Asset Liability Management:

Capital Market Assumptions: Survey & Methodology

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Board of Administration Offsite
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Executive Summary

- This presentation summarizes the process we use to develop our Capital Market Assumptions (CMAs), which includes a survey and our internal validation methodologies. We are not recommending CMAs at this time.
- The overall trend has been towards lower expected returns accompanied by higher expected return volatility. The survey data supports our view that managers and consultants have diverse views, and our ALM process incorporates this uncertainty.
- The survey also tells us that private assets (e.g., real assets, private equity, private debt) and emerging market equities, are amongst the higher returning opportunities, while emerging market debt is an additional diversifier.
- Our process includes surveying external asset managers and consultants to gain expert projections on expectations for market returns risk and to understand the diversity of opinions. In March 2020 and December 2020, all 11 of the organizations surveyed provided responses. In March 2021, 6 organizations responded, as not all organizations update CMAs on a quarterly basis.
- The survey responses provided 11 views on 10-year returns, 6 views on 20-year returns and 3 views on 30-year returns. As long-term investors, we believe the longer views are most relevant to our discount rate.
- CalPERS also develops economic and market views that allow us to validate the results of the CMA survey. We do this not because we have a comparative advantage relative to the external organizations, but because the process of developing our own views deepens our understanding of market opportunities and risks, and of the factors that drive the risks and returns in our portfolios. Our internal CMAs have no privileged role in developing our overall market views.
- Finally, we provide a high-level summary of our internal CMA methodology and use this to illustrate why CMAs can vary from survey to survey and across respondents.

Summary of Survey Responses

Capital Market Assumption Survey Participants

- AllianceBernstein
- AQR Capital Management
- BlackRock
- Goldman Sachs Asset Management
- Invesco - Investment Solutions
- J.P. Morgan Asset Management
- Meketa Investment Group
- PIMCO
- RVK, Inc.
- State Street Global Advisors
- Wilshire

	3/31/2020 Mid-Cycle Review* 11 Respondents		12/31/2020 11 Respondents			3/31/2021 6 Respondents		
Asset Class	**10 Year**	**20 Year**	**10 Year**	**20 Year**	**30 Year**	**10 Year**	**20 Year**	**30 Year**
Global Equity - Cap Weighted	11	6	11	6	3	6	2	3
Global Equity - Factor Weighted	5	3	8	4	2	5	1	2
Private Equity	11	5	11	6	3	5	2	3
Emerging Market Equities	11	6	11	6	4	6	2	4
Private Debt	-	-	7	4	1	3	2	2
Emerging Market Debt	-	-	7	4	2	5	2	3
Long Treasuries	11	6	11	6	4	6	2	4
Long Spread	11	6	11	8	3	6	6	3
High Yield	4	5	5	2	4	3	1	4
US Real Estate	10	5	9	5	3	4	2	3
Liquidity	10	5	11	6	4	6	2	4
US Inflation	10	5	11	7	-	6	3	-

We survey several managers and consultants, knowing not all will respond, and those that do may not provide all requested data points. This can be seen in the lower response rate for the most recent survey. Their responses represent an estimate of the range of expected return outcomes and the median value represents a market view on probable outcomes.

