



**BNY MELLON**  
INVESTMENT MANAGEMENT



**Investor Solutions**

# 10-Year Capital Market Assumptions

Calendar Year 2020

## About the Assumptions

On an annual basis, BNY Mellon Investor Solutions, LLC develops capital market return assumptions for approximately 50 asset classes around the world. The assumptions are based on a 10-year investment time horizon and are intended to guide investors in developing their long-term strategic asset allocations. The capital market assumptions team consists of more than 30 investment professionals including investment strategists, economists, manager research specialists and portfolio managers. We developed the initial baseline assumptions using general market expectations and consensus data. The assumptions were then adjusted to reflect views and potential dislocations in global markets, based on research from across BNY Mellon Investment Management. This document outlines forecasts for the next 10 years and provides supporting details behind the data.

## A note on Covid-19

Estimation of the capital market assumptions take places during the fourth quarter of each calendar year and the assumptions are subsequently published at the start of the next calendar year. Consequently the capital market assumptions for 2020 were based on information available up to and including the end of 2019 only. Therefore the assumptions published in this document do not yet reflect our evaluation of the effects of the COVID-19 pandemic on the underlying economic and capital market variables that form the building blocks of our return, volatility and correlation estimates. An updated version of BNY Mellon's assumptions will be published later in the year once a full assessment the long term macroeconomic implications of the pandemic has been completed.

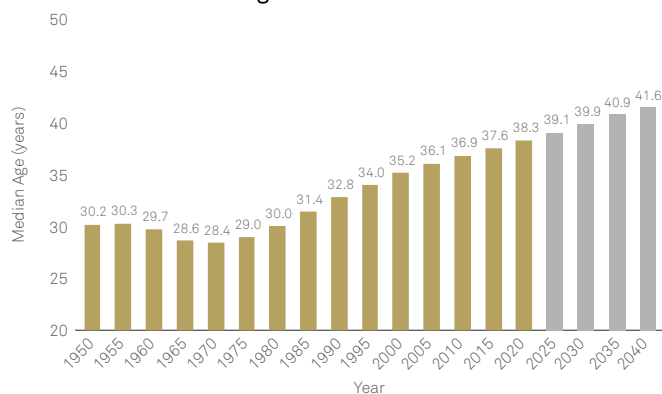
## Economic and Demographic Backdrop

When developing capital market assumptions, most forecasters start with assumptions around two of the most fundamental economic variables: growth and inflation.

Research indicates that demographics influence both growth and inflation for a given region. Generally speaking, older nations tend to grow more slowly and experience lower levels of inflation. There are a number of potential reasons for this. Some demographers argue that mature nations are less capital intensive than their developing counterparts, leading to lower overall levels of growth. Others would say that older nations are on the back end of the household formation cycle and overall credit demand slows in such an environment. It may be that a country with more retired individuals naturally sees a greater demand for fixed income. Causal factors may be debated, but the data points to a meaningful relationship between age and potential growth/inflation.

For most of the post-World War II era in the United States, the population has been aging. As Exhibit 1 demonstrates, median age in the U.S. reached a relative low of 28 years in 1970, but has since climbed to about 38 years.

Exhibit 1: U.S. Median Age



Source: BNY Mellon Wealth Management, OECD. Data as of December 31, 2018.

The aging population trend has acted as a headwind to potential GDP growth in the United States, as shown in Exhibit 2. In the early 1960s, when the median age in the U.S. was below 30 years, potential real GDP growth trended between 4-5%. Since then, potential real GDP has been steadily declining, falling to as low as 1% in 2010. Because the population is expected to continue to age over the next decade, we should also expect slower GDP growth relative to historical standards.

Potential real GDP growth is forecasted to be around 2% over the coming decade.

Exhibit 2: U.S. Potential Real GDP Growth

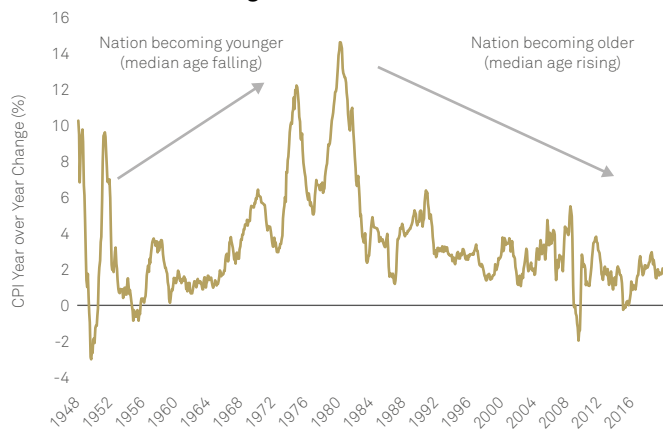


Source: Congressional Budget Office. Data as of December 2, 2019.

Historically, there has also been a strong relationship between inflation and median age.

From the late 1950s to the early 1970s, the median age in the United States fell from 30 years to 28 years. As Exhibit 3 demonstrates, the nation becoming younger also coincided with escalating inflation.

**Exhibit 3: Annual Change in Inflation (Consumer Price Index)**



Source: U.S. Bureau of Labor Statistics. Data as of December 2019.

From the mid-1980s to today, the nation has been growing older. This underlying demographic trend has led to subdued inflation despite easy monetary policy from the Federal Reserve.

The continued aging of the United States is expected to remain a headwind to inflationary forces. Demographics remain supportive of our 2.1% inflation assumption in the United States.

Looking outside of the U.S., demographic trends have similar impacts on growth and inflation. With many developed economies having even stronger demographic headwinds, growth and inflation is expected to remain very low. Younger economies in the emerging markets are expected to see elevated levels of growth and inflation.

