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INVESTMENT COMMITTEE
EDUCATION WORKSHOP
VIRTUAL

November 10, 2020 at 2:00pm MT

AGENDA

ITEM		**PRESENTER**
A.	Meeting the Investor's Challenge Part II • The Important Role of Strategic Asset Allocation and Setting Total Risk Tolerance	Dominic Garcia Chief Investment Officer Tom Toth Wilshire Associates
B.	Building Long Term Portfolios to Meet Investor's Objectives Post-COVID • Outlook for Future Returns • Should Investor's Re-evaluate Risk Tolerance? • Does Diversification Matter?	Bryan D. Belton, Managing Director, Multi Asset Investments PanAgora Inigo Fraser Jenkins, Co-Head Portfolio Strategy, Bernstein Research

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INVESTMENT COMMITTEE EDUCATION WORKSHOP

November 10, 2020 at 2:00pm MT

Please join the PERA Investment Committee Education Session
When: Nov 10, 2020 02:00 PM Mountain Time (US and Canada)
Topic: PERA Investment Committee Education Workshop

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Meeting the Investment Challenge

Investment Committee Education Session

Dominic Garcia, CIO

November 10, 2020

Investment Objectives & Strategic Goals*

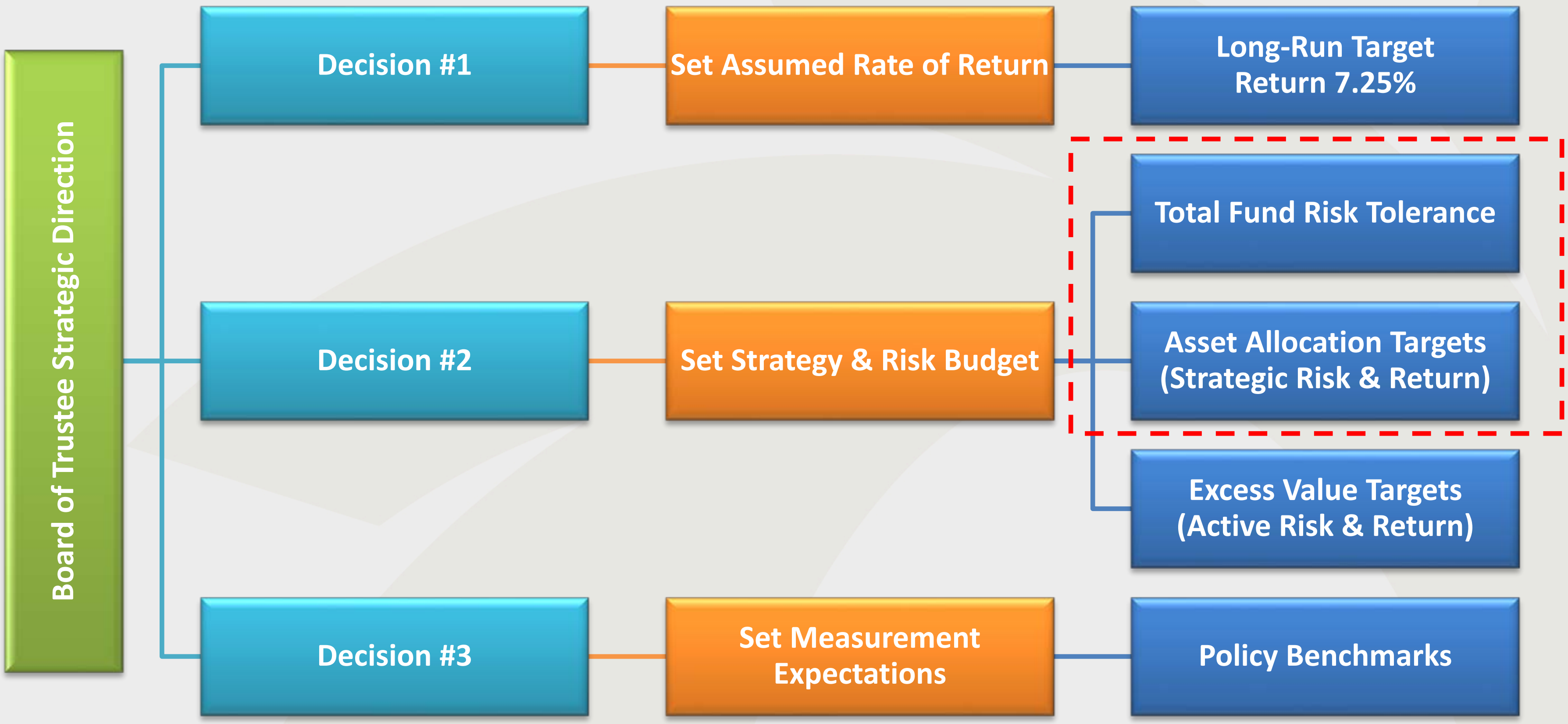
1. Set Strategic Asset Allocation (Policy Index Portfolio) to Meet the Actuarial Assumed Return (7.25%) Over the Long-Run.

2. Produce Returns to Meet or Exceed Benchmarks
   A. Meet or exceed the Policy Index over the long-term
   B. Meet or exceed the Reference Portfolio over the long-term

3. Be Cost-Efficient
   - Achieve a total investment cost at or below the benchmark cost relative to peers adjusted for fund size, allocations, and strategy.

* Objectives are set in PERA's 5-Year Strategic Plan (2018-2023) & set PERA's performance measures reviewed and monitored by Legislative Finance Committee (LFC) and Department of Finance & Administration (DFA)

Investment Strategic Governance



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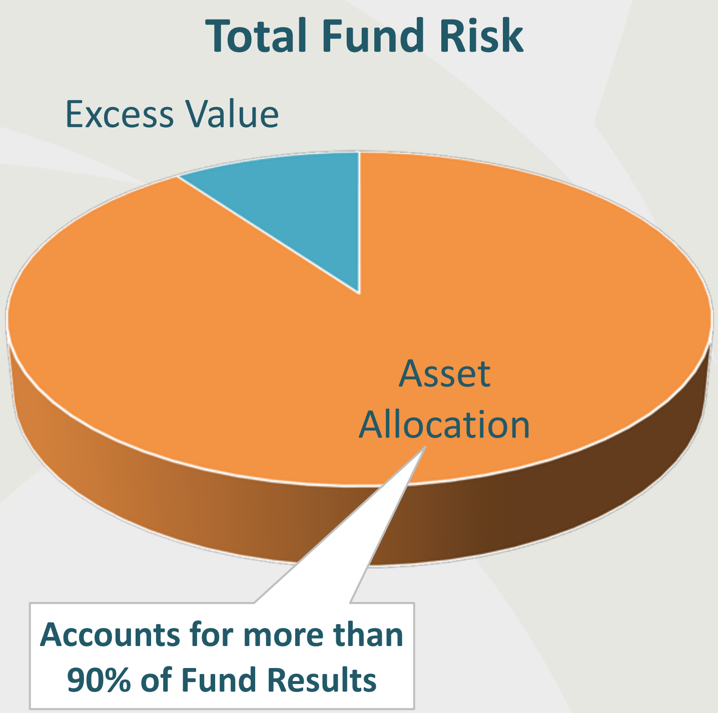
Current Strategy & Risk Budget

10.5% Total Fund Volatility

Asset Allocation Targets		Excess Value Risk & Return Targets	
Global Equity	35.5%	Active Return	1.0%
Risk Reduction	19.5%	Active Risk	1.5%-2.0%
Credit	15.0%		
Real Assets	20.0%		
Multi-Risk	10.0%		

Lower Total Risk Tolerance



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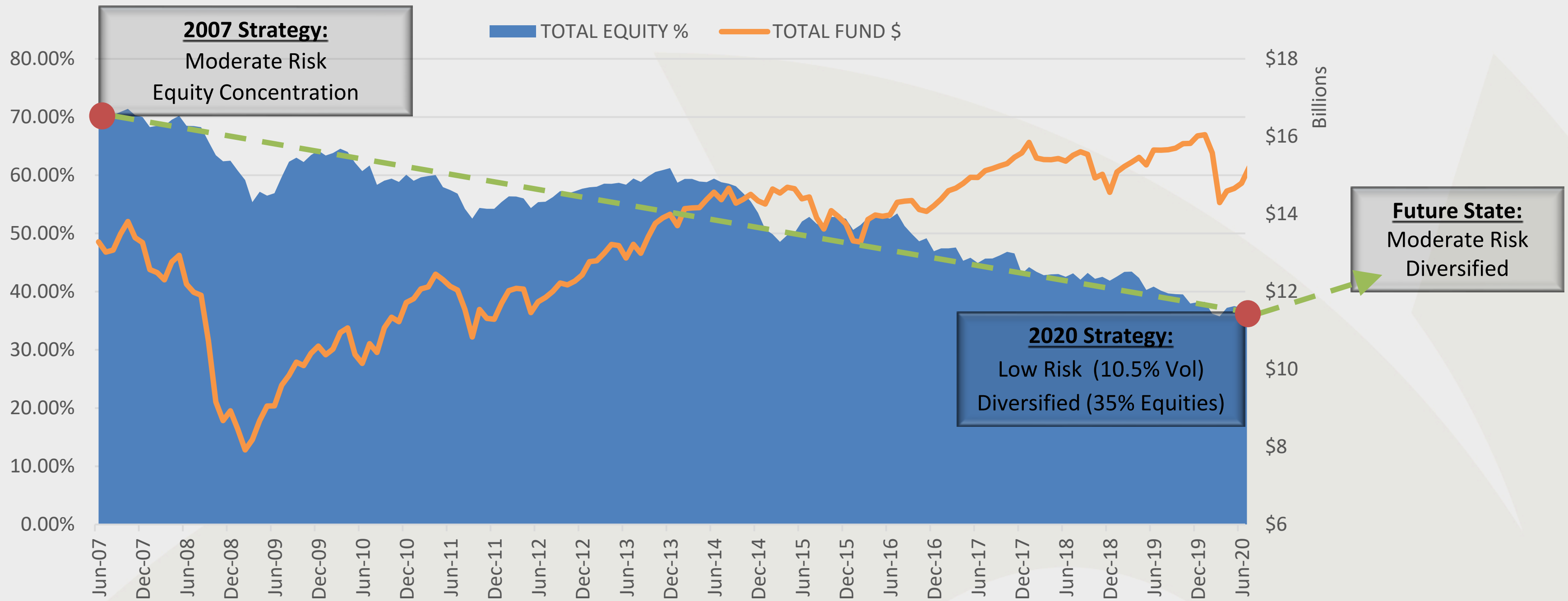
PERA Investment Strategy Timeline



