



November 20, 2008

Kick-Off – Asset / Liability Modeling Investment Committee Meeting Ohio Bureau of Workers' Compensation

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Purpose of Today's Meeting

1. **Goals, Objectives, and Background**
2. **Asset Modeling Assumptions**
3. **Liability Modeling Assumptions**
4. **Key Metrics**
5. **Next steps**
6. **Appendix**

Goals, Objectives, and Background

BWC Goals and Objectives

- Mercer hired by BWC to help understand :
 - What is the desired funding ratio?
 - Funding ratio is a measure of the overall financial strength
 - What asset allocation best achieves the desired funded ratio?
 - What asset allocation best protects the desired funded ratio?

- Factors that Influence funding ratio
 - Assets
 - Liabilities
 - Cash flow
 - Proper projection of claims, medical inflation, premium income
 - Discount rates
 - Currently, fixed at 5%

Mercer Approach

- Set objectives, constraints
- Modeling tools
 - Mean-variance analysis, adjusted to include liability measures
 - Capital Market Simulator
 - Model capital markets from basic economic fundamentals
 - Liability projection tool
 - Incorporate liability projections: discount rates
- Produce first round of results, review with staff and Board
 - Adjust modeling or asset allocations to be tested based on feedback, results
- Test final portfolios and formulate recommendations
- Work on implementation of final recommendations

Asset Modeling Assumptions

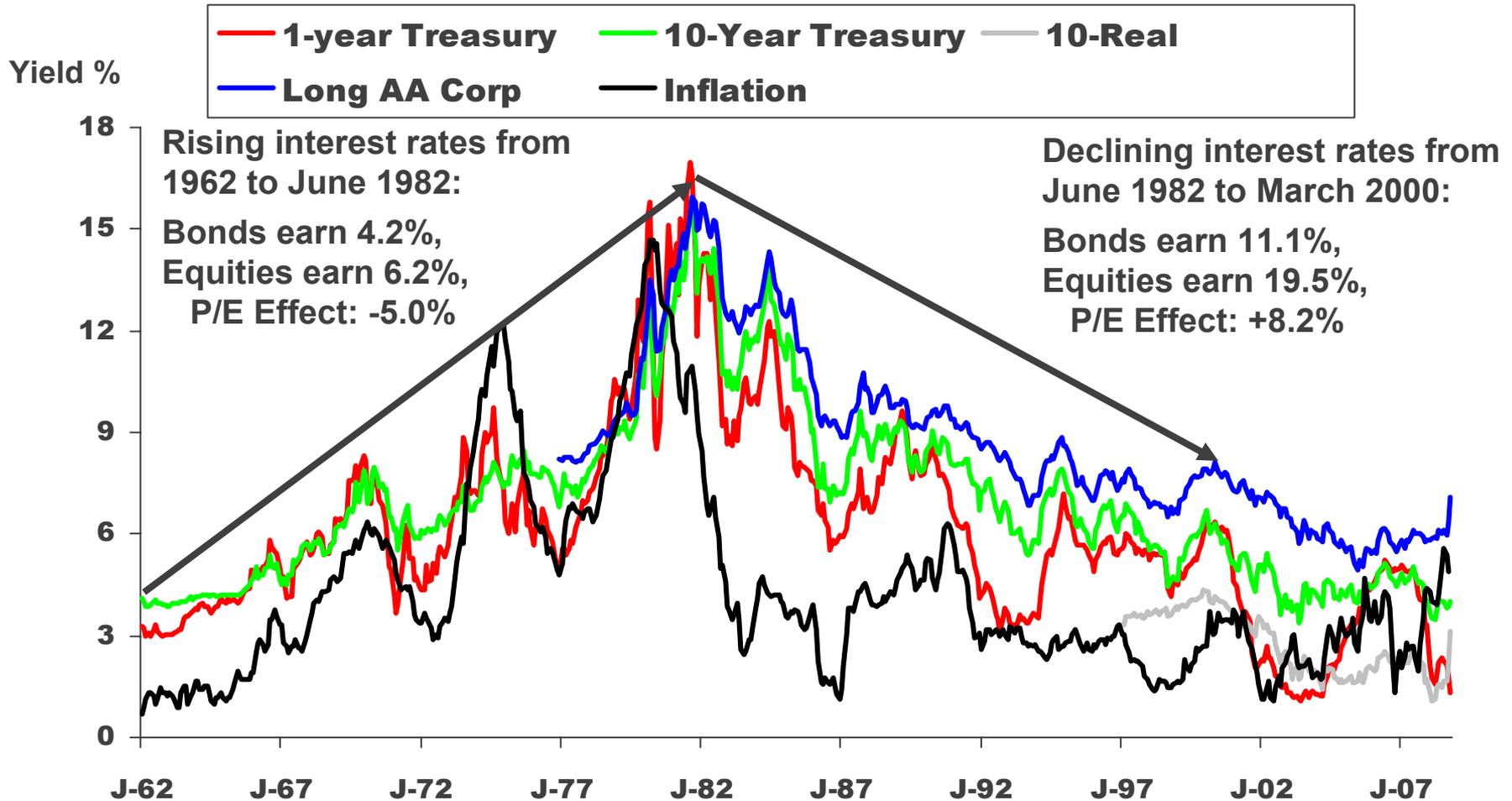
Drivers of the Capital Markets

There are three main drivers of the capital markets:

- Inflation
- Economic growth
 - Strong economic growth flows through to profits, wages
- Interest rates (Time value of money / Risk Premiums)
 - Real and nominal
 - Corporate spreads
 - Dividend yields, equity yields (P/E inverted)

Initial conditions are very important. Current yields and expectations are reflected in current pricing and determine the path of the capital markets.

Starting Conditions are Important!



