

# 2017 TEN-YEAR CAPITAL MARKET ASSUMPTIONS

## TABLE OF CONTENTS

2017 vs. 2016 Assumptions	2
Summary & Highlights	2
Creating Arithmetic Returns	3
Creating Geometric Returns	3
Detailed Assumptions	Appendix



## 2017 vs. 2016 ASSUMPTIONS

A comparison of PCA's 2017 10-year compound asset class total return assumptions versus those in 2016.

ASSET CLASSIFICATION	2016 COMPOUND EXPECTED RETURN	2017 COMPOUND EXPECTED RETURN	CHANGE from 2016 to 2017
Cash	2.00	2.25	0.25
Treasury Inflation Protected Securities	3.00	2.75	-0.25
US Treasuries Only Fixed Income	1.90	2.10	0.20
US Core Fixed Income	2.90	2.90	0.00
US Credit Fixed Income	3.85	3.50	-0.35
Core Real Estate (unlevered)	5.10	5.00	-0.10
Domestic Equity	6.90	6.25	-0.65
International Equity	7.45	7.25	-0.20
Global Equity	7.45	7.15	-0.30
Hedged International Equity	7.65	7.40	-0.25
Private Equity/Venture Capital	9.05	8.50	-0.55
Inflation	2.25	2.25	0.00

## 2017 SUMMARY & HIGHLIGHTS

1. We use a building block method for estimating arithmetic returns as detailed on page 3:  
*(Inflation) + (Real Risk Free Rate of Cash) + (Premium over Real Risk Free Rate)*
2. All risky-asset class return expectations (all asset classes that are not cash) are built as risk premiums over cash. Our expectations for long-term cash returns match our inflation expectation of 2.25%.
3. Compound expected return estimates are the result of first estimating arithmetic average asset class returns and volatilities, which are then converted to geometric return estimates.
4. We project cash returns to match inflation over the next 10-year period.
5. Based on these assumptions, an allocation of 60% global public equities, 20% core bonds, 10% core real estate (unlevered), and 10% private equity, has an expected long-term compound return of approximately 6.8%.
6. Mean-variance analysis is a reasonable starting point for portfolio analysis; other approaches are warranted.

## CREATING ARITHMETIC RETURNS

ASSET CLASS	INFLATION	+	REAL RISK-FREE RATE	+	RISK PREMIUM	=	ARITHMETIC RETURN
US Treasuries Only Fixed Income	2.25	+	0.00	+	0.10	=	2.35
US Core Fixed Income					0.80	=	3.05
US Credit Fixed Income					1.50	=	3.75
Core Real Estate (unlevered)					3.25	=	5.50
Domestic Equity					5.75	=	8.00
International Equity					7.25	=	9.50
Global Equity					6.75	=	9.00
Hedged International Equity					7.10	=	9.35
Alt. Inv./Private Equity					9.50	=	11.75

## CREATING GEOMETRIC RETURNS

$$(\text{ARITHMETIC RETURN ESTIMATE}) - (\text{VOLATILITY PENALTY}) = (\text{GEOMETRIC RETURN ESTIMATE})$$

ASSET CLASSIFICATION	ARITHMETIC RETURN ESTIMATE	VOLATILITY PENALTY	GEOMETRIC RETURN ESTIMATE	EXPECTED STANDARD DEVIATION
Cash	2.25	n/a	2.25	1.50
Treasury Infl. Protected Securities	3.00	-0.25	2.75	7.00
US Treasuries Only Fixed Income	2.35	-0.25	2.10	7.00
US Core Fixed Income	3.05	-0.15	2.90	5.50
US Credit Fixed Income	3.75	-0.25	3.50	7.00
Core Real Estate (unlevered)	5.50	-0.50	5.00	10.00
Domestic Equity	8.00	-1.75	6.25	19.50
International Equity	9.50	-2.25	7.25	22.00
Global Equity*	9.00	-1.85	7.15	20.00
Hedged International Equity	9.35	-1.95	7.40	20.50
Private Capital/Venture Capital	11.75	-3.25	8.50	27.00
Inflation	2.25	n/a	2.25	1.50

\*Not a simple average of international and domestic equity compound returns. Lower volatility penalty due to diversification leads to higher compound return.

