2013 ALM Workshop: Introduction to Capital Market Assumptions

Investment Committee Workshop

May 13, 2013

CalPERS Investment Office
Asset Allocation

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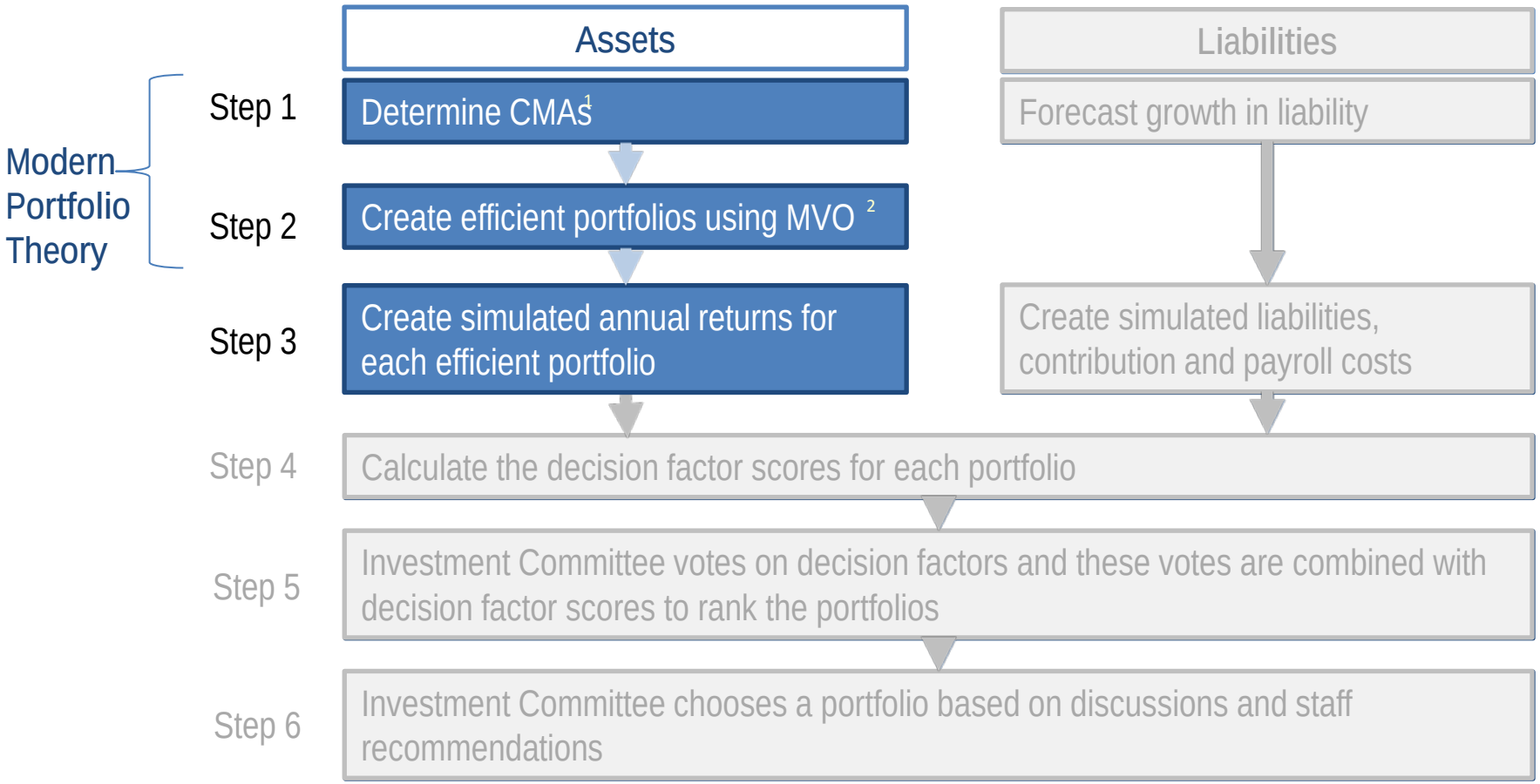
I. Brief Overview of Capital Market Assumptions

Eric Baggesen, Ben Meng

Steps to Obtain Policy Portfolio in Past ALM Workshops



1 Capital Market Assumptions
2 Mean-Variance Optimization

Three Components of CMAs

- Expected returns
- Expected volatility
- Expected correlations between asset classes

Methodology for Expected Returns

- Various Fundamental Valuations Models
- Predictions on valuation metrics, such as earnings yield, credit spread and capitalization rate
- Industry survey

Expected Returns (Examples)

Public Equity

- Dividend Discount Model
- Income + Growth + Valuation
- Inflation + Real Risk Free Rate of Cash + Risk Premium

Private Equity

- Public Equity plus illiquidity premium and other adjustment

Fixed Income

- Yield-to-maturity plus spread adjustment

Real Estate

- Cash Flow forecast plus capitalization rate forecast
- Risk premium between Equity and Fixed Income

Risks and Correlations Estimation

- Is largely based on observed historical asset class behavior and an understanding of the response of individual asset classes to changes in economic factors

- Adjusts the historical asset class behavior to account for evident trends and recent abnormalities of discrete 5-year data periods

II. Capital Market Assumptions – A Basic Primer

Allan Emkin, Pension Consulting Alliance

Purpose

- We use quantitative models to develop intuition about the future
- All models and modeling require assumptions
- Everyday example: the weather forecast (today, tomorrow, 5-day)
- Weather forecasting is sophisticated and necessary, but is often erroneous
- Forecasting for investments begins with capital market assumptions (CMAs)
- CMAs express views about future growth and risk of major market segments

Purpose – General CMA Characteristics

Capital market assumptions are organized by types of investment assets

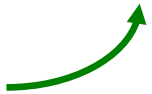
- e.g., equities, fixed income, real estate, cash, etc.
- Public vs. private, domestic vs. international
- Typically kept at high-level to reflect most dominant market and/or risk segments

Many practitioners over-model dozens of market categories

- Should focus on no more than the top 6-to-8 categories

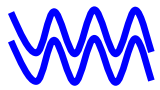
For each asset, an assumption about:

- Expected growth (typically: 10-year annualized return)



- Expected risk (standard deviation – i.e., average per year volatility)

- Expected relationship with other assets (correlation)



vs.

