



**PERSPECTIVES
THAT DRIVE
ENTERPRISE
SUCCESS**



JUNE 2018

City of San Jose Federated Employees' Retirement System

Risk Allocation

Asset allocation analysis

	P&F Interim	Staff	Meketa	Peer	Return (10 Yr)	Standard Deviation	Sharpe Ratio
Domestic Equity	16.0	13.0	13.7	26.0			
US Large	13.0	10.0	12.1	26.0	4.5	15.7	0.15
US Small	3.0	3.0	1.6	-	4.4	21.5	0.10
International Equity	18.0	18.0	13.8	24.3			
International Developed	12.0	8.0	4.3	18.2	8.6	18.1	0.35
Emerging Markets	6.0	10.0	9.5	2.5	7.3	26.6	0.19
Global Equity	-	-	-	3.6	6.3	17.5	0.23
Total Equity	34.0	31.0	27.5	50.3			
Domestic Fixed Income	24.0	27.0	27.9	24.6			
Core Fixed Income	5.0	-	-	24.6	2.9	6.4	0.11
Core Plus Fixed Income	-	-	4.9	-	3.3	8.4	0.13
US Treasury	8.0	-	4.9	-	2.4	6.8	0.03
Short-Term Gov't/Credit	2.0	25.0	14.6	-	2.5	3.7	0.08
Long-Term Credit	3.0	-	-	-	3.5	9.4	0.14
High Yield Corp. Credit	2.0	-	-	-	3.7	11.6	0.13
Bank Loans	2.0	-	1.0	-	4.9	10.5	0.26
US TIPS	2.0	2.0	2.5	-	2.6	5.5	0.07
International Fixed Income	4.0	6.0	2.9	2.0			
Global Sovereign ex-US	-	3.0	-	2.0	2.7	9.9	0.05
Emerging Market Debt (Hard)	2.0	1.5	-	-	5.1	12.8	0.23
Emerging Market Debt (Local)	2.0	1.5	2.9	-	5.8	12.1	0.30
Total Fixed Income	28.0	33.0	30.8	26.6			

Based on Verus' 2018 Capital Market Assumptions; Note: 10-year inflation assumption of 2.1%; Peer: IF Universe of DB Plans greater than \$1B

Asset allocation analysis

	P&F Interim	Staff	Meketa	Peer	Return (10 Yr)	Standard Deviation	Sharpe Ratio
Real Assets	16.0	13.0	13.7	7.9			
Commodities*	6.0	5.0	2.8	1.1	4.3	15.9	0.13
Core Real Estate	8.0	5.0	5.0	6.8	6.0	12.7	0.30
Value Add Real Estate	-	2.0	2.3	-	8.0	19.5	0.30
Opportunistic Real Estate	-	1.0	2.3	-	10.0	26.0	0.30
Infrastructure	2.0	-	1.3	-	7.1	18.9	0.26
Private Investments	16.0	16.0	19.3	6.7			
Private Equity*	8.0	12.0	13.5	6.7	6.4	25.8	0.16
Private Credit	8.0	4.0	5.8	-	6.9	10.5	0.45
Other Alternatives	6.0	7.0	7.7	7.0			
Hedge Fund	-	7.0	-	7.0	4.0	7.9	0.23
Hedge Fund - Relative Value	3.0	-	-	-	3.9	6.8	0.25
Hedge Fund - Macro	3.0	-	7.7	-	3.3	8.5	0.12
Total Alternatives	38.0	36.0	40.7	21.6			
Cash	-	-	1.0	1.5	2.2	1.2	-
Total Allocation	100	100	100	100			

Mean Variance Analysis

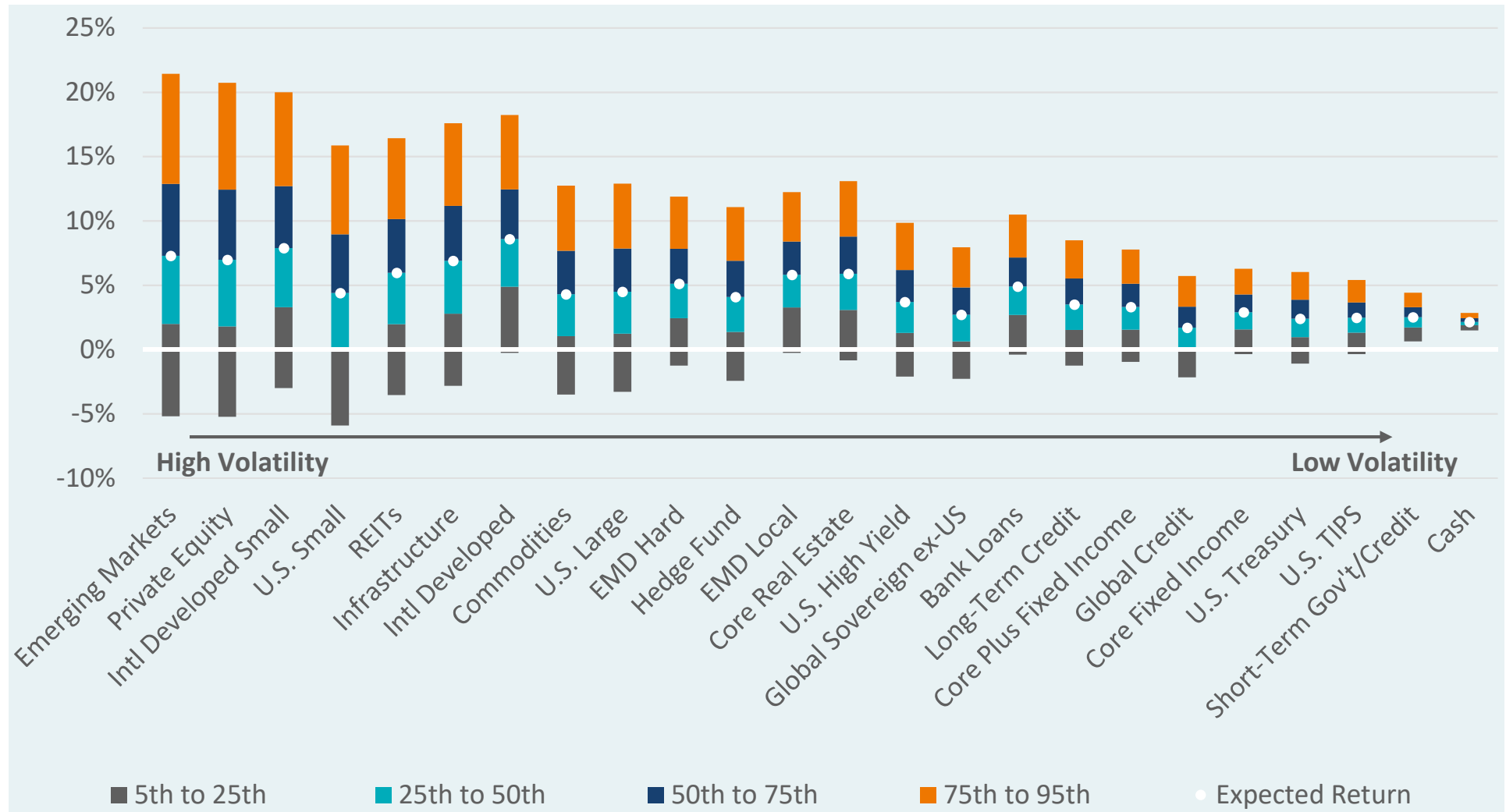
Forecast 10 Year Return	5.9	5.7	5.8	5.6
Forecast 10 Year <u>Real</u> Return	3.8	3.6	3.7	3.5
Standard Deviation	10.5	10.6	10.3	11.0
Sharpe Ratio	0.39	0.37	0.39	0.35