Summary of Investment Class Assumptions

	Expected Arithmetic Average Nominal Annual Return	Expected Geometric Compound Nominal Annual Return	Expected Risk of Nominal Returns (Annl. SD)	Cash	TIPS	TSY	CoreFxd	Credit	RealEst	USEq	IntlEq	GlblEq	HIntlEq	PrivEq
Cash	2.25	2.25	1.50											
Treasury Infl. Protected Securities	3.00	2.75	7.00	0.20										
US Treasuries Only Fixed Income	2.35	2.10	7.00	0.30	0.50									
US Core Fixed Income	3.05	2.90	5.50	0.25	0.60	0.40								
US Credit Fixed Income	3.75	3.50	7.00	0.00	0.65	0.00	0.75							
Core Real Estate (unlevered)	5.50	5.00	10.00	0.30	0.00	0.00	0.00	0.00						
Domestic Equity	8.00	6.25	19.50	0.00	0.00	-0.25	0.20	0.40	0.40					
International Equity	9.50	7.25	22.00	0.00	0.00	-0.35	0.10	0.20	0.30	0.80				
Global Equity <sup>2</sup>	9.00	7.15	20.00	0.00	0.00	-0.30	0.15	0.30	0.35	0.90				
Hedged International Equity	9.35	7.40	20.50	0.00	0.00	-0.30	0.10	0.30	0.35	0.85	0.90			
Private Equity/Venture Capital	11.75	8.50	27.00	0.00	0.00	-0.30	0.00	0.30	0.30	0.85	0.80	0.80		
Inflation	2.25	2.25	1.50	0.50	0.45	-0.10	0.00	0.10	0.35	0.20	0.20	0.20	0.20	0.10

Significant Changes from Last Year's Ten-Year Assumptions (January 2017 vs January 2016)

- Inflation expectations remained the same as last year at 2.25%. While the observed level of breakeven inflation rose to 2% by year end, realized inflation came in below this level in 2016, and consensus projections remain in line with PCA's estimate.
- PCA increased our volatility expectations across all classes, indicating increased uncertainty in inflation, interest rates and growth expectations globally.
- Core fixed income expectations remain similar to last year. While interest rates increased slightly from last year, credit spreads tightened.
- U.S. equity expectations declined, following another year of above average appreciation leading to higher valuation levels.
- Non-U.S. equity expectations remained similar to last year, but with increased volatility.

Indices Used in Modeling Asset Class Assumptions

Asset Class	Index
Cash	Citigroup 3 month US Treasury Bill Index
TIPS	Barclays Capital TIPS, simulated TIPS series per Bridgewater
US Treasuries Only Fixed Income	Barclays Capital US Treasuries Index
US Core Fixed Income	Barclays Capital Universal, Barclays Capital Aggregate Index, Barclays Capital G/C Index, Barclays Capital Intermediate Govt. Index, Barclays Capital Corp/Credit Index
US Credit Fixed Income	Barclays Capital US Universal Spread 1-10 Index, Barclays Capital Corp/Credit Index
Core Real Estate (unlevered)	NCREIF NPI Index, Prior Indices
Domestic Equity	Russell 3000 Index, S&P 500 Index
International Equity	MSCI/Barra ACWI ex-US Index, MSCI/Barra EAFE Index
Global Equity	MSCI/Barra ACWI Index
Hedged Intl. Equity	Hedged MSCI/Barra EAFE Index, MSCI/Barra ACWI ex-US Index, MSCI/Barra EMF Index
Private Equity	Prior Brinson Venture Capital Index, VCJ Post Venture Capital Index

<sup>1</sup> Geometric returns are comparable to actuarial assumption rates for pension funds.

<sup>2</sup> The compound return estimate of Global Equity is not a simple average between Domestic Equity and International Equity compound returns. International Equity and Domestic Equity are not perfectly correlated. Therefore, a Global Equity portfolio has lower volatility than the weighted average of component volatilities. Lower volatility results in higher compound returns.

