PCA

2018

TEN-YEAR CAPITAL MARKET ASSUMPTIONS

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2018 vs. 2017 ASSUMPTIONS

A comparison of PCA's 2018 10-year compound asset class total return assumptions versus those in 2017.

ASSET CLASSIFICATION	2017 COMPOUND EXPECTED RETURN	2018 COMPOUND EXPECTED RETURN	CHANGE from 2017 to 2018
Cash	**2.25**	**2.25**	0.00
Treasury Inflation Protected Securities	**2.75**	**2.75**	0.00
U.S. Treasuries Only Fixed Income	**2.10**	**2.65**	0.55
U.S. Core Fixed Income	**2.90**	**3.40**	0.50
U.S. Credit Fixed Income	**3.50**	**3.75**	0.25
Core Real Estate (unlevered)	**5.00**	**5.00**	0.00
Domestic Equity	**6.25**	**5.75**	-0.50
International Equity	**7.25**	**6.80**	-0.45
Global Equity	**7.15**	**6.70**	-0.45
Private Equity	**8.50**	**7.90**	-0.60
Inflation	**2.25**	**2.25**	0.00

2018 SUMMARY & HIGHLIGHTS

1. Expected returns are fundamental-based and reflect a building block methodology:
   (Inflation) + (Real Risk-Free Rate of Cash) + (Premium over Real Risk-Free Rate)

2. The methodology/algorithm to convert arithmetic returns to geometric returns (or vice versa) will impact a portfolio's estimated expected return. PCA uses a horizon-dependent algorithm to convert between the two.

3. Data points related to current yields, forward curves, economic growth, default rates, and other quantitative-based measures form the basis of most class return expectations. Surveys and practitioner insight are marginally incorporated into certain projections (e.g., inflation).

4. We project cash returns to match inflation over the next 10-year period.

5. The spread between fixed income and equity expected returns narrowed from 2017. This largely reflects valuation increases across the equity landscape and higher yields across the fixed income segment.

6. Based on these assumptions, an allocation of 60% global public equities, 20% core bonds, 10% core real estate (20% LTV), and 10% private equity has an expected compound return of approximately 6.5%.

7. Excluding private equity, no standalone class is projected to produce a return above 7% over the next 10 years.

Summary of Investment Class Assumptions

	Expected Arithmetic Average Nominal Annual Return	Expected Geometric[1] Compound Nominal Annual Return	Expected Risk of Nominal Returns (Annl. SD)	Cash	TIPS	TSY	CoreFxd	Credit	RealEst	USEq	IntlEq	GlblEq	PrivEq
Cash	2.25	2.25	1.25										
Treasury Infl. Protected Securities	3.00	2.75	7.00	0.20									
U.S. Treasuries Only Fixed Income	2.85	2.65	6.50	0.30	0.55								
U.S. Core Fixed Income	3.55	3.40	5.50	0.25	0.60	0.75							
U.S. Credit Fixed Income	4.00	3.75	7.00	0.00	0.65	0.40	0.70						
Core Real Estate (unlevered)	5.50	5.00	10.00	0.30	0.05	0.00	0.00	0.00					
Domestic Equity	7.25	5.75	19.00	0.00	0.00	-0.25	0.00	0.35	0.40				
International Equity	8.70	6.80	21.50	0.00	0.00	-0.35	0.00	0.25	0.30	0.80			
Global Equity	8.25	6.70	19.50	0.00	0.00	-0.30	0.00	0.30	0.35	0.90	0.90		
Private Equity	10.75	7.90	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	-0.20	-0.15	0.10	0.35	0.20	0.20	0.20	0.10

Key Takeaways and Significant Changes from PCA's 2017 Ten-Year Assumptions

- PCA's inflation expectation remains the same as last year at 2.25%. U.S. breakeven inflation, realized inflation, the Federal Reserve Bank of Cleveland's expectation, and other consensus estimates generally forecast inflation to be between 1.90% and 2.25%.
- PCA continues to forecast a 0% real return to cash.
- PCA marginally decreased volatility expectations across the public equity classes. These decreases reflect the likelihood of the current low volatility environment persisting in the near-term followed by a reversion to more historical averages.
- Fixed income return expectations increased across the board. Current yields are generally higher than last year and forward curves forecast a tepid pace to interest rate increases, which will ultimately benefit long-term investors in these segments.
- Equity return expectations universally decreased. Strong recent returns coupled with high valuations lead to modestly unattractive return expectations on an absolute basis. International equity markets exhibit marginally more attractive return expectations compared to the U.S.
- With the exception of Private Equity, no standalone class is forecasted to achieve a compound return above 7% over the next 10 years.

