

Asset Allocation

South Dakota Investment Council
South Dakota Retirement System Board of Trustees
June 5-6, 2019

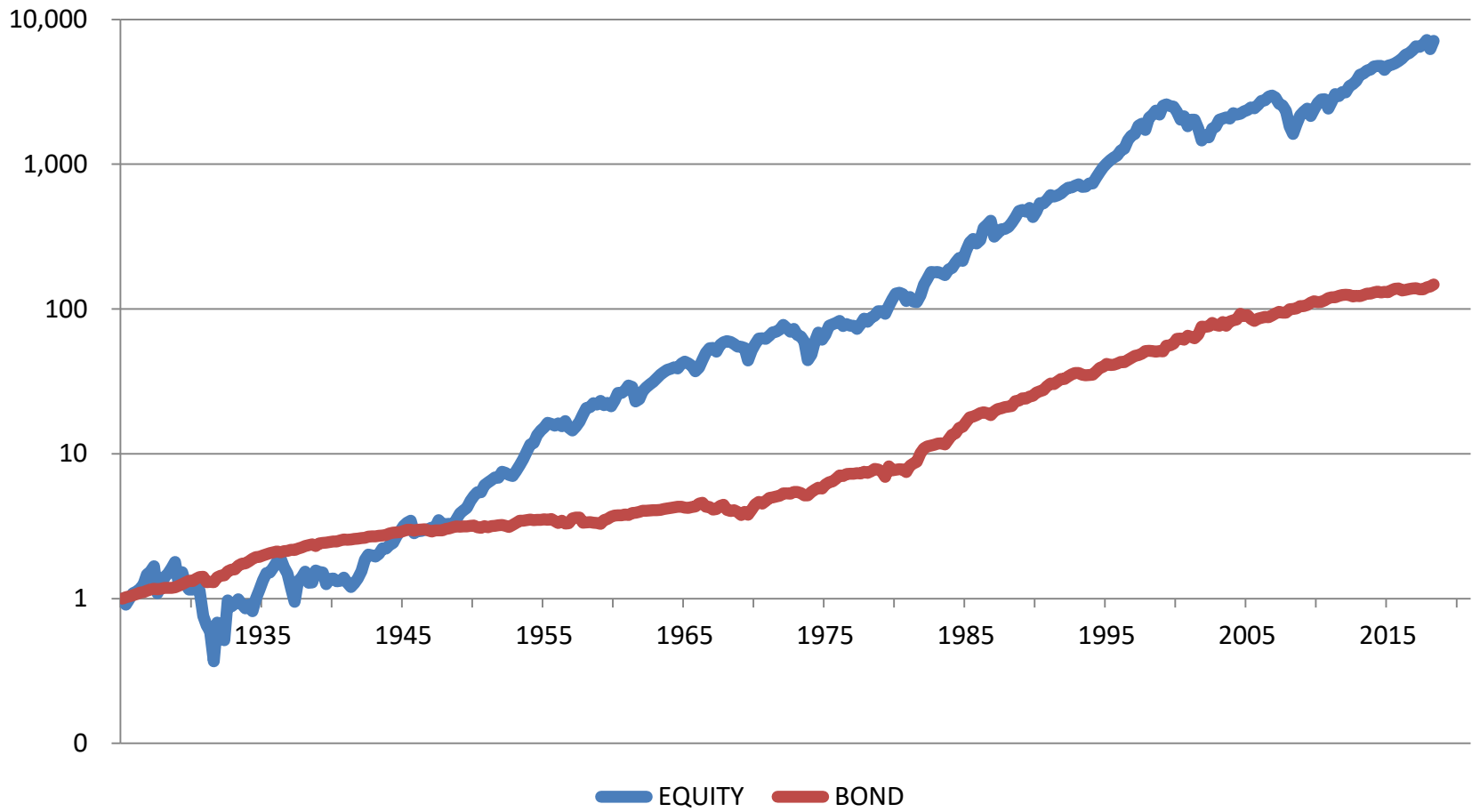
Discussion topics

- Recommended benchmark equity-like and bond-like risk and ranges
- Equity-like and bond-like risk embedded in other categories
- Recommended benchmark asset category allocation and ranges
- Expected return and standard deviation
- Asset category valuation
- Allocation movement within ranges

Benchmark equity and bond risk

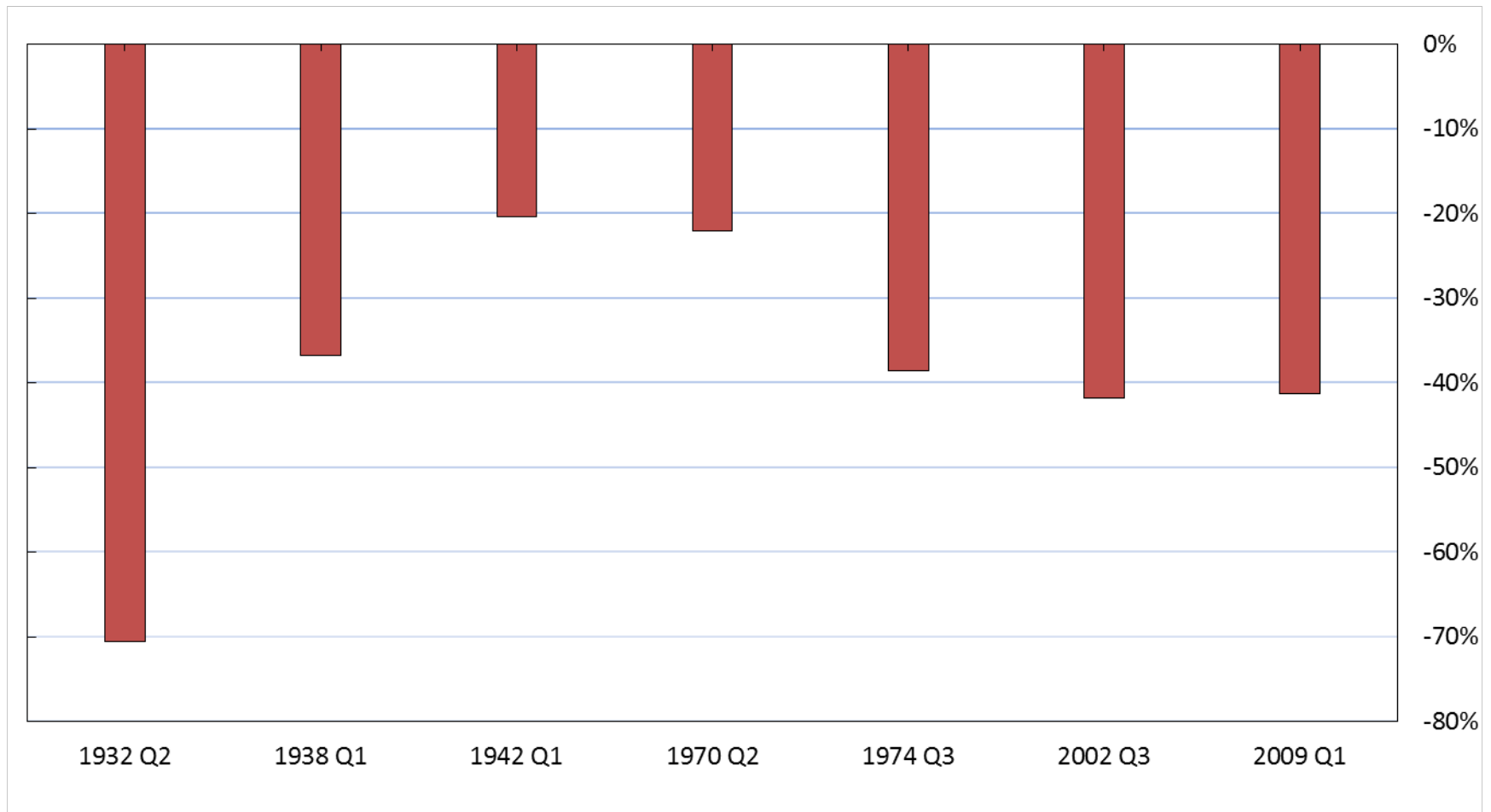
- Historical outcomes are helpful in relating to impact of risk
- Long term return history is available only for equity, bonds, and cash
- Equity returns are best over the very long term, but are volatile
- Bonds returns are lower over the long term, but provide diversification
- Return/risk tradeoff depends on willingness to endure volatility

Equity long term returns much higher



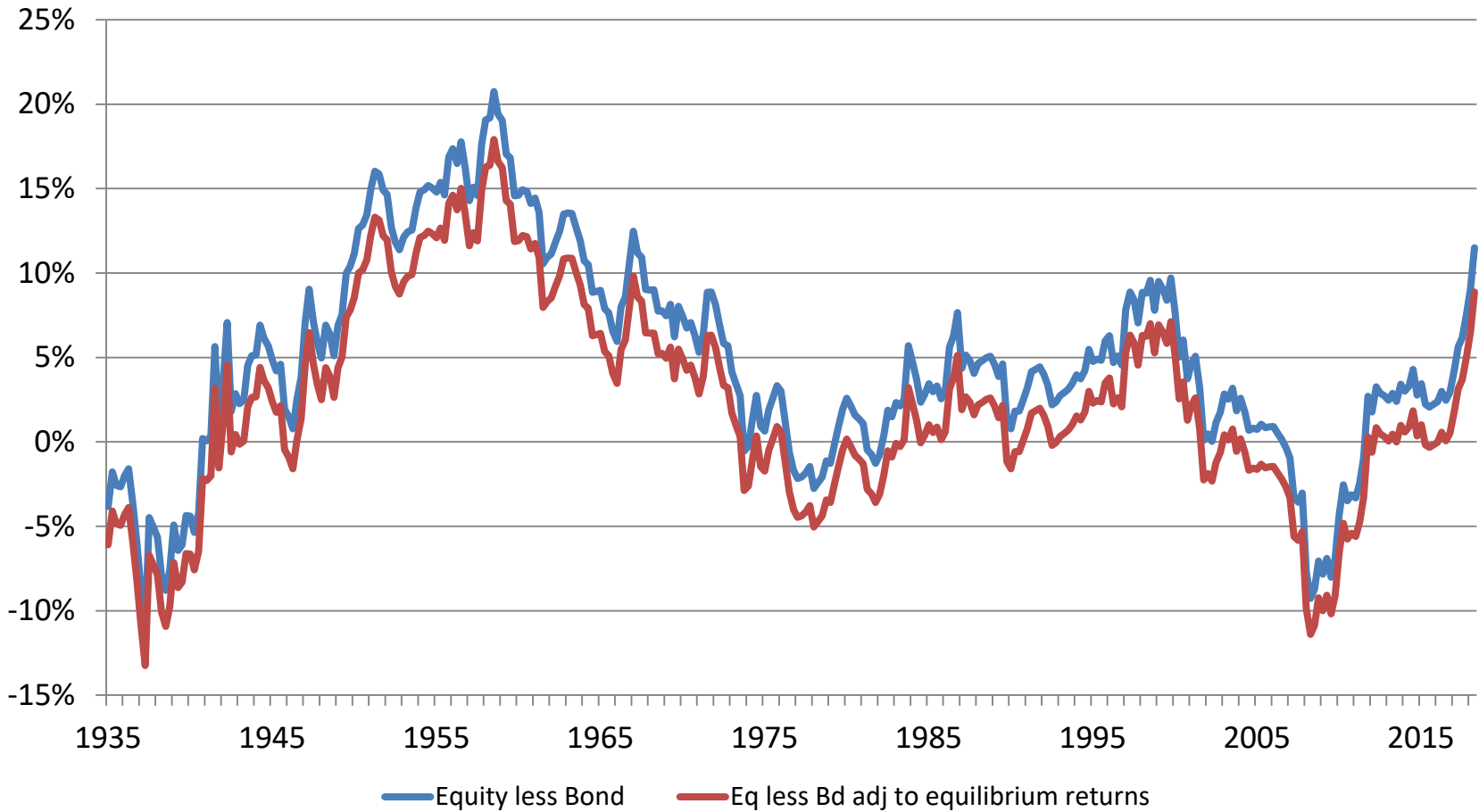
Equity downturns can be brutal

two year periods with equity returns below negative 20%



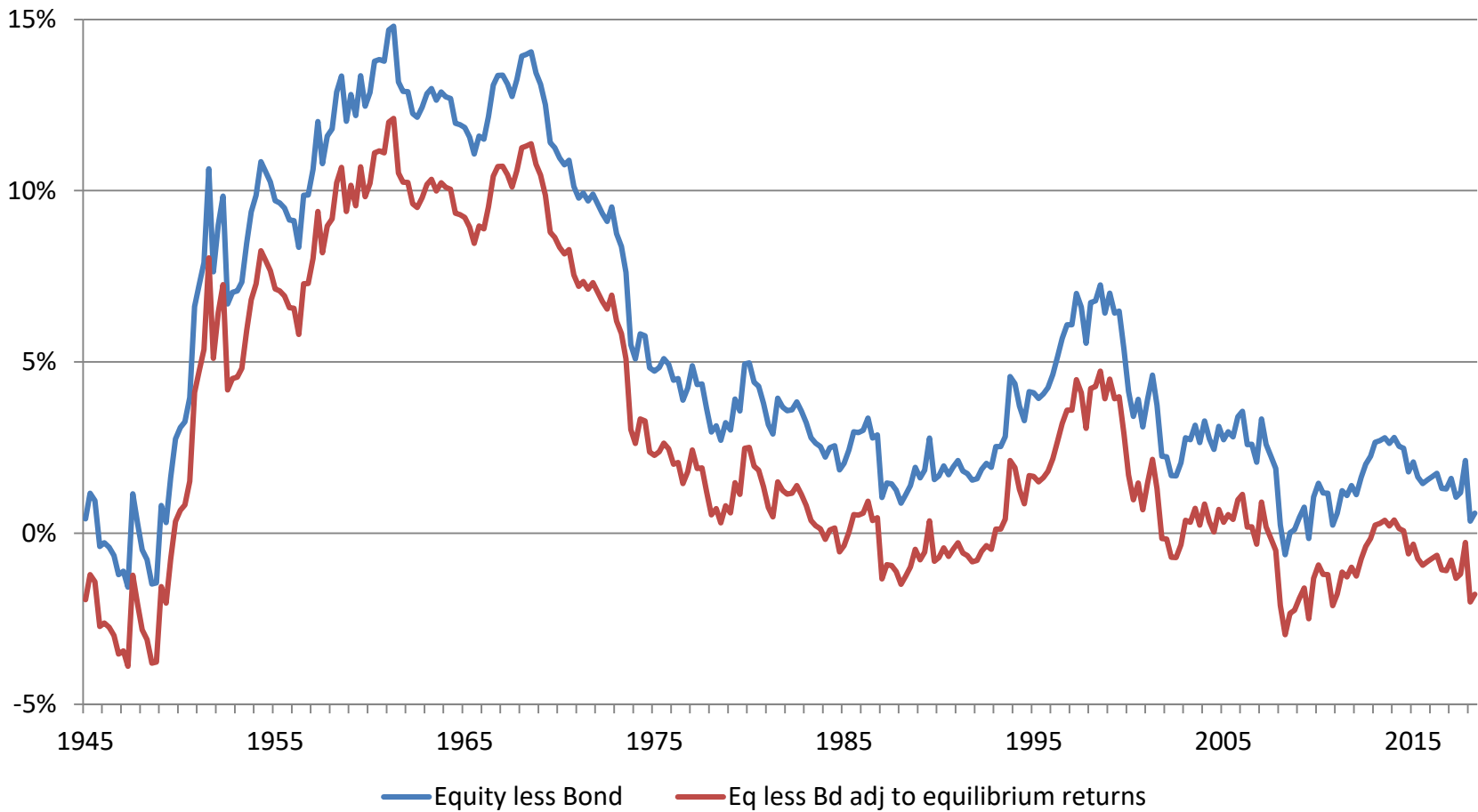
Equity less bond return rolling 10 year periods

