Invesco

2023 Long-Term Capital Market Assumptions

Invesco Investment Solutions | United States Dollar (USD)

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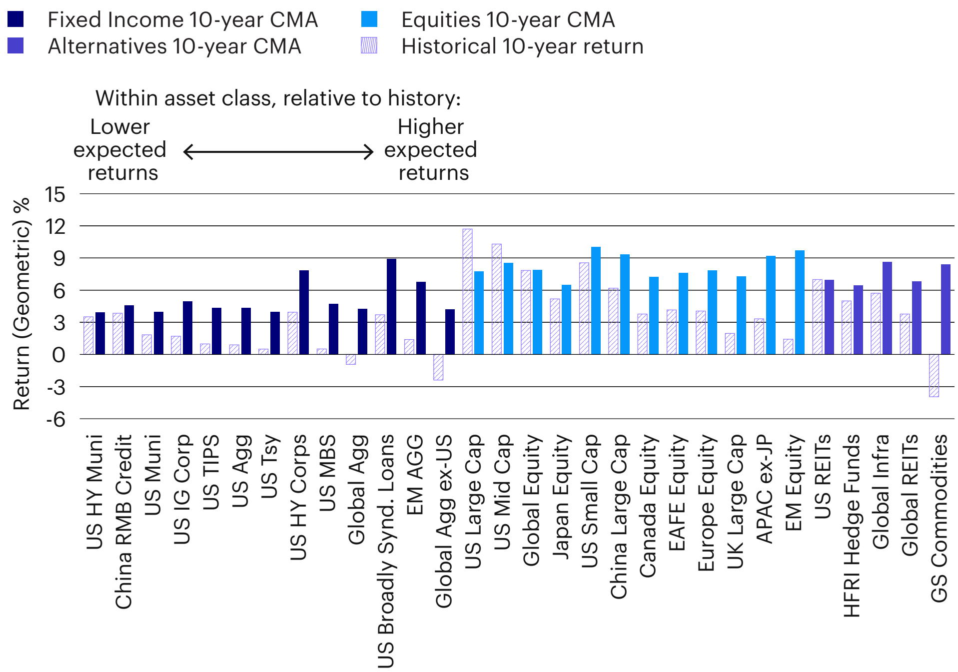
Executive Summary

Duy Nguyen
CIO, Invesco Investment Solutions

Invesco Investment Solutions provides forecasts for 170+ assets in over 20 currencies, including 10 private assets. For additional CMA data, views, or analysis, please reach out to your Invesco representative.

- Our team at Invesco Investment Solutions remains quite positive on our long-term capital market assumptions (CMAs). Most of the 170+ assets we cover are expected to return more in the coming decade than the last decade.
- As central banks have begun to unwind years of excess liquidity through quantitative tightening and rapid rate hikes, only one thing is certain, cash has become more valuable. Investors can now be prudent in their risk taking and, in nominal terms, the risk-free rate actually returns something for savers.
- Fixed income assets, particularly long duration government bonds, have corrected meaningfully in 2022, and while major economies have yet to register a technical recession, cash flows have been discounted by higher interest rates resulting in drawdowns within overvalued portions of equity markets.

Figure 1: Expectations relative to historical average (USD)



Source: Invesco, estimates as of September 30, 2022. Proxies listed in **Figure 8**. These estimates are forward-looking, are not guarantees, and they involve risks, uncertainties, and assumptions. Please see page 9 for information about our CMA methodology. These estimates reflect the views of Invesco Investment Solutions, the views of other investment teams at Invesco may differ from those presented here.

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Asset Allocation Insights

Jacob Borbidge
Senior Portfolio Manager,
Head of Investment Research,
Invesco Investment Solutions

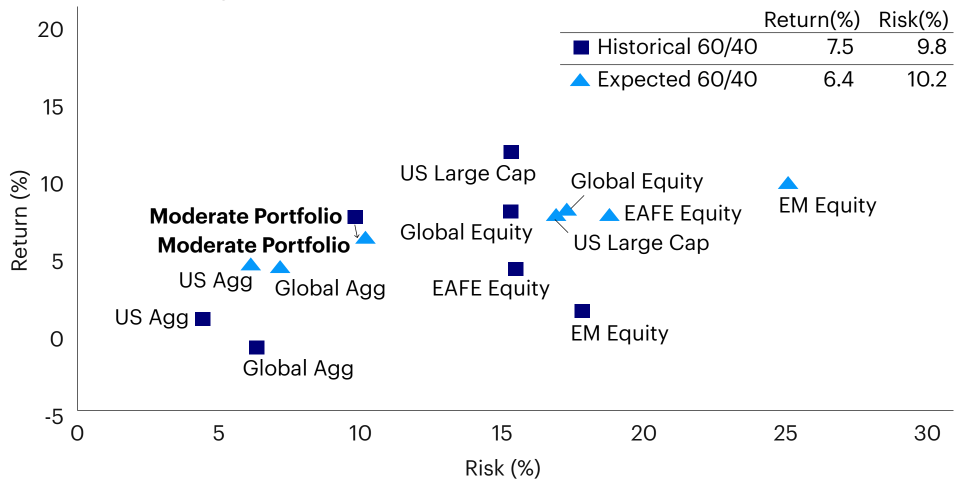
For further details on our process for defining scenarios and adjustments, please refer to our CMA Methodology paper.

Strategic perspective

2022 has been a year for the record books, at least for most investor's professional careers, and not in a good way. Since 1928, we have yet to register a year in which both equities and long duration treasuries experience double digit declines simultaneously. It is not an exaggeration to say that even moderate investors have had one of worst calendar year investment periods, ever. And after accounting for persistently high inflation, 2022 may be the worst year the 60/40 portfolio has ever seen. At least the simple mix of assets had little exposure to meme stocks or cryptocurrencies.

