indicates.

For reference, based on the longer horizon (20 to 30 years) CMAs that were provided by some investment firms, the median expected return for a 20-year period is 6.72%. Over the last three years, the average median expected return for the 20-year period was 7.08%.

Our preferred return assumption based upon our most current CMAM and 10-year expectations would be 5.71%. We recognize that capital market assumptions are volatile, and because of that we can consider the average of recent CMAMs. If we look at the three-year average of CMAM results, we think an assumed return of up to 7% can be justified, because the 3-year average arithmetic expectation is 7.05%. The average of 20-year expectations also can justify a 7% assumption. However, we caution that 7% is really an upper bound. An assumption closer to the median would be more likely to remain reasonable for a longer time period than an assumption close to 7%.

Nothing in this report should be construed as GRS giving investment advice.

**Comments and Recommendations**

Capital market assumptions have declined significantly since the most recent PERA General Plan experience study. Although the statutory rate of 7.5% appeared reasonable based on the information available in 2019, based on the analysis in this letter, **GRS believes the 7.5% statutory rate is outside of the reasonable range for PERA valuations as of July 1, 2021. We will, of course, comply with statutes and produce the valuation based upon 7.5%, but Actuarial Standards will require us to include a statement indicating that "the prescribed assumption significantly conflicts with what, in our professional judgment, would be reasonable."**

**For GASB work, we will need to use an assumption that can be deemed reasonable based upon actuarial standards of practice.**

**We recommend that PERA consider an investment return assumption in the range of 5.71% to 6.61%. Based on the data reviewed, we can support a 7.0% discount rate for the 2021 valuation, but PERA should note that the selection of an investment return assumption near the upper end of this range may not be sustainable. A rate near the bottom of the range, such as 5.75%, would be more likely to be sustainable for a longer period. If in a future year the assumption is deemed unreasonable, we would need to qualify our report and we would not be able to use the assumption in the GASB calculations.**

Our valuation reports are required to demonstrate the sensitivity of the discount rate assumption by providing key metrics using a discount rate 1% higher and 1% lower than the prescribed rate. We will comment in the reports that the 6.5% discount rate is within a reasonable range, and that the 7.5% and 8.5% discount rates are outside of the reasonable range.

Brian B. Murphy and Bonita J. Wurst are independent of the plan sponsor and are Members of the American Academy of Actuaries who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. In addition, Mr. Murphy meets the requirements of "approved actuary" under Minnesota Statutes 356.215, Subdivision 1, Paragraph (c).

This report has been prepared by actuaries who have substantial experience valuing public employee retirement systems. To the best of our knowledge and belief, the information contained in this report was performed in accordance with the requirements of Minnesota Statutes 356.215, and the requirements of the Standards of Actuarial Work established by the Legislative Commission on Pensions and Retirements. All calculations have been made in conformity with generally accepted actuarial principles and practices, and with the Actuarial Standards of Practice issued by the Actuarial Standards Board and with applicable statutes.

Respectfully submitted,

Bonita J. Wurst

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Senior Consultant

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Senior Consultant

BJW/BBM:sc

PUBLIC EMPLOYEES
RETIREMENT ASSOCIATION

| PERA's Funding Values<br>December 12, 2019 | |
|---|---|
| #1 – Funding Status | The Plan's funding ratio (Market Value of Assets / Actuarial Accrued Liability), determined using approved assumptions, should project to achieve and sustain a level of at least 100 percent within a reasonable period of time. |
| #2 – Approved Assumptions | Assumptions should be based upon the actuary's recommendations made in accordance with Actuarial Standards of Practice. Assumptions should not be changed exclusively for the purpose of achieving benefit or funding motives. |
| #3 – Amortization Period | The current Unfunded Actuarial Accrued Liability (UAAL) should be fully amortized by June 30, 2048. Subsequent annual UAAL changes resulting from actuarial gains, or losses, assumption changes, or benefit changes should be amortized over 20 years from the date of establishment. |
| #4 – Funding Commitment | A commitment should be made to meet the funding status goal within the amortization period by using automatic annually adjusted retiree Cost of Living Adjustments (COLAs) and periodically adjusted employee and employer contribution rates. |
| #5 – Contribution Allocation | The allocation of ongoing contributions between employee and employer within each Plan should reflect the goal of achieving inter-generational equity. |
| #6 – Supplemental Contributions | The status of supplemental contributions intended to reduce the Unfunded Actuarial Accrued Liability should be considered before contributions are reduced or benefits are enhanced. |
| #7 – Contribution Target | The long-term target for contributions is that the total employee and employer contributions should be approximately equal to the normal cost for the agreed upon, reasonable level of benefits. |

The above statements collectively express PERA's funding values relative to the General Employees, Police & Fire, and Correctional Employees Plans. The values will be used to facilitate communication with PERA stakeholders and to set foundations for potential future legislative initiatives.

Horizon Actuarial Services, LLC®

# Survey of Capital Market Assumptions

## 2021 Edition

Horizon Actuarial Services, LLC is proud to serve as the actuary to over 100 multiemployer defined benefit pension plans across the United States and across various industries. As actuary to these plans, we must develop assumptions regarding future investment returns on plan assets. We then use those assumptions as we determine the actuarial values of the benefits promised by these plans to their participants and beneficiaries, as well as to project plan funding and solvency levels years into the future.

At Horizon Actuarial, we are retirement and healthcare actuaries, not investment professionals. Therefore, when developing assumptions as to what returns a pension plan's assets might be expected to earn in the future, we seek input from our colleagues in the investment advisory community. Each year, as part of this survey, we ask different investment firms to provide their "capital market assumptions" – their expectations for future risk and returns for different asset classes in which pension plans commonly invest. The information gathered from this survey can help answer the common question: "Are my plan's investment return assumptions reasonable?"

There are many factors to consider when evaluating a plan's investment return assumptions, such as its asset allocation, the maturity of its participant population, and the purpose of the measurement. Any of these factors can make the expected return for one plan very different from others. Therefore, this report does not opine on the reasonableness of any one plan's investment return assumptions. Nevertheless, we hope this report will be a useful resource for trustees, actuaries, and investment professionals alike.

***Horizon Actuarial sincerely thanks the 39 investment advisors who participated in this survey.***

Atlanta ▪ Cleveland ▪ Denver ▪ Irvine ▪ Los Angeles
Miami ▪ San Diego ▪ San Francisco ▪ Washington, D.C.


www.horizonactuarial.com
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*Horizon Actuarial Services, LLC is an independent consulting firm specializing in providing actuarial and consulting services to multiemployer benefit plans. Horizon Actuarial does not provide investment, legal, or tax advice. Please consult with your investment advisor, legal counsel, or tax advisor for information specific to your plan's investment, legal, or tax implications.*

## Summary

Horizon Actuarial first conducted this survey in 2010, and it included 8 investment advisors. In 2012, we first published a report on the survey results, which included 17 advisors. The survey has expanded considerably in recent years; this 2021 edition of the survey includes assumptions from 39 different investment firms.

Over the last five years, expected returns have declined for all but a few asset classes. The steepest declines have been for fixed income investments such as US corporate bonds and Treasuries, where return expectations have fallen more than 100 basis points since 2019. These declines were driven by recent monetary and fiscal policy interventions, and may have significant implications for multiemployer pension plans. Other asset classes (including both developed market and US equities) have seen significant declines in recent years as well, with the steepest declines generally occurring from 2020 to 2021.

As we have seen in prior surveys, expected returns are noticeably lower over the short term than over the long term. This trend is apparent when we focus on the 24 advisors who provided assumptions for both the short term (up to 10 years) and long term (20 years or more).

For less mature ongoing pension plans without solvency issues, we believe a horizon of 20 years or more is appropriate for evaluating the reasonableness of the long-term investment return assumption. A shorter horizon, such as 10 years, may be more appropriate for evaluating the return assumption for a plan that is more mature or has solvency issues. Even for plans with long-term investment horizons, it is important to understand the potential impact of lower expected returns over the short term. Therefore, this survey shows return expectations over horizons of both 10 years and 20 years.

For illustration, this report also constructs an asset allocation for a hypothetical multiemployer pension plan and uses the results from the survey to develop a range of reasonably expected returns for the plan. Driven by lower expectations across most asset classes, the expected returns for this 2021 edition were 46 basis points lower over a 10-year horizon than they were last year, and 104 basis points lower than they were a mere five years ago. Over a 20-year horizon, the expected returns are 41 basis points lower than last year, and 118 basis points lower than they were five years ago in the 2016 edition of the survey.

If you have questions about how the results of this survey relate to your multiemployer plan, please contact your consultant at Horizon Actuarial or visit the "contact us" page on our website, www.horizonactuarial.com. For questions about the survey itself, please contact Ben Ablin at ben.ablin@horizonactuarial.com.

## Survey Participants

Exhibit 1 below lists the 39 investment advisors whose capital market assumptions are included in the 2021 survey. This report does not attribute specific assumptions to individual firms, which is a precondition of the survey.

Originally, this survey was exclusive to the multiemployer plan community; it included only assumptions from investment advisors to multiemployer pension plans. The survey has expanded over the years, and it now includes assumptions from investment advisors outside of the multiemployer plan community.

A complete listing of the firms participating in the survey is provided below.

***Exhibit 1***

| 2021 Survey Participants | |
|---|---|
| *AJ Gallagher* | *Meketa Investment Group* |
| *Alan Biller* | *Mercer* |
| *AndCo Consulting* | *Merrill* |
| *Aon* | *Milliman* |
| *The Atlanta Consulting Group* | *Morgan Stanley Wealth Management* |
| *Bank of New York Mellon** | *NEPC* |
| *BlackRock** | *PFM Asset Management, LLC* |
| *Callan Associates* | *Research Affiliates, LLC** |
| *Cambridge Associates* | *Royal Bank of Canada* |
| *CapTrust* | *RVK* |
| *Ellwood Associates* | *Segal Marco Advisors* |
| *Envestnet* | *SEI* |
| *Goldman Sachs Asset Management* | *Sellwood Consulting* |
| *Graystone Consulting* | *SunTrust* |
| *Invesco** | *UBS* |
| *Investment Performance Services, LLC (IPS)* | *The Vanguard Group* |
| *Janney Montgomery Scott, LLC* | *Verus* |
| *J.P. Morgan Asset Management** | *Voya Investment Management** |
| *Marquette Associates* | *Willis Towers Watson* |
| | *Wilshire* |

**Assumptions obtained from published white paper.*

## Investment Horizons

When evaluating the expected return assumption for an active, ongoing multiemployer pension plan, actuaries usually consider investment returns over a long-term investment horizon of 20 years or more. A shorter time horizon, say over the next 10 years, may be more appropriate when evaluating the return assumption for a mature plan, a plan that has high negative cash flows, or a plan that is projected to become insolvent.

It is also important to understand the sensitivity of plan funding to changes in future investment returns. For example, the actuary for an active, ongoing pension plan will typically set the plan's investment return assumption based on expectations over a long-term horizon. However, evaluating the sensitivity of funding results to short-term investment returns that are expected to be higher or lower than the long-term assumption also plays an integral role in the decision-making process.

Advisors provided their most recent capital market assumptions: expected returns for different asset classes, standard deviations (i.e., volatilities) for those expected returns, and a correlation matrix. The advisors also indicated the investment horizon(s) to which their assumptions apply. If the advisor develops separate assumptions for different time horizons, they provided multiple sets of assumptions, one for each time horizon.

In the 2021 edition of the survey, 15 advisors provided one set of assumptions: of which all 15 specified a time horizon of 10 years. The remaining 24 advisors provided assumptions over both shorter-term (5 to 10 years) and longer-term (20 years or more) horizons. Note that two of the advisors rely on the same assumptions as other survey participants. Each assumption set was only counted once, even if it was provided by more than one advisor.

Exhibit 2 below summarizes the time horizons specified by each advisor.

***Exhibit 2***

| Investment Time Horizons | |
|---|---|
| **Time Horizon** | **Total** |
| 10 Years | 15 |
| Both Short- and Long-Term | 24 |
| Total | 39 |

## Short-Term vs. Long-Term

As noted in the previous section, survey participants provided expected returns over different time horizons. Given current market conditions, many investment advisors may expect returns for certain asset classes to be different in the short term versus over the long term.

For comparability, this survey groups expected returns into two time horizons: 10 years and 20 years. As pension plan actuaries, we often refer to the 10-year expected returns as "short-term" and the 20-year expected returns as "long-term." Note, however, that many investment firms consider 10-year expectations to be "long-term."

When comparing the expected returns for the 24 advisors who provided both short-term and long-term assumptions,[1] we see some interesting differences. See Exhibit 3 below. The expected returns shown below are annualized (geometric) over the indicated time horizons.

***Exhibit 3***

**Average Expected Returns: Short-Term vs. Long-Term**
***Subset of 24 Survey Respondents***

| Asset Class | 10-Year Horizon | 20-Year Horizon | Difference |
|---|---|---|---|
| US Equity - Large Cap | 5.94% | 6.65% | 0.71% |
| US Equity - Small/Mid Cap | 6.51% | 7.04% | 0.53% |
| Non-US Equity - Developed | 6.53% | 7.14% | 0.61% |
| Non-US Equity - Emerging | 7.30% | 7.81% | 0.51% |
| US Corporate Bonds - Core | 2.07% | 3.23% | 1.16% |
| US Corporate Bonds - Long Dur. | 2.13% | 3.43% | 1.30% |
| US Corporate Bonds - High Yield | 3.78% | 4.98% | 1.19% |
| Non-US Debt - Developed | 1.33% | 2.25% | 0.93% |
| Non-US Debt - Emerging | 4.46% | 5.32% | 0.86% |
| US Treasuries (Cash Equivalents) | 1.25% | 1.90% | 0.65% |
| TIPS (Inflation-Protected) | 1.59% | 2.38% | 0.79% |
| Real Estate | 5.53% | 6.21% | 0.68% |
| Hedge Funds | 4.66% | 5.33% | 0.67% |
| Commodities | 3.32% | 3.96% | 0.64% |
| Infrastructure | 6.35% | 6.79% | 0.43% |
| Private Equity | 9.13% | 9.65% | 0.52% |
| Private Debt | 6.48% | 6.87% | 0.39% |
| Inflation | 2.14% | 2.23% | 0.09% |

*The 10-year and 20-year returns shown above are the averages for the 24 advisors who provided both short-term and long-term assumptions. Expected returns are annualized (geometric).*

The consensus among these 24 advisors was that returns are expected to be lower in the short term compared to the long term. In general, the difference between long-term and short-term returns is more pronounced for fixed income investments. However, the differences are also relatively large for equities and alternative investments such as private equity, real estate, and hedge funds.

As noted earlier, the results shown in Exhibit 3 are based on a subset of 24 advisors. If we include all 39 survey advisors, the differences between short-term and long-term expected returns do not change dramatically for most asset classes. See Exhibit 4 below.

***Exhibit 4***

**Average Expected Returns: Short-Term vs. Long-Term**
***All Survey Respondents***

| Asset Class | 10-Year Horizon | 20-Year Horizon | Difference |
|---|---|---|---|
| US Equity - Large Cap | 5.78% | 6.65% | 0.87% |
| US Equity - Small/Mid Cap | 6.27% | 7.04% | 0.77% |
| Non-US Equity - Developed | 6.38% | 7.14% | 0.76% |
| Non-US Equity - Emerging | 7.24% | 7.81% | 0.57% |
| US Corporate Bonds - Core | 2.09% | 3.23% | 1.13% |
| US Corporate Bonds - Long Dur. | 2.18% | 3.43% | 1.25% |
| US Corporate Bonds - High Yield | 3.78% | 4.98% | 1.19% |
| Non-US Debt - Developed | 1.40% | 2.25% | 0.86% |
| Non-US Debt - Emerging | 4.24% | 5.32% | 1.08% |
| US Treasuries (Cash Equivalents) | 1.15% | 1.90% | 0.75% |
| TIPS (Inflation-Protected) | 1.60% | 2.38% | 0.78% |
| Real Estate | 5.50% | 6.21% | 0.71% |
| Hedge Funds | 4.46% | 5.33% | 0.88% |
| Commodities | 3.06% | 3.96% | 0.90% |
| Infrastructure | 6.20% | 6.79% | 0.58% |
| Private Equity | 8.82% | 9.65% | 0.83% |
| Private Debt | 6.45% | 6.87% | 0.42% |
| Inflation | 2.12% | 2.23% | 0.10% |

*10-year horizon results include all 39 survey respondents.*
*20-year horizon results include a subset of 24 survey respondents.*
*Expected returns are annualized (geometric).*

The 10-year expected returns shown above include assumptions from all 39 advisors, while the 20-year expected returns include assumptions from only the 24 advisors who provided longer-term assumptions.

Given the significant differences in expected returns over the short term and the long term, it remains important for actuaries to illustrate the effects of near-term underperformance on their clients' pension funds. Furthermore, it may be appropriate for actuaries to attribute more weight to nearer term expectations when setting the investment return assumption for mature plans whose liabilities have a shorter duration.

[1] In cases where an advisor indicated a time horizon shorter than 10 years, the shorter-term expected returns were combined with the longer-term expected returns to achieve a 10-year horizon. Similarly, if an advisor indicated a time horizon longer than 20 years, the longer-term expected returns were combined with the shorter-term expected returns to achieve a 20-year horizon.

## Differing Opinions

Exhibit 5 below shows the distribution of expected returns and standard deviations (i.e., volatilities) for each asset class in the survey, as provided by the 39 individual advisors in the survey. The expected returns shown are geometric.

Note that the exhibit below focuses on a 10-year horizon in order to include assumptions from all 39 advisors. See Exhibits 16 and 17 in the appendix to this report for a more detailed look at the distribution of expected returns and standard deviations over both 10- and 20-year horizons. The ranges of expected returns by asset class can be found in the appendix as Exhibits 18 and 19.

A summary of the average survey assumptions can be found in the appendix to this report as Exhibit 15. This summary includes expected returns, standard deviations, and a correlation matrix.

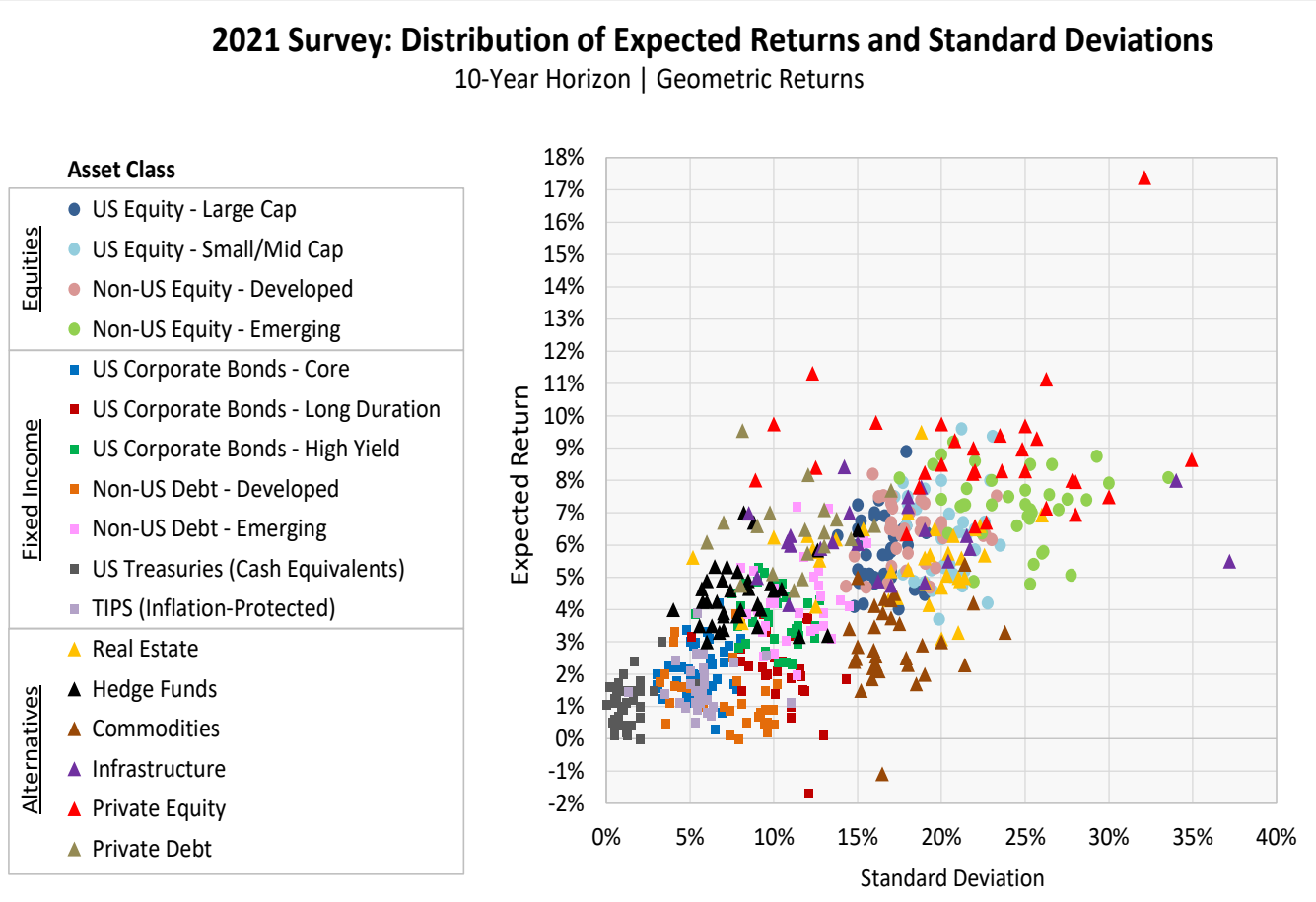
The exhibit below shows that there are significant differences in expected returns and standard deviations among investment advisors. As the saying goes, "reasonable people may differ."

The distribution of assumptions in the 2021 edition of the survey is wider than ever before, with an expected return of over 17% for private equity from one advisor and an expected return of almost negative 2% for long duration corporate bonds from another advisor.

The differences in assumptions are more pronounced for alternative investments such as real estate, hedge funds, and private equity. A contributing factor may be differences in the underlying strategies different advisors apply to these alternative investments.

To contrast, the differences in expected returns and volatilities are smaller for more traditional investments, such as US equity and US fixed income.

***Exhibit 5***



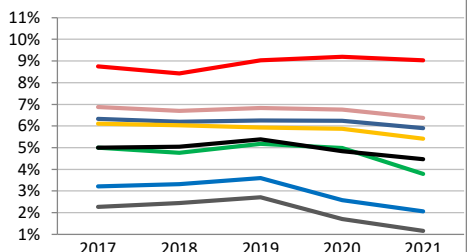
## Changing Outlooks: 2017 to 2021

In recent years, there has been much discussion about whether it is reasonable to expect that future investment returns will be as high as they have been historically. Citing various reasons such as increased equity prices, tightening credit spreads, and the persistence of historically low interest rates, many advisors have lowered their expectations over the last five years.

Exhibit 6 below shows average expected returns over a 10-year horizon for selected asset classes each year from 2017 to 2021. For consistency, this exhibit includes only the 30 advisors who provided short-term assumptions in each of these years.

