March 26, 2019

2019 Asset Allocation

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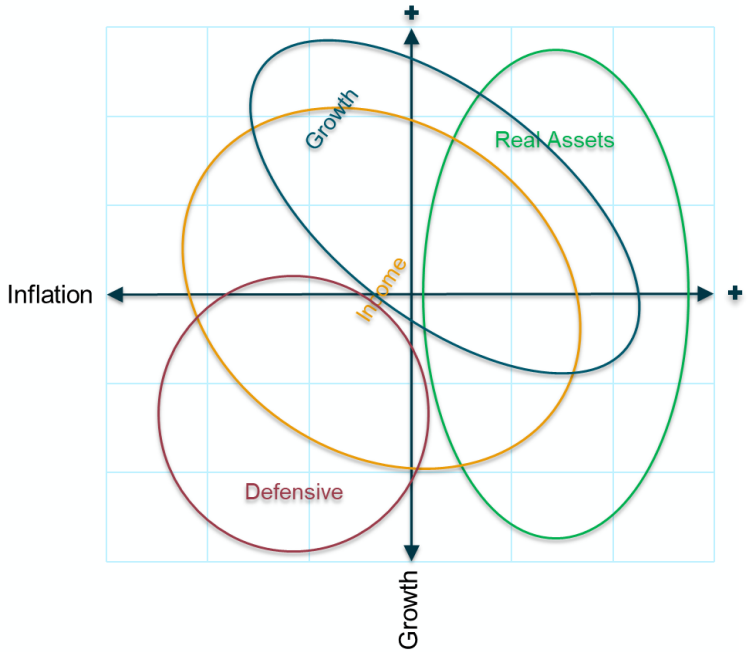
Introduction

- Framing the portfolio in order to diversify across fundamental, long-term drivers of economic regimes
- Simplify thinking for clarity and communication
- Return expectations:
  - Growth: CPI + 6%
  - Real Assets: CPI + 5.5%
  - Income: CPI + 4.5%
  - Defensive: CPI + 2.5%



Introduction

- Investment objective: CPI + 5%
  - 10-year inflation estimate at ~2.2% (long term average ~3.3%)
  - 7.2% is a minimum target return

- Risk parameters adopted in 2016
  - Volatility similar to 70/30 stocks and bonds mix (14% historically, 12% forecasted)
  - Drawdown of -25%, -45% in extreme scenario
  - 35% max illiquidity
  - All asset classes up for consideration (de-emphasize investments similar to SITLA activities)

- Given return objective and drawdown tolerance, we estimate annualized volatility of ~14% is maximum acceptable
  - Three downside standard deviations implies ~35% drawdown if ~7% expected return
  - Historical volatility of 70/30 mix is 14% historically, 12% forecasted

- Forward-looking returns are low, current target is not forecasted to earn CPI + 5% using FEG CMA
  - Review and discuss level of concern and potential options

Introduction

- Feedback from modeling is not prescriptive, but is the best framework we have
  - Decisions based on risk/return but also non-model factors such as capabilities of staff and consultant, liquidity preferences, risk tolerance, etc.
  - Avoid year-to-year whipsaw (strategic not tactical exercise)
- Improving our process, relying less on constraints to maintain pragmatism and diversification
- Embracing uncertainty
- Stress test, revisit, evolve

Introduction

- Modeling flaws
  - Estimation bias
  - Input sensitivity
  - Extreme output
  - Unintuitive (betas, distributions)
  - Non-dynamic (nonadaptive)

- Address modeling flaws
  - Constraints
  - Capital market assumptions
  - Bayesian (update priors) techniques
  - Multiple optimization models
  - Include sensitivities to understand them

Introduction

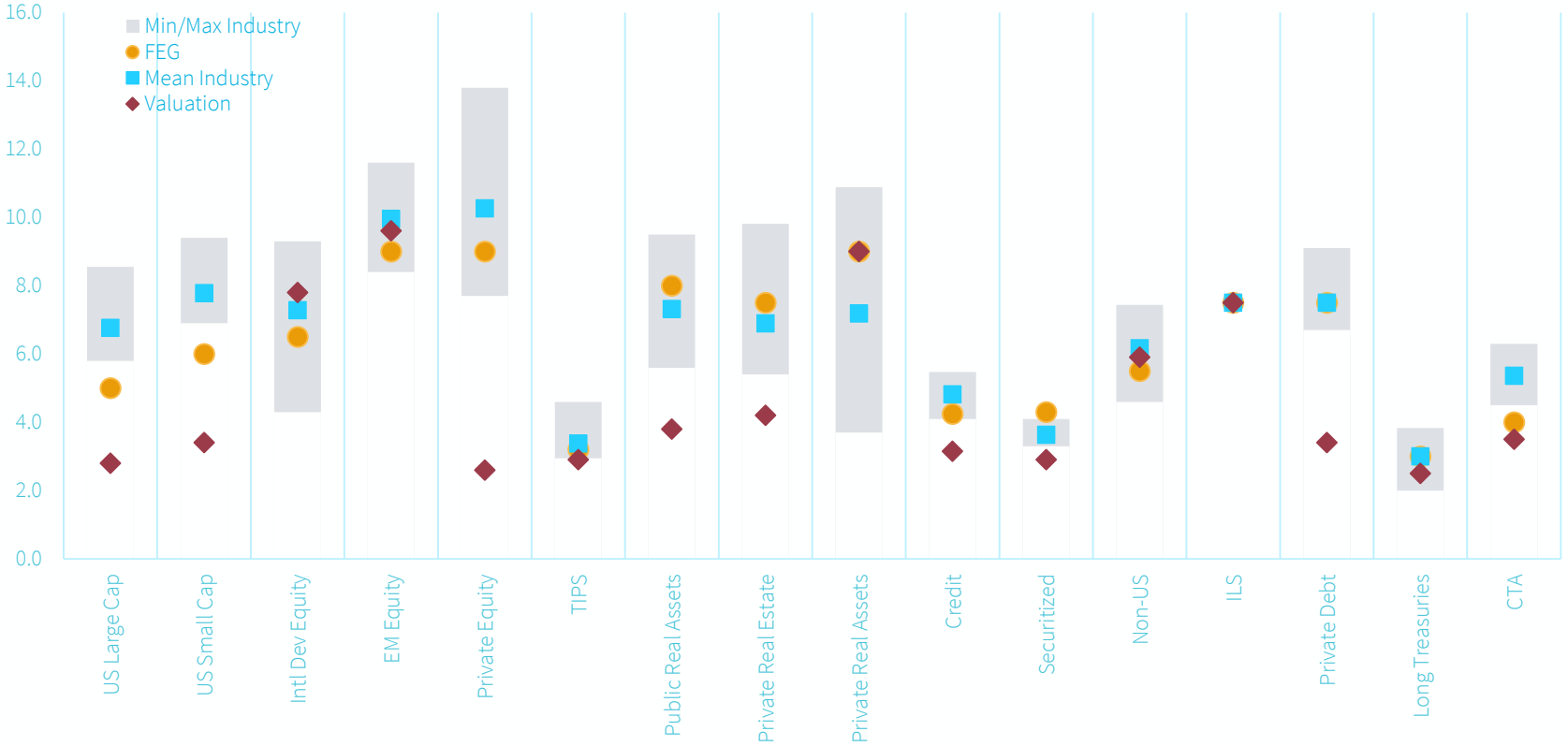
- Executive summary
  - Late-cycle economies across the globe and high valuations suggest lower expected returns
  - Models emphasize non-U.S. markets and private markets
  - Target portfolio partly reflects this, could modify further
  - SITFO includes potentially higher return strategies than mapped in FEG CMAs (frontier, microcap, etc.)
  - SITFO includes smaller, niche managers, working towards more efficient strategy structures where possible
  - Diversification and patience are valuable

Step 1: Capital Market Assumptions

- CMA are forecasts
- CMA are betas and exclude manager alpha
- CMA are not 100% mapping of SITFO portfolio
- To address the first problem, multiple sources and framing of CMA
  - FEG
  - Industry
  - Valuation
- Identify deterministic tilts