2007-2009	2010-2013	2013-2017	2017 to Current
Great Recession Experience	Recovery from Great Recession Drawdown	Streamlined SAA	Enhanced Governance
Strategy: (1) Moderate Risk (2) Concentrated in Equities- 70%	Strategy: (1) Begin to De-Risk & Lower Risk Tolerance (2) Diversify Away from Equities	Strategy: (1) Continue De-Risk to Low Risk Tolerance (2) Diversify Significantly into Private and Other Assets	Strategy: (1) Maintain Low Risk Tolerance (2) Diversify Across Assets & Risks (3) Improve Active Mgmt. as Excess Value Generator

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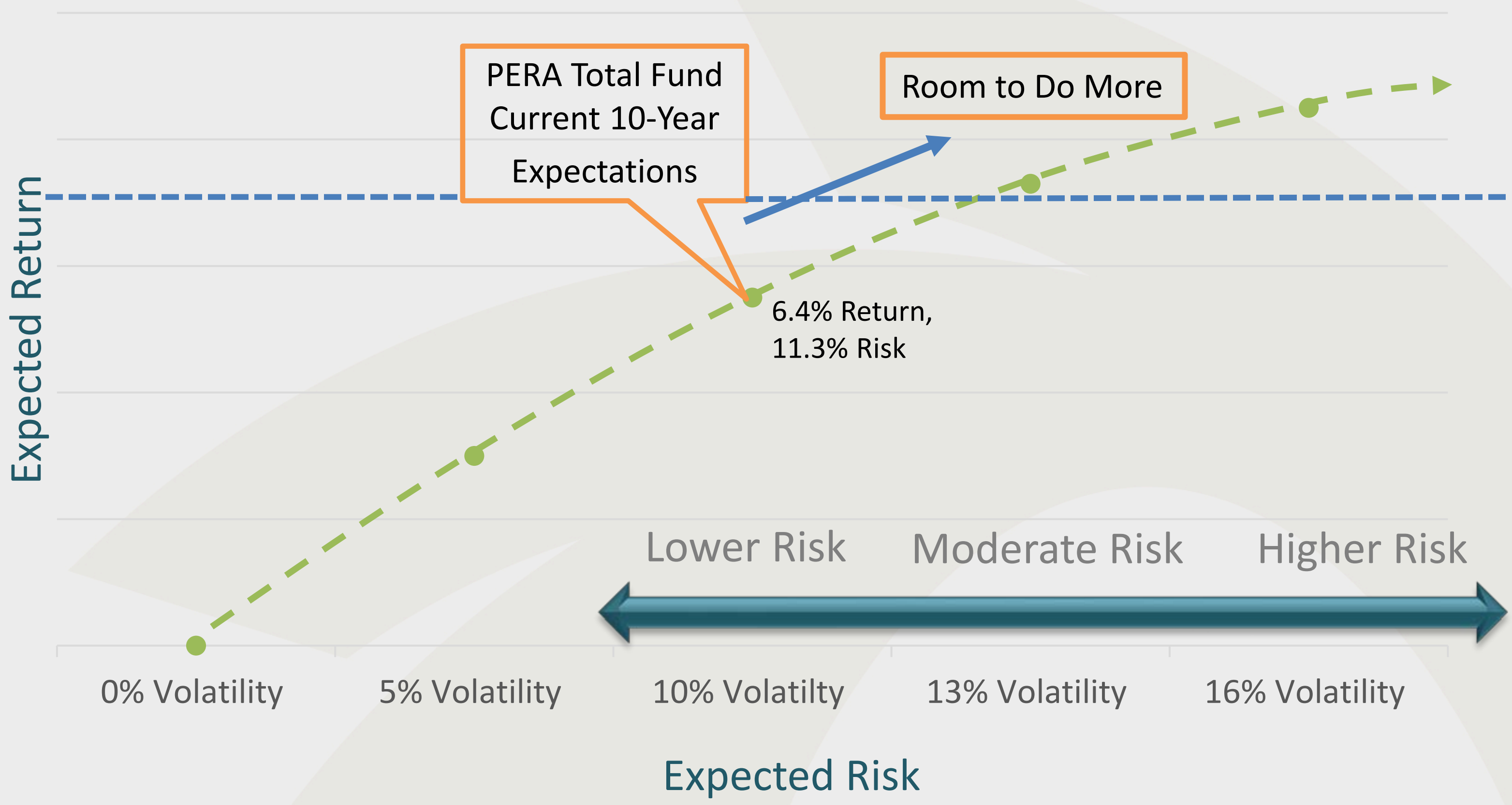
Potential to Take More Risk



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Discussion Topics for the Day

- Re-Education on Importance and Impact of Asset Allocation
- Outlook for Future Returns
- Setting Appropriate Risk Tolerance to Meet Objectives
- Does Diversification Still Matter?

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Asset Allocation
The Investor's Challenge

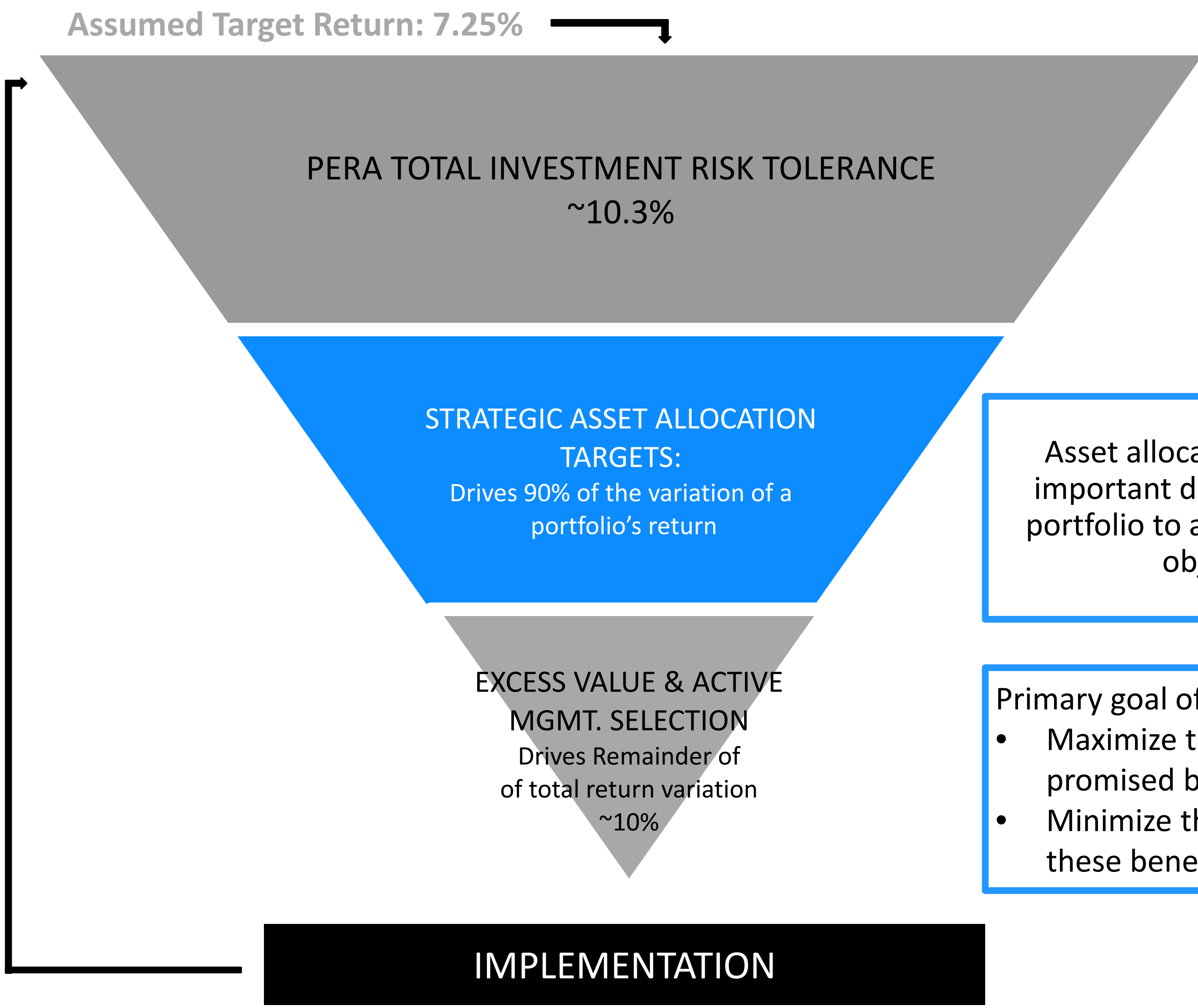
NOVEMBER 2020

Core Board Decisions

Focus discussion on the most important decisions

1. Investment objective/actuarial hurdle rate—7.25%
   - What is PERA's investment philosophy, stakeholder roles and responsibilities, process and procedures, and long term objectives?
     - **Investment Policy Statement**
2. Investment Strategy & Risk Management
   - How much total risk does PERA take to reach investment objectives?
     - **Asset Allocation**
   - How much active risk & excess value will PERA target to help achieve investment goals?
     - **Active Risk Budget**
3. Monitoring
   - How does one measure the effectiveness of PERA's investment program?
     - **Benchmarks**

Investment Strategy & Asset Allocation



Asset allocation is the most important decision to build a portfolio to achieve the fund's objectives

Primary goal of asset allocation:

- Maximize the safety of promised benefits
- Minimize the cost of funding these benefits

Strategic asset allocation is the main strategy to meet long term risk tolerance and **<u>most importantly the assumed target return of 7.25%</u>**

Asset Allocation Optimization

Expectations for future returns and risk are a key input into the asset allocation optimization process

INPUTS

Median Return

- 50% probability that the return will be greater/less than than the expected return.