Investment Strategy

Capital Market Simulator

Step 1. Generate

- Inflation
- Economic growth

Step 2. Generate

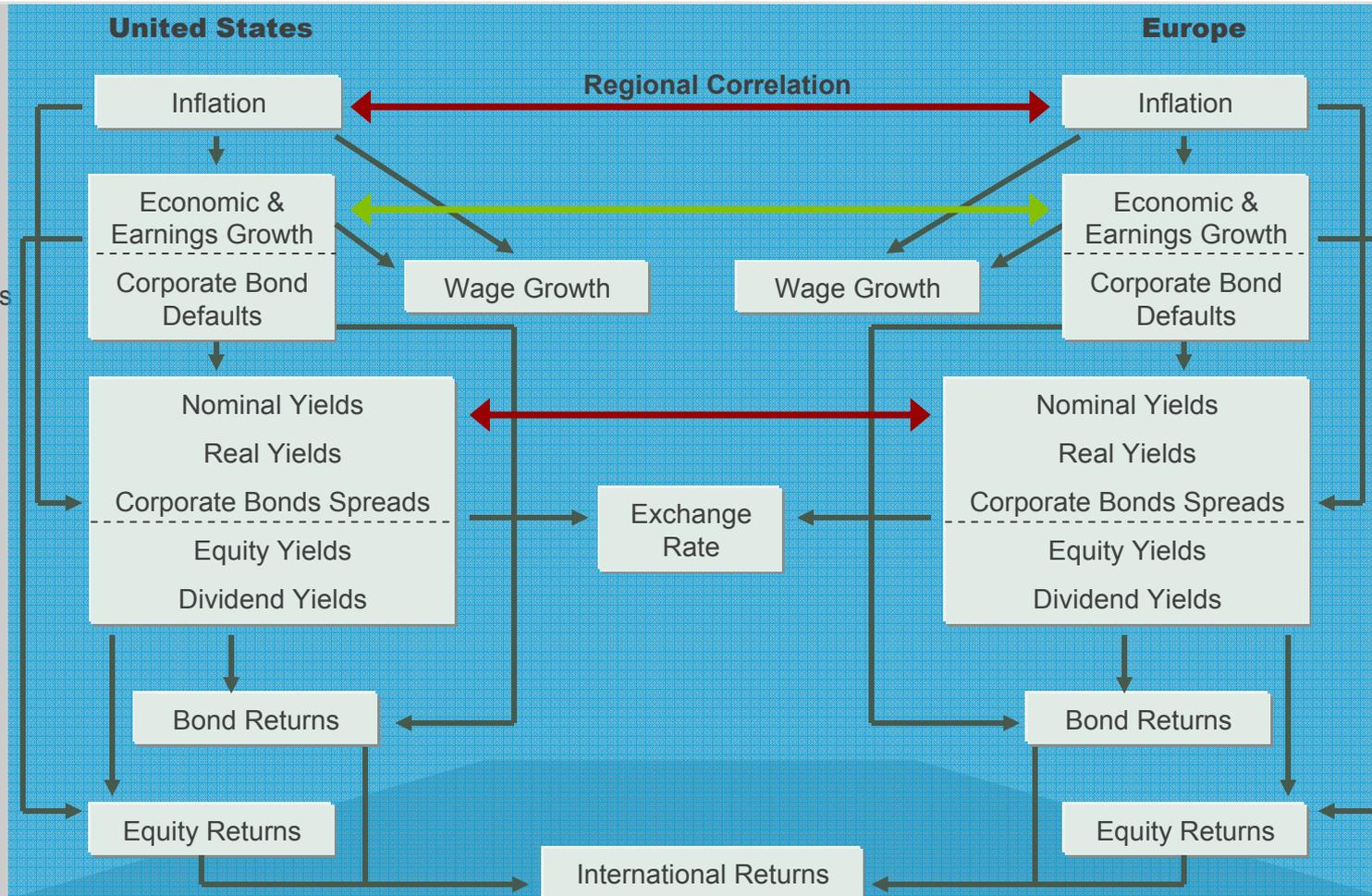
- Nominal yield curve
- Real yield curve
- Equity yields, dividend yields
- Corporate bond spreads