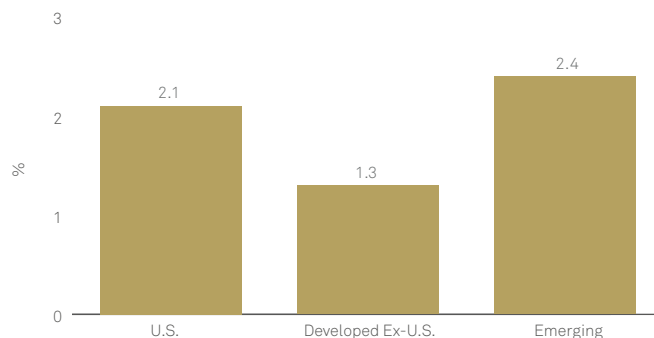
## Inflation and Real Short-Term Interest Rates

Inflation and real short-term interest rates provide the foundation for expected returns across global asset classes. Both are primary building blocks for developing equity and fixed income returns and, eventually, alternative asset class returns. Later, we will explain how we used inflation and real interest rates when developing our return expectations. For now, we will focus on inflation and real interest rate expectations over the next 10 years. We look at three driving factors to develop the baseline assumptions for our global inflation expectations:

1. Market expectations based on breakeven rates
2. Consensus forecasts
3. Central bank targets

We forecast U.S. annualized inflation over the next 10 years will be 2.1%, which is slightly above the Federal Reserve target but in line with market-implied rates and consensus estimates. In the developed world outside of the U.S., we expect inflation to be lower at 1.6%, due to sluggish growth and aging populations. In emerging economies, we expect inflation to be 3%, which is in line with consensus forecasts.

**Exhibit 4: 10-Year Annual Inflation Expectations From 2020 to 2029**



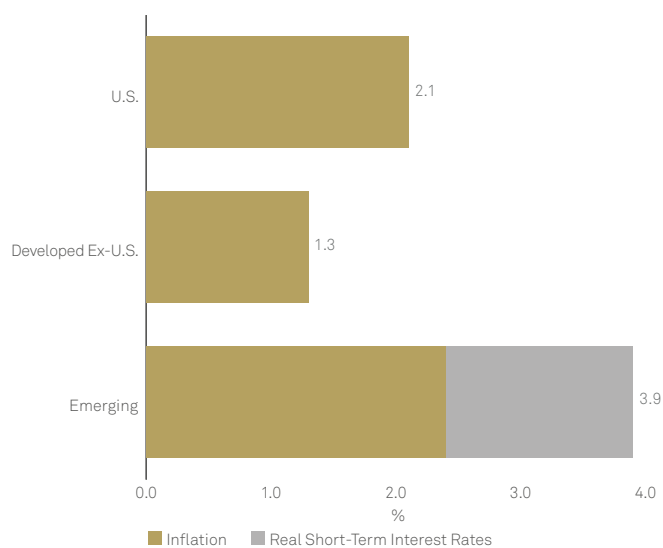
Source: BNY Mellon Investor Solutions.

Due to unprecedented efforts from central banks around the globe, nominal short-term interest rates have been driven to very low levels. Given positive inflation, the result is negative or zero real short-term interest rates in most developed markets and positive but low rates in emerging markets. We believe that real short-term interest rates will climb closer to historical averages, but will remain slightly depressed due to limited upward inflation pressure from sluggish growth and demographic headwinds.

In the U.S., we expect real short-term interest rates to remain at a level close to zero. We expect other central banks in the developed world outside of the U.S. to follow suit, with real rates gradually moving from negative to a level close to zero. In emerging economies, we expect real short-term interest rates to migrate slightly higher to 1.5%.

Our projected nominal short-term interest rates for the U.S., developed markets excluding the U.S., and emerging markets are shown in Exhibit 5. The nominal rate includes our inflation expectations plus the real rate described previously. We expect rates to gradually increase from today's levels to the projected rates in five years.

**Exhibit 5: Projected Nominal Short-Term Interest Rates**



Projected rates in five years for U.S., Developed Ex-U.S. and Emerging.

Source: BNY Mellon Investors Solutions. As at September 30, 2019.

## Fixed Income Market Return Expectations

Our fixed income return assumptions rely on a building-block approach to project yields over the next 10 years. When applicable, we add curve slope and credit spreads to our normalized short-term interest rates. The result is our expectation of normalized fixed income yields. For developing additional yield due to maturity, we first look to historical relationships between the slope of the curve, inflation expectations and the level of short-term rates. Based on a regression analysis, our research suggests that inflation expectations and the level of short-term interest rates have some level of predictive power for the slope of the yield curve.

The results of our analysis are shown in Exhibit 6. The chart compares the actual U.S. 10-year bond slope (10-year yield minus three-month yield) to simulated results from our regression analysis. The same formula that produces the simulated results is then used to determine the slope of the entire curve based on our expectation of inflation and short-term interest rates.

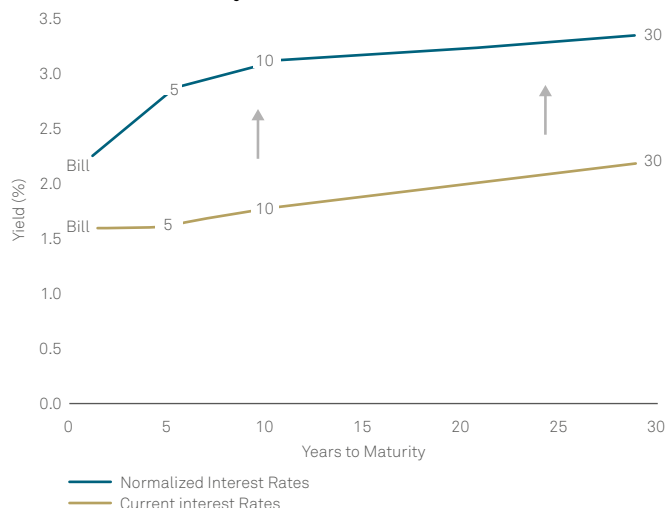
**Exhibit 6: U.S. Yield Curve Slope**



Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of November 30, 2019.

If we relied purely on the model demonstrated above, the difference between the U.S. 10-year bond yield and three-month bond yield would be approximately 160 basis points. Due to the impact of an aging population, we believe inflation and growth will be limited and result in a flatter yield curve. Our revised projection for the difference between the 10-year bond yield and three-month bond yield is 100 basis points. Overall, we see U.S. Treasury yields rising until they reach a normalized level in five years. We expect the short end of the curve to rise about 50 basis points and the 10-year yield and 30-year yield to rise more than 100 basis points.