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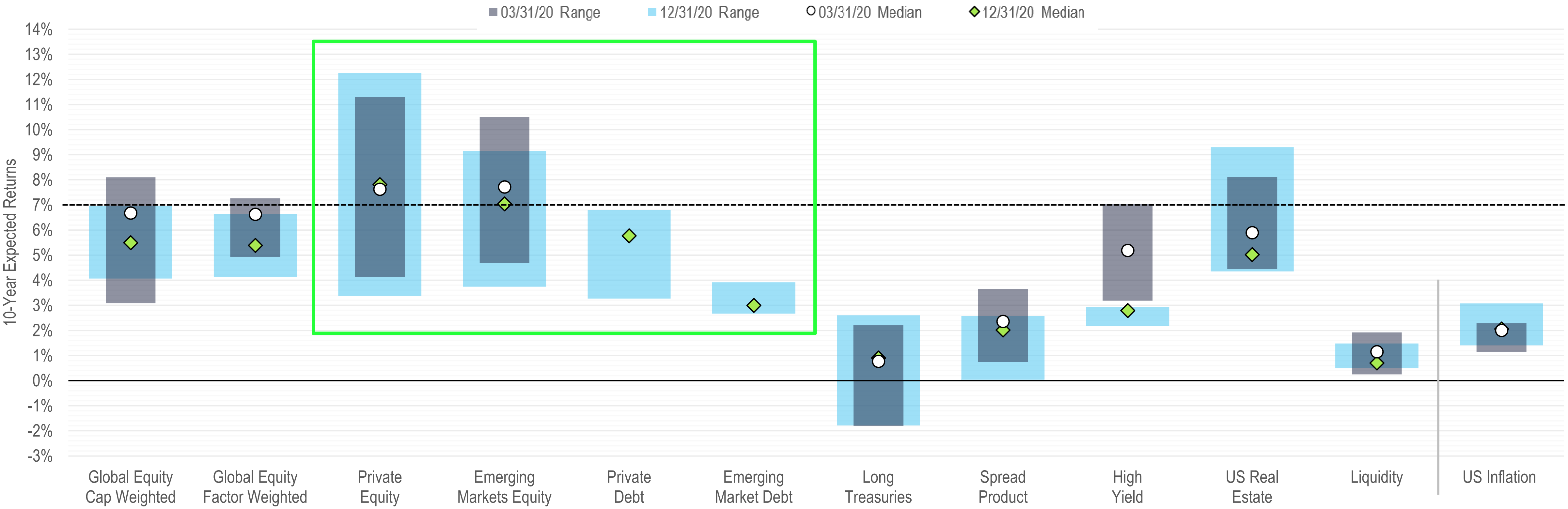
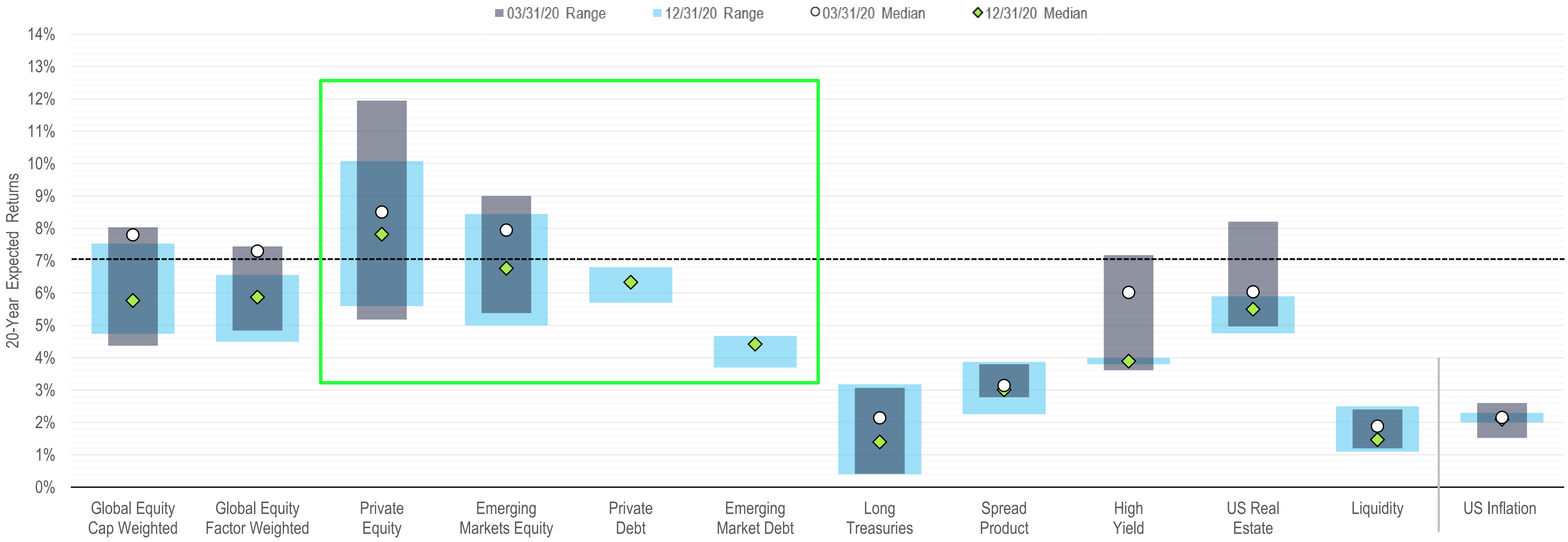
*The 2020 Mid-Cycle CMA Survey did not include 30-year estimates, private debt, and emerging market debt.