Based on Verus' 2018 Capital Market Assumptions; Note: 10-year inflation assumption of 2.1%; Peer: IF Universe of DB Plans greater than \$1B;

Commodities allocation includes Private Natural Resources; Private Equity includes Buyouts and Venture Capital

Range of likely 10 year outcomes

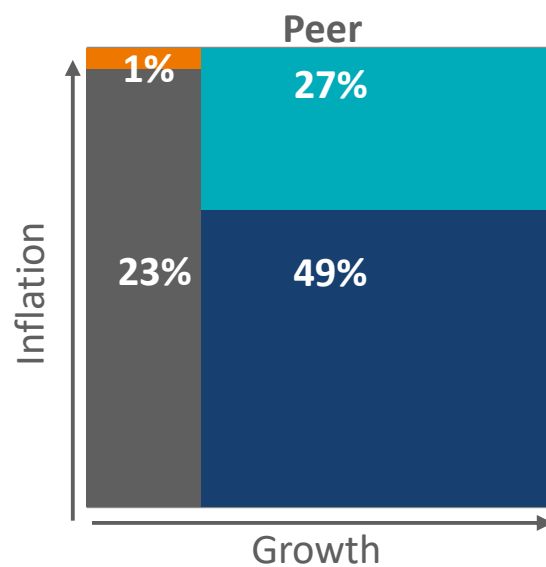
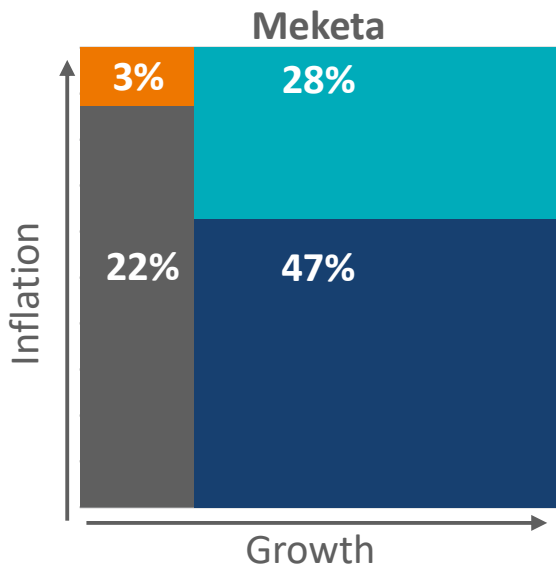
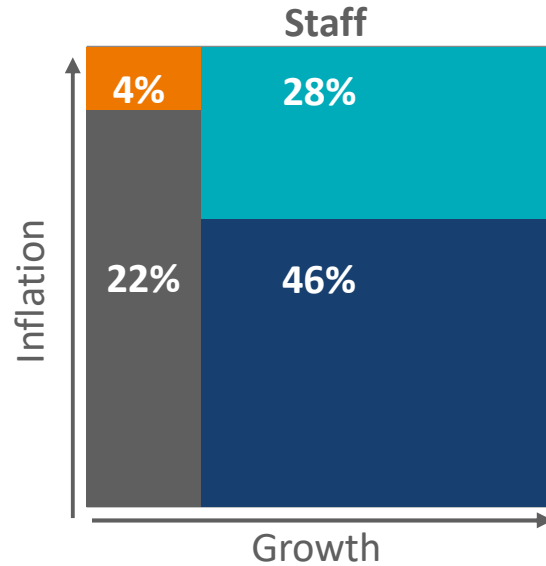
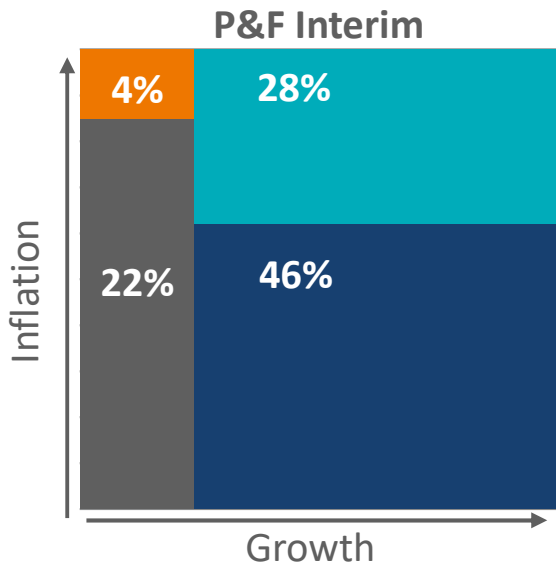
10 YEAR RETURN 90% CONFIDENCE INTERVAL