**Exhibit 7: U.S. Treasury Yield Curve**



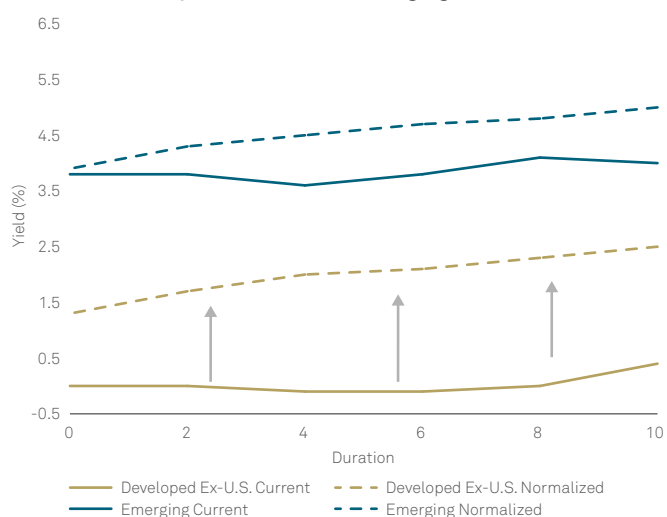
Current Interest Rates as of November 30, 2019.

Normalized Interest Rates are projected in five years.

Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of November 30, 2019.

In the developed world outside of the U.S., we see similar increases in government bond yields due to extremely low current levels. However, we expect the overall level of government bond yields outside the U.S. to remain lower due to subdued inflation and lower growth expectations. Emerging markets will likely also experience rising rates due to normalization, though the increase may not be as pronounced as developed markets.

**Exhibit 8: Developed Ex-U.S. and Emerging Market**

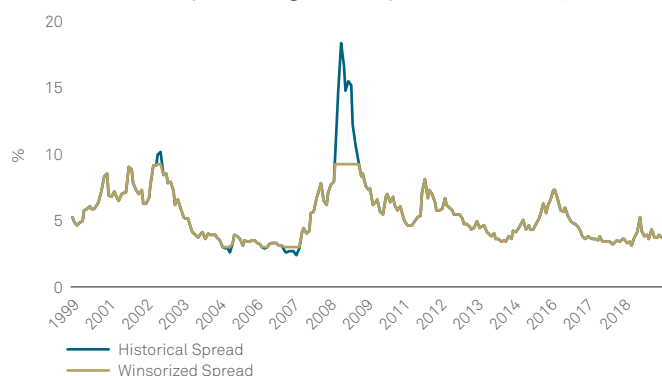


Current Interest Rates as of September 30, 2019. Normalized Interest Rates are projected in five years for Developed Ex-U.S. and Emerging.

Source: BNY Mellon Investor Solutions. Data as of September 30, 2019.

We expect credit spreads to migrate toward long-term historical averages over a time horizon consistent with our view on interest rate increases. To determine the historical average, we limit extreme values in the statistical data (known as “Winsorizing”) to eliminate skews to the average from extreme events such as the credit crisis. As shown in Exhibit 9, this Winsorized approach applies a floor and ceiling on the data at the fifth and 95th percentiles to eliminate extreme shocks and provide a more consistent data stream for determining the average.

**Exhibit 9: U.S. Corporate High Yield Spread to Treasury**



Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of September 30, 2019.

We expect most credit spreads to widen slightly from today’s levels to long-term averages because most sectors are currently trading tighter than historical averages. We also expect default and recovery rates to be in line with historical averages.

Overall, fixed income returns will be relatively suppressed due to low current yields and principal losses due to rising interest rates. However, higher yields in the future will help offset poor returns in the near term. We expect spread sectors that are less sensitive to rising interest rates to be among the best performers. We also expect emerging markets to perform well due to higher yields in the current environment and less principal loss from less significant interest rate increases. We expect returns to be lowest in the developed world outside of the U.S., due to extremely low current yields and loss of principal from rising rates.

**Exhibit 10: 10-Year Fixed Income Expected Returns From 2020 to 2029 (in USD)**

U.S. Aggregate	2.3%
U.S. Treasury	1.8%
U.S. Treasury Bills	2.0%
U.S. Investment Grade Credit	2.6%
U.S. TIPS	2.3%
U.S. Intermediate Municipal	1.9%
U.S. High Yield	4.5%
U.S. Bank Loans	5.1%
Global Aggregate Ex-U.S.	0.1%
Global Treasury Ex-U.S.	-0.2%
Global Corporate Ex-U.S.	1.2%
Emerging Markets Sovereign USD	5.3%
Emerging Markets Corporate USD	4.7%
Emerging Markets Sovereign Local Currency	3.6%

Source: BNY Mellon Investor Solutions.

Please see page 10 for a list of representative indexes.

## Comparing Fixed Income Returns to Yields

One technique to affirm our expected return assumptions for fixed income is to compare the returns to current yields in the market. Regardless of where projections indicate yields may go in the future, the current yield could be viewed as a strong indicator of future returns. To demonstrate this point, Exhibit 11 shows rolling 10-year annualized returns of the Bloomberg Barclays U.S. Aggregate index and compares those returns to the yield of the index at the beginning of the 10-year period. We have witnessed significant rate movements over the past 30 years, but the return of the U.S. bond market over 10 years is fairly consistent with the yield of the market at the start of the period. Rarely is the difference more than 1%. With yields at the end of 2019 around 2.3%, one should be skeptical of expected returns for U.S. bonds being more than 3.3% or less than 1.3% based on a 10-year horizon. Our expected return for U.S. Aggregate is 2.3% over a 10-year horizon.