How did we get here? Rampant inflation from reopening stimulus and supply shocks have been a thorn in the side of policy makers. As central banks have begun to unwind years of excess liquidity through quantitative tightening and rapid rate hikes, only one thing is certain, cash has become more valuable. Investors can now be prudent in their risk taking and the risk-free rate actually returns something for savers. Fixed income assets, particularly long duration government bonds, have corrected meaningfully, and while major economies have yet to register a technical recession, cash flows have been discounted by higher interest rates resulting in drawdowns within overvalued portions of equity markets. Outside of the US, growth prospects have been diminished in other regions due to COVID-lockdowns, food and energy crises, and the war in the Ukraine. It has been a long time since a global 60/40 has looked this attractive on a forward-looking basis.

Figure 2: Historical returns for the 60/40 have fallen amid recent selloff while expected returns are improving (USD)



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Despite most forecasters predicting a recession in 2023 due to the lagged effects of rate hikes, our team at Invesco Investment Solutions remains quite positive on our long-term capital market assumptions (CMAs). Most of the 170+ assets we cover are expected to return more in the coming decade than the last decade. This is a dramatic shift felt throughout the CMAs and particularly within fixed income. While our goal is not to predict when the next business cycle will begin, when examining the spread of our shorter-term forecasts (5 years) and longer-term ones (10 years), cyclical assets tied with an accelerating economy like broadly syndicated loans, small cap equities, value factor-oriented strategies, and emerging markets (EM) seem to be front-loading returns, an indication that growth prospects may be positive going forward. We anticipate sharpe ratios of portfolios will increase and the value of diversification will return as correlations between assets normalize.

3Q22 CMA Observations (10Y, USD):

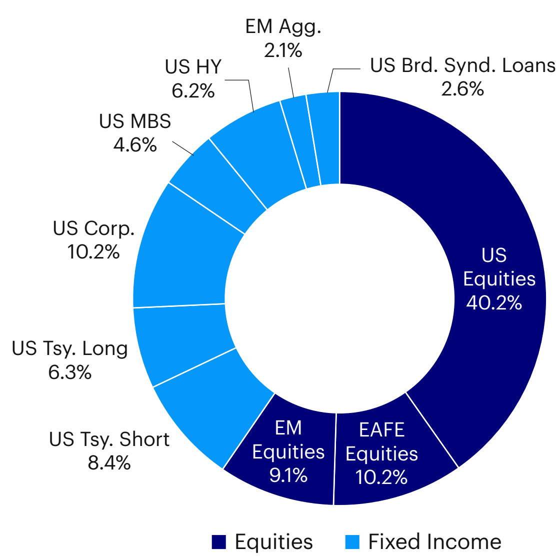
Equities: Nominal growth is very high, and earnings have not yet collapsed but are expected to moderate. Thus far in 2022, inflation has been a life raft for nominal earnings but when the support of inflation recedes we expect nominal earnings to struggle in the short term. However, our global equity CMAs are still approaching 8% nominal returns with some assets, like US small caps and EM equities are close to 10%. Developed market (DM) equity CMAs outside of the US continue to lag due to a challenging growth environment and we have manually adjusted the earnings growth building block of our forecast down for these regions due to persistent issues stemming from the war in the Ukraine. Quarter over quarter, the largest shift in expected return has been in our currency adjustment building block as countries begin to normalize their interest rates. Year over year, the largest detractor to our equity CMAs has been the earnings growth component as a period of high growth is expected to slow.

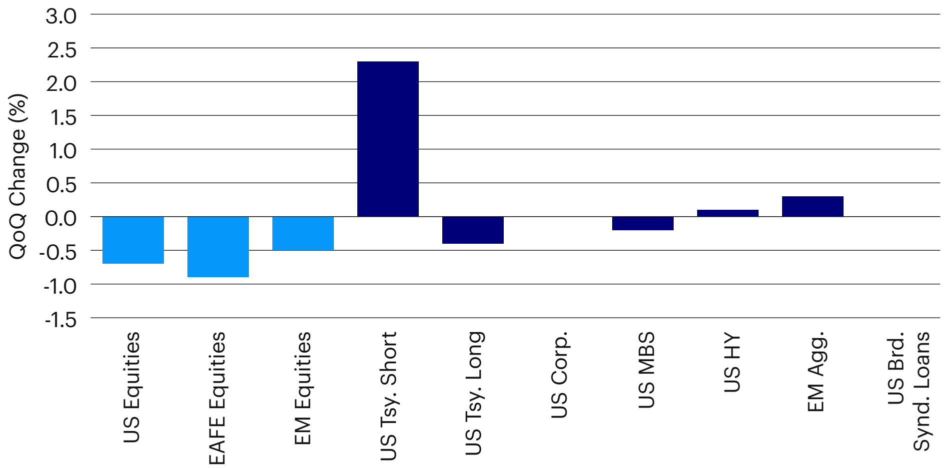
Fixed Income: Sharpe ratios of fixed income assets typically hover around 1, while equity assets are on average closer to .5. Artificially low interest rates over the past few years created an investment environment where the opposite was true. Today's Sharpe ratios are closer to normal, providing opportunities for multi-asset investors to increase allocations to fixed income instruments. US Treasury CMAs are 4%, a 2.5% increase over the past year. The forecasts for most fixed income assets have improved as current yields have risen. Expected yields are slightly lower than present yield curves resulting in an improvement to valuation change, however curves are flatter and thus detracting from roll return. Credit assets like loans and high yield are up almost 5% this past year as higher credit spreads are anticipated to revert to their long-term average.