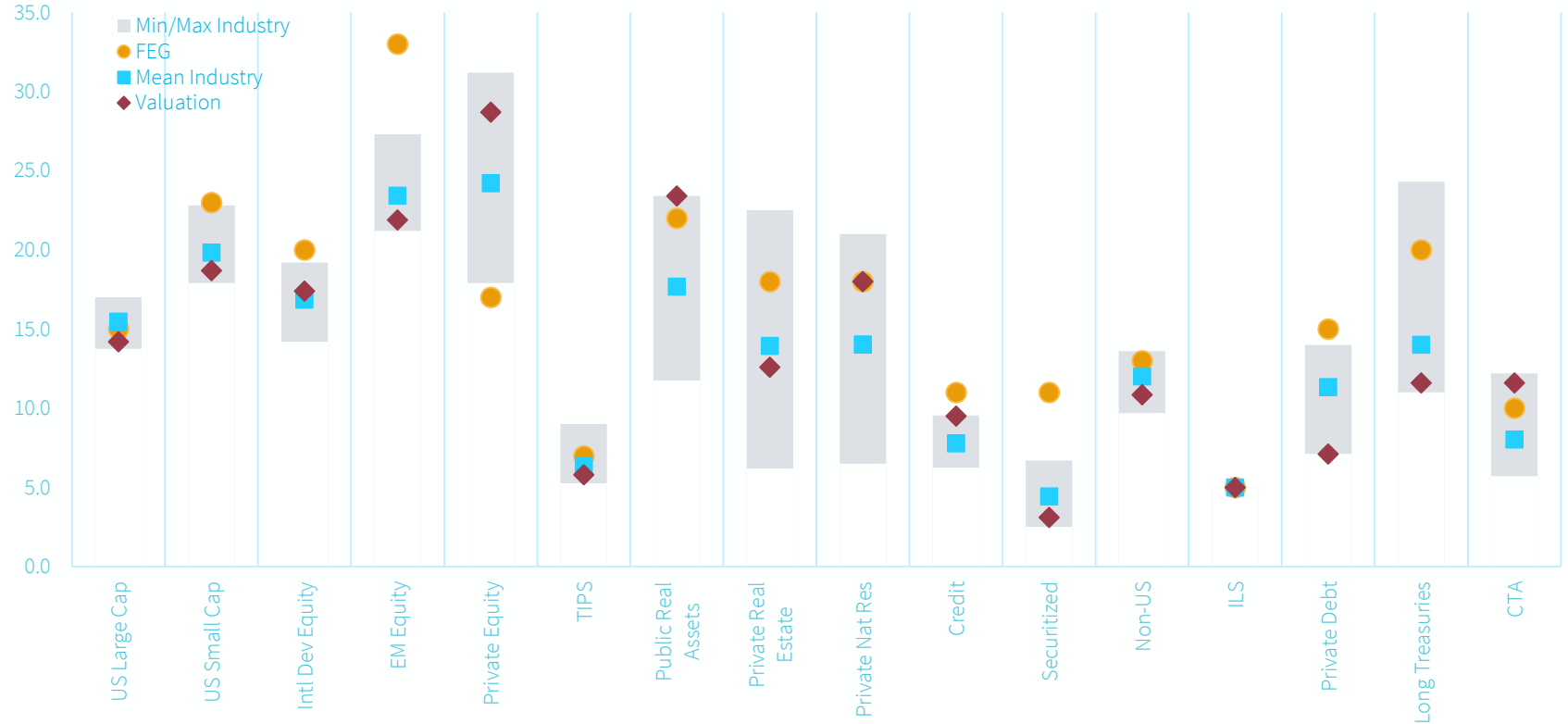
Step 1: Capital Market Assumptions

2019 Return



Step 1: Capital Market Assumptions

2019 Risk



Step 1: Capital Market Assumptions

Historical CMA

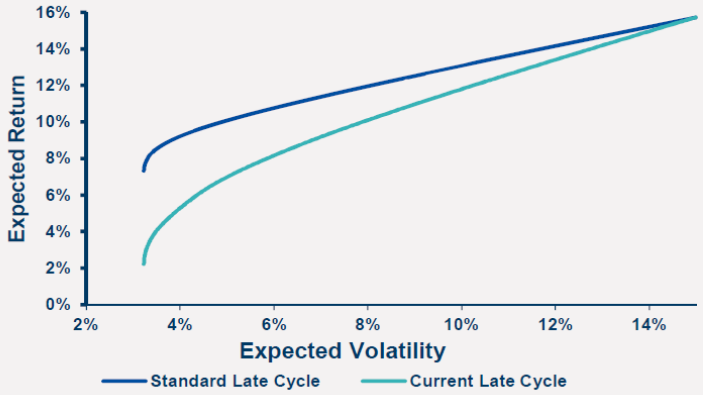
Return	FEG 2016	FEG 2017	FEG 2018	Industry μ 2018	FEG 2019	Industry μ 2019
Inflation	2.0	2.2	2.2		2.2	
Growth						
U.S. Large Cap	5.2	5.0	4.5	6.2	5.0	6.8
U.S. Small Cap	5.7	5.5	5.5	7.0	6.0	7.8
Intl Dev Equity	7.2	7.0	7.0	6.9	6.5	7.3
EM Equity	9.2	9.5	9.0	9.4	9.0	10.0
Private Equity	10.0	10.0	9.5	9.3	9.0	10.3
Real Assets						
TIPS	2.5	2.7	2.6	2.7	3.2	3.4
Public Real Assets	5.8	7.0	7.0	7.9	8.0	7.3
Private Real Estate	8.0	8.0	8.0	7.2	7.5	6.9
Private Real Assets	10.0	10.0	10.0	8.5	9.0	7.2
Income						
Credit	6.5	3.8	3.6	4.0	**4.3**	4.8
Securitized	6.0	4.2	4.0	3.4	**4.3**	3.6
Non-U.S.	5.3	5.2	5.0	5.3	5.5	6.2
ILS			7.4	7.4	**7.5**	7.5
Private Debt	9.0	8.0	7.5	7.4	7.5	7.5
Defensive						
Long Treasuries	2.5	3.0	3.2	2.6	**3.0**	3.0
Systematic Con.	5.5	5.5	5.5	4.9	4.0	4.0
Cash	1.5	1.5	1.6	2.1	2.2	2.2

Risk	FEG 2016	FEG 2017	FEG 2018	Industry μ 2018	FEG 2019	Industry μ 2019
Growth						
U.S. Large Cap	22.1	20.0	20.0	16.2	15.0	15.5
U.S. Small Cap	30.0	27.0	27.0	18.9	23.0	19.8
Intl Dev Equity	24.6	25.0	22.0	18.3	20.0	16.9
EM Equity	34.0	34.0	34.0	24.5	33.0	23.4
Private Equity	35.0	35.0	35.0	20.7	17.0	24.2
Real Assets						
TIPS	6.5	6.5	6.5	6.8	7.0	6.3
Public Real Assets	22.9	22.5	22.3	19.0	22.0	17.7
Private Real Estate	25.0	25.0	25.0	13.5	18.0	13.9
Private Real Assets	30.0	30.0	30.0	18.3	18.0	14.0
Income						
Credit	15.0	11.0	8.0	8.0	**11.0**	7.8
Securitized	12.0	11.4	15.0	3.3	**11.0**	4.4
Non-U.S.	14.0	14.0	14.0	10.2	13.0	12.0
ILS			5.0	5.0	**5.0**	5.0
Private Debt	21.0	21.0	21.0	10.9	15.0	11.3
Defensive						
Long Treasuries	12.0	8.5	8.5	9.5	**20.0**	14.0
Systematic Con.	12.0	12.0	12.0	9.1	10.0	8.0
Cash	0.0	0.0	0.0	0.7	0.0	0.7

Step 1: Capital Market Assumptions

- Current conditions suggest lower returns for given levels of risk
- Mature financial cycles tend to be more vulnerable due to higher valuations, higher levels of debt, and tightening liquidity / financial conditions
- The risk per unit of return is skewed to the downside as valuations are higher, yields are lower, and growth is expected to be slower

1/ **Expect a lower efficient frontier**



The chart compares two efficient frontiers and plots the risk and total return profiles of 200 efficient cross asset portfolios (with different allocations optimised by volatility levels) for each frontier. The Standard Late Cycle frontier is calculated on historical average yearly returns and a covariance matrix during the Late Cycle regime. The Current Late Cycle frontier is calculated taking into account current bond and dividend yields. Asset class universe (local currency): US equities total return (S&P 500), US and Euro govies (JPM), US and Euro IG (ML), US and Euro HY (ML), GEM bond (JPM), US IL all maturities (Barclays).

Source: Amundi Research, Bloomberg. Data as of 15 October 2018.

Step 2: Select CMA and Optimization Models

- Three sets of inputs
  - FEG
  - Industry
  - Valuation

- Three optimization models
  - Mean-variance
  - Mean-downside
  - CVaR
  - Resample each “run”

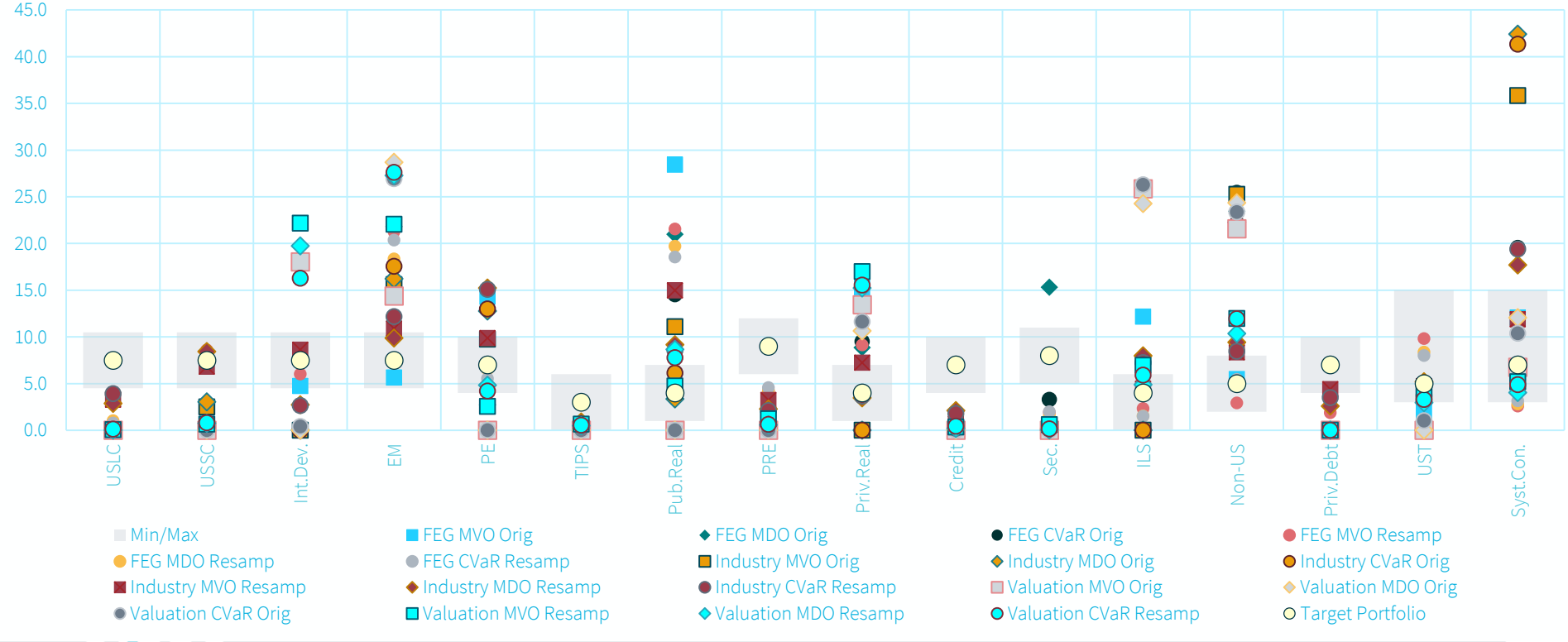
- Constraints
  - Liquidity
  - Avoiding determinism