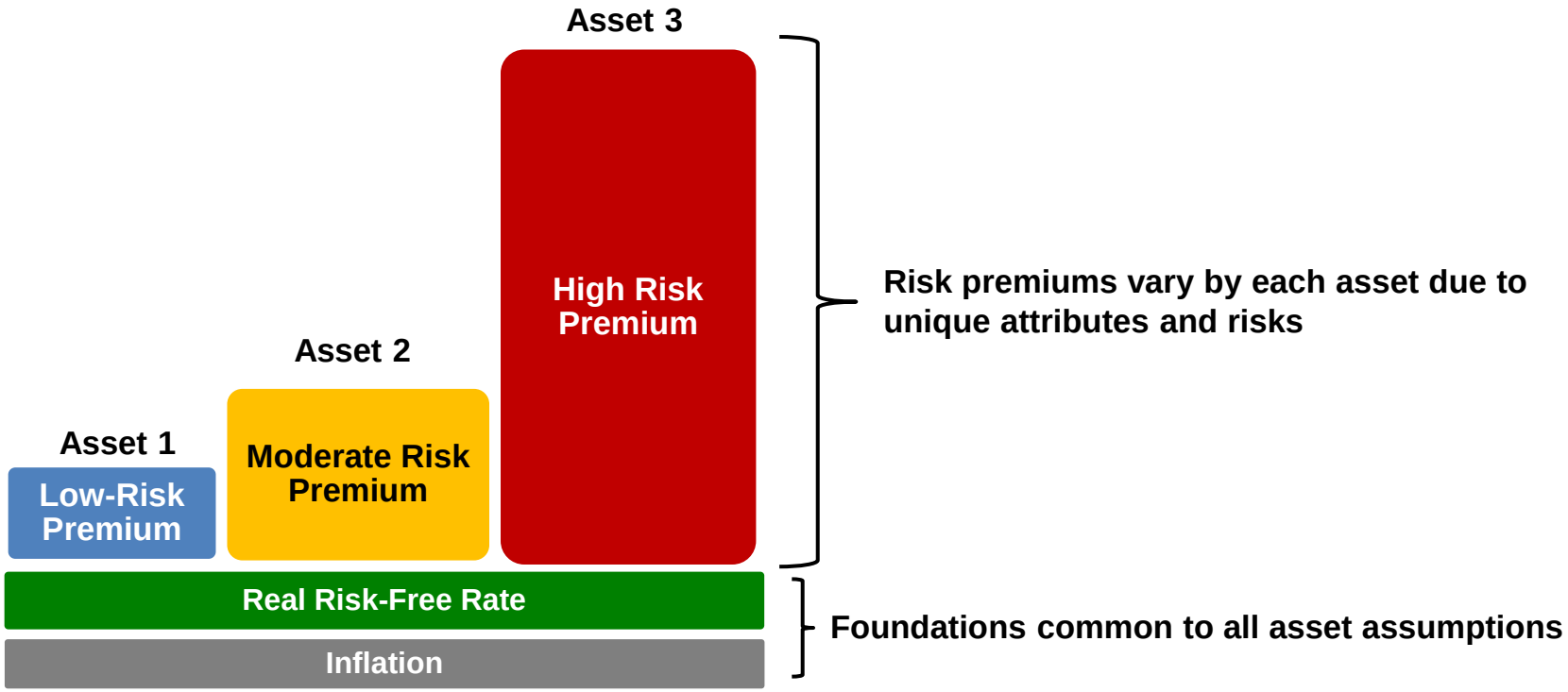
Caveats

- **Precision is not accuracy**
- **Assumptions indicate *tendencies,* not pinpoint forecasts**
- **Basic return, risk, and correlation assumptions assume a special-case world:**
  - Normal distributions (i.e., crises should occur less often than really they do)
  - A certain level of stability (entropy and chaos are not assumed)
  - Randomness (the future is never influenced by the past)

Determining Expected Growth – Building Blocks

Each asset is viewed by its ability to:

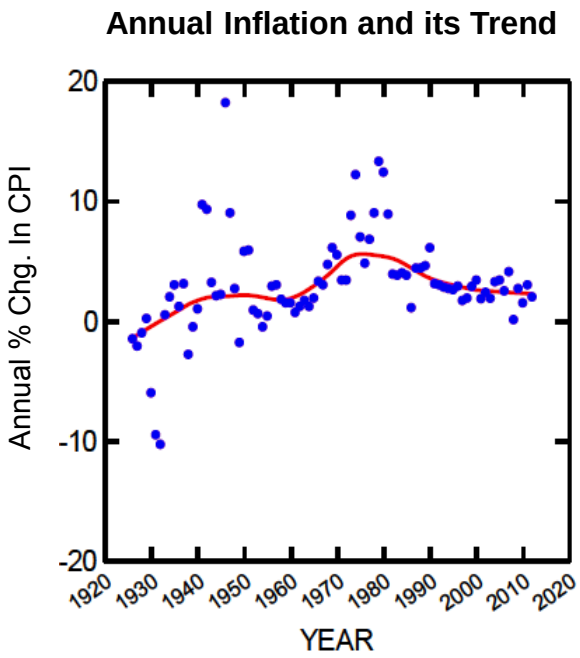
- Grow with inflation
- Provide growth relative to inflation: (i) a "risk-free" lending rate, (ii) a premium for additional risk



Determining Expected Growth – Building Blocks

Inflation

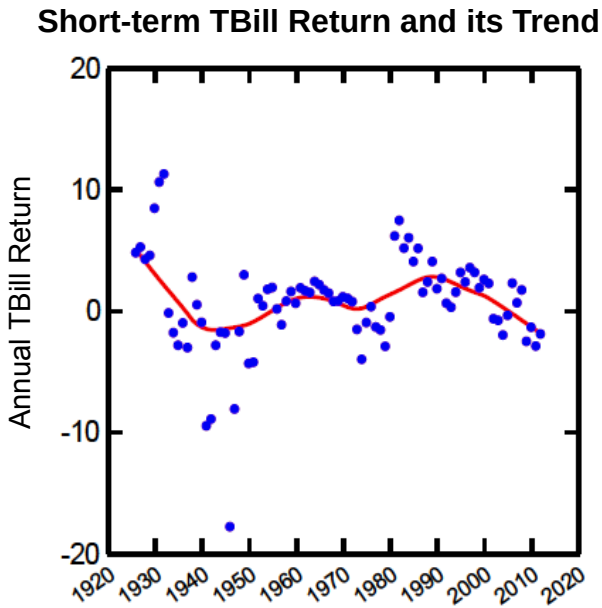
- Since inflation is a foundational building block, each asset is expected to compensate for inflation over the long-term
- Over the last 20 years, inflation has been relatively easy to model
- Inflation levels forecasted using:
  - 10-year TIPS/10-year Treasury differentials
  - Consensus economic forecasts
  - General view about Federal Reserve Bank policy
- Recent inflation has been relatively stable, but volatility is increasing



Determining Expected Growth – Building Blocks

Real "Risk-Free" Rate

- Typically, the short-term default-free lending rate in excess of inflation*
- The "risk-free" rate has experienced cyclical volatility; today it is negative
- Short-term lending rate forecasted using:
  - Current and historical levels of T Bills
  - General view about Federal Reserve Bank policy
- Key assumptions:
  - Accommodation now
  - "Catching up" later