Returns: 10-year expectations affirm our interest in private equity, private debt and real assets. We will also look at broadening our exposure to emerging markets



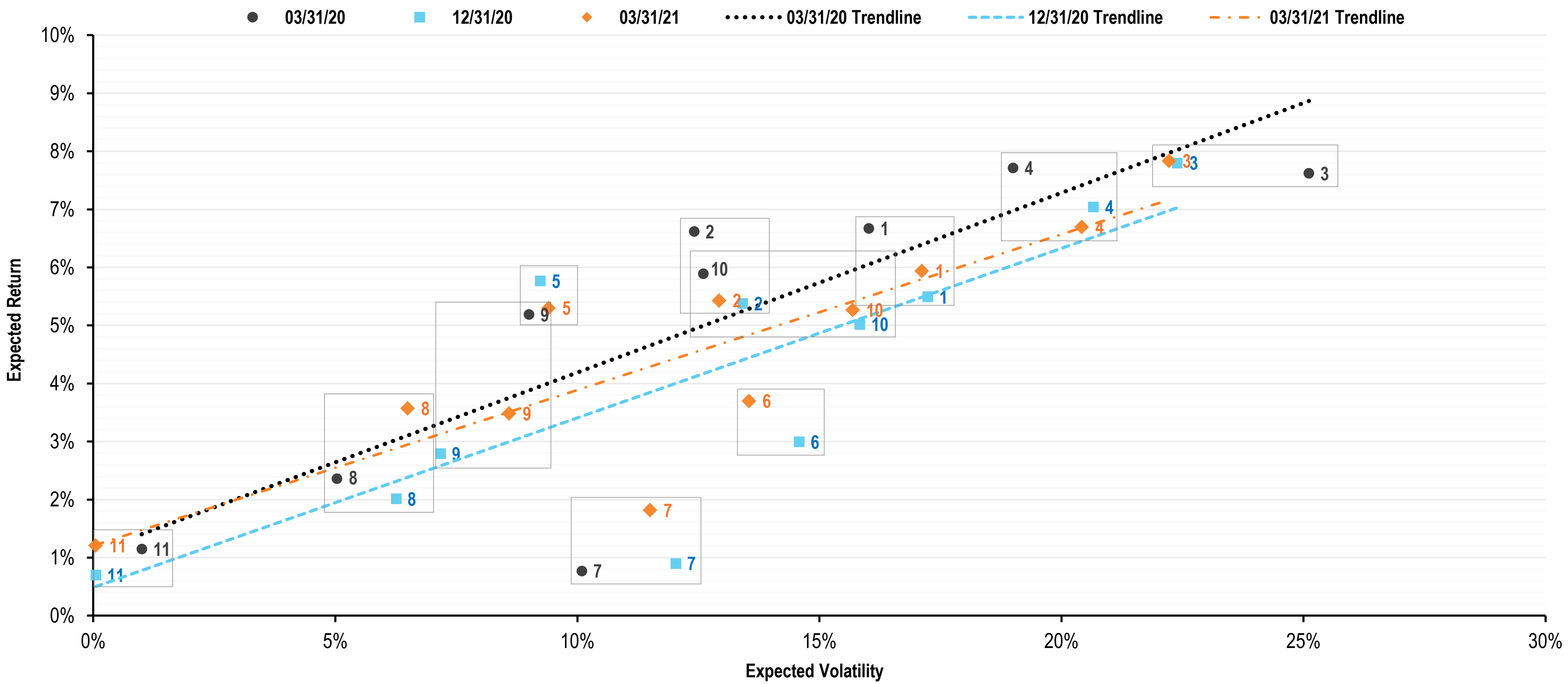
The survey results show a diverse range of expert opinion, with ranges increasing from 2020 to 2021. In general, diversity of opinion reflects the uncertainty regarding factors influencing expected returns, such as the impact of shocks (e.g. COVID) and recent policy responses. The ten-year expected returns help us understand the path to longer-term expected returns.