red line adjusted to impose future equilibrium returns on past



Equity less bond return rolling 20 year periods

red line adjusted to impose future equilibrium returns on past



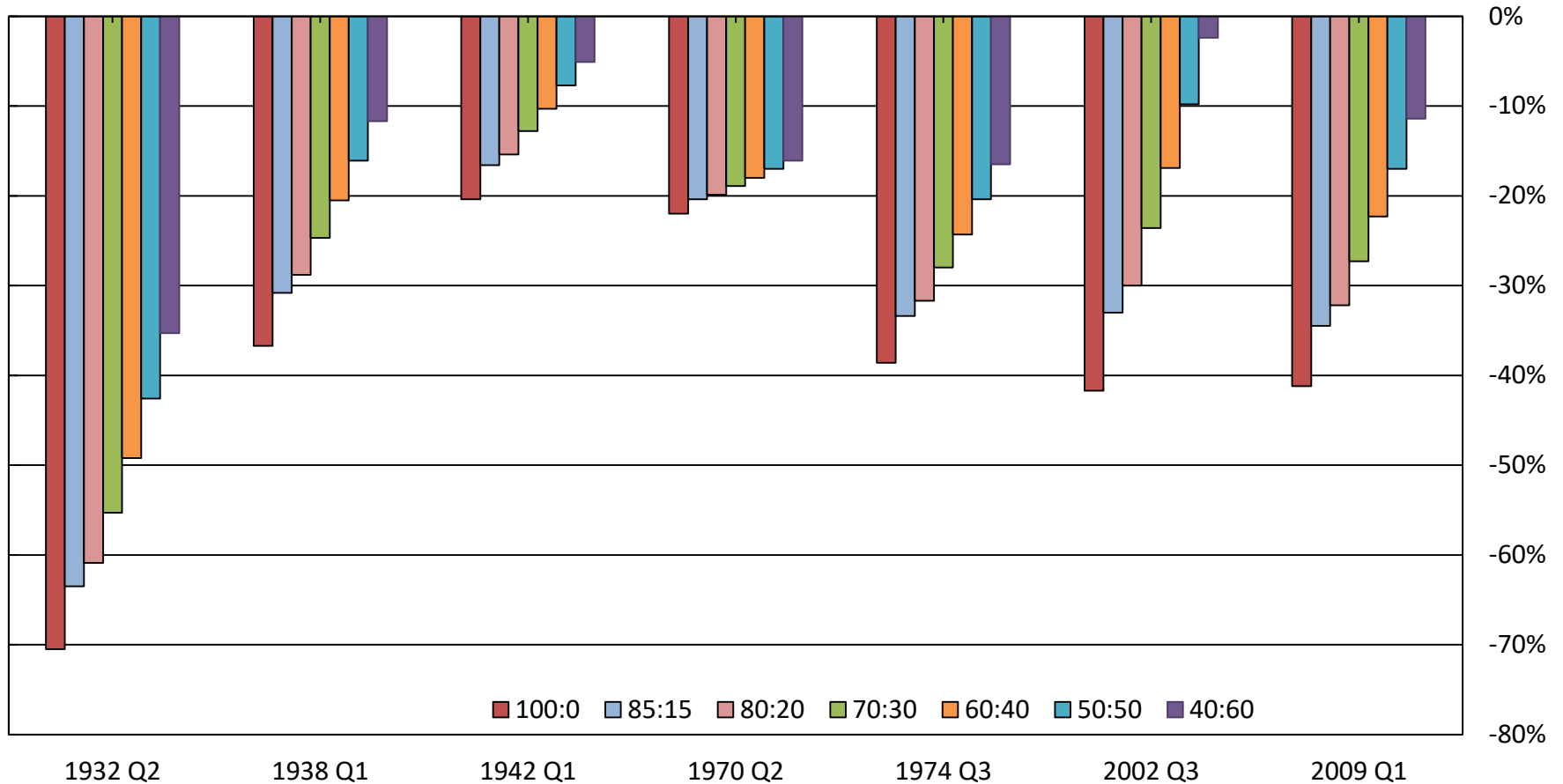
Equity-like and bond-like risk

benchmark and ranges

- Recommend benchmark equity-like risk of 70%, bond-like risk of 30% (including 2% cash)
 - 70/30 balances long term returns with drawdown risk remembering benchmark should represent what can be adhered to through thick and thin
- Recommend 50% (or 40%) to 85% equity-like range, bond-like of 15% to 50 (60%)
 - Current 50% equity-like risk minimum believed appropriate when markets are quite expensive using our valuation measures. This provides meaningful exposure if wrong or a decade early
 - Recommend considering additional steps of 45% and 40% for when markets are extremely expensive which in the model history beginning in 1965 has been reached only in the late 1990s
 - 40% minimum would be significantly below the benchmark and increase underperformance risk. Would reduce absolute risk when markets extremely expensive (and likely after big gains)
 - 85% believed appropriate when markets are very cheap using our valuation measures. The cheapness would suggest much or most of a potential decline already occurred
 - 85% maximum similar to peak reached in financial crisis which seemed appropriate
 - Goal is to enter market downturns with below benchmark risk then increase toward maximum risk level during downturn to benefit from eventual rebound
 - Markets typically continue to rise or fall further, sometimes significantly, after reaching thresholds to move to our minimum or maximum risk position. Essential to be patient for 5 years or more

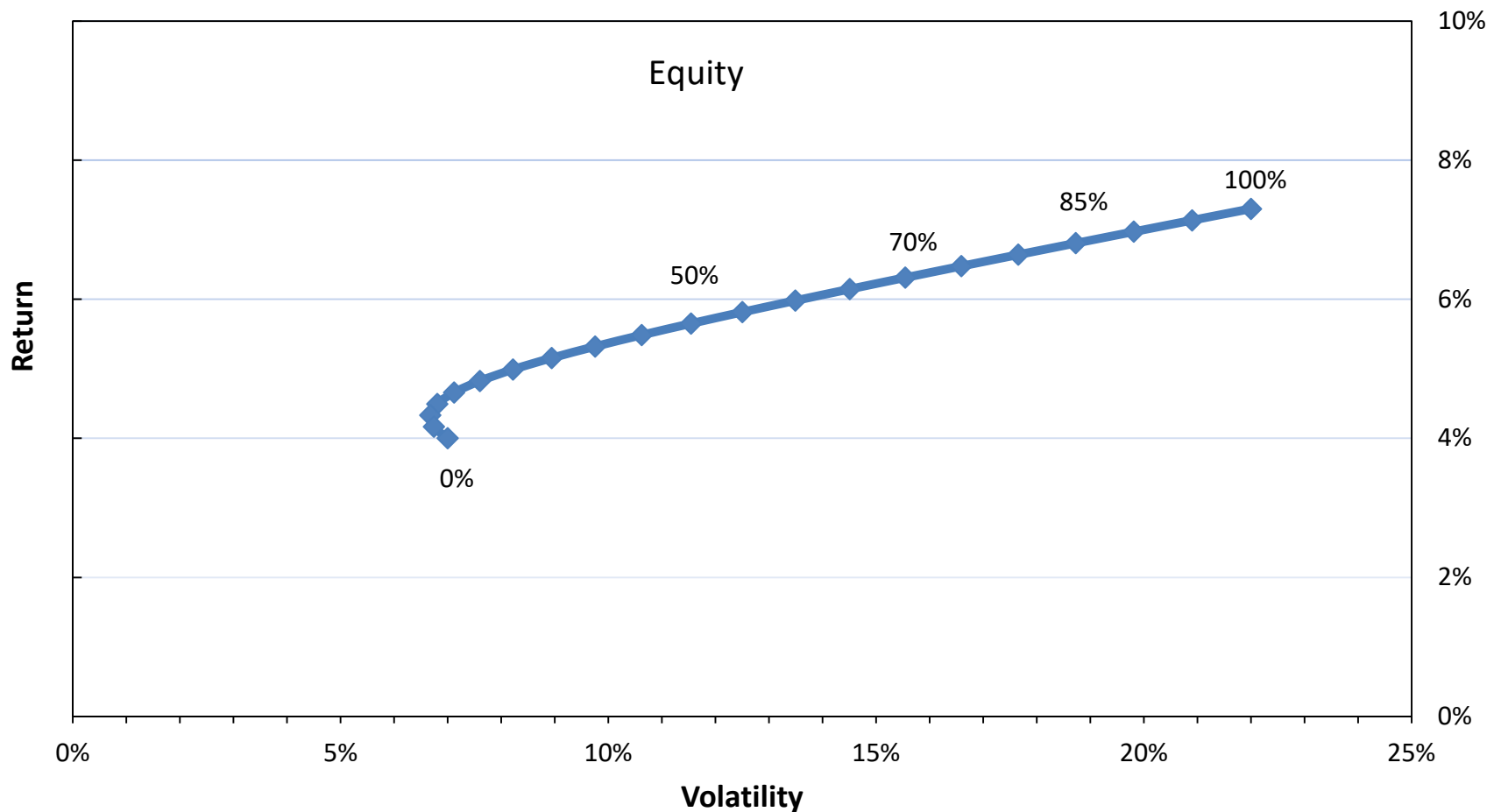
Risk of various equity allocations

two year periods with equity returns below negative 20%



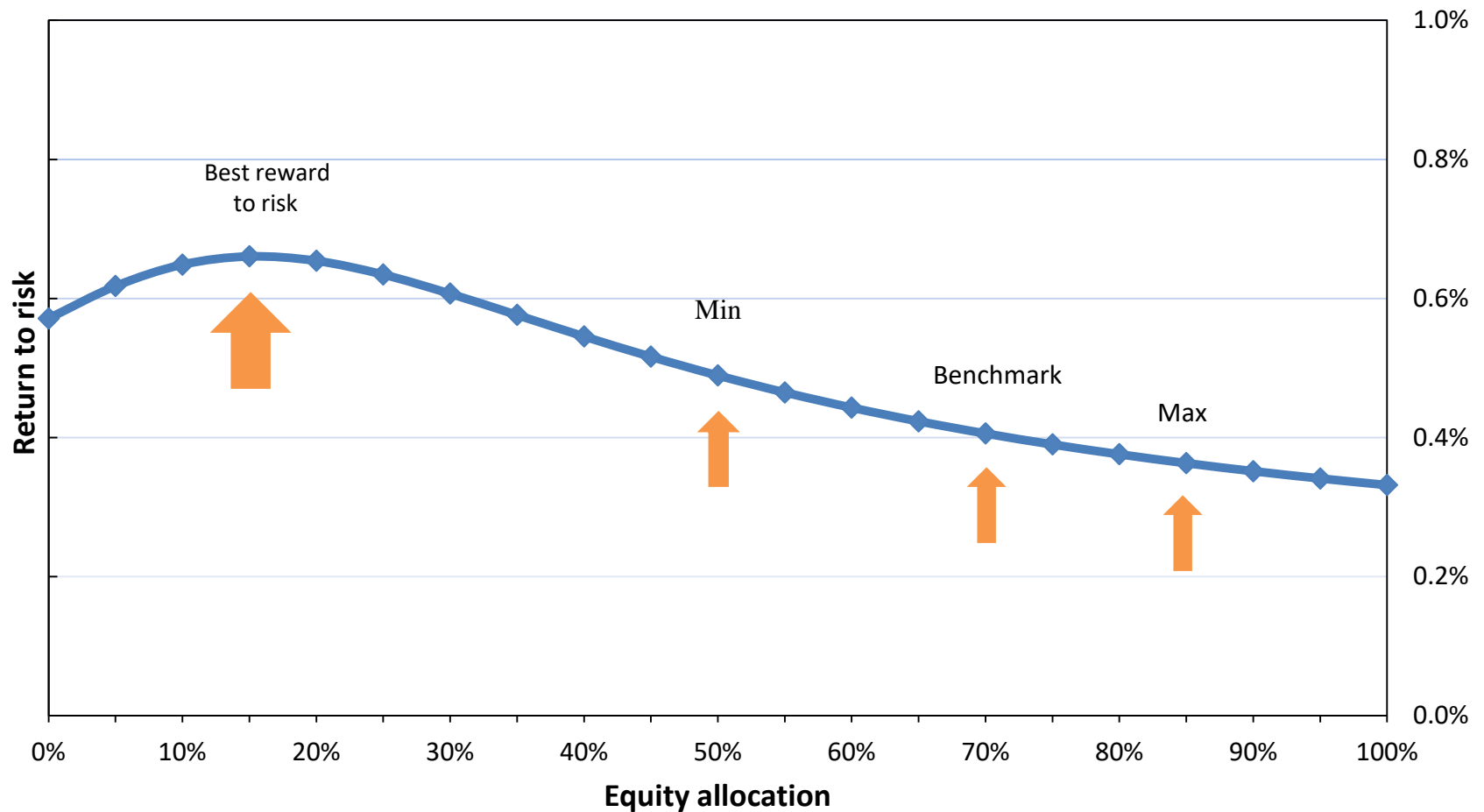
Return and risk for stock/bond allocations

using SDIC long term expected returns and fat tail adjusted volatility



Reward for assuming additional equity risk

increase in expected return per unit increase in volatility



Equity-like and bond-like risk for other categories

- Other categories are mapped to equivalent equity/bond/cash risk
 - REITS mapped primarily to equity with remainder mapped to short duration bonds
 - High yield mapped to equity and short duration bonds depending on credit quality
 - Private equity treated as leveraged equity
 - Opportunistic RE treated as leveraged REITs
- Exposures embedded in other categories is taken into account when targeting overall equity-like/bond-like/cash-like risk

Benchmark construction

- Categories in benchmark are significant and passively implementable
 - equity, bonds, real estate (REITS), high yield, and cash
- Skill/niche categories excluded from benchmark, but have permitted range
 - private equity, opportunistic real estate, arbitrage and hedge fund, commodities
 - equivalent stock/bond/cash risk is taken into account and offset if invest in these
- Benchmark constructed to achieve 70% equity-like, 28% bond-like, and 2% cash-like risk exposures