Step 2 or 3 for the model output? This is not a page

- Insert nine two-page PDFs of model output

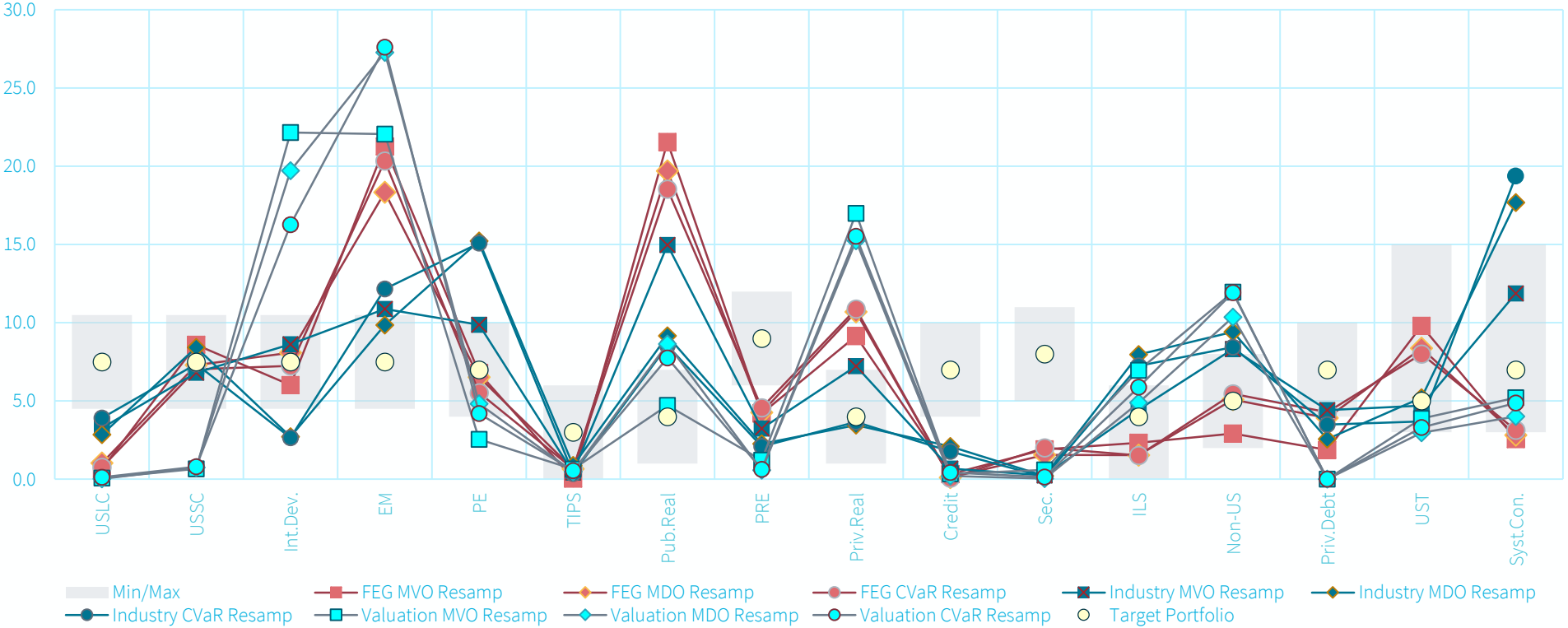
Step 3: Generate Model Output

- Aggregated output across asset class
- Asset class weights for efficient portfolios meeting CPI + 5% portfolio return (7.25%-7.5%)



Step 3: Generate Model Output

- As above, but drop unaffected efficient frontiers in favor of resampled frontiers
- Asset class weights for efficient portfolios meeting CPI + 5% portfolio return (7.25%-7.5%)



Step 3: Generate Model Output

- As above, but drop unaffected efficient frontiers in favor of resampled frontiers (table form)
- Asset class weights for efficient portfolios meeting CPI + 5% portfolio return (7.25%-7.5%)

	FEG MVO Resamp	FEG MDO Resamp	FEG CVaR Resamp	Industry MVO Resamp	Industry MDO Resamp	Industry CVaR Resamp	Valuation MVO Resamp	Valuation MDO Resamp	Valuation CVaR Resamp
US Large Cap	0.7	1.0	0.8	3.3	2.9	3.9	0.1	0.0	0.1
US Small Cap	8.6	7.3	7.0	6.8	8.4	7.4	0.7	0.7	0.8
Int Dev Equity	6.0	8.1	7.3	8.6	2.7	2.6	22.2	19.7	16.3
Emerging Markets	21.3	18.3	20.3	10.9	9.9	12.2	22.1	27.3	27.6
Private Equity	6.8	6.5	5.5	9.9	15.2	15.1	2.5	4.8	4.2
TIPS	0.0	0.7	0.7	0.4	0.9	0.4	0.7	0.5	0.5
Public Real Assets	21.6	19.7	18.5	15.0	9.2	8.5	4.7	8.6	7.8
Private Real Estate	4.2	4.3	4.6	3.2	2.3	2.1	1.2	0.6	0.6
Private Real Assets	9.1	10.7	10.9	7.2	3.5	3.7	17.0	15.2	15.5
Credit Composite	0.3	0.1	0.1	0.7	2.1	1.8	0.3	0.2	0.4
Securitized	1.9	1.6	2.0	0.2	0.2	0.1	0.6	0.0	0.1
ILS	2.3	1.5	1.5	4.4	8.0	7.2	7.0	4.9	5.9
Non-US Debt	2.9	5.1	5.5	8.3	9.4	8.4	12.0	10.4	11.9
Private Debt	1.9	3.9	4.3	4.4	2.6	3.5	0.0	0.0	0.0
Long Term Treasurys	9.8	8.4	8.0	4.7	5.2	3.7	3.9	3.0	3.3
Systematic Convexity	2.6	2.8	3.1	11.9	17.7	19.4	5.2	4.0	4.9

Step 4: Select Specific Portfolios

- Target portfolio
- 70/30 portfolio
- Observation portfolio 1
  - Feasible portfolio, within existing targets and ranges
- Observation portfolio 2
  - Anchored portfolio to existing targets but outside allowable ranges
  - An expression of what the models are suggesting
  - More non-U.S. equity, less income, larger private allocation, more systematic convexity

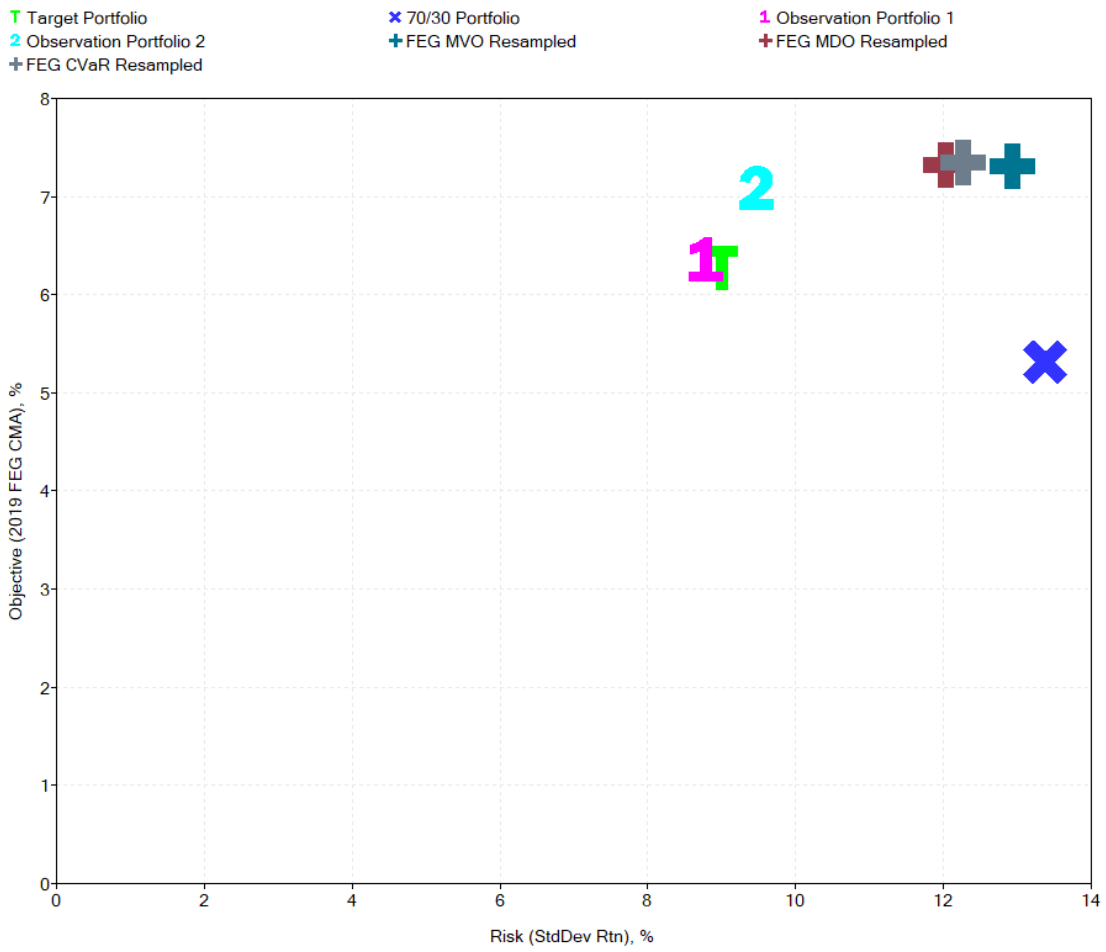
	Min	Max	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
U.S. Large Cap	4.5	10.5	7.5	35.0	7.5	4.5
U.S. Small Cap	4.5	10.5	7.5		5.5	4.5
Int Dev Equity	4.5	10.5	7.5	35.0	7.5	7.5
Emerging Markets	4.5	10.5	7.5		7.5	10.0
*Private Equity	7.0	10.0	7.0		9.0	15.0*
TIPS	0.0	6.0	3.0		3.0	2.0
Public Real Assets	1.0	7.0	4.0		4.0	10.0*
*Private Real Estate	6.0	12.0	9.0		7.0	2.0*
*Private Real Assets	1.0	7.0	4.0		6.0	15.0*
Credit Composite	4.0	10.0	7.0	30.0	7.0	2.0*
Securitized	5.0	11.0	8.0		8.0	2.0*
ILS	0.0	6.0	4.0		4.0	2.0
Non-U.S. Debt	2.0	8.0	5.0		5.0	4.0
*Private Debt	4.0	10.0	7.0		7.0	5.0
Long Term Treasurys	3.0	15.0	5.0		5.0	5.0
Systematic Convexity	3.0	15.0	7.0		7.0	9.5