Risk limits

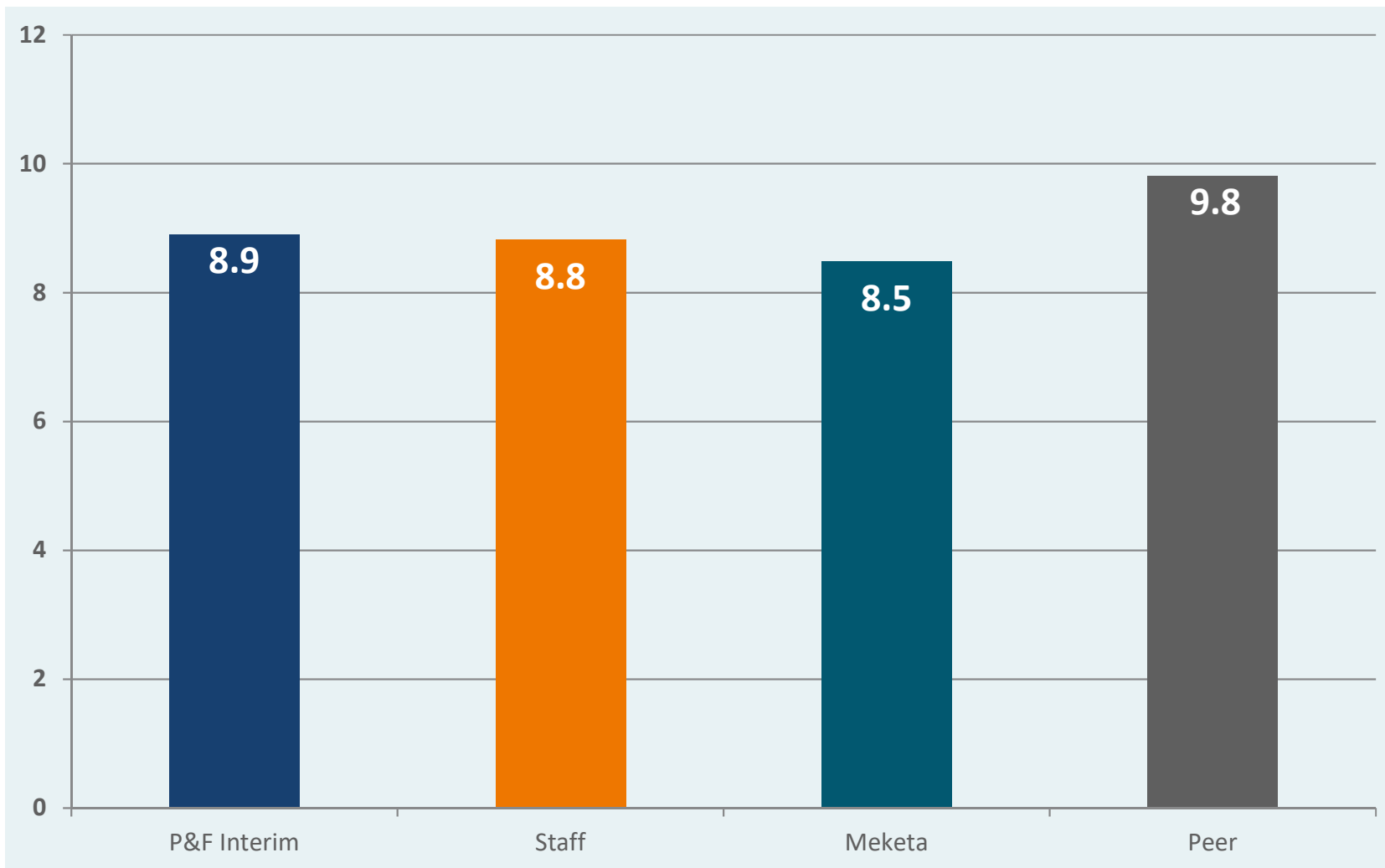
Metric	Measurement	Board Limit	P&F			
			Interim	Staff	Meketa	Peer
Funded ratio	Actuarial funded ratio	60%	Expected to reach 100% in 15 years			
Sponsor contributions	Sponsor contributions in a single year	\$335mm	Sponsor contributions are expected to rise to 212M in 2025, then begin to fall			
Interest on UAL	Interest cost of unfunded actuarial liability	\$150mm	Interest cost is expected to be 76M in 2018, then begin to fall			
Total fund absolute volatility	Annualized standard deviation of returns of the actual portfolio	12%	8.9%	8.8%	8.5%	9.8%