***Exhibit 6***

**Average Expected Returns (10-Year Horizon)**




| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Private Equity | 8.7% | 8.4% | 9.0% | 9.2% | 9.0% |
| Non-US Eq. (Dev) | 6.9% | 6.7% | 6.8% | 6.8% | 6.4% |
| US Eq. (Large Cap) | 6.3% | 6.2% | 6.2% | 6.2% | 5.9% |
| Real Estate | 6.1% | 6.0% | 5.9% | 5.9% | 5.4% |
| US Bonds (HY) | 5.0% | 4.8% | 5.2% | 5.0% | 3.8% |
| Hedge Funds | 5.0% | 5.0% | 5.4% | 4.8% | 4.5% |
| US Bonds (Core) | 3.2% | 3.3% | 3.6% | 2.6% | 2.1% |
| US Treasuries | 2.3% | 2.5% | 2.7% | 1.7% | 1.2% |

Figures are average geometric returns for selected asset classes for the 30 advisors who provided short-term assumptions in each of the surveys from 2017 through 2021.

For this subset of advisors, average expected returns over a 10-year horizon have declined for most asset classes. The sharpest declines from 2017 to 2021 were for fixed income investments such as high-yield US bonds (from 5.0% to 3.8%) and core US corporate bonds (from 3.2% to 2.1%).

The declines for other asset classes, such as non-US developed market equities, large cap US equities, real estate, and hedge funds have been more gradual, but significant nonetheless, over the 5-year period. The steepest declines generally occurred from 2020 to 2021 for these asset classes.

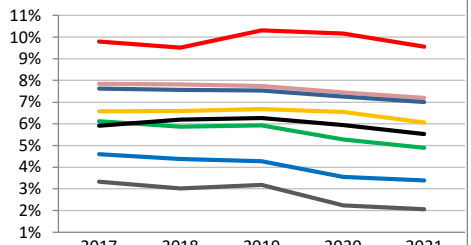
Expected returns over a 10-year horizon have only increased for one asset class over the 5-year period shown: private equity.

Exhibit 7 below shows how average expected returns have changed for the same asset classes for a subset of 9 advisors who provided assumptions each year from 2017 to 2021 over a 20-year horizon.

Note that the expected returns shown in Exhibits 6 and 7 are not directly comparable with those in other sections or previous surveys because we include only a subset of advisors who participated in each of the last 5 years.

***Exhibit 7***

**Average Expected Returns (20-Year Horizon)**




| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Private Equity | 9.8% | 9.5% | 10.3% | 10.2% | 9.6% |
| Non-US Eq. (Dev) | 7.8% | 7.8% | 7.7% | 7.4% | 7.2% |
| US Eq. (Large Cap) | 7.6% | 7.6% | 7.5% | 7.3% | 7.0% |
| Real Estate | 6.6% | 6.6% | 6.7% | 6.5% | 6.1% |
| US Bonds (HY) | 6.1% | 5.9% | 5.9% | 5.3% | 4.9% |
| Hedge Funds | 5.9% | 6.2% | 6.3% | 5.9% | 5.5% |
| US Bonds (Core) | 4.6% | 4.4% | 4.3% | 3.6% | 3.4% |
| US Treasuries | 3.3% | 3.0% | 3.2% | 2.2% | 2.1% |

Figures are average geometric returns for selected asset classes for the 9 advisors who provided long-term assumptions in each of the surveys from 2017 through 2021.

Although the expected returns are generally higher over a 20-year horizon than a 10-year horizon, the trends over the 5-year period are very similar.

The overarching theme indicated by the advisors in this 2021 survey is similar to the theme from 2020. Namely, steep declines in return expectations for fixed income investments over both 10-year and 20-year horizons driven by substantial monetary and fiscal policy interventions. These developments remain troubling for defined benefit pension plans. They may not only lead to reduced returns on plan assets, but they may also lead to lower discount rates, resulting in higher present values of promised benefits (liabilities).

Even though multiemployer plans are not required to discount their liabilities using bond yields, they generally have significant allocations to fixed income securities. As a result of these allocations, portfolio level expected returns are likely to decline. For these reasons, the consequences of these interventions on defined benefit pension plans of all types cannot be understated.

## Evaluating the Return Assumption

Multiemployer pension plans are usually invested in a well-diversified mix of stocks, bonds, real estate, and alternative investments structured to meet the goals of the Trustees. This typically involves maximizing returns over the long term while minimizing return volatility.

The actuary of a multiemployer pension plan must consider the plan's asset allocation and, based on expectations of future returns, develop an assumption for what plan assets are projected to earn over the long term. This assumption is then used (along with others) to determine the actuarial present value of the benefits promised by the plan to its participants and beneficiaries.

The actuary will often seek input on future return expectations from the plan's investment advisor in developing the plan's investment return assumption. However, as noted earlier, different investment advisors often have widely differing opinions on what future returns will be. Therefore, it can be beneficial to keep in mind other advisors' expectations when setting the investment return assumption.

In the following exhibits, we will evaluate the investment return assumption for a hypothetical multiemployer pension plan. Exhibit 8 below shows the asset allocation for this hypothetical plan. The asset allocations are arbitrary, except for the fact that we made sure to include at least a small allocation to every asset class in the survey.

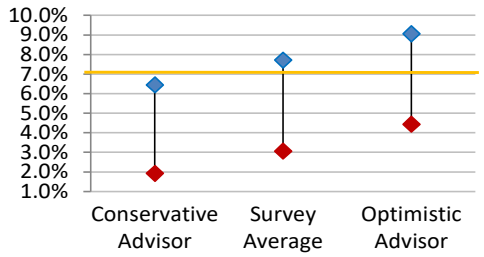
***Exhibit 8***

| Asset Class - Hypothetical Plan | Weight |
|---|---|
| US Equity - Large Cap | 20.0% |
| US Equity - Small/Mid Cap | 10.0% |
| Non-US Equity - Developed | 7.5% |
| Non-US Equity - Emerging | 5.0% |
| US Corporate Bonds - Core | 7.5% |
| US Corporate Bonds - Long Duration | 2.5% |
| US Corporate Bonds - High Yield | 5.0% |
| Non-US Debt - Developed | 5.0% |
| Non-US Debt - Emerging | 2.5% |
| US Treasuries (Cash Equivalents) | 5.0% |
| TIPS (Inflation-Protected) | 5.0% |
| Real Estate | 7.5% |
| Hedge Funds | 5.0% |
| Commodities | 2.5% |
| Infrastructure | 2.5% |
| Private Equity | 5.0% |
| Private Debt | 2.5% |
| **TOTAL PORTFOLIO** | **100.0%** |

Exhibit 9 shows expected annualized (geometric) returns for the hypothetical plan over a 10-year horizon. These results may be appropriate for modeling sensitivities of future funding results to short-term investment returns, or for evaluating the return assumption for a plan with severely negative cash flows or solvency issues.

***Exhibit 9***

**Annualized Expected Returns**
Hypothetical Multiemployer Pension Fund
***10-Year Horizon***

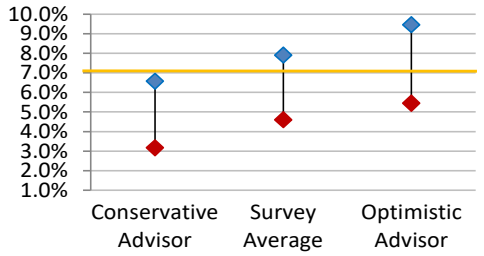



| | Conservative Advisor | Survey Average | Optimistic Advisor |
|---|---|---|---|
| 75th percentile | 6.44% | 7.70% | 9.05% |
| 25th percentile | 1.91% | 3.06% | 4.43% |
| *Probability of Meeting or Exceeding*: | | | |
| 7.50% per Year | 16.1% | 26.9% | 41.2% |
| 7.00% per Year | 20.0% | 31.9% | 46.9% |
| 6.50% per Year | 24.4% | 37.2% | 52.8% |

Exhibit 10 shows expected annualized (geometric) returns for the hypothetical plan over a 20-year horizon based on assumptions from the 24 advisors who provided longer-term assumptions. These results may be more appropriate for evaluating the return assumption for a less mature plan with no projected solvency issues.

***Exhibit 10***

**Annualized Expected Returns**
Hypothetical Multiemployer Pension Fund
***20-Year Horizon***




| | Conservative Advisor | Survey Average | Optimistic Advisor |
|---|---|---|---|
| 75th percentile | 6.57% | 7.90% | 9.46% |
| 25th percentile | 3.17% | 4.60% | 5.45% |
| *Probability of Meeting or Exceeding*: | | | |
| 7.50% per Year | 14.8% | 30.5% | 49.4% |
| 7.00% per Year | 19.9% | 38.0% | 56.1% |
| 6.50% per Year | 25.9% | 46.0% | 62.6% |

## Evaluating the Return Assumption (cont.)

It is important to keep in mind that the expected returns shown in Exhibits 9 and 10 apply only to the hypothetical asset allocation shown in Exhibit 8. The expected returns will be different – perhaps significantly – for different asset allocations. The following are points to consider when reviewing the results in Exhibits 9 and 10:

Range of Reasonable Assumptions: When setting the investment return assumption for pension valuations, actuaries traditionally constructed a range of reasonable assumptions and then selected a best-estimate point within that range. Actuaries would often consider the reasonable range to be the middle 50 percent of possible results, bounded by the 25th and 75th percentiles.

The applicable actuarial standards of practice were updated in 2013, and the updated standards de-emphasize use of the reasonable range when setting the investment return assumption. Nevertheless, considering this range remains instructive; it may be difficult for an actuary to justify an assumption outside of this range.

Based on the average assumptions in this 2021 survey, the middle 50 percent range for this hypothetical pension plan is very wide: 4.60% to 7.90% over the next 20 years. Note that the range is even wider for a 10-year horizon: 3.06% to 7.70%. This is due to the fact that, while returns may be volatile from one year to the next, deviations will be lower when returns are annualized (in other words, smoothed out) over longer horizons.

Probability of Meeting/Exceeding the Benchmark: For example, say that the actuary for this hypothetical pension plan expects its investment returns to be 7.00% per year, represented by the gold lines in Exhibits 9 and 10. Based on the average assumptions in this 2021 survey, there is a 38.0% probability the plan will meet or beat its 7.00% benchmark on an annualized basis over a 20-year period. The probability is lower, 31.9%, that the plan will meet or beat its benchmark over the next 10 years.

Also note that over a 20-year period, the probability that the annualized investment return will exceed 7.50% (arbitrarily, 50 basis points above the benchmark return) is 30.5%. The probability that the annualized return will exceed 6.50% (50 basis points below the benchmark) is 46.0%. These probabilities are a bit lower when focusing on a 10-year horizon rather than a 20-year horizon.

Purpose of the Measurement: It is important to note that this survey focuses on the investment return assumption, which may (or may not) be the same as the assumption used to discount a plan's projected benefit payments to measure its liabilities. The applicable standards of practice emphasize that the actuary should consider the purpose of the measurement (e.g., contribution budgeting, defeasance or settlement, market measurements, pricing) as a primary factor in choosing a discount rate.

Optimistic and Conservative Assumptions: As previously noted, different investment advisors may have widely varying future capital market expectations. Therefore, it may also be interesting to consider the range of expected returns based on the assumptions provided by the most conservative and most optimistic advisors in the survey.

For this hypothetical asset allocation, the assumptions from the most conservative advisor indicate that the probability of beating the 7.00% benchmark assumption over the next 20 years is 19.9%. Using assumptions from the most optimistic advisor results in a probability of 56.1%. Again, reasonable people may differ.

Limitations: The following are some important limiting factors to keep in mind when reviewing these results.

- The asset classes in this survey do not always align perfectly with the asset classes provided by the investment advisors. Adjustments were made to standardize the different asset classes provided.
- Many of the advisors develop their future assumptions based on investment horizons of no more than 10 years, and returns are generally expected to be lower in the short term. The typical multiemployer pension plan will have an investment horizon that is much longer than 10 years.
- The return expectations are generally based on market returns. In other words, they do not reflect any additional returns that may be earned due to active asset managers outperforming the market ("alpha").
- The return expectations do not adjust for plan size. Specifically, they do not take into account the fact that certain investment opportunities are more readily available to larger plans, as well as the fact that larger plans may often receive more favorable investment fee arrangements than smaller plans.
- The ranges of expected annualized returns were constructed using basic, often simplified, formulas and methodologies. More sophisticated investment models – which may consider various economic scenarios, non-normal distributions, etc. – could produce significantly different results.

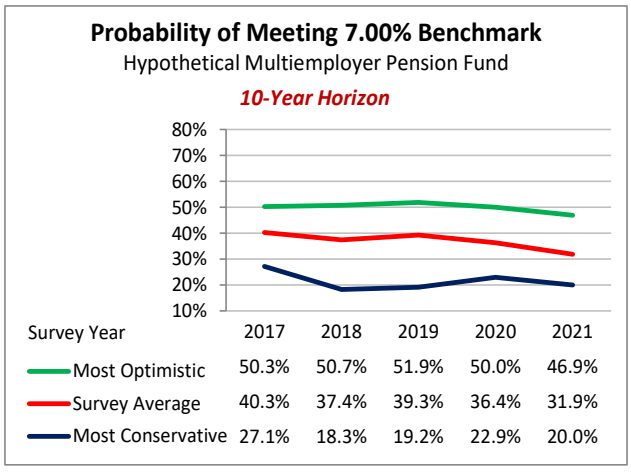
Use of the Survey: This survey is not intended to be a substitute for the expectations of individual portfolio managers, advisors, or actuaries performing their own independent analyses. The actuarial standards of practice provide for various methods of selecting and supporting the investment return assumption. This survey is intended to be used in conjunction with these methods, with appropriate weighting of various resources based on the plan actuary's professional judgment.

## Comparison with Prior Surveys

Exhibits 6 and 7 showed how expected returns for certain asset classes have changed over the past few years. Similarly, Exhibits 11 and 12 below show how return expectations for the hypothetical multiemployer pension plan whose asset allocation is shown in Exhibit 8 have changed from 2017 to 2021. (Note that the allocation was changed slightly to include private debt for the first time in 2019.)

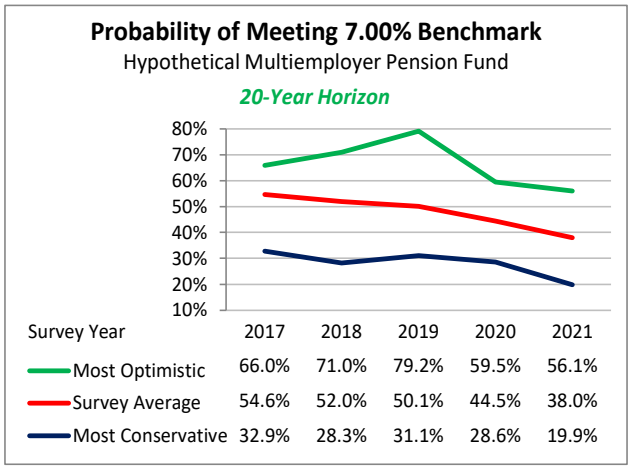
Both exhibits show the probabilities that the hypothetical pension plan will meet or exceed its 7.00% benchmark return on an annualized basis over the given time horizon. Exhibit 11 focuses on expected returns over a 10-year period, and Exhibit 12 focuses on expected returns over a 20-year period. Probabilities are shown for the survey average for each year from 2017 through 2021. For comparison, probabilities are also shown for the most conservative and optimistic advisors in each survey.

***Exhibit 11***




| Survey Year | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Most Optimistic | 50.3% | 50.7% | 51.9% | 50.0% | 46.9% |
| Survey Average | 40.3% | 37.4% | 39.3% | 36.4% | 31.9% |
| Most Conservative | 27.1% | 18.3% | 19.2% | 22.9% | 20.0% |

***Exhibit 12***




| Survey Year | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| Most Optimistic | 66.0% | 71.0% | 79.2% | 59.5% | 56.1% |
| Survey Average | 54.6% | 52.0% | 50.1% | 44.5% | 38.0% |
| Most Conservative | 32.9% | 28.3% | 31.1% | 28.6% | 19.9% |

As shown in Exhibits 11 and 12, the probabilities that this hypothetical pension plan would meet or beat a benchmark return of 7.00% have generally decreased from 2017 to 2021.

For example:

- Based on the average assumptions from the 2021 survey, the probability of this hypothetical plan meeting or exceeding an annualized return of 7.00% over the next 10 years is 31.9%. The probability was considerably higher (40.3%) five years ago when the 2017 survey was conducted.

- Based on the average assumptions from the 2021 survey, the probability of this hypothetical plan meeting or exceeding an annualized return of 7.00% over the next 20 years is 38.0%. This represents a steep decline from 2017 when the probability was 54.6%, with the majority of the decline occurring in the last two years. The decrease in probability from 2019 to 2020 was driven primarily by lower expected returns for fixed income investments, while the decline from 2020 to 2021 was driven by lower expectations across asset classes.

Other points of note when comparing the results from the 2021 survey to those from prior years:

- The results for the most conservative advisor over a 10-year horizon reached their lowest point in 2018 when there was an 18.3% probability of meeting the 7.00% benchmark, and have hovered around 20.0% since 2019. Over a 20-year horizon, the results for the most conservative advisor hovered close to 30.0% from 2017 through 2020, and then declined significantly to just below 20.0% in 2021. For 2021, the most conservative advisors over both 10- and 20-year horizons project only a 1 in 5 chance of meeting the 7.00% benchmark.

- The results for the most optimistic advisor in each survey have also declined in recent years. Over a 10-year horizon, the probability of meeting the 7.00% benchmark reached an all-time low of 46.9% in 2021. Over a 20-year horizon, the results are more pronounced. After reaching a high of 79.2% in 2019, the most optimistic advisor in the 2021 survey projects 56.1% chance of meeting the 7.00% benchmark over the long term.

- Note that the most conservative and most optimistic advisors are not necessarily the same from year to year or for different time horizons.

## Glossary

The following are basic definitions of some of the investment terminology used in this report.

*Expected Return*

The *expected return* is the amount, as a percentage of assets, that an investment is expected to earn over a period of time. Expected returns in this survey are generally market returns that do not reflect value added or fees due to active management. Returns for asset classes where passive investments are not available (e.g., hedge funds and private equity) are generally net of fees.

*Arithmetic vs. Geometric Returns*

An *arithmetic* return is the average return in any one year. A *geometric* return is the annualized return over a multi-year period. In general, it is more appropriate to focus on geometric returns when evaluating expected returns over multi-year horizons. However, arithmetic returns are also important. For example, the expected return of a portfolio is calculated as the weighted average of arithmetic returns, not geometric returns.

This survey focuses on geometric returns. Many advisors provide both arithmetic and geometric expected returns. For advisors who provided expected returns only on an arithmetic basis, we converted them to geometric returns for consistency. The following formula was used to make this conversion.

$$E[R_G] = ((1 + E[R_A])^2 - VAR[R])^{1/2} - 1$$

In this formula, $E[R_G]$ is the expected geometric return, $E[R_A]$ is the expected arithmetic return, and VAR[R] is the variance of the expected annual (arithmetic) return.

*Standard Deviation*

The *standard deviation* is a measure of the expected volatility in the returns. Generally, the standard deviation expresses how much returns may vary in any one year. Assuming that returns are "normally distributed," there is about a 68% probability that the actual return for a given year will fall within one standard deviation (higher or lower) of the expected return. There is about a 95% probability that the actual return will fall within two standard deviations of the expected return.

*Correlation*

The degree to which the returns for two different asset classes move in tandem with one another is their *correlation*. For example, if two asset classes are perfectly correlated, their correlation coefficient will be 1.00; in other words, if one asset class has a return of X% in a given market environment, then the other asset class is expected to also have a return of X%. A portfolio becomes better diversified as its asset classes have lower (or even negative) correlations with each other.

## Methodology

The following is a high-level description of the methodology used in compiling the survey results.

*Standardized Asset Classes*

Not all investment advisors use the same asset classes when developing their capital market assumptions. Some are very specific (more asset classes), while others keep things relatively simple (fewer asset classes).

We exercised judgment in classifying each advisor's capital market assumptions into a standard set of asset classes. In the event that an advisor did not provide assumptions for a given asset class, the average assumptions from the other advisors was used when developing expected returns for that advisor.

*Investment Horizons*

This survey considers "short-term" expected returns to apply to a 10-year investment horizon, and "long-term" expected returns to apply to a 20-year horizon.

In this 2021 edition of the survey, 15 of the 39 advisors provided only short-term assumptions, indicating a horizon of no more than 10 years. Included in this group is one advisor who provided assumptions over a horizon of seven years.

All 24 advisors who provided long-term assumptions over horizons of 20 years or more also provided short-term assumptions. In cases where such an advisor indicated a horizon shorter than 10 years, the shorter-term expected returns were combined with the longer-term expected returns to achieve a 10-year horizon. If an advisor indicated a time horizon longer than 20 years, the longer-term expected returns were combined with the shorter-term expected returns to achieve a 20-year horizon.

*No Adjustment for Alpha*

No adjustment was made to reflect the possible value added by an active investment manager outperforming market returns (earning "alpha").

*Normally-Distributed Returns*

This survey assumes that investment returns will be normally distributed according to the capital market assumptions provided. The survey also assumes that the investment return in one year does not affect the investment return in the following year.

*Equal Weighting*

Each assumption set was given equal weight in developing the average assumptions for the survey, regardless of factors such as total assets under advisement, research methodology, etc.

### *Exhibit 13*

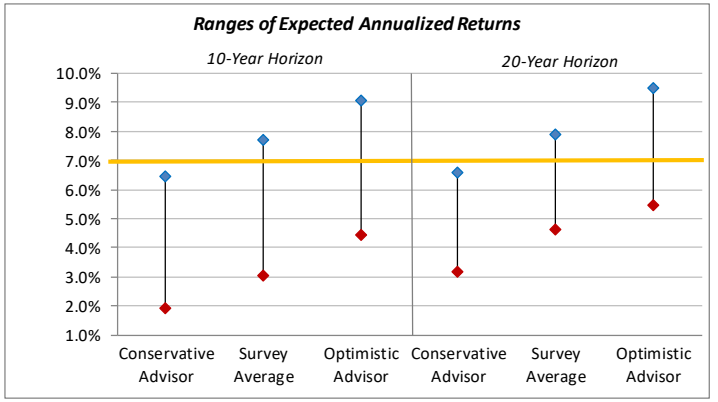
The following exhibit evaluates the investment return assumption for a hypothetical multiemployer pension plan. It reflects the same hypothetical asset allocation as shown in Exhibit 8, and it provides more detail than Exhibits 9 and 10. Note that the most conservative and optimistic advisors for the 10-year horizon are not necessarily the same as the most conservative and optimistic advisors for the 20-year horizon. This hypothetical pension plan has a benchmark return of 7.00% per year, which is indicated by the gold line in the exhibit below.

