

Capital Market Assumptions Methodology Board Education Session

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CalPERS Board of Administration Offsite
Monday, July 13, 2020

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What are Capital Market Assumptions?

Capital Market Assumptions (CMAs) are beliefs about the future performance of available asset segments that incorporate theories, observations and experience.

Capital Market Assumptions: Asset Segment Components

- Each asset segment is characterized by estimated:
 - expected **returns**
 - expected **volatility (variance, risk)**
- The interaction between asset segments is characterized by estimated:
 - expected **correlation** between returns

What is the Capital Market Assumptions Time Horizon?

- A 10-year horizon is common for the asset side in Asset-Liability-Management
- This time horizon enables a long-term investor to:
 - earn an illiquidity premium in private asset classes
 - invest in opportunities that take longer to realize
 - hold positions during market dislocations
- A 20-year horizon is available, but is less common

Building Portfolios with Capital Market Assumptions

- Utilize Mean Variance Optimization (MVO) to evaluate the CMAs to maximize **desired return** (mean) for any given level of **undesired risk** (variance)
- Incorporate allocation **constraints** into this process to ensure that:
 - pricing discipline is maintained at strategy implementation (maximum constraint on private assets)
 - portfolio has enough protection against drawdown risk (minimum constraint on bonds)
- MVO finds the portfolio with the highest **return** for any given level of **variance or risk**
- These portfolios compose the Efficient Frontier

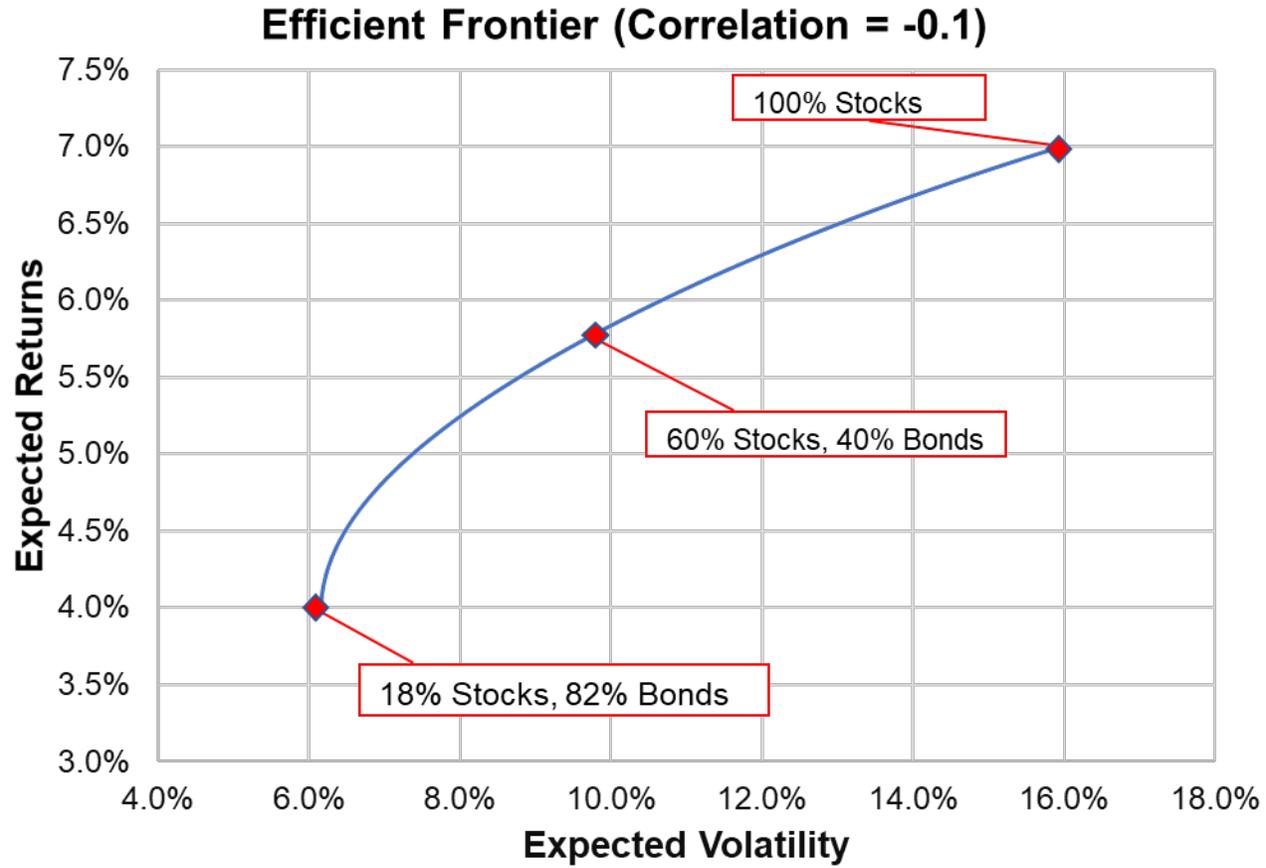
The Efficient Frontier: A Two Asset Segment Example