Returns: 20-year expectations tell a similar story



Twenty year expected returns also show a diverse range of outcomes, again reflecting a diversity opinions regarding the interpretation of long term economic and market factors.

Risk & Return: 10-year Expectation Comparison

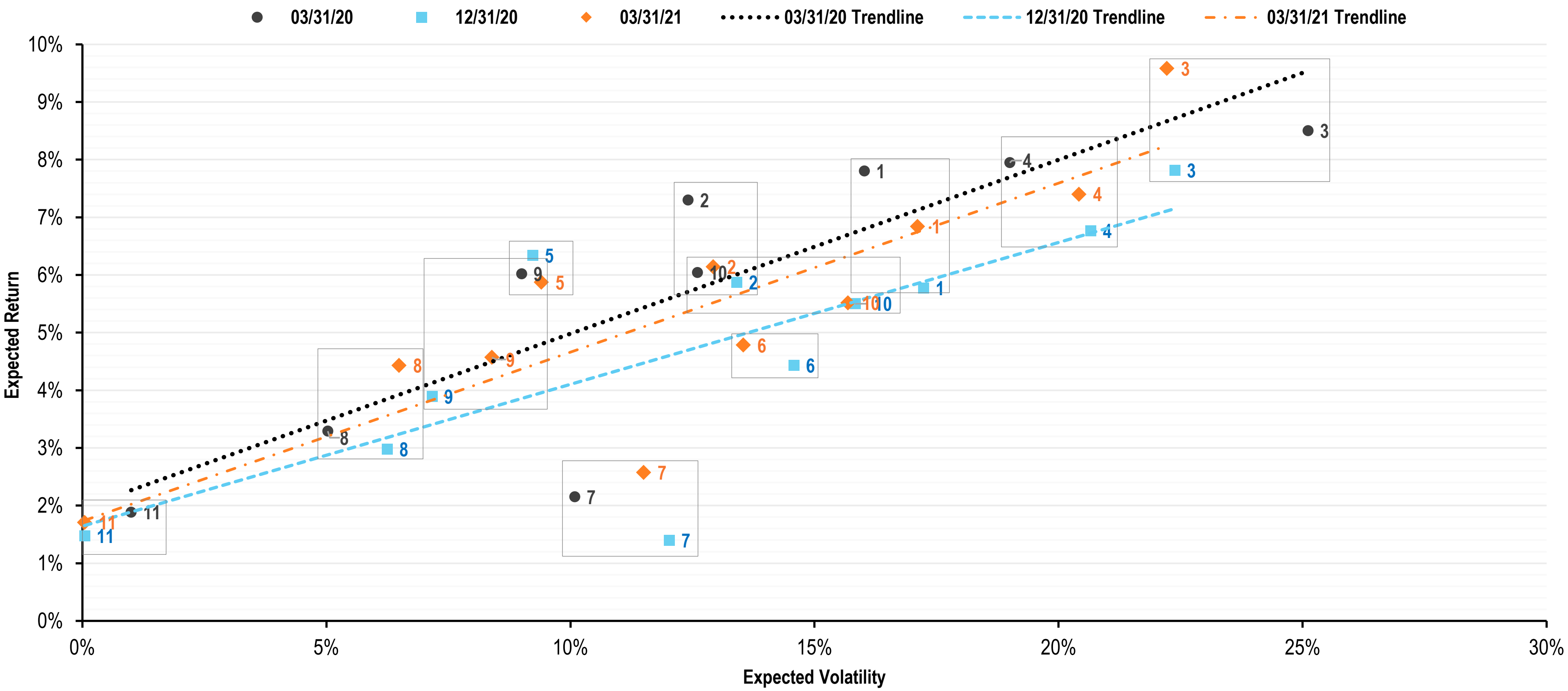


Asset Classes

1 Equities - Cap Weighted
2 Equities - Factor Weighted
3 Private Equity
4 Equities – Emerging Markets
5 Private Debt
6 Emerging Market Debt
7 Long Treasury
8 Long Spread
9 High Yield
10 US Real Estate
11 Liquidity

When comparing the survey results of 2020 and 2021, one broad trend is very apparent. Expected returns are lower, while expected risk has increased. This trend tells us our risk and return trade-off will be more costly.

Risk & Return: 20-year Expectation Comparison



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The 20-year expected returns, most meaningful to the discount rate, show the same trend - expected returns lower and expected risks higher. Though there are exceptions to the trend, the trend is applicable to all the scalable, liquid asset classes.