**Hypothetical Multiemployer Plan**

**2021 Survey of Capital Market Assumptions**

| | | *Average Survey Assumptions* | | |
|---|---|---|---|---|
| **Asset Class** | Portfolio Weight | 10-Year Horizon | 20-Year Horizon | Standard Deviation |
| US Equity - Large Cap | 20.0% | 5.78% | 6.65% | 16.42% |
| US Equity - Small/Mid Cap | 10.0% | 6.27% | 7.04% | 20.17% |
| Non-US Equity - Developed | 7.5% | 6.38% | 7.14% | 18.32% |
| Non-US Equity - Emerging | 5.0% | 7.24% | 7.81% | 24.33% |
| US Corporate Bonds - Core | 7.5% | 2.09% | 3.23% | 5.52% |
| US Corporate Bonds - Long Duration | 2.5% | 2.18% | 3.43% | 10.39% |
| US Corporate Bonds - High Yield | 5.0% | 3.78% | 4.98% | 9.88% |
| Non-US Debt - Developed | 5.0% | 1.40% | 2.25% | 7.18% |
| Non-US Debt - Emerging | 2.5% | 4.24% | 5.32% | 11.26% |
| US Treasuries (Cash Equivalents) | 5.0% | 1.15% | 1.90% | 1.30% |
| TIPS (Inflation-Protected) | 5.0% | 1.60% | 2.38% | 5.64% |
| Real Estate | 7.5% | 5.50% | 6.21% | 17.62% |
| Hedge Funds | 5.0% | 4.46% | 5.33% | 8.09% |
| Commodities | 2.5% | 3.06% | 3.96% | 17.31% |
| Infrastructure | 2.5% | 6.20% | 6.79% | 17.04% |
| Private Equity | 5.0% | 8.82% | 9.65% | 22.25% |
| Private Debt | 2.5% | 6.45% | 6.87% | 11.42% |
| Inflation | N/A | 2.12% | 2.23% | 2.05% |
| **TOTAL PORTFOLIO** | **100.0%** | *Expected returns are geometric.* | | |

| | *10-Year Horizon* | | | *20-Year Horizon* | | |
|---|---|---|---|---|---|---|
| | **Conservative Advisor** | **Survey Average** | **Optimistic Advisor** | **Conservative Advisor** | **Survey Average** | **Optimistic Advisor** |
| ***Expected Returns*** | | | | | | |
| Average Annual Return (Arithmetic) | 4.71% | 5.94% | 7.29% | 5.48% | 6.82% | 8.27% |
| Annualized Return (Geometric) | 4.18% | 5.38% | 6.74% | 4.87% | 6.25% | 7.45% |
| Annual Volatility (Standard Deviation) | 10.60% | 10.89% | 10.83% | 11.27% | 10.94% | 13.30% |
| ***Range of Expected Annualized Returns*** | | | | | | |
| 75th Percentile | 6.44% | 7.70% | 9.05% | 6.57% | 7.90% | 9.46% |
| 25th Percentile | 1.91% | 3.06% | 4.43% | 3.17% | 4.60% | 5.45% |
| ***Probabilities of Exceeding Certain Returns*** | | | | | | |
| 7.50% per Year, Annualized | 16.1% | 26.9% | 41.2% | 14.8% | 30.5% | 49.4% |
| 7.00% per Year, Annualized | 20.0% | 31.9% | 46.9% | 19.9% | 38.0% | 56.1% |
| 6.50% per Year, Annualized | 24.4% | 37.2% | 52.8% | 25.9% | 46.0% | 62.6% |




***Considerations and Limitations***

- Allocations may be approximated if certain asset classes are not included in the survey.
- Many investment advisors provided only shorter-term assumptions (10 years or less).
- Assumptions are generally based on indexed returns and do not reflect anticipated alpha.
- Assumptions do not reflect investment opportunities or fee considerations available to larger funds.

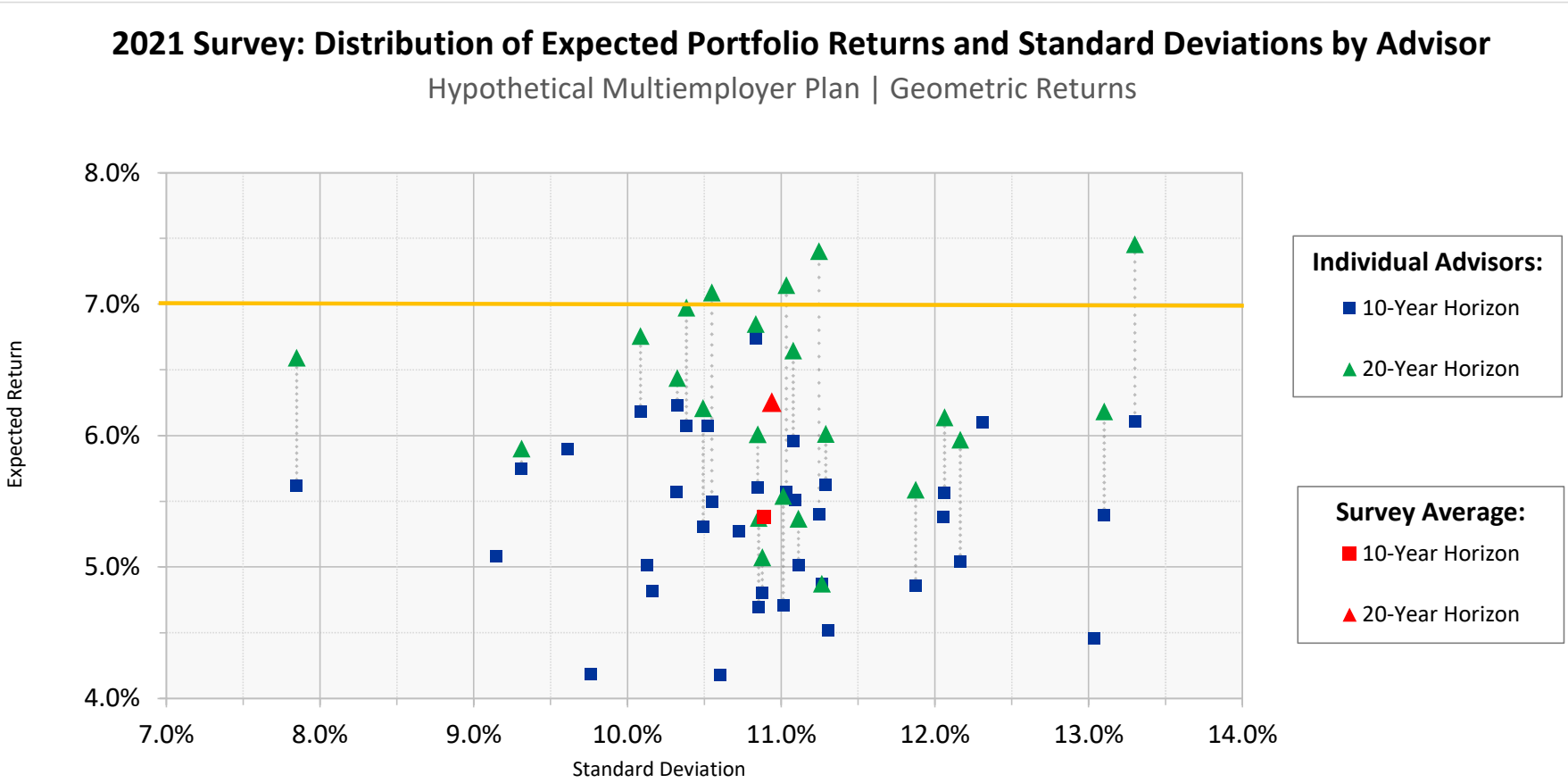
*SOURCE: Horizon Actuarial 2021 Survey of Capital Market Assumptions*

*Expected returns over a 10-year horizon include all 39 survey participants.*

*Expected returns over a 20-year horizon are based a subset of 24 survey participants who provided long-term assumptions.*

***Exhibit 14***

The following exhibit shows the distribution of expected annualized returns and annual standard deviations for the same hypothetical asset allocation that is shown in Exhibit 13. The expected annualized return and annual standard deviation of the hypothetical asset allocation are shown separately for each advisor who participated in the survey. Individual advisors are grouped by investment horizon, and the survey average assumptions are shown in red. Similar to Exhibit 13, the benchmark return of 7.00% for this hypothetical plan is indicated by the gold line. The exhibit shows that there are a wide variety of investment return assumptions that could be considered to be reasonable for any given asset allocation.




*SOURCE: Horizon Actuarial 2021 Survey of Capital Market Assumptions*
*Expected returns over a 10-year horizon include all 39 survey participants.*
*Expected returns over a 20-year horizon are based a subset of 24 survey participants who provided long-term assumptions.*

***Exhibit 15***

The following exhibit provides the average capital market assumptions for all 39 investment advisors in the 2021 survey. Each of the 39 advisors was given equal weight in determining the average assumptions. For reference, expected returns are shown over 10-year and 20-year horizons. Expected returns are also provided on both an arithmetic basis (one-year average) and geometric basis (multi-year annualized). The standard deviations (volatilities) and correlations apply to both arithmetic and geometric expected returns.

**Horizon Actuarial 2021 Survey of Capital Market Assumptions**

**Average Survey Assumptions**

| | | *Expected Returns* | | | | | ***Correlation Matrix*** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 10-Year Horizon | | 20-Year Horizon | | Standard | | | | | | | | | | | | | | | |
| | Asset Class | Arith. | Geom. | Arith. | Geom. | Deviation | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 1 | US Equity - Large Cap | 7.05% | 5.78% | 7.96% | 6.65% | 16.42% | 1.00 | | | | | | | | | | | | | | | | |
| 2 | US Equity - Small/Mid Cap | 8.18% | 6.27% | 9.01% | 7.04% | 20.17% | 0.90 | 1.00 | | | | | | | | | | | | | | | |
| 3 | Non-US Equity - Developed | 7.97% | 6.38% | 8.79% | 7.14% | 18.32% | 0.82 | 0.77 | 1.00 | | | | | | | | | | | | | | |
| 4 | Non-US Equity - Emerging | 10.01% | 7.24% | 10.78% | 7.81% | 24.33% | 0.72 | 0.70 | 0.80 | 1.00 | | | | | | | | | | | | | |
| 5 | US Corporate Bonds - Core | 2.25% | 2.09% | 3.38% | 3.23% | 5.52% | 0.19 | 0.15 | 0.20 | 0.18 | 1.00 | | | | | | | | | | | | |
| 6 | US Corporate Bonds - Long Duration | 2.74% | 2.18% | 3.97% | 3.43% | 10.39% | 0.18 | 0.13 | 0.18 | 0.15 | 0.86 | 1.00 | | | | | | | | | | | |
| 7 | US Corporate Bonds - High Yield | 4.26% | 3.78% | 5.46% | 4.98% | 9.88% | 0.63 | 0.63 | 0.62 | 0.62 | 0.43 | 0.36 | 1.00 | | | | | | | | | | |
| 8 | Non-US Debt - Developed | 1.63% | 1.40% | 2.53% | 2.25% | 7.18% | 0.15 | 0.10 | 0.30 | 0.26 | 0.55 | 0.51 | 0.24 | 1.00 | | | | | | | | | |
| 9 | Non-US Debt - Emerging | 4.86% | 4.24% | 5.99% | 5.32% | 11.26% | 0.48 | 0.45 | 0.52 | 0.61 | 0.49 | 0.43 | 0.60 | 0.41 | 1.00 | | | | | | | | |
| 10 | US Treasuries (Cash Equivalents) | 1.13% | 1.15% | 1.91% | 1.90% | 1.30% | (0.06) | (0.06) | (0.04) | (0.03) | 0.12 | 0.09 | (0.10) | 0.16 | 0.01 | 1.00 | | | | | | | |
| 11 | TIPS (Inflation-Protected) | 1.77% | 1.60% | 2.56% | 2.38% | 5.64% | 0.05 | 0.02 | 0.07 | 0.12 | 0.66 | 0.59 | 0.27 | 0.47 | 0.35 | 0.13 | 1.00 | | | | | | |
| 12 | Real Estate | 7.06% | 5.50% | 7.65% | 6.21% | 17.62% | 0.60 | 0.62 | 0.55 | 0.49 | 0.28 | 0.26 | 0.52 | 0.24 | 0.43 | (0.01) | 0.19 | 1.00 | | | | | |
| 13 | Hedge Funds | 4.79% | 4.46% | 5.71% | 5.33% | 8.09% | 0.68 | 0.68 | 0.68 | 0.65 | 0.22 | 0.17 | 0.59 | 0.19 | 0.48 | (0.01) | 0.12 | 0.45 | 1.00 | | | | |
| 14 | Commodities | 4.43% | 3.06% | 5.45% | 3.96% | 17.31% | 0.34 | 0.34 | 0.42 | 0.44 | 0.08 | 0.02 | 0.38 | 0.21 | 0.33 | 0.02 | 0.18 | 0.25 | 0.40 | 1.00 | | | |
| 15 | Infrastructure | 7.77% | 6.20% | 8.09% | 6.79% | 17.04% | 0.62 | 0.59 | 0.65 | 0.58 | 0.29 | 0.32 | 0.56 | 0.32 | 0.50 | (0.03) | 0.19 | 0.50 | 0.52 | 0.41 | 1.00 | | |
| 16 | Private Equity | 11.23% | 8.82% | 12.27% | 9.65% | 22.25% | 0.74 | 0.74 | 0.69 | 0.61 | 0.10 | 0.10 | 0.51 | 0.11 | 0.38 | (0.03) | 0.01 | 0.50 | 0.59 | 0.33 | 0.54 | 1.00 | |
| 17 | Private Debt | 7.10% | 6.45% | 7.52% | 6.87% | 11.42% | 0.54 | 0.55 | 0.54 | 0.52 | 0.26 | 0.29 | 0.71 | 0.15 | 0.44 | (0.04) | 0.11 | 0.46 | 0.56 | 0.37 | 0.50 | 0.54 | 1.00 |
| | Inflation | 2.13% | 2.12% | 2.24% | 2.23% | 2.05% | | | | | | | | | | | | | | | | | |

*Expected returns over a 10-year horizon include all 39 survey participants.*

*Expected returns over a 20-year horizon are based a subset of 24 survey participants who provided long-term assumptions.*

***Exhibit 16***

Earlier in this report, Exhibit 5 showed the distribution of expected returns and standard deviations for all 39 advisors who provided short-term assumptions. The exhibit below shows the same distribution, broken out by asset type: equities, fixed income, and alternatives. Note that the average expected return and standard deviation from the 2021 survey are listed in brackets for each asset class. Also note that every advisor did not provide expectations for every asset class.

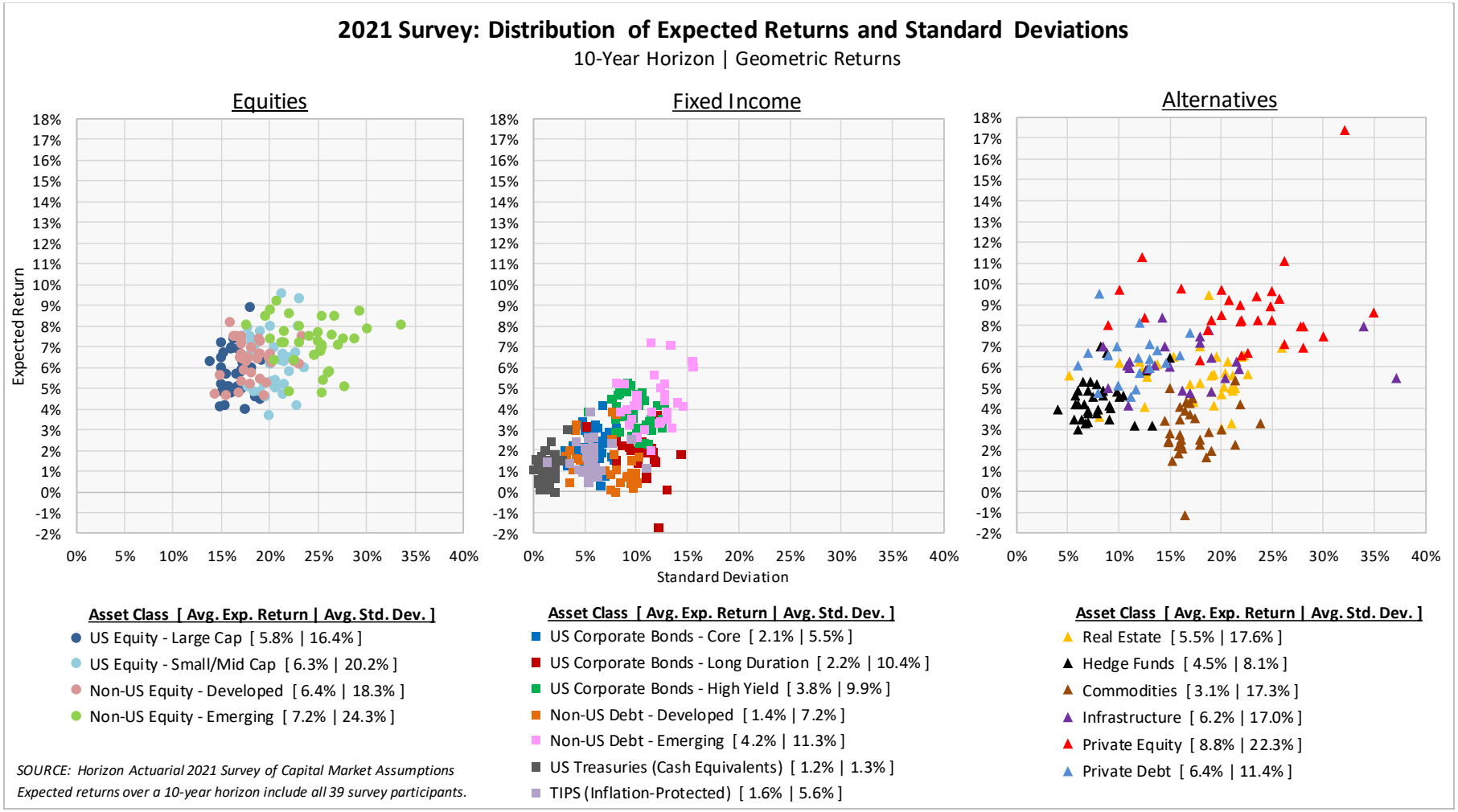


***Exhibit 17***

Exhibit 16 showed the distribution of expected returns and standard deviations over an investment horizon of 10 years. The exhibit below shows the same distribution, but for a horizon of 20 years. Note that while Exhibit 16 included all 39 advisors in the survey, the exhibit below only includes assumptions for the 24 advisors who provided longer-term assumptions (horizons of 20 years or more). Also note that every advisor did not provide expectations for every asset class.

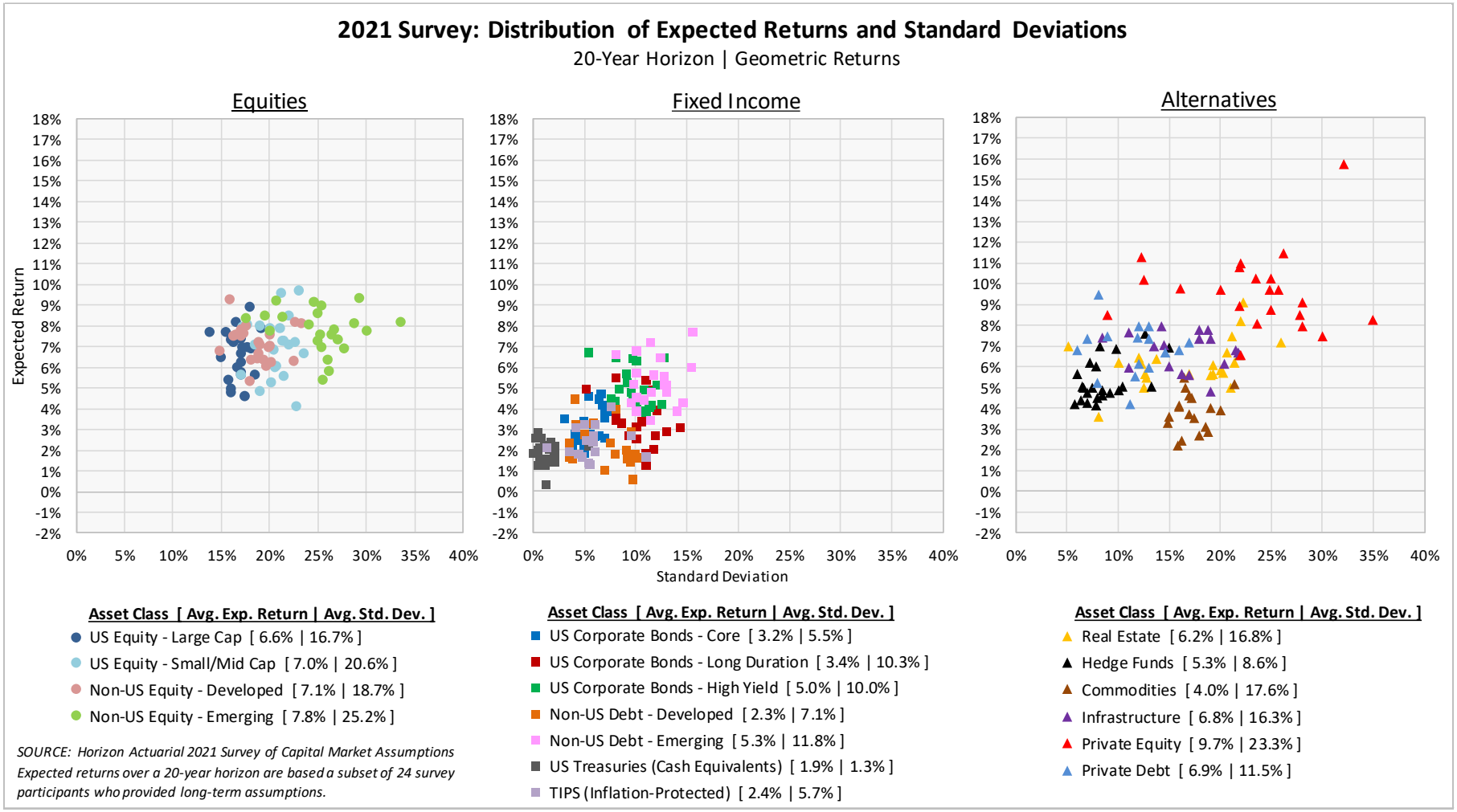
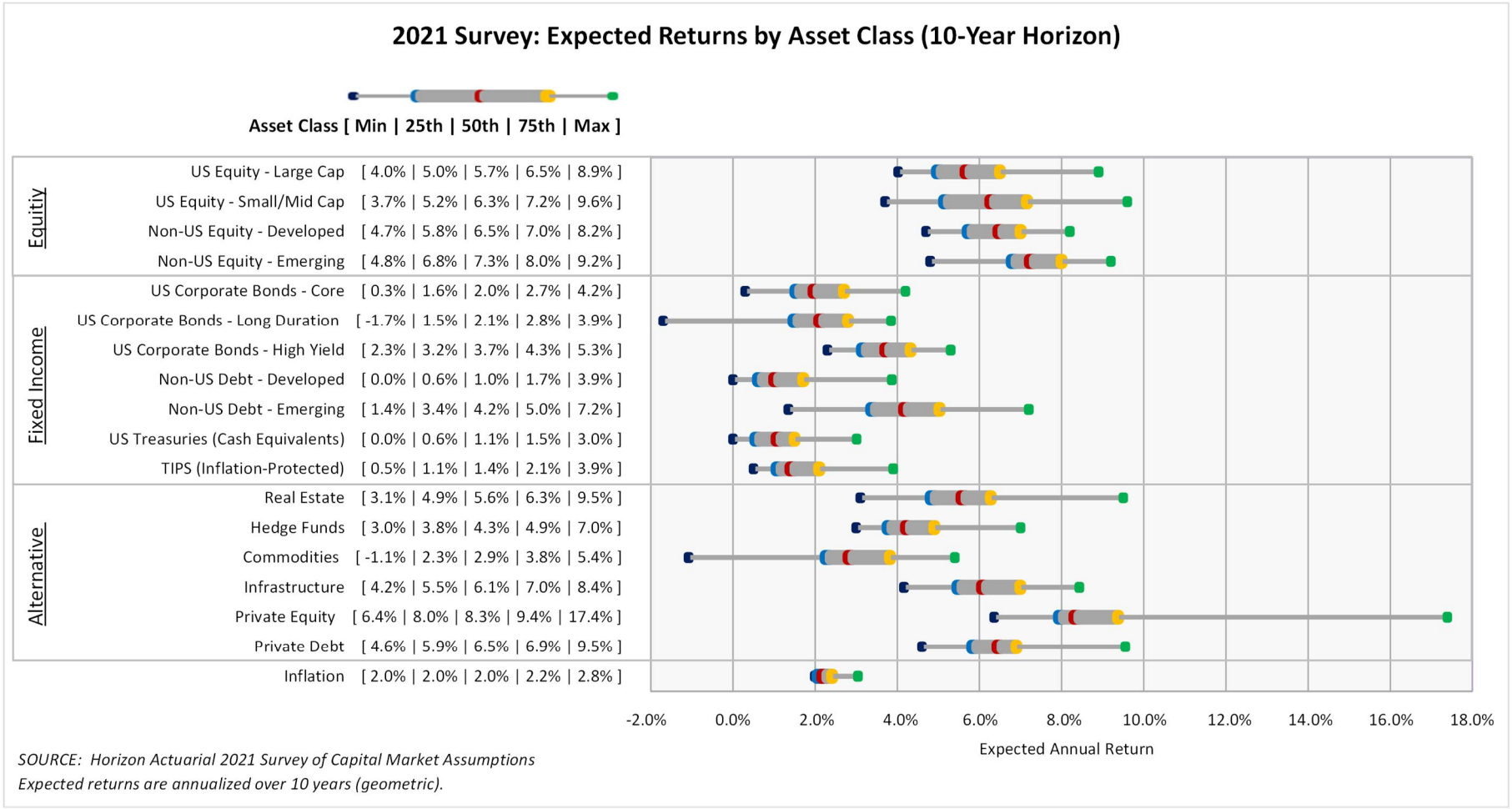


***Exhibit 18***

The exhibit below shows the ranges of expected annual returns for different asset classes over a 10-year investment horizon. The ranges shown below include assumptions for all the 39 advisors in the 2021 survey. Expected returns shown below are annualized (geometric).