**35% max total private allocation*

** Outside existing constraints*

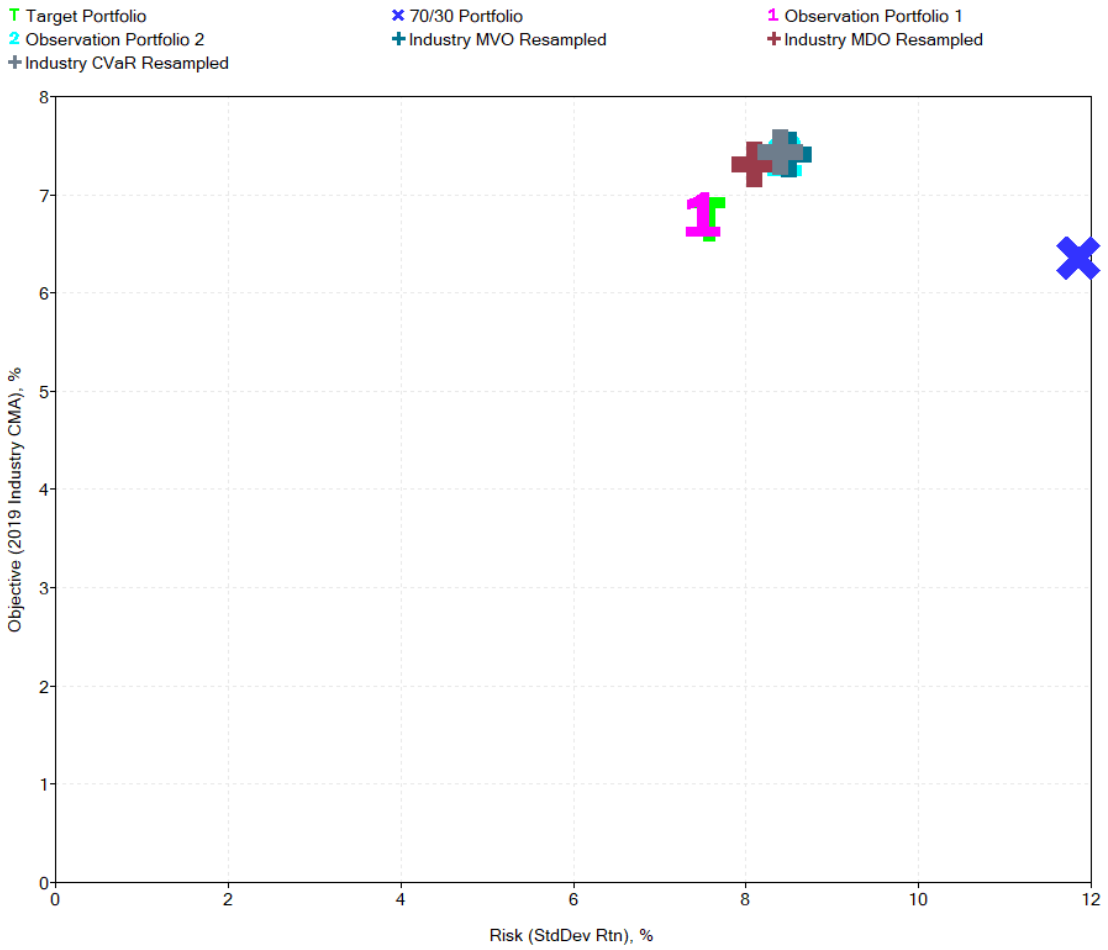
Step 5: Analyze Selected Portfolios

- Using FEG CMA
- Plotting seven portfolios
  - Four selected portfolios
  - Three efficient portfolios (CPI + 5% efficient portfolio per model)



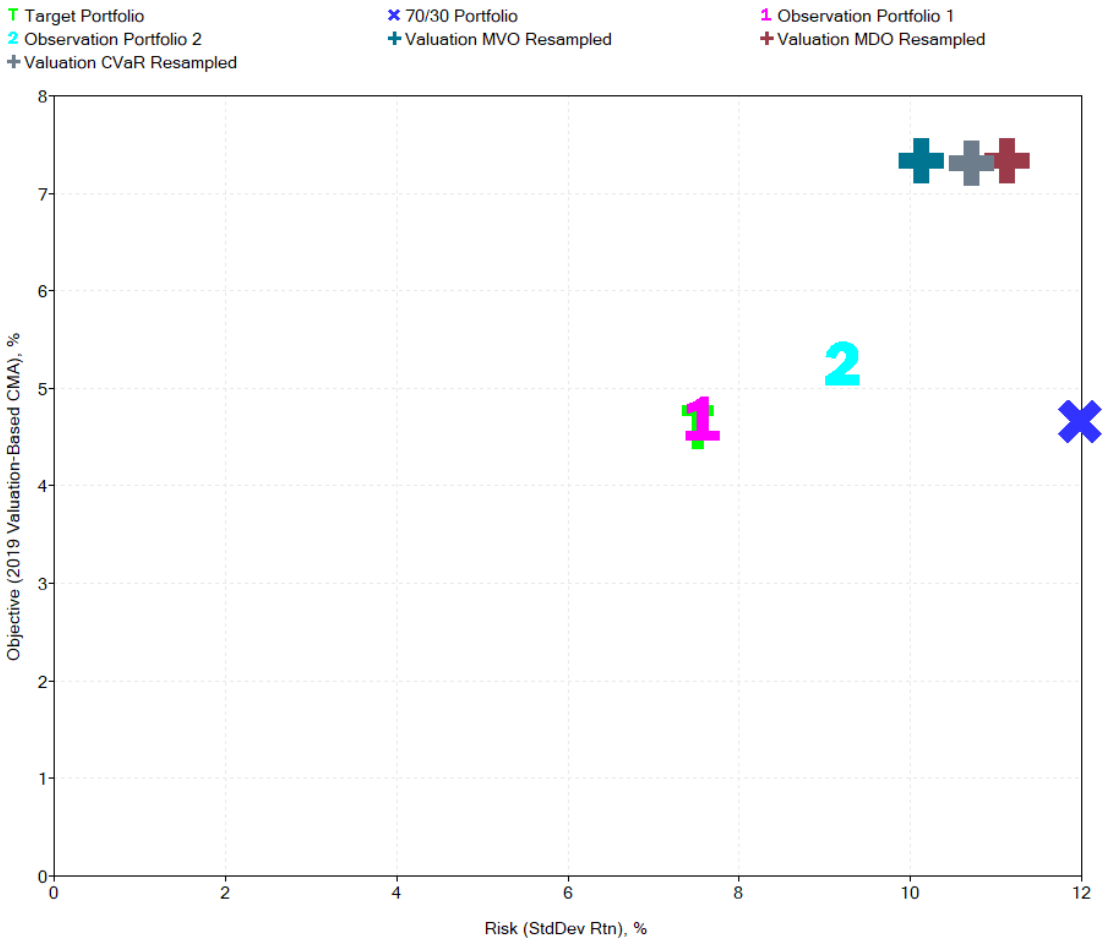
Step 5: Analyze Selected Portfolios

- Using industry CMA
- Plotting seven portfolios
  - Four selected portfolios
  - Three efficient portfolios (CPI + 5% efficient portfolio per model)



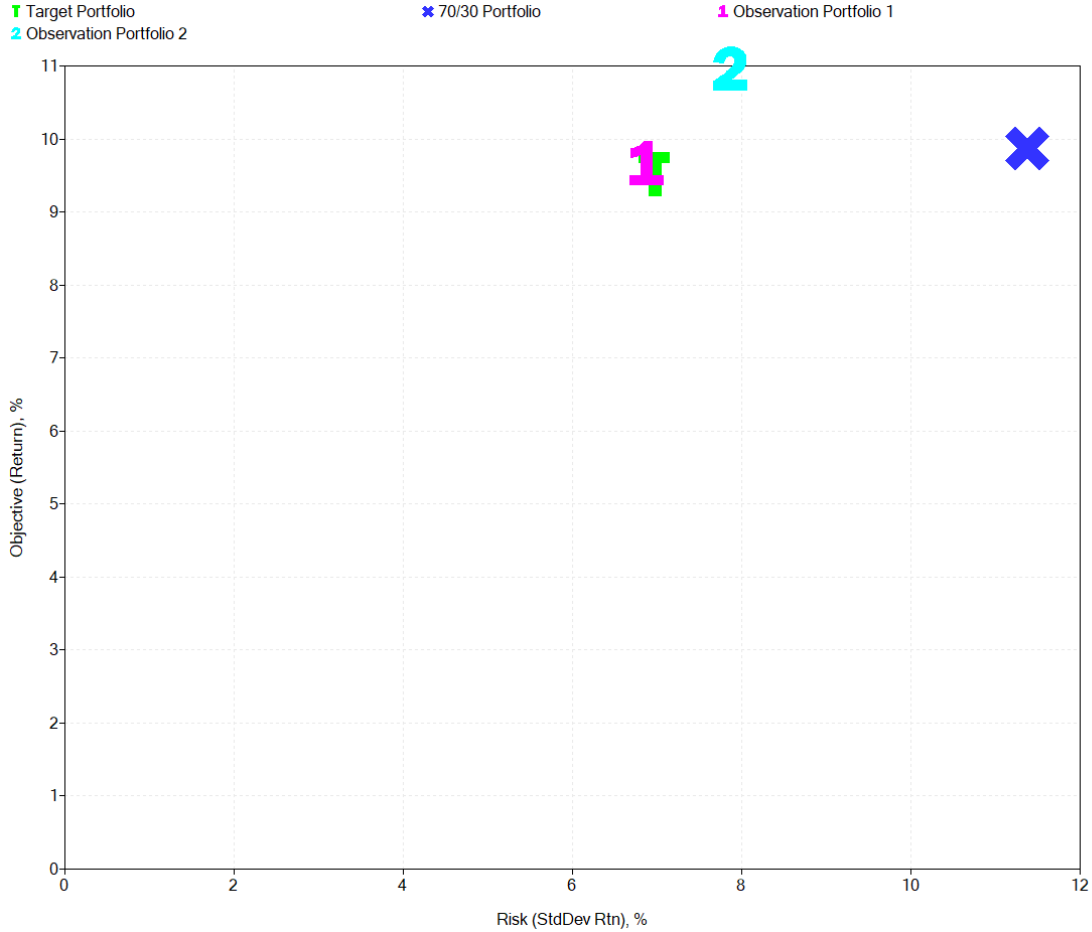
Step 5: Analyze Selected Portfolios

- Using valuation CMA
- Plotting seven portfolios
  - Four selected portfolios
  - Three efficient portfolios (CPI + 5% efficient portfolio per model)