CMA Comparison for Current PERF Portfolio

	Survey Parameter	2017 ALM*	2020 Mid-Cycle ALM Survey Median Value 03/31/20	2021 Initial ALM Survey Median Value 12/31/20	2021 Second ALM Survey Median Value 03/31/21
10-Year Expectations	Expected Return	6.1%	5.7%	4.9%	5.3%
	Expected Risk	11.4%	10.5%	11.5%	11.3%
	Expected Return/Risk	0.54	0.54	0.43	0.47
20-Year Expectations	Expected Return	7.0%*	6.6%	5.4%	6.2%
	Expected Risk	11.4%	10.5%	11.5%	11.3%
	Expected Return/Risk	0.73	0.63	0.47	0.55

Applying the survey results to our current portfolio mix, we do see lower expected returns and higher expected risk. Note the December 2020 survey results indicated a much steeper decline in our portfolio expected returns. This variability reflects both the degree of uncertainty in the projections, and the pace of events that influence those projections.

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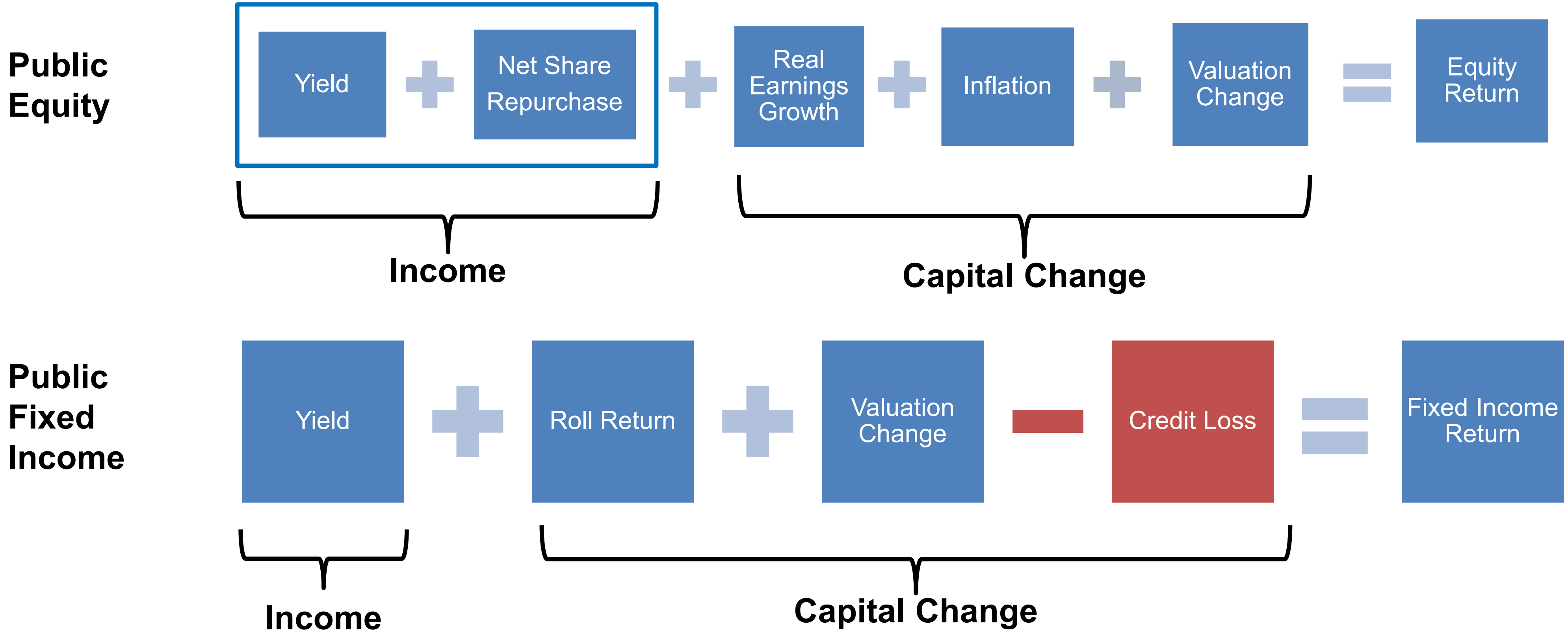
*The 2017 20-year expected return of 7.0% is the long-term blended expected return for years 1-60, which is made up of the 1-10 year expected return of 6.1% and the 11-60 year expected return of 8.3%.