Asset	Compound Return	Volatility
Stocks	7%	16%
Bonds	3%	7%

Correlation Matrix	Stocks	Bonds
Stocks	1.0	-0.1
Bonds	-0.1	1.0

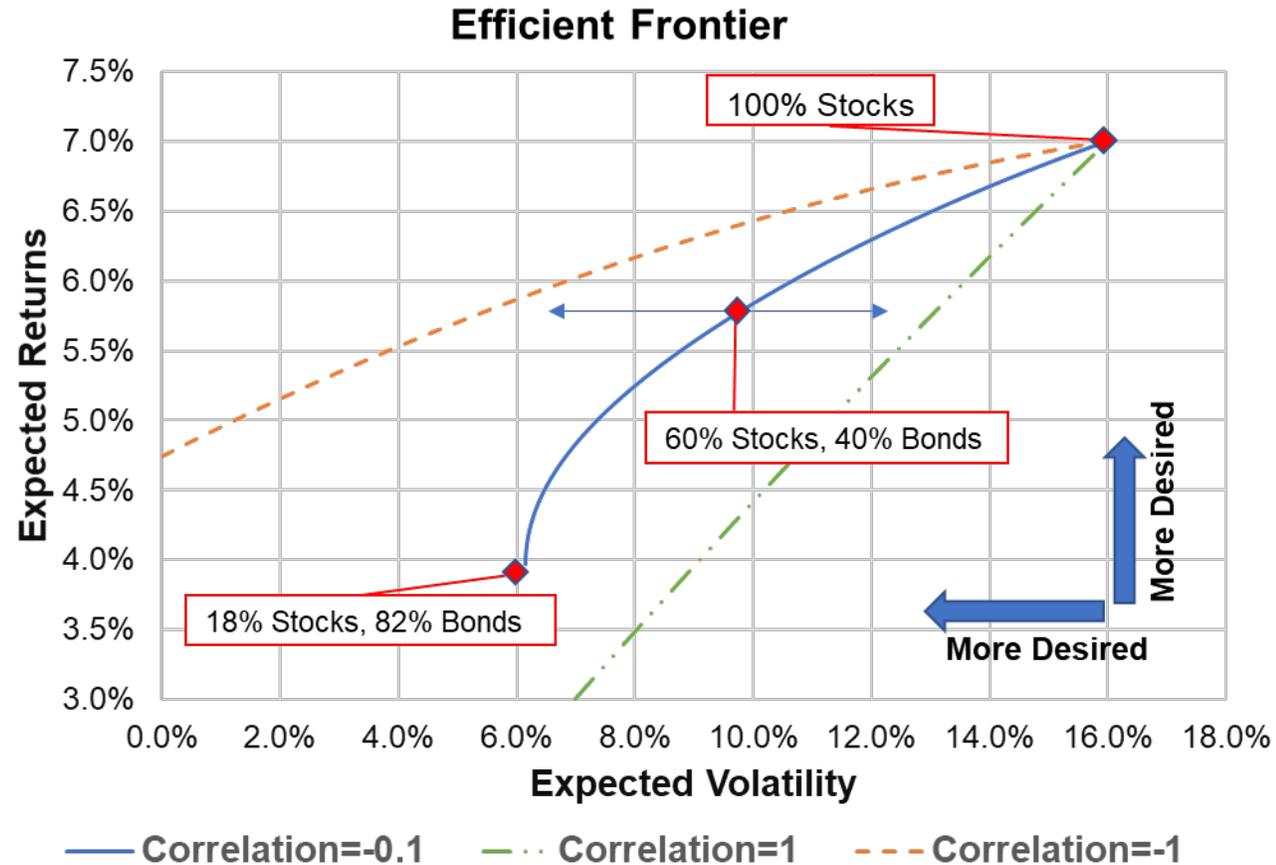
Constructing the Efficient Frontier

Each portfolio on the efficient frontier has the highest possible **return** for that level of **risk**



The Efficient Frontier and the Effect of Correlation

The lower the **correlation** between the asset returns, the greater the diversification benefits



Forecasting Uncertainty using Models & Assumptions

- Financial modeling:
 - provides investors a common analytical framework to share ideas
