



Invesco Global Solutions

2019 Long-term capital market assumptions

United States Dollar (USD)

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Understanding Invesco's 2019 long-term capital market assumptions



Dear Investor,

Investing has always required a belief in the future. At the very least, it requires a belief that an asset will be worth more tomorrow than it is today. However, investing based only on the expectation of returns fails to consider that the future is uncertain. As Professor Elroy Dimson of Cambridge University once noted: "Risk means that more things can happen than will happen".

Only the clairvoyant investor can afford to disregard risk. The rest of us are faced with considering return, risk, and diversification in our investment decisions, taking into account our observations and experiences about the world, markets, and the evolution of asset prices. In short, our beliefs about the future are central to the success of our investment endeavors.

This is where Invesco can help. Given the importance of establishing reasoned expectations for the future performances of assets, Invesco's Global Solutions group devotes substantial resources to developing and updating long-term estimates of asset class returns, risk and correlations for use by investors around the world. Aggregating the expertise and experience of a diverse team of investment researchers and practitioners across the globe, the team focuses on developing estimates that have a solid foundation in theory but are also supported by practical experience. We complement these expectations with views from our Global Market Strategist office that provide insights regarding geopolitical and macroeconomic forces likely to influence capital markets going forward.

Our goal is to provide investors with forward-looking views that balance quantitative rigor with a qualitative perspective on the markets to help inform their beliefs as they face the uncertainty of the future in pursuing their investment objectives. We hope that you find our 2019 long-term capital market assumptions useful.

Best regards,

Martin L. Flanagan
President and CEO, Invesco Ltd.

Executive summary



- **2019 promises to be another year of opportunity and challenges.** We expect global growth to remain resilient but to slow across most major developed market (DM) and emerging market (EM) economies. However, economic policy is now more explicitly politicized than at any time in the post-Soviet/China-WTO era of globalization, which threatens the structure of a global economy open for trade, corporate and financial investment. The uncertainties of Brexit, Eurozone (EZ) political risk and US-China tension are already affecting financial markets and confidence.
- **We expect cyclical deceleration to continue yet to leave growth near or above trend in key economies** - especially in the US (2.5% real GDP growth) and EZ (1.7%), and still strong if slowing growth in major EMs, with China (6.0%) and India (7.4%). But the balance of risks is tilted to the downside, due to cyclical divergence that might cause another bout of dollar strength and tighter global financial conditions; and US-China, Brexit and EZ tensions threaten to undermine business and household confidence and deter, divert or delay investment across borders, and household consumption, especially of big-ticket or discretionary items like homes, cars and white goods.
- **The uncertain macro environment of growth/policy divergence and structural risks points to continued high market volatility and considerable differentiation in performance across geographies and asset classes.** This variability is likely to include both dollar strength and weakness in 2019 as Fed policy likely continues to tighten then plateau, with risks of delayed policy changes by the ECB, BoE and BoJ due to intra-EZ, Brexit or trade friction.
- As a result of our CMA estimates, we believe USD investors are likely to experience higher risk-adjusted returns in equities than most fixed-income asset classes. Global, EZ, UK and US equities are expected to deliver comparable USD risk-adjusted returns. In alternatives, we expect energy, base metals and infrastructure to outperform soft commodities, precious metals and hedge funds.

Global market overview

Macroeconomic overview

2019 promises to be another year of opportunities and challenges. The good news: Our base case is positive, with expansion resilient even as major economies continue to slow from above trend toward trend growth, which should contain inflation as major central banks normalize policy. We expect the US to grow 2.5%; Eurozone (EZ) 1.7%; Japan 1.0% versus potential 2.0%, 1.5%, 1.0% respectively. We expect China to slow to 6.0% and India, 7.4%; Brazil and Russia to accelerate to 1.5 to 2.0%.

The not so good news: cyclical and structural threats - ongoing growth/policy divergence and trade, investment, geopolitical friction across major economies. A cyclical challenge of 2018 may well persist in 2019: Europe, Japan and China may slow more than the US, leading their central bank decisions and market pricing to diverge from the Fed. We expect the US expansion to mature and set a new record as the longest post-WWII expansion. But the US growth rate and output level likely exceeds potential, so the Fed is set to keep raising rates and cutting its balance sheet, even as US growth slows.

Structural risks span trade, investment, technology and migration, as well as national security issues. Economic policies are becoming more explicitly politicized than in the entire post-Soviet/China-WTO era of globalization, threatening partial economic and financial fragmentation. Such risks may crystallize only in many years, or never materialize, but associated uncertainty is already biting. The UK has fallen from the fastest to among the slowest growing, highest inflation economy in the G7 on Brexit unknowns. US tariffs and fiscal stimulus seem to have brought forward global trade and US GDP growth. Italy's rejection of EZ fiscal rules is driving up its bond yields, contributing to a sharp growth slowdown and pressure on some banks due to losses on their bond portfolios. This backdrop implies continued elevation in market volatility, perhaps another round of dollar strength, a combination that could tighten global financial conditions and slow global growth, especially in EM economies.