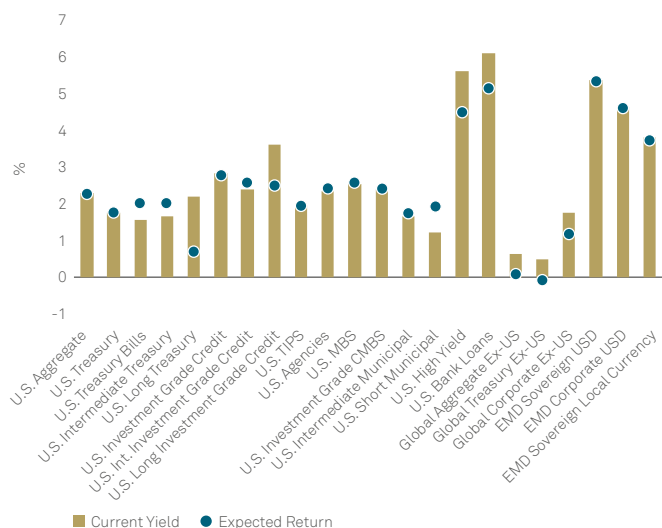
**Exhibit 11: U.S. Aggregate Index Returns vs. Starting Yields**



Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Data as of November 30, 2019.

In Exhibit 12, we compare current yields across many fixed income sectors to our expected return assumptions. For most asset classes, the expected return is generally consistent with the current yield. One major exception is high yield fixed income, where defaults result in a return less than the current yield. Another outlier is long-duration fixed income which is impacted the most from rising interest rates.

**Exhibit 12: Current Fixed Income Yields vs. Expected Returns**



Source: BNY Mellon Investor Solutions, Bloomberg Barclays. Current yield as of November 30, 2019.

## Equity Market Return Expectations

We develop equity assumptions using a building-block approach consisting of nominal earnings growth, income return consisting of dividends and net buybacks of stock, valuation adjustments, and currency adjustments.

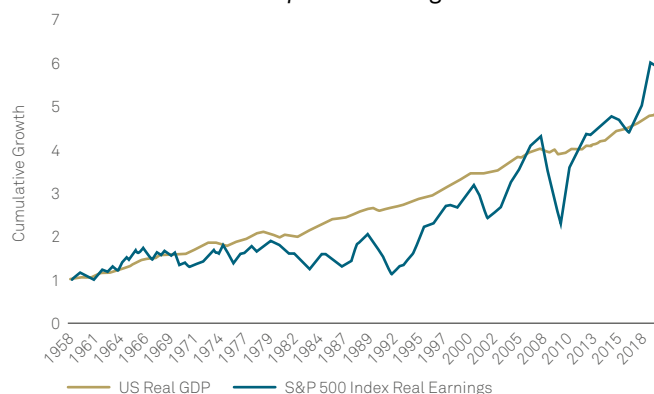
## Inflation

We break down nominal earnings growth into inflation expectations and real earnings growth. Our returns are published in U.S. dollars, so our expected inflation for earnings growth around the world is based on our U.S. inflation expectation of 2.1%, which assumes purchasing power parity.

## Real Earnings Growth

As a baseline assumption, we assume real corporate earnings growth will be consistent with consensus expectations of real GDP growth. As Exhibit 13 indicates, historically, there has been a relationship between corporate earnings growth and GDP growth over a long-term time horizon.

**Exhibit 13: U.S. GDP vs. Corporate Earnings Growth**



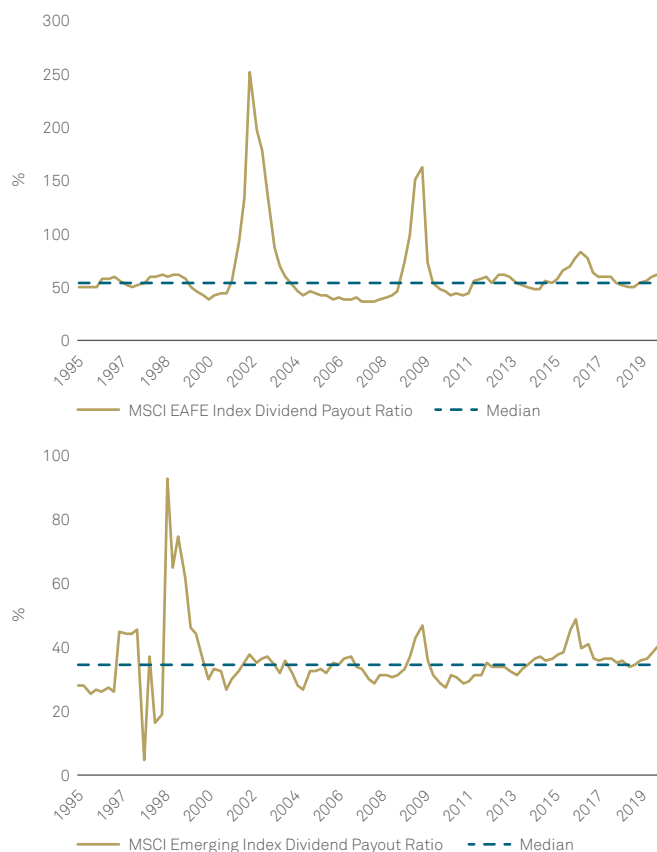
Source: BNY Mellon Investor Solutions, Bloomberg. Data as of September 30, 2019.

In the U.S., developed markets outside of the U.S., and emerging markets, we believe real earnings growth will be in line with our expectation of regional real GDP growth. We anticipate real earnings growth of 2% in the U.S., 1.2% in the developed markets outside of the U.S. and 3.9% in emerging markets.

## Dividend/Buyback Yield

Over the next 10 years, we expect dividend yields to be in line with long-term payout ratios and earnings yield levels. Outside the U.S., we see dividend yields of 2.8% and 2.5% for developed markets and emerging markets, respectively. These figures are based on long-term average dividend payout ratios of 50% for developed markets outside of the U.S. and 35% for emerging markets (see Exhibit 14). The dividend yield is determined by applying the payout ratio to historical average earnings yield of approximately 5.5% for developed markets outside of the U.S. and 7% for emerging markets.