Standard Deviation

- Measures the dispersion of asset class returns around the expected return.

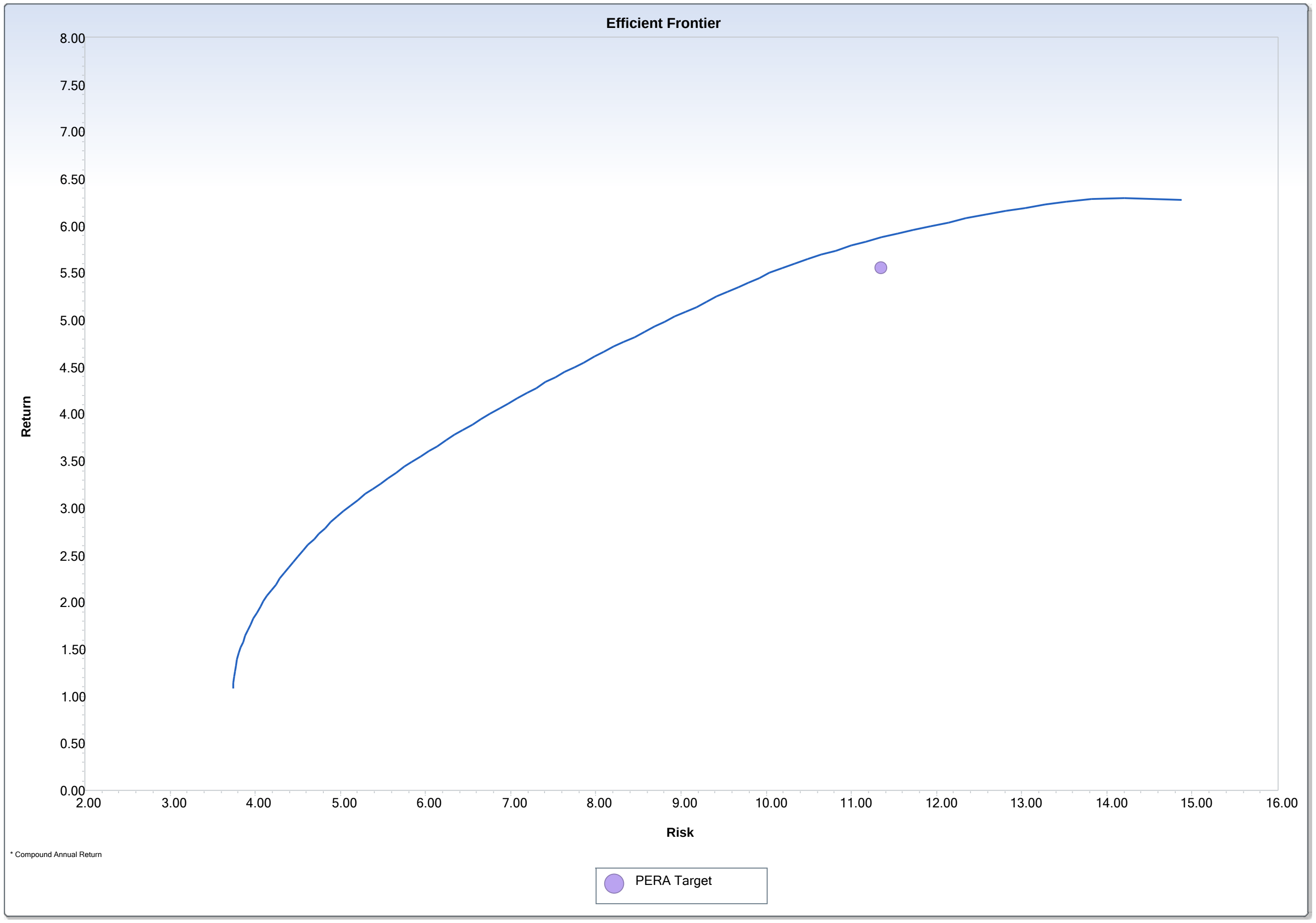
Correlation

- Measures the movement of asset class returns in relation to one another.

OUTPUT

Efficient Frontier

- Portfolios that maximize expected return for a given level of risk



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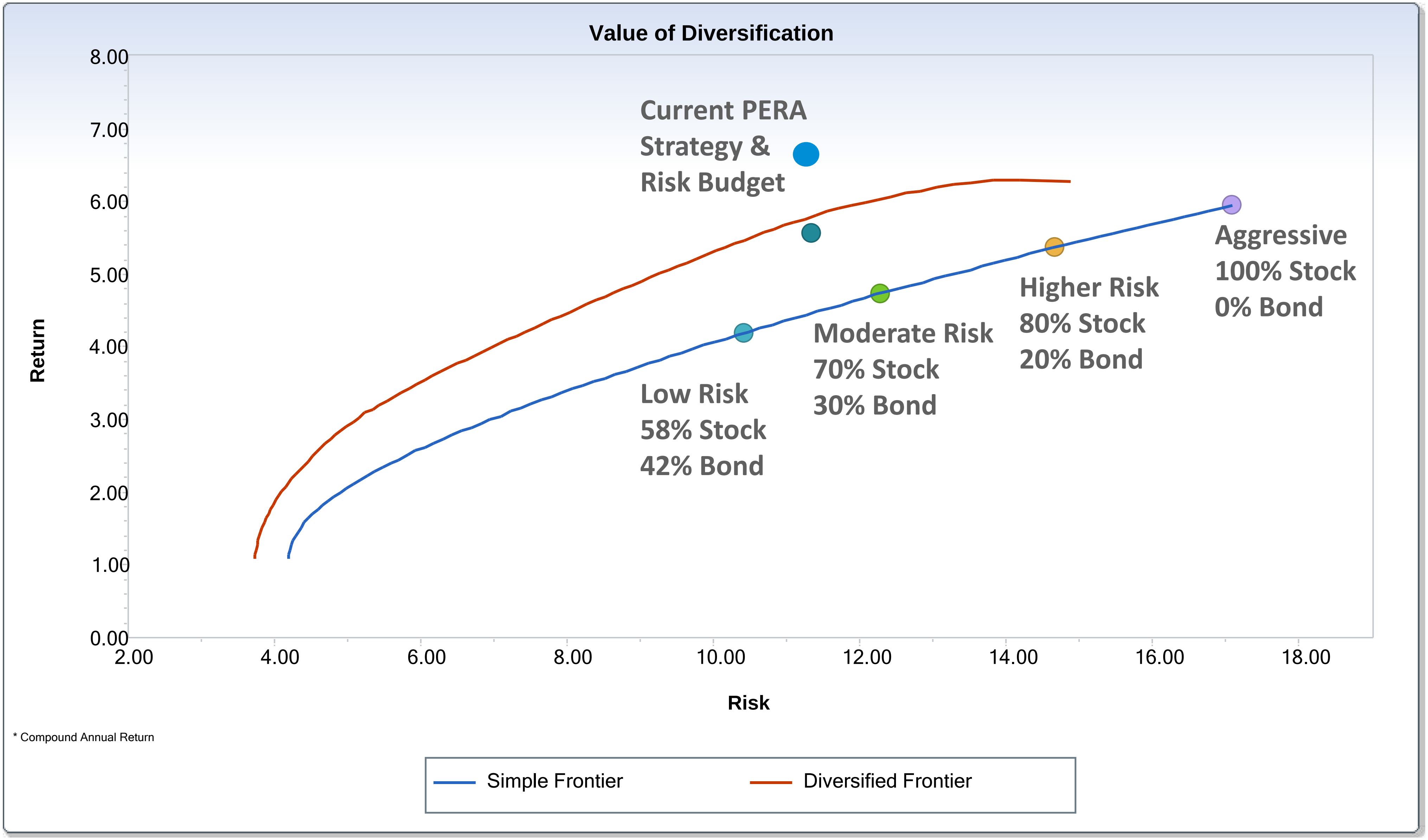
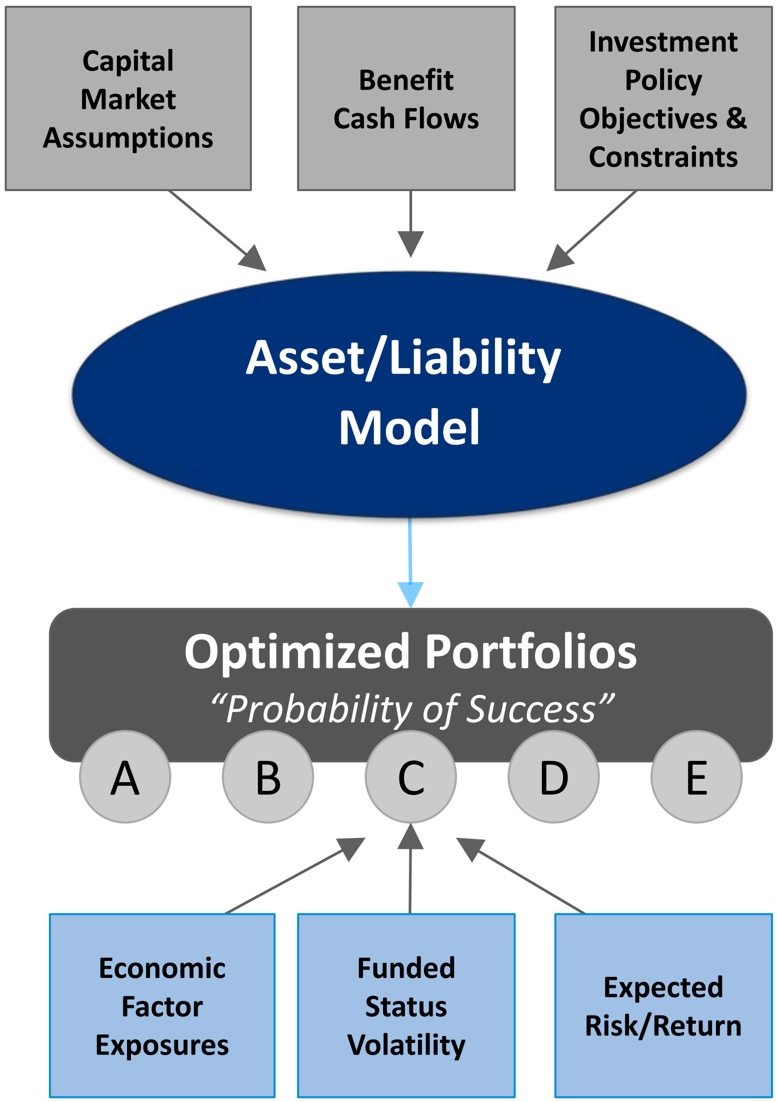
Asset Allocation and Diversification