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.

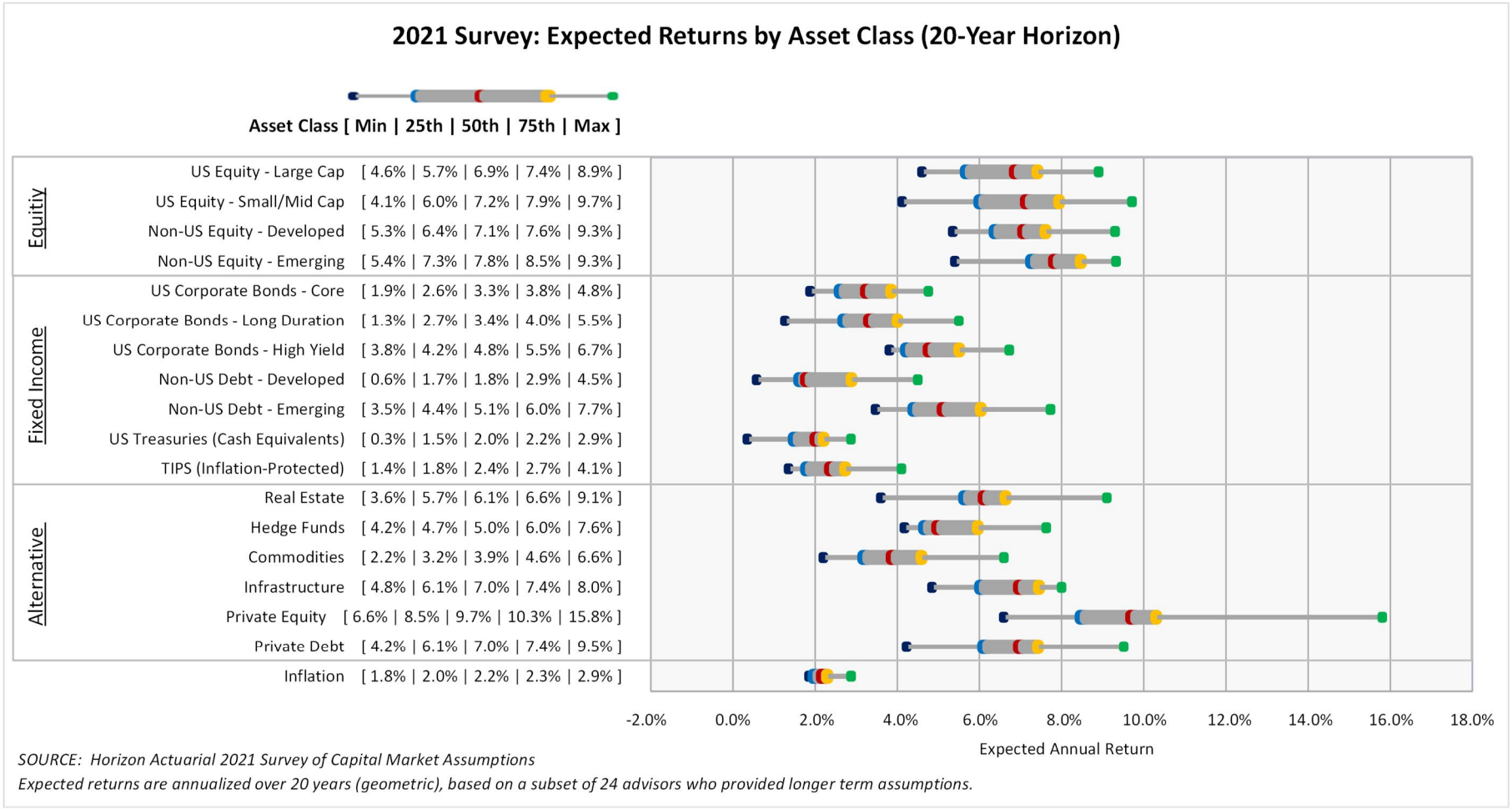



*SOURCE: Horizon Actuarial 2021 Survey of Capital Market Assumptions*
*Expected returns are annualized over 10 years (geometric).*

***Exhibit 19***

The exhibit below shows the ranges of expected annual returns for different asset classes over a 20-year investment horizon. The ranges shown below are based on the assumptions for 24 advisors who provided longer-term assumptions (horizons of 20 years or more). Expected returns shown below are annualized (geometric). Note that the ranges of expected returns are somewhat narrower when the investment horizon is longer.

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.




*SOURCE: Horizon Actuarial 2021 Survey of Capital Market Assumptions*

*Expected returns are annualized over 20 years (geometric), based on a subset of 24 advisors who provided longer term assumptions.*

# NASRA Issue Brief:
# Public Pension Plan Investment Return Assumptions

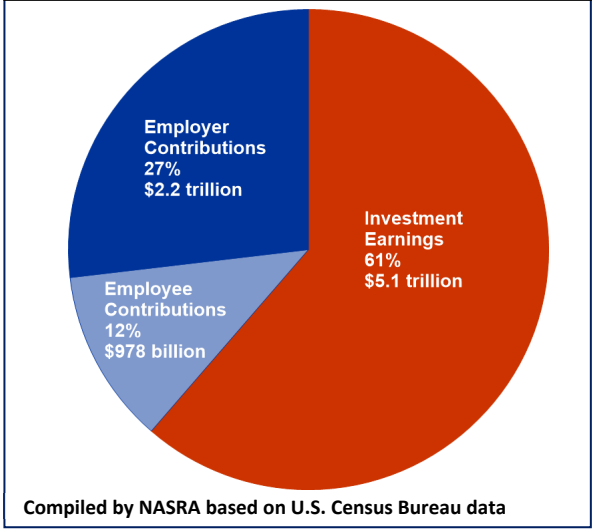
**Updated February 2021**

**As of December 31, 2020, state and local government retirement systems held assets of approximately $5.1 trillion.[1] These assets are held in trust and invested to pre-fund the cost of pension benefits. The investment return on these assets matters, as investment earnings account for a majority of public pension financing. A shortfall in long-term expected investment earnings must be made up by higher contributions or reduced benefits.**

**Funding a pension benefit requires the use of projections, known as actuarial assumptions, about future events. Actuarial assumptions fall into one of two broad categories: demographic and economic. Demographic assumptions are those pertaining to a pension plan's membership, such as changes in the number of working and retired plan participants; when participants will retire, and how long they'll live after they retire. Economic assumptions pertain to such factors as the rate of wage growth and the future expected investment return on the fund's assets.**

**As with other actuarial assumptions, projecting public pension fund investment returns requires a focus on the long-term. This brief discusses how investment return assumptions are established and evaluated, compares these assumptions with public funds' actual investment experience, and the challenging investment environment public retirement systems currently face.**

Figure 1: Public Pension Sources of Revenue, 1990-2019




Compiled by NASRA based on U.S. Census Bureau data

Because investment earnings account for a majority of revenue for a typical public pension fund, the accuracy of the return assumption has a major effect on a plan's finances and actuarial funding level. An investment return assumption that is set too low will overstate liabilities and costs, causing current taxpayers to be overcharged and future taxpayers to be undercharged. A rate set too high will understate liabilities, undercharging current taxpayers, at the expense of future taxpayers. An assumption that is significantly wrong in either direction will cause a misallocation of resources and unfairly distribute costs among generations of taxpayers.

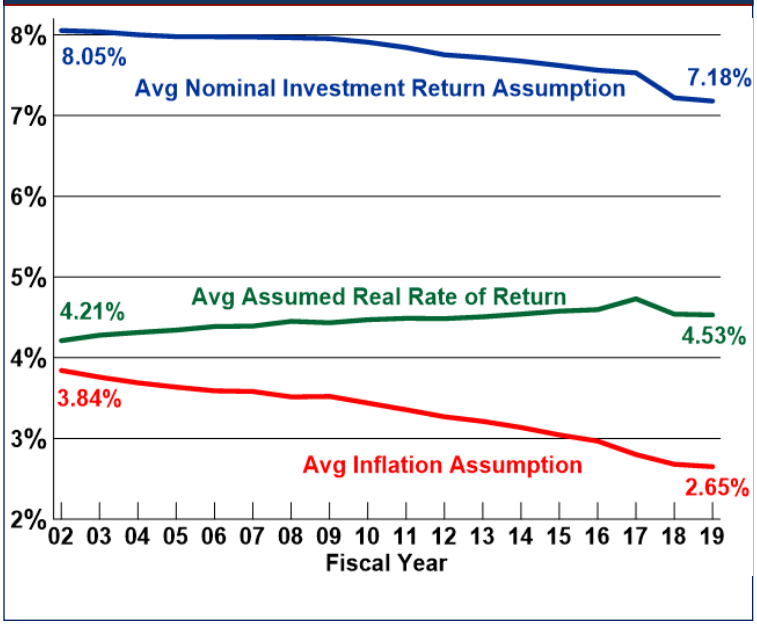
As shown in Figure 1, for the 30-year period ended in 2019, public pension funds accrued approximately $8.3 trillion in revenue, of which $5.1 trillion, or 61 percent, is from investment earnings. Employer contributions account for $2.2 trillion, or 27 percent of the total, and employee contributions total $978 billion, or 12 percent.[2] The large portion of revenues from investment earnings reflect the important role they play in funding public pension benefits.

Public retirement systems typically review their actuarial assumptions regularly, pursuant to state or local statute or system policy. The entity (or entities) responsible for setting the return assumption, as identified in Appendix B, typically works with one or more professional actuaries, who follow guidelines set forth by the Actuarial Standards Board in Actuarial Standards of Practice No. 27: Selection of Economic Assumptions for Measuring Pension Obligations (ASOP 27). ASOP 27 prescribes the factors actuaries should consider in setting economic actuarial assumptions, and recommends that actuaries consider the context of the measurement they are making, as defined by such factors as the purpose of

[1] Federal Reserve, *Flow of Funds Accounts of the United States: Flows and Outstandings, Fourth Quarter 2020*, Table L.120

[2] US Census Bureau, Annual Survey of Public Pensions, State & Local Data

Figure 2: Average nominal and real rate of return, and average assumed inflation rate, FY 02 – FY 19




the measurement, the length of time the measurement period is intended to cover, and the projected pattern of the plan's cash flows.

ASOP 27 also advises that actuarial assumptions be reasonable, defined in subsection 3.6 as being consistent with five specified characteristics; and requires that actuaries consider relevant data, such as current and projected interest rates and rates of inflation; historic and projected returns for individual asset classes; and historic returns of the fund itself. For long investment horizon, i.e., 20 to 30 years, which is the length of a typical public pension plan's funding period. One key purpose for relying on a long timeframe is to promote the key policy objectives of cost stability and predictability, and intergenerational equity among taxpayers.

The investment return assumption used by public pension plans typically contains two components: inflation and the real rate of return. The sum of these components is the nominal rate of return, which is the rate that is most often used and cited. The system's inflation assumption typically is also applied to other actuarial assumptions, such as the level of wage growth and, where relevant, assumed rates of cost-of-living adjustments (COLAs). Achieving an investment return approximately commensurate with the inflation rate normally is attainable by investing in securities, such as US Treasuries.

The second component of the investment return assumption is the real rate of return, which is the return on investment after adjusting for inflation. The real rate of return is intended to reflect the return produced as a result of the risk taken by investing the assets. Achieving a return higher than the risk-free rate requires taking some investment risk; for public pension funds, this risk takes the form of investments in assets such as public and private equities and real estate, which contain more risk than Treasury bonds.

Figure 3: Median public pension annualized investment returns for period ended 12/31/2020

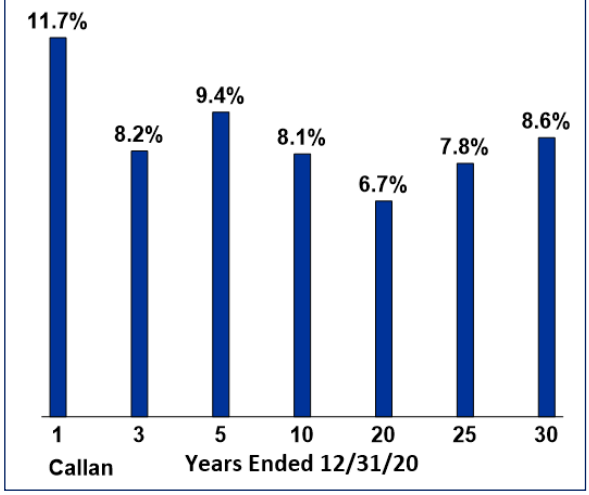
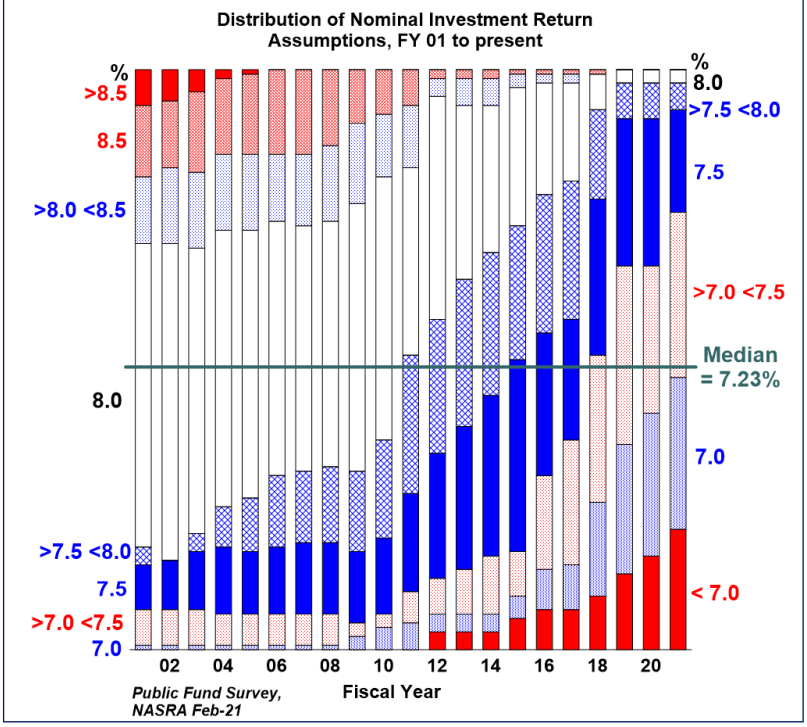



Figure 2 illustrates the changes in the average nominal (non-inflation-adjusted) return, the inflation assumption, and the resulting real rate of return assumption. As the chart shows, although the average nominal public pension fund investment return has been declining, because the average rate of assumed inflation has been dropping more quickly, the average real rate of return has risen, from 4.21 percent in FY 02 to 4.53 percent in FY 19. One factor that may be contributing to the higher real rate of return is public pension funds' higher allocations to alternative assets, particularly private equities, which usually have a higher expected return than other asset classes.

Figure 3 plots median public pension fund annualized investment returns for a range of periods ended December 31, 2020. As the figure shows, strong returns in 2019 helped raise annualized returns for the three- and five-year periods.

Figure 4: Change in Distribution of Public Pension Investment Return Assumptions. FY 01 to FY 21




In the wake of the 2008-09 capital market decline and Great Recession, global interest rates and inflation declined and have remained low by historic standards. These low interest rates have led to reductions in projected returns for most asset classes, which, in turn, has resulted in an unprecedented number of reductions in the pension plans. This trend is illustrated by Figure 4, which plots the distribution of investment return assumptions among a representative group of plans since 2001. Among the 130 plans measured, 101, or 78 percent, have reduced their assumed rate of return since fiscal year 2017, and all but five plans (96 percent) have done so since fiscal year 2010. These reductions have resulted in a decline in the average return assumption from 7.53 percent in FY 17 to 7.18 percent in FY 21. Appendix A lists the assumptions in use or adopted for future use by the 130 plans in this dataset, as of February 2021.

One challenging facet of setting the investment return assumption that has emerged more recently is a divergence between expected returns over the near term, i.e., the next five to 10 years, and over the longer term, i.e., 20 to 30 years[3]. Many investment return projections conclude that near-term returns will be lower than both historic norms as well as projected returns over longer timeframes. Because many near-term projections calculated recently are well below the long-term assumption most plans are using, some plans face the difficult choice of either maintaining a return assumption that is higher than near-term expectations, or lowering their return assumption to reflect near-term expectations.

If actual investment returns in the near-term prove to be lower than historic norms, plans that maintain their long-term return assumption risk experiencing a steady increase in unfunded pension liabilities and corresponding costs. Alternatively, plans that reduce their assumption in the face of diminished near-term projections will experience an immediate increase unfunded liabilities and required costs. As a rule of thumb, a 25 basis point reduction in the return assumption, such as from 7.5 percent to 7.25 percent, will increase the cost of a plan that has an automatic COLA, by three percent of pay (such as from 10 percent to 13 percent), and a plan that does not have a COLA, by two percent of pay.

## Conclusion

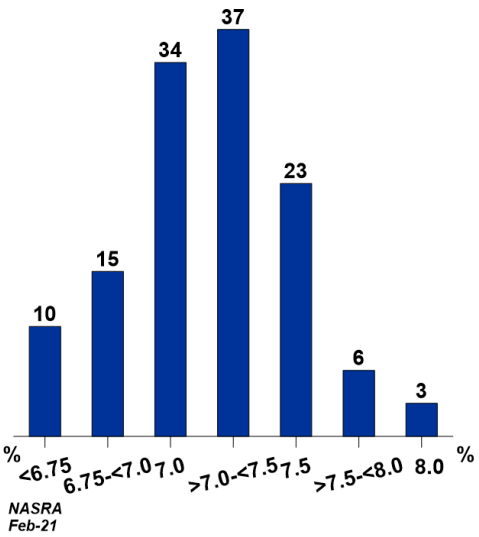
The investment return assumption is the single most consequential of all actuarial assumptions in terms of its effect on a pension plan's finances. The sustained period of low interest rates since 2009, combined with lower projected returns for most asset classes, has caused many public pension plans to reduce their long-term expected investment returns. Absent other changes, a lower investment return assumption increases both the plan's unfunded liabilities and cost. The process for evaluating a pension plan's investment return assumption should include abundant input and feedback from investment experts and actuarial professionals, and should reflect consideration of the factors prescribed in actuarial standards of practice.