Upside risks deserve attention too. Cyclically the oil price fall should support global demand by boosting spending among oil importers and reducing inflation pressures. A silver lining of gradual/partial global economic fragmentation, should say US-China tensions persist or escalate: Opportunities for diversification and discrimination across countries, sectors, firms would rise as economic cycles would be less synchronized and growth models could diverge, leading to differentiated financial cycles and return possibilities.

Implications

As we look ahead to 2019, we expect monetary policy to continue to normalize, which we believe will cause capital markets to continue to normalize as well. That means an erosion of the support that Fed policy has given to stocks globally. In this environment, we expect a continued reduction in correlations among stocks as fundamentals become more important, as well as continued volatility. In addition, this normalization of US monetary policy suggests that US asset markets are prone to mean reversion over the course of this unusual cycle, with downside risks stemming from trade tensions and geopolitics. Mean reversion would imply somewhat higher bond yields and discount rates for corporate cash flows and would probably be reflected in higher corporate credit and equity risk premia. In addition, the potential for some fragmentation caused by geopolitical disruption would likely result in higher volatility and perhaps even reduced corporate earnings power if US firms have less access to global markets, including China - which has until now been expected to continue as a major driver of global growth and a major source of revenue and earnings growth for both US and other multinational firms. Even with these downside risks and volatility, we would expect US bonds to underperform US stocks, which we expect to post modest gains. In the Eurozone and Japan, we expect continued support of risk assets because of more accommodative monetary policy, which could result in modest positive stock returns for those regions despite relatively low economic growth. In emerging markets, we expect the Fed-driven re-pricing to continue to spill over into global markets through a stronger dollar, higher US bond yields and tighter global financial conditions, pointing to more pressure on EM currencies, putting downward pressure on growth and upward pressure on inflation - a challenging scenario for EM equities, bonds and currencies. However, there is a significant possibility that by mid-year, the Fed is likely to have moderated its normalization

as economic growth slows, which should result in some moderation in the investment implications mentioned above.

We expect unusual behavior to continue across commodities with the tendency to a strong dollar, global divergence between the US and the risk of global growth downgrades tending to pull the overall commodity complex down. Base metals are among the commodities more exposed to these downside risks, driven by the deleveraging-led slowdown in China and the general downward pressures on global capex due to trade frictions. Against that, however, geopolitical risks and trade tensions hold out the prospect of continued divergences across commodities, notably in oil, where tensions in the Mid-East may cause renewed upward price pressures. Soft commodities remain exposed to developments in US-China negotiations, with China's tariffs on US agricultural exports representing a potential bargaining chip in any negotiations that might lead to a reprieve or succumb to a new round of tensions or tariff increases.

In this environment, we believe exposure to risk assets is important for meeting long-term goals - especially given that an upward bias for stocks may continue to exist, although it is growing weaker. Attempting to mitigate downside risk will be critical, and that includes being well-diversified within equities and fixed income; that is also important given the divergence in growth in different economies. And, perhaps most important during this period of uncertainty, we believe that exposure to alternative investments can help with diversification and risk mitigation. That may include strategies such as market neutral portfolios and other lower-correlating asset classes, especially ones including those with income producing potential.

US market overview

Despite a flattening yield curve, we do not believe the US is at any significant risk of a recession in the coming year. We expect the US economy to decelerate modestly but remain solid in 2019. Tax reform legislation has provided the US economy with powerful stimulus; however, Fed tightening has been a countervailing force to that stimulus. In addition, the ongoing tariff dispute between the US and China is causing economic policy uncertainty that could depress capital spending and lower profit margins, as well as raise prices for consumers. Unemployment should remain low and consumer spending should remain relatively strong.

While Fed policy remains data dependent, we believe Fed tightening will continue in 2019 although it may be modest. In the wake of the mid-term elections, there is both upside and downside potential. There is the possibility that the President and Congress are able to agree on an infrastructure spending package, which could be very positive for the US economy. However, there is also the potential that the executive and legislative branches dissolve into acrimony and division in the coming year, which could undermine investor confidence.

In this environment, the dollar is likely to experience volatility as changing expectations about US monetary policy push the dollar both higher and lower over the coming year.

Fixed income

As a result of our CMA estimates, we believe that high yielding asset classes - US high yield, Asian dollar high yield, US preferred stocks, US bank loans, EM corporate debt and EM sovereign debt are set to offer respectable risk adjusted returns over the longer term. US short-term Treasuries are likely to generate low risk adjusted returns over the long run. The greater strength of the US economy suggests continued monetary policy divergence and relative USD strength.