Step 3. Determine change in exchange rates

Step 4. Compute

- Bond returns
- Equity returns

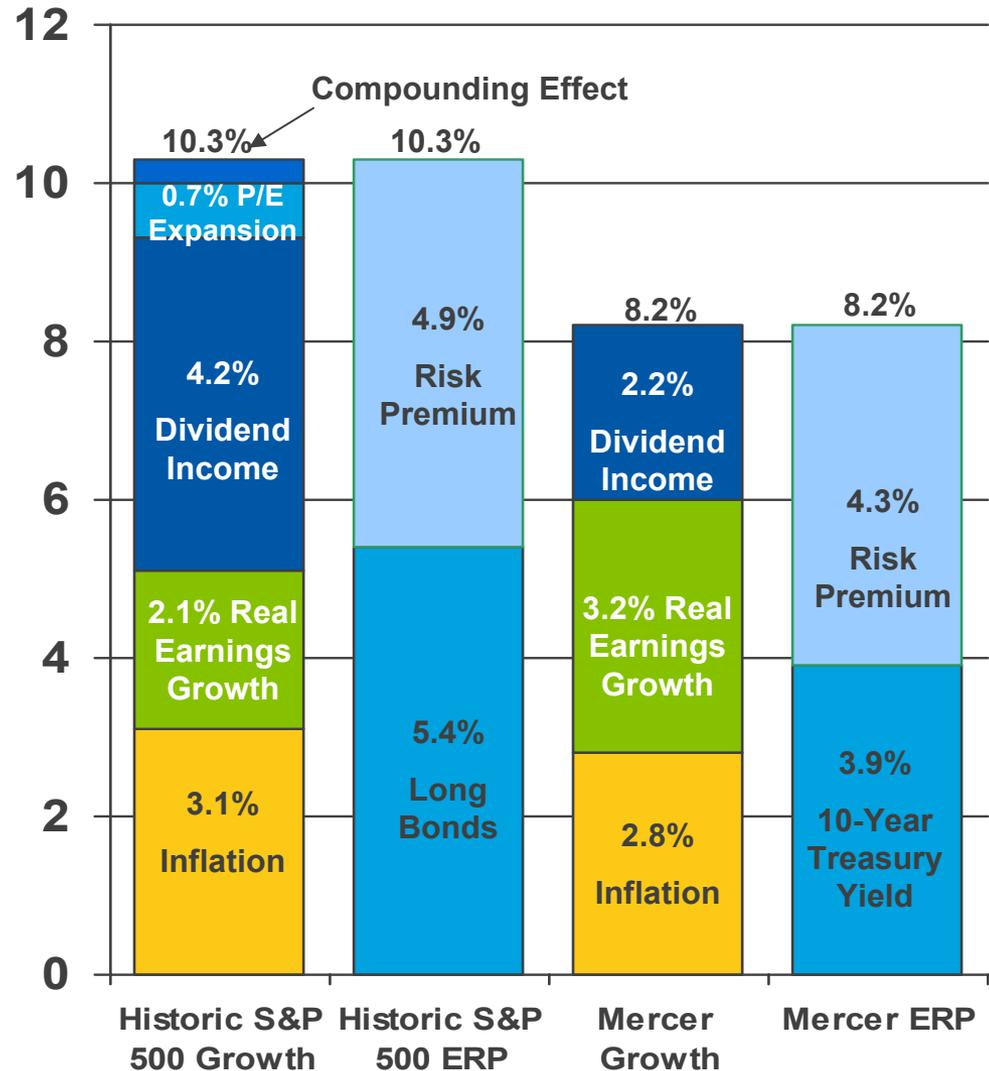
Step 5. Determine Int'l returns



Asset Allocation Approach

Historical and Expected Equity Returns

- From 1926 through 2007, the S&P 500 earned a 10.3% geometric return
 - Lower income return, as dividends are much lower, but higher earnings growth
 - No P/E expansion
 - Lower inflation
- We forecast 8.2% for the S&P 500



Data sources: Ibbotson Associates, Standard & Poors, Federal Reserve. Analysis by Mercer.

Asset Classes to Consider

- Domestic Equities
 - Russell 3000 or Wilshire 5000
- International Equity
 - MSCI ACWI x US
 - This includes emerging markets
- Real Estate
 - Both private and public (REITS)
- Private Assets
 - Private Equity
 - Infrastructure Equity
- Commodities
- Multiple Fixed Income Classes
 - Market Bond (Lehman Aggregate)
 - Intermediate Fixed Income
 - Long fixed income
 - 14 year duration
 - Inflation indexed bonds (TIPS)
 - Cash