[3] Horizon Actuarial Services, "Survey of Capital Market Assumptions, 2020 Edition (August 2020) p4

## See Also:

- Financial Reporting for Pension Plans, Statement No. 67, Governmental Accounting Standards Board
- The Liability Side of the Equation Revisited, Missouri SERS, September 2006

Figure 5: Distribution of investment return assumptions

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National Association of State Retirement Administrators

# Appendix A: Investment Return Assumption by Plan

Figures reflect the nominal assumption in use, or announced for use, as of February 2021.
This list of nominal investment return assumptions is updated at www.nasra.org/latestreturnassumptions

| Plan | Rate (%) |
|---|---|
| Alabama ERS | 7.70 |
| Alabama Teachers | 7.70 |
| Alaska PERS | 7.38 |
| Alaska Teachers | 7.38 |
| Arizona Public Safety Personnel | 7.30 |
| Arizona SRS | 7.50 |
| Arkansas PERS | 7.15 |
| Arkansas State Highway ERS | 8.0 |
| Arkansas Teachers | 7.50 |
| California PERF[1] | 7.0 |
| California Teachers | 7.0 |
| Chicago Teachers | 6.75 |
| City of Austin ERS | 7.0 |
| Colorado Affiliated Local | 7.0 |
| Colorado Fire & Police Statewide | 7.0 |
| Colorado Municipal | 7.25 |
| Colorado School | 7.25 |
| Colorado State | 7.25 |
| Connecticut SERS | 6.90 |
| Connecticut Teachers | 6.90 |
| Contra Costa County | 7.0 |
| DC Police & Fire | 6.50 |
| DC Teachers | 6.50 |
| Delaware State Employees | 7.0 |
| Denver Employees | 7.25 |
| Denver Public Schools | 7.25 |
| Fairfax County Schools | 7.25 |
| Florida RS | 7.0 |
| Georgia ERS[2] | 7.30 |
| Georgia Teachers | 7.25 |
| Hawaii ERS | 7.0 |
| Houston Firefighters | 7.0 |
| Idaho PERS | 7.0 |
| Illinois Municipal | 7.25 |
| Illinois SERS | 7.0 |
| Illinois Teachers | 7.0 |
| Illinois Universities | 6.75 |
| Indiana PERF | 6.75 |
| Indiana Teachers | 6.75 |
| Iowa PERS | 7. 0 |
| Kansas PERS | 7.75 |
| Kentucky County | 6.25 |
| Kentucky ERS[3] | 5.25 |
| Kentucky Teachers | 7.50 |
| Los Angeles County ERS | 7.0 |
| Louisiana Parochial Employees | 6.50 |
| Louisiana SERS[4] | 7.55 |
| Louisiana Teachers[5] | 7.45 |
| Maine Local | 6.75 |
| Maine State and Teacher | 6.75 |
| Maryland PERS | 7.40 |
| Maryland Teachers | 7.40 |
| Massachusetts SERS | 7.25 |
| Massachusetts Teachers | 7.25 |
| Michigan Municipal | 7.35 |
| Michigan Public Schools[6,7] | 6.80 |
| Michigan SERS[7] | 6.70 |
| Minnesota PERF | 7.50 |
| Minnesota State Employees | 7.50 |
| Minnesota Teachers | 7.50 |
| Mississippi PERS[8] | 7.75 |
| Missouri DOT and Highway Patrol | 7.0 |
| Missouri Local | 7.25 |
| Missouri PEERS | 7.50 |
| Missouri State Employees | 6.95 |
| Missouri Teachers | 7.50 |
| Montana PERS | 7.65 |
| Montana Teachers | 7.50 |
| Nebraska Schools | 7.50 |
| Nevada Police Officer and Firefighter | 7.50 |
| Nevada Regular Employees | 7.50 |
| New Hampshire Retirement System | 6.75 |
| New Jersey PERS[9] | 7.30 |
| New Jersey Police & Fire[9] | 7.30 |
| New Jersey Teachers[9] | 7.30 |
| New Mexico PERA | 7.25 |
| New Mexico Teachers | 7.0 |
| New York City ERS | 7.0 |
| New York City Teachers | 7.0 |
| New York State Teachers | 7.10 |
| North Carolina Local Government | 6.50 |
| North Carolina Teachers and State Employees | 6.50 |
| North Dakota PERS | 7.0 |
| North Dakota Teachers | 7.25 |
| NY State & Local ERS | 6.80 |
| NY State & Local Police & Fire | 6.80 |
| Ohio PERS | 7.20 |
| Ohio Police & Fire | 8.0 |
| Ohio School Employees | 7.50 |

| | |
|---|---|
| Ohio Teachers | 7.45 |
| Oklahoma PERS | 6.5 |
| Oklahoma Teachers | 7. 0 |
| Orange County ERS | 7.0 |
| Oregon PERS | 7.20 |
| Pennsylvania School Employees | 7.25 |
| Pennsylvania State ERS | 7.0 |
| Phoenix ERS | 7.0 |
| Rhode Island ERS | 7.0 |
| Rhode Island Municipal | 7.0 |
| Richmond Retirement System | 7.0 |
| San Diego County | 7.0 |
| San Francisco City & County | 7.40 |
| South Carolina Police | 7.25 |
| South Carolina RS | 7.25 |
| South Dakota RS | 6.50 |
| St. Louis School Employees | 7.50 |
| St. Paul Teachers | 7.50 |
| Texas County & District | 8.0 |
| Texas ERS | 7. 0 |
| Texas LECOS | 7. 0 |

| | |
|---|---|
| Texas Municipal | 6.75 |
| Texas Teachers | 7.25 |
| Tennessee Political Subdivisions | 7.25 |
| Tennessee State and Teachers | 7.25 |
| University of California | 6.75 |
| Utah Noncontributory | 6.95 |
| Vermont State Employees | 7.0 |
| Vermont Teachers | 7.0 |
| Virginia Retirement System | 6.75 |
| Washington LEOFF Plan 1 | 7.50 |
| Washington LEOFF Plan 2 | 7.40 |
| Washington PERS 1 | 7.50 |
| Washington PERS 2/3 | 7.50 |
| Washington School Employees Plan 2/3 | 7.50 |
| Washington Teachers Plan 1 | 7.50 |
| Washington Teachers Plan 2/3 | 7.50 |
| West Virginia PERS | 7.50 |
| West Virginia Teachers | 7.50 |
| Wisconsin Retirement System | 7.0 |
| Wyoming Public Employees | 7.0 |

1. In February 2017 the CalPERS Board adopted a risk mitigation policy, effective beginning FY 2021, that calls for a reduction in the system's investment return assumption commensurate with the pension fund achieving a specified level of investment return. Details are available online: https://www.calpers.ca.gov/docs/board-agendas/201702/financeadmin/item-9a-02.pdf.
2. For each year in which the actual rate of investment return exceeds the target rate of return, the Georgia ERS will reduce its investment return assumption by 0.1% (10 basis points) until a target rate of return assumption of 7.0% is reached.
3. The Kentucky ERS is composed of two plans: Hazardous and Non-Hazardous. The rate shown applies to the plan's Non-Hazardous plan, which accounts for more than 90 percent of the Kentucky ERS plan liabilities. The investment return assumption used for the Hazardous plan is 6.25 percent.
4. LASERS is reducing its discount rate to 7.40% effective FY 22. The discount rate used to determine the FY 2020/2021 funding requirement is 7.55%, which is net of gain-sharing. The investment return assumption differs from the discount rate because of the effective cost of providing potential future ad hoc postretirement benefit increases, or gain-sharing. The investment return assumption, which includes gain-sharing, is reducing incrementally to 7.75% by FY 22.
5. The TRS of Louisiana is reducing its discount rate from 7.45% to 7.40%, effective July 1, 2021. The investment return assumption differs from the discount rate because of the effective cost of providing potential future ad hoc postretirement benefit increases, or gain-sharing. The investment return assumption, which includes gain-sharing, will reduce to 7.75%.
6. The Michigan Public School Employees' Retirement System administers three plans: a defined benefit plan and two hybrid plans (Pension Plus and Pension Plus 2). The rate shown applies to the defined benefit plan and the Pension Plus Plan. The investment return assumption used for the Pension Plus 2 plan is 6.0 percent.
7. In August 2017 the Michigan SERS and PSERS adopted a dedicated investment gains policy that calls for a reduction in the assumed rate of return in years when investment earnings exceed the assumed rate of return. The size of the reduction depends on the level of investment return. More details are available here: https://www.nasra.org//Files/Topical%20Reports/Actuarial/MI%20Dedicated%20Gains%20policy.pdf

8. A 2019 amendment to the Mississippi PERS funding policy stipulates that the investment return assumption will be reduced until it reaches the rate recommended by the actuary in the most recent experience study using investment gains based on the following parameters:
    a. 2% excess return over assumed rate, lower assumption by 5 basis points
    b. 5% excess return over assumed rate, lower assumption by 10 basis points
    c. 8% excess return over assumed rate, lower assumption by 15 basis points
    d. 12% excess return over assumed rate, lower assumption by 20 basis points
9. The assumed rate of return for the New Jersey PERS, Police & Fire, and Teachers plans is scheduled to decrease to 7.3 percent for FY 21 and FY 22, and to 7.0 percent effective FY 23.

# Appendix B: Entity Responsible for Setting Investment Return Assumption for Selected State Plans

| State | System | Investment Return Assumption Set By |
|---|---|---|
| AK | Alaska Public Employees Retirement System | Alaska Retirement Management Board |
| AK | Alaska Teachers Retirement System | Alaska Retirement Management Board |
| AL | Retirement Systems of Alabama | Retirement board |
| AR | Arkansas Public Employees Retirement System | Retirement board |
| AR | Arkansas State Highway Employees' Retirement System | Retirement board |
| AR | Arkansas Teachers Retirement System | Retirement board |
| AZ | Arizona Public Safety Personnel Retirement System | Retirement board |
| AZ | Arizona State Retirement System | Retirement board |
| CA | California Public Employees Retirement System | Retirement board |
| CA | California State Teachers Retirement System | Retirement board |
| CO | Colorado Public Employees Retirement Association | Retirement board |
| CO | Fire & Police Pension Association of Colorado | Retirement board |
| CT | Connecticut State Employees Retirement System | State Employees Retirement Commission |
| CT | Connecticut Teachers Retirement Board | Retirement board |
| DC | District of Columbia Retirement Board | Retirement board |
| DE | Delaware Public Employees Retirement System | Retirement board |
| FL | Florida Retirement System | FRS Actuarial Assumption Estimating Conference[1] |
| GA | Georgia Employees Retirement System | Retirement board |
| GA | Georgia Teachers Retirement System | Retirement board |
| HI | Hawaii Employees Retirement System | Retirement board |
| IA | Iowa Public Employees Retirement System | IPERS Investment Board |
| ID | Idaho Public Employees Retirement System | Retirement board |
| IL | Illinois State Universities Retirement System | Retirement board |
| IL | Illinois State Employees Retirement System | Retirement board |
| IL | Illinois Municipal Retirement Fund | Retirement board |
| IL | Illinois Teachers Retirement System | Retirement board |
| IN | Indiana Public Retirement System | Retirement board |
| KS | Kansas Public Employees Retirement System | Retirement board |
| KY | Kentucky Retirement Systems | Retirement board |
| KY | Kentucky Teachers Retirement System | Retirement board |
| LA | Louisiana State Employees Retirement System | Retirement board |
| LA | Louisiana Parochial Employees' Retirement System | Retirement board |
| LA | Louisiana Teachers Retirement System | Retirement board |
| MA | Massachusetts State Employees Retirement System | Collaborative between the legislature, state treasurer, governor, and the Massachusetts Public Employee Retirement Administration Commission |
| MA | Massachusetts Teachers Retirement Board | Collaborative between the legislature, state treasurer, governor, and the Massachusetts Public Employee Retirement Administration Commission |
| MD | Maryland State Retirement and Pension System | Retirement board |
| ME | Maine Public Employees Retirement System | Retirement board |
| MI | Michigan Public School Employees Retirement System | Retirement board |
| MI | Michigan State Employees Retirement System | Retirement board |
| MI | Municipal Employees' Retirement System of Michigan | Retirement board |
| MN | Minnesota Public Employees Retirement Association | Legislature |
| MN | Minnesota State Retirement System | Legislature |
| MN | Minnesota Teachers Retirement Association | Legislature |

| | | |
|---|---|---|
| MO | Missouri Local Government Employees Retirement System | Retirement board |
| MO | Missouri Public Schools Retirement System | Retirement board |
| MO | Missouri State Employees Retirement System | Retirement board |
| MO | MoDOT & Patrol Employees' Retirement System | Retirement board |
| MS | Mississippi Public Employees Retirement System | Retirement board |
| MT | Montana Public Employees Retirement Board | Retirement board |
| MT | Montana Teachers Retirement System | Retirement board |
| NC | North Carolina Retirement Systems | Retirement board |
| ND | North Dakota Public Employees Retirement System | Retirement board |
| ND | North Dakota Teachers Fund for Retirement | Retirement board |
| NE | Nebraska Public Employees Retirement System | Retirement board |
| NH | New Hampshire Retirement System | Retirement board |
| NJ | New Jersey Division of Pension and Benefits | Retirement board and state treasurer |
| NM | New Mexico Educational Retirement Board | Retirement board |
| NM | New Mexico Public Employees Retirement Association | Retirement board |
| NV | Nevada Public Employees Retirement System | Retirement board |
| NY | New York State & Local Retirement Systems | State comptroller |
| NY | New York State Teachers Retirement System | Retirement board |
| OH | Ohio Police and Fire Pension Fund | Retirement board |
| OH | Ohio Public Employees Retirement System | Retirement board |
| OH | Ohio School Employees Retirement System | Retirement board |
| OH | Ohio State Teachers Retirement System | Retirement board |
| OK | Oklahoma Public Employees Retirement System | Retirement board |
| OK | Oklahoma Teachers Retirement System | Retirement board |
| OR | Oregon Public Employees Retirement System | Retirement board |
| PA | Pennsylvania Public School Employees Retirement System | Retirement board |
| PA | Pennsylvania State Employees Retirement System | Retirement board |
| RI | Rhode Island Employees Retirement System | Retirement board |
| SC | South Carolina Retirement Systems | Legislature |
| SD | South Dakota Retirement System | Retirement board |
| TN | Tennessee Consolidated Retirement System | Retirement board |
| TX | Teacher Retirement System of Texas | Retirement board |
| TX | Texas County & District Retirement System | Retirement board |
| TX | Texas Employees Retirement System | Retirement board |
| TX | Texas Municipal Retirement System | Retirement board |
| UT | Utah Retirement Systems | Retirement board |
| VA | Virginia Retirement System | Retirement board |
| VT | Vermont State Employees Retirement System | Retirement board |
| VT | Vermont Teachers Retirement System | Retirement board |
| WA | Washington Department of Retirement Systems | Legislature |
| WI | Wisconsin Retirement System | Retirement board |
| WV | West Virginia Consolidated Public Retirement Board | Retirement board |
| WY | Wyoming Retirement System | Retirement board |

1. The Conference consists of staff from the Florida House, Senate, and Governor's office

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Investment Institute

# 2021 Capital Market Assumptions

## Methodology — The building-block approach

In this special report


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*Asset allocation* ..... 7
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# 2021 Capital Market Assumptions methodology — The building-block approach

Among other things, successful investing requires investors to make important choices about opportunities for growth and income. As part of our asset allocation and investment strategy, we regularly review our capital market assumptions (CMAs) as well as our strategic and tactical asset allocation mixes. Our CMAs are hypothetical return expectations based on longer-term trends we expect to prevail over the next 10 to 15 years (covering at least one, if not two, market cycles). Two perspectives are used to create the inputs: historical data series and forward-looking capital market adjustments. These assumptions are intended not to predict the future but rather to put into perspective realistic expectations of potential investment risk and return traits. They do not represent the returns an investor should expect in any particular year. Also, they may differ markedly from recent experience, especially after an unusual series of market conditions, such as those we experienced in early 2020.

CMAs are developed for two important reasons: to help determine portfolio allocations and to assess the probability that investors will be able to reach their financial goals. CMAs consist of several factors, including return, risk, and correlation expectations for the specific asset classes in our investment strategies. This report discusses our methodology for constructing CMAs of the various asset classes as well as the long-term factors that may affect the overall investment-strategy process. It is intended to accompany our monthly Asset Allocation Strategy report.

## Background

The process of allocating assets starts with our assumptions for the risk and return that investors might expect from each of the asset classes we use in the Wells Fargo Investment Institute investment objectives.

These assumptions are intended to reflect the relative behavior of the asset classes over the next one or two market cycles, somewhere between 10 and 15 years. Our CMAs are based on a combination of an analysis of historical observations and our understanding of the returns that investors demand for varying types and levels of risk. By design, they are not updated in response to recent asset-class performance. They are intended to be realistic — but conservative — estimates, typically erring on the high side for risk and the low side for return. We believe that it is best to base an investment plan on conservative assumptions, and these assumptions should provide investors with a context for how they might reasonably expect the various asset classes to perform over a multiple-cycle period.

As part of our asset allocation and investment strategy, we create these longer-term CMAs as inputs for two primary applications. We use CMAs as inputs into a mean-variance optimizer (MVO), which is a tool used to allocate assets to build optimal portfolios based on risk and return and is a key component used in developing specific portfolio allocations. An optimizer, or tool, constrained to produce diversified allocations, can provide directional guidance in setting strategic asset allocations. The MVO process searches for the efficient frontier based on CMAs (that is, return, risk, and correlation) that we formulate. We also use CMAs to populate risk and return expectations for investment planning software designed to forecast investors' probability of meeting their financial goals based on investment objective allocations and estimated cash flows. Bear in mind, our CMAs are estimates of how asset classes and combinations of classes may respond across various market environments. The assumptions are not designed to predict actual performance, and there are no assurances that any estimates used will be achieved.

# Capital Market Assumptions — Methodology

CMAs are developed to reflect the expected relationship of capital markets with inflation over one to two market cycles, spanning a 10- to 15-year time horizon. CMAs consist of three distinct parts: hypothetical return, hypothetical risk, and hypothetical expectations for correlations between asset classes. Keep in mind, correlation measures the degree to which asset classes move in sync; it does not measure the magnitude of that movement. Our return and risk assumptions are compared with historical rolling 10-year average returns and standard deviations and generally fall within the minimum and maximum of those ranges.

Inflation forms the first building block of the approach, as investors demand this level of return just to break even in real (inflation-adjusted) terms.

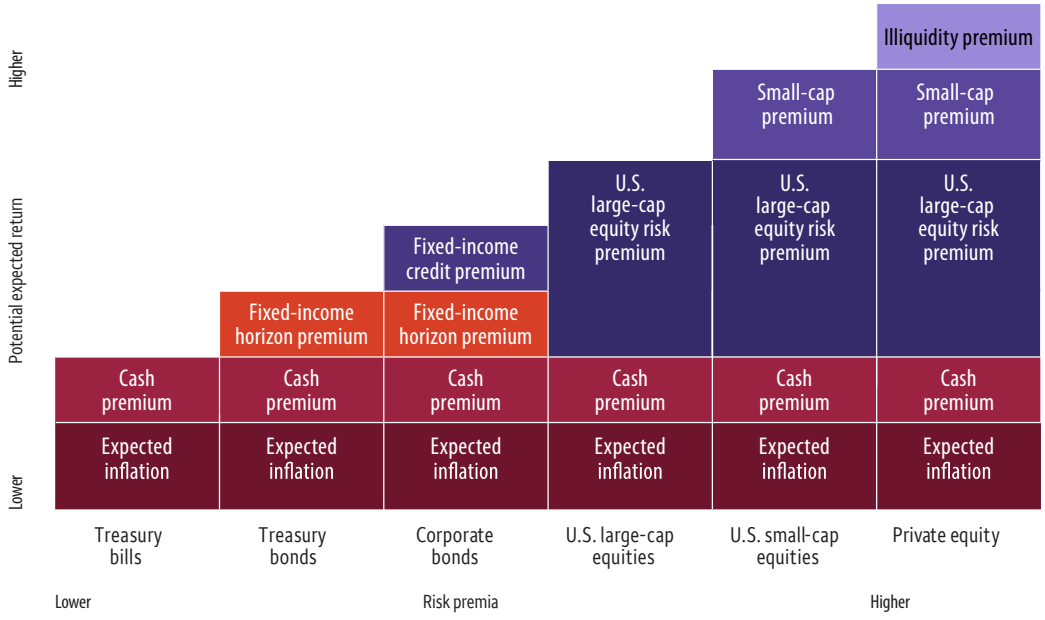
## Hypothetical return

We use a building-block approach based on the underlying principle that investors demand compensation for each element of risk in an asset class. Inflation forms the first building block of the approach, as investors demand this level of return just to break even in real (inflation-adjusted) terms.

The cash premium or discount is the second building block. Expected inflation plus the cash premium or minus the cash discount equals our expected risk-free rate of return — the theoretical rate of return of an investment with the lowest risk. This sum forms one of the input variables for a technique called the Sharpe-ratio analysis — which compares various levels of the risk versus reward trade-off — explained below.

Next, various types and amounts of risk premia are added to the risk-free rate to determine our return expectations for each of the asset classes. These risk premia include fixed-income duration risk (for short-, intermediate-, and long-term premia), credit risk, default risk, equity risk, hedge fund risk, and private capital illiquidity risk, among others. Historical performance relationships are used as a foundation for estimating the building-block risk premia. After adding relevant risk premia to the risk-free rate, the result is an arithmetic mean hypothetical return for each asset class.

**Conceptual view of building-block risk premia**




For illustrative purposes only. Chart is conceptual and does not reflect any actual returns or represent any specific asset classifications.

The arithmetic mean return is a simple average that typically represents performance for a single period. This is useful when considering how an asset class can perform in a given year. However, our time frame goes beyond one year, and we need to factor in the compounding effect on returns over multiple time periods. Therefore, we believe that the more appropriate way to express return assumptions over a long time horizon is to convert the arithmetic mean for each asset class to the geometric mean.

To illustrate the difference between arithmetic and geometric returns, suppose $100,000 was invested in a stock portfolio and that portfolio experiences successive returns of +20.00% in one year and -20.00% in the second. At the end of the first year, the portfolio is worth $120,000, and at the end of the second year, it is worth $96,000. The annual arithmetic mean is 0.00%, whereas the annual geometric mean is -2.02%. As you can see, the geometric mean captures changes in portfolio performance over multiple years (that is, compounding) and is generally lower than the arithmetic mean, thus providing a more conservative estimate for our return assumptions.

Sharpe ratios rise for equity risk, hedging strategies, and illiquidity premia, creating a roughly linear capital market line.

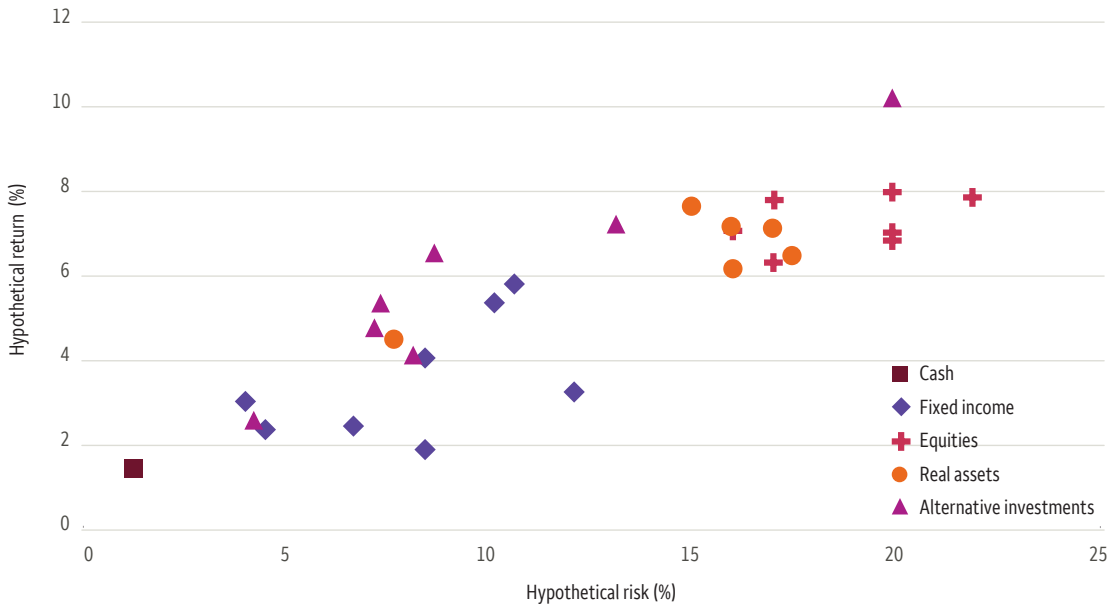
## Hypothetical risk

The risk assumptions of our CMA methodology, measured as volatility or variability of returns, are based on a historical perspective and future expectations. We consider the variability of historical returns within the context of how current macroeconomic conditions differ from those when the historical returns occurred.

We then overlay a Sharpe-ratio equivalency analysis for each asset group. In effect, the Sharpe ratio measures the additional return that an investor could expect to receive for taking on additional risk.

In our analysis, we assume a certain level of market efficiency, which means that similar asset classes will have similar Sharpe ratios. Otherwise, traders would take advantage of persistent arbitrage opportunities. Sharpe ratios rise for equity risk, alternative strategies, and illiquidity premia, creating a roughly linear capital market line. The use of a Sharpe-ratio equivalency analysis assists in preventing overallocation to asset classes that may be preferred by the MVO.

**Capital market line based on Wells Fargo Investment Institute forward-looking capital market assumptions**




**Source:** Wells Fargo Investment Institute, as of July 19, 2021

For illustrative purposes. Hypothetical returns represent our estimate of likely average returns over the next several market cycles. They do not represent the returns that an investor should expect in any particular year. The return and risk assumptions are statistical averages that do not represent the experience of any individual investor or any specific time period. Hypothetical risk is measured by standard deviation. Standard deviation is a measure of volatility. It reflects the degree of variability surrounding the outcome of an investment decision; the higher the standard deviation, the greater the risk. The assumptions are not designed to predict actual performance. Hypothetical return estimates are subject to uncertainty and error. They are based on estimates that may not be achieved and assumptions that may not occur.