SDRS Capital Market Benchmark

allocations, indexes, min max ranges, and equity-like risk (50% min eq-like risk)

| | | Public Equity | Real Estate REIT/Core | HY Corp Debt | Investment Grade Debt | Cash | Private Equity | Opportunistic Real Estate | HY Real Estate Debt | Aggressive Absolute Return | TIPS | Commodities | Merger Arb | Convert Arb | Equity Like Risk | |
|---------------------------------|---|--|-----------------------------|----------------------------|-----------------------------|-------------------------------|-------------------|---------------------------------|---------------------------|----------------------------------|------|-------------|---------------|----------------|---------------------|-----|
| Maximum | 1 | 75% | 20% 2 | 15% | 50% | 50% | 12% | 15% 2 | 10% | 5% | 5% | 5% | 10% | 5% | 85% | |
| 2020 Benchmark (proposed) | | 58% | 10% | 7% | 23% | 2% 3 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 70% | |
| Minimum | 1 | 25% | 2% | 0% | 13% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 50% | |
| Index | | <i>MSCI AC IMI (3/4) + MSCI IMI US (1/4)</i> | <i>MSCI REIT</i> | <i>FTSE High Yield</i> | <i>FTSE BIG</i> | <i>FTSE 3 mo.Tsy bill</i> | | | | | | | | | | |
| <u>Benchmark history</u> | | | | | | | | | | | | | | | | |
| 2019 Benchmark | | 58% | 10% | 7% | 23% | 2% 3 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 70% |
| 2018 Benchmark | | 58% | 10% | 7% | 23% | 2% 3 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 70% |
| 2017 Benchmark | | 58% | 10% | 7% | 23% | 2% 3 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 0% 4 | 70% |
| 2016 Benchmark | | 58% | 10% | 7% | 23% | 2% | 0% | | | 0% | 0% | 0% | 0% | 0% | 0% | 70% |
| 2015 Benchmark | | 60% | 10% | 7% | 19% | 2% | 0% | | | 0% | 1% | 1% | 0% | 0% | 0% | 70% |
| 2014 Benchmark | | 56% | 8% | 7% | 18% | 2% | 7% | | | 0% | 1% | 1% | 0% | 0% | | |
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| 2012 Benchmark | | 58% | 8% | 7% | 18% | 2% | 5% | | | 0% | 1% | 1% | 0% | 0% | | |
| 2011 Benchmark | | 57% | 7% | 6% | 18% | 1% | 5% | | | | | 1% | 2% | 3% | | |

1. Buffer for market drift of 1% for Equity and 1/2% for debt (example: Investment Grade debt minimum of 13% can drift to 12.5%)

2. Real Estate (RE) maximum applies to REITS/Core RE and Opportunistic combined. Opportunistic RE counts 1.3x against RE max. Projected case allocation used for partnerships

3. Cash to provide liquidity for benefits payments and rebalancing

4. Skill and niche categories are not included in benchmark but do have a permitted range to invest in opportunistically

SDRS Capital Market Benchmark

allocations, indexes, min max ranges, and equity-like risk (40% min eq-like risk)

| | | Public <u>Equity</u> | Real Estate <u>REIT/Core</u> | HY Corp <u>Debt</u> | Investment Grade <u>Debt</u> | <u>Cash</u> | Private <u>Equity</u> | Opportunistic Real <u>Estate</u> | HY Real Estate <u>Debt</u> | Aggressive Absolute <u>Return</u> | <u>TIPS</u> | <u>Commodities</u> | Merger <u>Arb</u> | Convert <u>Arb</u> | Equity <u>Like Risk</u> | |
|------------------------------|--------------|--|------------------------------------|----------------------------|------------------------------------|--------------------------------|--------------------------|--|----------------------------------|---|-----------------|--------------------|----------------------|-----------------------|----------------------------|--|
| Maximum | ¹ | 75% | 20% ² | 15% | 60% | 50% | 12% | 15% ² | 10% | 5% | 5% | 5% | 10% | 5% | 85% | |
| 2020 Benchmark (proposed) | | 58% | 10% | 7% | 23% | 2% ³ | 0% ⁴ | 0% ⁴ | 0% ⁴ | 0% ⁴ | 0% ⁴ | 0% ⁴ | 0% ⁴ | 0% ⁴ | 70% | |
| Minimum | ¹ | 20% | 2% | 0% | 13% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 40% | |
| Index | | <i>MSCI AC IMI (3/4) + MSCI IMI US (1/4)</i> | <i>MSCI REIT</i> | <i>FTSE High Yield</i> | <i>FTSE BIG</i> | <i>FTSE 3 mo. Tsy bill</i> | | | | | | | | | | |
| Benchmark history | | | | | | | | | | | | | | | | |
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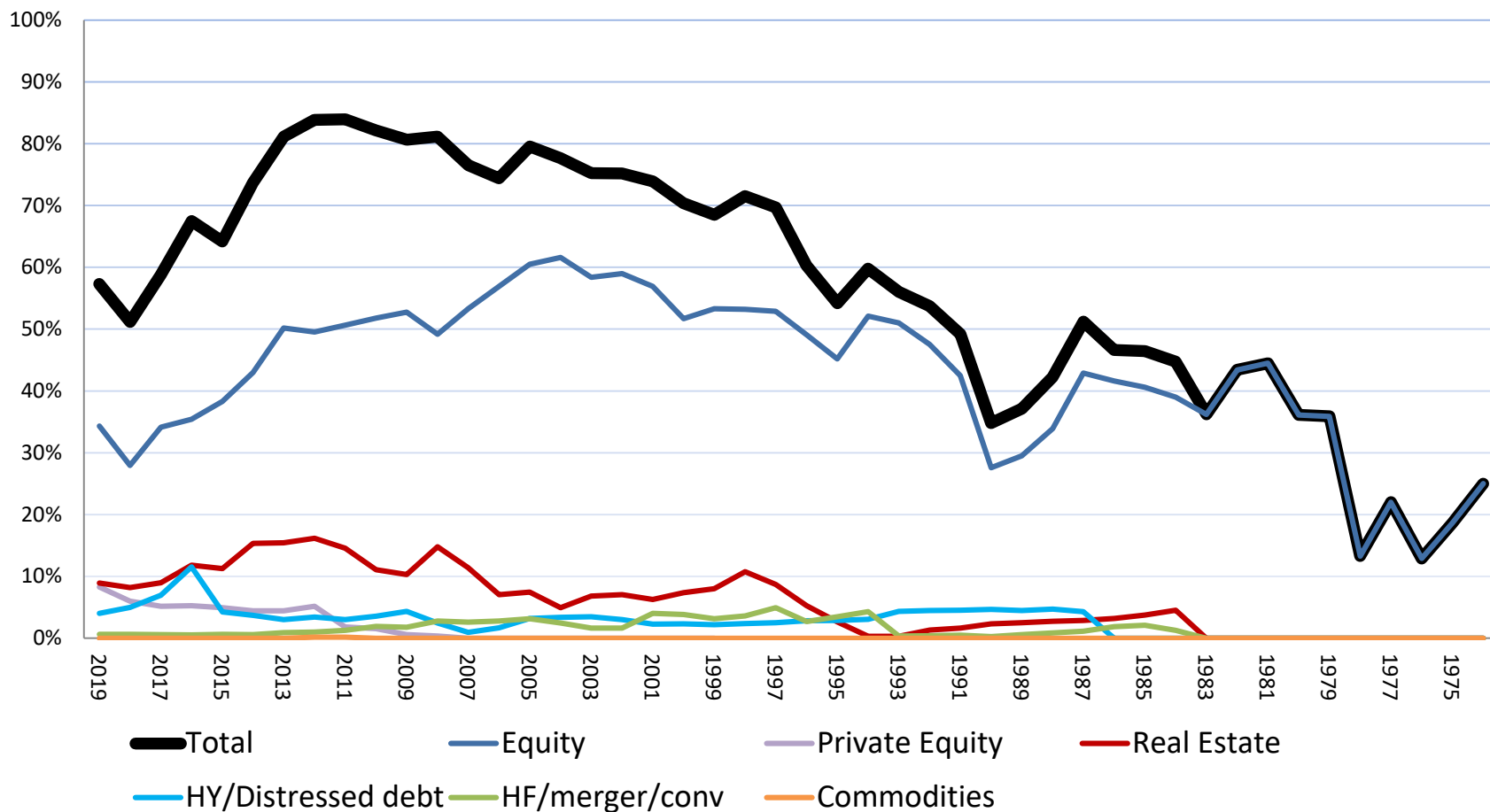
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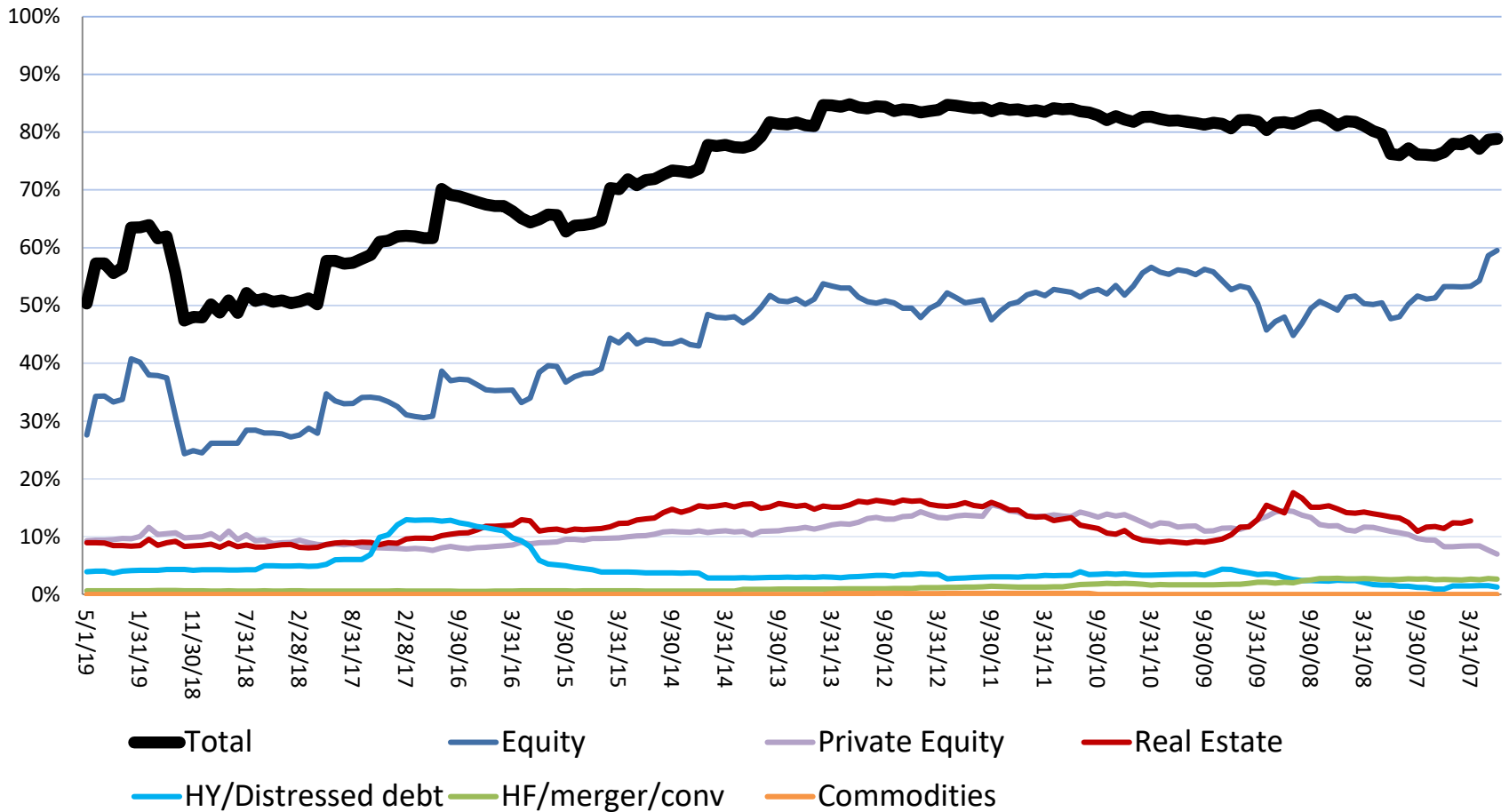
Equity-like risk (equity and embedded equity from other categories)

total and contribution of each component May 31, 2017 back to 1987



Equity-like risk (equity and embedded equity from other categories)

total and contribution of each component 5/1/2019 back to 12/31/2006



Additional risk measures and control

- Risk measurement
 - Focus on equity-like and bond-like risk as easier to relate to historical returns for stocks and bonds
 - Statistical measures of risk, such as standard deviation and correlation, are also calculated but are adjusted to reflect higher real world frequency and magnitude of adverse outlier events
 - Behavior of some assets can vary depending on inflation or deflation rooted market crisis
- Risk control
 - Risk managed by broad diversification and reducing amounts invested in expensive assets
 - Adequate liquidity maintained to avoid liquidations of depressed assets and allow rebalancing
- Need to participate in economic system
 - Participation in free enterprise economic system provides highest long-term rewards
 - To get the long term rewards, must endure the short term ebbs and flows
 - Faith in the long term despite periodic bumps in the road and potentially rockier future
- Strength and determination to handle tough markets
 - Strong funding and benefit design helpful to managing downside volatility
 - In very difficult circumstances, benefits may require further adjustment to maintain funding

SDRS expected return and standard deviation

using J.P. Morgan inputs as proxy for conventional inputs

| | Expected Standard | | Correlation Matrix | | | | | | | | | | RE | |
|-----------------------------------|-------------------|------------|--------------------|------|-------|-------|------|------|------|------|---------|--------|------|--|
| | Return | Deviation* | US Eq | Intl | Hedge | Bonds | Cash | HY | Comd | RE | Priv Eq | Opport | Tips | |
| Domestic (US) Equity | 5.3% | 14% | 100% | | | | | | | | | | | |
| International Equity | 6.8% | 17% | 88% | 100% | | | | | | | | | | |
| Hedge Funds | 4.8% | 9% | 79% | 81% | 100% | | | | | | | | | |
| Investment Grade debt | 4.0% | 4% | 0% | 10% | -11% | 100% | | | | | | | | |
| Cash | 2.0% | 1% | -7% | -1% | -2% | 9% | 100% | | | | | | | |
| High Yield debt | 5.5% | 8% | 68% | 74% | 76% | 20% | -11% | 100% | | | | | | |
| Commodity Index | 2.3% | 16% | 44% | 53% | 57% | 5% | 8% | 45% | 100% | | | | | |
| REITs | 6.3% | 16% | 72% | 65% | 50% | 29% | -7% | 61% | 24% | 100% | | | | |
| Private Equity | 6.3% | 21% | 74% | 78% | 81% | -27% | 6% | 69% | 61% | 44% | 100% | | | |
| Real Estate Opportunistic | 7.8% | 20% | 56% | 46% | 59% | -21% | -7% | 54% | 41% | 65% | 49% | 100% | | |
| Tsy Inflation Protected Sec(TIPS) | 3.3% | 5% | 5% | 16% | 5% | 77% | 7% | 31% | 27% | 22% | 7% | 6% | 100% | |