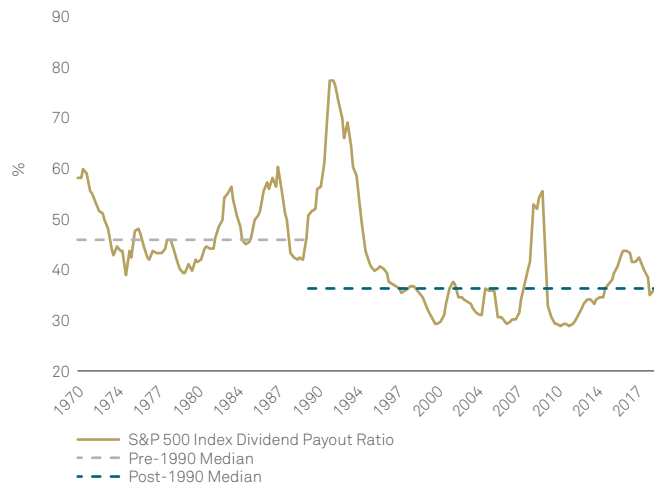
**Exhibit 14: Dividend Payout Ratios Outside the U.S.**



Source: BNY Mellon Investor Solutions, MSCI. Data as of September 30, 2019.

In the U.S., we also expect dividend yields to be based on payout ratios and current earnings yield levels, but a simple long-term average cannot be applied to the U.S. for several reasons. During the 1980s, a structural change took place in the way U.S. companies returned capital to shareholders. Prior to the 1980s, capital was predominately returned via dividends, with an average payout ratio of approximately 45% of earnings. After the 1980s, the average dividend payout ratio shrank to 35% due to companies replacing dividends with share buybacks as a form of returning capital to investors (see Exhibit 15). This structural shift occurred due to changes in tax law that made capital gains more advantageous than dividends for investors and the addition of safe-harbor provisions that made share repurchasing less likely to violate share-price-manipulation rules. Buybacks are less common outside of the U.S. due to different regulatory environments, so no adjustments are made.

**Exhibit 15: Dividend Payout Ratio in the U.S.**



Source: BNY Mellon Investor Solutions, S&P Data as of September 30, 2019.

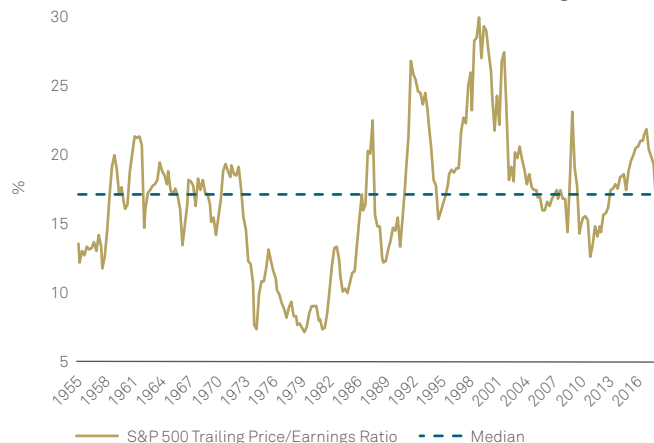
To account for income returned to investors via dividends and share buybacks, we've assumed a total payout ratio of 45% in the U.S. Based on a historical average earnings yield of approximately 5.8%, we've assumed a total yield of 2.6% in the U.S.

## Valuation Adjustments

As we demonstrated in our 2017 paper, changes in equity market valuation are the primary reason why return expectations are different than actual returns going forward. Over the long run, inflation, real earnings growth and income return are fairly predictable, but valuation changes are not. Given the uncertainty of predicting valuation changes in the future, we are very careful not to make valuation adjustments unless we believe there is strong evidence to support it. Consistent with the 2019 assumptions, we believe there is still evidence in 2020 to make modest valuation adjustments for U.S. and non-U.S. developed equity market returns.

Exhibit 16 shows the price-to-earnings (P/E) ratio of the S&P 500 index over the past 60+ years. History shows mean reversion of the ratio with an average of approximately 17. As at the end of 2019, the trailing P/E ratio is elevated to a level near 20.

**Exhibit 16: Historical P/E Ratios Relative to the Average**

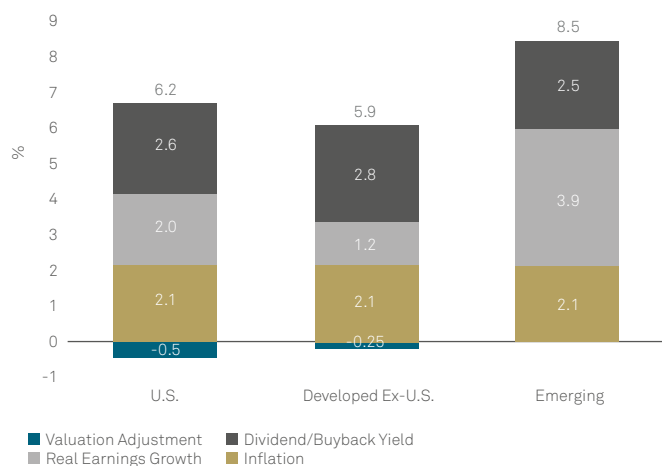


Source: BNY Mellon Investor Solutions, S&P 500 Index. Data as of September 30, 2019.

If we assumed full mean reversion over the next 10 years and earnings growth consistent with our outlook, the annualized reduction in return would be about 1.5%, resulting in U.S. equity returns near 5% per annum over the next 10 years. Given the uncertainty of predicting valuation metrics, we want to implement a valuation adjustment with high confidence based on history. Using monthly S&P 500 index data going back to 1954, we have isolated all months when trailing P/E ratios were elevated near 20 or above. We then isolated the future return driven by a changing (mostly shrinking) P/E ratio. Based on history, we would be about 90% confident in a valuation adjustment of -0.5% or higher. With this research, we are maintaining the 2019 valuation adjustment to U.S. equity of -0.5%. We see similar, less material valuation concerns in non-U.S. developed markets. For non-U.S. developed markets, we are maintaining our valuation adjustment of -0.25%. We do not see strong evidence for adjusting returns in emerging markets.

Overall, we see global equity market returns ranging from 6% to 8% per annum. We anticipate emerging market equity will lead the way with returns over 8% primarily due to stronger earnings growth. We see returns in developed markets to be around 6%.

**Exhibit 17: Equity Market Expected Returns From 2020 to 2029 (in USD)**



Source: BNY Mellon Investor Solutions.

In line with their higher levels of risk, we expect mid and small cap stocks to outperform large cap stocks over the next 10 years.