*PCA also examines the longer-term expected return of 10-year TIPS

Determining Expected Growth – Building Blocks

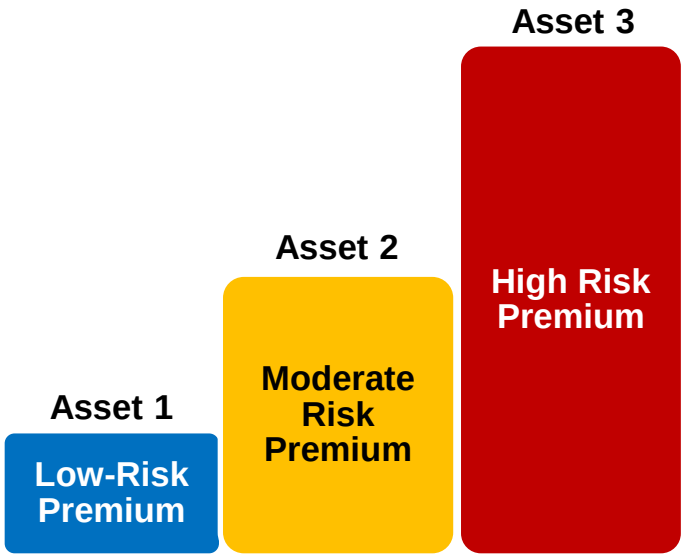
PCA Assumptions and Actual Results: Inflation & Real Risk-Free Returns

Foundational Building Blocks	In 2003	Today
Expected Results		
Inflation	**2.50**	**3.00**
Real Risk-Free Rate	**1.50**	**-0.75**
Total Nominal Risk-Free Return	**4.00**	**2.25**
Actual Results		
Inflation (ten years hence)	**2.40**	**??**
Risk-Free Return (ten years hence)	**-0.70**	**??**
Nominal Risk-Free Return	**1.70**	**??**

- Inflation expectations could be considered reasonably accurate
- Even the short-term "risk-free" rate is difficult to predict; PCA expects it to remain negative

Determining Expected Growth – Building Blocks

Individual Class Risk Premiums:



- Size of premium typically linked directly to amount of risk taken
- Return/risk tradeoff declines the more risk you take
- Level of precision difficult to nail down, particularly with more private markets
- Wilshire Associates will discuss specific risk premiums in more detail

Arithmetic vs. Geometric (Compound) Returns

- Different practitioners apply different building-block approaches
  - Arithmetic Return estimates (what will happen in any one year)
  - Compound Return estimates (what will accrue over an entire horizon)
- Compound return = (arithmetic return – penalty for bearing risk overtime)
- Arithmetic returns have attractive statistical properties
- Compound returns matter the most

III. Asset Forecasting Uncertainty

Steve Foresti, Wilshire Associates
Michael Schlachter, Wilshire Associates

Wilshire

Agenda

- Review basic approaches to asset class modeling
  - i.e. what are we attempting to measure?
- Discuss predictive accuracy across major asset class categories
  - Bonds
  - Stocks
  - Commodities
- Observations on the impact of forecasting uncertainty
- Conclusions / Q&A

General Approaches to Forecasting Investment Returns

Equities (Stocks, Real Estate, etc.)

- DDM (Dividend-Discount Model)
- Component Model (Income + Growth + Valuation)

Fixed Income

- Yield driven (current & expected)
- Defaults & recoveries

Commodities

- Inflation-plus

Private Markets

- Adjust public market proxy assumptions for appropriate level of financial leverage

General Approaches to Forecasting Investment Returns

- While there are various modeling techniques, all asset classes can be viewed from the prism of a components model
  - Income + Growth + Valuation Change

- Importance of contributors

	Income	Growth	Valuation
Equity	X	X	X
Fixed Income	X		X
Commodities			X

- Some components are more challenging to forecast

Fixed Income Components

Income

- Yield-to-maturity is a reliable starting point for forecasting bond returns (especially high quality bonds)
- Interest rate changes will impact the reinvestment yield (i.e. income in future years)

Growth

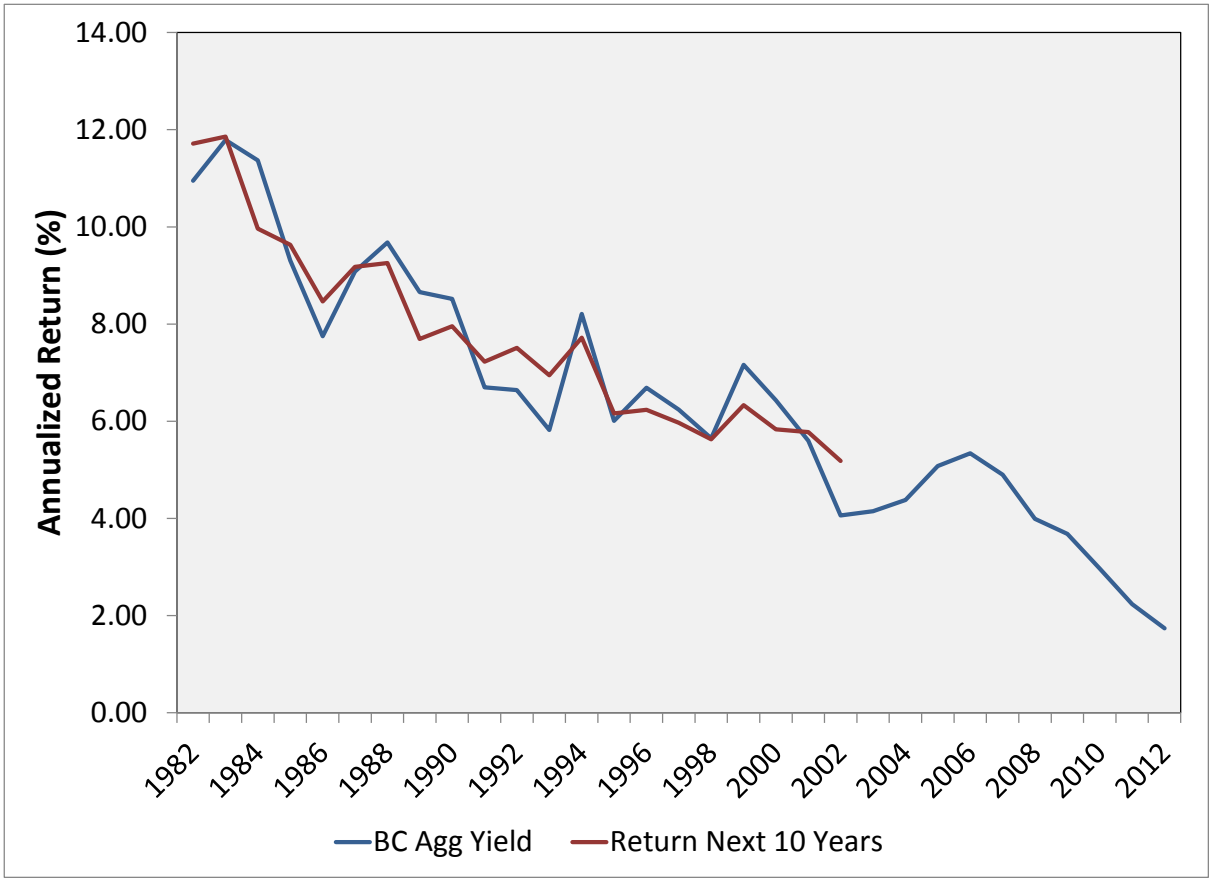
- No contribution from growth (other than default, cash flows are known in advance)