* Standard deviation is a measure of volatility. There is a 66% chance of being within plus or minus 1 standard deviation, a 95% chance of being within 2 standard deviations.

| | U.S. Equity | Intl Equity | Hedge Funds | Bonds | Cash | High Yield | Comm -odity | Private REITs | RE Equity | RE Opport | HY RE Debt | Mean Expected Return | 1 year Standard Deviation | 5 year Standard Deviation | 10 year Standard Deviation | 20 year Standard Deviation |
|---------------------------|-------------|-------------|-------------|-------|------|------------|-------------|---------------|-----------|-----------|------------|----------------------|---------------------------|---------------------------|----------------------------|----------------------------|
| 100/0 Equity/Bond | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 5.25% | 13.8% | 6.1% | 4.3% | 3.1% |
| 70:30 Equity/Bond | 70% | 0% | 0% | 30% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 4.88% | 9.7% | 4.3% | 3.1% | 2.2% |
| add International EQ | 47% | 23% | 0% | 30% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 5.22% | 10.1% | 4.5% | 3.2% | 2.3% |
| add REITs | 42% | 20% | 0% | 28% | 0% | 0% | 0% | 10% | 0% | 0% | 0% | 5.30% | 10.2% | 4.5% | 3.2% | 2.3% |
| add High Yield | 40% | 19% | 0% | 24% | 0% | 7% | 0% | 10% | 0% | 0% | 0% | 5.35% | 10.1% | 4.5% | 3.2% | 2.3% |
| add Cash | 40% | 19% | 0% | 22% | 2% | 7% | 0% | 10% | 0% | 0% | 0% | 5.31% | 10.1% | 4.5% | 3.2% | 2.3% |
| add Private Equity | 32% | 17% | 0% | 22% | 4% | 7% | 0% | 10% | 8% | 0% | 0% | 5.30% | 10.0% | 4.5% | 3.2% | 2.2% |
| add RE Opportunistic | 31% | 16% | 0% | 22% | 6% | 7% | 0% | 2% | 8% | 8% | 0% | 5.34% | 9.8% | 4.4% | 3.1% | 2.2% |
| Benchmark FY20 (proposed) | 39% | 19% | 0% | 23% | 2% | 7% | 0% | 10% | 0% | 0% | 0% | 5.30% | 10.0% | 4.5% | 3.2% | 2.2% |
| SDRS Current AA | 22% | 11% | 1% | 13% | 25% | 4% | 0% | 0% | 8% | 8% | 7% | 4.55% | 7.4% | 3.3% | 2.3% | 1.7% |

| Return Ranges | Mean | 1 Year Horizon | | | 5 Year Horizon | | | 10 Year Horizon | | | 20 Year Horizon | | |
|---------------------------|-------|----------------|--------|---------|----------------|--------|---------|-----------------|--------|---------|-----------------|--------|---------|
| | | Exp Ret | up 1sd | dn 1 sd | dn 2 sd | up 1sd | dn 1 sd | dn 2 sd | up 1sd | dn 1 sd | dn 2 sd | up 1sd | dn 1 sd |
| Benchmark FY20 (proposed) | 5.30% | 15.3% | -4.7% | -14.7% | 9.8% | 0.8% | -3.6% | 8.5% | 2.1% | -1.0% | 7.5% | 3.1% | 0.8% |

SDRS expected return and standard deviation

using SDIC expected returns and fat-tail adjusted risk measures

| | Expected Standard | | Correlation Matrix | | | | | | | | | | |
|-----------------------------------|-------------------|------------|--------------------|---------|-------|------|------|------|------|------|---------|--------|------|
| | Return | Deviation* | US Eq | Intl Eq | Hedge | Debt | Cash | HY | Comd | RE | Priv Eq | RE Opp | TIPS |
| Domestic (US) Equity | 7.3% | 22% | 100% | | | | | | | | | | |
| International Equity | 7.3% | 22% | 100% | 100% | | | | | | | | | |
| Hedge Funds | 5.4% | 12% | 73% | 73% | 100% | | | | | | | | |
| Investment Grade debt | 4.0% | 7% | 0% | 0% | -10% | 100% | | | | | | | |
| Cash | 3.6% | 1% | 0% | 0% | 0% | 0% | 100% | | | | | | |
| High Yield debt | 5.6% | 12% | 75% | 75% | 35% | 23% | 0% | 100% | | | | | |
| Commodity Index | 4.0% | 22% | 50% | 50% | 35% | -20% | 0% | 20% | 100% | | | | |
| REITs | 6.9% | 24% | 75% | 75% | 30% | 0% | 0% | 50% | 30% | 100% | | | |
| Private Equity | 8.0% | 30% | 88% | 88% | 30% | 0% | 0% | 55% | 40% | 70% | 100% | | |
| Real Estate Opportunistic | 7.6% | 32% | 75% | 75% | 25% | 2% | 0% | 60% | 25% | 90% | 60% | 100% | |
| Tsy Inflation Protected Sec(TIPS) | 4.0% | 7% | 0% | 0% | 0% | 100% | 0% | 24% | 0% | 0% | 0% | 0% | 100% |

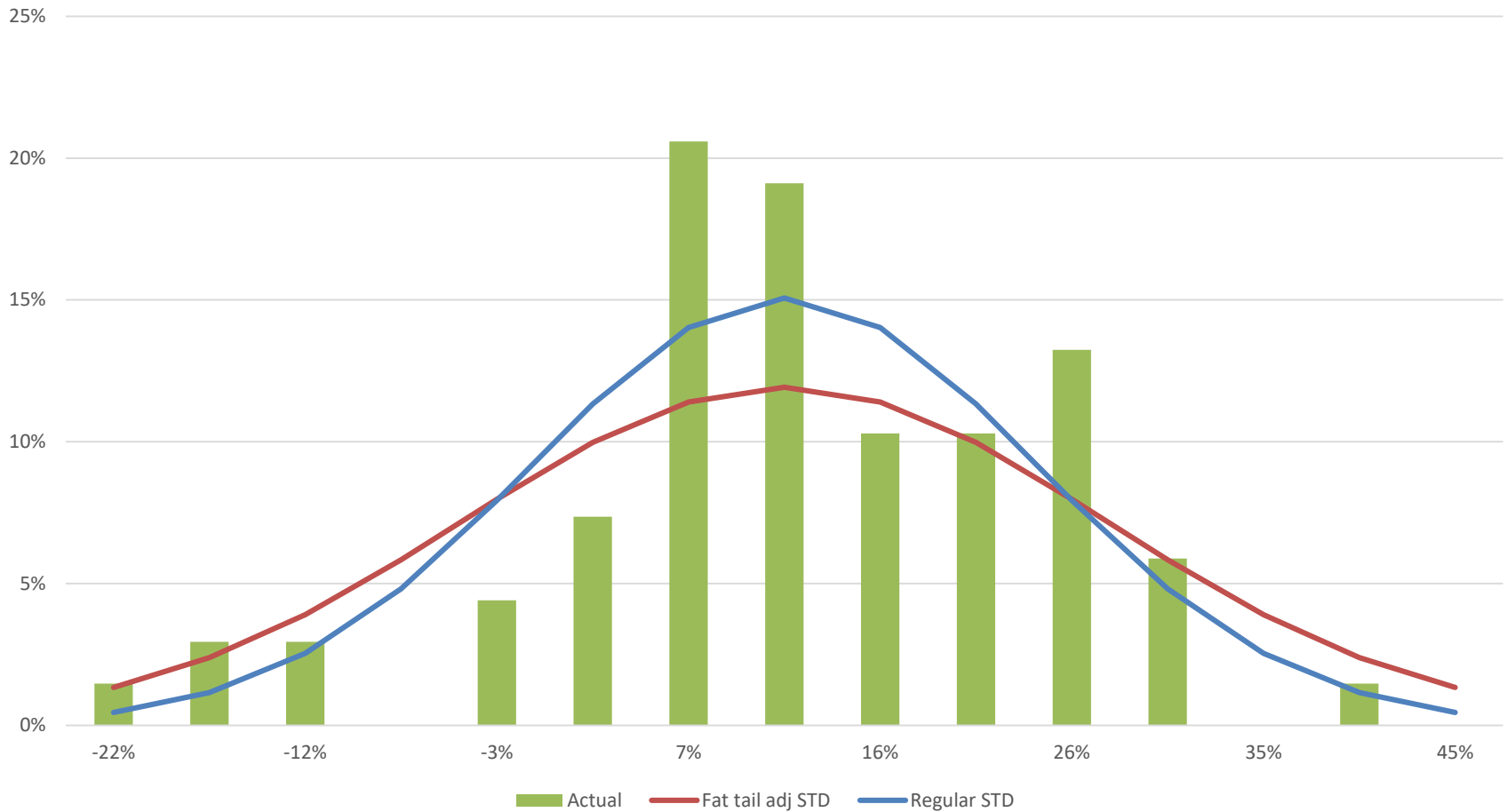
* Standard deviation is a measure of volatility. There is a 66% chance of being within plus or minus 1 standard deviation, a 95% chance of being within 2 standard deviations.

| | US Equity | Intl Equity | Hedge Funds | Inv Gr Debt | Cash | HY Debt | Comm -odity | REITs | Private Equity | RE Opport | HY RE Debt | Mean | 1 year | 5 year | 10 year | 20 year |
|---------------------------|-----------|-------------|-------------|-------------|------|---------|-------------|-------|----------------|-----------|------------|-----------------|--------------------|--------------------|--------------------|--------------------|
| | | | | | | | | | | | | Expected Return | Standard Deviation | Standard Deviation | Standard Deviation | Standard Deviation |
| 100:0 Equity/Debt | 100% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 7.30% | 22.0% | 9.8% | 7.0% | 4.9% |
| 70:30 Equity/Debt | 70% | 0% | 0% | 30% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 6.30% | 15.5% | 7.0% | 4.9% | 3.5% |
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| add REITs | 42% | 20% | 0% | 28% | 0% | 0% | 0% | 10% | 0% | 0% | 0% | 6.32% | 15.6% | 7.0% | 4.9% | 3.5% |
| add High Yield debt | 40% | 19% | 0% | 24% | 0% | 7% | 0% | 10% | 0% | 0% | 0% | 6.33% | 15.6% | 7.0% | 4.9% | 3.5% |
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| add RE Opportunistic | 31% | 16% | 0% | 22% | 6% | 7% | 0% | 2% | 8% | 8% | 0% | 6.29% | 15.6% | 7.0% | 4.9% | 3.5% |
| Benchmark FY20 (proposed) | 39% | 19% | 0% | 23% | 2% | 7% | 0% | 10% | 0% | 0% | 0% | 6.29% | 15.4% | 6.9% | 4.9% | 3.4% |
| SDRS Current AA | 22% | 11% | 1% | 13% | 25% | 4% | 0% | 0% | 8% | 8% | 7% | 5.65% | 11.9% | 5.3% | 3.8% | 2.7% |

| Return Ranges | Mean Exp Ret | 1 Year Horizon | | | 5 Year Horizon | | | 10 Year Horizon | | | 20 Year Horizon | | |
|---------------------------|--------------|----------------|---------|---------|----------------|---------|---------|-----------------|---------|---------|-----------------|---------|---------|
| | | up 1sd | dn 1 sd | dn 2 sd | up 1sd | dn 1 sd | dn 2 sd | up 1sd | dn 1 sd | dn 2 sd | up 1sd | dn 1 sd | dn 2 sd |
| Benchmark FY20 (proposed) | 6.29% | 21.7% | -9.1% | -24.5% | 13.2% | -0.6% | -7.5% | 11.2% | 1.4% | -3.4% | 9.7% | 2.9% | -0.6% |

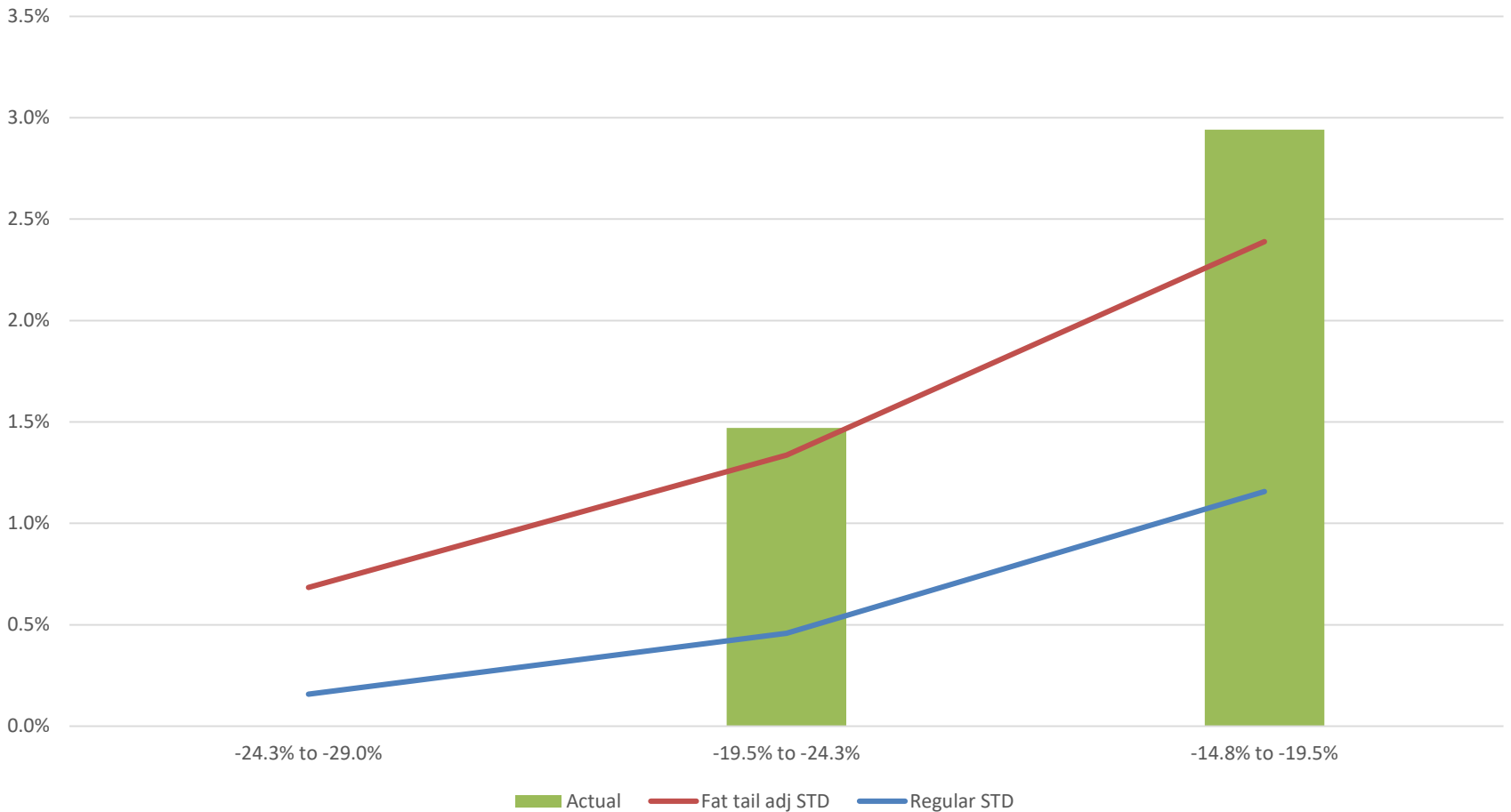
Actual vs expected with fat tail adjusted volatility

two year annualized equity returns



Focus on severe adverse outcomes

two annualized equity returns actual versus expected



SDRS expected long term return recap

- Benchmark asset allocation expected return is 6.29%
- Negative dollar cost averaging effect may lower by .25%
- Expected returns are the midpoint of a wide distribution with a 50% chance of being higher and a 50% chance of being lower
- Standard deviation is 15.4% adjusted to reflect real world frequency of severe negative returns and correlations during severe periods. Conventionally measured standard deviation is 10.0%.