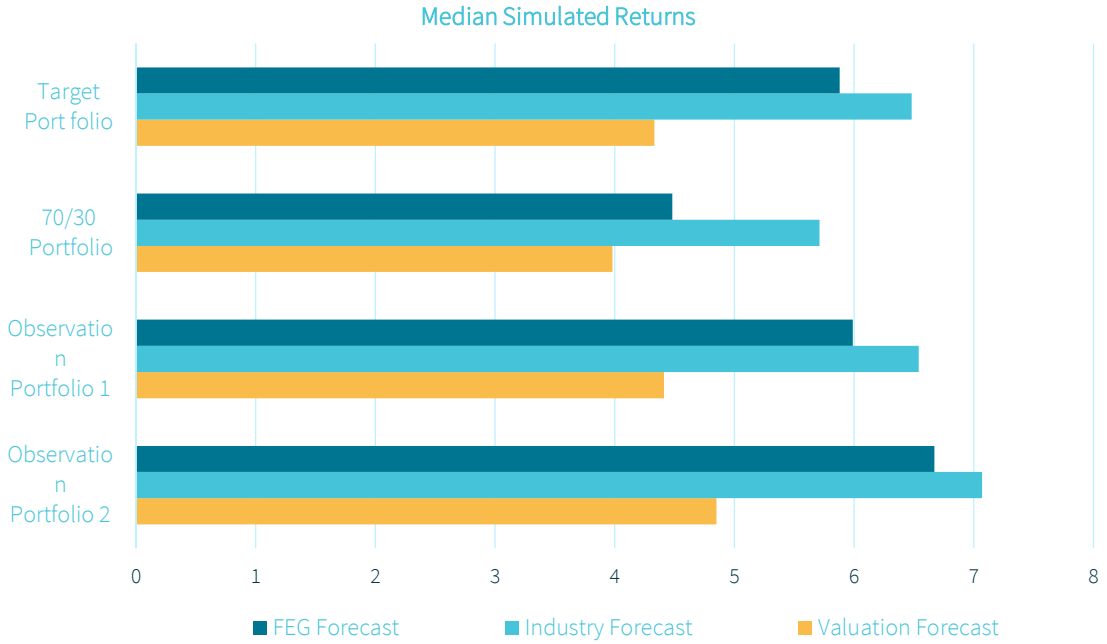
Step 5: Analyze Selected Portfolios

- Using historical data as CMA



Step 5: Analyze Selected Portfolios

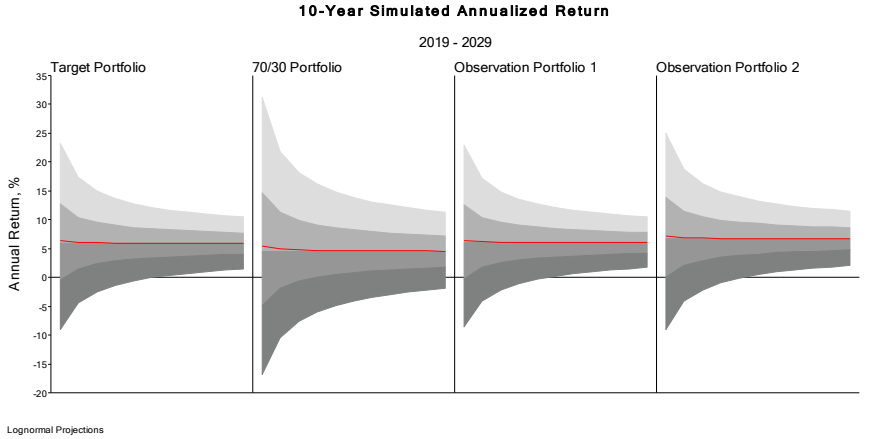
- Summary of simulated return distributions
  - Retain forecast context to retain range of analysis
  - Historically correlated, Brownian motion asset paths
  - Median / 50th percentile implies 50% probability
  - Simulated distributions are centered on same median for both 10- and 25- year projects
  - $S_T = S_0 \exp\{(\mu - \sigma^2/2)T + \sigma B_T\}$



	Target Port folio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
FEG Forecast	5.88	4.48	5.99	6.67
Industry Forecast	6.48	5.71	6.54	7.07
Valuation Forecast	4.33	3.98	4.41	4.85

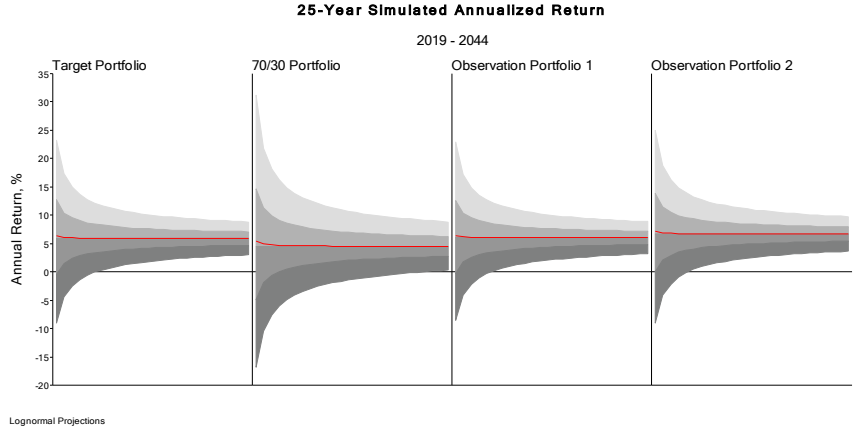
Step 5: Analyze Selected Portfolios

- Simulated return distributions
  - FEG CMA
  - Four selected portfolios
  - 10- and 25- year simulations



10-Year Simulated Annualized Returns

	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
5th Percentile	1.28	-2.23	1.51	1.84
25th Percentile	3.97	1.67	4.13	4.66
50th Percentile	5.88	4.48	5.99	6.67
75th Percentile	7.83	7.36	7.89	8.71
95th Percentile	10.69	11.64	10.68	11.72



25-Year Simulated Annualized Return

	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
5th Percentile	2.96	0.20	3.15	3.60
25th Percentile	4.68	2.70	4.82	5.40
50th Percentile	5.88	4.48	5.99	6.67
75th Percentile	7.10	6.28	7.18	7.95
95th Percentile	8.88	8.93	8.92	9.82

Step 5: Analyze Selected Portfolios

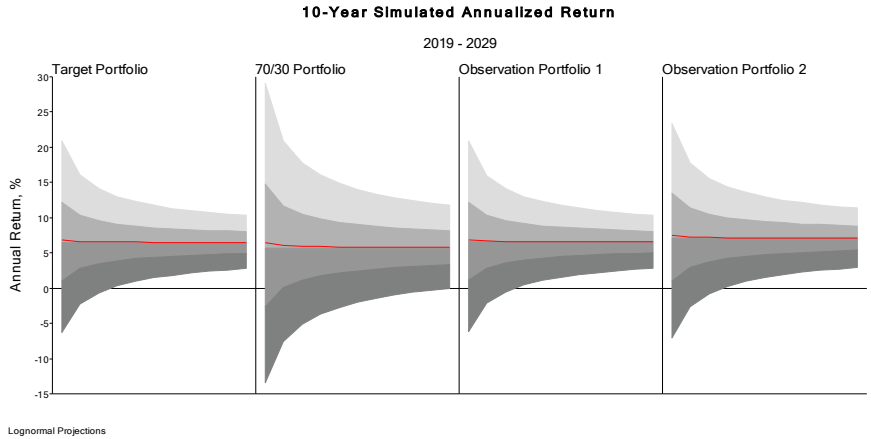
- Simulated return distributions
  - Industry CMA
  - Four selected portfolios
  - 10- and 25- year simulations

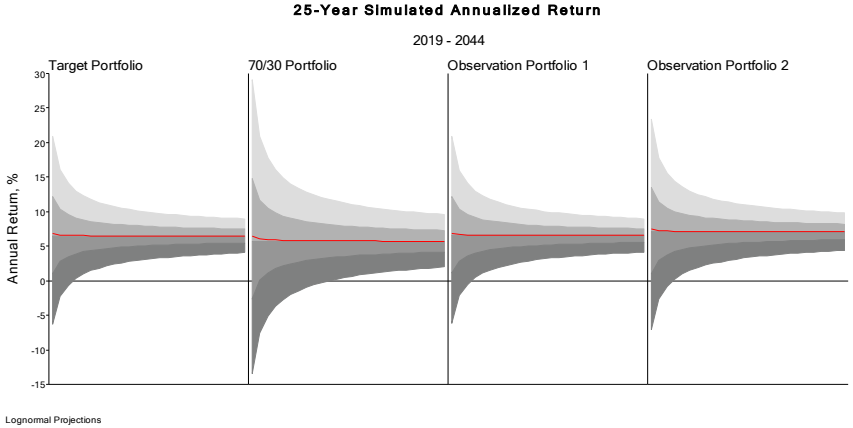
10-Year Simulated Annualized Returns

	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
5th Percentile	2.59	-0.28	2.68	2.75
25th Percentile	4.86	3.21	4.94	5.28
50th Percentile	6.48	5.71	6.54	7.07
75th Percentile	8.11	8.26	8.16	8.90
95th Percentile	10.51	12.05	10.53	11.58

25-Year Simulated Annualized Return

	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
5th Percentile	4.01	1.90	4.09	4.33
25th Percentile	5.46	4.13	5.53	5.94
50th Percentile	6.48	5.71	6.54	7.07
75th Percentile	7.50	7.31	7.55	8.22
95th Percentile	9.00	9.65	9.03	9.89





Step 5: Analyze Selected Portfolios

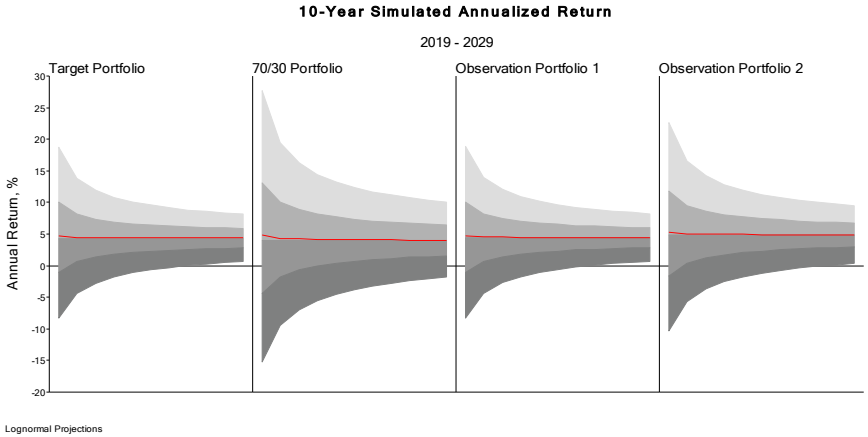
- Simulated return distributions
  - Valuation CMA
  - Four selected portfolios
  - 10- and 25- year simulations