## Correlation

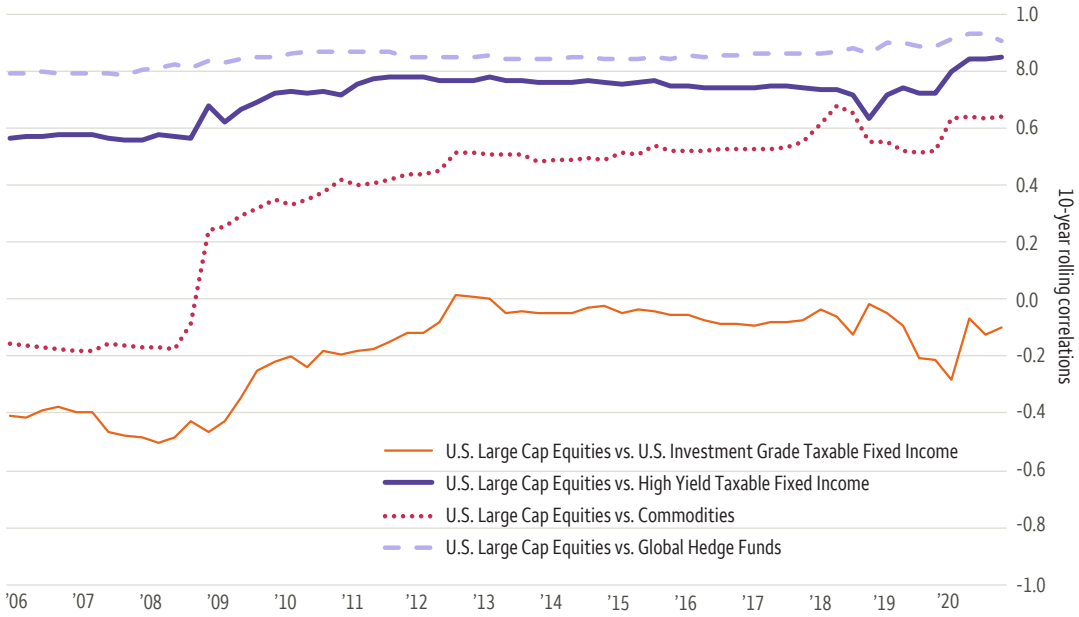
Correlation plays an important role in portfolio diversification and is a primary input in portfolio construction. Correlation is a statistical measure that describes the degree of association between two asset classes. That is, it reflects the degree to which two asset classes move in the same direction. Different from mean return and standard deviation, correlation does not indicate the magnitude of asset-class movement. Correlation can range in value between -1 and +1. A correlation of -1 between two asset classes indicates perfect negative association in movement (that is, they always move in the opposite direction), whereas a correlation of +1 denotes perfect positive association. It is important to note that historical correlation is reflective of past performance and that past performance is no guarantee of future results.

As shown in the following chart, correlations among asset classes can vary in value over time and through different environments. For example, during significant market downturns, systematic macro factors dominate over idiosyncratic (or asset-specific) factors. As a result, many asset classes tend to move in the same direction, causing correlations among them to increase significantly. High correlation implies diminished diversification benefit to help mitigate risk.

Correlation is a statistical measure that describes the degree of association between two asset classes.

**Correlation between U.S. large-cap equities and various asset classes**

***Historical 10-year rolling correlations, 2006–2020***




**Sources:** Bloomberg, Morningstar Direct, and Wells Fargo Investment Institute, as of December 31, 2020

Index returns represent general market results; assume reinvestment of dividends and other distributions; and do not reflect deductions for fees, expenses, or taxes applicable to an actual investment.

U.S. Large Cap Equities = Ibbotson SBBI U.S. Large Cap Stock Index
U.S. Investment Grade Taxable Fixed Income = Bloomberg Barclays U.S. Aggregate Bond Index
High Yield Taxable Fixed Income = Bloomberg Barclays U.S. Corporate High Yield Index
Commodities = Bloomberg Commodity Index
Global Hedge Funds = HFRI Fund Weighted Composite Index

Chart is for illustrative purposes only and is not indicative of any investment. An index is unmanaged and not available for direct investment.
**Past performance is no guarantee of future results.** There is no direct correlation between the performance of an index and the performance of a client portfolio, and there is no guarantee that future correlations between the indexes will remain the same.

Please see the following page for definitions of the representative indexes.

We use a look-back period that covers 20 years to construct correlations among asset classes. We incorporate a comprehensive list of asset classes in our correlation matrix so it can be used for a wide range of asset allocation applications and investor profiles.

We also tested the correlation matrix to understand its impact on asset allocation and ensure that it has required statistical properties.

## Asset-class correlation matrix 2000–2020

| | Cash Alternatives | U.S. Inv. Grade Bonds | High Yield Taxable Fixed Income | Dev. Mkt. Ex-U.S. Bonds | Emerg. Mkt. Bonds | U.S. Large Cap Equities | U.S. Mid Cap Equities | U.S. Small Cap Equities | Dev. Mkt. Ex-U.S. Equities | Emerg. Mkt. Equities | Public Real Estate | Commodities | Global Hedge Funds |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cash Alternatives | 1.0 | 0.15 | -0.16 | 0.03 | -0.08 | -0.19 | -0.18 | -0.16 | -0.10 | 0.01 | -0.05 | 0.02 | -0.04 |
| U.S. Inv. Grade Bonds | | 1.0 | -0.05 | 0.56 | 0.28 | -0.32 | -0.30 | -0.34 | -0.23 | -0.16 | -0.01 | -0.14 | -0.24 |
| High Yield Taxable Fixed Income | | | 1.0 | 0.03 | 0.78 | 0.74 | 0.79 | 0.72 | 0.74 | 0.79 | 0.76 | 0.57 | 0.81 |
| Dev. Mkt. Ex-U.S. Bonds | | | | 1.0 | 0.30 | -0.04 | -0.03 | -0.07 | 0.17 | 0.12 | 0.21 | 0.19 | 0.03 |
| Emerg. Mkt. Bonds | | | | | 1.0 | 0.58 | 0.62 | 0.54 | 0.61 | 0.70 | 0.67 | 0.47 | 0.64 |
| U.S. Large Cap Equities | | | | | | 1.0 | 0.97 | 0.92 | 0.89 | 0.80 | 0.78 | 0.46 | 0.86 |
| U.S. Mid Cap Equities | | | | | | | 1.0 | 0.96 | 0.91 | 0.85 | 0.83 | 0.53 | 0.93 |
| U.S. Small Cap Equities | | | | | | | | 1.0 | 0.86 | 0.79 | 0.79 | 0.44 | 0.88 |
| Dev. Mkt. Ex-U.S. Equities | | | | | | | | | 1.0 | 0.90 | 0.84 | 0.55 | 0.91 |
| Emerg. Mkt. Equities | | | | | | | | | | 1.0 | 0.77 | 0.60 | 0.91 |
| Public Real Estate | | | | | | | | | | | 1.0 | 0.50 | 0.78 |
| Commodities | | | | | | | | | | | | 1.0 | 0.65 |
| Global Hedge Funds | | | | | | | | | | | | | 1.0 |

Index correlations represent past performance. **Past performance is no guarantee of future results.** There is no guarantee that future correlations among the indexes will remain the same. An index is unmanaged and not available for direct investment. Index returns reflect general market results and do not reflect actual portfolio returns or the experience of any investor, nor do they reflect the deductions for fees, expenses, or taxes applicable to an actual investment. Unlike most asset-class indexes, HFR Index returns reflect deductions for fees and expenses. There is no guarantee that future correlations between the indexes will remain the same. Please see the end of this report for the risks associated with these asset classes.

**The asset classes above are represented by the following indexes:**

**Cash Alternatives:** The Bloomberg Barclays 1–3 Month Treasury Bill Index is representative of money markets.

**U.S. Investment Grade Fixed Income:** The Bloomberg Barclays U.S. Aggregate Bond Index is a broad-based measure of the investment-grade, U.S.-dollar-denominated, fixed-rate taxable bond market.

**High Yield Taxable Fixed Income:** The Bloomberg Barclays U.S. Corporate High Yield Index covers the universe of fixed-rate, non-investment-grade debt.

**Developed Market Ex-U.S. Fixed Income:** The J.P. Morgan Non-U.S. Global Government Bond Index (Hedged) is an unmanaged market index representative of the total return performance, on a hedged basis, of major non-U.S. bond markets. It is calculated in U.S. dollars.

**Emerging Market Fixed Income:** The J.P. Morgan Emerging Markets Bond Index (EMBI) Global currently covers 27 emerging market countries. Included in the EMBI Global are U.S.-dollar-denominated Brady bonds, Eurobonds, traded loans, and local market debt instruments issued by sovereign and quasi-sovereign entities.

**U.S. Large Cap Equities:** The Ibbotson SBBI U.S. Large Cap Stock Index tracks the performance of the S&P 500 Index stocks. The S&P 500 Index is a market-capitalization-weighted index generally considered representative of the U.S. stock market.

**U.S. Mid Cap Equities:** The Russell Midcap® Index measures the performance of the 800 smallest companies in the Russell 1000® Index, which represent approximately 25% of the total market capitalization of the Russell 1000 Index.

**U.S. Small Cap Equities:** The Russell 2000® Index measures the performance of the 2,000 smallest companies in the Russell 3000® Index, which represents approximately 8% of the total market capitalization of the Russell 3000 Index.

**Developed Market Ex-U.S. Equities:** The MSCI EAFE Developed Market Index is a free-float-adjusted market-capitalization-weighted index that is designed to measure the equity market performance of 21 developed market countries, excluding the U.S. and Canada.

**Emerging Market Equities:** The MSCI Emerging Markets Index is a free-float-adjusted market-capitalization-weighted index that is designed to measure the equity market performance of 23 emerging markets.

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**Public Real Estate:** The FTSE EPRA/NAREIT Developed Index is designed to track the performance of listed real estate companies and REITs in developed countries worldwide.

**Commodities:** The Bloomberg Commodity Index is a broadly diversified index composed of futures contracts on 19 physical commodities traded on U.S. exchanges.

**Global Hedge Funds:** The HFRI Fund Weighted Composite Index is a global, equal-weighted index of over 2,000 single-manager funds that report to HFR Database. Constituent funds report monthly net-of-all-fees performance in U.S. dollars and have a minimum of $50 million under management or a 12-month track record of active performance. The HFRI Fund Weighted Composite Index does not include funds of hedge funds.

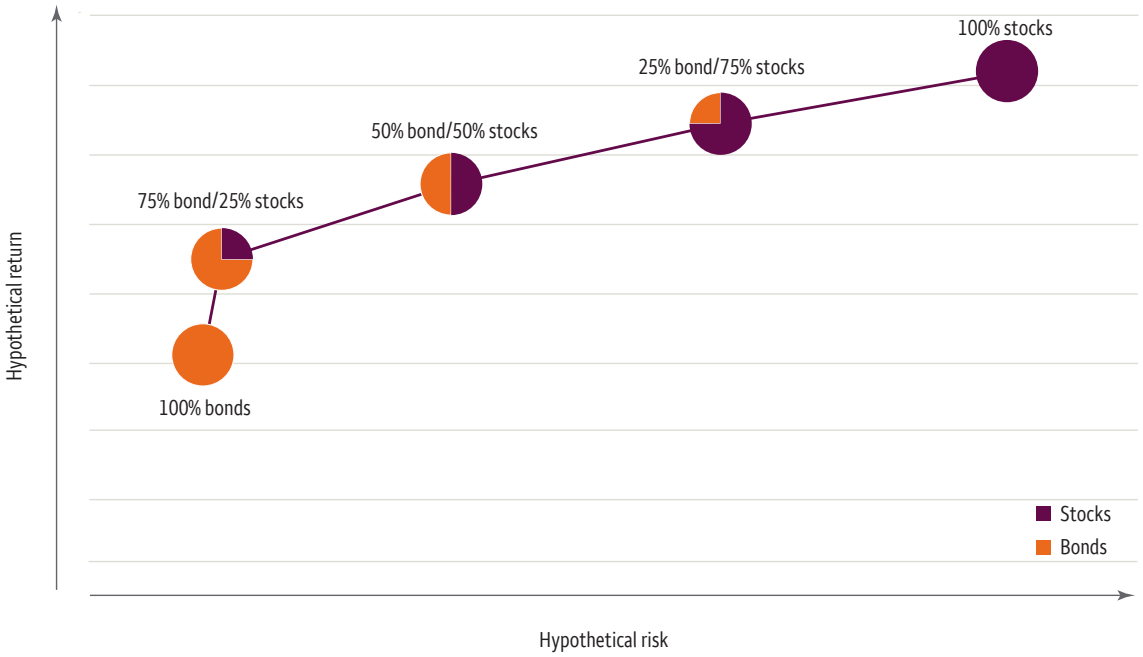
## Asset allocation

We apply Modern Portfolio Theory as a starting point in constructing our strategic asset allocations. The Modern Portfolio Theory was originally developed by Nobel Prize Laureate Harry Markowitz in 1952. It hypothesizes the existence of an efficient frontier of optimal portfolios that offer the maximum possible expected return for a given level of risk. Since its introduction, the theory has received broad acceptance in academia and in the financial industry.

In practice, the most common way to derive the efficient frontier is by a numerical optimization process known as Mean Variance Optimization, or MVO. The MVO process searches for the efficient frontier based on CMAs (that is, return, risk, and correlation) that we formulate. We also apply asset allocation constraints to the MVO process, to ensure continuity in the allocations from one year to another and that the final allocation is well diversified. The chart below illustrates a sample efficient frontier based on two asset classes: large-cap equities and investment-grade fixed income. In general, the more distinct asset classes are incorporated, the more efficient the optimized allocation.

**Conceptual view of portfolios representing an efficient frontier**

***Stocks and bonds***




**Source:** Wells Fargo Investment Institute, as of July 19, 2021

U.S. Large Cap Equities and U.S. Investment Grade Taxable Fixed Income are represented by Wells Fargo Investment Institute CMAs. The data assume reinvestment of all income and do not account for taxes or transaction costs. **Past performance is no guarantee of future results.** This chart is for illustrative purposes only and not indicative of any investment. An index is unmanaged and not available for direct investment.

## 2021 CMAs — Return expectations

We consider long-term themes in the development of our CMAs. Several of the key global investment trends we expect to see over the next 10 to 15 years are:

- Inflation that is lower than long-term averages and equal to the Federal Reserve's (Fed's) 2.0% target
- A continued cash discount to inflation
- Fixed-income yields rising from historical lows followed by stabilization at relatively low rates
- Capital gains in equities from increased revenues and operational efficiencies, but reduced yields as a percentage of price
- Stronger commodity-price gains as we enter a bull super-cycle[1] and post-pandemic global growth has demand outpacing supply
- Continued use of alternative investments to generate alpha (excess return over a benchmark) and reduce traditional asset-class risk

We expect inflation to run above 2% in 2021 and 2022 before returning to a 2% average for the remainder of the 10- to 15-year strategic time frame.

The data provided below is for illustrative and information purposes only and does not constitute advice or a recommendation of the suitability of any investment strategy, including strategies that allocate to alternative investments. CMAs are based on forecasts and are not promises of actual returns or performance that may be realized. They are based on estimates that may not be achieved and assumptions that may not occur. Consult your investment professional before taking any action based on this information.

## Inflation

Our long-term average assumption for inflation is held at 2.0%. Since 1913, the median U.S. inflation rate has been 2.6% and the average has been 3.2%. Despite an expected uptick in inflation in 2021 and 2022, we believe that inflation is likely to remain below its long-term average over the next 10 to 15 years. A primary reason underpinning our belief that inflation is likely to remain low over the long term is global central bank policymakers' focus on price stability and the ability of new technologies to foster lower prices for goods and services. Post 2008–2009 financial crisis, deflation (not inflation) has been the biggest concern for the Fed, the European Central Bank, the Bank of Japan, and other major central banks. Global central banks have provided extraordinary levels of stimulus to help ease economies out of the severe global recession caused by the coronavirus pandemic.

The economy's quick recovery allowed for a sharp uptick in inflation in 2021, and we expect elevated inflation to persist into 2022. However, we expect the moderate pace of economic growth in the post-pandemic world to lessen the risk of high inflation beyond 2022. Productivity enhancements implemented during the pandemic likely will add to the cushion against inflation as the pandemic crisis recedes. Additionally, we expect the structural headwinds that prevented higher inflation pre-pandemic to reassert their influence in the coming years. Unless systemic financial conditions change materially over the coming years, we would expect policymakers at the Fed to maintain their 2% inflation target by moderating the money supply.

Put into context, our projection for inflation of 2.0% is slightly above the 10-year historical average and slightly below the 20-year historical average. Specifically, over the past 20 years, the U.S. Consumer Price Index, which measures the price of a fixed basket of goods and services purchased by an average consumer, has averaged 2.1%, and it has averaged just 1.7% over the past 10 years.

1. Individual commodity prices tend to move together over very long bull and bear cycles, often lasting a decade or more.

## Cash and cash alternatives

Our cash return assumption is 1.5%.

Our cash return discount below inflation was increased this year from 0.25% to 0.5%. Although the historical real return of U.S. 30-day Treasury bills has been 0.43% since 1926,[2] for much of the past 10 years there has been a discount for cash relative to inflation. Over the forecast period, we expect a similar market environment to that of the past decade, in which cash returns less than inflation. Combining our long-term inflation assumption and cash discount, we arrive at our hypothetical expected risk-free return of 1.5%.

## Fixed income

Our view is that interest rates will rise from recent lows over the next few years as the U.S. economy quickly recovers. Rising interest rates likely will have a negative impact on bond prices (bond prices generally fall as interest rates rise and vice versa) and total returns in the near term; however, higher yields in the out years likely will offset some of the price declines. Interest rates have risen from 2020 lows, and we expect rates to rise modestly from current levels but do not expect them to rise materially over the strategic time frame.

### U.S. fixed income

Rising interest rates likely will have a negative impact on bond prices and total returns; however, higher yields likely will offset some of the price declines.

CMAs for U.S. investment-grade fixed income are intended to capture return and risk expectations for multiple bond asset classes, including various domestic investment-grade sectors across the maturity spectrum. It can be used as a core bond asset class and is developed using the Bloomberg Barclays U.S. Investment Grade Aggregate Bond Index.

U.S. short-, intermediate-, and long-term bond horizon (term) premia over cash are rooted in the historical yield-curve slope. Historically, the average spreads over the various constant-rate maturities[3] are as follows:

- Short term (Ibbotson U.S. 1-year Treasury/Bloomberg Barclays U.S. Treasury 1-3 year Index yield over U.S. Treasury 3-month T-bill auction yield/Bloomberg Barclays U.S. Treasury 1-3 month Index yield) is 58 basis points (bps; 100 bps equal 1.00%) (April 1953 to December 2020)
- Intermediate term (Ibbotson U.S. Intermediate Term Government Yield/Bloomberg Barclays U.S. Treasury 5-7 year Index yield over Ibbotson U.S. 1-year Treasury/Bloomberg Barclays U.S. Treasury 1-3 year Index yield) is 56 bps (April 1953 to December 2020)
- Long term (Ibbotson U.S. Long Term Yield/Bloomberg Barclays U.S. Treasury 10+ year Index yield over Ibbotson U.S. Intermediate Term Government Yield/Bloomberg Barclays U.S. Treasury 5-7 year Index yield) is 51 bps (January 1926 to December 2020)

In addition to the term premia, we also add premia for credit risk and default risk. The credit risk premium is derived from historical yield spreads relative to comparable Treasury yields, while the default risk premium is based on historical default and recovery rate experience. Our return expectations for most U.S. fixed-income asset classes are lower this year compared with last year, taking into account the lower cash discount.

Municipal fixed-income CMAs are calculated by taking the equivalent taxable return assumptions and applying a municipal/taxable yield ratio based on historical relationships.


2. Morningstar, as of December 31, 2020

3. Constant-rate maturities are the fixed maturities, currently 1, 3, and 6 months and 1, 2, 3, 5, 7, 10, 20, and 30 years, that exist along the yield curve. This yield (rate) is based on the closing market bid yields on actively traded Treasury securities in the over-the-counter market.

## High-yield fixed income

We use 505 bps as our forward-looking credit premium assumption and -176 bps as our default premium assumption.

U.S. high-yield fixed income refers to bonds that are rated below U.S. investment grade, and therefore, investors require a sizable spread premium over U.S. Treasuries to compensate for increased credit and default risk. The longer-term average credit premium is 505 bps.[4] We use 505 bps as our hypothetical forward-looking credit premium assumption and -176 bps as our default premium assumption. Over the strategic time horizon, we expect default levels to be consistent with historical experience. High-yield fixed income is similar in maturity and duration (duration measures a bond's price sensitivity to a 1% change in interest rates) to intermediate bonds, so we use a term premium of 110 bps. Overall, our hypothetical return assumption is below the long-term average and our risk assumption remains slightly higher than historical averages.

High-yield fixed income = Inflation - Cash discount + Term premium + Credit premium - Default discount

## Developed market ex-U.S. fixed income

Our hypothetical return assumption is lower and our risk assumption is unchanged this year.

The developed market (DM) ex-U.S. fixed-income asset class represents multiple yield curves with an average duration in between intermediate and long bonds. The historical average term premium of the J.P. Morgan Global Government Bond Index over the U.S. Treasury 3-month T-bill auction yield is 82 bps. Therefore, we give developed market bonds a term premium of 82 bps. We removed a -25 bps qualitative adjustment given the reduction of cash return. Our hypothetical return assumption is lower and our risk assumption is unchanged this year.

DM ex-U.S. fixed income = Inflation - Cash discount + Term premium

## Emerging market fixed income

The hypothetical return assumption is lower and our risk assumption is unchanged this year.

We use the J.P. Morgan Emerging Markets Bond Index (EMBI) Global to form our CMAs for emerging market (EM) fixed income. The J.P. Morgan EMBI Global is an intermediate- to long-duration, primarily U.S.-dollar-denominated index. Given average maturities that fall between intermediate and longer term, we give emerging market fixed income a term premium of 122 bps. A credit premium of 414 bps and a default premium of -42 bps are added for sovereign credit risk and potential default risk. We removed a -25 bps qualitative adjustment given the reduction of cash return. The hypothetical return assumption is lower and our risk assumption is unchanged this year.