Total fund relative volatility	Tracking error of the actual portfolio vs. the strategic asset allocation policy index	4%	Determined by tactical bets, managers selected			
Drawdown exposure	Average of three worst historical scenario drawdown events	-30%	19.2%	18.2%	17.8%	22.6%
Liquidity	Liquidity Coverage Ratio (LCR) 5-yr projection	1.2	2.4	2.5	2.3	2.6

Economic sensitivity



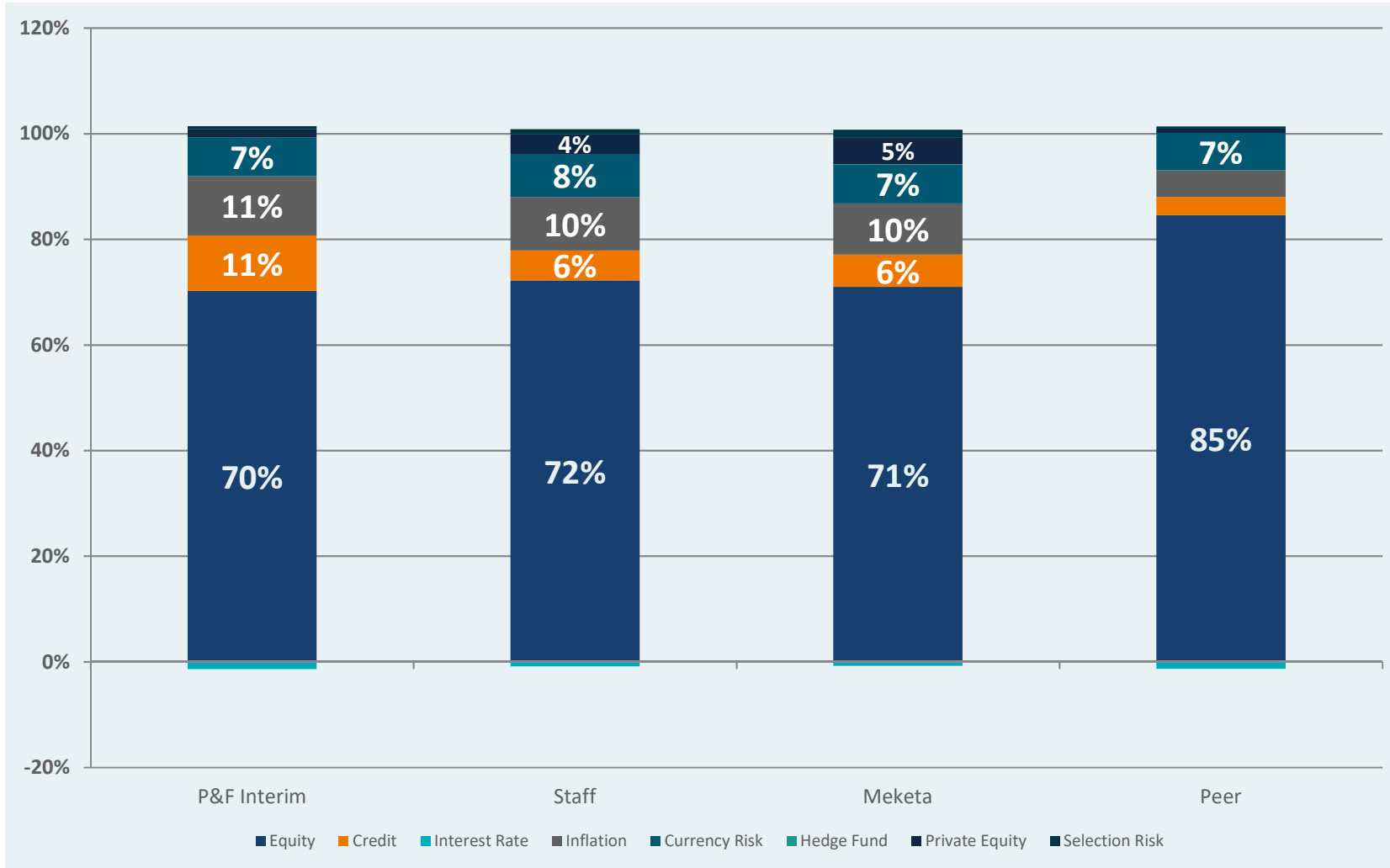
Portfolios have generally aligned themselves to prevailing market conditions: Strong equity markets, steady economic growth, low inflation, and falling risk premiums.