Indices/Assets Used in Modeling Asset Class Assumptions

Asset Class	Index/Asset
Cash	3-month U.S. Treasury Bills
TIPS	Bloomberg Barclays U.S. TIPS Index, Simulated TIPS series per Bridgewater
U.S. Treasuries Only Fixed Income	Bloomberg Barclays U.S. Government Index
U.S. Core Fixed Income	Bloomberg Barclays U.S. Aggregate Index, Bloomberg Barclays U.S. Govt/Credit Index
U.S. Credit Fixed Income	Bloomberg Barclays U.S. Credit Index (includes IG & HY))
Core Real Estate	NCREIF NPI Index
Domestic Equity	Russell 3000 Index, S&P 500 Index
International Equity	MSCI ACWI ex-U.S. Index, MSCI EAFE Index
Global Equity	MSCI ACWI Index
Private Equity	Cambridge Indices, VCJ Venture Capital Index

[1] Geometric returns are comparable to actuarial assumption rates for pension funds (i.e., compound/annualized returns).

Expected Inflation, Arithmetic 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 just south of 2% as of December 2017. The real rate on 10-year TIPS was somewhat volatile during 2017 but ultimately ended the year in-line with the beginning of the year. Realized inflation over the last two years has been around 2.0%, notably increasing from prior years. Market-based measures, Federal Reserve-generated models, and forecasts from a variety of market participants are generally forecasting inflation to be within the 1.90%-2.25% range over the next 10 years. A variety of economic factors such as GDP growth, unemployment, wages, interest rates, and commodity prices, among others, indicate that inflation is likely to be on the rise in the medium-term. The trajectory of all of these factors led PCA to forecast inflation at the higher-end of the consensus range.
Real Risk-Free Rates		
Short-Term (Cash)	0.00	The Federal Reserve continued to raise short-term lending rates throughout 2017. The target range is now 1.25%-1.50%. As of 12/31/17, short-term U.S. Treasury Bills were inside of that range. Forward curves for U.S. Treasuries indicate slowly rising rates over the next 10 years, with the average 3-month U.S. Treasury Bill yielding approximately 2.25% over this period. Expectations are for short-term rates to converge with inflation (on average), resulting in a zero real rate over the investment horizon.
Longer-Term (10-Year Real TIPS Yield)	0.45	The expected long-term real risk free rate is the current 10-year TIPS real yield. As of December 2017, the 10-Year TIPS real yield was approximately 0.45%, slightly decreasing from 0.50% in December 2016. Note, this is a rate, not an investment class. It is different from the TIPS asset class.
Risk Premiums Over Short-Term Risk-Free Rate		
U.S. Treasury Inflation Linked Securities (TIPS) U.S. Treasuries Only Fixed Income U.S. Core Fixed Income U.S. Credit Fixed Income	0.75 0.60 1.30 1.75	As of December 2017, the yield-to-worst (YTW) on the BB U.S. Treasury Index was 2.2%. The YTW on the BB U.S. Aggregate Index was 2.7%. The YTW on credit indices ranged from approximately 3.0% to 6.0% (depending on credit quality). Throughout 2017, the yield curve generally flattened as short and intermediate rates rose (on average), while longer term rates (10-30 years) declined modestly. The Fed raised rates three times in 2017, and credit spreads narrowed during the year. The broad markets (e.g., forward curves) are generally forecasting slowly rising rates over the next 10 years. Current expected returns assume near-term price declines with reinvestment at higher rates, modest spread widening, and historical default rates for credit-related securities.
Core Real Estate (unlevered)	3.25	Cap rates remained stable throughout 2017. Estimate assumes slowly rising interest rates and a stable-to-rising cap rate level, reverting towards historical averages.
Domestic Equity International Equity Global Equity	5.00 6.45 6.00	On average over the past nine years, the realized U.S. equity risk premium has been well above historical averages. After another year of above average realized returns in public equities, valuations (especially in the U.S.) are stretched. Our assumptions take into account earnings/yield, earnings/GDP growth/reversion, and expected valuation changes. Current U.S. equity valuations are well above historical averages and higher from a year ago. Non-U.S. equity valuations are in-line with their historical averages. We assume a modestly higher return for Non-U.S. equities due to both valuation differences and inherent risk.
Alternative Investments/Private Equity	8.50	Expected long-term illiquidity premium over U.S. public equity of 3.50% (arithmetic).

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. Correlations across different time horizons (monthly, quarterly, annual, etc.) were analyzed to improve robustness. 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.

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