Alternatives: Private market CMAs have been mixed this past year as interest rate sensitive assets like core real estate have suffered, going from 12.7% last year to around 9%, while shorter duration private credit has improved to 12.5% for our levered first lien forecast. Private assets remain a strategic decision based on liquidity needs and investor goals, be it improved returns, enhanced income, or diversification.

Strategic Asset Allocation Trends:

Figure 3: 2022 Q3 SAA Rebalance (USD)





Source: Invesco Investment Solutions, as of September 30, 2022. Proxies listed in **Figure 8**. These estimates reflect the views of Invesco Investment Solutions, the views of other investment teams at Invesco may differ from those presented here. References to overweights and underweights are relative to a 60% global equity and 40% global aggregate fixed income benchmark.

- **Portfolio level:** Compared to a global 60/40 benchmark, our strategic portfolio (5-10Y) is slightly overweight fixed income relative to equities.
- **Within equities:** We are overweight EM and US large cap equities while underweight DM ex-US equities. We have further reduced our exposure in DM ex-US equities amid growth concerns.
- **Within fixed income:** Presently overweight both treasuries and risky credit. Presently we have a neutral duration compared to our benchmark and have recently added to short term treasuries.

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2023 Capital Market Assumptions

Figure 4: 10-year asset class expectations (USD)

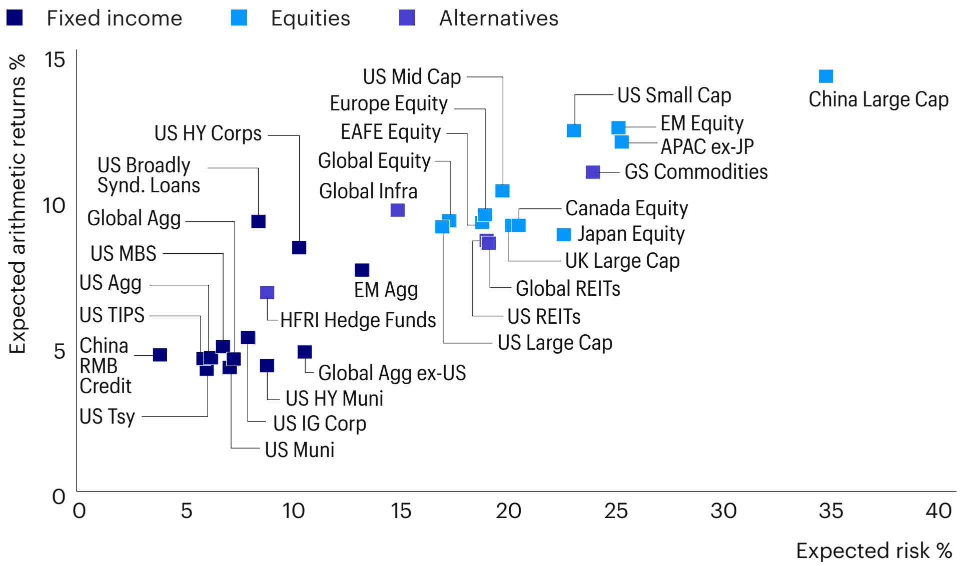

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Figure 5: CMA difference: 5-year minus 10-year assumptions (USD)