Portfolio Volatility



Notes: BarraOne XL model

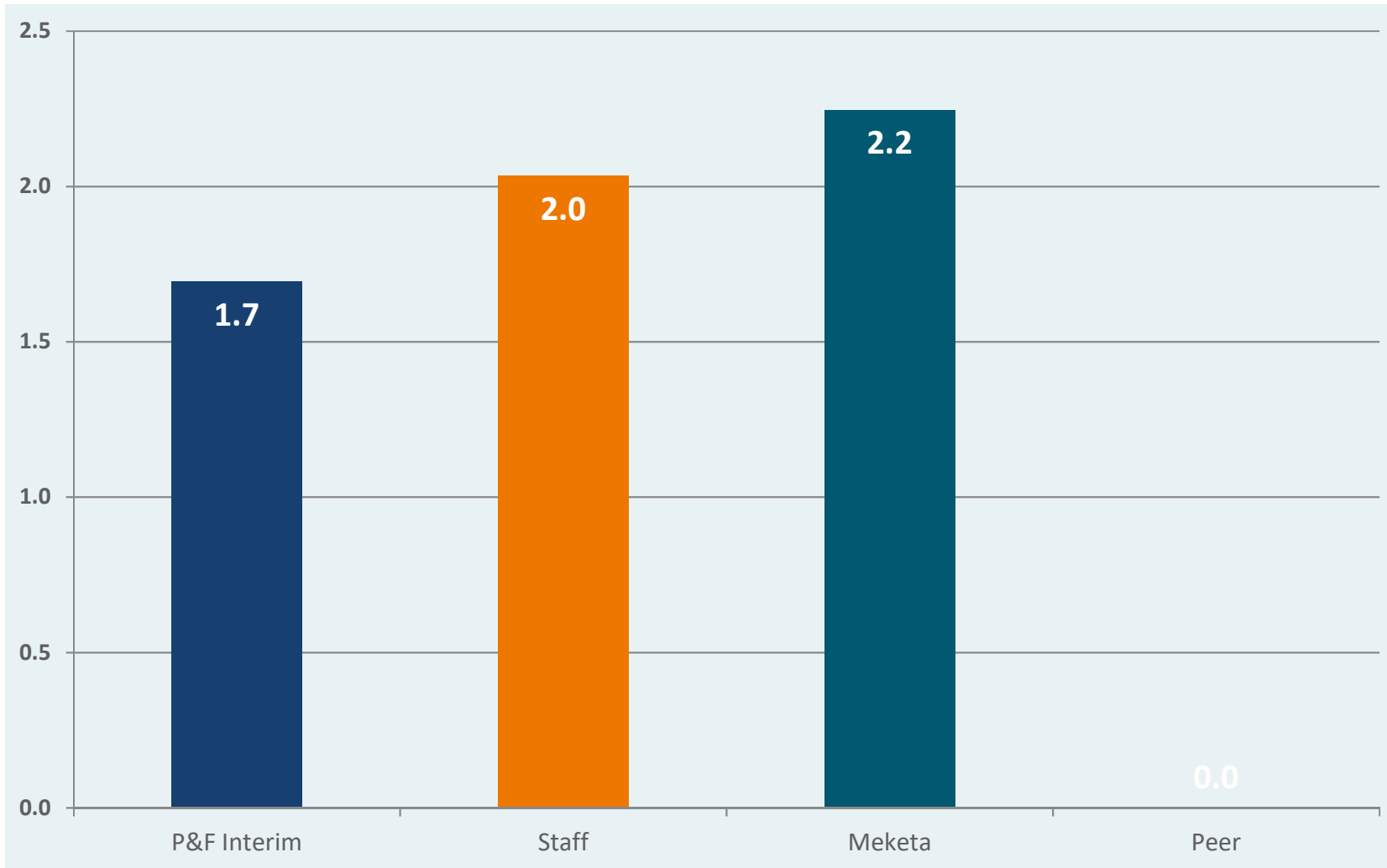
Risk Decomposition



The mixes considered have less concentration in equity factors

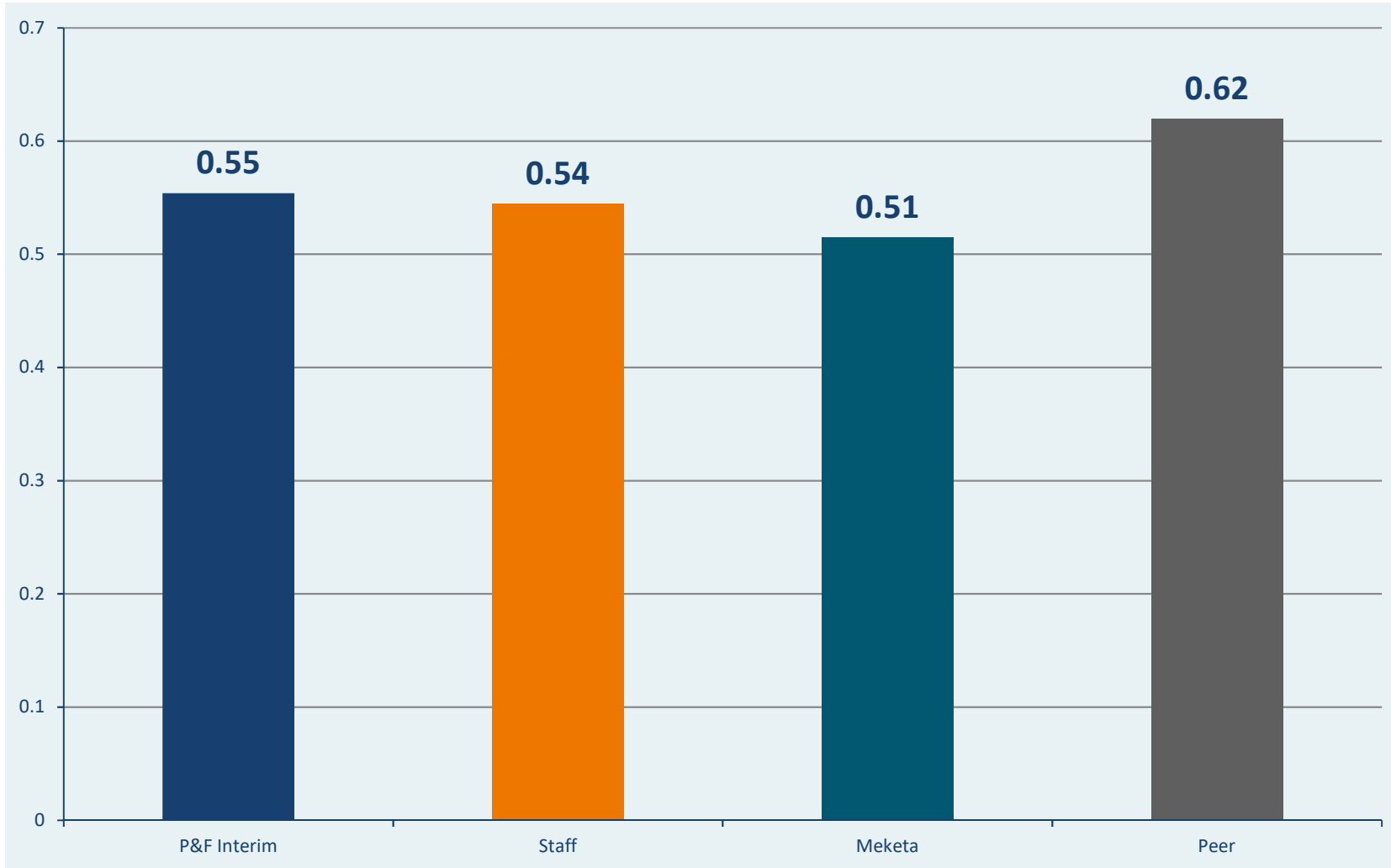
Source: BarraOne

Tracking error to peer



These mixes are different from the average peer universe.