Asset category valuation

- Equity-like and bond-like risk
 - Equity and bond valuation processes
- Real estate (REITS)
 - REIT valuation versus underlying equity and bond components
- High yield
 - High yield valuation versus underlying equity and bond components
- Private equity
 - Subjective and data assessment of risk adjusted added value versus equity
- Opportunistic real estate
 - Subjective and data assessment of risk adjusted added value versus REITS
- Arbitrage and other strategies
 - Monitor for signs of distress and bottom up underwriting of proxy transactions

Equity valuation

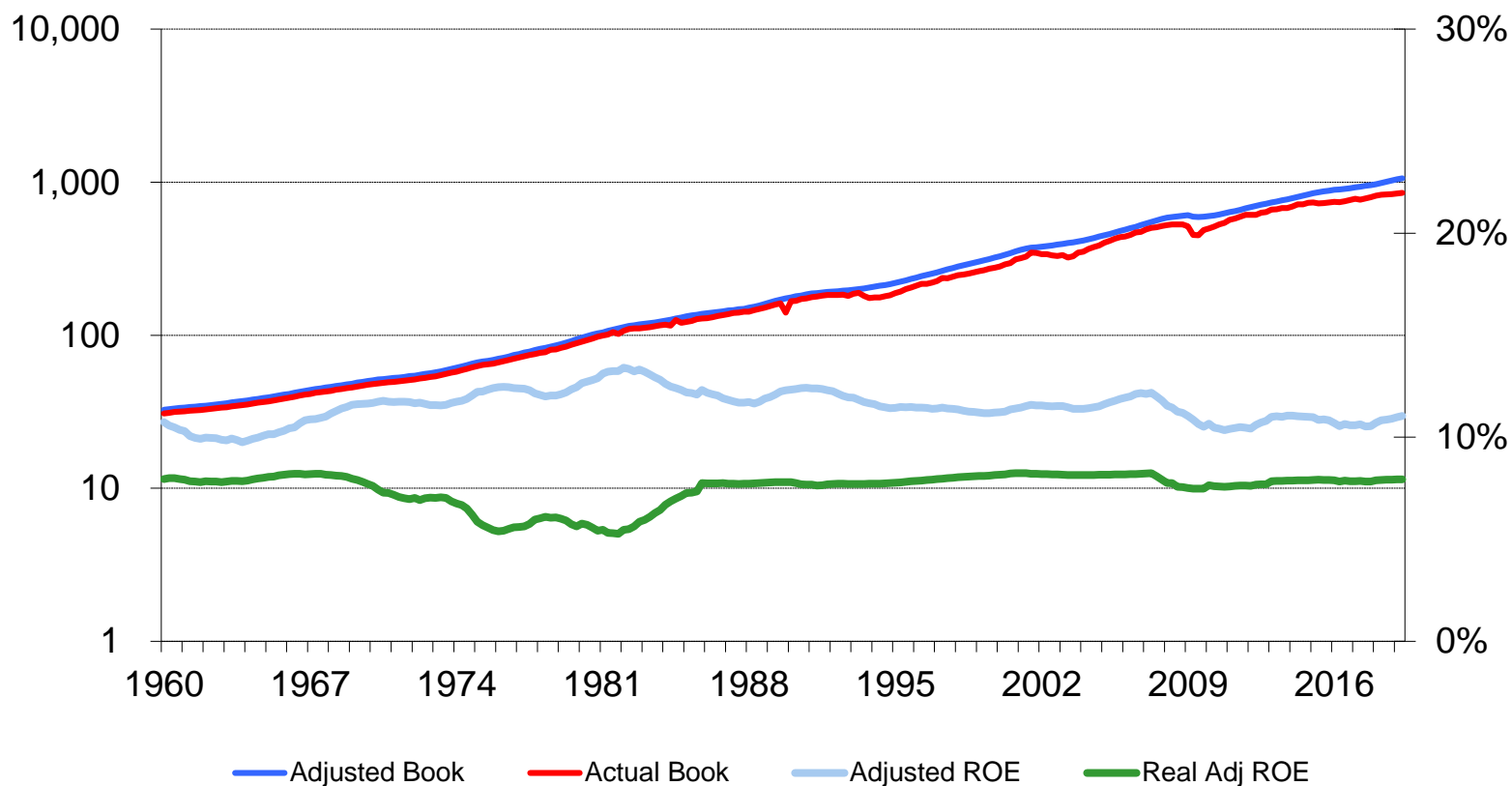
- Estimated future cash flows
 - Normal earnings
 - Growth rate
- Discount rate based on risk
 - Inflation + real cash yield + term premium + equity risk premium
- Value is discounted value of future cash flows
- Adjustments to value
 - Monetary stimulus/restraint
 - Earnings strength

Normal earnings

- Normal earnings
 - Adjusted book value multiplied by normal return on equity
- Adjusted book value
 - Book value is balance sheet reported value of assets net of liabilities
 - Book value may not track retained earnings due to index changes, mergers, and buybacks. These leakages must be addressed.
 - Book value write-downs are smoothed
- Normal return on equity = Historic Real ROE + Expected Inflation + ROE Adjustments
 - Return on equity is earnings divided by adjusted book value
 - Real ROE is return on equity less inflation
 - Historic Real ROE is the historic average Real ROE
 - Expected inflation is drawn from long term and recent history
- ROE Adjustments
 - Inflation can impact the level of real ROE
 - Governance can also impact real ROE

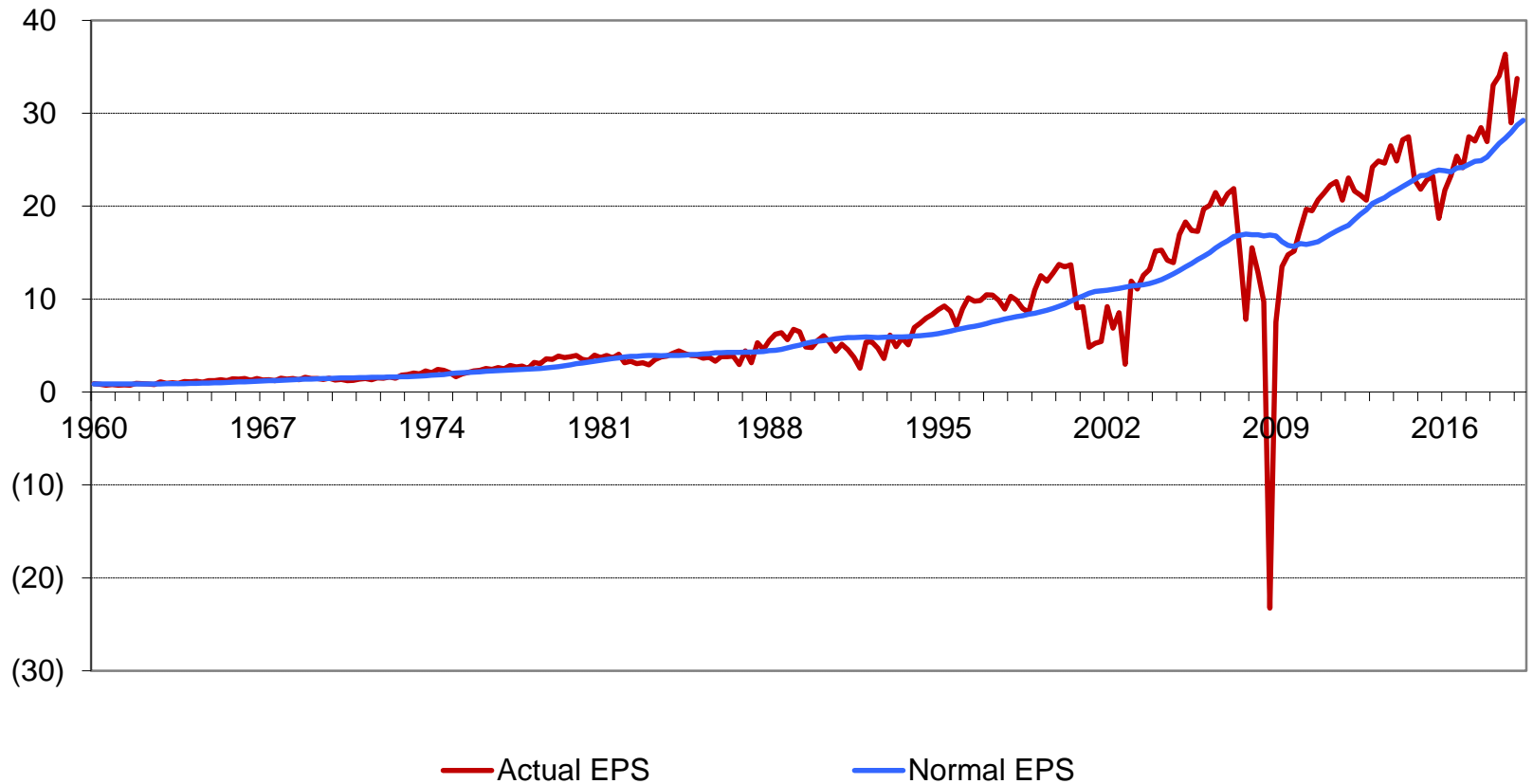
Book value and return on equity (RHS)

Incorporates book value adjustments



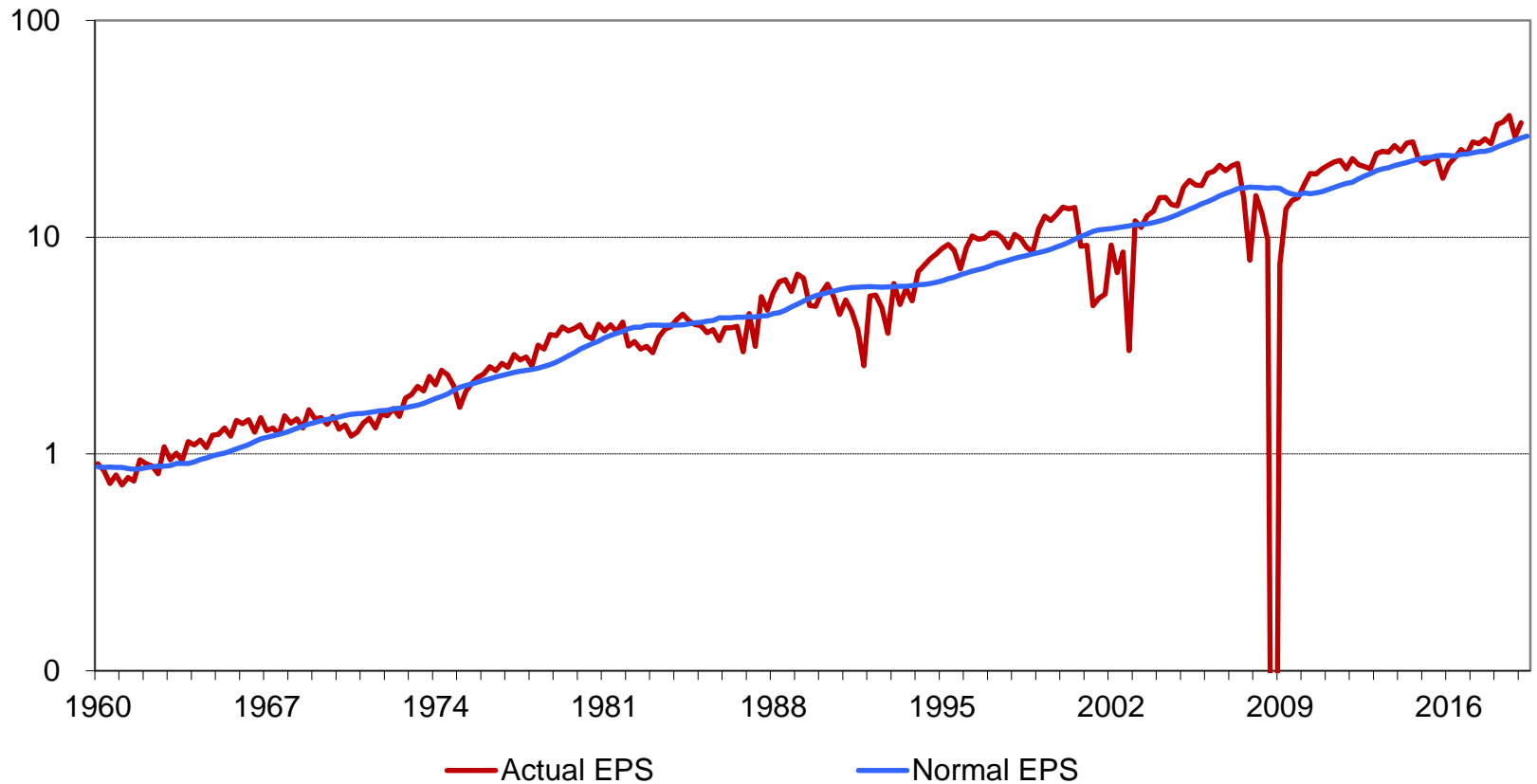
Normal EPS (regular scale to better see recent levels)

Book value multiplied by adjusted ROE



Normal EPS (Log scale to better see historic levels)