Valuation

- Interest rate changes will impact price levels (though bonds held to maturity will provide an agreed upon settlement price)

U.S. Core Bonds

Current yield vs. subsequent 10-year return



Equity Components

Income

- Dividend yields
- Relatively stable and predictable over time

Growth

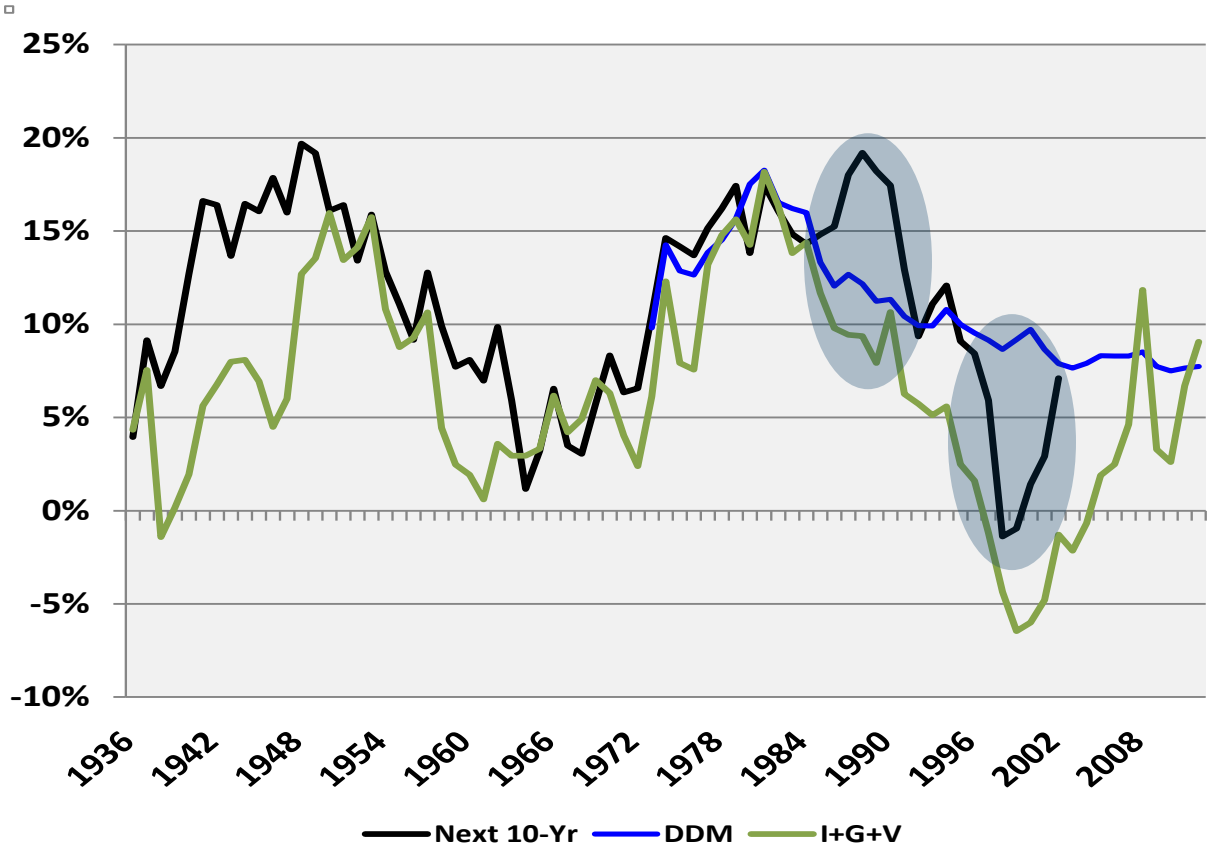
- Increases in corporate earnings and/or dividends
- Short-term swings can be difficult to project

Valuation

- Price multiples: how much investors are willing to pay for each $1 of earnings/dividends (i.e. changes in P/E and P/D ratios overtime)
- Volatile and extremely difficult (i.e. impossible) to accurately forecast over the short-term (even the long-term can be difficult)

U.S. Stocks: Model Forecasting

Dividend Discount Model (DDM) and Income + Growth + Valuation Model (IGV) Accuracy



Source: Wilshire Compass℠

Component Contributions by Decade

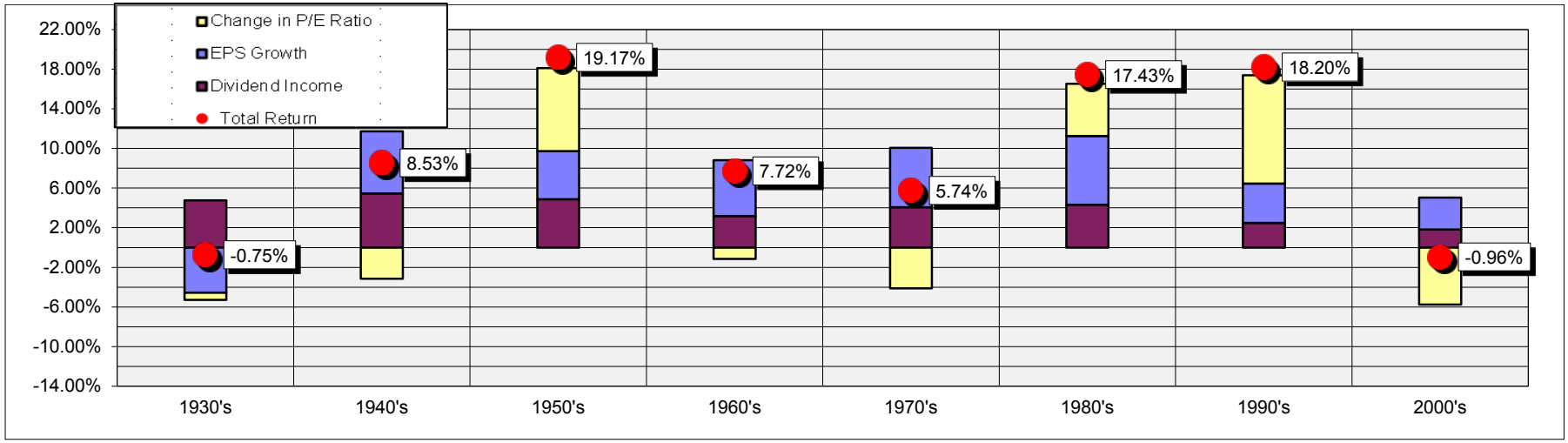
Income (I): Positive contributor in all 8 decades