**Expected Inflation, Average Annual Risk Free Rates & Annual Risk Premiums for Various Classes - %**

Category	Expectation – Annual %	Comments
Inflation	2.25	Long-term inflation expectations are the same as last year. The TIPS breakeven inflation rate, one important data point indicative of equilibrium pricing of inflation expectations, was 2% as of December 2016. The real rate of 10-year TIPS decreased in 2016 to approximately 0.5% as of year end. Realized inflation has also been very low, <2.0% on an annualized basis after seasonal adjustment. This marks the first time since the 1960s that realized inflation has been below 2% for five consecutive calendar years. Survey based inflation expectations are coming in at 2.2% for the ten year ahead estimate. Commodity prices (broadly) stabilized during the years, with oil prices rising back above \$50. The U.S. unemployment rate has continued to decline (dropping below 5.0%). Finally, the Fed raised their target short-term interest rate by 25 basis points at their December meeting, indicating confidence in the trajectory of the U.S. economy.
<b>Real Risk-Free Rates</b>		
Short-term (Cash)	0.00	Federal Reserve raised short-term lending rates in December to approximately 54 bps. This level is still much lower than long-term inflation expectations and recent realized inflation. Thus, the Fed's current short-term rates establish real lending rates that are significantly negative. Expectations are for these low short-term lending rates (thus negative real rates) to rise slowly, leading to a zero real rate over the investment horizon on average.
Longer-term (10-year real TIPS yield)	0.50	The expected long-term real risk free rate is the current 10-year TIPS real yield. As of December 2016, the 10-Year TIPS real yield was approximately 0.50%, falling from 0.75% in December 2015. Note, this is a rate, not an investment class. It is different from the TIPS asset class.
<b>Risk Premiums over Short-term Risk-free Rate:</b>		
US Treasuries Only Fixed Income	0.10	As of December 2016, the yield-to-maturity (YTM) on the U.S. Treasury Index was 1.9%. The YTM on the 10-year treasury was 2.5%. The YTM on the Barclays Capital U.S. Universal as of December 2016 was 3.0%. The YTM on the U.S. Universal Spread 1-to-10 year Index was 3.65%. 2016 saw credit spreads narrow year-over-year, moving below long-term average levels. Interest rates on U.S. Treasury debt increased post election, anticipating policy shifts from the incoming administration. The Fed raised interest rates again in December 2016, and expectations are for a slow rise over the investment horizon. Current expected returns represent no long-term spread compression from current levels and no movement in longer-term interest rates.
US Treasury Inflation Linked Securities (TIPS)	0.75	
US Core Fixed Income	0.80	
US Credit Fixed Income	1.50	
Core Real Estate (unlevered)	3.25	Assumes a mix of private core real estate and an allocation of 15% to public real estate securities. Estimate assumes stable interest rates, and a stable to rising cap rate level, reverting towards historical averages.
Domestic Equity International Equity Global Equity	5.75 7.25 6.75	On average over the past 8 years, the realized U.S. equity risk premium has been well above historical averages. After another year of above average realized returns, we expect some mean reversion to occur over the next several years in this premium. Fundamental expectations are in line with these expectations. Current U.S. valuations are well above historical averages and higher from a year ago. While, the non-U.S. equity valuations are below historical averages. For longer-term planning purposes, we assume non-U.S. equities to deliver a slightly higher return.
Hedged International Equity	7.10	International equity premium less frictional cost of hedging. Note that no long-term impact from currency movements is assumed on U.S. Dollar-based international equity returns.
Alternative Investments/Private Equity	9.50	Expected long-term illiquidity premium over global public equity of 2.75%.

### **Notes:**

PCA developed its average annual return premiums and standard deviation estimates using a combination of approaches. First, for major asset classes with an appropriate amount of history, PCA studied historical time series over both one-year and five-year holding periods to uncover any specific trends in the time series data. For example, domestic stock return premiums exhibit cyclical behavior, with each full cycle lasting approximately 40-50 years. Statistical procedures were used to identify such trends and extrapolate these trends 10-15 years forward. Second, PCA examined fundamental variables underlying several major asset classes and computed expectations based on consensus views of these variables. PCA also reviewed outlook opinions from a handful of leading investment banks and investment advisory firms. PCA compiled these opinions to develop consensus expectations for the major asset classes. PCA then used these consensus expectations as reference checks against its own expectations. Finally, PCA professionals discussed and debated asset expectations internally until a consensus view developed.

In recognizing that asset class risks are not always stable, PCA also examined risk trends utilizing similar statistical procedures. PCA also calculated risks weighting more recent periods heavier than earlier periods. In certain instances, weighted standard deviations differed materially from basic standard deviations. In these cases, PCA utilized weighted standard deviations as a base line for analysis.

In recognizing that correlations are also not always stable, PCA analyzed the current behavior of the correlations among major pairs of asset classes. In analyzing the correlation trends among pairs of assets, we focused on correlation trends across non-overlapping five-year holding periods. Using statistical procedures highlighted above, we extrapolated the trends of these correlations into the future to gain a sense of their level and direction. For correlation pairs containing short annual return histories, we analyzed correlations of annual returns. Similar to analyzing risks, we also applied a decay factor to return history and calculated weighted correlations where appropriate.

The investment class risk premia estimated for classes that consist of publicly traded securities are market "beta" returns, and do not assume returns to active management, nor active management fees. The risk premia for investment classes that, by definition, are actively managed (e.g. private real estate, hedge fund of funds, private equity), have been developed "net" of customary investment management fees, which are intrinsic to the indices from which the premia were developed.

Given the complexities associated with developing capital market expectations, we advise users of the above information to rely on judgment as well as optimization approaches in setting strategic allocations to any set of investment classes. Please note that all information shown is based on qualitative and quantitative analyses. Exclusive reliance on the above is not advised. This information is not intended as a recommendation to invest in any particular asset class or as a promise of future performance. References to future returns for either asset allocation strategies or asset classes are not promises or even estimates of actual returns a client portfolio may achieve.

Assumptions, opinions and estimates are provided for illustrative purposes only. They should not be relied upon as recommendations to invest in or avoid certain investments. Forecasts of financial market trends that are based on current market conditions constitute our judgment and are subject to change. We believe the information provided here is reliable, but do not warrant its accuracy or completeness. This material has been prepared for information purposes only.