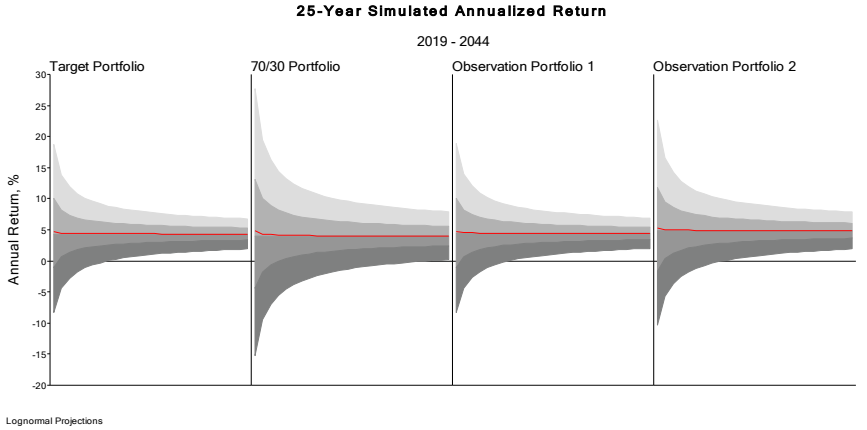
10-Year Simulated Annualized Returns

	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
5th Percentile	0.47	-2.06	0.53	0.16
25th Percentile	2.73	1.46	2.80	2.90
50th Percentile	4.33	3.98	4.41	4.85
75th Percentile	5.96	6.56	6.04	6.84
95th Percentile	8.34	10.39	8.44	9.77

25-Year Simulated Annualized Return

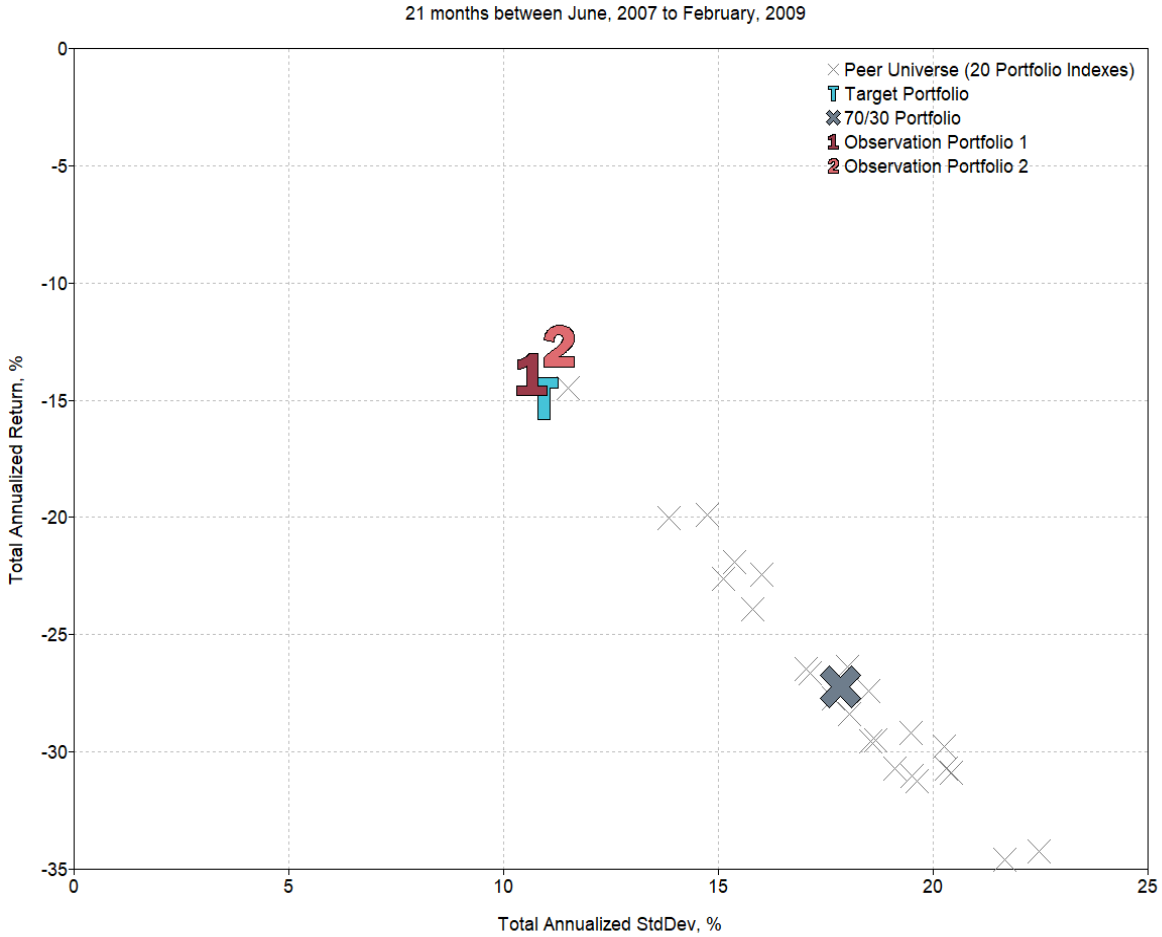
	Target Portfolio	70/30 Portfolio	Observation Portfolio 1	Observation Portfolio 2
5th Percentile	1.89	0.13	1.95	1.87
25th Percentile	3.32	2.38	3.39	3.62
50th Percentile	4.33	3.98	4.41	4.85
75th Percentile	5.35	5.59	5.43	6.10
95th Percentile	6.83	7.97	6.93	7.92





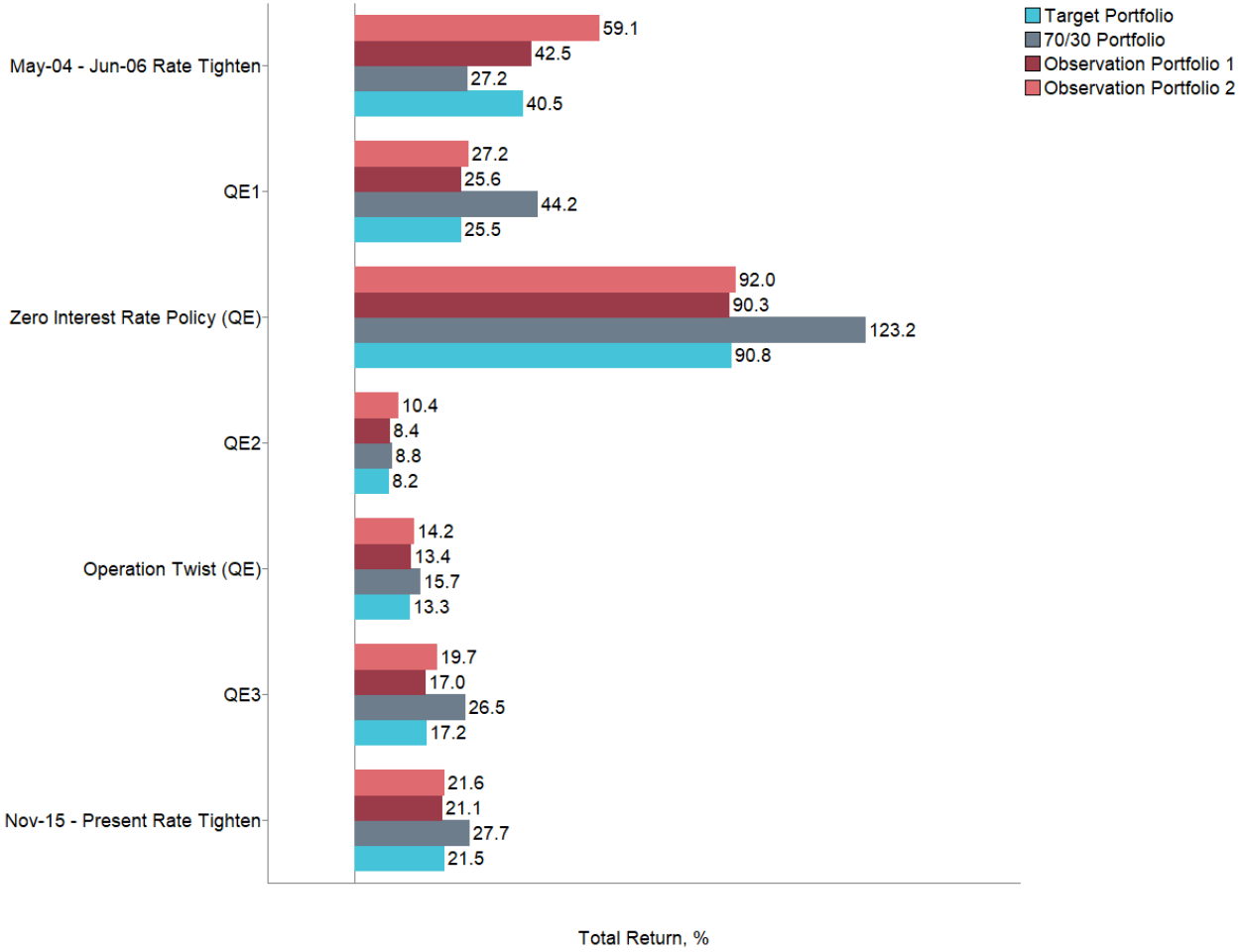
Step 5: Analyze Selected Portfolios

- Historical stress tests
  - Risk/return during global financial crisis
  - Four selected portfolios
  - Peer universe
  - 20 iterations of global and U.S. target date funds, aggressive/moderate portfolio indexes, equities and fixed income