Asset Allocation in a Liability Context



- Asset Liability Valuation (ALV) framework quantifies the impact of different asset allocations as it relates to PERA's liability stream
- Examine the impact on funded ratios, expected funded status volatility, annual contribution requirements, and other metrics

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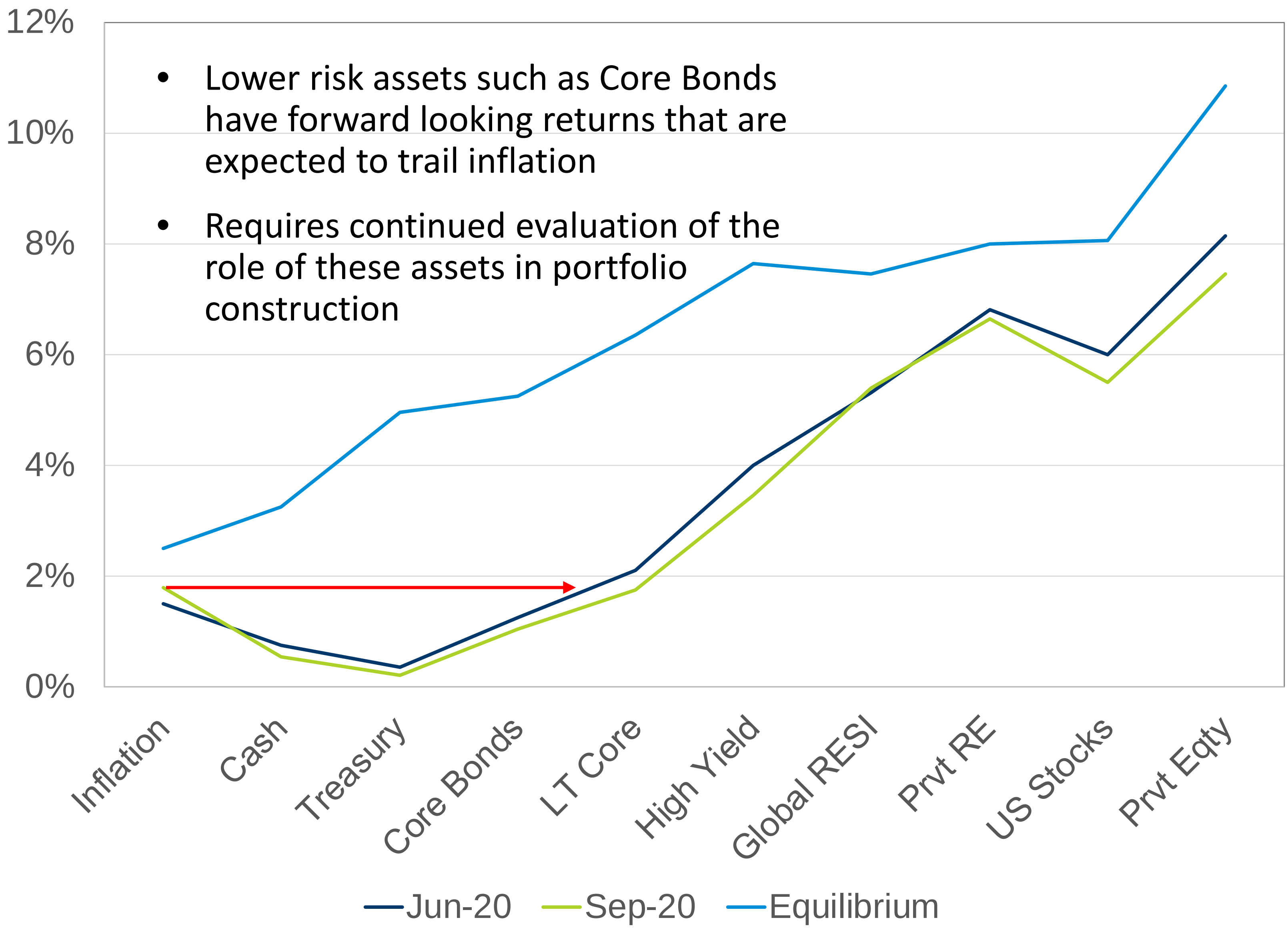
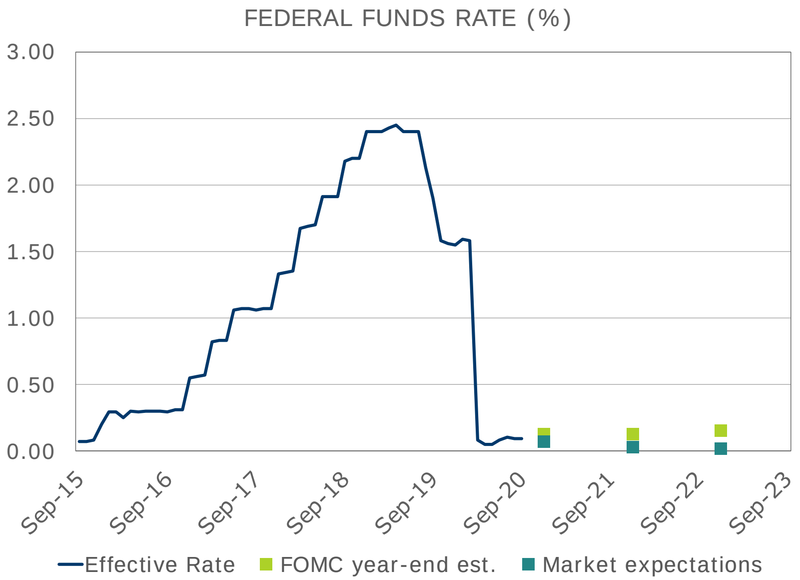
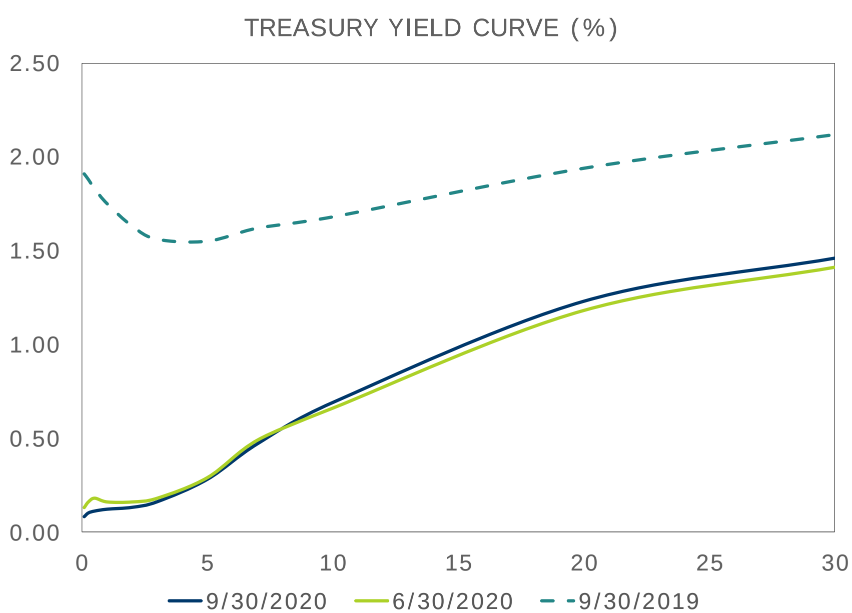
The Investor's Challenge

Current Expectations are lower than long term Equilibrium Asset Class Assumptions



The Investor's Challenge – Fixed Income



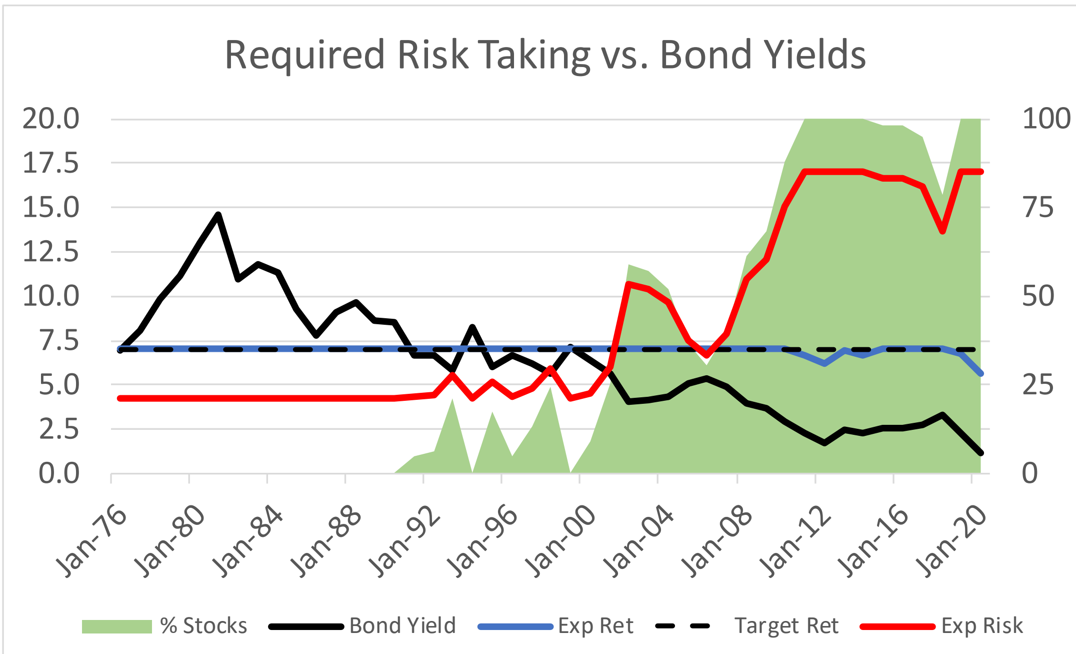


- Market expectations now forecast near 0% rates out to 2022
- Federal Reserve has pledged to keep rates low for the foreseeable future
  - Need to be satisfied that labor market conditions are consistent with their maximum employment goals
  - Inflation must reach 2%
  - Need assurance that inflation will continue to run moderately above 2%