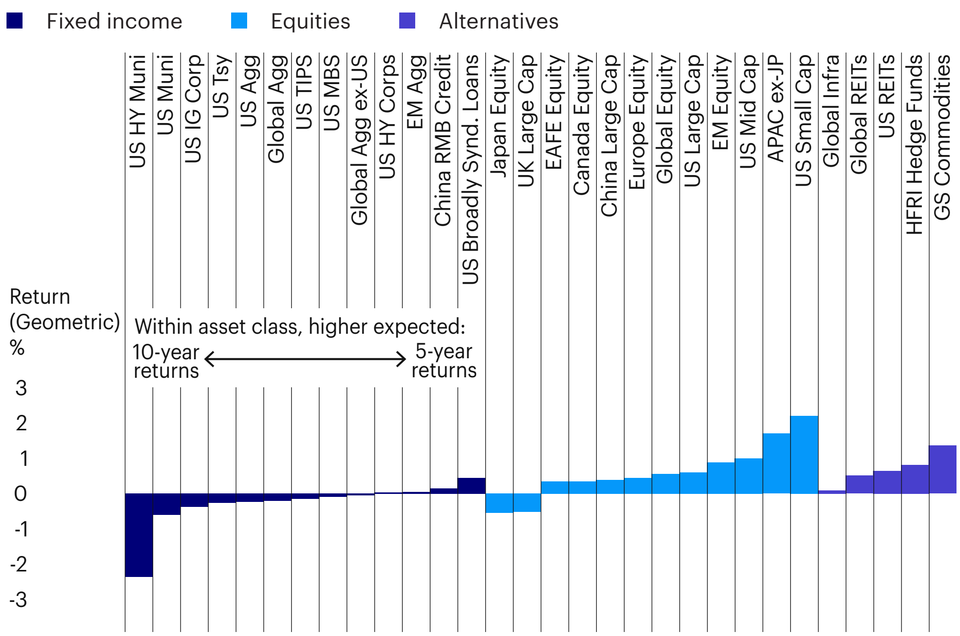

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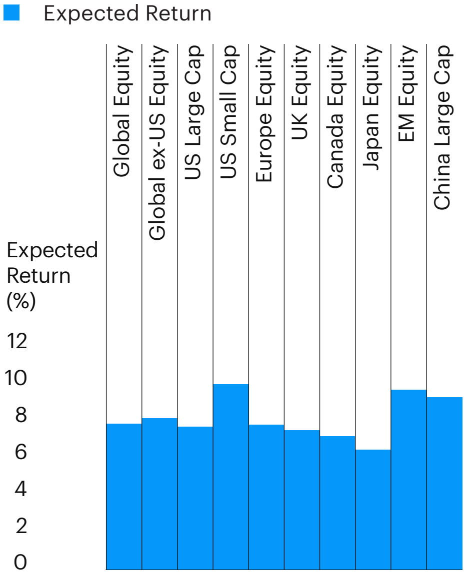
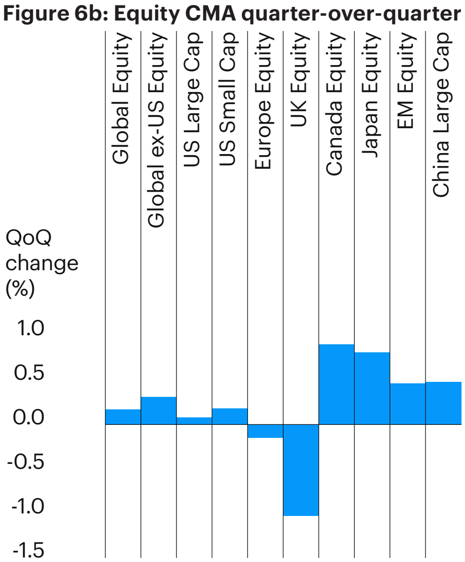
Figure 6a: Equity CMA and building block contribution (USD) (%)



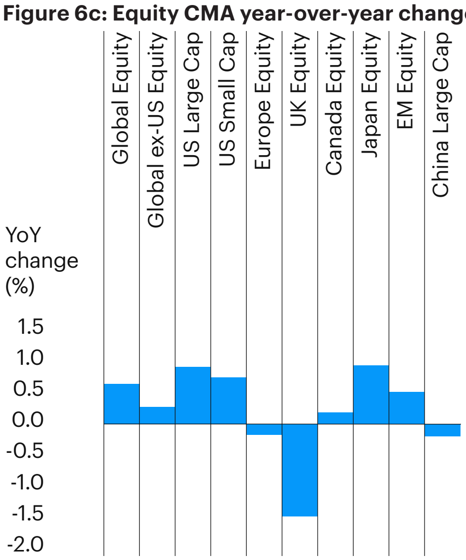
	Dividend Yield	Buyback Yield	LT Earnings Growth	Expected Inflation	Valuation Change	Currency Adj. (IRP)
Global Equity	2.32	0.79	1.90	2.18	0.35	0.34
Global ex-US Equity	3.29	0.00	1.85	1.90	0.22	0.91
US Large Cap	1.72	1.27	1.93	2.35	0.43	0.00
US Small Cap	1.56	0.80	3.31	2.35	1.95	0.00
Europe Equity	3.37	0.00	1.38	1.99	-0.09	1.18
UK Equity	4.02	0.00	1.76	2.45	-0.38	-0.34
Canada Equity	2.93	0.00	1.76	2.02	-0.16	0.63
Japan Equity	2.65	0.00	1.01	-0.44	-0.28	3.55
EM Equity	3.33	0.00	2.91	2.74	1.07	-0.40
China Large Cap	2.34	0.00	3.82	1.37	0.73	1.02

Figure 6b: Equity CMA quarter-over-quarter change and building block contribution (USD) (%)



	Dividend Yield	Buyback Yield	LT Earnings Growth	Expected Inflation	Valuation Change	Currency Adj. (IRP)
Global Equity	0.16	0.03	-0.17	-0.06	0.14	0.08
Global ex-US Equity	0.25	0.00	-0.25	-0.12	0.22	0.22
US Large Cap	0.13	0.02	-0.12	-0.03	0.09	0.00
US Small Cap	0.09	-0.02	-0.18	-0.03	0.32	0.00
Europe Equity	0.12	0.00	-0.16	-0.03	0.12	-0.19
UK Equity	0.04	0.00	-0.21	-0.06	0.23	-1.01
Canada Equity	0.21	0.00	-0.19	-0.05	0.06	0.87
Japan Equity	0.16	0.00	-0.28	-0.08	0.21	0.80
EM Equity	0.47	0.00	-0.39	-0.26	0.43	0.24
China Large Cap	0.49	0.00	-0.62	-0.88	0.65	0.88

Figure 6c: Equity CMA year-over-year change and building block contribution (USD) (%)



	Dividend Yield	Buyback Yield	LT Earnings Growth	Expected Inflation	Valuation Change	Currency Adj. (IRP)
Global Equity	0.56	0.14	-2.06	0.64	1.29	0.11
Global ex-US Equity	0.85	0.00	-2.21	0.48	0.84	0.34
US Large Cap	0.42	0.18	-1.96	0.72	1.58	0.00
US Small Cap	0.50	0.14	-2.46	0.72	1.87	0.00
Europe Equity	0.79	0.00	-2.18	0.76	0.76	-0.28
UK Equity	0.34	0.00	-1.90	0.68	0.34	-0.92
Canada Equity	0.43	0.00	-2.07	0.70	0.55	0.61
Japan Equity	0.64	0.00	-2.32	-0.28	0.82	2.09
EM Equity	1.02	0.00	-2.28	0.31	1.07	0.44
China Large Cap	0.49	0.00	-2.18	-1.54	0.79	2.37