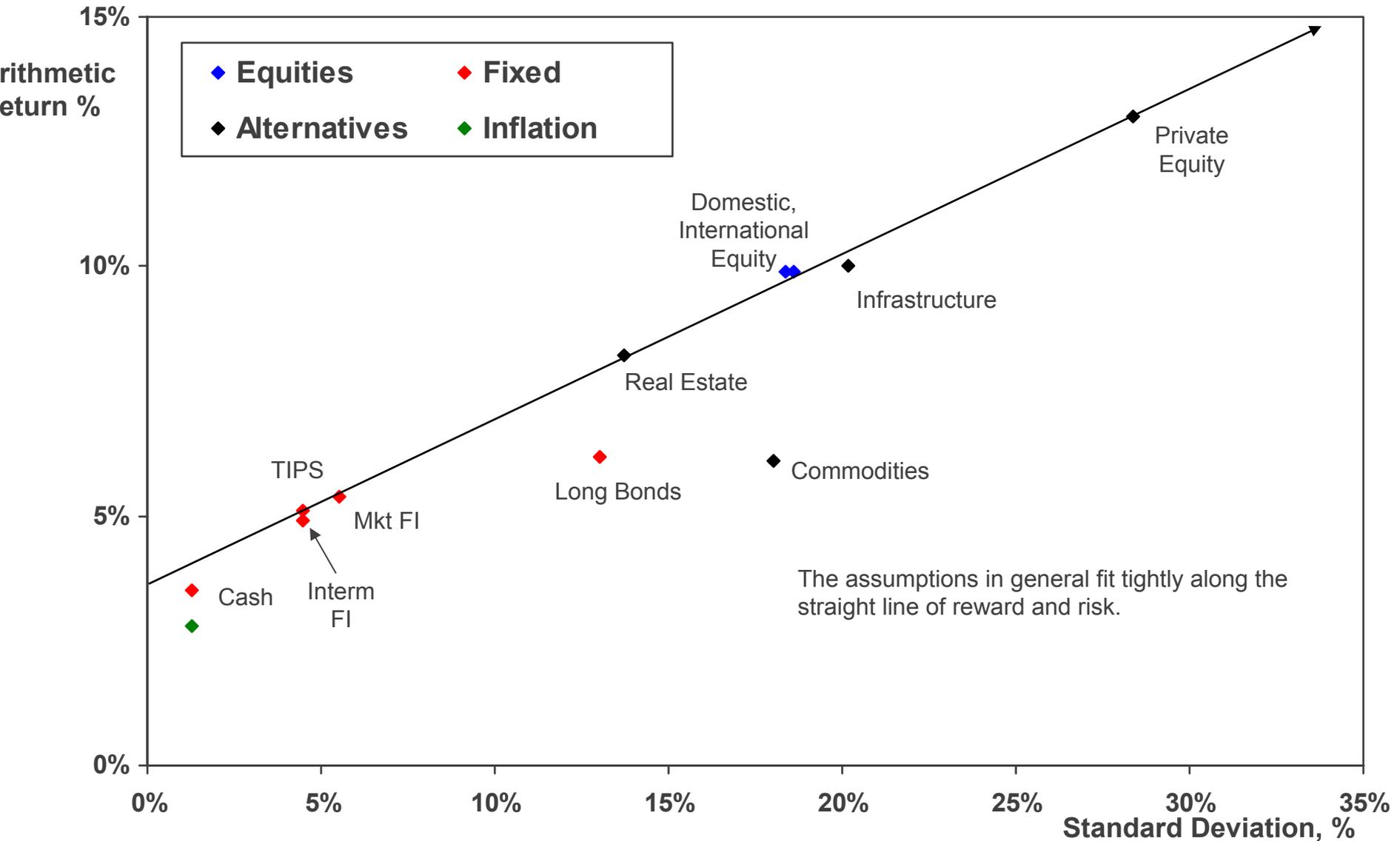
Mean-Variance Assumptions

	Geometric Return	Arithmetic Return	Standard Deviation	Beta	Duration	Liquidity
Domestic Equity	8.4%	9.9%	18.6%	1.00	0.0	9.0
International Equity	8.4%	9.9%	18.4%	1.00	0.0	8.8
Intermediate Bonds	4.8%	4.9%	4.5%	0.00	3.6	9.4
Mkt Bonds (Lehman Agg)	5.3%	5.4%	5.5%	0.10	4.8	9.3
Long Duration (14 yrs)	5.4%	6.2%	13.0%	0.00	14.0	9.5
TIPS	5.0%	5.1%	4.5%	0.00	2.4	9.7
Cash	3.5%	3.5%	1.3%	0.00	0.1	10.0
Real Estate [1]	7.3%	8.2%	13.7%	0.75	0.0	4.5
Private Equity	9.6%	13.0%	28.4%	1.35	0.0	0.0
Infrastructure	8.2%	10.0%	20.2%	1.10	0.0	0.0
Commodities	4.6%	6.1%	18.0%	0.00	0.0	9.5
Inflation	2.8%	2.8%	1.3%	--	--	--

	Dom Eq	Intl Eq	Inmd FI	Mkt FI	Long FI	TIPS	Cash	Real Estate	Private Eq	Infrastr
Domestic Equity	1.00									
International Equity	0.70	1.00								
Intermediate Bonds	0.20	0.10	1.00							
Mkt Bonds (Lehman Agg)	0.20	0.10	0.95	1.00						
Long Duration (14 yrs)	0.20	0.10	0.90	0.95	1.00					
TIPS	0.15	0.10	0.60	0.60	0.60	1.00				
Cash	0	0.0	0.25	0.10	0.10	0.30	1.00			
Real Estate [1]	0.60	0.40	0.20	0.30	0.20	0.30	0.10	1.00		
Private Equity	0.70	0.30	0.10	0.20	0.20	0.15	0	0.50	1.00	
Infrastructure	0.60	0.28	0.18	0.23	0.20	0.20	0	0.75	0.5	1.00
Commodities	0	0	0	0	0	0.30	0	0	0	0

[1] Combination of REITS and private real estate.

Mean-Variance Assumptions: July 2008



Other Possible Asset Classes

- High yield bonds
 - More correlated with equities than bonds, especially in stress scenarios
- International fixed income
 - After adjusting for currency effects, returns are similar to US
- Hedge Funds/Absolute Return
 - Is it really an asset class or manager alpha?

Other Considerations

- We often break down our asset allocation analysis into:
 - Public equities
 - Sum of Domestic and International Equities and REITS
 - Fixed Income
 - Nominal with specific duration
 - TIPS
 - Alternatives
 - Private Equity, Infrastructure, Private Real Estate, Hedge Funds, Commodities

Liquidity Issues

- Mercer includes liquidity as a separate measure
 - It roughly measures the ability to liquidate or rebalance an asset class in a one week time frame. It would reflect the total amount that can be traded, adjusted for transactions costs
 - For example, cash should have the highest liquidity. A plan should be able to access 100% of the current value; hence a perfect score of 10
 - Private equity offers no ability to transact in a week's time frame; hence a liquidity score of 0.