Growth (G): Positive contributor in 7 of 8 decades

- Negative contributor (contraction) in the 1930's

Valuation (V): Positive contributor in 3 of 8 decades

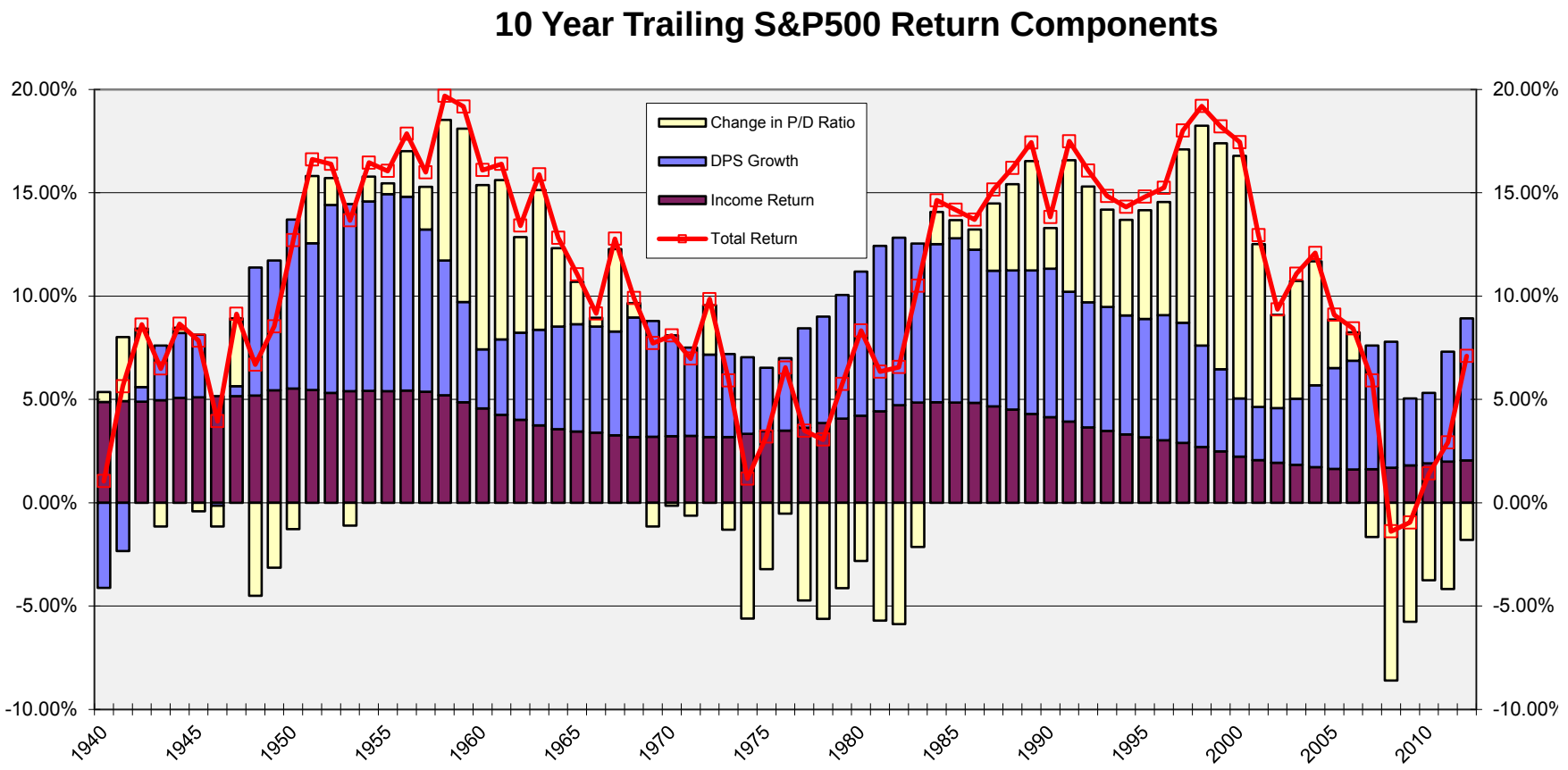
- Huge contributor in the 1980's and 1990's



Source: S&P

10-Year Rolling Component Contributions

The valuation component is a dominant (and volatile) contributor to realized returns