Equities

In conclusion of our CMA estimates, we believe that global, US, UK and EZ equities are likely to deliver comparable risk adjusted returns, and higher than most fixed income asset classes, over the long run as global yields rise and major central banks normalize monetary policy.

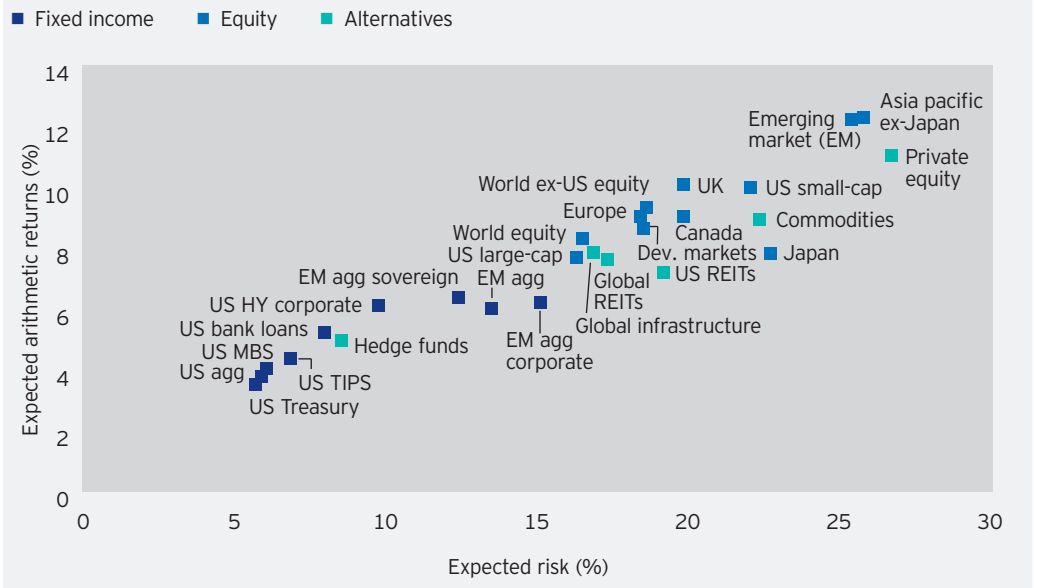
Alternatives

Based on our long-term CMA estimates, we expect private equity, infrastructure and certain commodity sectors, notably energy and base metals, to outperform other alternatives such as agriculture, precious metals and hedge funds.

2019 Long-term capital market assumptions

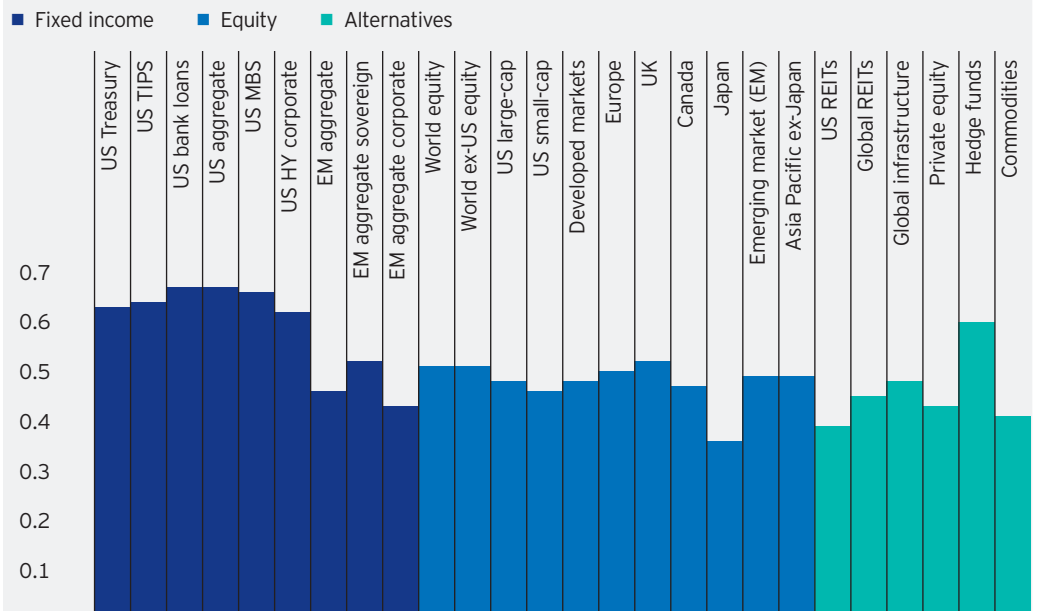
United States Dollar (USD)

Figure 1: 10-year asset class expectations (USD)



Source: Invesco, estimates as of October 31, 2018. Proxies listed in figure 3. 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. Please see page 12 for additional CMA information. These estimates reflect the views of Invesco Global Solutions, the views of other investment teams at Invesco may differ from those presented here.