 - evaluates complex, real world investments with simplified mathematical constructs
- Simplification requires assumptions, such as:
 - asset returns are normally distributed
 - mean, variance, and correlations are constant and known
- To counterbalance assumptions:
 - set constraints to ensure market feasibility of the allocation and guard against drawdown
 - stress-test portfolios using Monte Carlo simulations and historical economic regimes

CMA Methodology

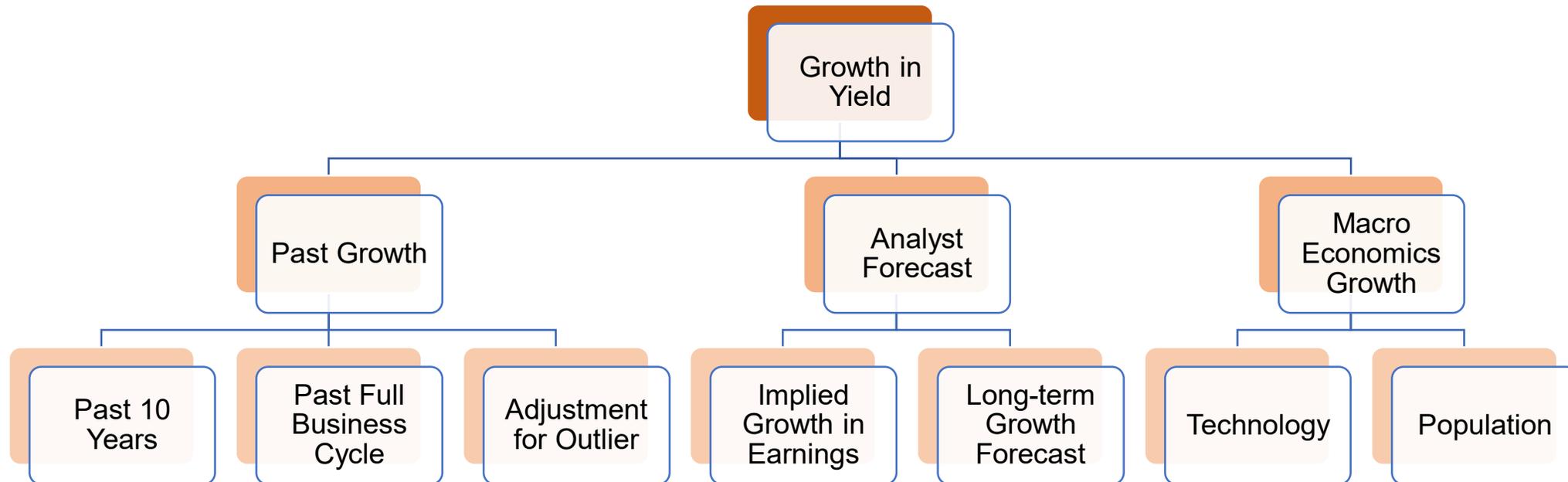
Establishing CMAs is a mix of art and science, as models only approximate reality.