Data Source: Federal Reserve, Bloomberg

The Investor's Challenge - Equity

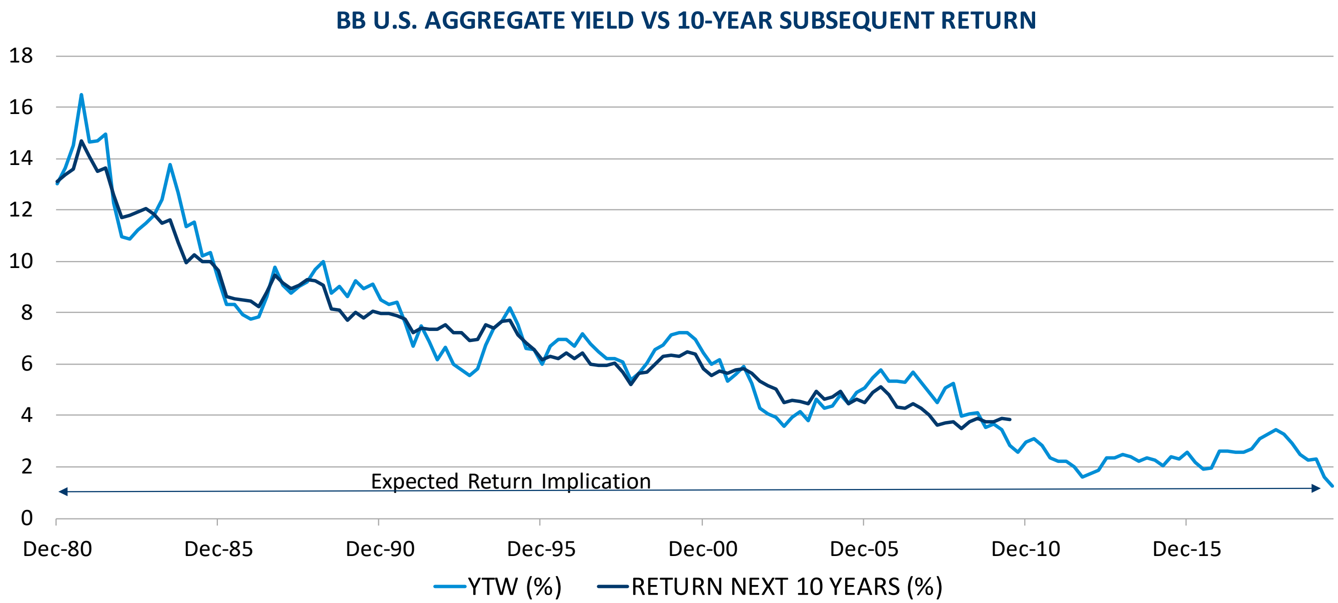
- Current low rate environment imposes significant challenges, through lower expected returns, and related pressure to take on greater levels of risk
- Exhibit below demonstrates how much risk taking is required within a stock/bond portfolio to meet a 7% return target
- Note that the current equity risk premium (of nearly 4.5%) is larger than the historical average (3.5%)

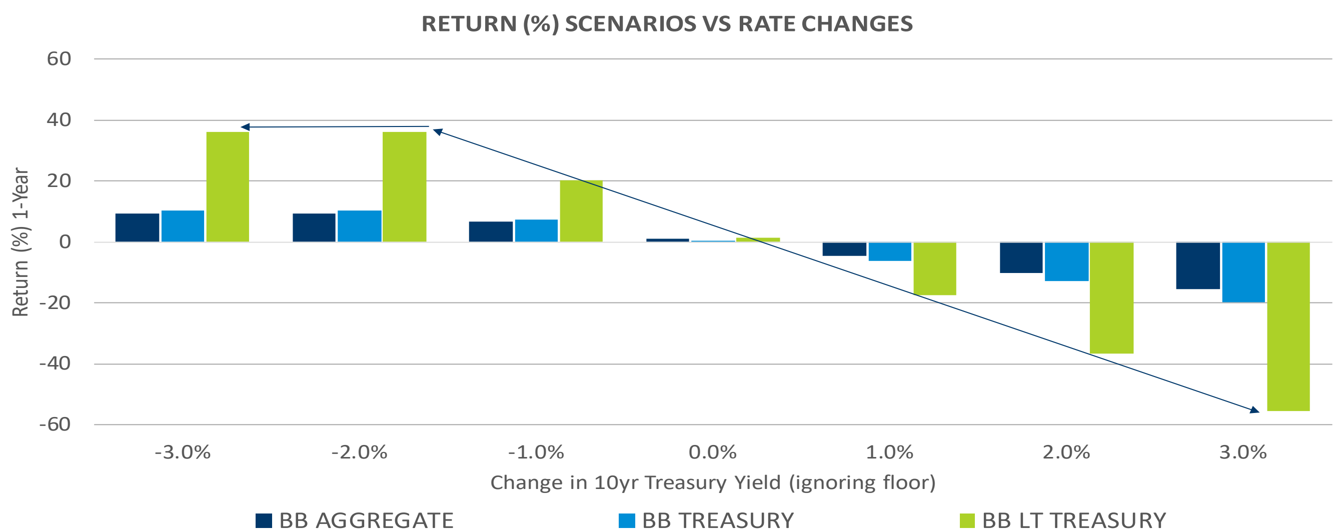


- Key challenge is establishing an asset allocation that increases risk in a more <u>diversified</u> fashion

Expanding Risk Mitigating Assets

Risk Mitigation Assets: “Running on Empty”





Source: Wilshire, Bloomberg

Risk Mitigating Assets

- Need to identify asset classes that can contribute to portfolio diversification via their negative expected sensitivity to growth
  - Treasury Inflation Protected Securities (TIPS)
    - » Unlike nominal bonds, TIPS are directly impacted by real yields which do not have a practical floor like nominal yields
    - » While their long-term return potential in the expected case remains low, TIPS can provide outsized returns during period of rising inflation
  - Gold
    - » Can provide a growth offset during times of stress, as investors turn to the precious metal as a safe-haven asset
    - » Unlike nominal bonds, lacks cash yield
- Asset sensitivities to different economic regimes and potential return paths can provide diversification at the total fund level

Expanding Risk Mitigation Assets

Source: Wilshire, Bloomberg

Inflation and Asset Allocation

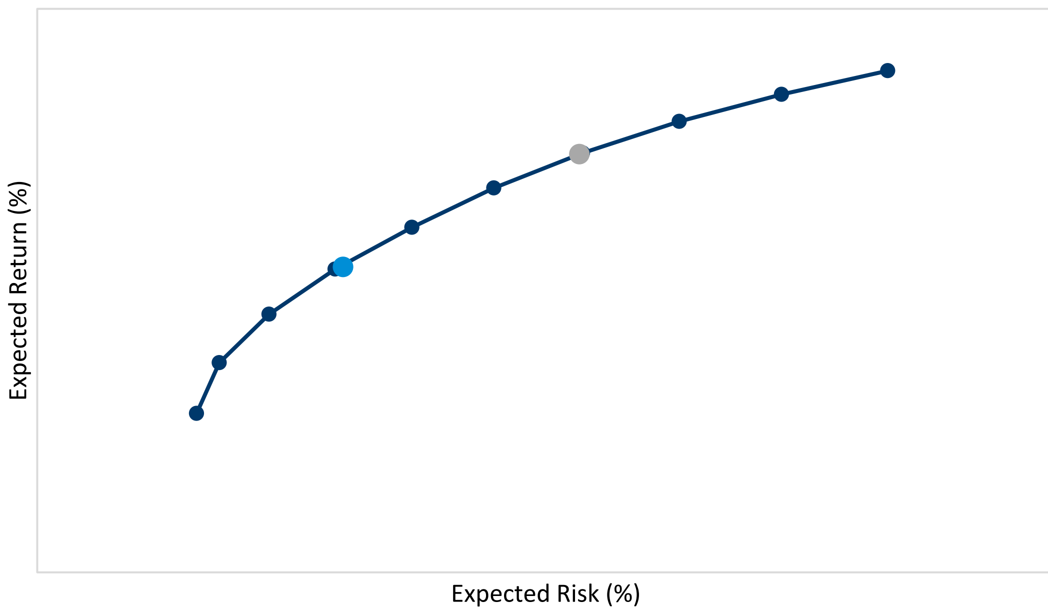
- **Potential drivers of higher inflation in coming years**
    - Structurally easier monetary policy
    - Unprecedented fiscal expansion
    - Global central banks willingness to tolerate higher inflation overshoot explicit 2% target
    - De-globalization of supply chains around the world that amount to a negative supply shock
    - More politically expedient for economies to inflate their way out of debt rather than reintroduce austerity measures

Data Source: Federal Reserve, Bloomberg

Leverage in Portfolio Construction

Enhancing Return

- Portfolio diversification is often overlooked in order to achieve higher return targets
  - Portfolio A is well balanced – in allocation and risk contribution – but expected return is a modest 4.3%
  - Portfolio B has a 1% higher expected return, but…
    - Over half of the portfolio is in equity and nearly 92% of the risk comes from equity



	Weight	Ctrb to Risk
Global Equity	30.0	66.0
U.S. Core Fixed Income	65.0	33.0
Cash	5.0	1.0
Total Assets	100.0	100.0