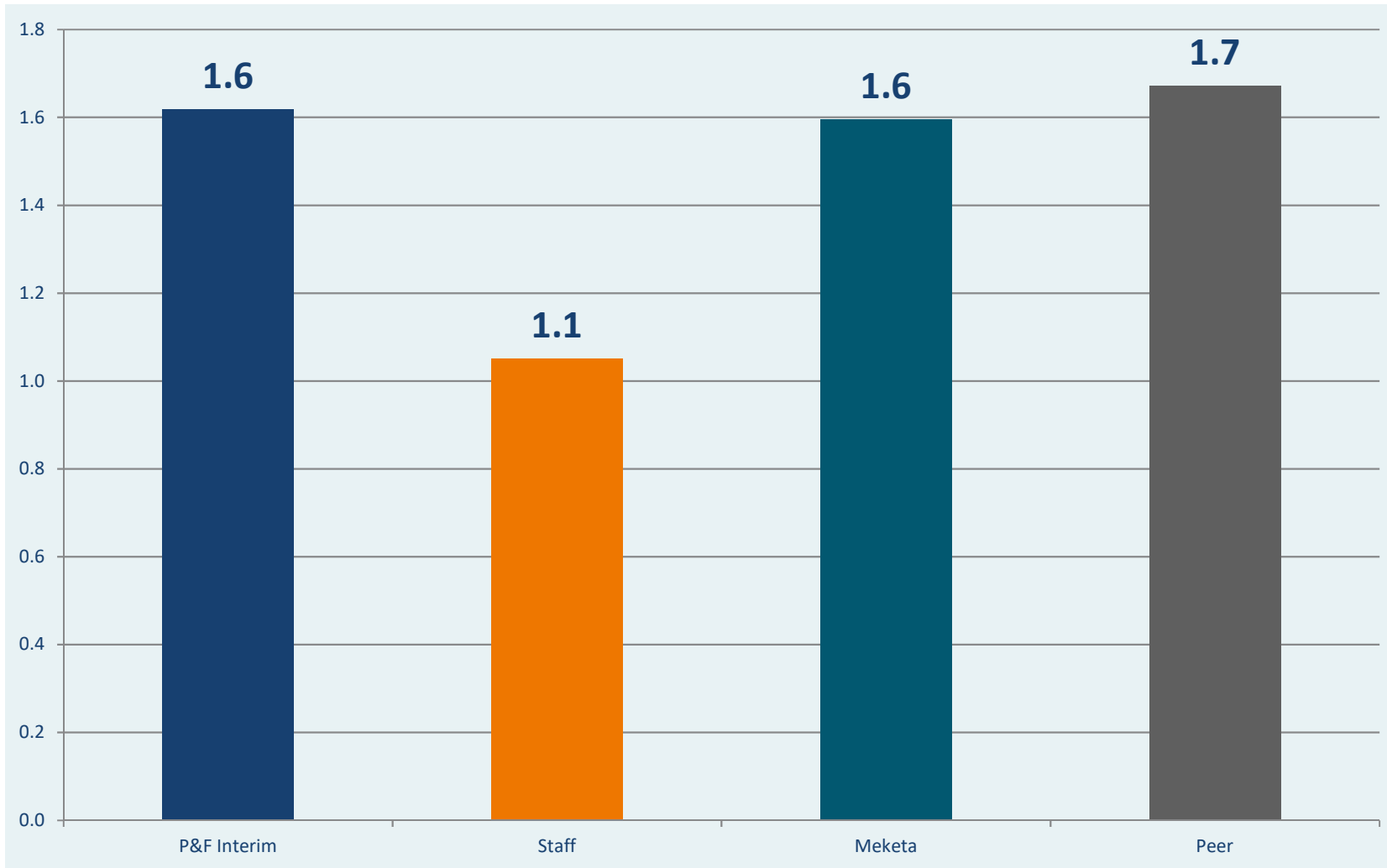
Portfolio equity beta



Portfolio beta for all mixes is lower than the average peer group

Source: BarraOne

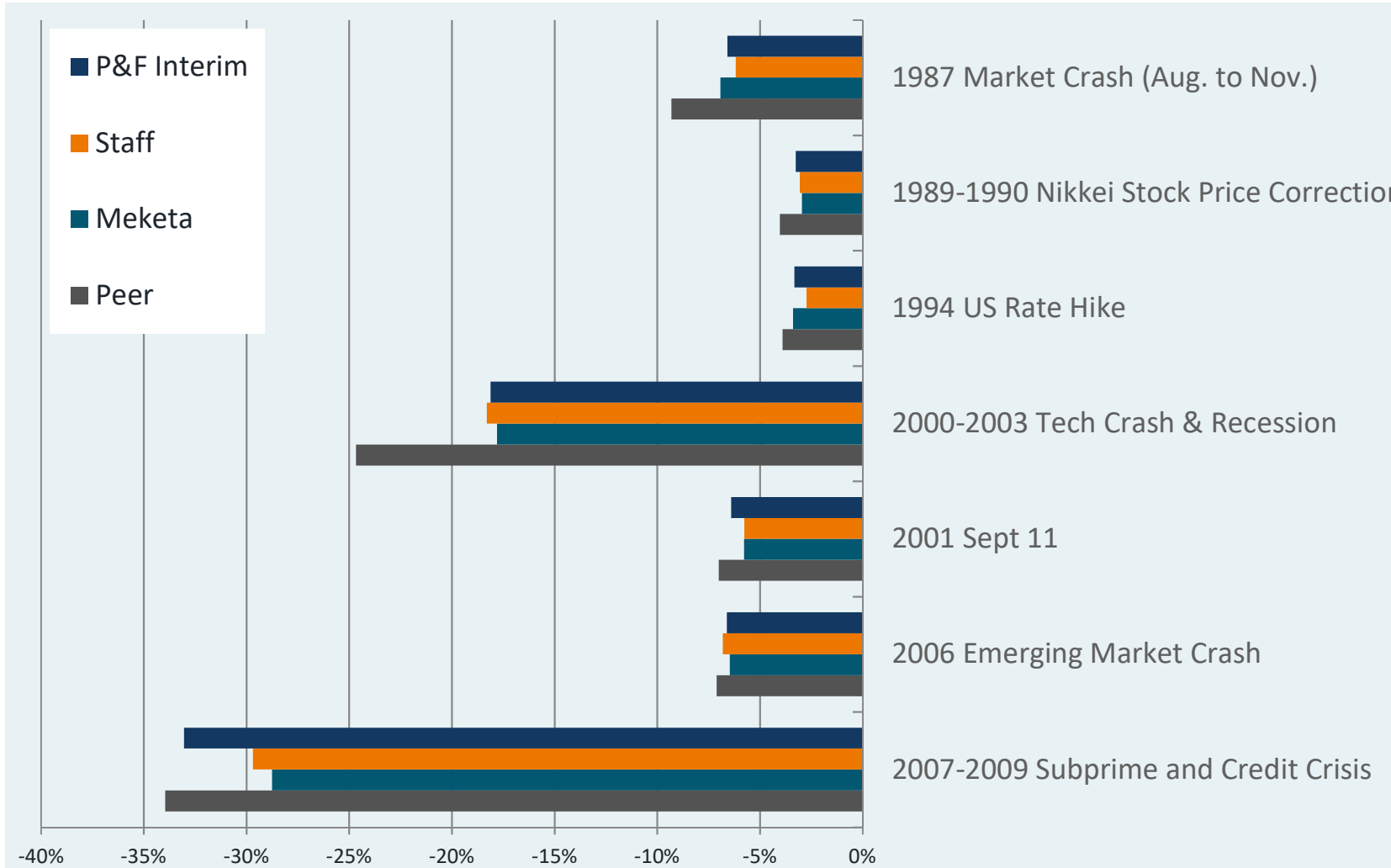
Portfolio duration



Portfolio duration is lowest under the recommended Staff mix

Source: BarraOne

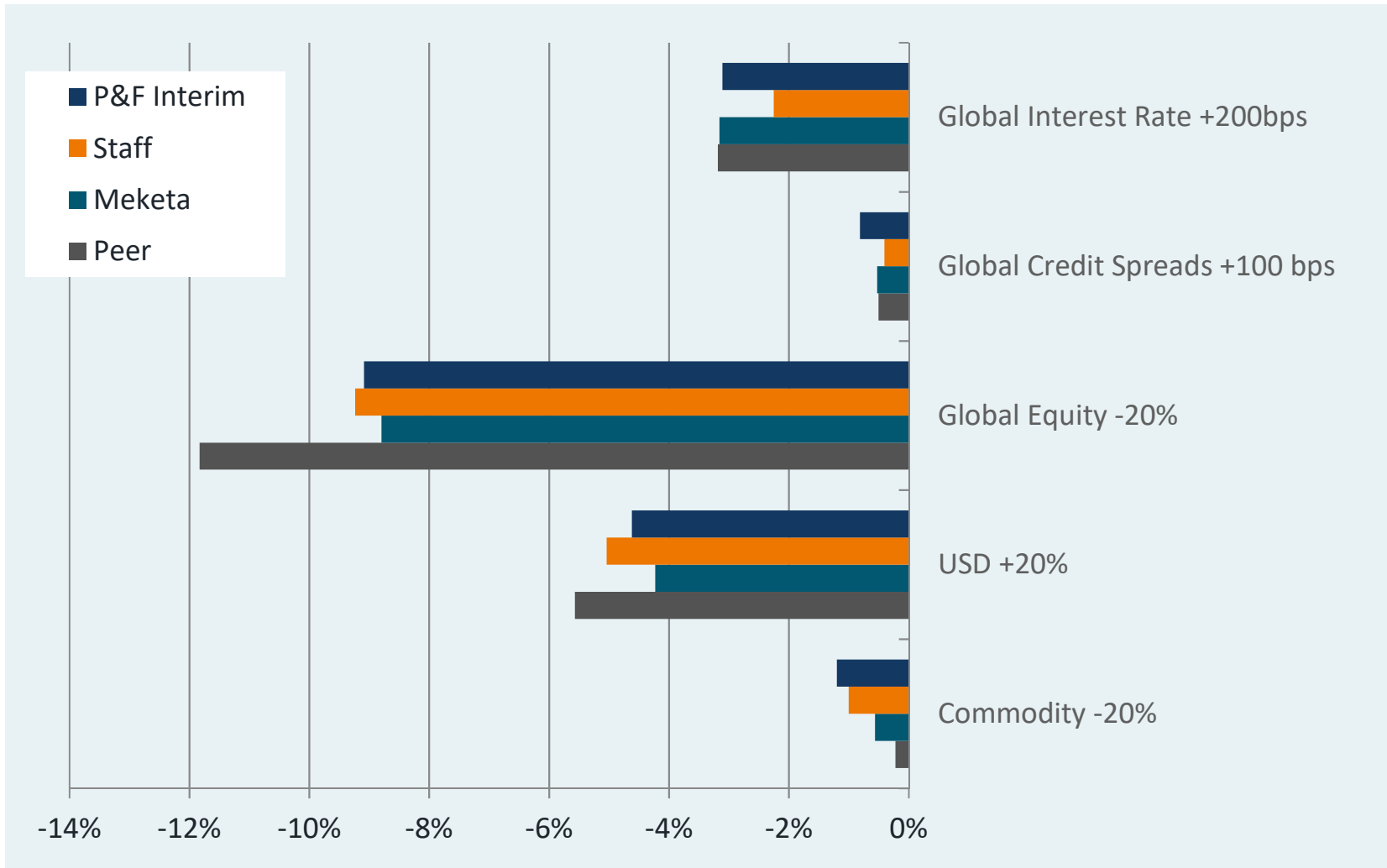
Scenario analysis



The Staff and Meketa mixes perform 4-6% better than the peer group in the subprime crisis

Source: BarraOne

Stress tests



All mixes perform the worst during a global equity shock

Source: BarraOne

Capital market assumptions

Methodology

CORE INPUTS

- We use a fundamental building block approach based on several inputs, including historical data and academic research to create asset class return forecasts.
- For most asset classes, we use the long-term historical volatility after adjusting for autocorrelation.
- Correlations between asset classes are calculated based on the last 10 years. For illiquid assets, such as private equity and private real estate, we use BarraOne correlation estimates.

Asset	Return Methodology	Volatility Methodology*
Inflation	25% weight to the University of Michigan Survey 5-10 year ahead inflation expectation and the Survey of Professional Forecasters (Fed Survey), and the remaining 50% to the market's expectation for inflation as observed through the TIPS breakeven rate	-
Cash	Real yield estimate + inflation forecast	Long-term volatility
Bonds	Nominal bonds: current yield; Real bonds: real yield + inflation forecast	Long-term volatility
International Bonds	Current yield + implied currency effect	Long-term volatility
Credit	Current option-adjusted spread + U.S. 10-year Treasury – effective default rate	Long-term volatility
International Credit	Current option-adjusted spread + foreign 10-year Treasury – effective default rate + implied currency effect	Long-term volatility