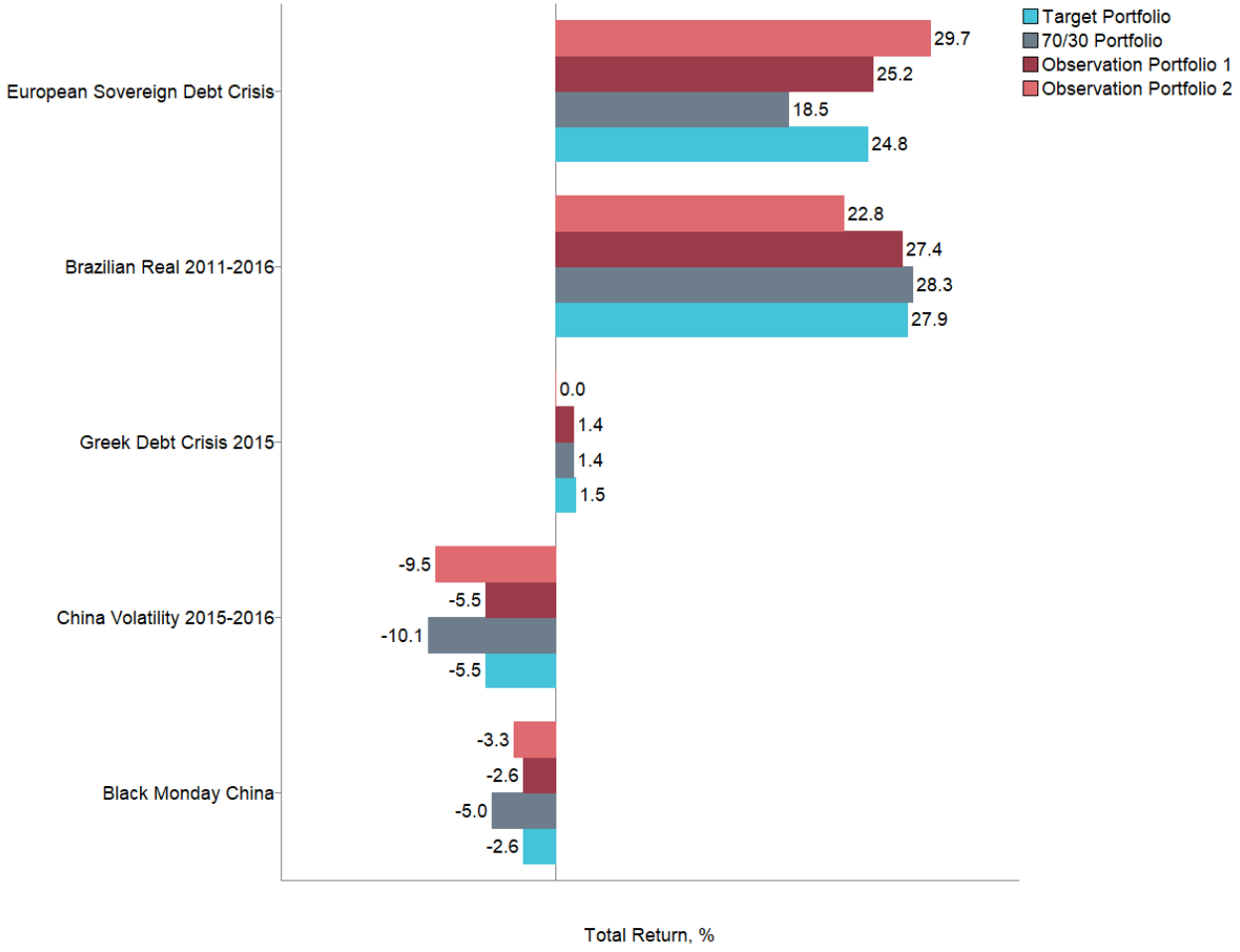
Step 5: Analyze Selected Portfolios

- Historical stress tests
  - Performance during periods o change in interest rates
  - Sensitivity to duration



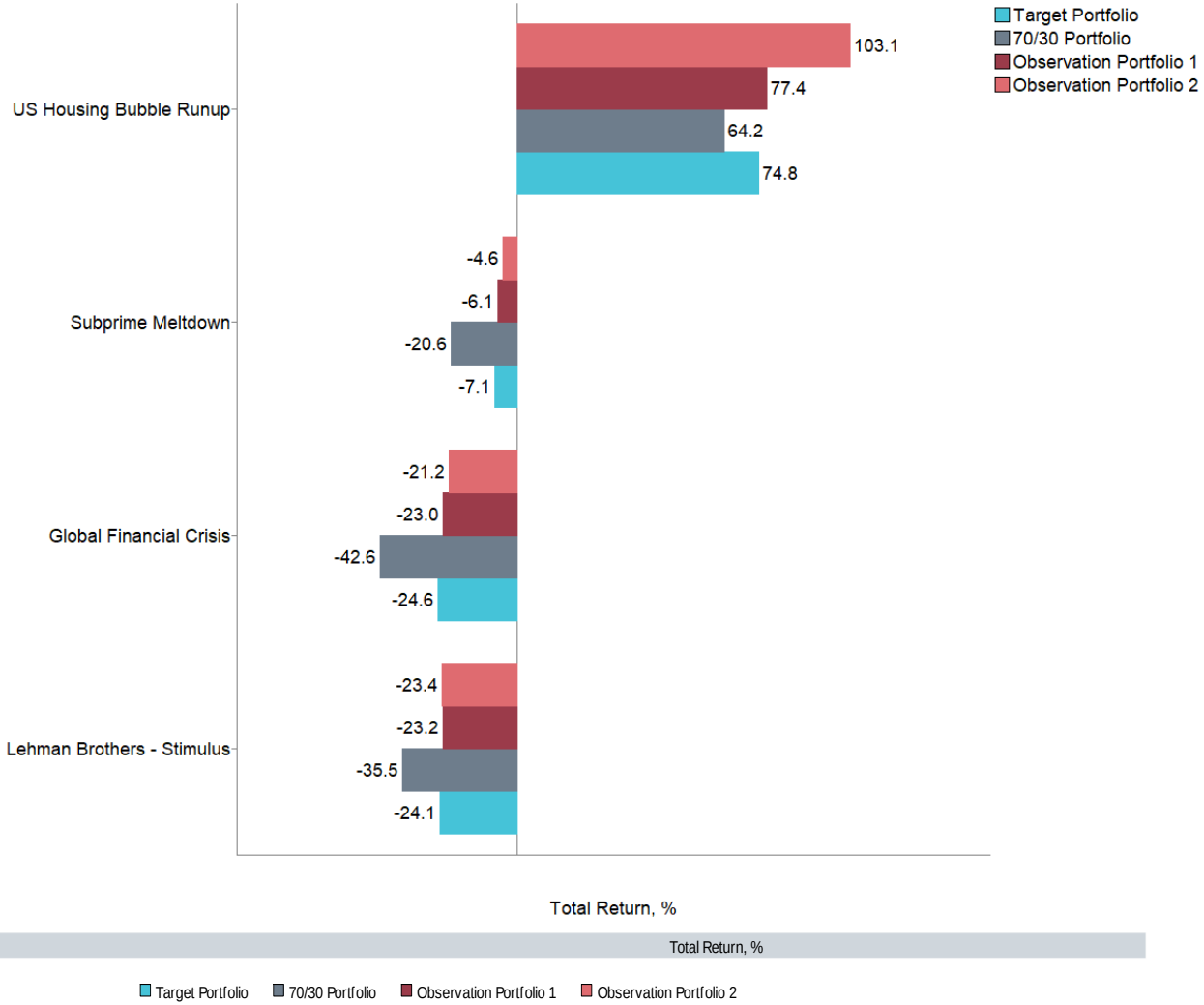
Step 5: Analyze Selected Portfolios

- Historical stress tests
  - Non-U.S market led drawdow
  - Sensitivity to currency, as well as non-U.S. equity and credit



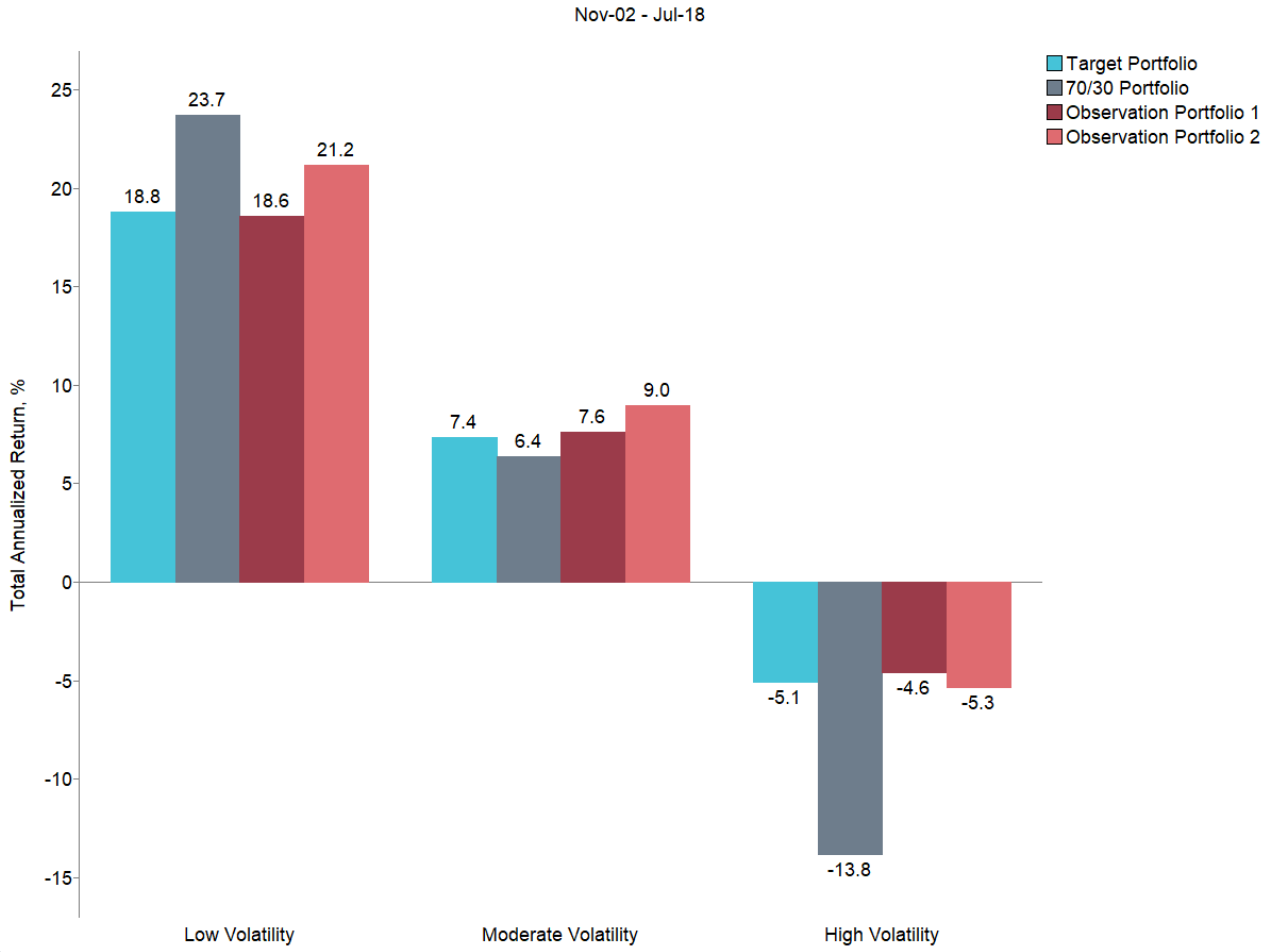
Step 5: Analyze Selected Portfolios

- Historical stress tests
  - Sensitivity to U.S. led market stress
  - U.S. equity and credit sensitivit and feedback loops