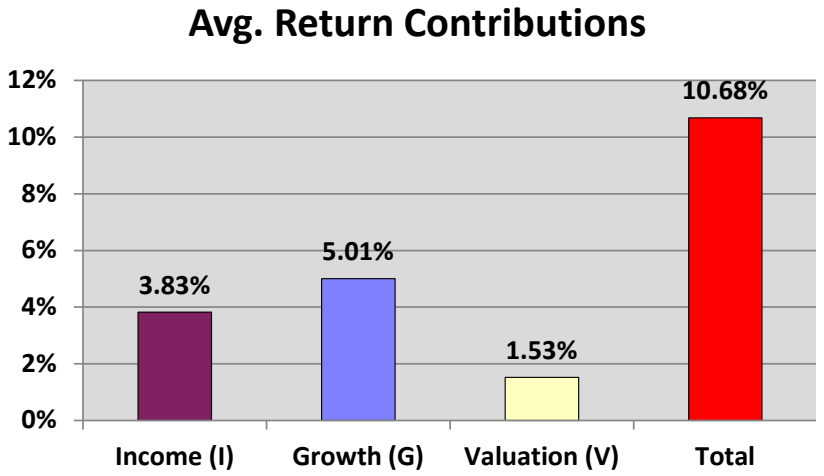


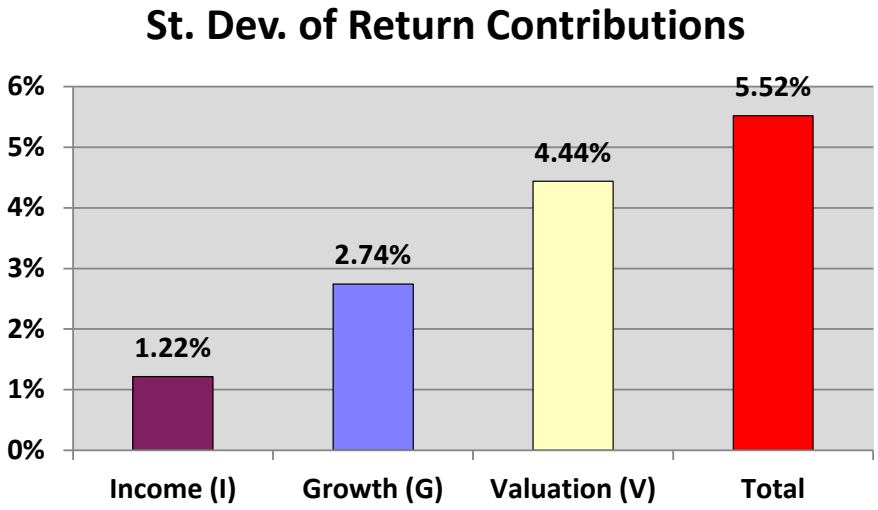
Source: S&P

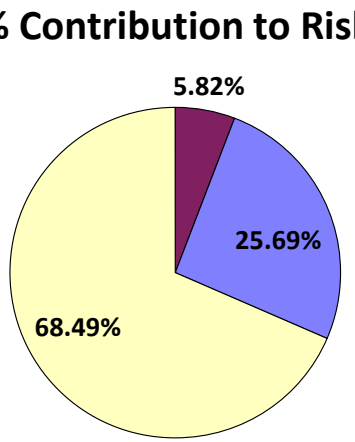
10-Year Rolling Component Contributions

Contribution statistics over 73 distinct 10-year periods

- Income (I)
- Growth (G)
- Valuation (V)







Source: S&P

Commodities Components

Income

- None (other than from the underlying collateral held in conjunction with exposure via futures contracts)

Growth

- None
- No direct cash flows from which to grow

Valuation

- Price fluctuations
- Volatile and difficult to forecast accurately

Commodities Futures: Model Forecasting

Inflation-plus vs. subsequent 10-year return

Source: Gary Gorton and K. Geert Rouwenhorst "Facts and Fantasies about Commodity Futures," (February, 2005), Wilshire Compass℠

Observations: Forecasting Uncertainty

“What Could Possibly go wrong?”

Macroeconomic shock to…

- Inflation (spikes or deflation)
- Interest rates/Access to capital (or spreads)
- Growth rates (GDP, corporate earnings, etc.)
- Market levels (“popping of a bubble”)

Geopolitical shocks

- War/ Terrorism/ National unrest
- Could serve as a trigger to the macroeconomic shocks above