Figure 2: 10-year asset class expected return-to-risk (USD)



Source: Invesco, estimates as of October 31, 2018. Proxies listed in figure 3. 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. Please see page 12 for additional CMA information. These estimates reflect the views of Invesco Global Solutions, the views of other investment teams at Invesco may differ from those presented here.

Figure 3: 10-year asset class expected returns and volatility (USD)

	Asset class	Index	Expected geometric return (%)	Expected arithmetic return (%)	Risk (%)
Fixed income	US Treasury (short)	Bloomberg Barclays US Treasury Short	2.7	2.7	1.6
	US Treasury (intermediate)	Bloomberg Barclays US Treasury Intermediate	3.1	3.2	4.6
	US Treasury (long)	Bloomberg Barclays US Treasury Long	3.1	3.7	11.4
	US TIPS	Bloomberg Barclays US TIPS	3.5	3.7	5.8
	US bank loans	CSFB Leverage Loan Index	5.0	5.3	8.0
	US aggregate	Bloomberg Barclays US Aggregate	3.8	4.0	6.0
	US IG corporates	Bloomberg Barclays US Investment Grade	4.0	4.3	7.6
	US MBS	Bloomberg Barclays US MBS	4.1	4.3	6.7
	US preferred stocks	BOA ML Fixed Rate Pref Securities	4.6	5.3	12.4
	US HY corporates	Bloomberg Barclays US High Yield	5.5	6.0	9.8
	US intermediate municipals	BOA ML US Municipal (3Y-15Y)	3.7	3.8	6.1
	US HY municipals	Bloomberg Barclays Municipal Bond High Yield	2.6	3.0	8.9
	Global aggregate	Bloomberg Barclays Global Aggregate	3.7	3.9	7.0
	Global aggregate ex-US	Bloomberg Barclays Global Aggregate Ex US	3.5	4.0	10.6
	Global Treasury	Bloomberg Barclays Global Treasuries	3.6	4.0	8.8
	Global sovereign	Bloomberg Barclays Global Sovereign	3.5	3.7	6.7
	Global corporate	Bloomberg Barclays Global Corporate	4.0	4.3	7.5
	Global IG	Bloomberg Barclays Global Corporate Inv Grd	3.9	4.2	7.7
	Eurozone corporate	Bloomberg Barclays Euro Aggregate Credit Corporate	3.9	4.8	13.4
	Eurozone Treasury	Bloomberg Barclays Euro Aggregate Government Treasury	4.2	5.0	12.7
	Asian dollar IG	BOA Merrill Lynch ACIG	4.2	4.6	8.9
	Asian dollar HY	BOA Merrill Lynch ACHY	8.3	10.0	19.0
	EM aggregate	Bloomberg Barclays EM Aggregate	5.2	6.0	13.5
	EM aggregate sovereign	Bloomberg Barclays EM Sovereign	5.6	6.3	12.5
	EM aggregate corporate	Bloomberg Barclays EM Corporate	5.3	6.3	15.1
EM corporate IG	Bloomberg Barclays Emerging Markets USD Aggregate Corporate IG	4.4	4.7	8.4	
Equities	World equity	MSCI ACWI	7.1	8.3	16.5
	World ex-US equity	MSCI ACWI Ex-US	7.8	9.3	18.7
	US broad market	Russell 3000	6.6	8.0	17.1
	US large-cap	S&P 500	6.5	7.7	16.4
	US mid-cap	Russell Midcap	7.3	8.9	18.9
	US small-cap	Russell 2000	7.9	10.0	22.1
	Developed	MSCI EAFE	7.2	8.7	18.4
	Europe	MSCI Europe	7.6	9.1	18.4
	Eurozone	MSCI Euro X UK	7.3	9.0	19.5
	UK large-cap	FTSE 100	8.4	10.1	19.8
	UK small-cap	FTSE Small Cap UK	9.2	11.9	25.2
	Canada	S&P TSX	7.3	9.1	19.8
	Japan	MSCI JP	5.5	7.9	22.8
	Emerging market	MSCI EM	9.5	12.3	25.4
	Asia Pacific ex-Japan	MSCI APXJ	9.5	12.3	25.8
	Pacific ex-Japan	MSCI Pacific X JP	8.8	11.5	25.0
	Alternatives	US REITs	FTSE NAREIT Equity	5.5	7.2
Global REITs		FTSE EPRA/NAREIT Developed	6.3	7.7	17.3
Global infrastructure		S&P Global Infrastructure	6.6	7.9	16.7
Private equity		DJ Private Equity Total Return	8.1	11.1	26.6
Hedge funds		HFRI HF	4.7	5.0	8.5
Commodities		S&P GSCI	6.7	9.0	22.4
Agriculture		S&P GSCI Agriculture	1.8	4.0	21.7
Energy		S&P GSCI Energy	9.2	14.1	34.4
Industrial metals		S&P GSCI Industrial Metals	6.4	9.0	24.4
Precious metals	S&P GSCI Precious Metals	3.9	5.6	18.9	

Source: Invesco, estimates as of October 31, 2018. All total returns data is annual. These estimates are based on our capital market assumptions which are forward looking, are not guarantees, and they involve risks, uncertainties and assumptions. Please see page 9 for information about our CMA methodology. Please see page 12 for additional CMA information. These estimates reflect the views of Invesco Global Solutions, the views of other investment teams at Invesco may differ from those presented here.