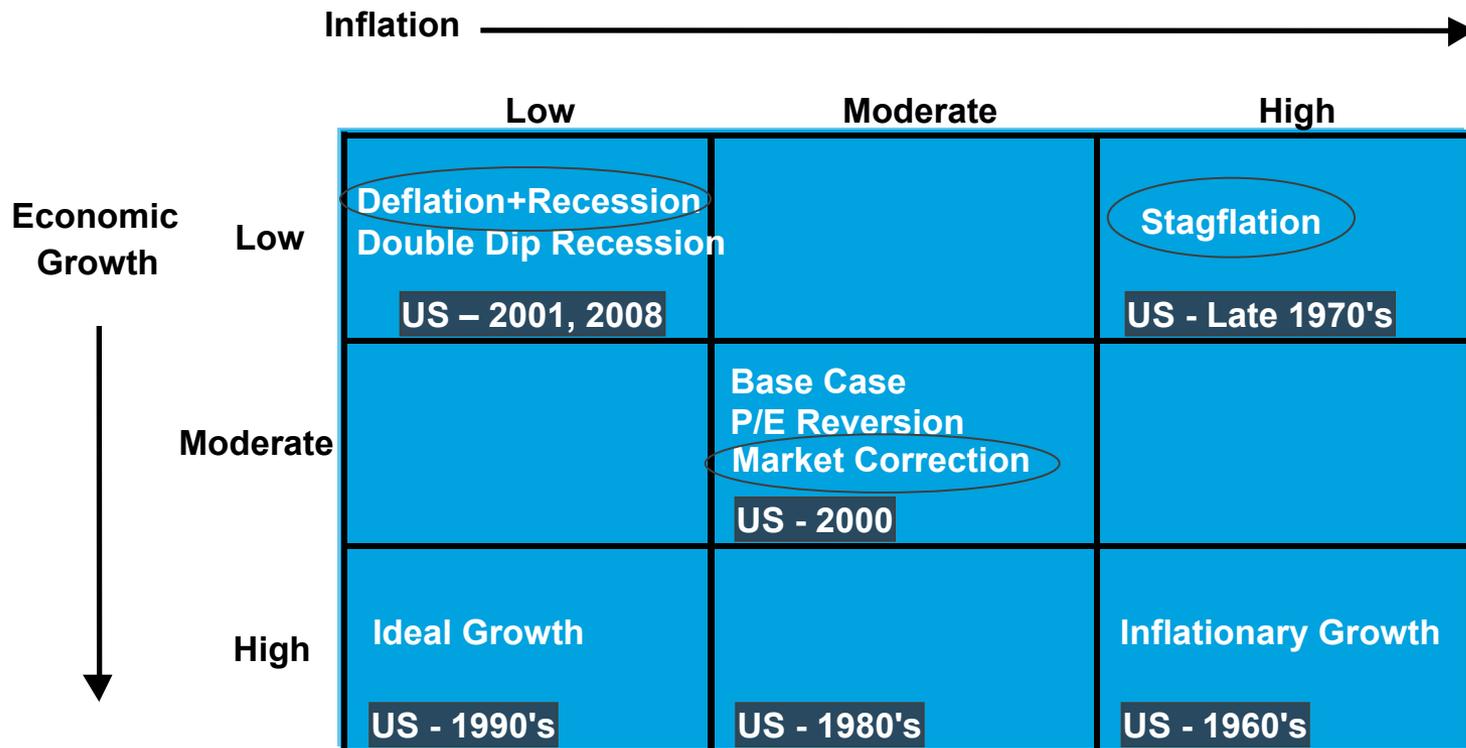
Correlation Issues

- We set long term correlations as direct inputs into our mean-variance optimizer to help guide our modeling process
- In times of stress, correlations tend to go to 1.0 for all risky assets and to -1.0 compared to riskless assets (cash, treasuries).
 - Our scenario analysis explicitly incorporates this in the recession scenario
 - In our stochastic analysis, we see correlation for equities and fixed income to have the expected median (around 0.2), but range from +0.7 to -0.5, so varying correlations do occur

Methodology & Tools

Scenario Analysis – Economic Scenario Framework

- The purpose of scenario testing is to stress test the asset policies and to understand what economic scenarios actually present risks to the Plan.



Description of Economic Scenarios

- Base Case: Interest rates rise, especially at the short end, to sustainable levels. Equities earn as projected.
- Stagflation: Rising inflation, rising interest rates, weak equity markets in first three years of projection
- Recession: Declining inflation, falling interest rates, weak equity markets in first three years of projection
- Inflationary Growth: Rising inflation, rising interest rates, but growth remains strong. Equity returns are initially weak, but rebound to high levels
- Ideal Growth: Low inflation, high growth
- Market Correction: Equities drop 25% in first year, but then normalize

Volatility of Interest Rates

- We model interest rates directly, using history as a guide.
 - Specifically, we look at relative volatility, which determines absolute volatility of interests

Historical Yield Volatility

Specific Bond		Time Period			Projected Volatility of Yields		
		Jan-63	Jan-83	Jan-98	Current Yield	Assumed Volatility	Current Absolute Std Dev
		Jul-08	Jul-08	Jul-08			
10-Year US Treasury	Relative Volatility	15.8%	16.8%	16.6%	3.99%	16.5%	0.66%
	Serial Correlation	-0.13	-0.36	-0.35			
3-Month US T-Bill	Relative Volatility		41.3%	51.6%	1.68%	30.0%	0.50%
	Serial Correlation		0.29	0.32			
10-Year US TIPS	Relative Volatility			21.2%	1.65%	20.0%	0.33%
	Serial Correlation			0.09			
Moody's AA Corp	Relative Volatility		10.3%	9.1%	6.09%	15.0%	0.91%
	Serial Correlation		-0.33	-0.11			

Liability Modeling Assumptions

Current Investment Policy

State Insurance Fund

	Policy Target Allocation	Policy Range	Benchmark
US Common Stock -- Large Cap	12%	9 - 15%	S&P 500 Wilshire 4500/Russell 2500
US Common Stock -- Small/Mid Cap	3%	2 - 4%	
Total US Common Stock	15%		
Non-US Stock -- International unhedged	5%	4 - 6%	MSCI EAFE
Total Non-US Stock	5%		
US Fixed Income -- Long	54%	51 - 57%	Lehman Long Govt/Cred ML High Yield Master Lehman US TIPS 90-Day T-Bill
US Fixed Income -- High Yield	5%	4 - 6%	
US Fixed Income -- TIPS	20%	17 - 23%	
US Fixed Income -- Cash	1%	0 - 6%	
Total Fixed Income	80%		
Total Alternatives	<1%	N/A	Wilshire 5000 + 5%
US Equity vs. Non-US Equity	75:25		

Background

- Two types of liabilities
 - Medical indemnity: growing at 9% per year
 - Wage replacement: growing at inflation + productivity growth
 - Medical duration vs. wage duration
- Deloitte study
 - Developed Funding Status policy
- Discount rate currently at 5%
 - Deloitte has recommended 4%
 - We also recommend reviewing the liabilities under a mark to market discount rate that reflects current interest rates
 - Use 10-year Treasury yield as riskless rate

Asset & Liability Summary

As of June 30, 2008

Ohio Bureau of Workers' Compensation

As of June 30, 2008 (in \$Millions)

	Unpaid Losses		Fund Assets*	Funded Ratio
	Undiscounted	5% Discounted		
State Insurance Fund (SIF)	28,953	15,701	15,944	102%
All Other Funds				
Disabled Workers' Relief Fund (DWRF)	3,828	1,895		
Coal-Workers Pneumoconiosis Fund (CWPF)	98	63		
Public Work-Relief Employees' Compensation Fund (PWREF)	7	4		
Marine Industry Fund (MIF)	6	3		
Self-Insuring Employers Guaranty Fund (SIEGF)	1,625	719		
Administrative Cost Fund (ACF)	2,025	1,098		
Sub Total	7,589	3,782	1,472	39%
Total All Funds	36,542	19,483	17,416	89%