Private Credit	Bank loan forecast + 2% illiquidity premium	Long-term volatility
Equity	Current yield + real earnings growth (historical average) + inflation on earnings (inflation forecast) + expected P/E change	Long-term volatility
Intl Developed Equity**	Current yield + real earnings growth (historical average) + inflation on earnings (intl. inflation forecast) + expected P/E change + implied currency effect	Long-term volatility
Private Equity	US large cap domestic equity forecast * 1.85 beta adjustment	1.2 * Long-term volatility of U.S. small cap
Commodities	Collateral return (cash) + spot return (inflation forecast) + roll return (assumed to be zero)	Long-term volatility
Hedge Funds	Return coming from traditional betas + 15-year historical idiosyncratic return	Long-term volatility
Hedge Funds (FoF)	Return coming from traditional betas + 15-year historical idiosyncratic return – 1% expected fund of funds management fee	Long-term volatility
Core Real Estate	Cap rate + real income growth – capex + inflation forecast	65% of REIT volatility
REITs	Core real estate	Long-term volatility
Value-Add Real Estate	Core real estate + 2%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Opportunistic Real Estate	Core real estate + 4%	Volatility to produce Sharpe Ratio (g) equal to core real estate
Infrastructure	Current yield + real income growth + inflation on earnings (inflation forecast)	Long-term volatility
Risk Parity	Expected Sharpe Ratio * target volatility + cash rate	Target volatility

*Long-term historical volatility data is adjusted for autocorrelation (see Appendix)

**We use local inflation for international developed equity markets. When using local inflation rates, expected returns are adjusted for the implied currency effect based on currency forward contract rates (see Appendix)