Book Value multiplied by adjusted ROE

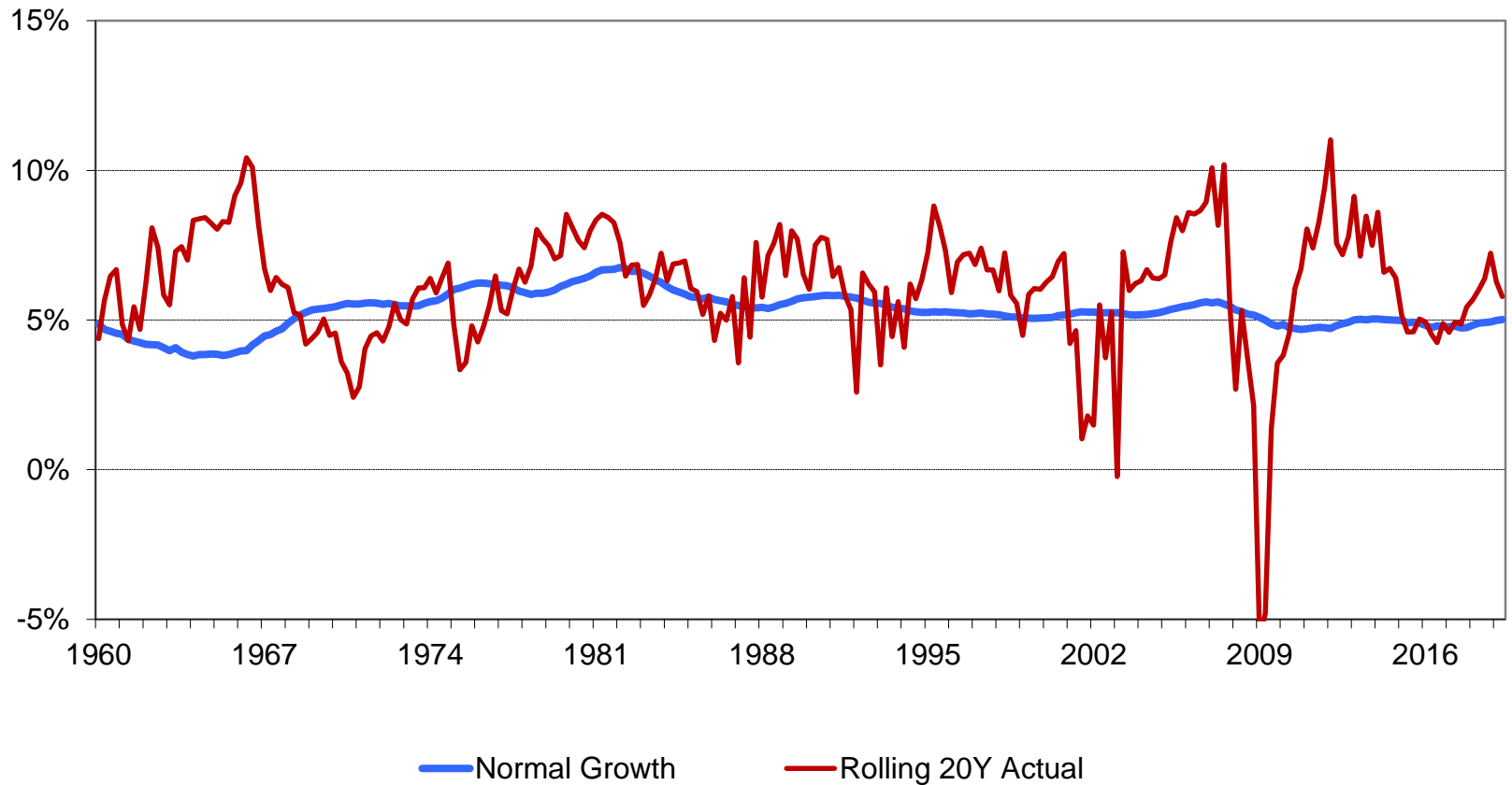


Normal growth

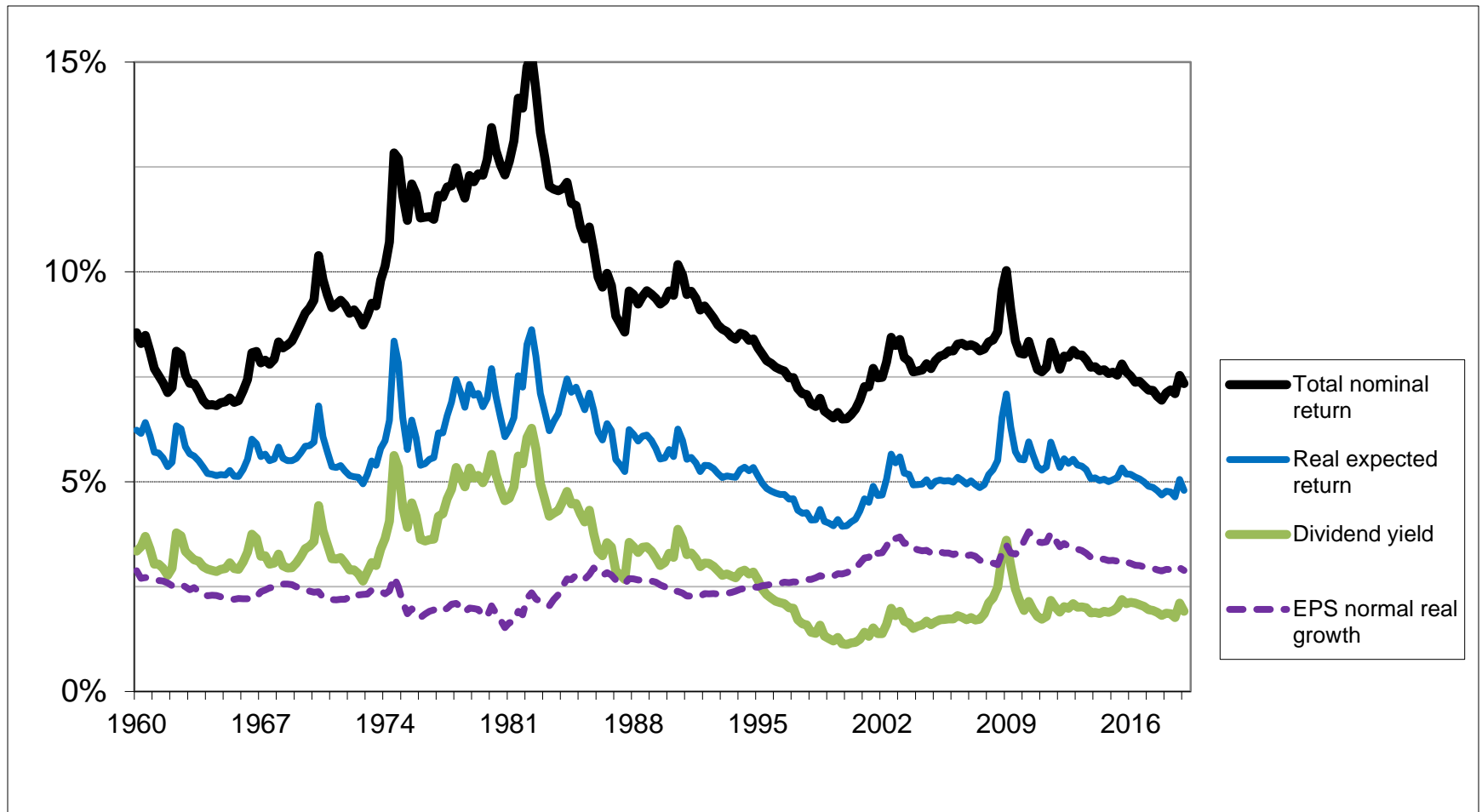
- Normal Growth = organic + acquisition + inflation pass through – attrition
 - Organic growth = organic reinvestment times normal ROE
 - Organic reinvestment = portion of earnings reinvested excluding acquisitions
 - Normal ROE adjusted to avoid double counting of inflation pass-through effect
 - Acquisition growth = acquisition investment times cost of capital
 - Acquisition investment = portion of earnings invested in acquisitions
 - Acquisitions return based on cost of capital
 - Inflation pass through = expected inflation x pass-through percentage
 - Expected Inflation = Same as used for Normal ROE
 - Pass-through percentage = Percent of expected inflation estimated to pass through as an increase in normal earnings
 - Attrition = estimated mortality rate of normal earnings
 - Adjust for bias of earnings power (absent further investment) to be at risk of erosion
 - Attrition rate helps reconcile historic actual growth with the growth otherwise expected

EPS growth

Normal versus 20 year actual

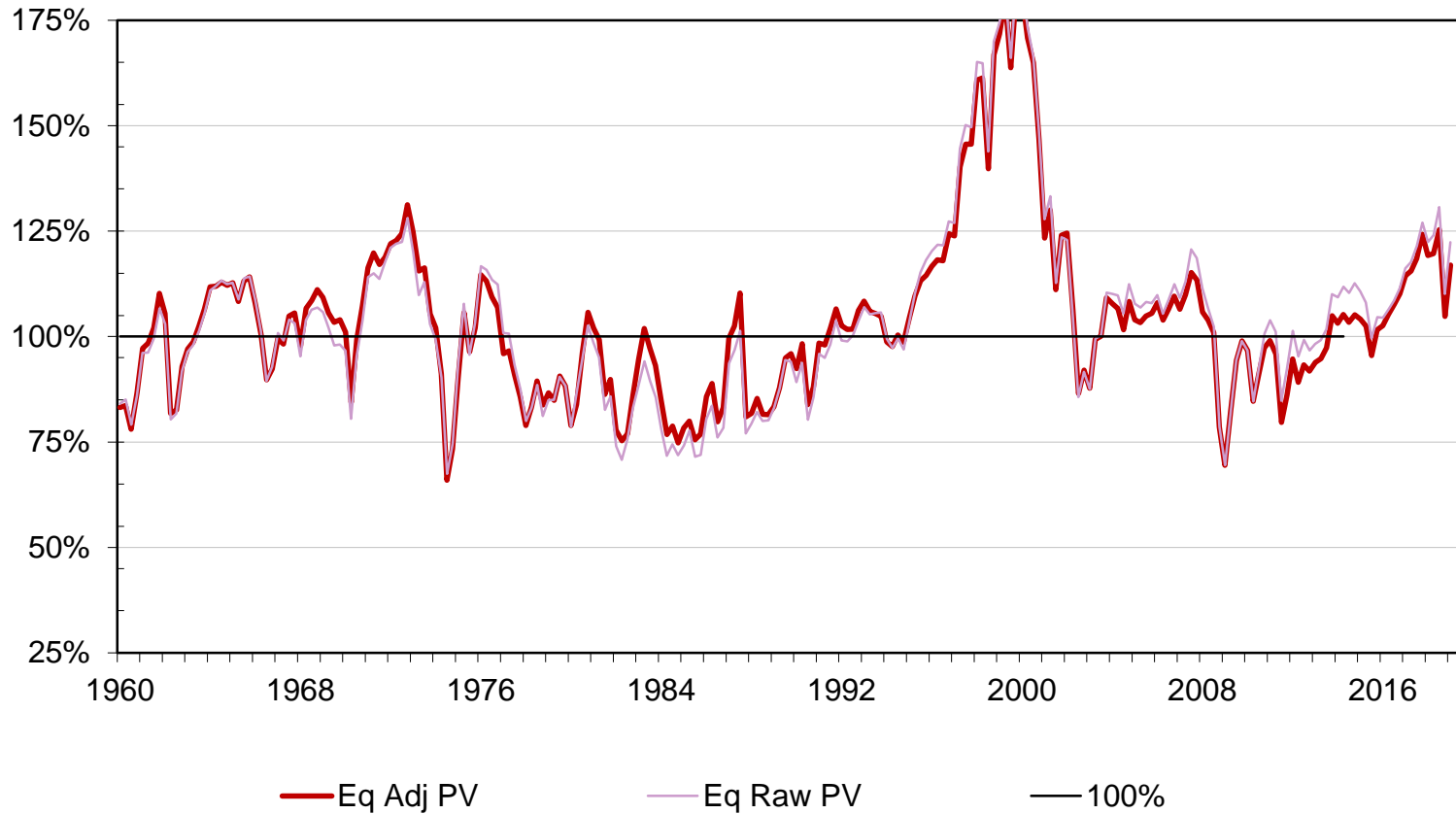


Equity expected return – nominal and real



Equity price to value

raw and with monetary and earnings adjustments

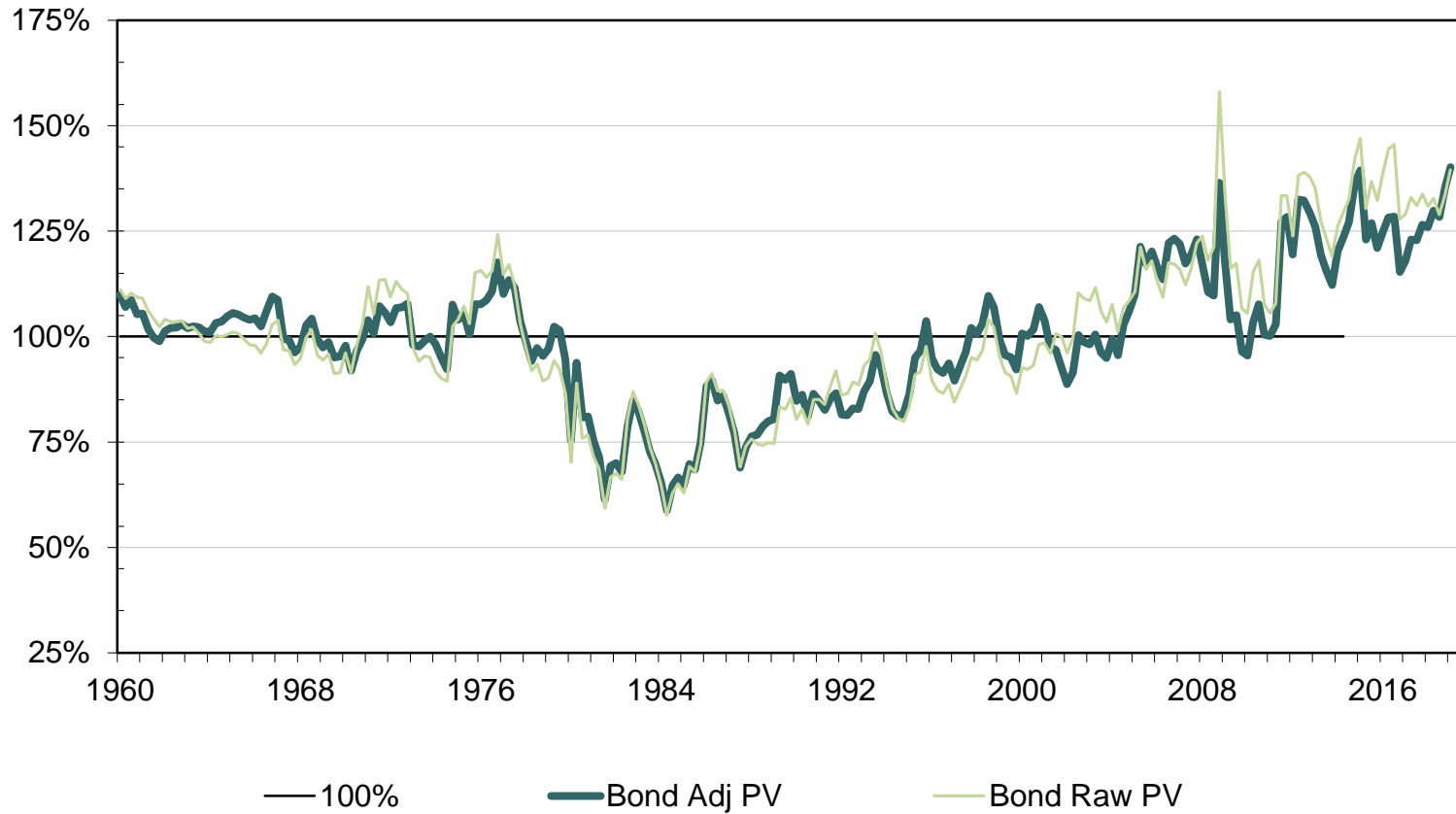


Bond valuation

- Equilibrium yield estimated
 - Inflation
 - Real cash yield
 - Term premium
- Bond value based on equilibrium yield
- Adjustments to value
 - Monetary stimulus/restraint
 - Earnings strength