**Exhibit 18: 10-Year Equity Market Expected Returns From 2020 to 2029 (in USD)**

U.S. Equity	6.2%
U.S. Large Cap Equity	6.1%
U.S. Mid Cap Equity	6.5%
U.S. Small Cap Equity	7.0%
International Developed Equity	5.9%
International Small Cap Equity	6.0%
Emerging Equity	8.5%

Source: BNY Mellon Investor Solutions.

Please see page 10 for a list of representative indices.

## Alternative Market Return Expectations

We believe expected returns for alternative asset classes will generally be in line with publicly traded markets on a risk-adjusted basis. To calculate risk-adjusted returns, we first determine the beta of the asset class relative to public markets, based on our expectations of return standard deviations and correlations. We apply the beta to the public-market expected return to determine the expected return of the alternative asset class. For private markets, we add additional return to account for illiquidity. For hedge funds and private real estate, we add additional return to reflect the residual risk not captured by market returns. The additional return assumes an information ratio of 0.3 multiplied by the residual risk.

**Exhibit 19: 10-Year Alternative Market Expected Returns From 2020 to 2029 (in USD)**

Hedge Funds	4.2%
Commodities	2.1%
Global Natural Resources Equity	6.1%
U.S. Core Real Estate	5.6%
U.S. REIT	5.7%
Global REIT	5.9%
U.S. Private Equity	8.2%

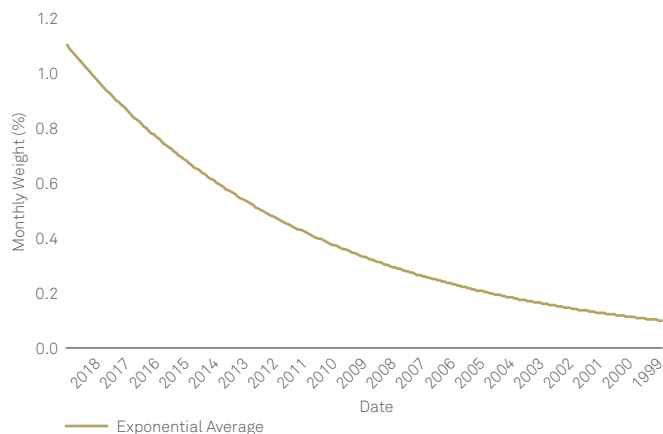
Source: BNY Mellon Investor Solutions.

Please see page 10 for a list of representative indices.

## Standard Deviations and Correlations

At a high level, our standard deviations and correlations are based on long-term historical returns with additional emphasis on near-term history. Especially with illiquid asset classes, we've made adjustments for serial correlation and smoothing of historical asset returns. For determining standard deviations and correlations, we utilized exponential weighting of the last 20 years of monthly returns (see Exhibit 20). This approach ensures an appropriate covariance matrix and smooths out results on a year-by-year basis.

**Exhibit 20: Historical Weighting for Standard Deviations and Correlations**



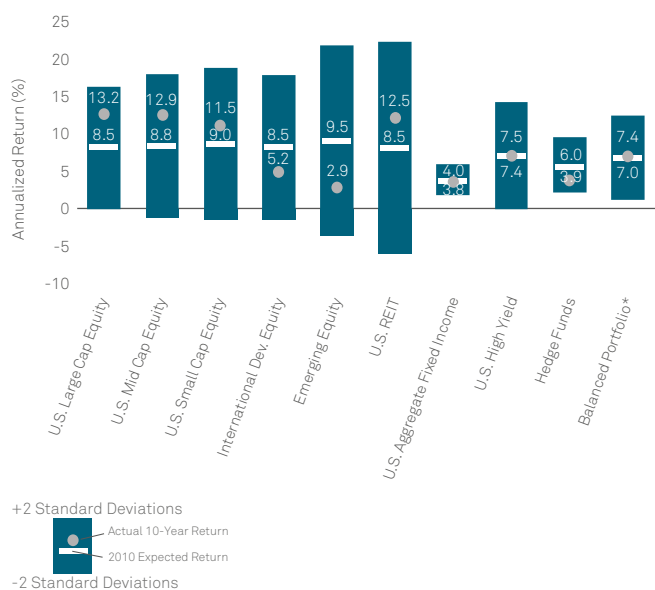
Source: BNY Mellon Investor Solutions. Data as of December 31, 2019.



## Comparing our Projections to Actual History

It is important to look back in time at how accurate our assumptions were to continuously make adjustments and improve our methodology. Shown below in Exhibit 21 is a comparison of our published 2010 capital market assumptions and actual returns over the past 10 years. The white lines represent our expected returns from 10 years ago with the top and bottom of the blue bars representing plus and minus two standard deviations from the expected return. Actual returns over the past 10 years are represented by the gray circles. As the chart demonstrates, actual returns for each asset class and a hypothetical balanced portfolio easily fell within the two standard deviation range. Actual returns for U.S. equity were higher than expected and the opposite held true for international equity. Expected returns for fixed income were extremely close to actual returns. Hedge funds slightly underperformed expectations. The Balanced Portfolio of 55% equity, 30% fixed income and 15% alternatives had an expected return of 7%, which compares closely to the actual return of 7.4%. This lookback demonstrates our methodology has worked well in predicting long-term returns over the past 10 years. This lookback has been completed for the last three calendar years with similar results.

**Exhibit 21: 2010 Capital Market Return Assumptions vs. Actual 10-Year Returns Ending 12/31/2019**



\*Assumes a hypothetical Balanced Portfolio with weights of 20% U.S. Large Cap Equity, 7% U.S. Mid Cap Equity, 4% U.S. Small Cap Equity, 16% International Developed Equity, 6% Emerging Equity, 2% U.S. REIT, 25% U.S. Aggregate Fixed Income, 5% U.S. High Yield, and 15% Hedge Funds.

Source: BNY Mellon Investor Solutions, Bloomberg.

## Implications for Taxable Investors

All of the return assumptions highlighted in this paper are before the impact of paying taxes. Especially for individuals in higher tax brackets, the long-term reduction in return due to taxes can be substantial. Shown below in Exhibit 22 is an illustration of how return expectations can be adjusted for taxes.