EM fixed income = Inflation - Cash discount + Term premium + Credit premium - Default discount

4. Bloomberg Barclays U.S. High Yield Corporate Index, as of December 31, 2020

# Equities

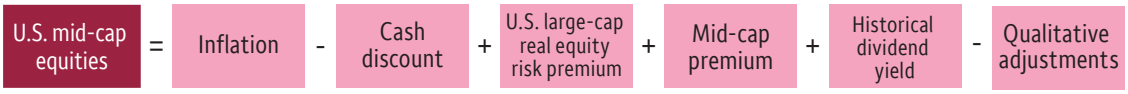
## U.S. equities

Equity return assumptions also begin with our long-term inflation and cash-discount assumptions. Then we add the real equity risk premium (approximated from historical analysis) and a forward-looking dividend-yield assumption (derived from an adjustment to the historical dividend yield) to arrive at our total-return assumption. The equity risk premium is calculated using a U.S. large-cap index (for U.S. equity asset classes) or a developed market (DM) ex-U.S. equity index (for international equity asset classes) as the starting point for each of the equity asset classes. The equity risk premium spreads for U.S. equity asset classes are added to the U.S. large-cap equity risk premium, and the equity risk premium spreads for non-U.S. equity asset classes are added to the DM ex-U.S. equity risk premium. We then subtract the income component of the appropriate index and the cash return approximated from the Ibbotson Associates Stocks, Bonds, Bills, and Inflation (IA SBBI) U.S. 30 Day T-Bill Total Return Index[5] for the corresponding time period. Forward-looking qualitative adjustments may be made to both return and standard deviation to bring risk-adjusted returns (Sharpe ratios) in line with our outlook.

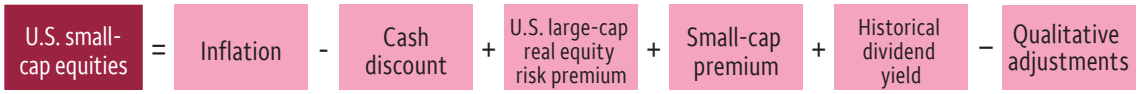
**Large cap.** Our real equity risk premium estimate for U.S. large-cap equities is 459 bps. We expect an average hypothetical dividend yield of 190 bps over the strategic time horizon, lower than the historical average dividend rate of 3.9% and last year's expectation of 2.1% but in line with the average dividend yields in the past 10- to 20-year period, as represented by the S&P 500 Index. Our hypothetical return and risk assumptions are unchanged.

Our hypothetical return and risk assumptions are unchanged this year, but our yield assumptions are lower.


**Mid cap.** Our mid-cap premium over large cap is 181 bps. We expect an average hypothetical dividend yield of 155 bps over the strategic time horizon, in line with the average dividend yields of the past 10- to 20-year period, as represented by the Russell Midcap Index. Recent history shows that mid caps have outperformed both large- and small-cap stocks. However, we adjust the return assumption lower relative to historical averages to maintain a risk/return relationship that we believe should be between large- and small-cap assumptions. Our hypothetical return and risk assumptions are unchanged.




**Small cap**. Our small-cap premium over large cap is based on the historical average of 148 bps, as represented by the Russell 2000 Index. We expect an average dividend yield of 130 bps over the strategic time horizon, slightly lower than the historical average dividend rate. Our hypothetical return and risk assumptions are unchanged from last year.




5. The IA SBBI U.S. 30 Day T-Bill Total Return Index shows the growth in value of $100 from 30-day U.S. Treasury bills, including gross interest reinvested.

## Developed market ex-U.S. equities

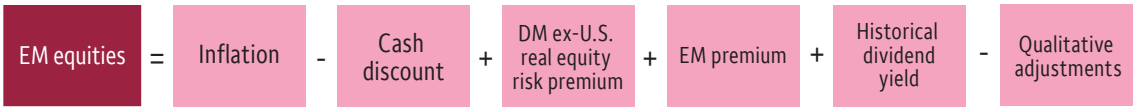
Return is lower and risk remains somewhat higher than that for U.S. large-cap equities.

Similar to U.S. equity return assumptions, developed market ex-U.S. equity return assumptions begin with our long-term inflation and cash-discount assumptions. Then we add our real equity risk premium of 303 bps derived from historical analysis based on the MSCI EAFE Index. We then add 285 bps as a hypothetical assumption for the dividend yield. We expect that developed market ex-U.S. equities are likely to underperform U.S. large-cap equities over the strategic time frame. Overall, return is lower and risk remains somewhat higher than that for U.S. large-cap equities.


## Emerging market equities

Our hypothetical return assumption is higher and risk assumption is lower than last year.

We begin with our EM premium over DM ex-U.S. equities of 599 bps derived from historical analysis based on the MSCI Emerging Markets Index. We then add 230 bps as an assumption for the dividend yield. This is slightly below the historical average dividend yield. Reflecting our view that emerging equity markets are maturing, we subtract 275 bps as a qualitative adjustment. The EM equity return assumption was increased this year to reflect the increased tech exposure in the EM index and some strength in EM currencies that should support prices. The risk assumption is reduced this year to move more in line with historical averages.



# Real assets

## Real estate

U.S. public real estate has been reclassified as an equity sector to reflect its similar characteristics to equities, including trading on equity exchanges.

U.S. public real estate has been reclassified as an equity sector to reflect its similar characteristics to equities, including trading on equity exchanges. Real estate investment trusts (REITs) differ from other equities, however, in that they are required to distribute at least 90% of taxable income to shareholders annually. Our return assumption begins with our long-term inflation and cash-premium assumptions. Then we add the real equity risk premium of 178 bps (approximated from historical analysis based on the FTSE EPRA/NAREIT Index) and an assumption for the dividend yield of 4.00%, which is consistent with the historical average. Private real estate will continue to be classified as a real asset where the return assumption is derived from adding our yield assumption for the asset class to the public real estate equity risk premium and the risk-free rate.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Public real estate | = | Inflation | - | Cash discount | + | Real equity risk premium | + | Historical dividend yield | + | Qualitative adjustments |
| Private real estate | = | Inflation | - | Cash discount | + | Public real estate real equity risk premium | + | Dividend yield | - | Qualitative adjustments |

## Infrastructure

Our return assumption is based on a yield assumption of 4.25% and a real equity risk premium of 505 bps (approximated from historical analysis based on the S&P Global Infrastructure Index).[6] This is added to the risk-free rate, and a downward adjustment of 250 bps is made to account for the short historical period and our neutral outlook going forward. Our assumptions are far more conservative than historical returns would suggest; however, we think that many of the inefficiencies of this market have been removed.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Infrastructure | = | Inflation | - | Cash discount | + | Real equity risk premium | + | Historical dividend yield | - | Qualitative adjustments |

## Commodities

Commodity consumption should correlate with global growth (International Monetary Fund forecast at 4.1% over our strategic horizon), and therefore, commodity prices should move in line with global inflation (forecast at 120 bps higher than U.S. inflation over the forecast horizon). We added a 25 bps positive qualitative adjustment this year, reflecting our belief that the commodities are entering a period of more sustained price gains. We expect that most of the strategic time frame will be comprised of a bull market.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Commodities | = | Global Inflation | - | Cash discount | + | Global real GDP | + | Qualitative adjustments |

6. The S&P Global Infrastructure Index is designed to track 75 companies from around the world chosen to represent the listed infrastructure industry while maintaining liquidity and tradability. To create diversified exposure, the index includes three distinct infrastructure clusters: energy, transportation, and utilities.

# Alternative investments

## Hedge funds

Like other asset classes, hedge fund return assumptions begin with our long-term inflation and cash-discount assumptions. Then we add the hedge fund premium (approximated from historical analysis). The hedge fund premium is calculated using the appropriate total-return index as the starting point for each of the four hedge fund strategies, then subtracting the cash return approximated from the IA SBBI U.S. 30 Day T-Bill Total Return Index starting in 2000. We use data starting in 2000 because returns for hedge funds were much higher in the 1990s than current levels and future expectations due to the high interest rate environment, fewer funds employing alpha-generating strategies, and strong U.S. equity returns. Even though we are limiting our time frame to 2000 to the present, that time frame still contains data from two full market cycles. Forward-looking qualitative adjustments may be made to both return and standard deviation to bring risk-adjusted returns (Sharpe ratios) in line with our outlook.

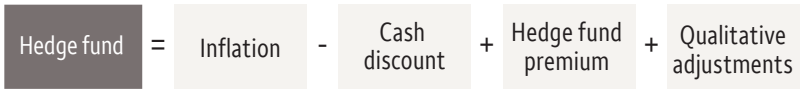
Hedge fund return assumptions are constructed using the building-block approach, starting with the long-term inflation and cash-discount assumptions. Hedge fund historical risk premiums are then added, and our long-term outlook for the various strategies is reflected in the qualitative adjustments.[7]

The hedge fund premia for the four hedge fund strategies are as follows:

- Relative Value (HFRI Relative Value Index) hedge fund premium is 456 bps (January 2000 to December 2020)
- Macro (HFRI Macro Index) hedge fund premium is 295 bps (January 2000 to December 2020)
- Event Driven (HFRI Event Driven Index) hedge fund premium is 511 bps (January 2000 to December 2020)
- Equity Hedge (HFRI Relative Value Index) hedge fund premium is 438 bps (January 2000 to December 2020)

The Relative Value, Macro, and Event Driven returns are slightly lower, and the Equity Hedge return is higher. Relative Value and Macro risk is increased to better reflect our forward-looking expectations for increased risk in those asset classes.

We also include CMAs for Global Hedge Funds proxied by the HFRI Fund Weighted Composite Index. These assumptions are intended to capture return and risk expectations for multiple hedge fund strategies.




**7. Alternative investments, such as hedge funds, private capital, and private real estate funds, are not suitable for all investors.** They are speculative and involve a high degree of risk that is suitable only for those investors who have the financial sophistication and expertise to evaluate the merits and risks of an investment in a fund and for which the fund does not represent a complete investment program.

## Private capital (equity and debt)

One major distinction between private capital and its public counterparts is illiquidity. In other words, private capital investments do not trade frequently. This illiquidity can provide a sizable return premium to private capital over time. However, it also poses challenges to accurately pricing private capital investments and estimating performance statistics, especially standard deviation and correlation of return. We use U.S. small-cap equities as a public proxy for private equity and have observed a historical illiquidity premium that is factored into our return assumption. Risk is difficult to measure using smoothed quarterly private equity returns. Therefore, we turn to our public proxy to measure potential volatility that might be comparable with de-smoothed private equity performance.

Private debt return assumptions rely heavily on yield expectations and the historical relationship with public high-yield debt. We expect a premium over high-yield fixed income for illiquidity and for potential equity warrants. Second-lien private debt typically generates a premium over high-yield fixed income, while mezzanine debt can offer an even higher illiquidity premium. Finally, distressed debt investors could experience equity-like returns during periods of market dislocation.

## 2021 capital market assumptions adjustments

| Asset group | CMA adjustments | Rationale | Allocation implications |
|---|---|---|---|
| Inflation | Maintained long-term inflation assumption of 2.0% | Inflation is expected to be above the 10-year average, near the 20-year average, and below the long-term average in the forecast period and equal to the Fed's 2.0% target | |
| Cash | Lowered long-term cash-discount assumption to -0.5% and lowered cash return to 1.5% | Cash returns have been lower than inflation over the past 10 to 20 years | Slightly reduced cash allocation, but maintained a small cash allocation for expenses, rebalancing, and tactical opportunities |
| Fixed income | Returns for most asset classes reduced | Lower cash return assumption led to a decrease in return assumptions | Reduced allocations to U.S. Investment Grade Fixed Income and High Yield Fixed Income |
| Equities | Slight increase in return assumptions and decrease in risk assumptions for emerging market and frontier market equity | Sector composition changes and expectations of higher commodities prices and some emerging market currency strength | Rebalanced allocations to equity asset classes, maintaining a long-term favorable view of U.S. and EM equities over DM ex-U.S. equities and small caps over large caps |
| Real assets | Increased commodities return assumption | Commodities likely are entering a period of more sustained price gains; we expect that most of the strategic time frame will be comprised of a bull market | Strategic allocation to commodities is added in certain investment objectives to reflect higher expected returns in coming years |
| Alternative investments | Slight increase in Global Hedge Fund return and risk assumptions<br>Slight decrease in Private Debt return assumptions | Adjustments in Relative Value, Equity Hedge, and Macro CMAs contribute to increase in Global Hedge Funds return and risk<br>Adjusted return to reflect lower cash return assumptions | Added allocations to Private Debt generally funded from U.S. Investment Grade and High Yield Fixed Income |

**Alternative investments, such as hedge funds, private capital, and private real estate funds, are not suitable for all investors.** They are speculative and involve a high degree of risk that is suitable only for those investors who have the financial sophistication and expertise to evaluate the merits and risks of an investment in a fund and for which the fund does not represent a complete investment program.

## 2021 asset-class return and volatility assumptions

***Capital market assumptions (10- to 15-year horizon)***

| | Arithmetic return | Geometric return | Standard deviation | Yield | Downside risk | Sharpe ratio |
|---|---|---|---|---|---|---|
| Inflation | 2.0% | – | – | – | – | – |
| Cash Alternatives | 1.5% | 1.5% | 1.0% | 1.5% | -0.1% | 0.00 |
| U.S. Investment Grade Taxable Fixed Income | 3.2% | 3.1% | 3.8% | 3.1% | -2.9% | 0.44 |
| U.S. Short Term Taxable Fixed Income | 2.1% | 2.1% | 1.5% | 2.1% | -0.3% | 0.42 |
| U.S. Intermediate Term Taxable Fixed Income | 3.2% | 3.1% | 3.8% | 3.1% | -2.9% | 0.45 |
| U.S. Long Term Taxable Fixed Income | 3.8% | 3.3% | 9.5% | 3.3% | -11.1% | 0.24 |
| High Yield Taxable Fixed Income | 5.9% | 5.4% | 10.0% | 5.4% | -9.7% | 0.44 |
| U.S. Investment Grade Tax Exempt Fixed Income | 2.5% | 2.4% | 4.3% | 2.4% | -4.3% | 0.24 |
| Short Term Tax Exempt Fixed Income | 1.9% | 1.8% | 1.8% | 1.8% | -1.0% | 0.20 |
| Intermediate Term Tax Exempt Fixed Income | 2.4% | 2.3% | 4.3% | 2.3% | -4.5% | 0.21 |
| Long Term Tax Exempt Fixed Income | 3.1% | 2.9% | 5.5% | 2.9% | -5.7% | 0.28 |
| High Yield Tax Exempt Fixed Income | 4.4% | 4.1% | 8.3% | 4.1% | -8.6% | 0.35 |
| Developed Market Ex-U.S. Fixed Income | 2.3% | 2.0% | 8.3% | 2.0% | -10.7% | 0.10 |
| Emerging Market Fixed Income | 6.4% | 5.9% | 10.5% | 5.9% | -9.9% | 0.47 |
| Inflation Linked Fixed Income | 2.7% | 2.5% | 6.5% | 2.5% | -7.7% | 0.18 |
| Preferred Stock | 4.0% | 3.3% | 12.0% | 3.3% | -14.5% | 0.21 |
| U.S. Large Cap Equities | 8.3% | 7.1% | 16.0% | 1.9% | -15.9% | 0.42 |
| U.S. Mid Cap Equities | 9.1% | 7.8% | 17.0% | 1.6% | -16.4% | 0.45 |
| U.S. Small Cap Equities | 9.8% | 8.0% | 20.0% | 1.3% | -19.7% | 0.42 |
| Developed Market Ex-U.S. Equities | 7.7% | 6.4% | 17.0% | 2.8% | -17.8% | 0.36 |
| Developed Market Ex- U.S. Small Cap Equities | 8.7% | 6.9% | 20.0% | 2.3% | -20.8% | 0.36 |
| Emerging Market Equities | 10.0% | 7.9% | 22.0% | 2.2% | -22.1% | 0.39 |
| Frontier Market Equities | 8.9% | 7.1% | 20.0% | 3.3% | -20.6% | 0.37 |
| Public Real Estate | 7.9% | 6.5% | 17.5% | 4.0% | -18.3% | 0.37 |
| Private Real Estate | 8.7% | 7.7% | 15.0% | 5.5% | -14.1% | 0.48 |
| Infrastructure | 8.3% | 7.1% | 16.0% | 4.3% | -15.9% | 0.43 |
| Master Limited Partnerships | 8.5% | 7.2% | 17.0% | 6.2% | -17.0% | 0.41 |
| Timberland | 4.7% | 4.5% | 7.5% | 3.0% | -7.1% | 0.43 |
| Commodities | 7.3% | 6.2% | 16.0% | 0.0% | -16.8% | 0.36 |
| Global Hedge Funds | 5.4% | 5.2% | 6.5% | 0.0% | -4.9% | 0.60 |
| Hedge Funds — Relative Value | 5.1% | 4.8% | 7.0% | 0.0% | -6.0% | 0.51 |
| Hedge Funds — Macro | 4.5% | 4.1% | 8.0% | 0.0% | -8.2% | 0.37 |
| Hedge Funds — Event Driven | 5.6% | 5.4% | 7.2% | 0.0% | -5.7% | 0.58 |
| Hedge Funds — Equity Hedge | 6.9% | 6.5% | 8.5% | 0.0% | -6.5% | 0.63 |
| Global Liquid Alternatives | 2.7% | 2.6% | 4.0% | 0.0% | -3.7% | 0.30 |
| Private Equity | 11.9% | 10.1% | 20.0% | 0.0% | -17.7% | 0.52 |
| Private Debt | 8.0% | 7.2% | 13.0% | 6.8% | -12.0% | 0.50 |

**Source:** Wells Fargo Investment Institute

Capital market and asset-class assumptions are estimates of how asset classes and combinations of classes may respond during various market environments. For example, downside risk is based on our assumptions about average returns, and the variability of returns represents the minimum return that would be statistically likely in 95% of annual returns. In other words, in 19 out of 20 years, performance likely would be better than this figure, and in the 20th year, it likely would be worse. There is no guarantee that any particular 20-year period would follow this pattern. Hypothetical returns represent our estimate of likely average returns over the next several market cycles. They do not represent the returns that an investor should expect in any particular year. Geometric return is the compounded annual return that would give the same result as a given series of annual returns based on those same assumptions. The return and risk assumptions are statistical averages that do not represent the experience of any individual investor or any specific time period. Standard deviation is a measure of volatility. It reflects the degree of variability surrounding the outcome of an investment decision; the higher the standard deviation, the greater the risk. Yield on a bond is the yield-to-maturity of the bond. Dividend yield on an equity or real-asset investment represents the projected dividend as a percentage of the purchase price. The assumptions are not designed to predict actual performance, and there are no assurances that any estimates used will be achieved. The information given has been provided as a guide to help with investment planning and does not represent the maximum loss a portfolio could experience. Sharpe ratio measures the additional return that an investor could expect to receive for accepting additional risk.

**Alternative investments, such as hedge funds, private capital, and private real estate funds, are not suitable for all investors.** They are speculative and involve a high degree of risk that is suitable only for those investors who have the financial sophistication and expertise to evaluate the merits and risks of an investment in a fund and for which the fund does not represent a complete investment program.

Global liquid alternatives are investment strategies such as mutual funds, exchange-traded funds, and closed-end funds that may provide daily liquidity.

# Strategic asset allocations — Illiquid (four-asset-group)

***May include fixed income, equities, real assets, and alternative investments***

| Income | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** |
| **Total Cash Alternatives** | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% |
| U.S. Investment Grade Taxable Fixed Income | 59.0% | 62.0% | -3.0% | 46.0% | 48.0% | -2.0% | 33.0% | 36.0% | -3.0% |
| High Yield Taxable Fixed Income | 4.0% | 6.0% | -2.0% | 4.0% | 7.0% | -3.0% | 6.0% | 8.0% | -2.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 3.0% | 3.0% | 0.0% | 5.0% | 5.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| **Total Global Fixed Income** | 66.0% | 71.0% | -5.0% | 55.0% | 60.0% | -5.0% | 47.0% | 52.0% | -5.0% |
| U.S. Large Cap Equities | 8.0% | 6.0% | 2.0% | 12.0% | 10.0% | 2.0% | 15.0% | 11.0% | 4.0% |
| U.S. Mid Cap Equities | 2.0% | 2.0% | 0.0% | 4.0% | 4.0% | 0.0% | 6.0% | 8.0% | -2.0% |
| U.S. Small Cap Equities | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 4.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 2.0% | 2.0% | 0.0% | 4.0% | 4.0% | 0.0% | 4.0% | 4.0% | 0.0% |
| Emerging Market Equities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Equities** | 12.0% | 10.0% | 2.0% | 22.0% | 20.0% | 2.0% | 27.0% | 27.0% | 0.0% |
| Private Real Estate | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Global Hedge Funds | 11.0% | 11.0% | 0.0% | 11.0% | 11.0% | 0.0% | 11.0% | 11.0% | 0.0% |
| Private Equity | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Private Debt | 4.0% | 0.0% | 4.0% | 4.0% | 0.0% | | 6.0% | 0.0% | 6.0% |
| **Total Alternative Investments*** | 15.0% | 11.0% | 4.0% | 15.0% | 11.0% | 4.0% | 17.0% | 11.0% | 6.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

| Growth and income | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** |
| **Total Cash Alternatives** | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% |
| U.S. Investment Grade Taxable Fixed Income | 31.0% | 31.0% | 0.0% | 21.0% | 21.0% | 0.0% | 14.0% | 14.0% | 0.0% |
| High Yield Taxable Fixed Income | 4.0% | 6.0% | -2.0% | 4.0% | 6.0% | -2.0% | 3.0% | 6.0% | -3.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 3.0% | 5.0% | -2.0% | 4.0% | 6.0% | -2.0% | 6.0% | 6.0% | 0.0% |
| **Total Global Fixed Income** | 38.0% | 42.0% | -4.0% | 29.0% | 33.0% | -4.0% | 23.0% | 26.0% | -3.0% |
| U.S. Large Cap Equities | 16.0% | 14.0% | 2.0% | 18.0% | 18.0% | 0.0% | 22.0% | 22.0% | 0.0% |
| U.S. Mid Cap Equities | 6.0% | 8.0% | -2.0% | 8.0% | 8.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| U.S. Small Cap Equities | 2.0% | 4.0% | -2.0% | 3.0% | 5.0% | -2.0% | 4.0% | 6.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Emerging Market Equities | 5.0% | 3.0% | 2.0% | 6.0% | 4.0% | 2.0% | 7.0% | 5.0% | 2.0% |
| **Total Global Equities** | 34.0% | 34.0% | 0.0% | 41.0% | 41.0% | 0.0% | 48.0% | 48.0% | 0.0% |
| Private Real Estate | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% | 6.0% | 6.0% | 0.0% |
| Commodities | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% |
| **Total Global Real Assets** | 7.0% | 5.0% | 2.0% | 8.0% | 6.0% | 2.0% | 8.0% | 6.0% | 2.0% |
| Global Hedge Funds | 10.0% | 10.0% | 0.0% | 10.0% | 10.0% | 0.0% | 7.0% | 9.0% | -2.0% |
| Private Equity | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% | 9.0% | 8.0% | 1.0% |
| Private Debt | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 3.0% |
| **Total Alternative Investments*** | 19.0% | 16.0% | 3.0% | 20.0% | 17.0% | 3.0% | 19.0% | 17.0% | 2.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

***Alternative investments, such as hedge funds, private capital, and private real estate funds, are not suitable for all investors.** They are speculative and involve a high degree of risk that is suitable only for those investors who have the financial sophistication and expertise to evaluate the merits and risks of an investment in a fund and for which the fund does not represent a complete investment program.