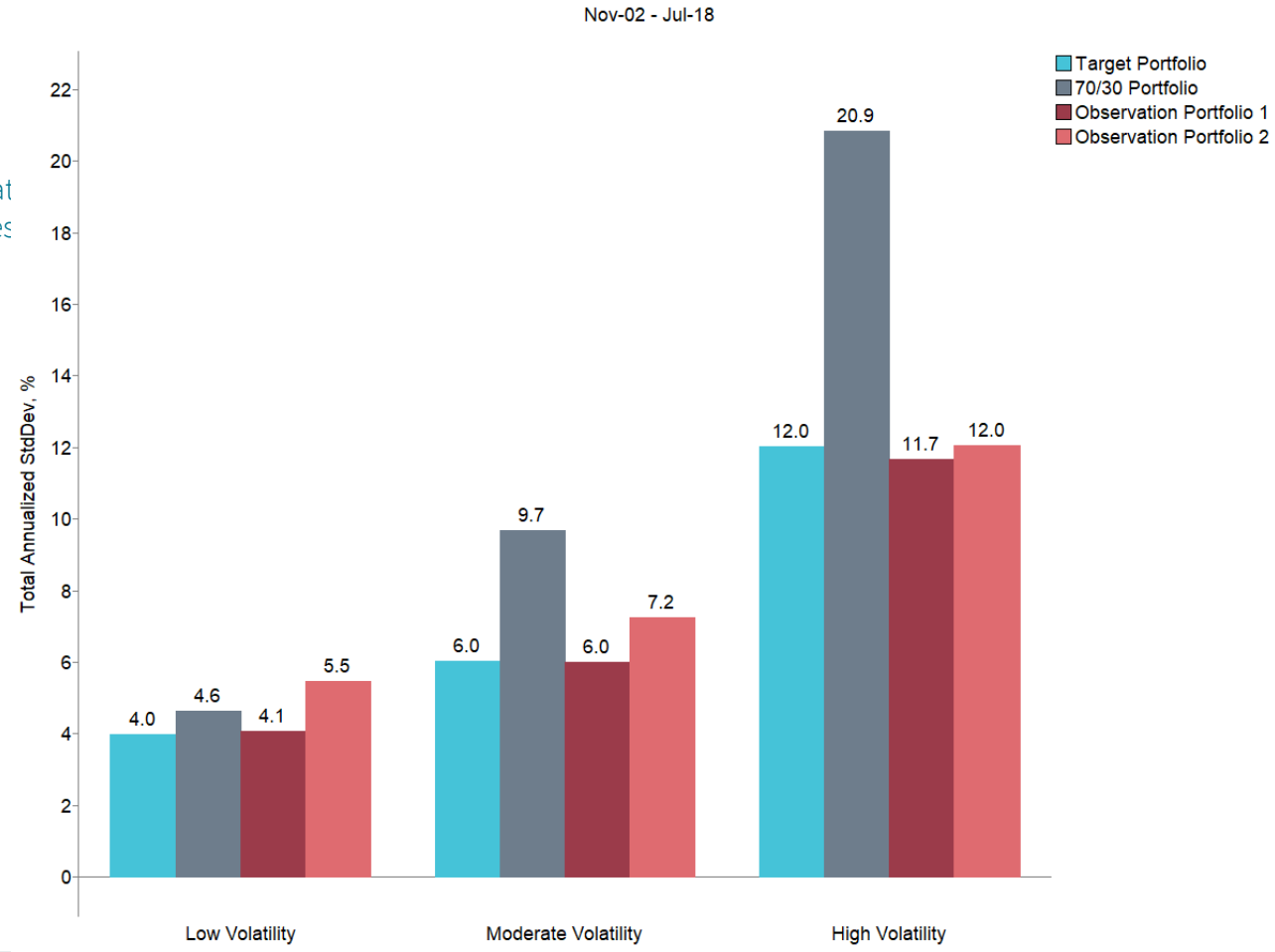
Step 5: Analyze Selected Portfolios

- Historical stress tests
  - Sensitivity to volatility (VIX) regimes



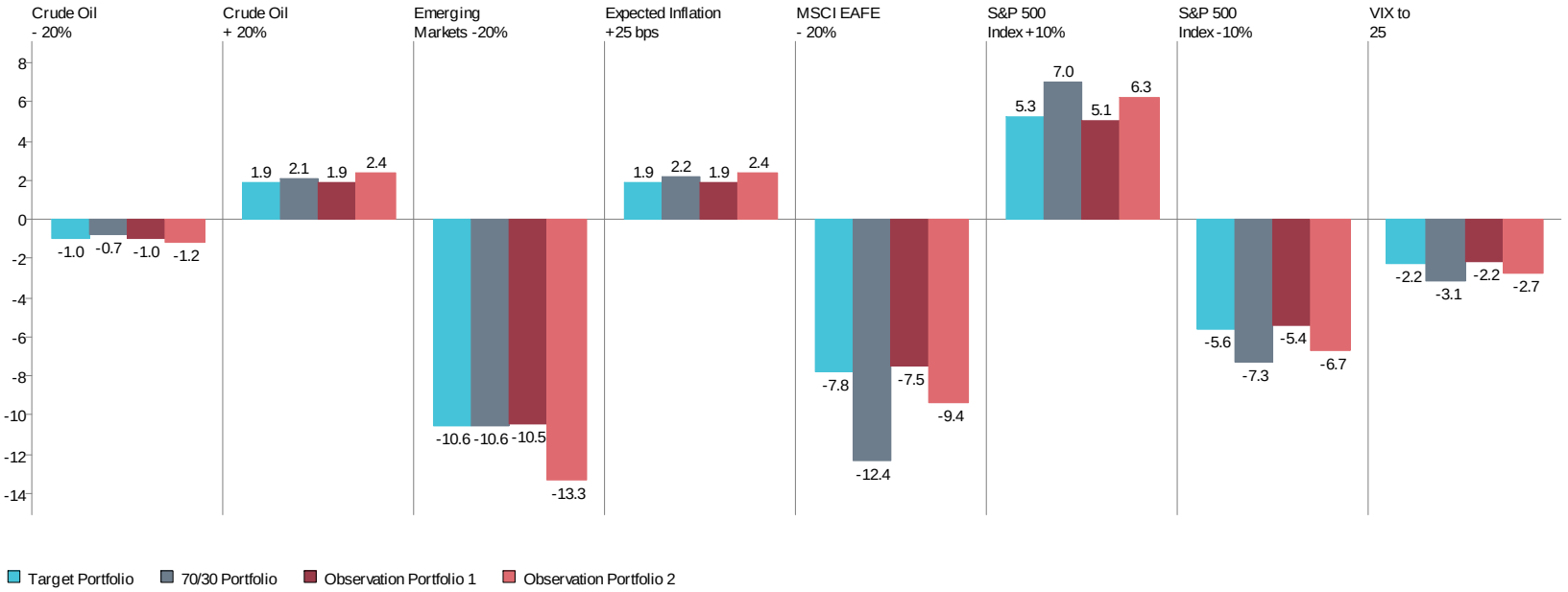
Step 5: Analyze Selected Portfolios

- Historical stress tests
  - Sensitivity of standard deviat during volatility (VIX) regimes



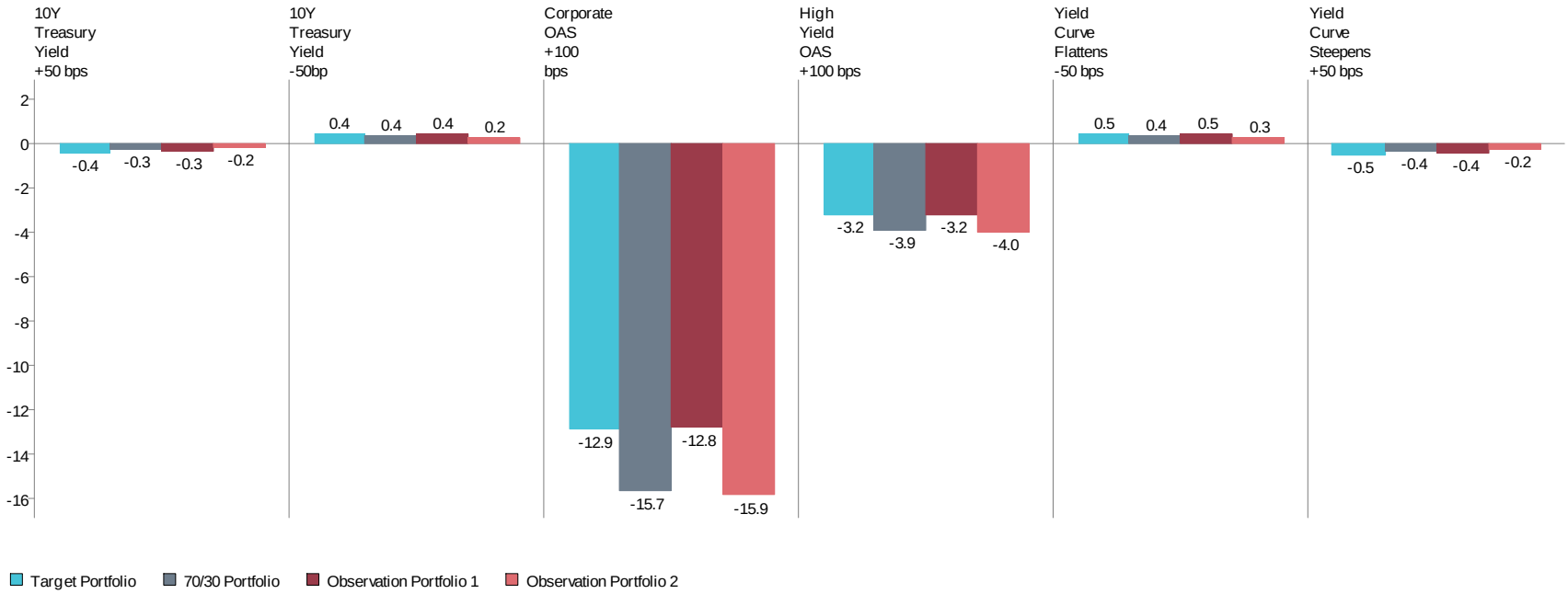
Step 5: Analyze Selected Portfolios

- Performance during market stress based on various factor shocks (inflation, commodity, and equity)



Step 5: Analyze Selected Portfolios

- Performance during market stress based on various factor shocks (credit and rates)



Conclusion

- Executive summary
  - Late-cycle economies across the globe and high valuations suggest lower expected returns
  - Models emphasize non-U.S. markets and private markets
  - Target portfolio partly reflects this, could modify further
  - SITFO includes potentially higher return strategies than mapped in FEG CMAs (frontier, microcap, etc.)
  - SITFO includes smaller, niche managers, working towards more efficient strategy structures where possible
  - Diversification and patience are valuable