**Exhibit 22: Illustration of After-Tax Return Assumptions**

Asset Class	Pre-Tax Return	Income / Dividend	Short-Term Turnover	Long-Term Turnover	After-Tax Return	Effective Tax Rate
U.S. Large Cap Equity	6.1%	2%	0%	5%	5.1%	17%
U.S. Investment Grade Credit	2.6%	3%	0%	25%	1.6%	37%
Hedge Funds	4.2%	0%	100%	0%	2.7%	37%

Source: BNY Mellon Investor Solutions. As at September 30, 2019.

Exhibit 22 assumes general asset class income and turnover assumptions along with the highest U.S. federal tax rates. Under these assumptions, the reduction in return from taxes is substantial for investments that pay high levels of income or have high turnover. When constructing portfolios, this exemplifies the importance of how an asset class investment is implemented. Implementation of the asset class in a tax-efficient manner is as important as selecting the proper asset class.

It is important to note the impact of taxes on a portfolio is extremely dependent on individual circumstances and cannot be broadly applied to capital market assumptions. Individual tax brackets, portfolio cost basis, and specific investment characteristics of income and turnover will drive the impact of taxation. It is critical to analyze each situation individually to determine the optimal strategy.

## Return Expectations for Investors Outside of the U.S.

Although this paper focuses on return expectations for U.S. investors, our process and capabilities can be applied to create assumptions for any global investor. Assumptions can be created in any currency on a hedged or unhedged basis. Please contact us to learn more about this capability and potentially request non-USD returns.

## Asset Class Expected 10-Year Returns and Standard Deviations

Asset Class	Representative Index	Expected Return	Standard Deviation	
Equity	U.S. Equity	Russell 3000	6.2%	15.3%
	U.S. Large Cap Equity	Russell 1000	6.1%	15.1%
	U.S. Mid Cap Equity	Russell Mid Cap	6.5%	17.0%
	U.S. Small Cap Equity	Russell 2000	7.0%	20.0%
	U.S. Micro Cap Equity	Dow Jones Wilshire U.S. Micro-Cap	6.7%	20.8%
	Global Equity	MSCI ACWI	6.3%	15.3%
	International Developed Equity	MSCI World Ex-U.S.	5.9%	16.5%
	International Small Cap Equity	MSCI World Ex-U.S. Small Cap	6.0%	17.4%
	Emerging Equity	MSCI Emerging	8.5%	20.8%
Fixed Income	U.S. Aggregate	Bloomberg Barclays U.S. Aggregate	2.3%	3.4%
	U.S. Treasury	Bloomberg Barclays U.S. Treasury	1.8%	4.2%
	U.S. Treasury Bills	Bloomberg Barclays U.S. Treasury Bills 3-6 Month	2.0%	0.5%
	U.S. Intermediate Treasury	Bloomberg Barclays U.S. Intermediate Treasury	2.0%	2.8%
	U.S. Long Treasury	Bloomberg Barclays U.S. Long Treasury	0.7%	12.0%
	U.S. Investment Grade Credit	Bloomberg Barclays U.S. Credit	2.6%	4.9%
	U.S. Intermediate Investment Grade Credit	Bloomberg Barclays U.S. Intermediate Credit	2.7%	3.5%
	U.S. Long Investment Grade Credit	Bloomberg Barclays U.S. Long Credit	2.5%	9.3%
	U.S. TIPS	Bloomberg Barclays U.S. Inflation Linked Bonds	2.3%	5.4%
	U.S. Agencies	Bloomberg Barclays U.S. Agencies	2.5%	2.8%
	U.S. MBS	Bloomberg Barclays U.S. MBS	2.6%	2.5%
	U.S. Investment Grade CMBS	Bloomberg Barclays Investment Grade CMBS	2.6%	7.2%
	U.S. Intermediate Municipal	S&P Municipal Bond Intermediate	1.9%	3.7%
	U.S. Short Municipal	S&P Municipal Bond Short	1.9%	1.6%
	U.S. High Yield	Bloomberg Barclays U.S. Corporate High Yield	4.5%	8.4%
	U.S. Bank Loans	CSFB Leveraged Loan	5.1%	5.6%
	Global Aggregate Ex-US	Bloomberg Barclays Global Aggregate Ex-USD	0.1%	7.5%
	Global Treasury Ex-US	Bloomberg Barclays Global Treasury Ex-USD	-0.2%	7.6%
	Global Corporate Ex-US	Bloomberg Barclays Global Corporate Ex-USD	1.2%	8.6%
	Emerging Markets Sovereign USD	Bloomberg Barclays EM USD Sovereign	5.3%	7.9%
Emerging Markets Corporate USD	Bloomberg Barclays EM USD Corporate	4.7%	9.1%	
Emerging Markets Sovereign Local Currency	Bloomberg Barclays EM Local Currency Government	3.6%	10.5%	
Alternatives	Absolute Return <sup>1,2</sup>	HFRX Global Hedge Fund	4.0%	5.0%
	Hedge Funds <sup>1,2</sup>	HFRI Fund Weighted Composite	4.2%	5.7%
	Hedge Funds – Equity Hedge <sup>1,2</sup>	HFRI Equity Hedge	5.0%	8.0%
	Hedge Funds – Event Driven <sup>1,2</sup>	HFRI Event Driven	4.3%	5.7%
	Hedge Funds – Macro <sup>1,2</sup>	HFRI Macro	3.8%	4.9%
	Hedge Funds – Relative Value <sup>1,2</sup>	HFRI Relative Value	3.6%	3.9%
	Hedge Funds – Managed Futures <sup>1,2</sup>	CS Managed Futures Liquid Index	4.6%	10.2%
	Commodities	Dow Jones UBS Commodities	2.1%	14.2%
	Global Natural Resources Equity	S&P Global Natural Resources Index	6.1%	20.2%
	U.S. REIT	FTSE NA REIT Equity	5.7%	21.0%
	Global REIT	FTSE EPRA/NA REIT Developed Index	5.9%	17.7%
	Energy Infrastructure	Alerian MLP Infrastructure	6.2%	19.1%
	U.S. Private Equity <sup>1,2</sup>	Cambridge Associates LLC U.S. Private Equity	8.2%	17.8%
U.S. Core Real Estate	NCREIF ODCE Index	5.6%	8.5%	

1. Consistent with the Representative Index, returns are net of management fees.

2. The Representative Index is not investable. Returns for these are based on the average of manager returns that report to those index providers. Actual results may vary significantly.

