2013 ALM Workshop: Introduction to Capital Market Assumptions

Investment Committee Workshop

May 13, 2013
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I. Brief Overview of Capital Market Assumptions

Eric Baggesen, Ben Meng
Steps to Obtain Policy Portfolio in Past ALM Workshops

**Modern Portfolio Theory**

### Assets

**Step 1**
Determine CMAs

**Step 2**
Create efficient portfolios using MVO

**Step 3**
Create simulated annual returns for each efficient portfolio

**Step 4**
Calculate the decision factor scores for each portfolio

**Step 5**
Investment Committee votes on decision factors and these votes are combined with decision factor scores to rank the portfolios

**Step 6**
Investment Committee chooses a portfolio based on discussions and staff recommendations

### Liabilities

**Step**
Forecast growth in liability

Create simulated liabilities, contribution and payroll costs

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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

Risk premiums vary by each asset due to unique attributes and risks

Foundations common to all asset assumptions
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

<table>
<thead>
<tr>
<th>Foundational Building Blocks</th>
<th>In 2003</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expected Results</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation</td>
<td>2.50</td>
<td>3.00</td>
</tr>
<tr>
<td>Real Risk-Free Rate</td>
<td>1.50</td>
<td>-0.75</td>
</tr>
<tr>
<td>Total Nominal Risk-Free Return</td>
<td>4.00</td>
<td>2.25</td>
</tr>
<tr>
<td><strong>Actual Results</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation (ten years hence)</td>
<td>2.40</td>
<td>??</td>
</tr>
<tr>
<td>Risk-Free Return (ten years hence)</td>
<td>-0.70</td>
<td>??</td>
</tr>
<tr>
<td>Nominal Risk-Free Return</td>
<td>1.70</td>
<td>??</td>
</tr>
</tbody>
</table>

- 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
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

<table>
<thead>
<tr>
<th></th>
<th>Income</th>
<th>Growth</th>
<th>Valuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Fixed Income</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Commodities</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

- 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 CompassSM
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
The valuation component is a dominant (and volatile) contributor to realized returns.
10-Year Rolling Component Contributions

**Contribution statistics over 73 distinct 10-year periods**

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

**Avg. Return Contributions**

<table>
<thead>
<tr>
<th>Component</th>
<th>Avg. Return</th>
<th>St. Dev. of Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income (I)</td>
<td>3.83%</td>
<td>1.22%</td>
</tr>
<tr>
<td>Growth (G)</td>
<td>5.01%</td>
<td>2.74%</td>
</tr>
<tr>
<td>Valuation (V)</td>
<td>1.53%</td>
<td>4.44%</td>
</tr>
<tr>
<td>Total</td>
<td>10.68%</td>
<td>5.52%</td>
</tr>
</tbody>
</table>

**% Contribution to Risk**

- **Income (I)**: 5.82%
- **Growth (G)**: 25.69%
- **Valuation (V)**: 68.49%

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

1-Year Returns Ending:

- 16.0% return
- 2012
- 2010
- 2006
- 1999
- 1997
- 1996
- 1991
- 1988
- 1983
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- 1986
- 1982
- 1985
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- 2003
- 1955
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- 1956
- 1947
- 1951
- 1968
- 1972
- 1944
- 1949
Histogram of 5-Year S&P 500 Returns

5-Year Annualized Returns Ending:
Histogram of 10-Year S&P 500 Returns

10-Year Annualized Returns Ending: 7.1% return

- 2012
- 2007
- 2006
- 2005
- 2002
- 1982
- 1981
- 1980
- 1979
- 1976
- 1973
- 1972
- 1971
- 1970
- 1969
- 1966
- 1949
- 1911
- 2010
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- 1951
- 1958
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)
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Wrap Up

- Questions
- Next Steps
- Adjourn