Bond price to value

raw and with monetary and earnings adjustments



Real Estate valuation

- Real estate capitalization rate is adjusted to a typical equity/debt structure
- Discount rate is linked to the equity discount rate
- Difference between leverage adjusted cap rate and discount rate is converted into price to value

High Yield spread model

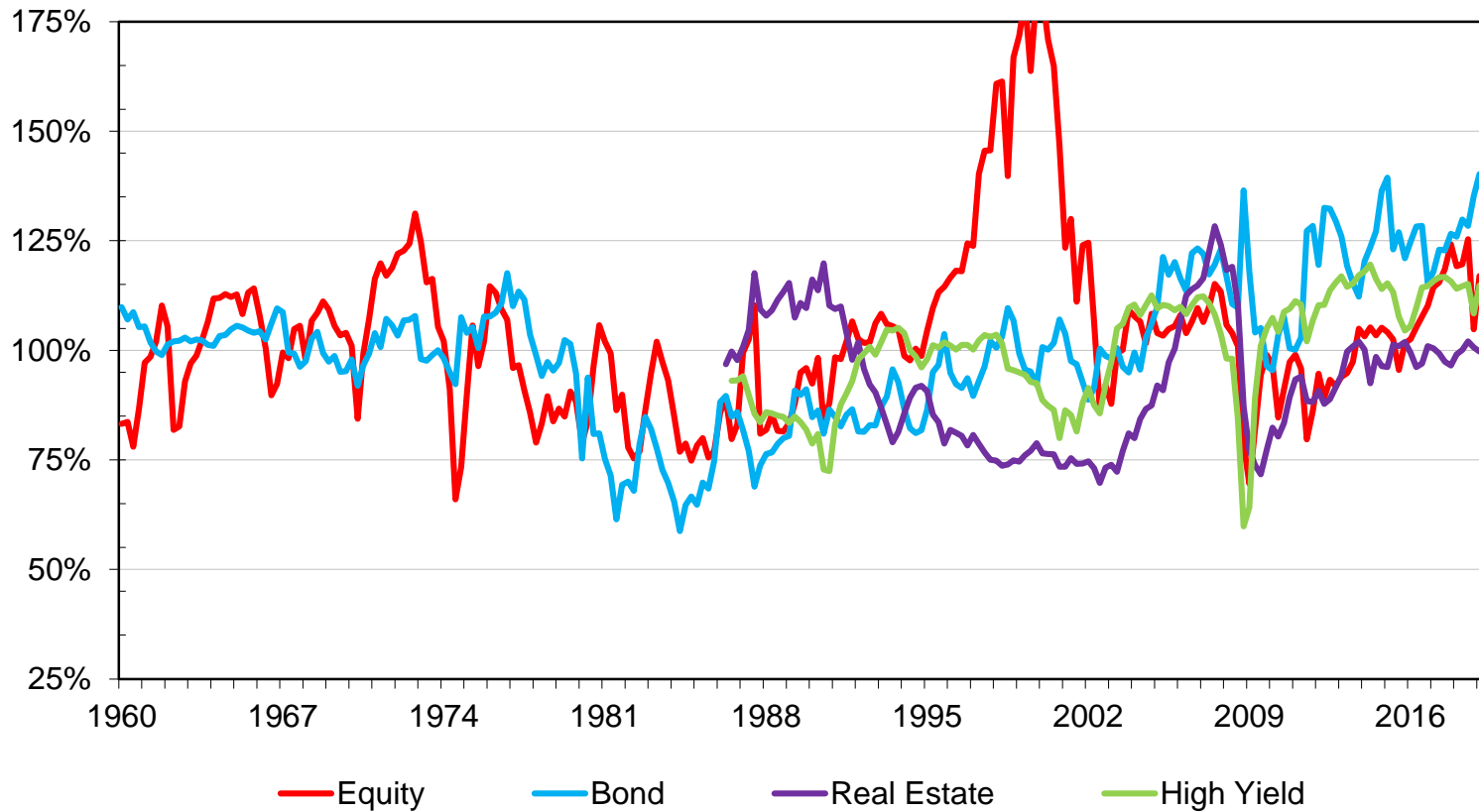
- Fair spread to treasuries based on long-term average spread and internal credit modeling research
- Difference between current spread and fair spread is converted into price to value

High Yield valuation model

- Fair yield
 - Fair yield of similar duration treasuries plus
 - Fair yield spread to treasuries
- Current yield is compared to fair yield
- Yield difference is converted to price to value

Price to value

equity, bond, real estate, high yield



Allocation over and under-weights based on valuation

- **Thresholds to adjust equity-like and bond-like risk**
 - Meaningfully cheap or expensive to initiate over or under-weight
 - Move back toward fair value to remove over or under-weight
 - Several steps between the benchmark and minimum and maximum levels
- **Other categories over and under-weights depend on valuation relative to valuation of risk mapped blend of stock/bonds/cash**
 - Equity-like, bond-like, and cash-like risk from other categories is offset by adjusting weight of stocks, bonds, or cash

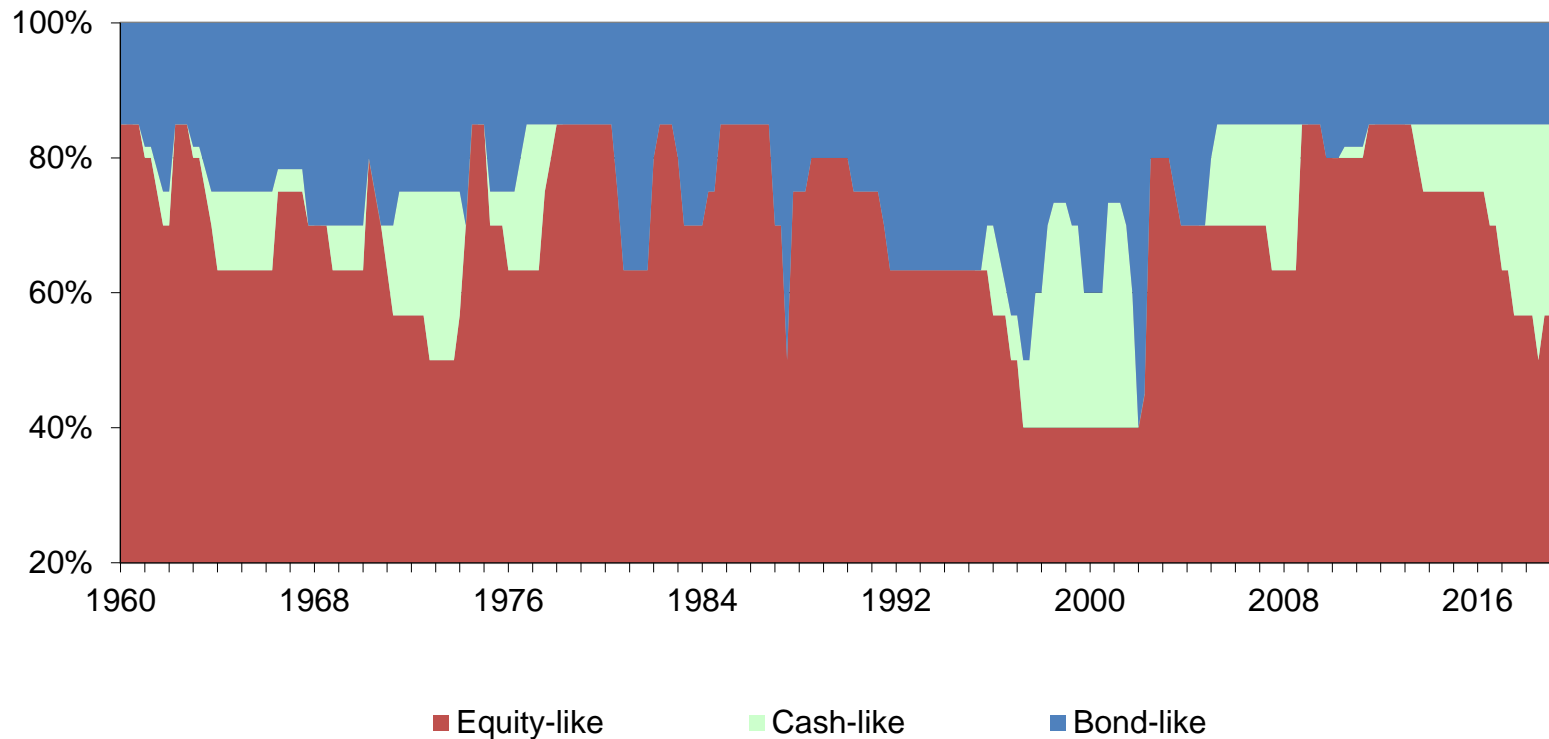
Allocation table example

equity-like risk and bond-like risk (entry and exit levels not shown)

| Equity | Eq | Eq | Equity-like | Bond | Bond | Bond | Bond-like weight if equity-like weight is | | | | | | | | |
|----------|-------|------|-------------|-------------------------------|-------|------|---|-------|-------|-----|-------|-------|-------|-------|-------|
| Position | Entry | Exit | Weight | Position | Entry | Exit | 85% | 80% | 75% | 70% | 63.3% | 56.7% | 50% | 45% | 40% |
| 3 | | | 85% | 3 | | | 15% | 20% | 25% | 30% | 36.7% | 43.3% | 50% | 55% | 60% |
| 2 | | | 80% | 2 | | | 15% | 20% | 25% | 30% | 34.4% | 38.9% | 43.3% | 46.7% | 50% |
| 1 | | | 75% | 1 | | | 15% | 20% | 25% | 30% | 32.2% | 34.4% | 36.7% | 38.3% | 40% |
| 0 | | | 70% | 0 | | | 15% | 20% | 25% | 30% | 30% | 30% | 30% | 30% | 30% |
| -1 | | | 63.3% | -1 | | | 15% | 18.3% | 21.7% | 25% | 25.6% | 26.1% | 26.7% | 25% | 26.7% |
| -2 | | | 56.7% | -2 | | | 15% | 16.7% | 18.3% | 20% | 21.1% | 22.2% | 23.3% | 20% | 23.3% |
| -3 | | | 50% | -3 | | | 15% | 15% | 15% | 15% | 16.7% | 18.3% | 20% | 15% | 20% |
| -4 | | | 45% | Equity steps -4 and -5 | | | | | | | | | | | |
| -5 | | | 40% | proposed for consideration | | | | | | | | | | | |

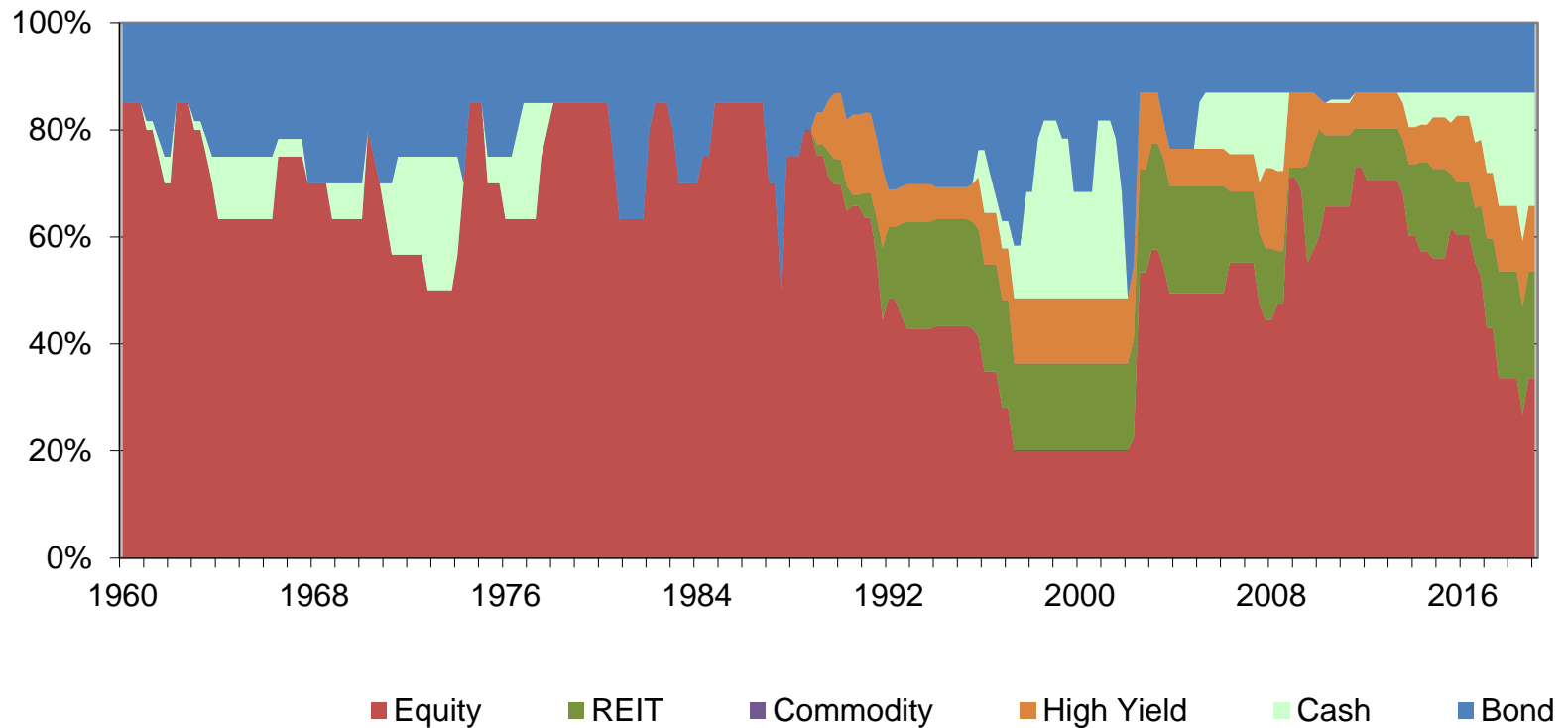
Model suggested allocations

Equity-like, bond-like, cash-like (using 40% equity-like risk minimum)