CMA Survey – Internal Validation

- Internal CMA forecasting provides a consistent framework for interpreting external CMAs and developing our own.
- The internal CMA forecasting framework is anchored on underlying economic regime assumptions for a range of economic scenarios.
- We use the overall framework for forecasting expected returns based on the fundamental drivers of income and capital change of investment.

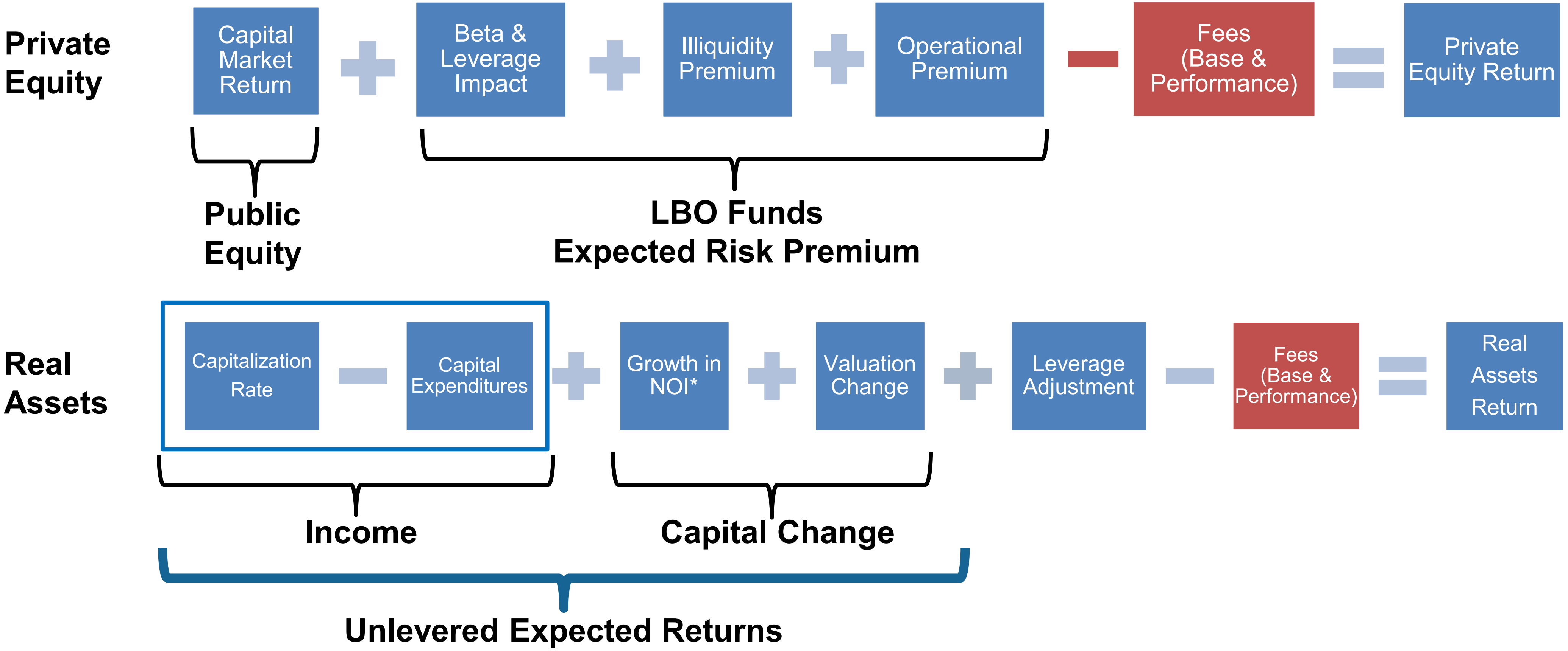
Our internal CMA process facilitates our understanding and interpretation of the surveyed CMAs and helps to ensure the expected returns are appropriate for our asset classes and strategies.