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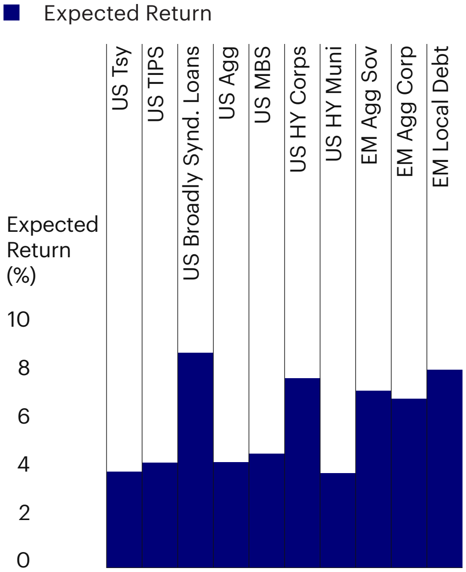
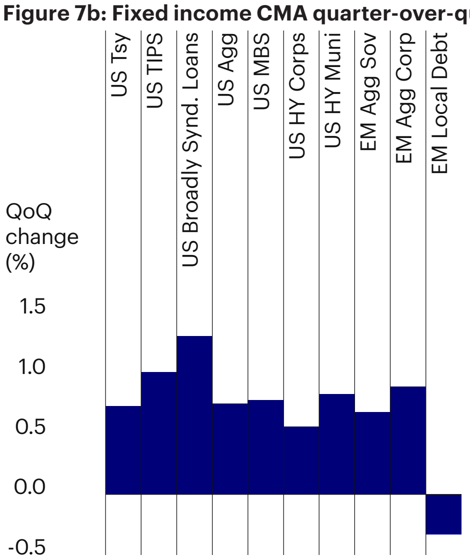
Figure 7a: Fixed income CMA and building block contribution (USD) (%)



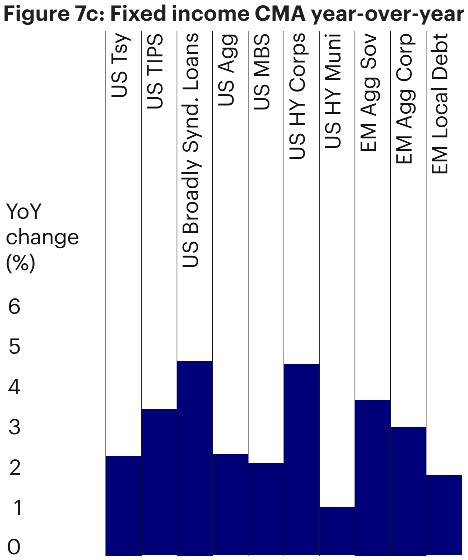
	Average Yield	Roll Return	Valuation Change (Yield Curve)	Valuation Change (OAS)	Credit Loss	Currency Adj. (IRP)
US Tsy	4.26	-0.11	-0.16	0.00	0.00	0.00
US TIPS	4.54	-0.10	-0.08	0.00	0.00	0.00
US Broadly Synd. Loans	9.49	0.00	-0.01	0.35	-0.93	0.00
US Agg	4.86	-0.11	-0.16	0.02	-0.25	0.00
US MBS	4.82	-0.11	-0.16	0.17	0.00	0.00
US HY Corps	9.51	-0.10	-0.05	0.18	-1.70	0.00
US HY Muni	7.01	0.20	-0.65	-1.76	-0.90	0.00
EM Agg Sov	8.13	-0.03	-0.27	0.75	-1.25	0.00
EM Agg Corp	8.58	-0.10	-0.05	0.31	-1.73	0.00
EM Local Debt	7.57	0.54	-0.26	0.00	0.00	0.35

Figure 7b: Fixed income CMA quarter-over-quarter change and building block contribution (USD) (%)



	Average Yield	Roll Return	Valuation Change (Yield Curve)	Valuation Change (OAS)	Credit Loss	Currency Adj. (IRP)
US Tsy	0.93	-0.33	0.14	0.00	0.00	0.00
US TIPS	1.00	-0.31	0.32	0.00	0.00	0.00
US Broadly Synd. Loans	1.22	0.00	0.02	0.07	0.00	0.00
US Agg	0.86	-0.35	0.23	0.04	-0.03	0.00
US MBS	0.83	-0.33	0.14	0.14	0.00	0.00
US HY Corps	0.71	-0.25	0.17	-0.07	0.00	0.00
US HY Muni	0.66	0.06	0.11	-0.02	0.02	0.00
EM Agg Sov	0.76	-0.15	0.25	-0.18	0.00	0.00
EM Agg Corp	0.97	-0.25	0.17	0.00	0.00	0.00
EM Local Debt	0.13	-0.07	0.12	0.00	0.00	-0.52

Figure 7c: Fixed income CMA year-over-year change and building block contribution (USD) (%)



	Average Yield	Roll Return	Valuation Change (Yield Curve)	Valuation Change (OAS)	Credit Loss	Currency Adj. (IRP)
US Tsy	2.77	-0.83	0.53	0.00	0.00	0.00
US TIPS	3.54	-0.90	0.99	0.00	0.00	0.00
US Broadly Synd. Loans	3.99	0.00	0.03	0.81	0.00	0.00
US Agg	2.69	-0.83	0.53	0.22	-0.12	0.00
US MBS	2.37	-0.74	0.41	0.25	0.00	0.00
US HY Corps	3.72	-0.60	0.46	1.17	0.00	0.00
US HY Muni	2.26	-0.43	-0.08	-0.30	-0.26	0.00
EM Agg Sov	3.08	-0.75	0.60	1.02	-0.10	0.00
EM Agg Corp	3.19	-0.73	0.52	0.42	-0.21	0.00
EM Local Debt	1.65	-0.16	0.39	0.00	0.00	0.10

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Figure 8: 10-year asset class expected returns, risk, and return-to-risk (USD)