Figure 4: 10-year correlations and risk ratios (USD)

Asset class		Fixed income																														
		US Treasury (short)	US Treasury (intermediate)	US Treasury (long)	US TIPS	US bank loans	US aggregate	US IG corporates	US MBS	US preferred stocks	US HY corporates	US intermediate municipals	US HY municipals	Global aggregate	Global aggregate-ex US	Global treasury	Global sovereign	Global corporate	Global IG	Eurozone corporate	Eurozone treasury	Asian dollar IG	Asian dollar HY	EM aggregate	EM aggregate sovereign	EM aggregate corporate	EM corporate IG	EM corporate HY				
Fixed Income	US Treasury (short)	1.00																														
	US Treasury (intermediate)	0.33	1.00																													
	US Treasury (long)	0.09	0.82	1.00																												
	US TIPS	0.13	0.65	0.61	1.00																											
	US bank loans	-0.18	-0.39	-0.31	0.18	1.00																										
	US aggregate	0.19	0.86	0.85	0.79	-0.03	1.00																									
	US IG corporates	0.01	0.52	0.58	0.71	0.33	0.84	1.00																								
	US MBS	0.27	0.84	0.74	0.67	-0.14	0.90	0.64	1.00																							
	US preferred stocks	-0.03	0.11	0.12	0.27	0.23	0.31	0.50	0.12	1.00																						
	US HY corporates	-0.15	-0.20	-0.14	0.32	0.80	0.20	0.56	0.05	0.43	1.00																					
	US intermediate municipals	0.09	0.60	0.59	0.58	0.07	0.74	0.66	0.65	0.32	0.21	1.00																				
	US HY municipals	-0.12	0.14	0.23	0.41	0.51	0.38	0.45	0.32	0.22	0.43	0.57	1.00																			
	Global aggregate	0.12	0.59	0.48	0.66	0.06	0.70	0.67	0.59	0.35	0.31	0.51	0.25	1.00																		
	Global aggregate-ex US	0.08	0.44	0.32	0.55	0.09	0.53	0.54	0.43	0.32	0.31	0.38	0.19	0.98	1.00																	
	Global treasury	0.17	0.61	0.50	0.62	-0.05	0.66	0.57	0.56	0.30	0.20	0.47	0.18	0.98	0.97	1.00																
	Global sovereign	0.09	0.46	0.40	0.70	0.27	0.70	0.76	0.57	0.38	0.53	0.50	0.39	0.88	0.84	0.80	1.00															
	Global corporate	0.02	0.36	0.32	0.66	0.39	0.66	0.84	0.48	0.50	0.61	0.48	0.38	0.88	0.84	0.78	0.92	1.00														
	Global IG	0.01	0.35	0.32	0.65	0.41	0.65	0.85	0.47	0.50	0.63	0.48	0.38	0.85	0.80	0.73	0.91	0.99	1.00													
	Eurozone corporate	0.03	0.18	0.06	0.42	0.28	0.35	0.50	0.25	0.36	0.47	0.24	0.18	0.82	0.86	0.75	0.82	0.87	0.87	1.00												
	Eurozone treasury	0.09	0.25	0.15	0.41	0.12	0.39	0.44	0.30	0.28	0.36	0.21	0.12	0.84	0.88	0.78	0.81	0.79	0.78	0.81	1.00											
Asian dollar IG	0.07	0.46	0.45	0.72	0.42	0.74	0.82	0.63	0.29	0.54	0.55	0.52	0.60	0.48	0.51	0.80	0.78	0.80	0.51	0.45	1.00											
Asian dollar HY	-0.12	-0.07	-0.09	0.41	0.71	0.26	0.56	0.17	0.27	0.77	0.19	0.42	0.35	0.32	0.23	0.62	0.65	0.67	0.51	0.40	0.74	1.00										
EM aggregate	-0.01	0.16	0.19	0.54	0.50	0.49	0.69	0.39	0.33	0.73	0.37	0.46	0.51	0.45	0.43	0.78	0.73	0.74	0.53	0.56	0.77	0.80	1.00									
EM aggregate sovereign	0.02	0.22	0.26	0.55	0.42	0.53	0.69	0.43	0.32	0.68	0.42	0.46	0.54	0.48	0.47	0.80	0.72	0.72	0.51	0.58	0.75	0.73	0.98	1.00								
EM aggregate corporate	-0.10	0.12	0.11	0.59	0.61	0.47	0.72	0.37	0.33	0.78	0.32	0.39	0.54	0.49	0.40	0.76	0.77	0.78	0.62	0.50	0.87	0.91	0.94	0.88	1.00							