	Portfolio B (%)	
	Weight	Ctrb to Risk
Global Equity	57.0	91.5
U.S. Core Fixed Income	43.0	8.5
Cash	0.0	0.0
Total Assets	100.0	100.0

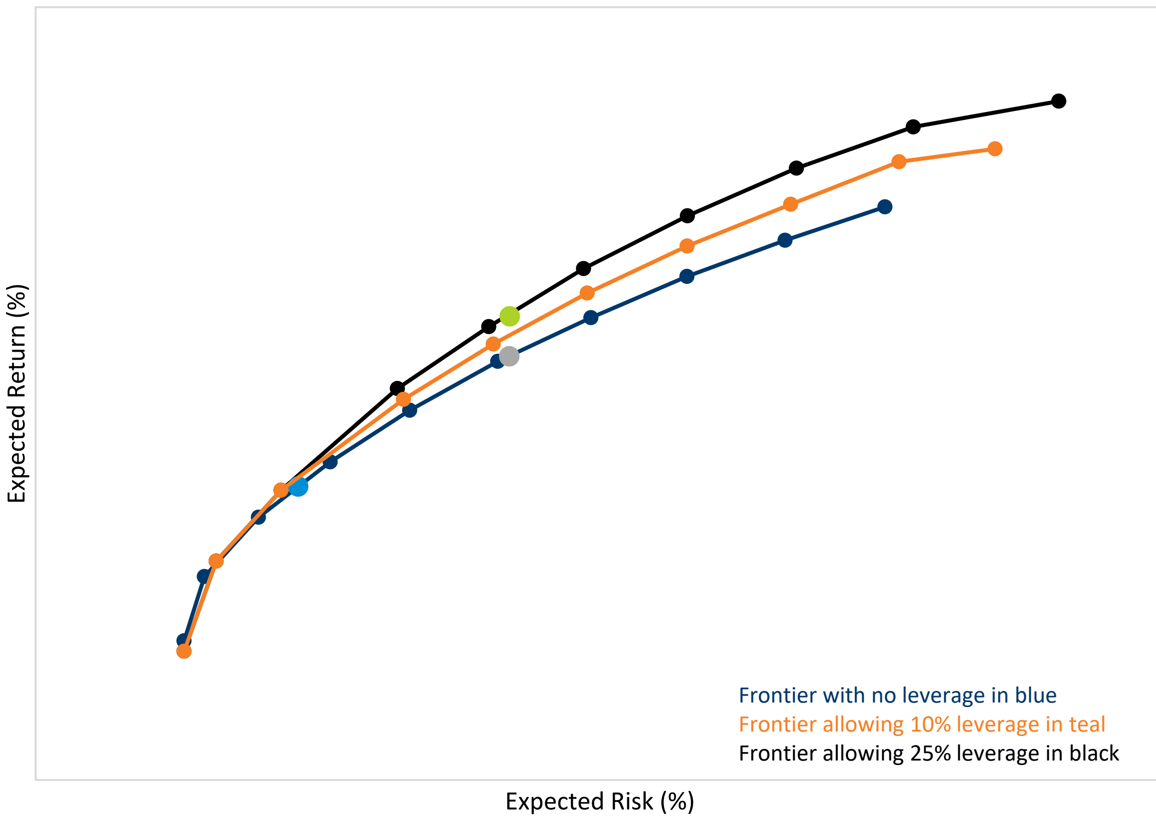
- High portfolio risk concentration stems from a combination of return objectives, market opportunities, and constraints

Portfolio Construction

- Leverage is a tool that investors often . . .
  - Consider too risky
  - Under-utilize
- Leverage Aversion
  - Many market participants are not willing or able to utilize leverage in their portfolio
    - Explicit statutory restrictions
    - Lack of expertise in managing leverage
  - To meet return targets, those investors overweight riskier assets and bid up prices, reducing their expected returns going forward
  - Underweight less risky assets, increasing their expected returns going forward
    - **Opportunity for higher risk-adjusted returns for those without leverage constraints**
- Leverage can serve as a tool for risk reduction, balancing contributions to risk, and improving diversification while increasing total return

Improving the Frontier

- Leverage improves the efficient frontier where each step up in return sacrifices less diversification
  - Portfolios C has similar expected risk as Portfolio B, but higher expected return



	Portfolio A (%)	
	Weight	Ctrb to Risk
Global Equity	30.0	66.0
U.S. Core Fixed Income	65.0	33.0
Cash	5.0	1.0
Total Assets	100.0	100.0

	Portfolio B (%)	
	Weight	Ctrb to Risk
Global Equity	57.0	91.5
U.S. Core Fixed Income	43.0	8.5
Cash	0.0	0.0
Total Assets	100.0	100.0

	Portfolio C (%)	
	Weight	Ctrb to Risk
Global Equity	53.0	81.4
U.S. Core Fixed Income	72.0	18.6
Cash	0.0	0.0
Leverage	25.0	-
Total Assets	125.0	100.0

Efficient Frontier graph for illustration purpose only

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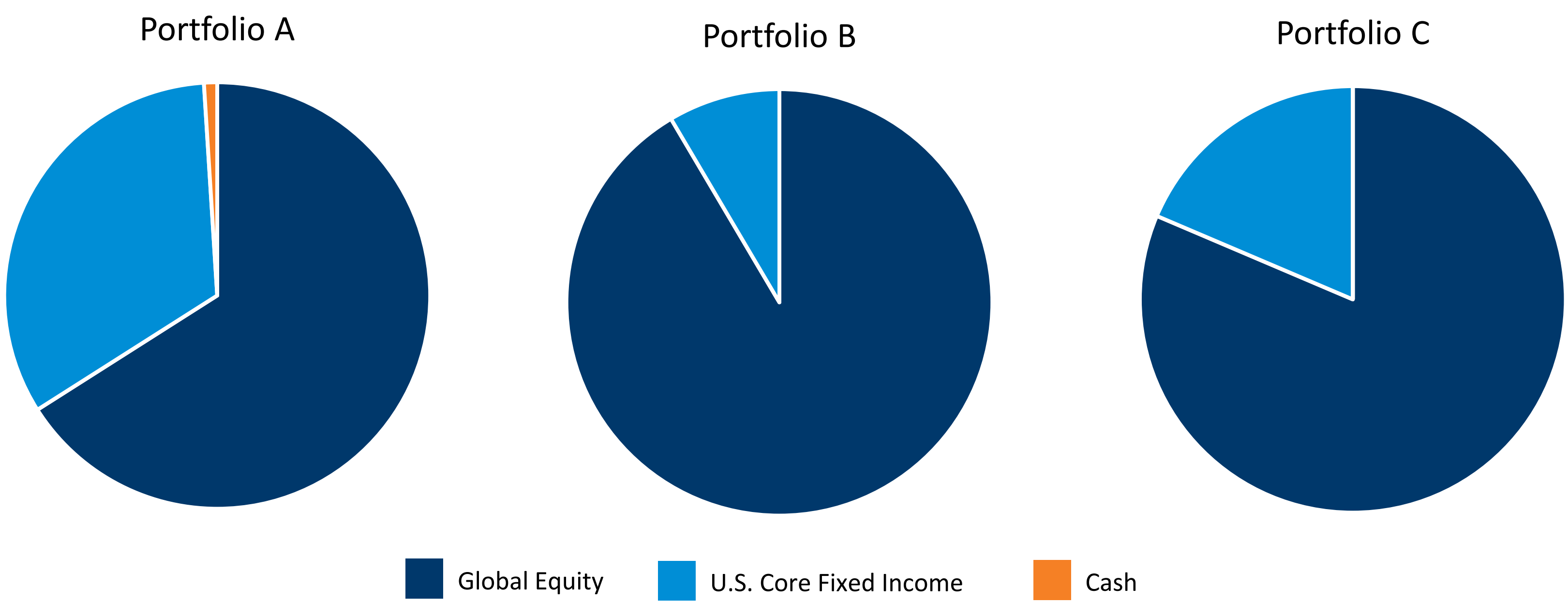
Portfolio Risk Profile

- From a contribution to risk perspective, Portfolio C provides **greater risk balance/more diversification** than Portfolio B - more similar to the risk allocation of Portfolio A
  - However, Portfolio C has an expected return that is 1.1% greater than that of Portfolio A



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PanAgora

November 2020

PanAgora Asset Management

Positioning to Meet the Current and Future Challenges

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Creating a hypothetical portfolio from sub-indices bifurcated by yield levels ("Low Yielder Index")

- Bloomberg Barclays Global Treasury Index: 41 countries
- Low Yield Index country selection
  - Average Yield to Worst of country averaged below 1% for the past 5 years
  - Average weight in the Global Treasury Index exceeded 0.50% for the past 5 years
  - 7 Countries- Japan, Belgium, France, Germany, Ireland, Netherlands, Spain
  - Use Bloomberg Barclays Global Treasury index weights and normalize to 100%
- Global Treasury excluding Low Yielding countries
  - Remove 7 low yielding countries from the Global Treasury index (approximately 43% of the weight)
  - Normalize the index weights of the remaining countries to 100%

Agenda

Overview

Overview

Key Considerations for Plan Sponsors over the Next 10 Years

- The return on cash is gone; it needs to be replaced or the required return needs to be reduced
- More return needs to come from risk taking, increased manager skill, or both
- Dual objective remains: achieving required return and maintaining stability of funding status
- The use of diversified leverage can prevent these objectives from competing against one another

Does Diversification Still Matter? Of Course it Does.