	Asset class	Index	Expected geometric return %	Expected arithmetic return %	Total Yield %	Expected risk %	Arithmetic return to risk ratio
Fixed income	US Tsy Short	BBG US Tsy Short	3.7	3.7	3.5	1.5	2.44
	US Tsy IM	BBG US Tsy IM	4.1	4.2	4.2	4.6	0.91
	US Tsy Long	BBG US Tsy Long	3.0	3.7	4.0	12.1	0.30
	US TIPS	BBG US TIPS	4.4	4.5	4.5	5.8	0.78
	US Broadly Synd. Loans	CSFB Leverage Loan	8.9	9.2	9.8	8.3	1.11
	US Agg	BBG US Agg	4.4	4.5	4.8	6.1	0.74
	US IG Corp	BBG US IG	4.9	5.2	5.7	7.8	0.67
	US MBS	BBG US MBS	4.7	4.9	4.8	6.7	0.74
	US Preferred Stocks	BOA ML Fixed Rate Pref Securities	5.2	5.9	6.9	12.4	0.48
	US HY Corps	BBG US HY	7.8	8.3	9.7	10.2	0.81
	US Muni	BOA ML US Muni	4.0	4.2	4.1	7.0	0.60
	US Muni (Taxable)	ICE BOA US Taxable Muni Securities Plus	4.6	4.9	5.2	8.1	0.60
	US HY Muni	BBG Muni Bond HY	3.9	4.3	6.0	8.7	0.49
	Global Agg	BBG Global Agg	4.3	4.5	4.6	7.2	0.63
	Global Agg ex-US	BBG Global Agg ex-US	4.2	4.7	4.6	10.5	0.45
	Global Tsy	BBG Global Tsy	4.2	4.5	4.3	8.6	0.52
	Global Sov	BBG Global Sov	4.5	4.8	5.2	8.0	0.59
	Global Corp	BBG Global Corp	5.0	5.3	5.8	8.0	0.66
	Global IG	BBG Global Corp IG	5.0	5.4	5.9	8.2	0.65
	Eurozone Corp	BBG Euro Agg Credit Corp	5.2	6.1	5.9	13.5	0.45
	Eurozone Tsy	BBG Euro Agg Gov Tsy	4.3	5.1	4.4	12.8	0.40
	Asian Dollar IG	BOA ML AC IG	5.1	5.4	5.8	8.3	0.65
	EM Agg	BBG EM Agg	6.8	7.6	8.2	13.2	0.57
	EM Agg IG	BBG EM USD Agg IG	4.9	5.2	5.8	8.9	0.59
	China Policy Bk & Tsy	BBG China PB Tsy TR	4.2	4.2	3.6	4.3	0.98
	China RMB Credit	BBG China Corporate	4.6	4.6	4.1	3.8	1.24
Equities	Global Equity	MSCI ACWI	7.9	9.2	3.5	17.2	0.54
	Global ex-US Equity	MSCI ACWI ex-US	8.2	9.8	4.2	19.0	0.52
	US Broad Market	Russell 3000	7.9	9.3	3.0	17.7	0.53
	US Large Cap	S&P 500	7.7	9.0	3.0	16.9	0.53
	US Mid Cap	Russell Midcap	8.5	10.3	2.9	19.7	0.52
	US Small Cap	Russell 2000	10.0	12.3	2.4	23.0	0.54
	EAFE Equity	MSCI EAFE	7.6	9.2	4.9	18.7	0.49
	Europe Equity	MSCI Europe	7.8	9.4	4.5	18.9	0.50
	Eurozone Equity	MSCI Euro ex-UK	7.9	9.7	4.8	19.9	0.49
	UK Large Cap	FTSE 100	7.3	9.1	3.7	20.1	0.45
	UK Small Cap	FTSE Small Cap UK	8.7	11.6	3.2	25.9	0.45
	Canada Equity	S&P TSX	7.2	9.1	3.6	20.4	0.44
	Japan Equity	MSCI JP	6.5	8.8	6.2	22.5	0.39
	EM Equity	MSCI EM	9.7	12.4	2.9	25.1	0.50
	APAC ex-JP	MSCI APXJ	9.2	11.9	2.7	25.2	0.47
	China Large Cap	CSI 300	9.3	14.3	3.4	34.7	0.41
Alternatives	US REITs	FTSE NAREIT Equity	6.9	8.6	4.0	19.0	0.45
	Global REITs	FTSE EPRA/NAREIT Developed	6.8	8.5	4.7	19.0	0.44
	HFRI Hedge Funds	HFRI HF	6.4	6.8	-	8.7	0.78
	GS Commodities	S&P GSCI	8.4	10.9	-	23.9	0.46
	Agriculture	S&P GSCI Agriculture	4.0	6.1	-	21.5	0.28
	Energy	S&P GSCI Energy	11.2	16.7	-	37.1	0.45
	Industrial Metals	S&P GSCI Industrial Metals	7.5	10.1	-	24.2	0.42
	Precious Metals	S&P GSCI Precious Metals	5.3	6.9	-	18.5	0.37

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Figure 9: 10-year correlations (USD)