EM corporate IG	0.02	0.35	0.37	0.70	0.43	0.68	0.82	0.55	0.41	0.69	0.52	0.46	0.63	0.54	0.54	0.87	0.81	0.82	0.57	0.57	0.86	0.76	0.91	0.91	0.90	1.00						
EM corporate HY	-0.04	0.03	0.03	0.43	0.54	0.34	0.58	0.27	0.27	0.72	0.26	0.39	0.43	0.40	0.34	0.70	0.66	0.67	0.51	0.52	0.69	0.81	0.97	0.94	0.92	0.83	1.00					
Equities	World equity	-0.13	-0.29	-0.26	0.14	0.56	0.01	0.33	-0.08	0.40	0.72	-0.02	0.24	0.32	0.37	0.21	0.51	0.56	0.57	0.55	0.53	0.35	0.66	0.62	0.58	0.65	0.54	0.64				
	World ex-US equity	-0.09	-0.24	-0.22	0.19	0.56	0.06	0.38	-0.04	0.40	0.72	0.03	0.26	0.40	0.46	0.30	0.58	0.64	0.64	0.63	0.59	0.40	0.68	0.66	0.63	0.69	0.58	0.68				
	US broad market	-0.16	-0.33	-0.27	0.06	0.52	-0.05	0.24	-0.13	0.36	0.67	-0.07	0.20	0.18	0.22	0.08	0.38	0.42	0.43	0.40	0.39	0.27	0.58	0.53	0.49	0.55	0.45	0.55				
	US large-cap	-0.16	-0.32	-0.27	0.06	0.50	-0.05	0.24	-0.13	0.36	0.65	-0.07	0.20	0.19	0.23	0.09	0.38	0.42	0.43	0.40	0.40	0.27	0.56	0.52	0.48	0.55	0.44	0.54				
	US mid-cap	-0.14	-0.32	-0.25	0.11	0.58	-0.02	0.29	-0.11	0.38	0.72	-0.02	0.23	0.20	0.23	0.10	0.40	0.45	0.46	0.41	0.38	0.31	0.62	0.56	0.52	0.59	0.48	0.57				
	US small-cap	-0.12	-0.34	-0.28	0.02	0.49	-0.09	0.18	-0.16	0.31	0.63	-0.10	0.10	0.11	0.14	0.02	0.28	0.32	0.33	0.31	0.25	0.21	0.52	0.45	0.41	0.46	0.36	0.47				
	Developed	-0.10	-0.25	-0.23	0.16	0.54	0.05	0.36	-0.05	0.40	0.70	0.02	0.23	0.39	0.44	0.28	0.56	0.62	0.63	0.62	0.58	0.37	0.64	0.63	0.59	0.65	0.55	0.65				
	Europe	-0.09	-0.25	-0.25	0.13	0.53	0.03	0.33	-0.06	0.38	0.68	0.02	0.23	0.38	0.44	0.27	0.55	0.61	0.61	0.64	0.60	0.34	0.61	0.60	0.57	0.62	0.53	0.63				
	Eurozone	-0.08	-0.24	-0.24	0.12	0.50	0.03	0.32	-0.06	0.37	0.67	0.00	0.20	0.38	0.44	0.28	0.55	0.60	0.60	0.64	0.62	0.32	0.59	0.60	0.56	0.62	0.52	0.62				
	UK	-0.11	-0.26	-0.26	0.14	0.56	0.02	0.33	-0.06	0.35	0.67	0.04	0.28	0.35	0.40	0.23	0.51	0.59	0.59	0.59	0.51	0.35	0.61	0.57	0.54	0.60	0.50	0.61				
Canada	-0.04	-0.23	-0.22	0.22	0.57	0.05	0.34	-0.02	0.34	0.68	0.05	0.28	0.33	0.37	0.24	0.48	0.55	0.54	0.50	0.45	0.38	0.65	0.62	0.57	0.65	0.53	0.64					
Japan	-0.12	-0.20	-0.14	0.14	0.40	0.04	0.29	-0.04	0.33	0.51	-0.01	0.13	0.26	0.29	0.17	0.38	0.44	0.44	0.37	0.36	0.29	0.48	0.47	0.43	0.51	0.39	0.48					
Emerging market	-0.05	-0.20	-0.18	0.24	0.53	0.09	0.38	-0.01	0.37	0.71	0.03	0.29	0.37	0.41	0.30	0.56	0.60	0.60	0.55	0.57	0.41	0.69	0.68	0.66	0.68	0.60	0.69					
Asia Pacific ex-Japan	-0.08	-0.19	-0.15	0.21	0.50	0.09	0.38	-0.02	0.38	0.68	0.03	0.28	0.34	0.37	0.27	0.53	0.57	0.58	0.50	0.52	0.41	0.68	0.63	0.60	0.65	0.56	0.63					
Pacific ex-Japan	-0.07	-0.16	-0.14	0.27	0.53	0.13	0.42	0.03	0.40	0.70	0.07	0.28	0.42	0.45	0.32	0.60	0.64	0.64	0.59	0.54	0.45	0.71	0.67	0.64	0.68	0.61	0.67					
Alternatives	US REITs	-0.05	-0.01	0.05	0.29	0.50	0.26	0.42	0.12	0.44	0.63	0.20	0.31	0.35	0.33	0.29	0.52	0.51	0.51	0.39	0.36	0.41	0.52	0.53	0.52	0.53	0.54	0.48				
	Global REITs	-0.05	-0.05	0.01	0.34	0.57	0.27	0.51	0.13	0.51	0.72	0.20	0.37	0.47	0.47	0.38	0.64	0.67	0.67	0.56	0.52	0.51	0.66	0.66	0.64	0.66	0.65	0.62				
	Global infrastructure	-0.02	-0.05	-0.01	0.36	0.53	0.27	0.51	0.14	0.48	0.71	0.18	0.31	0.56	0.58	0.46	0.69	0.73	0.73	0.71	0.64	0.51	0.62	0.69	0.68	0.67	0.66	0.67				
	Private equity	-0.11	-0.24	-0.26	0.21	0.63	0.05	0.35	-0.05	0.49	0.72	-0.01	0.24	0.34	0.38	0.22	0.52	0.60	0.61	0.61	0.46	0.43	0.68	0								