## Asset Class Expected Correlations

		Equity			Fixed Income										Alternatives						
		U.S. Equity	International Developed Equity	Emerging Equity	U.S. Aggregate	U.S. Treasury	U.S. Treasury Bills	U.S. Investment Grade Credit	U.S. TIPS	U.S. MBS	U.S. Intermediate Municipal	U.S. High Yield	Global Aggregate Ex-US	Emerging Markets Sovereign USD	Emerging Markets Sovereign LC	Absolute Return	Commodities	Global REIT	Energy Infrastructure	U.S. Private Equity	U.S. Core Real Estate
Equity	U.S. Equity	1.00	0.86	0.75	-0.10	-0.34	-0.14	0.19	0.05	-0.18	-0.11	0.69	0.20	0.42	0.43	0.71	0.44	0.73	0.55	0.96	0.27
	International Developed Equity	0.86	1.00	0.92	0.02	-0.26	-0.08	0.33	0.18	-0.06	0.00	0.75	0.45	0.62	0.66	0.76	0.57	0.78	0.55	0.82	0.27
	Emerging Equity	0.75	0.92	1.00	0.07	-0.20	-0.04	0.35	0.24	-0.01	0.03	0.72	0.45	0.63	0.69	0.71	0.58	0.72	0.51	0.71	0.26
Fixed Income	U.S. Aggregate	-0.10	0.02	0.07	1.00	0.92	0.20	0.88	0.80	0.90	0.75	0.17	0.54	0.55	0.38	0.04	-0.01	0.28	-0.02	-0.10	0.00
	U.S. Treasury	-0.34	-0.26	-0.20	0.92	1.00	0.25	0.66	0.70	0.84	0.67	-0.18	0.43	0.28	0.18	-0.21	-0.17	0.02	-0.23	-0.32	-0.09
	U.S. Treasury Bills	-0.14	-0.08	-0.04	0.20	0.25	1.00	0.06	0.14	0.27	0.10	-0.13	0.10	0.00	0.05	0.03	0.07	-0.03	0.02	-0.11	-0.09
	U.S. Investment Grade Credit	0.19	0.33	0.35	0.88	0.66	0.06	1.00	0.76	0.69	0.68	0.50	0.57	0.73	0.53	0.32	0.18	0.50	0.21	0.16	0.08
	U.S. TIPS	0.05	0.18	0.24	0.80	0.70	0.14	0.76	1.00	0.69	0.61	0.31	0.56	0.59	0.50	0.21	0.24	0.37	0.13	0.03	0.05
	U.S. MBS	-0.18	-0.06	-0.01	0.90	0.84	0.27	0.69	0.69	1.00	0.69	0.03	0.45	0.46	0.27	-0.05	-0.06	0.16	-0.07	-0.15	-0.11
	U.S. Intermediate Municipal	-0.11	0.00	0.03	0.75	0.67	0.10	0.68	0.61	0.69	1.00	0.17	0.40	0.46	0.30	0.00	-0.07	0.20	0.08	-0.11	-0.05
	U.S. High Yield	0.69	0.75	0.72	0.17	-0.18	-0.13	0.50	0.31	0.03	0.17	1.00	0.32	0.66	0.53	0.67	0.48	0.73	0.60	0.65	0.33
	Global Aggregate Ex-US	0.20	0.45	0.45	0.54	0.43	0.10	0.57	0.56	0.45	0.40	0.32	1.00	0.60	0.80	0.25	0.39	0.46	0.18	0.19	0.06
	Emerging Markets Sovereign USD	0.42	0.62	0.63	0.55	0.28	0.00	0.73	0.59	0.46	0.46	0.66	0.60	1.00	0.75	0.48	0.39	0.64	0.33	0.40	0.18
	Emerging Markets Sovereign LC	0.43	0.66	0.69	0.38	0.18	0.05	0.53	0.50	0.27	0.30	0.53	0.80	0.75	1.00	0.39	0.50	0.65	0.35	0.38	0.18
	Alternatives	Absolute Return <sup>1,2</sup>	0.71	0.76	0.71	0.04	-0.21	0.03	0.32	0.21	-0.05	0.00	0.67	0.25	0.48	0.39	1.00	0.56	0.59	0.58	0.71
Commodities		0.44	0.57	0.58	-0.01	-0.17	0.07	0.18	0.24	-0.06	-0.07	0.48	0.39	0.39	0.50	0.56	1.00	0.43	0.48	0.42	0.20
Global REIT		0.73	0.78	0.72	0.28	0.02	-0.03	0.50	0.37	0.16	0.20	0.73	0.46	0.64	0.65	0.59	0.43	1.00	0.46	0.68	0.37
Energy Infrastructure		0.55	0.55	0.51	-0.02	-0.23	0.02	0.21	0.13	-0.07	0.08	0.60	0.18	0.33	0.35	0.58	0.48	0.46	1.00	0.52	0.06
U.S. Private Equity <sup>1,2</sup>		0.96	0.82	0.71	-0.10	-0.32	-0.11	0.16	0.03	-0.15	-0.11	0.65	0.19	0.40	0.38	0.71	0.42	0.68	0.52	1.00	0.22
U.S. Core Real Estate <sup>2</sup>		0.27	0.27	0.26	0.00	-0.09	-0.09	0.08	0.05	-0.11	-0.05	0.33	0.06	0.18	0.18	0.20	0.20	0.37	0.06	0.22	1.00

1. Consistent with the Representative Index, returns are net of management fees.

2. The Representative Index is not investable. Returns for these are based on the average of manager returns that report to those index providers. Actual results may vary significantly.

Only a subset of the asset classes is shown in the matrix above. A full correlation matrix is available upon request.

For illustrative purposes only. There can be no assurance that the expected returns listed above will be achieved.



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