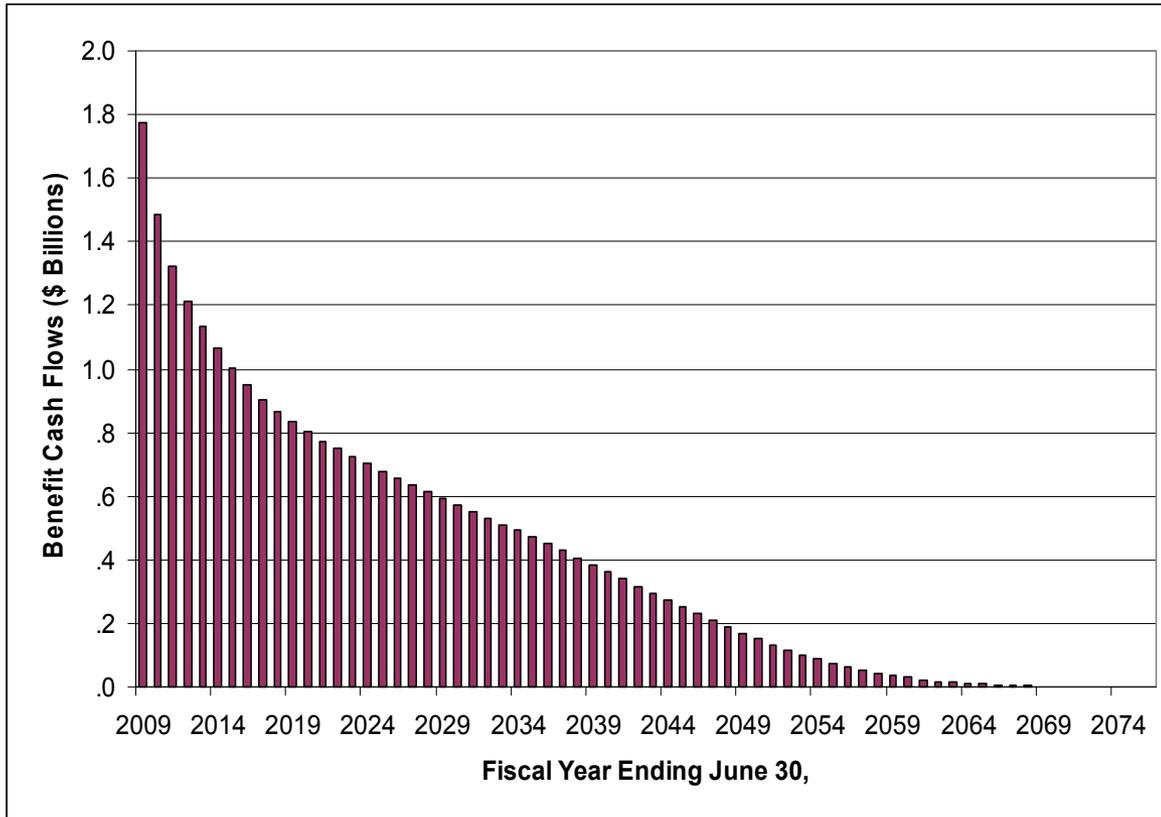
* Based on Asset Reporting Fund Composites

SIF Fund (break out by Employer Type)	5% Discounted Unpaid Losses
Private (PA)	11,918
Taxing Districts (PEC)	2,205
State Agencies (PES)	715
Self Insured	184
Health Partnership Program (HPP)	679
Total SIF Fund	15,701

Key Points

- State Insurance Fund (SIF) contains ~80% of the liabilities and ~92% of the overall assets
- SIF Plan is 102% funded on 5% discount rate basis.

Projected Benefit Payments and Interest Rate Sensitivity



6/30/2008 Unpaid Losses	Interest Rate		Duration
	5.00%	4.00%	
Private Employers (PA)			
--Medical	5,126	5,704	10.7
--TT	598	618	3.3
--PTD	2,772	3,056	9.8
--Death & Other Comp	3,422	3,696	7.7
Total	11,918	13,074	9.3
Public Employers (PEC & PES)			
--Medical	1,616	1,853	13.7
--TT	169	177	4.6
--PTD	539	593	9.5
--Death & Other Comp	596	645	7.9
Total	2,920	3,268	11.3
Combined Total	14,838	16,342	9.7

Comments

- Benefits will be paid over a very long period of time for all plans.
- These cashflows will be adjusted every year to reflect changes in census data and claims experience.
- On a mark to market basis, the overall duration of the liabilities is about 10

Projection Model

- **Liability Projection** The liabilities will be projected from the most recent available June 30, 2008 actuarial audit reflecting the current benefit structure and assumptions in effect within the valuation.
 - Economic Assumptions: medical inflation
 - Demographic assumptions: mortality, disability, and utilization trends
 - Liabilities will be considered a “closed book”. Injuries that will occur in the future (after June 30, 2008) are not include in this analysis
- **Projection Period**
 - Should coordinate with BWC’s planning horizon; suggest period between 5 and 10 years.
- **Future Discount Rates**
 - Currently using 5%
 - Deloitte recommended 4%
 - Rate varies with Treasury yields (mark to market)
- **Possibly incorporate year to date market returns since June 30, 2008**