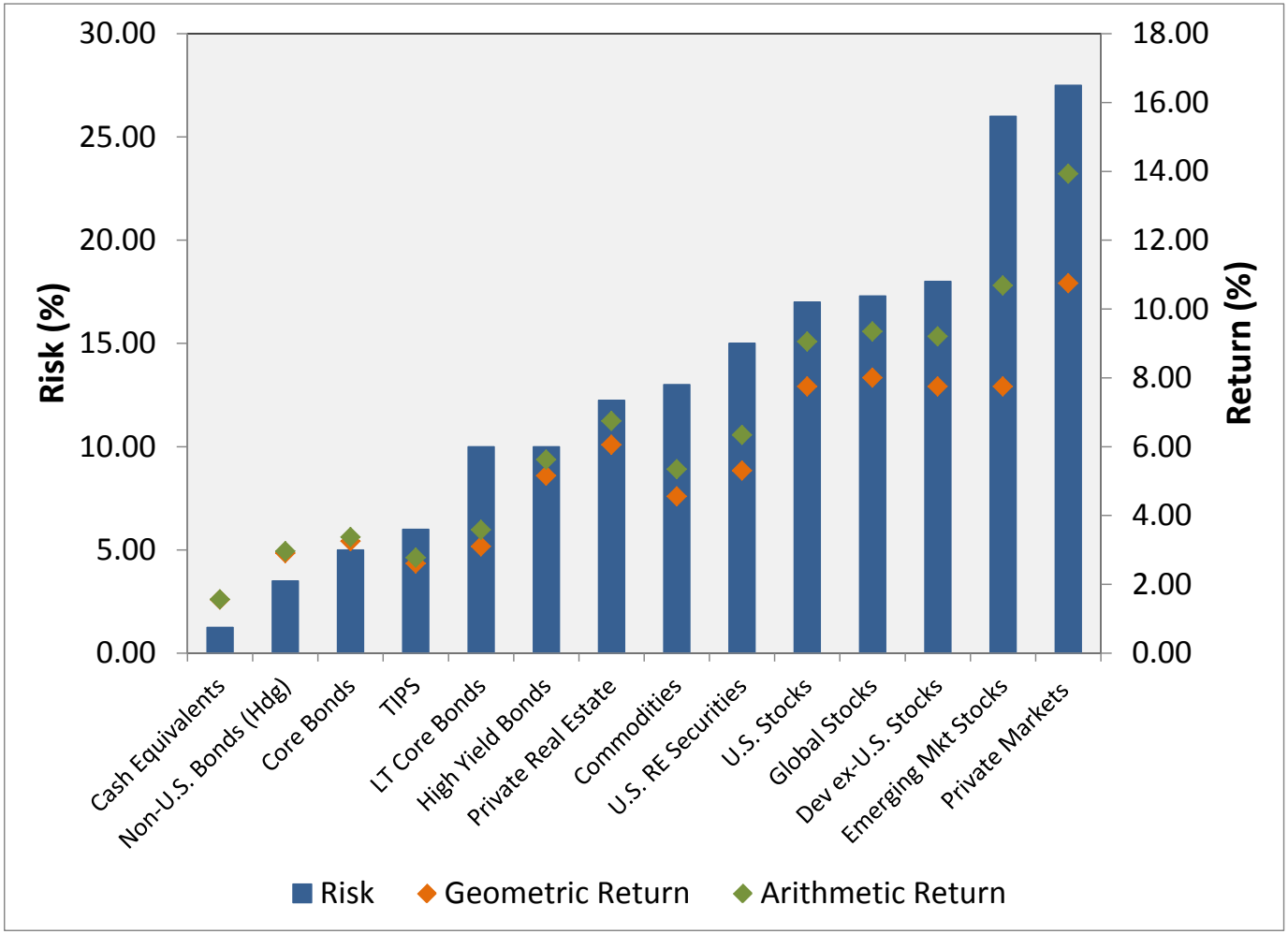
And then there are the unknown risks

- TBD

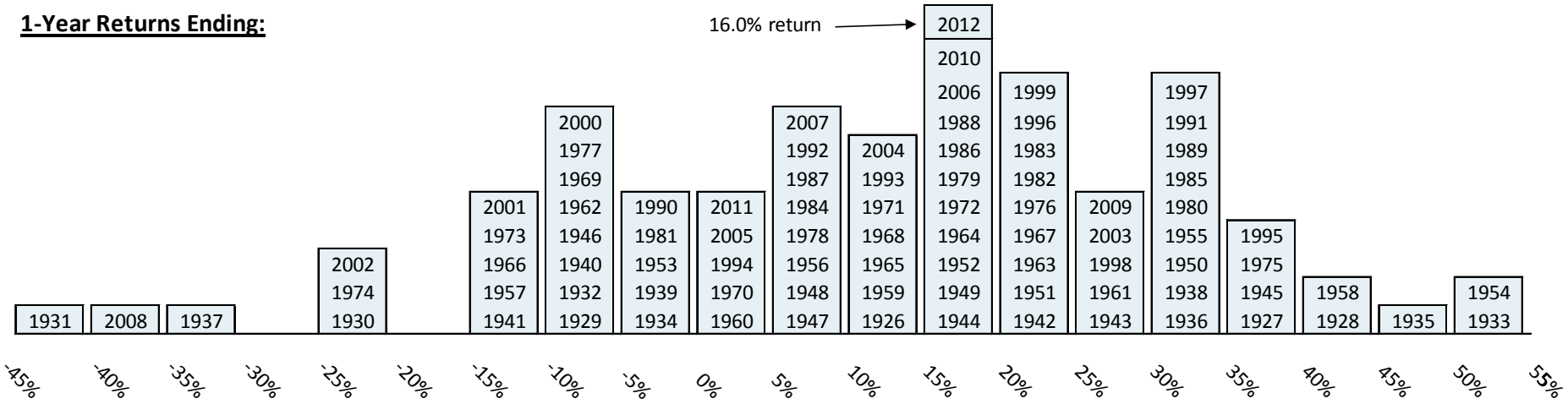
Observations: Forecasting Uncertainty

- Internal consistency of inputs is critical
  - Forecasting errors in a specific input can then uniformly impact various asset classes (potentially maintaining their relative relationship)
- In general, the more volatile the asset class, the more difficult it is to forecast accurately (often because the valuation component is a significant contributor)
- Longer term forecasts can have greater predictive accuracy
  - Long-term investors can benefit from a more dependable relationship between asset classes over extended holding periods

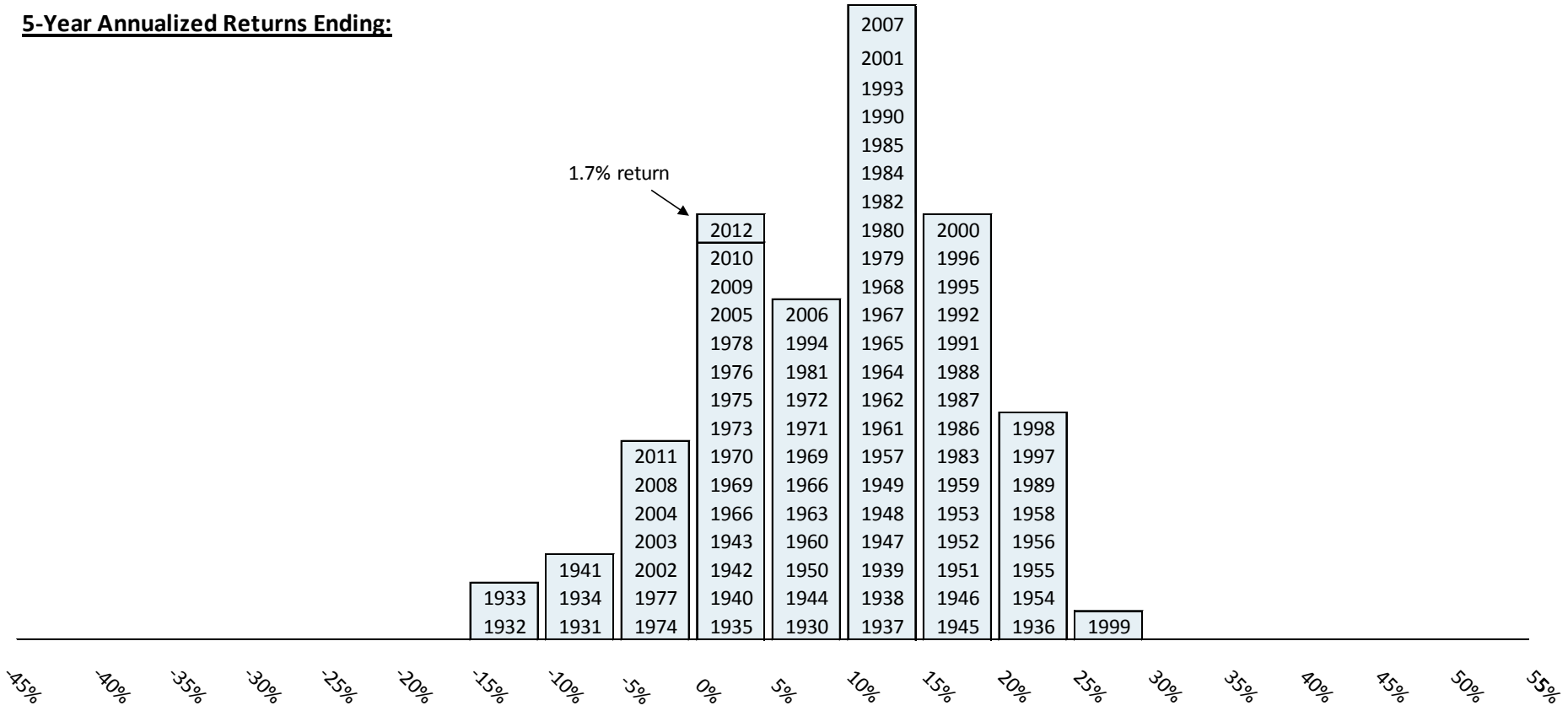
Wilshire's 2013 Return and Risk Assumptions