- Diversification can have a powerful impact on the mathematics of compounding returns
- Cumulative probability of loss declines with time and number of bets
- Diversification results in positive participation ratio differentials (upside – downside capture)
- How you diversify matters. We believe that risk-based diversification is most impactful

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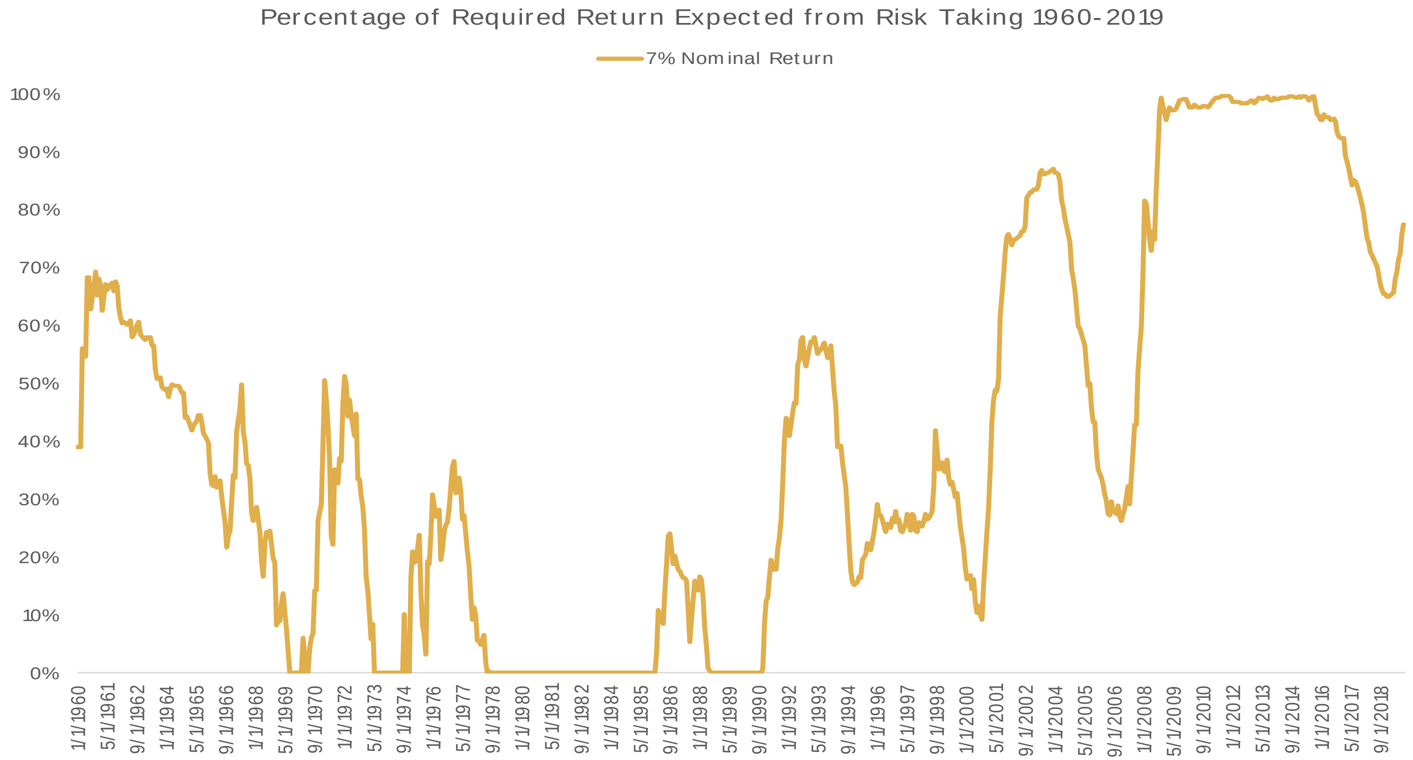
The Case for Taking More Risk

The Case for Taking More Risk

Low cash rates have penalized savers

- From 1960-2007, cash accounted for 64% of a 7% nominal return objective, on average
  - Since 2008, plans have relied almost solely on risk taking to achieve their return objectives



For illustrative purposes only. Shown for a fixed nominal return of 7% from 1/1/1960-9/30/2019. Expected return less cash. Cash is represented by the U.S. 3-month T-bill. Source: PanAgora, Bloomberg.

The Case for Taking More Risk

Summary Statistics from January 1976 to June 2020

- 60/40 has delivered strong risk adjusted returns over the past 44 years

	MSCI World	Barclays US Aggregate Bond Index	60/40*	T-Bill
Return	9.92%	7.52%	9.25%	4.47%
Risk	14.88%	5.00%	9.48%	-
Sharpe Ratio	0.37	0.61	0.50	-

*60/40 Index Portfolio consists of 60% MSCI World Hedged Index/40% Bloomberg Barclays US Aggregate Bond Index. The 60/40 Index information above is shown for illustrative purposes only and is not the strategy's official benchmark, which is the ICE BofA U.S. 3-Month Treasury Bill Index.

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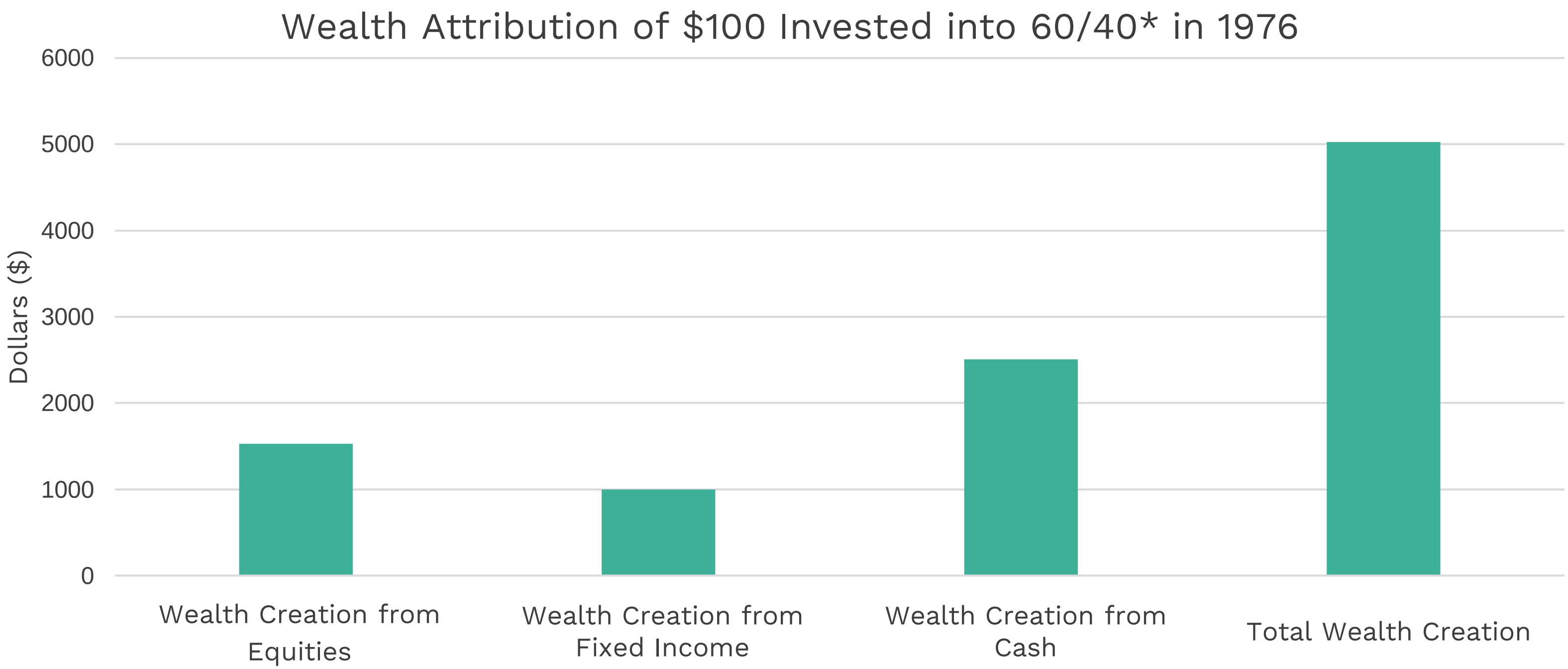
The Case for Taking More Risk

The return on cash has been a big driver of 60/40's return success

- Simple return attribution shows cash accounted for 50% of the wealth creation
  - Equity risk accounted for 30% of wealth creation while Fixed Income risk accounted for 20%



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The Case for Taking More Risk

With expected return on cash of 0%, the expected return of 60/40 is below 4%

- Applied 3 different forecasting methodologies using valuation and Sharpe ratio-based approach
  - Cross-sectional dispersion is 21 basis points

	MSCI World	US Aggregate	60/40
Valuation-Based Forecast	5.11%	1.25%	-
Estimated Risk	14.05%	3.34%	8.50%
Expected LT Sharpe Ratio	0.35	0.35	0.45
Sharpe-Based Forecast	4.92%	1.17%	3.83%

	60/40
Asset Class-Based Valuation Forecast	3.54%
Asset Class-Based Sharpe Ratio Forecast	3.42%
60/40-Based Sharpe Ratio Forecast	3.83%
Average Forecast	3.59%

Valuation-based forecast: we derive the return forecast for both the MSCI World and the Barclays US Aggregate indices. For MSCI World, we average the trailing and forward earnings to price ratios of the Index as of 6/30/2020. For the Barclays US Aggregate forecast, we use the Yield to Worst of the index as of the quarter's end.

Expected LT Sharpe Ratio-based forecast: we apply a long-term Sharpe Ratio expectation to the current estimate of ex-ante volatility for MSCI World Barclays US Aggregate. We assume a long-term Sharpe ratio of 0.35 for both indices, and estimate volatility using an expanding history of exponentially weighted historical returns with a five-year half-life.