- Greater than 0.70
- 0.30 to 0.70
- Less than 0.30

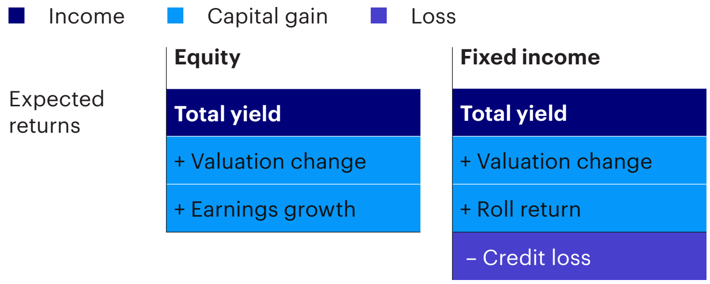
		Fixed income												Equities										Alternatives			
	Asset class	US Tsy IM	US TIPS	US Broadly Synd. Loans	US Agg	US IG Corp	US HY Corps	US Muni	US HY Muni	Global Agg	Global Agg ex-US	EM Agg	China RMB Credit	Global Equity	China Large Cap	US Large Cap	US Mid Cap	US Small Cap	EAFE Equity	UK Large Cap	Canada Equity	Japan Equity	EM Equity	Global REITs	Global Infra	GS Commodities	HFRI Hedge Funds
Fixed income	US Tsy IM	1.00																									
	US TIPS	0.67	1.00																								
	US Broadly Synd. Loans	-0.31	0.27	1.00																							
	US Agg	0.86	0.81	0.08	1.00																						
	US IG Corp	0.54	0.75	0.46	0.86	1.00																					
	US HY Corps	-0.03	0.48	0.82	0.38	0.68	1.00																				
	US Muni	0.54	0.64	0.30	0.74	0.72	0.47	1.00																			
	US HY Muni	0.25	0.53	0.57	0.52	0.61	0.58	0.80	1.00																		
	Global Agg	0.66	0.75	0.18	0.81	0.78	0.49	0.60	0.45	1.00																	
	Global Agg ex-US	0.53	0.66	0.20	0.68	0.68	0.48	0.50	0.38	0.98	1.00																
	EM Agg	0.26	0.63	0.63	0.60	0.80	0.81	0.58	0.62	0.67	0.63	1.00															
	China RMB Credit	0.21	0.29	0.10	0.29	0.27	0.20	0.20	0.18	0.42	0.44	0.26	1.00														
Equities	Global Equity	-0.11	0.35	0.63	0.23	0.51	0.79	0.26	0.38	0.46	0.50	0.69	0.29	1.00													
	China Large Cap	-0.06	0.14	0.28	0.12	0.25	0.34	0.08	0.17	0.23	0.25	0.34	0.27	0.44	1.00												
	US Large Cap	-0.12	0.32	0.59	0.22	0.47	0.74	0.23	0.35	0.38	0.41	0.61	0.26	0.97	0.38	1.00											
	US Mid Cap	-0.15	0.32	0.68	0.21	0.50	0.80	0.27	0.38	0.37	0.40	0.64	0.26	0.95	0.38	0.96	1.00										
	US Small Cap	-0.19	0.23	0.62	0.13	0.40	0.73	0.19	0.31	0.28	0.31	0.55	0.24	0.88	0.37	0.89	0.95	1.00									
	EAFE Equity	-0.10	0.33	0.60	0.22	0.49	0.77	0.27	0.37	0.48	0.53	0.69	0.28	0.97	0.42	0.88	0.88	0.81	1.00								
	UK Large Cap	-0.16	0.27	0.61	0.15	0.42	0.72	0.23	0.37	0.41	0.46	0.62	0.28	0.91	0.40	0.83	0.82	0.76	0.95	1.00							
	Canada Equity	-0.15	0.36	0.66	0.19	0.48	0.76	0.24	0.38	0.42	0.47	0.66	0.26	0.88	0.42	0.83	0.86	0.79	0.85	0.85	1.00						
	Japan Equity	-0.05	0.29	0.48	0.22	0.42	0.62	0.23	0.27	0.37	0.39	0.54	0.27	0.77	0.34	0.70	0.70	0.67	0.82	0.70	0.64	1.00					
	EM Equity	-0.09	0.34	0.59	0.22	0.48	0.72	0.23	0.37	0.48	0.53	0.71	0.34	0.86	0.56	0.73	0.76	0.71	0.85	0.79	0.82	0.67	1.00				
Alternatives	Global REITs	0.03	0.47	0.64	0.37	0.61	0.78	0.39	0.49	0.53	0.54	0.71	0.26	0.85	0.30	0.81	0.84	0.77	0.84	0.78	0.78	0.66	0.74	1.00			
	Global Infra	0.04	0.47	0.59	0.36	0.58	0.75	0.41	0.47	0.53	0.54	0.69	0.23	0.83	0.31	0.79	0.80	0.69	0.82	0.80	0.81	0.61	0.72	0.84	1.00		
	GS Commodities	-0.29	0.16	0.52	-0.11	0.13	0.47	0.03	0.25	0.15	0.23	0.35	0.12	0.50	0.18	0.43	0.48	0.45	0.52	0.61	0.65	0.37	0.50	0.41	0.50	1.00	
	HFRI Hedge Funds	-0.27	0.27	0.72	0.09	0.46	0.77	0.21	0.42	0.33	0.38	0.64	0.24	0.89	0.46	0.83	0.88	0.85	0.86	0.83	0.88	0.70	0.83	0.76	0.74	0.61	1.00

Source: Invesco, estimates as of September 30, 2022. Proxies listed in **Figure 8.** These estimates are forward-looking, are not guarantees, and they involve risks, uncertainties, and assumptions. Please see page 9 for information about our CMA methodology. These estimates reflect the views of Invesco Investment Solutions, the views of other investment teams at Invesco may differ from those presented here.

About our capital market assumptions methodology

We employ a fundamentally based "building block" approach to estimating asset class returns. Estimates for income and capital gain components of returns for each asset class are informed by fundamental and historical data. Components are then combined to establish estimated returns (Figure 10). Here we provide a summary of key elements of the methodology used to produce our long-term (10-year) estimates. Five-year assumptions are also available upon request. Please see Invesco's capital market assumption methodology whitepaper for more detail.