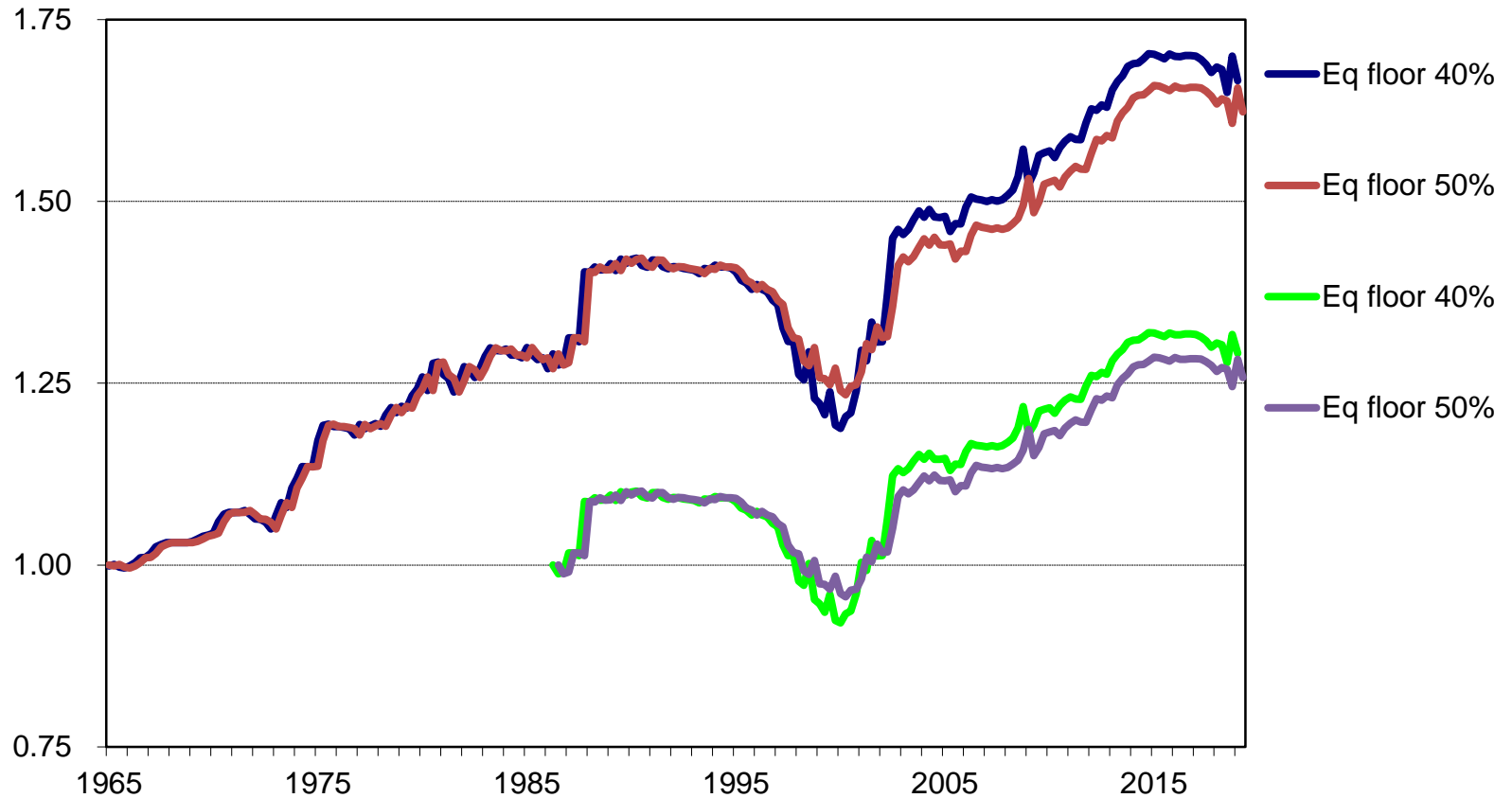
Model suggested allocations

including REITS and high yield (40% eq-like min and 20% equity min)



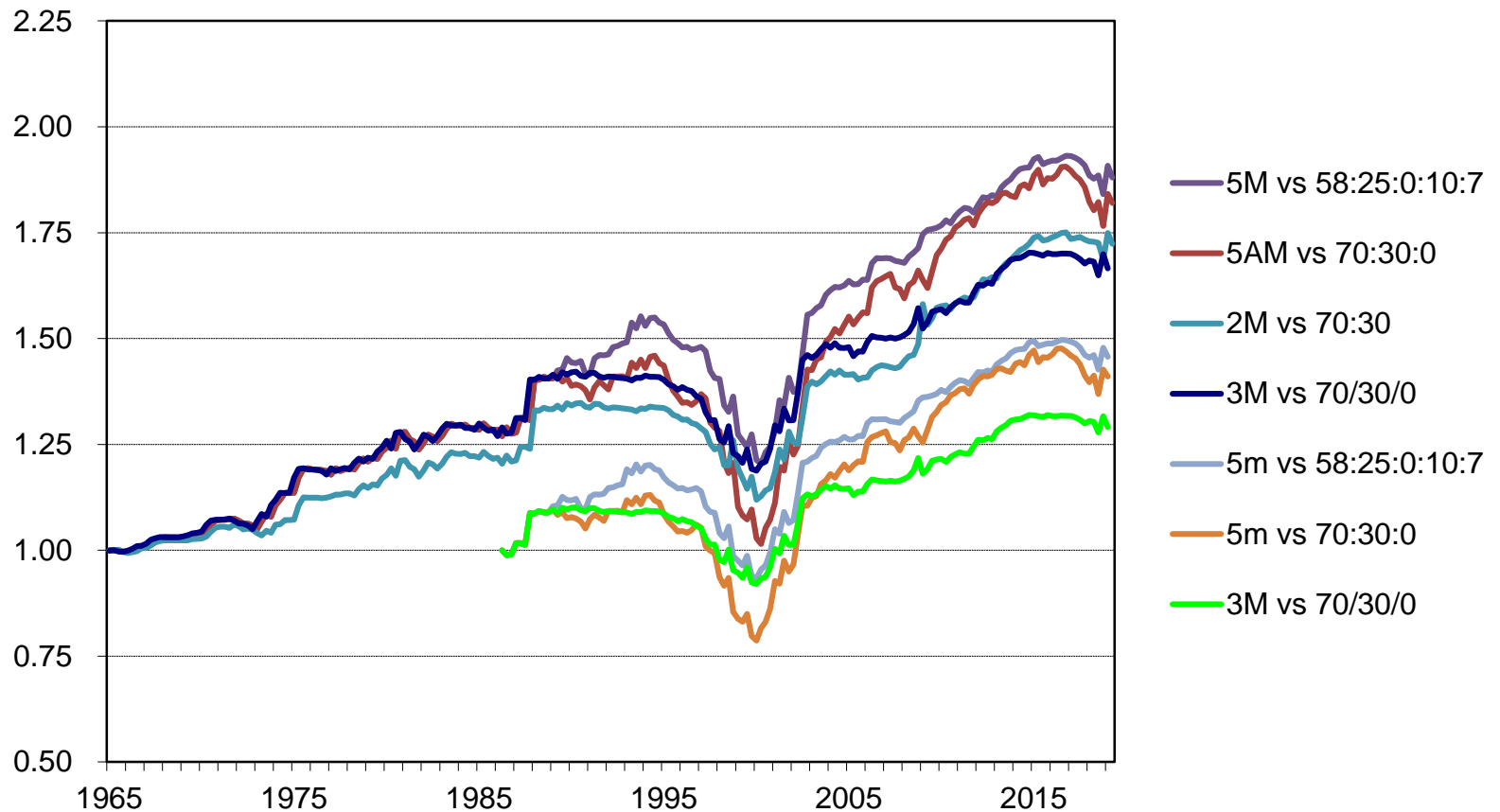
Model return versus 70/30 stock/bond

from 1965 to now and from 1986 initial use



Model return from 1965 and from 1986 initial use

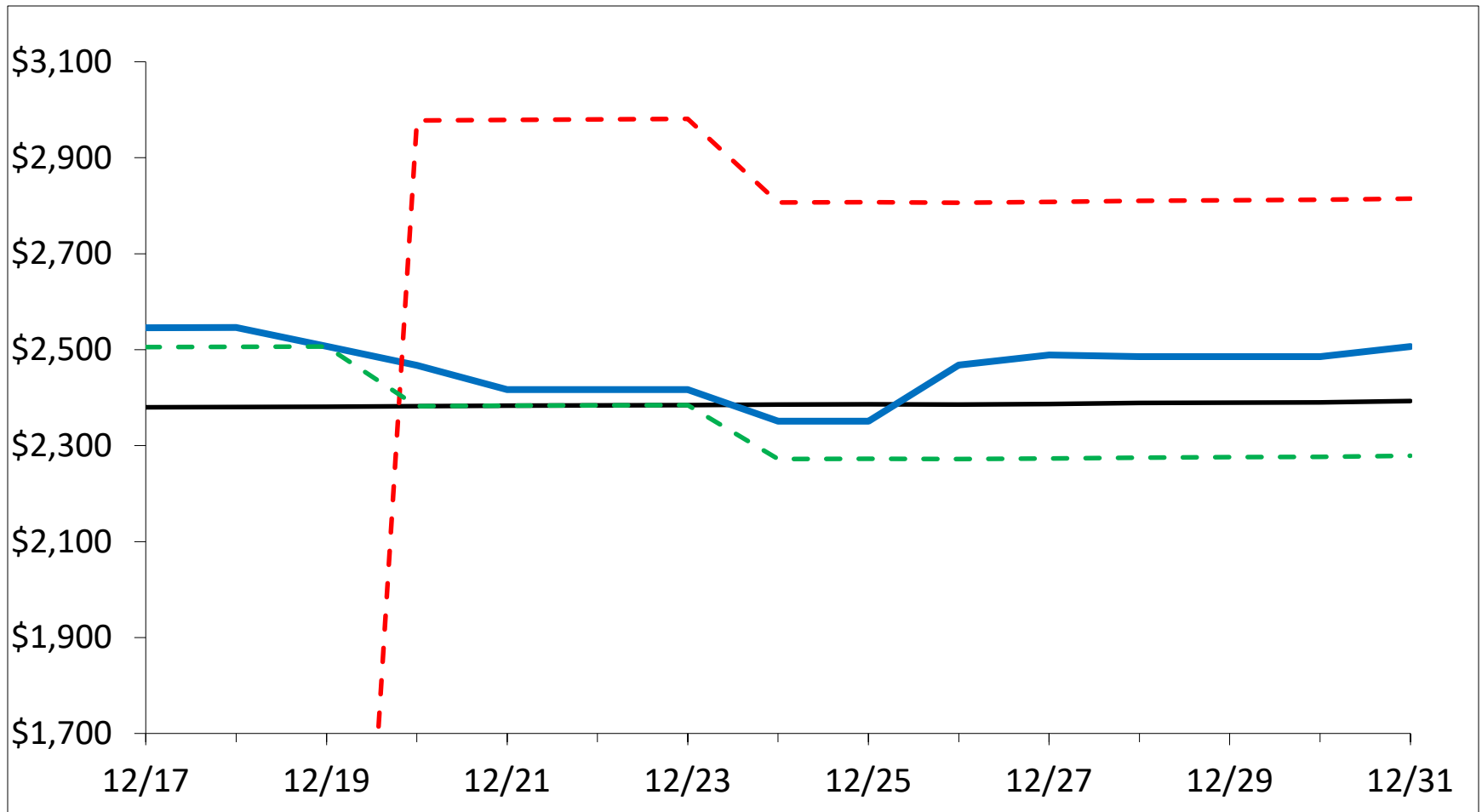
Eq/Bd/Ca vs 70:30:0, Eq/Bd vs 70:30, and Eq/Bd/Ca/REIT/HY vs 58/25/0/10/7



Daily asset allocation valuation and thresholds

| | Closing | Closing | Closing | Equity | Equity | | Move to FV | Move to FV | Price | Price |
|-----------|---------|---------|---------|----------|----------|----------|------------|------------|----------|----------|
| | S&P500 | Bond | Bill | accreted | accreted | Equity | next wgt | next wgt | next wgt | next wgt |
| Date | Price | Yield | Yield | Adj FV | Adj P/V | position | increase | decrease | increase | decrease |
| 17-Dec-18 | 2545.94 | 3.12% | 2.39% | 2379.91 | 1.07 | -3 | -5% | na | 2,505.17 | At Min |
| 18-Dec-18 | 2546.16 | 3.07% | 2.39% | 2380.67 | 1.07 | -3 | -5% | na | 2,505.97 | At Min |
| 19-Dec-18 | 2506.96 | 2.98% | 2.40% | 2381.09 | 1.05 | -3 | -5% | na | 2,506.41 | At Min |
| 20-Dec-18 | 2467.42 | 3.05% | 2.39% | 2382.26 | 1.04 | -2 | 0% | -20% | 2,382.26 | 2,977.83 |
| 21-Dec-18 | 2416.62 | 3.03% | 2.39% | 2383.18 | 1.01 | -2 | 0% | -20% | 2,383.18 | 2,978.97 |
| 22-Dec-18 | 2416.62 | 3.03% | 2.39% | 2383.97 | 1.01 | -2 | 0% | -20% | 2,383.97 | 2,979.97 |
| 23-Dec-18 | 2416.62 | 3.03% | 2.39% | 2384.77 | 1.01 | -2 | 0% | -20% | 2,384.77 | 2,980.97 |
| 24-Dec-18 | 2351.10 | 3.00% | 2.38% | 2385.68 | 0.99 | -1 | 5% | -15% | 2,272.08 | 2,806.69 |
| 25-Dec-18 | 2351.10 | 3.00% | 2.38% | 2386.48 | 0.99 | -1 | 5% | -15% | 2,272.84 | 2,807.63 |
| 26-Dec-18 | 2467.70 | 3.07% | 2.43% | 2385.50 | 1.03 | -1 | 5% | -15% | 2,271.91 | 2,806.47 |
| 27-Dec-18 | 2488.83 | 3.06% | 2.41% | 2387.06 | 1.04 | -1 | 5% | -15% | 2,273.39 | 2,808.30 |
| 28-Dec-18 | 2485.74 | 3.02% | 2.38% | 2388.88 | 1.04 | -1 | 5% | -15% | 2,275.12 | 2,810.45 |
| 29-Dec-18 | 2485.74 | 3.02% | 2.38% | 2389.68 | 1.04 | -1 | 5% | -15% | 2,275.88 | 2,811.39 |
| 30-Dec-18 | 2485.74 | 3.02% | 2.38% | 2390.48 | 1.04 | -1 | 5% | -15% | 2,276.65 | 2,812.33 |
| 31-Dec-18 | 2506.85 | 3.02% | 2.37% | 2392.84 | 1.05 | -1 | 5% | -15% | 2,278.89 | 2,815.10 |

Price (black) versus daily accreted adj fair value (blue) and buy (green) and sell (red) thresholds



Price (black) versus daily accreted adj fair value (blue) and buy (green) and sell (red) thresholds