10-year return & risk assumptions

Asset Class	Index Proxy	Ten Year Return Forecast		Standard Deviation Forecast	Sharpe Ratio Forecast (g)	Sharpe Ratio Forecast (a)	10-Year Historical Sharpe Ratio (g)	10-Year Historical Sharpe Ratio (a)
		Geometric	Arithmetic					
Equities								
U.S. Large	S&P 500	4.5%	5.6%	15.7%	0.15	0.22	0.50	0.56
U.S. Small	Russell 2000	4.4%	6.5%	21.5%	0.10	0.20	0.36	0.44
International Developed	MSCI EAFE	8.6%	10.1%	18.1%	0.35	0.44	0.11	0.2
International Developed Hedged	MSCI EAFE Hedged	8.6%	9.8%	16.2%	0.40	0.47	0.21	0.28
International Small	MSCI EAFE Small Cap	7.9%	10.2%	22.7%	0.25	0.35	0.24	0.33
International Small Hedged	MSCI EAFE Small Cap Hedged	7.9%	9.7%	20.1%	0.28	0.37	0.36	0.43
Emerging Markets	MSCI EM	7.3%	10.4%	26.6%	0.19	0.31	0.17	0.28
Global Equity	MSCI ACWI	6.3%	7.7%	17.5%	0.23	0.31	0.27	0.35
Private Equity	Cambridge Private Equity	6.4%	9.3%	25.8%	0.16	0.28	0.93	0.92
Fixed Income								
Cash	30 Day T-Bills	2.2%	2.2%	1.2%	-	-	-	-
U.S. TIPS	BBgBarc U.S. TIPS 5 - 10	2.6%	2.7%	5.5%	0.07	0.09	0.57	0.59
U.S. Treasury	BBgBarc Treasury 7-10 Year	2.4%	2.6%	6.8%	0.03	0.06	0.68	0.70
Global Sovereign ex U.S.	BBgBarc Global Treasury ex U.S.	2.7%	3.2%	9.9%	0.05	0.10	0.30	0.33
Global Sovereign ex U.S. Hedged	BBgBarc Global Treasury ex U.S. Hedged	2.7%	2.8%	3.3%	0.15	0.18	1.23	1.22
Core Fixed Income	BBgBarc U.S. Aggregate Bond	2.9%	3.1%	6.4%	0.11	0.14	1.09	1.08
Core Plus Fixed Income	BBgBarc U.S. Corporate IG	3.3%	3.6%	8.4%	0.13	0.17	0.81	0.81
Short-Term Gov't/Credit	BBgBarc U.S. Gov't/Credit 1 - 3 year	2.5%	2.6%	3.7%	0.08	0.11	1.36	1.34
Short-Term Credit	BBgBarc Credit 1-3 Year	2.4%	2.5%	3.7%	0.05	0.08	1.05	1.05
Long-Term Credit	BBgBarc Long U.S. Corporate	3.5%	3.9%	9.4%	0.14	0.18	0.64	0.67
High Yield Corp. Credit	BBgBarc U.S. Corporate High Yield	3.7%	4.3%	11.6%	0.13	0.18	0.64	0.67
Bank Loans	S&P/LSTA	4.9%	5.4%	10.5%	0.26	0.30	0.48	0.51
Global Credit	BBgBarc Global Credit	1.7%	2.0%	7.6%	-0.07	-0.03	0.59	0.61
Global Credit Hedged	BBgBarc Global Credit Hedged	1.7%	1.8%	5.0%	-0.10	-0.08	1.01	1.00
Emerging Markets Debt (Hard)	JPM EMBI Global Diversified	5.1%	5.9%	12.8%	0.23	0.29	0.74	0.76
Emerging Markets Debt (Local)	JPM GBI EM Global Diversified	5.8%	6.5%	12.1%	0.30	0.36	0.31	0.37
Private Credit	Bank Loans + 200 bps	6.9%	7.5%	10.5%	0.45	0.50	-	-
Other								
Commodities	Bloomberg Commodity	4.3%	5.5%	15.9%	0.13	0.21	-0.33	-0.25
Hedge Funds	HFRI Fund of Funds	4.0%	4.8%	7.9%	0.23	0.33	0.21	0.23
Hedge Fund of Funds	HFRI Fund of Funds	3.0%	3.8%	7.9%	0.10	0.20	0.21	0.23
Hedge Funds - Equity Hedge	HFRI Equity Hedge	4.2%	5.5%	11.1%	0.18	0.30	0.36	0.39
Hedge Funds - Event Driven	HFRI Event Driven	4.5%	5.6%	9.9%	0.22	0.34	0.55	0.57
Hedge Funds - Relative Value	HFRI Relative Value	3.9%	4.5%	6.8%	0.25	0.34	0.89	0.89
Hedge Funds - Macro	HFRI Macro	3.3%	4.7%	8.5%	0.12	0.29	0.43	0.44
Core Real Estate	NCREIF Property	6.0%	6.7%	12.7%	0.30	0.35	0.77	0.75
Value-Add Real Estate	NCREIF Property + 200bps	8.0%	9.7%	19.5%	0.30	0.38	-	-
Opportunistic Real Estate	NCREIF Property + 400bps	10.0%	12.9%	26.0%	0.30	0.41	-	-
REITs	Wilshire REIT	6.0%	7.7%	19.5%	0.19	0.28	0.16	0.28
Infrastructure	S&P Global Infrastructure	7.1%	8.7%	18.9%	0.26	0.34	0.27	0.34
Risk Parity	Risk Parity	7.2%	7.7%	10.0%	0.50	0.55	-	-
Currency Beta	Russell Conscious Currency	2.2%	2.3%	4.4%	0.00	0.02	0.23	0.24
Inflation		2.1%	-	-	-	-	-	-

Investors wishing to produce expected geometric return forecasts for their portfolios should use the arithmetic return forecasts provided here as inputs into that calculation, rather than the single-asset-class geometric return forecasts. This is the industry standard approach, but requires a complex explanation only a heavy quant could love, so we have chosen not to provide further details in this document – we will happily provide those details to any readers of this who are interested.

Asset mapping

	P&F Interim	Staff	Meketa	Verus CMA mapping
Cash Equivalents	0.0%	0.0%	1.0%	Cash
Short-term Investment Grade Bonds	2.0%	25.0%	13.0%	Short-term Gov't Credit
Investment Grade Bonds	5.0%	0.0%	5.0%	Core Plus Fixed Income
Investment Grade Corporate Bonds	3.0%	0.0%	0.0%	Long-term Credit
Intermediate Government Bonds	5.0%	0.0%	0.0%	Core Fixed Income
Long-term Government Bonds	3.0%	0.0%	6.0%	US Treasury
Long-term Strips	0.0%	0.0%	0.0%	
TIPS	0.0%	2.0%	0.0%	US TIPS
Short-term TIPS	2.0%	0.0%	4.0%	US TIPS
High Yield Bonds	2.0%	0.0%	0.0%	High Yield Corp. Credit
Bank Loans	2.0%	0.0%	0.0%	Bank Loans
Private Debt Composite	8.0%	4.0%	6.0%	Private Credit
Foreign Bonds	0.0%	3.0%	0.0%	Global Sovereign ex-US
Emerging Market Bonds (major)	2.0%	1.5%	1.5%	Emerging Market Debt (Hard)
Emerging Market Bonds (local)	2.0%	1.5%	1.5%	Emerging Market Debt (Local)
US Large Cap	13.0%	10.0%	12.0%	US Large
US Small Cap	3.0%	3.0%	2.0%	US Small
Developed Market Equity (non-US)	12.0%	8.0%	6.0%	International Developed
Emerging Market Equity	6.0%	10.0%	8.0%	Emerging Markets
Global Equity	0.0%	0.0%	0.0%	
Private Equity/Debt	0.0%	0.0%	0.0%	
Private Equity	8.0%	0.0%	0.0%	Private Equity
Buyouts	0.0%	8.0%	11.0%	Private Equity
Venture Capital	0.0%	4.0%	3.0%	Private Equity
Real Estate	8.0%	0.0%	0.0%	Core Real Estate
Core Private Real Estate	0.0%	5.0%	5.0%	Core Real Estate
Value-Added Real Estate	0.0%	2.0%	2.0%	Value Add Real Estate
Opportunistic Real Estate	0.0%	1.0%	2.0%	Opportunistic Real Estate
Natural Resources (Private)	0.0%	3.0%	1.0%	Commodities
Commodities (naive)	6.0%	2.0%	3.0%	Commodities
Core Infrastructure	2.0%	0.0%	2.0%	Infrastructure
Hedge Funds	0.0%	7.0%	0.0%	Hedge Fund
Global Macro	3.0%	0.0%	5.0%	Hedge Fund - Macro
Relative Value/Arbitrage	3.0%	0.0%	0.0%	Hedge Fund - Relative Value