Figure 10: Our building block approach to estimating returns



For illustrative purposes only.

Fixed income returns are composed of:

- **Average yield:** The average of the starting (initial) yield and the expected yield for bonds.
- **Valuation change (yield curve):** Estimated changes in valuation given changes in the Treasury yield curve.
- **Roll return:** Reflects the impact on the price of bonds that are held over time. Given a positively sloped yield curve, a bond's price will be positively impacted as interest payments remain fixed but time to maturity decreases.
- **Credit adjustment:** Estimated potential impact on returns from credit rating downgrades and defaults.

Equity returns are composed of:

- **Dividend yield:** Dividend per share divided by price per share.
- **Buyback yield:** Percentage change in shares outstanding resulting from companies buying back or issuing shares.
- **Valuation change:** The expected change in value given the current Price/Earnings (P/E) ratio and the assumption of reversion to the long-term average P/E ratio.
- **Long-term (LT) earnings growth:** The estimated rate in the growth of earnings based on the long-term average real GDP per capita and inflation.

Currency adjustments are based on the theory of Interest Rate Parity (IRP) which suggests a strong relationship between interest rates and the spot and forward exchange rates between two given currencies. Interest rate parity theory assumes that no arbitrage opportunities exist in foreign exchange markets. It is based on the notion that, over the long term, investors will be indifferent between varying rate of returns on deposits in different currencies because any excess return on deposits will be offset by changes in the relative value of currencies.

Volatility estimates for the different asset classes, we use rolling historical quarterly returns of various market benchmarks. Given that benchmarks have differing histories within and across asset classes, we normalise the volatility estimates of shorter-lived benchmarks to ensure that all series are measured over similar time periods.

Correlation estimates are calculated using trailing 20 years of monthly returns. Given that recent asset class correlations could have a more meaningful effect on future observations, we place greater weight on more recent observations by applying a 10-year half-life to the time series in our calculation.

Arithmetic versus geometric returns. Our building block methodology produces estimates of geometric (compound) asset class returns. However, standard mean-variance portfolio optimisation requires return inputs to be provided in arithmetic rather than in geometric terms. This is because the arithmetic mean of a weighted sum (e.g., a portfolio) is the weighted sum of the arithmetic means (of portfolio constituents). This does not hold for geometric returns. Accordingly, we translate geometric estimates into arithmetic terms. We provide both arithmetic returns and geometric returns given that the former informs the optimisation process regarding expected outcomes, while the latter informs the investor about the rate at which asset classes might be expected to grow wealth over the long run.

Contributors

Investment Solutions

Duy Nguyen
CFA, CAIA

CIO, Invesco Investment Solutions

Jacob Borbidge
CFA, CAIA

Senior Portfolio Manager, Head of Investment Research, Invesco Investment Solutions

Alessio de Longis
CFA

Senior Portfolio Manager, Head of Tactical Asset Allocation, Invesco Investment Solutions

Greg Chen
PhD, CFA

Senior Analyst

Patrick Hamel
MS, MBA

Quantitative Research Analyst

Chang Hwan Sung
PhD, CFA, FRM

Portfolio Manager, Solutions Research, APAC

Debbie Li
CFA

Senior Analyst

Diane Ellis
MS

Macro Research Analyst

Yu Li
PhD

Quantitative Research Analyst

Investment Solutions Thought Leadership

Drew Thornton
CFA
Head of Solutions Thought Leadership

Invesco Investment Solutions

Invesco Investment Solutions is an experienced multi-asset team that seeks to deliver desired client outcomes using Invesco's global capabilities, scale and infrastructure. We partner with you to fully understand your goals and harness strategies across Invesco's global spectrum of active, passive, factor and alternative investments that address your unique needs. From robust research and analysis to bespoke investment solutions, our team brings insight and innovation to your portfolio construction process. Our approach starts with a complete understanding of your needs:

- We help support better investment outcomes by delivering insightful and thorough analytics.
- By putting analytics into practice, we develop investment approaches specific to your needs.
- We work as an extension of your team to engage across functions and implement solutions.

The foundation of the team's process is the development of capital market assumptions — long-term forecasts for the behavior of different asset classes. Their expectations for returns, volatility, and correlation serve as guidelines for long-term, strategic asset allocation decisions.

Assisting clients in North America, Europe and Asia, Invesco's Investment Solutions team consists of over 75 professionals, with 20+ years of experience across the leadership team. The team benefits from Invesco's on-the-ground presence in 25 countries worldwide, with over 150 professionals to support investment selection and ongoing monitoring.

Investment risks

The value of investments and any income will fluctuate (this may partly be the result of exchange rate fluctuations) and investors may not get back the full amount invested.

Invesco Investment Solutions develops CMAs that provide long-term estimates for the behavior of major asset classes globally. The team is dedicated to designing outcome-oriented, multi-asset portfolios that meet the specific goals of investors. The assumptions, which are based on 5- and 10-year investment time horizons, are intended to guide these strategic asset class allocations. For each selected asset class, we develop assumptions for estimated return, estimated standard deviation of return (volatility), and estimated correlation with other asset classes. This information is not intended as a recommendation to invest in a specific asset class or strategy, or as a promise of future performance. Estimated returns are subject to uncertainty and error, and can be conditional on economic scenarios. In the event a particular scenario comes to pass, actual returns could be significantly higher or lower than these estimates.

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Unless otherwise stated, all information is sourced from Invesco, in USD and as of September 30, 2022.

Further information is available using the contact details shown overleaf.

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Notes

Contact

Neil Blundell

Head of Global Client Solutions

Development

212 278 9174

neil.blundell@invesco.com