Sources of Expected Returns | Public Assets



Broadly speaking, public asset CMAs reflect the potential for income and capital changes. Asset classes are differentiated by the relative importance of sources of income and capital changes. Fixed income, for example, has little direct sensitivity to growth while equity is dependent on growth. Both are exposed to changes in valuations.

Sources of Expected Returns | Private Assets



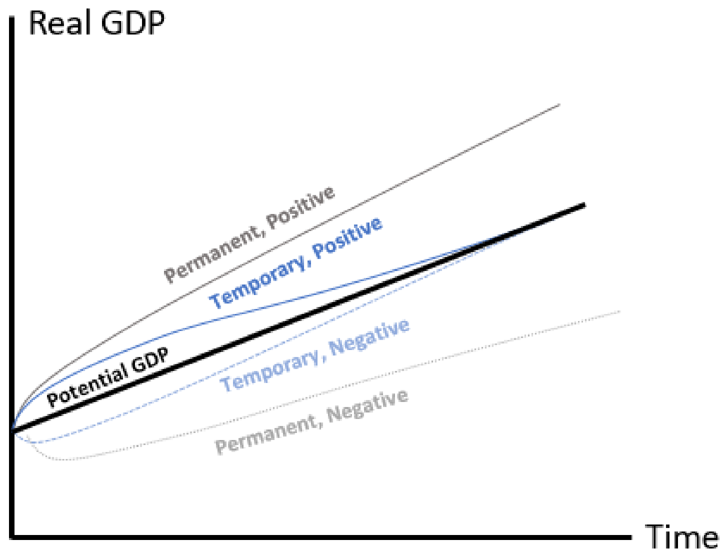
Private assets factors share factors with their public equivalents, and have additional factors related to fees and skill. Private equity has all the public equity factors, along with a liquidity premium, the potential for a skill-based operational premium, and fees.