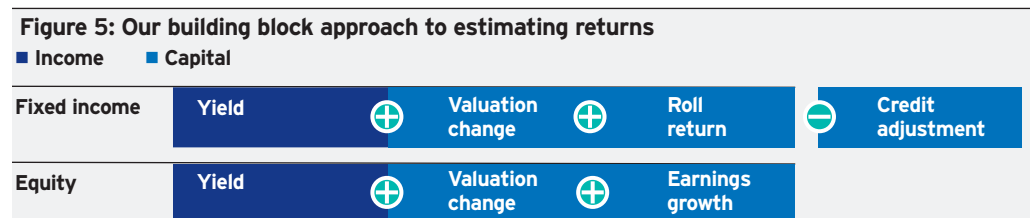
Figure 4 (continued): 10-year correlations and risk ratios (USD)

Asset class		Equities														Alternatives												
		World equity	World ex-US equity	US broad	US large-cap	US mid-cap	US small-cap	Developed	Europe	Eurozone	UK	Canada	Japan	Emerging market	Asia Pacific ex-Japan	Pacific ex-Japan	US REITs	Global REITs	Global infrastructure	Private equity	Hedge funds	Commodities	Agriculture	Energy	Industrial metals	Precious metals		
Fixed Income	US Treasury (short)																											
	US Treasury (intermediate)																											
	US Treasury (long)																											
	US TIPS																											
	US bank loans																											
	US aggregate																											
	US IG corporates																											
	US MBS																											
	US preferred stocks																											
	US HY corporates																											
	US intermediate municipals																											
	US HY municipals																											
	Global aggregate																											
	Global aggregate-ex US																											
	Global treasury																											
	Global sovereign																											
	Global corporate																											
	Global IG																											
	Eurozone corporate																											
	Eurozone treasury																											
Asian dollar IG																												
Asian dollar HY																												
EM aggregate																												
EM aggregate sovereign																												
EM aggregate corporate																												
EM corporate IG																												
EM corporate HY																												
Equities	World equity	1.00																										
	World ex-US equity	0.97	1.00																									
	US broad market	0.95	0.86	1.00																								
	US large-cap	0.95	0.86	1.00	1.00																							
	US mid-cap	0.93	0.86	0.96	0.94	1.00																						
	US small-cap	0.82	0.75	0.89	0.84	0.93	1.00																					
	Developed	0.97	0.99	0.86	0.86	0.85	0.74	1.00																				
	Europe	0.95	0.96	0.85	0.85	0.83	0.73	0.98	1.00																			
	Eurozone	0.93	0.95	0.84	0.84	0.83	0.73	0.97	0.99	1.00																		
	UK	0.91	0.93	0.81	0.82	0.79	0.67	0.94	0.95	0.90	1.00																	
	Canada	0.85	0.85	0.78	0.77	0.81	0.73	0.80	0.78	0.75	0.79	1.00																
	Japan	0.72	0.75	0.63	0.62	0.62	0.54	0.77	0.64	0.63	0.62	0.58	1.00															
	Emerging market	0.88	0.91	0.76	0.75	0.77	0.68	0.85	0.81	0.81	0.78	0.83	0.64	1.00														
	Asia Pacific ex-Japan	0.85	0.88	0.74	0.74	0.75	0.66	0.82	0.77	0.77	0.74	0.76	0.63	0.97	1.00													
Pacific ex-Japan	0.89	0.91	0.78	0.78	0.79	0.70	0.88	0.83	0.81	0.82	0.82	0.64	0.91	0.89	1.00													
Alternatives	US REITs	0.62	0.59	0.64	0.62	0.69	0.64	0.58	0.57	0.53	0.51	0.41	0.52	0.51	0.58	1.00												
	Global REITs	0.80	0.80	0.75	0.73	0.79	0.70	0.79	0.76	0.74	0.74	0.68	0.59	0.73	0.72	0.81	0.91	1.00										
	Global infrastructure	0.86	0.89	0.76	0.76	0.76	0.64	0.88	0.87	0.86	0.84	0.79	0.64	0.82	0.78	0.84	0.68	0.84	1.00									
	Private equity	0.90	0.89	0.85	0.85	0.84	0.75	0.90	0.88	0.87	0.84	0.74	0.76	0.77	0.75	0.79	0.67	0.81	0.79	1.00								
	Hedge funds	0.87	0.87	0.81	0.79	0.85	0.79	0.84	0.80	0.79	0.78	0.86	0.67	0.85	0.82	0.82	0.47	0.67	0.79	0.80	1.00							
	Commodities	0.43	0.48	0.35	0.34	0.39	0.33	0.45	0.43	0.39	0.49	0.61	0.33	0.46	0.40	0.46	0.16	0.31	0.46	0.45	0.50	1.00						