Key Metrics

When Analyzing the Asset Mix Decisions

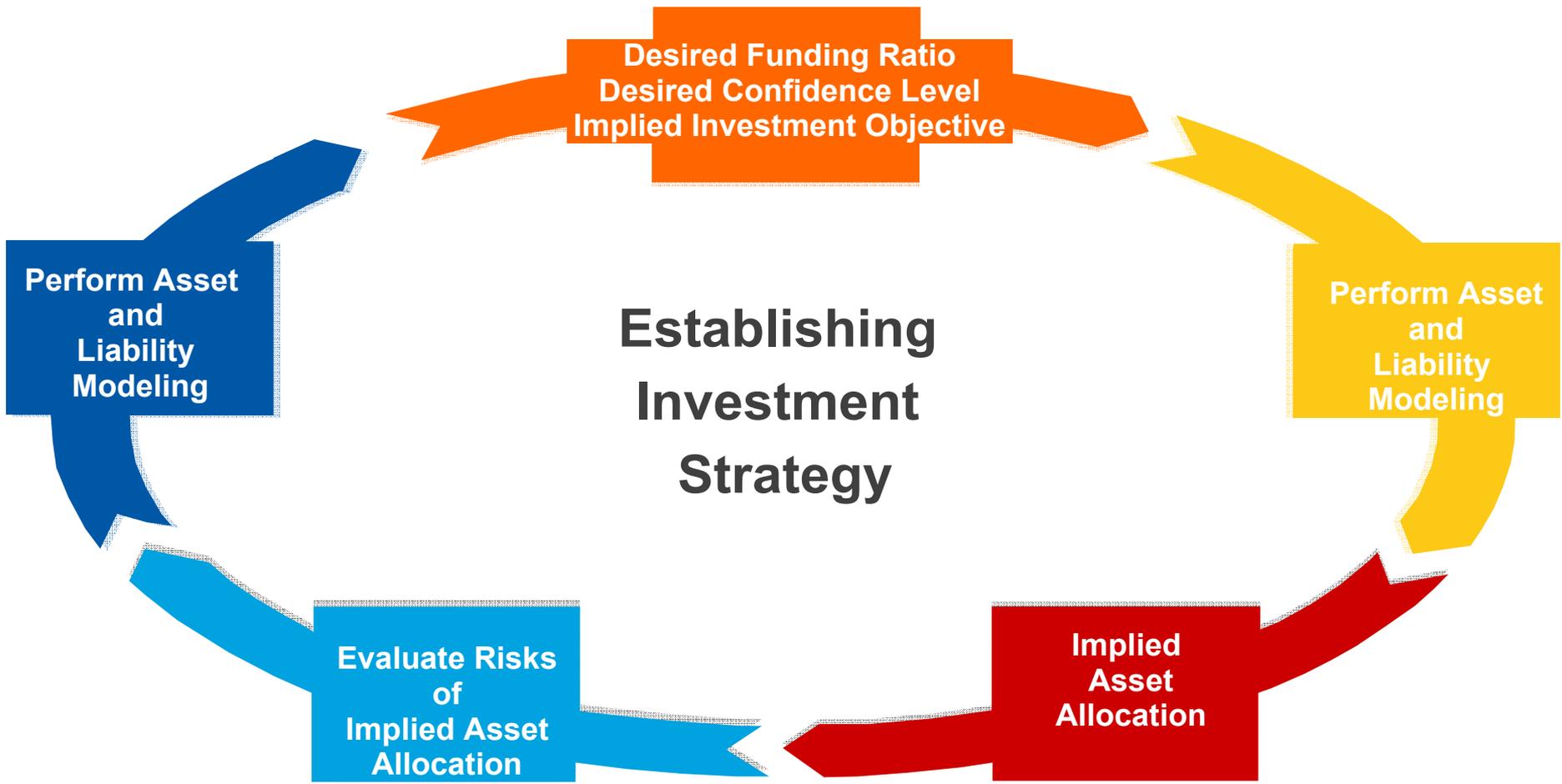
- Plan sustainability metrics:
 - Reward: probability of meeting objective
 - We recommend a Funding Ratio of 1.0 at 4.0% discount rate
 - Risk: 95th percentile of Funding Status
- Asset/Liability metrics
 - Reward: Median funded status at a point in time
 - Risk: Dispersion at a point in time
 - Risk: Dispersion of Funding Status
 - Variability of Funding Status
- Asset-only metrics:
 - Reward: Expected Return
 - Risk: Standard Deviation of Return
- Liquidity Score
- Funded Status Volatility (year to year)
 - Static vs “mark to market” discount rate

Next Steps

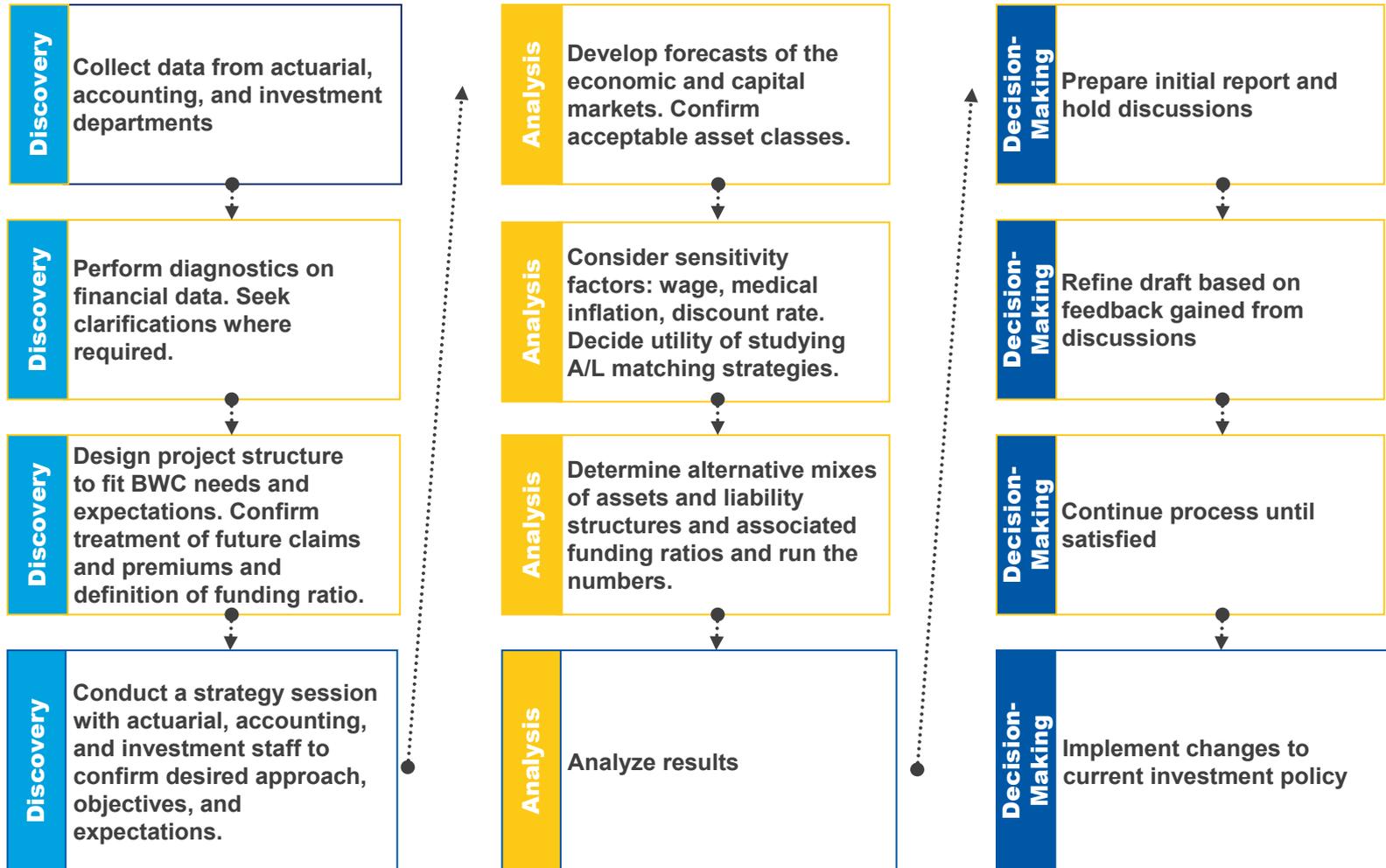
- Confirm Asset Class opportunity set
- Agree on Asset Class Returns and Correlation Assumptions
- Agree on Projection Parameters
- Confirm Key Metrics
- Perform Asset/Liability Analysis
- Begin preparation for next check-in meeting