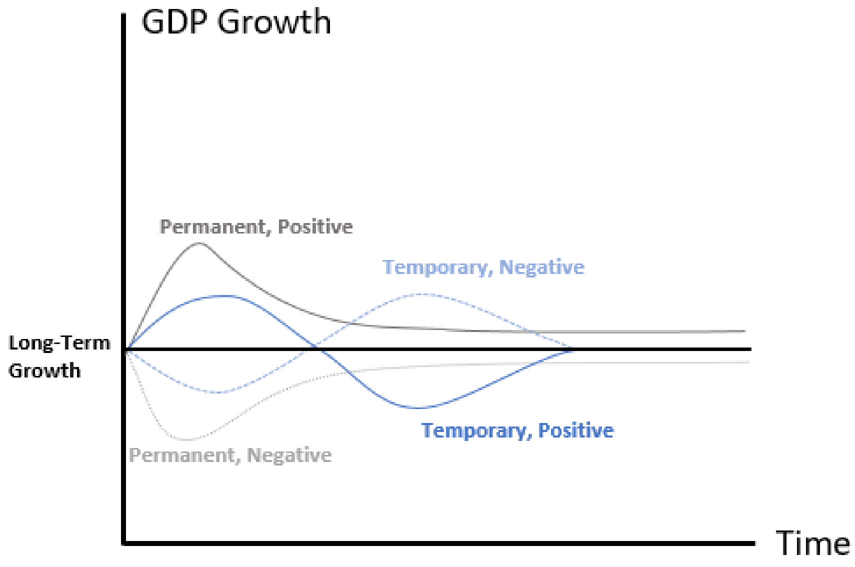
* Net Operating Income

Economic Scenarios: Short-Term vs. Long-Term

Shocks or surprises contain different information.

- Some shocks are short-lived - the surprise is large but contains little long-lived effects on the economy's GDP growth rate (blue lines).
- Other surprises feature very persistent effects (grey lines), which may impact the long-run equilibrium growth rate.
- Each of these shocks, or surprises are a separate scenario.





Our CMA survey results reflect the diversity of expert opinion regarding the influence of both short-term shocks and long-term factors on long-term expected returns. As long-term investors, we use the CMA survey to see past the short-term noise and better understand the potential for long term expected returns. Shorter term projections are more sensitive than long term projections to short term shocks.

What's in a scenario

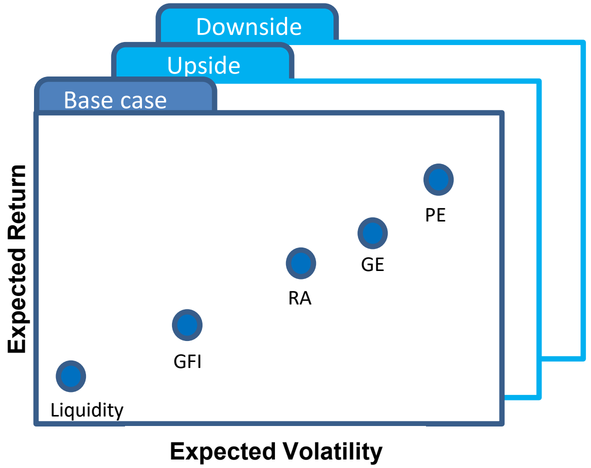
Each scenario has the information needed to construct optimal portfolios, and to estimate discount rates, liabilities, and contributions.

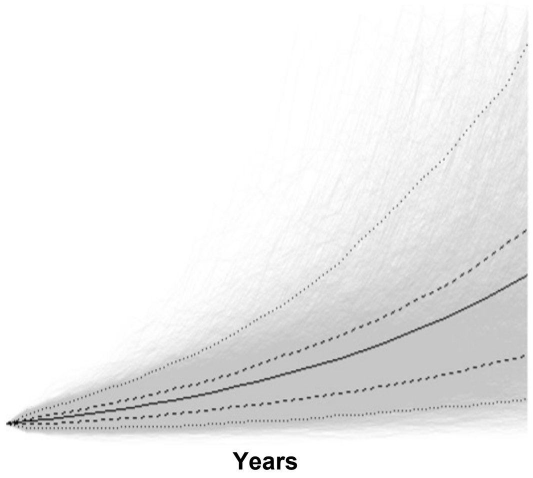
Economic Scenarios* → CMAs → Return Paths

	GDP	Inflation
Base case	1.8%	2.2%
Upside	2.2%	2.8%
Downside	1.5%	1.7%

For various existing and potential assets:

- Expected Return, Volatility and Correlation Matrix
- Mid-term and Long-term





Though each scenario has deterministic long term economic assumptions, the returns in the scenarios are not deterministic. For each scenario, returns are described by the expected returns, as well as other parameters representing the variability of returns.

*Scenarios are based on U.S. economic data as an example.