	Agriculture	0.32	0.34	0.26	0.26	0.26	0.20	0.32	0.31	0.31	0.31	0.36	0.18	0.35	0.31	0.38	0.21	0.30	0.32	0.29	0.28	0.39	1.00					
	Energy	0.37	0.41	0.30	0.29	0.33	0.30	0.39	0.37	0.33	0.43	0.54	0.31	0.39	0.33	0.38	0.11	0.24	0.40	0.40	0.44	0.98	0.24	1.00				
	Industrial metals	0.54	0.57	0.47	0.46	0.49	0.42	0.53	0.50	0.48	0.55	0.63	0.35	0.59	0.56	0.61	0.32	0.47	0.47	0.50	0.55	0.51	0.32	0.40	1.00			
	Precious metals	0.17	0.25	0.06	0.05	0.11	0.06	0.19	0.17	0.16	0.19	0.36	0.12	0.32	0.26	0.28	0.14	0.22	0.28	0.08	0.26	0.30	0.29	0.22	0.36	1.00		

Source: Invesco, estimates as of October 31, 2018. Proxies listed in figure 3. 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. Please see page 12 for additional CMA information. These estimates reflect the views of Invesco Global Solutions, the views of other investment teams at Invesco may differ from those presented here.

About our capital market assumption 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 5). 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.



Fixed income returns are composed of:

- **Average yield:** The average of the starting (initial) yield and the expected yield for bonds.
- **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.
- **Valuation change (yield curve):** Estimated changes in valuation given changes in the Treasury yield curve.
- **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.
- **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.
- **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.

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 longterm, 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 normalize 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 optimization 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 optimization process regarding expected outcomes, while the latter informs the investor about the rate at which asset classes might be expected growth wealth over the long run.

Contributors

Duy Nguyen
CFA, CAIA
CIO, Head of Global Advisory
Solutions

Jacob Borbidge
CFA, CAIA
Head of Research

Greg Chen
PhD
Quantitative Research Analyst

Christopher Armstrong
CFA, CAIA
Head of Manager Selection

Chang Hwan Sung
PhD, CFA, FRM
Director, Solutions Research,
APAC

Kenneth Blay
Head of Solutions
Thought Leadership

Kristina Hooper
Chief Market Strategist

Arnab Das
Global Market Strategist,
EMEA

Contact**Neil Blundell**

Head of Global Client Solutions
Development

Tel: 917 971 5044

Email: neil.blundell@invesco.com

About Invesco Global Solutions

Invesco Global 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 Global Solutions team consists of over 50 professionals, with 20+ years of experience across the leadership team. The team benefits from Invesco's on-the-ground presence in more than 20 countries worldwide, with over 150 professionals to support investment selection and ongoing monitoring.

About the Invesco Global Market Strategist office

The GMS office is comprised of investment professionals based in different regions, with different areas of expertise. It provides data and commentary on global markets, offering insights into key trends and themes and their investment implications.

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 Global 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 a 10-year investment time horizon, 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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