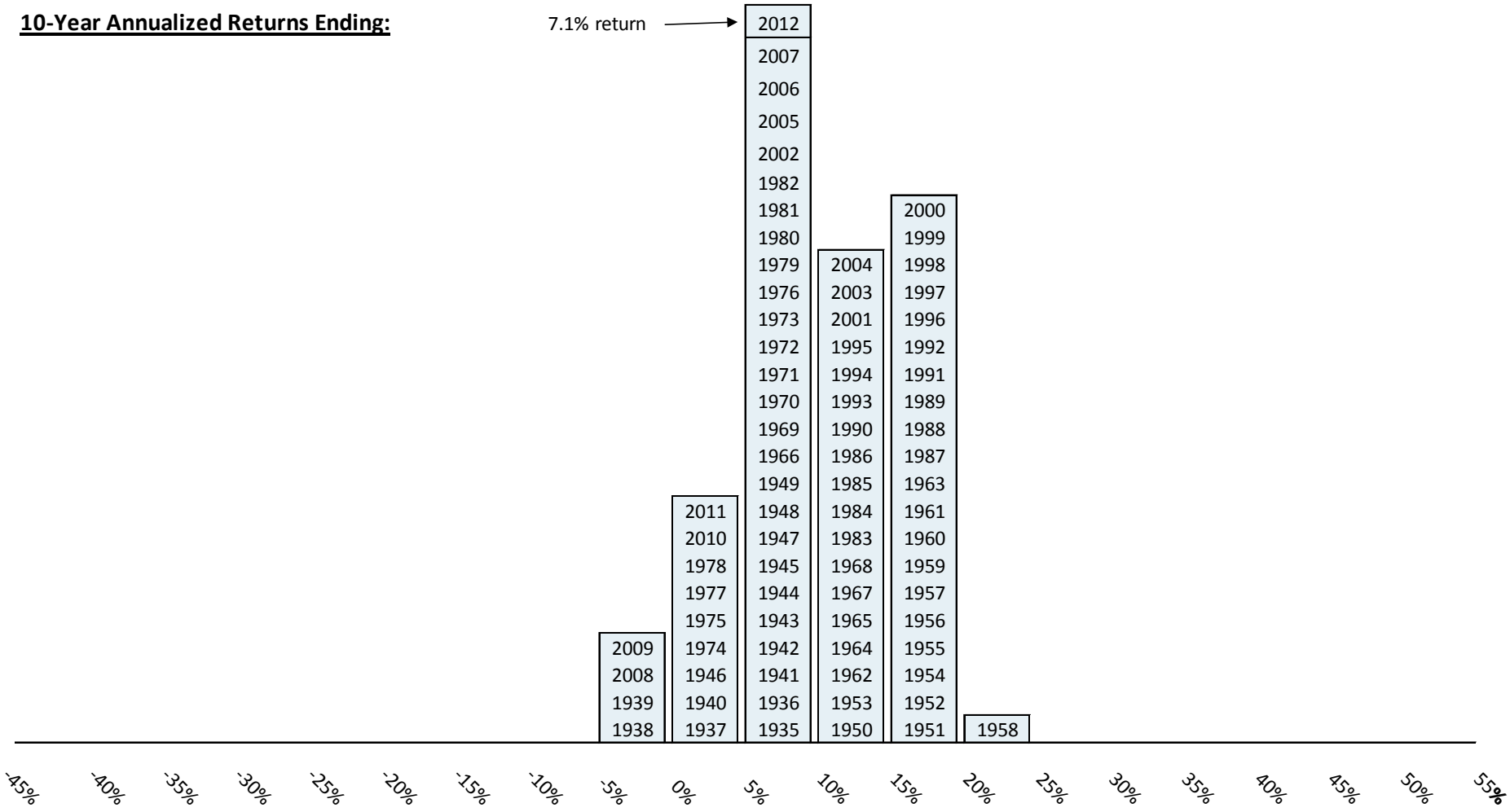
Histogram of 1-Year S&P 500 Returns



Histogram of 5-Year S&P 500 Returns

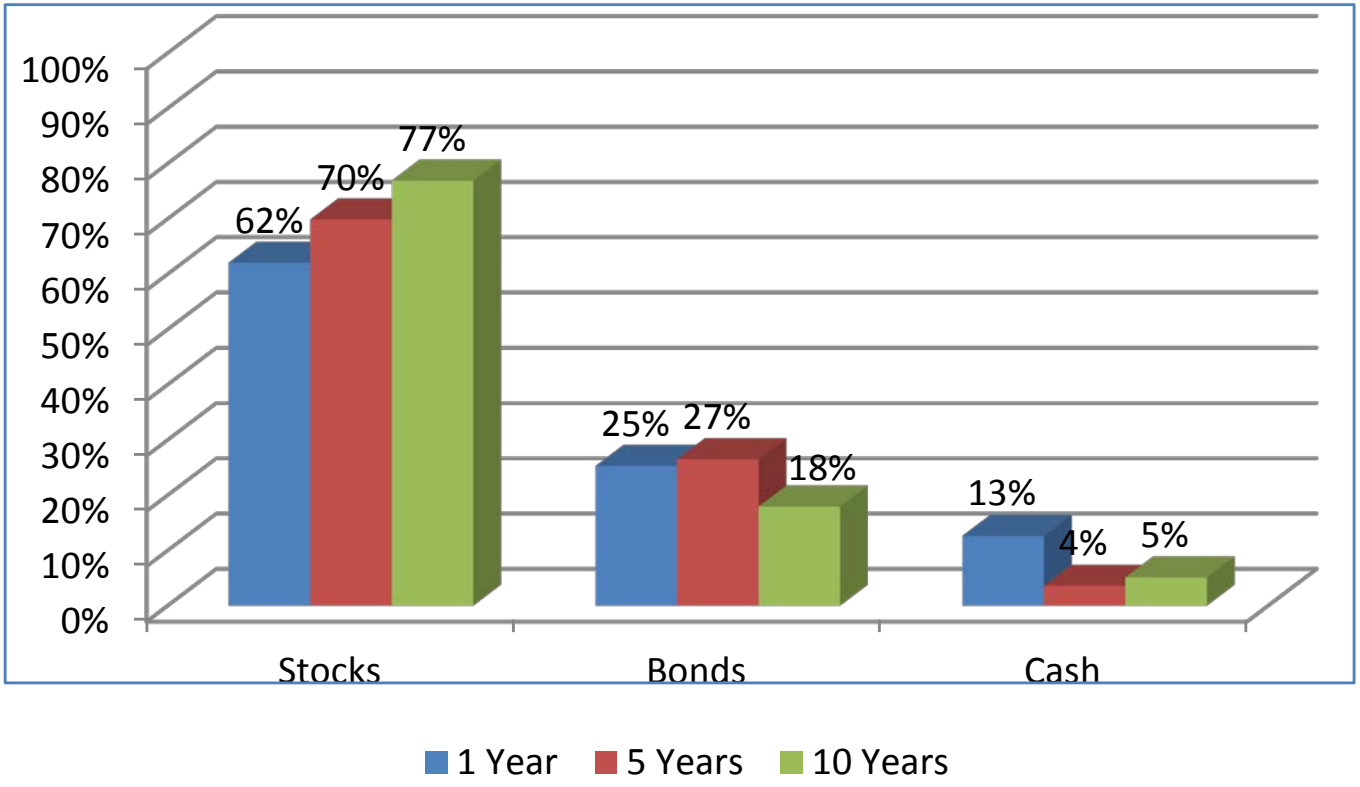


Histogram of 10-Year S&P 500 Returns



Market Leadership by Holding Periods

- The probability of receiving an equity risk premium increases with longer holding periods
- Winning percentages of stocks, bonds, and cash (annual data from 1926-2012)



Important Information

Wrap Up

- Questions
- Next Steps
- Adjourn