Appendix

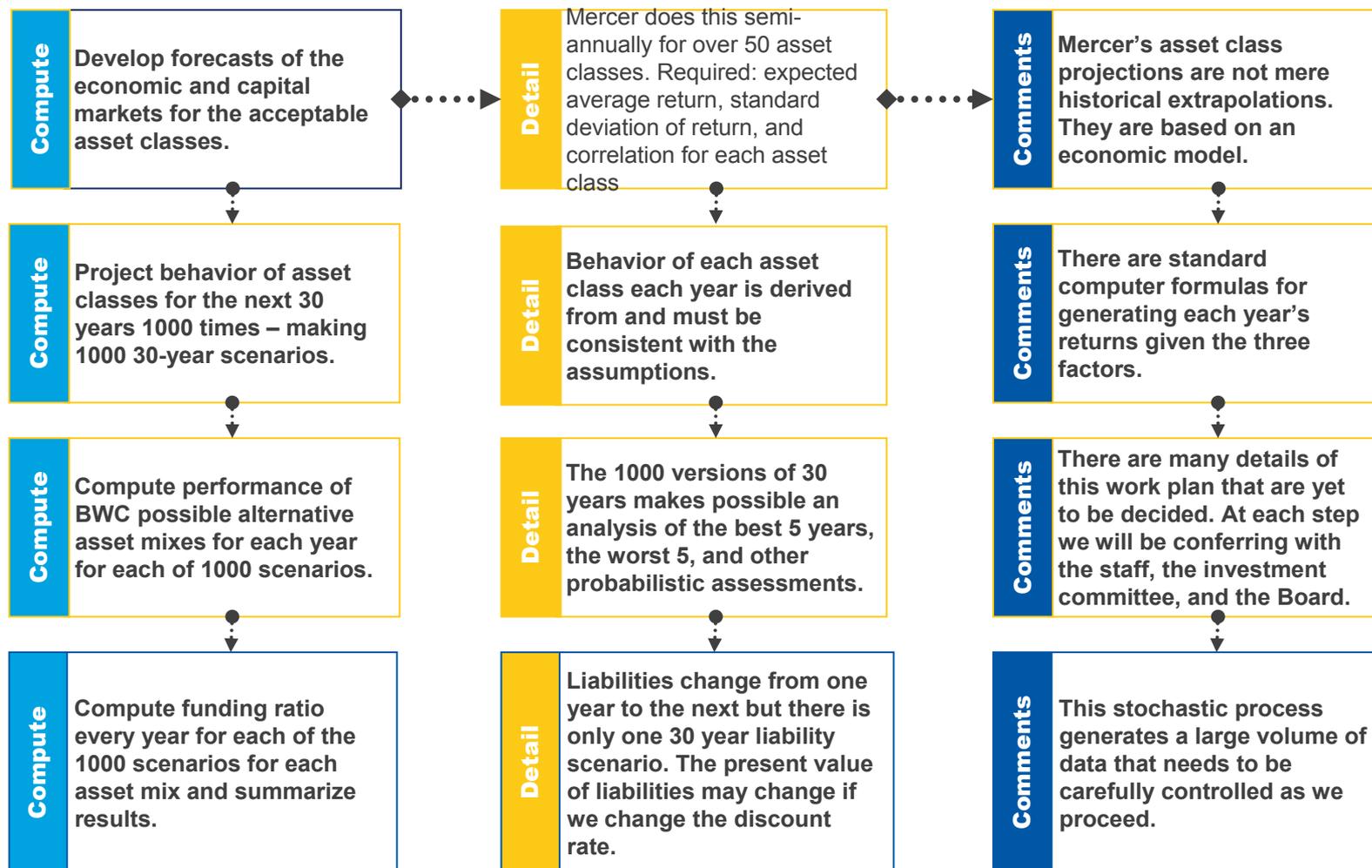
Overview of Process - Setting Investment Strategy



Work Plan – Strategic Study of Assets and Liabilities



Overview of How the Stochastic Simulation Works



MERCER



MARSH MERCER KROLL
GUY CARPENTER OLIVER WYMAN