*(Continued on page 19.)*

*(Continued from page 18.)*

| Growth | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 1.0% | 2.0% | -1.0% | 1.0% | 2.0% | -1.0% | 1.0% | 2.0% | -1.0% |
| U.S. Investment Grade Taxable Fixed Income | 9.0% | 9.0% | 0.0% | 4.0% | 4.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| High Yield Taxable Fixed Income | 3.0% | 5.0% | -2.0% | 2.0% | 4.0% | -2.0% | 0.0% | 2.0% | -2.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 3.0% | 5.0% | -2.0% | 3.0% | 3.0% | 0.0% | 0.0% | 2.0% | -2.0% |
| **Total Global Fixed Income** | 15.0% | 19.0% | -4.0% | 9.0% | 11.0% | -2.0% | 0.0% | 4.0% | -4.0% |
| U.S. Large Cap Equities | 24.0% | 24.0% | 0.0% | 24.0% | 24.0% | 0.0% | 24.0% | 24.0% | 0.0% |
| U.S. Mid Cap Equities | 9.0% | 9.0% | 0.0% | 13.0% | 13.0% | 0.0% | 15.0% | 15.0% | 0.0% |
| U.S. Small Cap Equities | 5.0% | 7.0% | -2.0% | 6.0% | 8.0% | -2.0% | 7.0% | 9.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 9.0% | 9.0% | 0.0% | 11.0% | 11.0% | 0.0% | 12.0% | 12.0% | 0.0% |
| Emerging Market Equities | 9.0% | 7.0% | 2.0% | 12.0% | 10.0% | 2.0% | 15.0% | 13.0% | 2.0% |
| **Total Global Equities** | 56.0% | 56.0% | 0.0% | 66.0% | 66.0% | 0.0% | 73.0% | 73.0% | 0.0% |
| Private Real Estate | 5.0% | 7.0% | -2.0% | 5.0% | 7.0% | -2.0% | 6.0% | 8.0% | -2.0% |
| Commodities | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% |
| **Total Global Real Assets** | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| Global Hedge Funds | 7.0% | 7.0% | 0.0% | 2.0% | 4.0% | -2.0% | 0.0% | 2.0% | -2.0% |
| Private Equity | 11.0% | 9.0% | 2.0% | 12.0% | 10.0% | 2.0% | 15.0% | 11.0% | 4.0% |
| Private Debt | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 3.0% |
| **Total Alternative Investments*** | 21.0% | 16.0% | 5.0% | 17.0% | 14.0% | 3.0% | 18.0% | 13.0% | 5.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

***Alternative investments, such as hedge funds, private capital, and private real estate funds, are not suitable for all investors.** They are speculative and involve a high degree of risk that is suitable only for those investors who have the financial sophistication and expertise to evaluate the merits and risks of an investment in a fund and for which the fund does not represent a complete investment program.

# Strategic asset allocations — Liquid (three-asset-group)

***May include fixed income, equities, and real assets***

## Income

| | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** |
| **Total Cash Alternatives** | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% |
| U.S. Investment Grade Taxable Fixed Income | 72.0% | 77.0% | -5.0% | 58.0% | 61.0% | -3.0% | 45.0% | 48.0% | -3.0% |
| High Yield Taxable Fixed Income | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 3.0% | 3.0% | 0.0% | 5.0% | 5.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| **Total Global Fixed Income** | 80.0% | 85.0% | -5.0% | 69.0% | 72.0% | -3.0% | 61.0% | 64.0% | -3.0% |
| U.S. Large Cap Equities | 12.0% | 6.0% | 6.0% | 16.0% | 12.0% | 4.0% | 19.0% | 15.0% | 4.0% |
| U.S. Mid Cap Equities | 4.0% | 4.0% | 0.0% | 5.0% | 5.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| U.S. Small Cap Equities | 0.0% | 0.0% | 0.0% | 4.0% | 4.0% | 0.0% | 4.0% | 6.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 2.0% | 2.0% | 0.0% | 4.0% | 4.0% | 0.0% | 7.0% | 5.0% | 2.0% |
| Emerging Market Equities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Equities** | 18.0% | 12.0% | 6.0% | 29.0% | 25.0% | 4.0% | 37.0% | 33.0% | 4.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

## Growth and income

| | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** |
| **Total Cash Alternatives** | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% |
| U.S. Investment Grade Taxable Fixed Income | 39.0% | 42.0% | -3.0% | 30.0% | 32.0% | -2.0% | 20.0% | 22.0% | -2.0% |
| High Yield Taxable Fixed Income | 6.0% | 6.0% | 0.0% | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 5.0% | 5.0% | 0.0% | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% |
| **Total Global Fixed Income** | 50.0% | 53.0% | -3.0% | 41.0% | 43.0% | -2.0% | 33.0% | 35.0% | -2.0% |
| U.S. Large Cap Equities | 20.0% | 17.0% | 3.0% | 24.0% | 21.0% | 3.0% | 28.0% | 25.0% | 3.0% |
| U.S. Mid Cap Equities | 8.0% | 10.0% | -2.0% | 10.0% | 12.0% | -2.0% | 12.0% | 14.0% | -2.0% |
| U.S. Small Cap Equities | 5.0% | 8.0% | -3.0% | 6.0% | 8.0% | -2.0% | 6.0% | 8.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 7.0% | 5.0% | 2.0% | 8.0% | 6.0% | 2.0% | 9.0% | 7.0% | 2.0% |
| Emerging Market Equities | 6.0% | 4.0% | 2.0% | 7.0% | 7.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| **Total Global Equities** | 46.0% | 44.0% | 2.0% | 55.0% | 54.0% | 1.0% | 63.0% | 62.0% | 1.0% |
| Commodities | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% |
| **Total Global Real Assets** | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

## Growth

| | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** | **2021** | **2020** | **Change** |
| **Total Cash Alternatives** | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% |
| U.S. Investment Grade Taxable Fixed Income | 16.0% | 18.0% | -2.0% | 8.0% | 11.0% | -3.0% | 3.0% | 3.0% | 0.0% |
| High Yield Taxable Fixed Income | 3.0% | 4.0% | -1.0% | 3.0% | 3.0% | 0.0% | 0.0% | 2.0% | -2.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 3.0% | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 2.0% | 2.0% | 0.0% |
| **Total Global Fixed Income** | 22.0% | 25.0% | -3.0% | 14.0% | 17.0% | -3.0% | 5.0% | 7.0% | -2.0% |
| U.S. Large Cap Equities | 30.0% | 29.0% | 1.0% | 31.0% | 29.0% | 2.0% | 28.0% | 27.0% | 1.0% |
| U.S. Mid Cap Equities | 13.0% | 15.0% | -2.0% | 14.0% | 16.0% | -2.0% | 16.0% | 18.0% | -2.0% |
| U.S. Small Cap Equities | 8.0% | 10.0% | -2.0% | 10.0% | 13.0% | -3.0% | 13.0% | 16.0% | -3.0% |
| Developed Market Ex-U.S. Equities | 11.0% | 9.0% | 2.0% | 12.0% | 10.0% | 2.0% | 16.0% | 14.0% | 2.0% |
| Emerging Market Equities | 12.0% | 10.0% | 2.0% | 15.0% | 13.0% | 2.0% | 18.0% | 16.0% | 2.0% |
| **Total Global Equities** | 74.0% | 73.0% | 1.0% | 82.0% | 81.0% | 1.0% | 91.0% | 91.0% | 0.0% |
| Commodities | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% |
| **Total Global Real Assets** | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

# Strategic asset allocations — Tax-efficient illiquid

***May include fixed income, equities, real assets, and alternative investments***

| Income | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% |
| U.S. Investment Grade Tax Exempt Fixed Income | 77.0% | 77.0% | 0.0% | 55.0% | 55.0% | 0.0% | 40.0% | 40.0% | 0.0% |
| High Yield Tax Exempt Fixed Income | 0.0% | 0.0% | 0.0% | 7.0% | 7.0% | 0.0% | 14.0% | 14.0% | 0.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Fixed Income** | 77.0% | 77.0% | 0.0% | 62.0% | 62.0% | 0.0% | 54.0% | 54.0% | 0.0% |
| U.S. Large Cap Equities | 6.0% | 6.0% | 0.0% | 16.0% | 16.0% | 0.0% | 19.0% | 19.0% | 0.0% |
| U.S. Mid Cap Equities | 3.0% | 3.0% | 0.0% | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% |
| U.S. Small Cap Equities | 0.0% | 0.0% | 0.0% | 3.0% | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% |
| Developed Market Ex-U.S. Equities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.0% | 5.0% | 0.0% |
| Emerging Market Equities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Equities** | 9.0% | 9.0% | 0.0% | 24.0% | 24.0% | 0.0% | 33.0% | 33.0% | 0.0% |
| Private Real Estate | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Global Hedge Funds | 5.0% | 5.0% | 0.0% | 5.0% | 5.0% | 0.0% | 4.0% | 4.0% | 0.0% |
| Private Equity | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Private Debt | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Alternative Investments*** | 5.0% | 5.0% | 0.0% | 5.0% | 5.0% | 0.0% | 4.0% | 4.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

| Growth and income | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 2.0% | 2.0% | 0.0% | 1.0% | 1.0% | 0.0% | 1.0% | 1.0% | 0.0% |
| U.S. Investment Grade Tax Exempt Fixed Income | 35.0% | 35.0% | 0.0% | 28.0% | 28.0% | 0.0% | 21.0% | 21.0% | 0.0% |
| High Yield Tax Exempt Fixed Income | 7.0% | 7.0% | 0.0% | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Fixed Income** | 42.0% | 42.0% | 0.0% | 33.0% | 33.0% | 0.0% | 27.0% | 27.0% | 0.0% |
| U.S. Large Cap Equities | 19.0% | 19.0% | 0.0% | 22.0% | 22.0% | 0.0% | 25.0% | 25.0% | 0.0% |
| U.S. Mid Cap Equities | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% | 9.0% | 9.0% | 0.0% |
| U.S. Small Cap Equities | 3.0% | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 4.0% | 4.0% | 0.0% |
| Developed Market Ex-U.S. Equities | 7.0% | 7.0% | 0.0% | 9.0% | 9.0% | 0.0% | 10.0% | 10.0% | 0.0% |
| Emerging Market Equities | 3.0% | 3.0% | 0.0% | 4.0% | 4.0% | 0.0% | 5.0% | 5.0% | 0.0% |
| **Total Global Equities** | 38.0% | 38.0% | 0.0% | 45.0% | 45.0% | 0.0% | 53.0% | 53.0% | 0.0% |
| Private Real Estate | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Global Hedge Funds | 4.0% | 4.0% | 0.0% | 4.0% | 4.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Private Equity | 7.0% | 7.0% | 0.0% | 10.0% | 10.0% | 0.0% | 12.0% | 12.0% | 0.0% |
| Private Debt | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Alternative Investments*** | 11.0% | 11.0% | 0.0% | 14.0% | 14.0% | 0.0% | 12.0% | 12.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

Note: Tax-efficient allocations use tax-exempt fixed income, and before-tax allocations use taxable fixed income.

*(Continued on page 22.)*

*(Continued from page 21.)*

| Growth | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 1.0% | 1.0% | 0.0% | 1.0% | 1.0% | 0.0% | 1.0% | 1.0% | 0.0% |
| U.S. Investment Grade Tax Exempt Fixed Income | 12.0% | 12.0% | 0.0% | 4.0% | 4.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| High Yield Tax Exempt Fixed Income | 6.0% | 6.0% | 0.0% | 5.0% | 5.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Fixed Income** | 18.0% | 18.0% | 0.0% | 9.0% | 9.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| U.S. Large Cap Equities | 28.0% | 28.0% | 0.0% | 32.0% | 32.0% | 0.0% | 33.0% | 33.0% | 0.0% |
| U.S. Mid Cap Equities | 11.0% | 11.0% | 0.0% | 11.0% | 11.0% | 0.0% | 13.0% | 13.0% | 0.0% |
| U.S. Small Cap Equities | 5.0% | 5.0% | 0.0% | 6.0% | 6.0% | 0.0% | 6.0% | 6.0% | 0.0% |
| Developed Market Ex-U.S. Equities | 11.0% | 11.0% | 0.0% | 12.0% | 12.0% | 0.0% | 12.0% | 12.0% | 0.0% |
| Emerging Market Equities | 6.0% | 6.0% | 0.0% | 8.0% | 8.0% | 0.0% | 13.0% | 13.0% | 0.0% |
| **Total Global Equities** | 61.0% | 61.0% | 0.0% | 69.0% | 69.0% | 0.0% | 77.0% | 77.0% | 0.0% |
| Private Real Estate | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Global Hedge Funds | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Private Equity | 13.0% | 13.0% | 0.0% | 14.0% | 14.0% | 0.0% | 15.0% | 15.0% | 0.0% |
| Private Debt | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Alternative Investments*** | 13.0% | 13.0% | 0.0% | 14.0% | 14.0% | 0.0% | 15.0% | 15.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

Note: Tax-efficient allocations use tax-exempt fixed income, and before-tax allocations use taxable fixed income.

# Strategic asset allocations — Tax-efficient liquid

***May include fixed income, equities, and real assets***

| Income | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 3.0% | 3.0% | 0.0% | 3.0% | 3.0% | 0.0% | 2.0% | 3.0% | -1.0% |
| U.S. Investment Grade Tax Exempt Fixed Income | 85.0% | 77.0% | 8.0% | 64.0% | 61.0% | 3.0% | 48.0% | 48.0% | 0.0% |
| High Yield Tax Exempt Fixed Income | 0.0% | 5.0% | -5.0% | 6.0% | 6.0% | 0.0% | 14.0% | 8.0% | 6.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 0.0% | 3.0% | -3.0% | 0.0% | 5.0% | -5.0% | 0.0% | 8.0% | -8.0% |
| **Total Global Fixed Income** | 85.0% | 85.0% | 0.0% | 70.0% | 72.0% | -2.0% | 62.0% | 64.0% | -2.0% |
| U.S. Large Cap Equities | 6.0% | 6.0% | 0.0% | 14.0% | 12.0% | 2.0% | 17.0% | 15.0% | 2.0% |
| U.S. Mid Cap Equities | 4.0% | 4.0% | 0.0% | 5.0% | 5.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| U.S. Small Cap Equities | 0.0% | 0.0% | 0.0% | 4.0% | 4.0% | 0.0% | 4.0% | 6.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 2.0% | 2.0% | 0.0% | 4.0% | 4.0% | 0.0% | 8.0% | 5.0% | 3.0% |
| Emerging Market Equities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Equities** | 12.0% | 12.0% | 0.0% | 27.0% | 25.0% | 2.0% | 36.0% | 33.0% | 3.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

| Growth and income | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% | 2.0% | 3.0% | -1.0% |
| U.S. Investment Grade Tax Exempt Fixed Income | 45.0% | 42.0% | 3.0% | 35.0% | 32.0% | 3.0% | 25.0% | 22.0% | 3.0% |
| High Yield Tax Exempt Fixed Income | 6.0% | 6.0% | 0.0% | 6.0% | 6.0% | 0.0% | 7.0% | 7.0% | 0.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 0.0% | 5.0% | -5.0% | 0.0% | 5.0% | -5.0% | 0.0% | 6.0% | -6.0% |
| **Total Global Fixed Income** | 51.0% | 53.0% | -2.0% | 41.0% | 43.0% | -2.0% | 32.0% | 35.0% | -3.0% |
| U.S. Large Cap Equities | 17.0% | 17.0% | 0.0% | 23.0% | 21.0% | 2.0% | 27.0% | 25.0% | 2.0% |
| U.S. Mid Cap Equities | 10.0% | 10.0% | 0.0% | 12.0% | 12.0% | 0.0% | 14.0% | 14.0% | 0.0% |
| U.S. Small Cap Equities | 6.0% | 8.0% | -2.0% | 6.0% | 8.0% | -2.0% | 6.0% | 8.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 8.0% | 5.0% | 3.0% | 9.0% | 6.0% | 3.0% | 11.0% | 7.0% | 4.0% |
| Emerging Market Equities | 6.0% | 4.0% | 2.0% | 7.0% | 7.0% | 0.0% | 8.0% | 8.0% | 0.0% |
| **Total Global Equities** | 47.0% | 44.0% | 3.0% | 57.0% | 54.0% | 3.0% | 66.0% | 62.0% | 4.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

| Growth | *Conservative* | | | *Moderate* | | | *Aggressive* | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2021 | 2020 | Change | 2021 | 2020 | Change | 2021 | 2020 | Change |
| **Total Cash Alternatives** | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% | 2.0% | 2.0% | 0.0% |
| U.S. Investment Grade Tax Exempt Fixed Income | 18.0% | 18.0% | 0.0% | 11.0% | 11.0% | 0.0% | 5.0% | 3.0% | 2.0% |
| High Yield Tax Exempt Fixed Income | 4.0% | 4.0% | 0.0% | 3.0% | 3.0% | 0.0% | 0.0% | 2.0% | -2.0% |
| Developed Market Ex-U.S. Fixed Income | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Emerging Market Fixed Income | 0.0% | 3.0% | -3.0% | 0.0% | 3.0% | -3.0% | 0.0% | 2.0% | -2.0% |
| **Total Global Fixed Income** | 22.0% | 25.0% | -3.0% | 14.0% | 17.0% | -3.0% | 5.0% | 7.0% | -2.0% |
| U.S. Large Cap Equities | 31.0% | 29.0% | 2.0% | 31.0% | 29.0% | 2.0% | 27.0% | 27.0% | 0.0% |
| U.S. Mid Cap Equities | 15.0% | 15.0% | 0.0% | 16.0% | 16.0% | 0.0% | 18.0% | 18.0% | 0.0% |
| U.S. Small Cap Equities | 8.0% | 10.0% | -2.0% | 11.0% | 13.0% | -2.0% | 14.0% | 16.0% | -2.0% |
| Developed Market Ex-U.S. Equities | 12.0% | 9.0% | 3.0% | 13.0% | 10.0% | 3.0% | 18.0% | 14.0% | 4.0% |
| Emerging Market Equities | 10.0% | 10.0% | 0.0% | 13.0% | 13.0% | 0.0% | 16.0% | 16.0% | 0.0% |
| **Total Global Equities** | 76.0% | 73.0% | 3.0% | 84.0% | 81.0% | 3.0% | 93.0% | 91.0% | 2.0% |
| Commodities | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Global Real Assets** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total Portfolio** | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% | 100.0% | 100.0% | 0.0% |

Note: Tax-efficient allocations use tax-exempt fixed income, and before-tax allocations use taxable fixed income.

**The asset classes in the tables are represented by broad-based securities market indexes, which have been selected because they are well known and easily recognizable by investors. Indexes have limitations because they have volatility and other material characteristics that may differ from those of an investor's portfolio. They are unmanaged and not available for direct investment. Hedge fund indexes have limitations that are typical of other widely used market indexes, but these indexes are also subject to survivorship bias and limited data. Unlike most asset-class indexes, HFR Index returns reflect fees and expenses. Investments included in individual portfolios may differ significantly from the holdings, weightings, and asset allocation of an index, and unlike an index, an investor's portfolio is subject to fees, expenses, taxes, transaction costs, and other charges typically associated with an investment account. The performance and volatility of an individual's portfolio may be materially different from the performance of an index and should not be relied upon as a measure of the performance that may be achieved. CMA forecasts are not promises of actual returns or performance that may be realized. They are based on estimates and assumptions that may not occur.**

## Risk considerations

**Asset allocation is an investment method used to help manage risk. It does not guarantee investment returns or eliminate the risk of loss. All investing involve risks, including the possible loss of principal. There can be no assurance that any investment strategy will be successful. Investments fluctuate with changes in market and economic conditions and in different environments due to numerous factors, some of which may be unpredictable. Each asset class has its own risk and return characteristics. The level of risk associated with a particular investment or asset class generally correlates with the level of return the investment or asset class might achieve. The risks associated with the representative asset classes discussed in this report include:**

**Alternative investments:** Alternative investments, such as hedge funds, private capital, and private real estate funds, are speculative and entail significant risks that can include losses due to leveraging or other speculative investment practices, lack of liquidity, volatility of returns, restrictions on transferring interests in a fund, potential lack of diversification, absence and/or delay of information regarding valuations and pricing, complex tax structures and delays in tax reporting, less regulation, and higher fees than mutual funds. Hedge fund, private capital, and private real estate fund investing involves other material risks, including capital loss and the loss of the entire amount invested. They are intended for qualified, financially sophisticated investors who can bear the risks associated with these investments. Hedge fund strategies, such as equity hedge, event driven, macro, and relative value may expose investors to risks such as short selling, leverage, counterparty, liquidity, volatility, the use of derivative instruments, and other significant risks.

**Cash alternatives:** Each type of cash alternatives, such as bank certificates of deposits, Treasury bills, and ultrashort bond mutual funds, has advantages and disadvantages. They typically offer lower rates of return than longer-term equity or fixed-income securities and may not keep pace with inflation over extended periods of time. While government securities are backed by the full faith and credit of the federal government as to payment of principal and interest if held to maturity and are considered free from credit risk, they are subject to interest rate risk.

**Commodities:** Exposure to the commodities markets may subject an investment to greater share price volatility than an investment in traditional equity or debt securities. The commodities markets are considered speculative, carry substantial risks, and have experienced periods of extreme volatility. Commodities may be affected by changes in overall market movements, commodity index volatility, changes in interest rates, or other factors affecting a particular industry or commodity.

**Equities:** Stock markets, especially foreign markets, are volatile. Stock values may fluctuate in response to general economic and market conditions, the prospects of individual companies, and industry sectors. Foreign investing has additional risks, including those associated with currency fluctuation, political and economic instability, and different accounting standards. These risks are heightened in emerging markets. Mid- and small-cap stocks are generally more volatile, are subject to greater risks, and are less liquid than large-company stocks. Preferred stocks are subject to issuer-specific and market risks. They are generally subordinated to bonds or other debt instruments in an issuer's capital structure, subjecting them to a greater risk of nonpayment than more senior securities.

**Fixed income:** Investments in fixed-income securities are subject to interest rate, credit/default, call, liquidity, inflation, and other risks. Bond prices fluctuate inversely to changes in interest rates. Therefore, a general rise in interest rates can result in a decline in the bond's price. Credit risk is the risk that an issuer will default on payments of interest and/or principal. This risk is heightened in lower-rated bonds. If sold prior to maturity, fixed-income securities are subject to market risk. All fixed-income investments may be worth less than their original cost upon redemption or maturity. Inflation-linked fixed-income securities are subject to interest rate risk, especially when real interest rates rise. Municipal bonds offer interest payments exempt from federal taxes, and potentially state and local income taxes. These bonds are subject to interest rate and credit/default risk and potentially the alternative minimum tax (AMT). Quality varies widely depending on the specific issuer.

**Master limited partnerships (MLPs):** MLPs involve certain risks that differ from an investment in the securities of a corporation. MLPs may be sensitive to price changes in oil, natural gas, etc.; regulatory risk; and rising interest rates. A change in the current tax law regarding MLPs could result in the MLP being treated as a corporation for federal income tax purposes, which would reduce the amount of cash flows distributed by the MLP. Other risks include the volatility associated with the use of leverage, volatility of the commodities markets, market risks, supply and demand, natural and man-made catastrophes, competition, liquidity, market price discount from net asset value, and other material risks.

**Real estate:** Investment in real estate securities have certain risks, including the possible illiquidity of the underlying properties, credit risk, interest rate fluctuations, and the impact of varied economic conditions.

**Timberland:** Timberland investments are subject to acts of nature such as fire, tornados, hurricanes, forest insects, invasive species, and diseases, in addition to the risks associated with short-term price volatility, interest rate fluctuations, and lack of liquidity.



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