- Step 1: Start with internal CMA models that a) reflect our internal knowledge and experience and b) incorporate cutting-edge practices and techniques from leading practitioners in the industry.
- Step 2: Add “humility” to the process by including CMA survey results of several asset managers and consultants, and understanding the drivers of significant differences.
- Step 3: Build consensus on asset segment CMAs with TLPMI/RSG, asset class experts, actuaries, and the Board Consultants to establish what we think the marketplace has to offer.

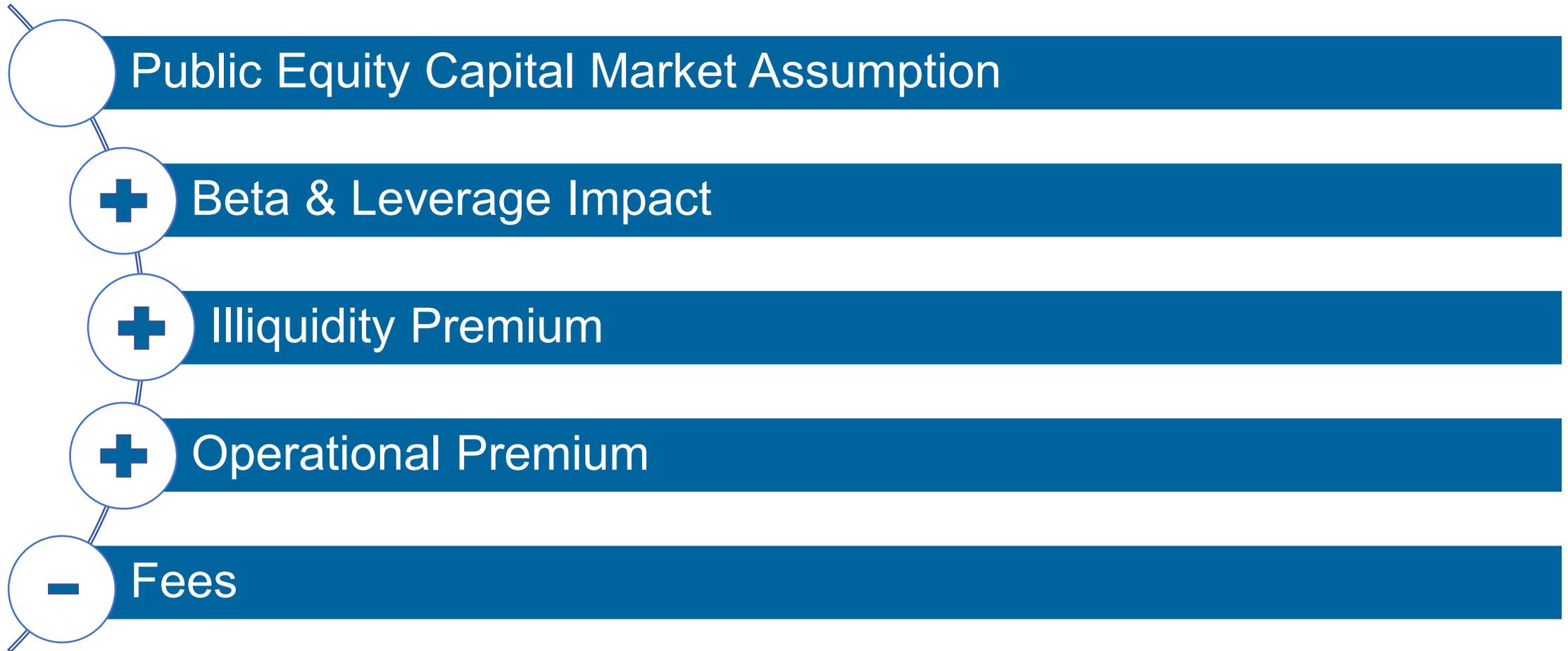
The Building Blocks of Expected Returns



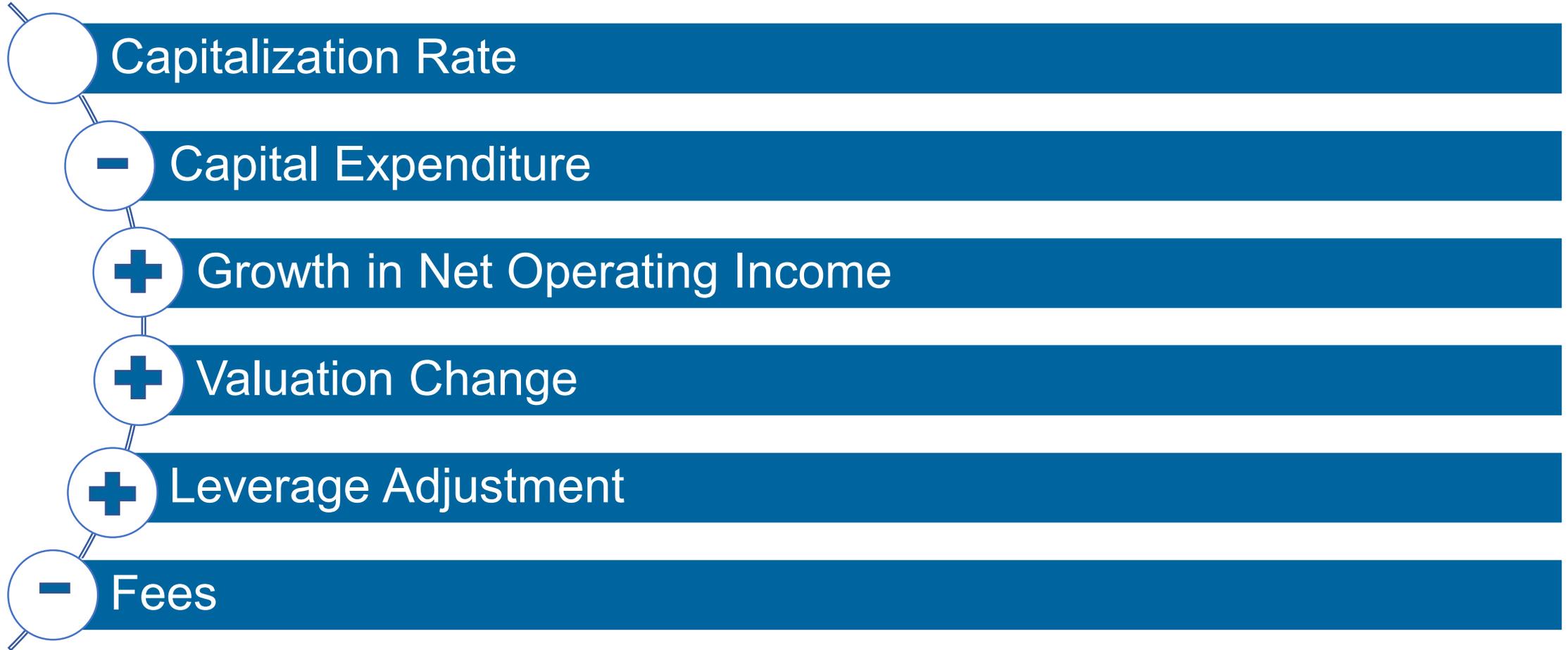
Building Blocks of Expected Returns: Public Equity Example



Building Blocks of Expected Returns: Private Equity Example



Building Blocks of Expected Returns: Real Assets Example



Expected Volatility and Expected Correlation Estimates

- Expected volatility (risk) estimates are primarily based on:
 - observed historical asset class behavior
 - understanding asset class responses to changes in economic factors

- Expected correlation estimates:
 - start with MSCI BarraOne model
 - incorporate beliefs on the future relationship between stocks-bonds given macroeconomic views and conditions

Shocks to the Estimates

- Macroeconomic shocks:
 - inflation (spikes or deflation)
 - interest rates / access to capital
 - growth rates (GDP, corporate earnings, etc.)
 - market levels (“popping of a bubble”)
- Geopolitical shocks:
 - war / terrorism / national unrest / pandemics
 - can trigger macroeconomic shocks
- Unknown risks

Future Developments

The CMA methodology is an evolving process that includes new research and models. Possible future developments include:

- utilizing macroeconomic research to incorporate expectations for future economic growth, inflation, and real interest rates into asset segment CMAs
- utilizing fundamental and thematic research to incorporate expectations for earnings growth potential into asset segment CMAs
- continued enhancement in estimation techniques and statistical models