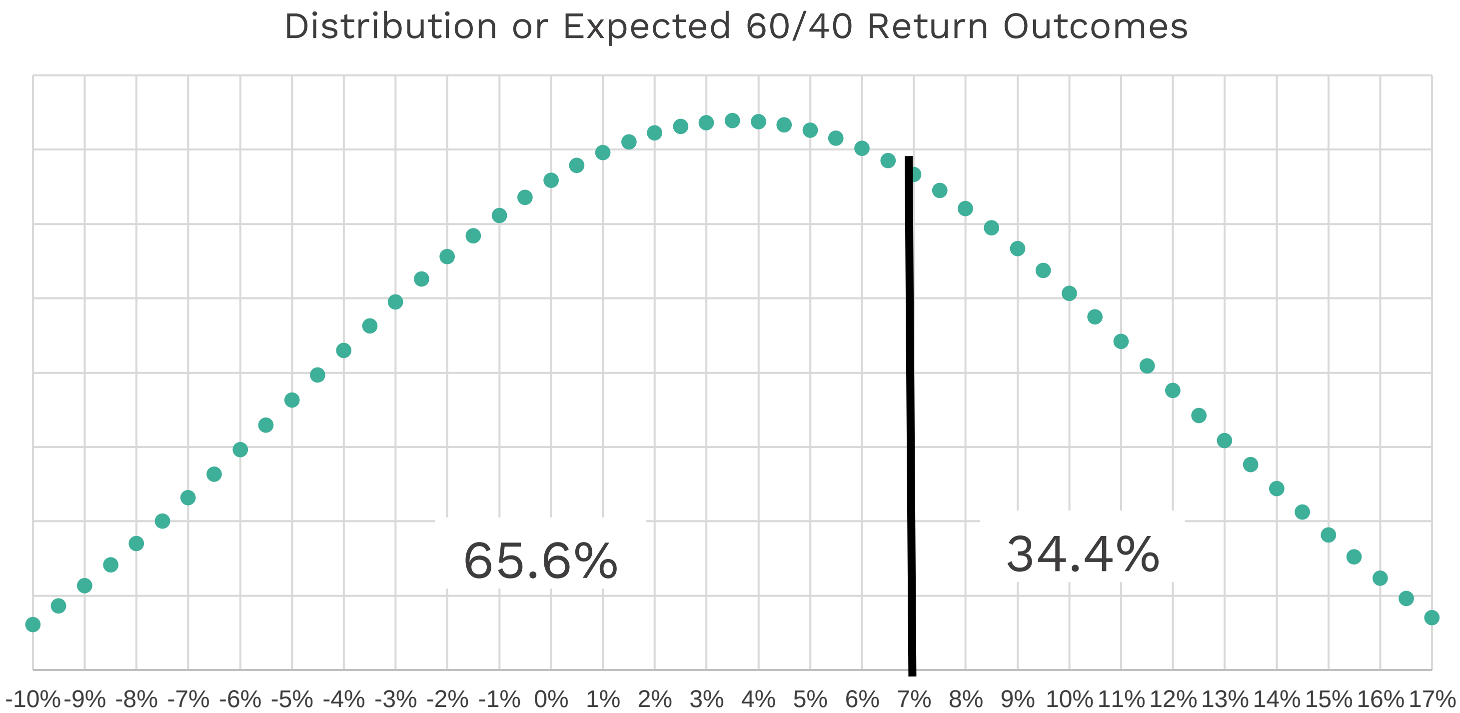
Sharpe Based Forecast: we assume a 0.45 long term Sharpe Ratio for the 60/40 portfolio and apply that to the portfolio's estimated volatility. The expected Sharpe ratio assumption for the 60/40 portfolio is higher than the estimate used for the MSCI World and the Barclays US Aggregate Index in acknowledgement of the benefit of portfolio diversification.

Hypothetical example. For illustrative purposes only. PanAgora accounts may have exposure to some or all of the markets and asset classes discussed herein. Forecast, estimates, and certain information herein are based upon proprietary research and should not be considered as investment advice or a recommendation of any particular security, strategy, or investment product. Source: PanAgora.

The Case for Taking More Risk

Time to Pivot to Something That Offers a Better Chance to Win

- Assuming Normal Distribution, 3.59% expected return, and risk of 8.50%
  - Cumulative probability of success is 34.4%, cumulative probability of failure is 65.6%



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The Case for Taking More Risk

Replacing the missing cash return from your total return

- A risk-free rate of 2% accounts for nearly 30% of a 7% total return target
- Today, and for the foreseeable future, the risk-free rate will offer no help in achieving a return target
- Assuming a portfolio's expected Sharpe ratio remains constant, more risk will need to be taken to achieve the same total return
  - In the example below, portfolio C targets 400 basis points more risk to achieve the same total return as Portfolio A
- Liquid portfolios with public market beta can be scalable to target varying levels of risk
  - One mechanism to vary risk is leverage which is currently on sale

	Portfolio A	Portfolio B	Portfolio C
Risk	10.00%	10.00%	14.00%
Sharpe Ratio	0.50	0.50	0.50
Risk-Free Rate	2.00%	0.00%	0.00%
Total Return	7.00%	5.00%	7.00%

Total Return = Risk * Sharpe Ratio + Risk-Free Rate

Hypothetical example for illustrative purposes only. No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to these shown. Please refer to the Appendix for the important hypothetical disclosure information. Source: PanAgora, MSCI, Bloomberg. As of August 2020.

Increasing Risk Through Concentration or Diversified Leverage?

Concentration or Diversified Leverage?

Plan Investors have a dual investment objective

- Grow plan assets through investment returns at a rate equivalent to the plan's actuarial hurdle
  - Invest in opportunities that have expected returns greater than cash
  - Take sufficient risk to achieve the required hurdle
- Minimize the impact of market volatility on the plan's funding status
  - Invest in assets that are diversifying to one another
  - Weight those investments so they influence the portfolio similarly

Strategic Asset Allocation options to consider

- 100% Equities
  - Consistent with the plan's return objective
  - Inconsistent with the plan's stability objective
- 20% Equities and 80% Fixed Income
  - Inconsistent with the plan's return objective
  - Consistent with the plan's stability objective
- 60% Equities and 240% Fixed Income
  - Consistent with the plan's return objective
  - Consistent with the plan's stability objective

For illustrative purposes only. No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to these shown. Source: PanAgora. As of August 2020.

Concentration or Diversified Leverage?

Risk can be changed via asset allocation (Target Date) or leverage (Risk Parity)

- A fixed weight combination of 26% MSCI World and 74% US Treasuries delivered a higher Sharpe ratio but lower returns than 100% MSCI World
- Levering this portfolio to have a similar risk as the MSCI World realized a higher Sharpe ratio and return

Jan 1973 – Aug 2020	MSCI World	Barclays US Aggregate Bond Index	26/74	70/203
Return	8.63%	7.05%	7.71%	12.38%
Risk	14.89%	5.13%	7.46%	14.89%
Sharpe Ratio	0.27	0.47	0.56	0.52

Total Return = Risk * Sharpe Ratio + Risk-Free Rate

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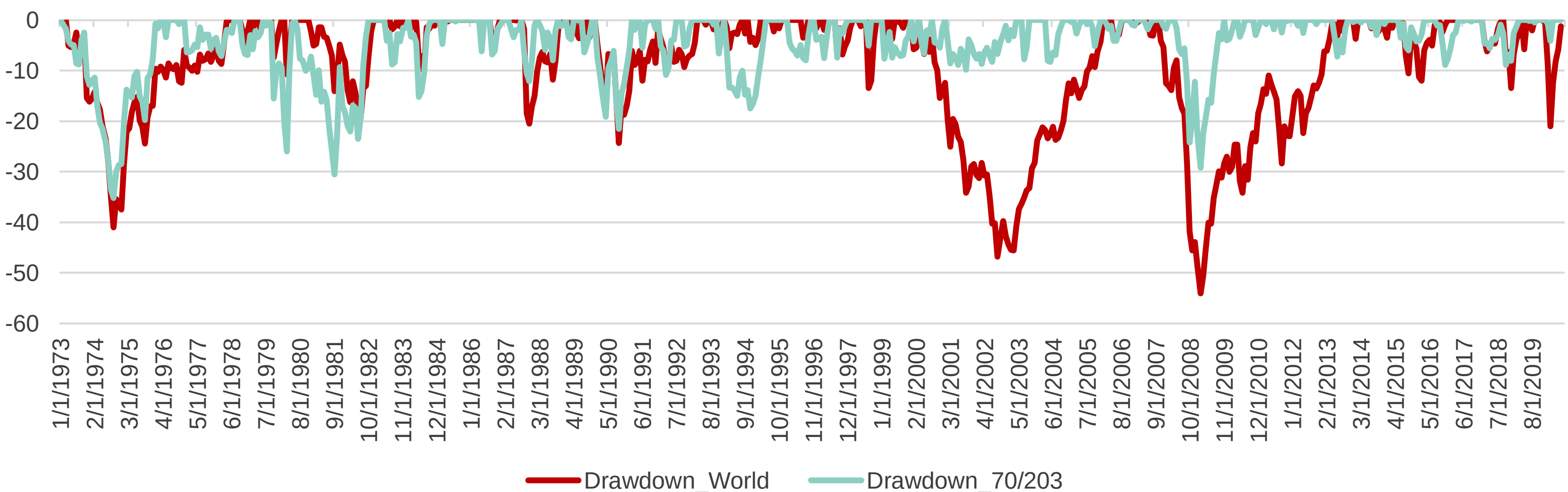
Concentration or Diversified Leverage?

At the same risk, a more diversified portfolio generally suffers shallower drawdowns

- The MSCI World suffered larger drawdowns and slower recoveries than the levered stock/bond portfolio
  - Dot Com (2000-2003), GFC (2008-2012), COVID (Q1 2020)
  - The levered portfolio of 70% MSCI World and 203% Barclays US Treasury Index had a smaller average distance from peak (4.6% vs. 9.0%)
- The levered stock/bond portfolio suffered a larger drawdown during the 1970s inflation shock
  - An allocation to inflation protected assets (commodities and inflation linked bonds) would have helped

Drawdowns 1973-2020 MSCI World and 70% World/203% US Treasury



Total Return = Risk * Sharpe Ratio + Risk-Free Rate

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Diversification Still Matters

Diversification Still Matters

"Compound Interest is the 8th Wonder of the World" – Albert Einstein

- For the same average return, the smoother path accumulates more wealth over time

Example: Mathematics of compounding returns rewards the more stable path to wealth creation

	Beginning Balance	Year 1	Year 2	Year 3	Average Return	Ending Balance
Investor A	$100.00	10.00%	10.00%	10.00%	10.00%	$133.10
Investor B	$100.00	10.00%	50.00%	-30.00%	10.00%	$115.50
Difference					**0.00%**	**$17.60**

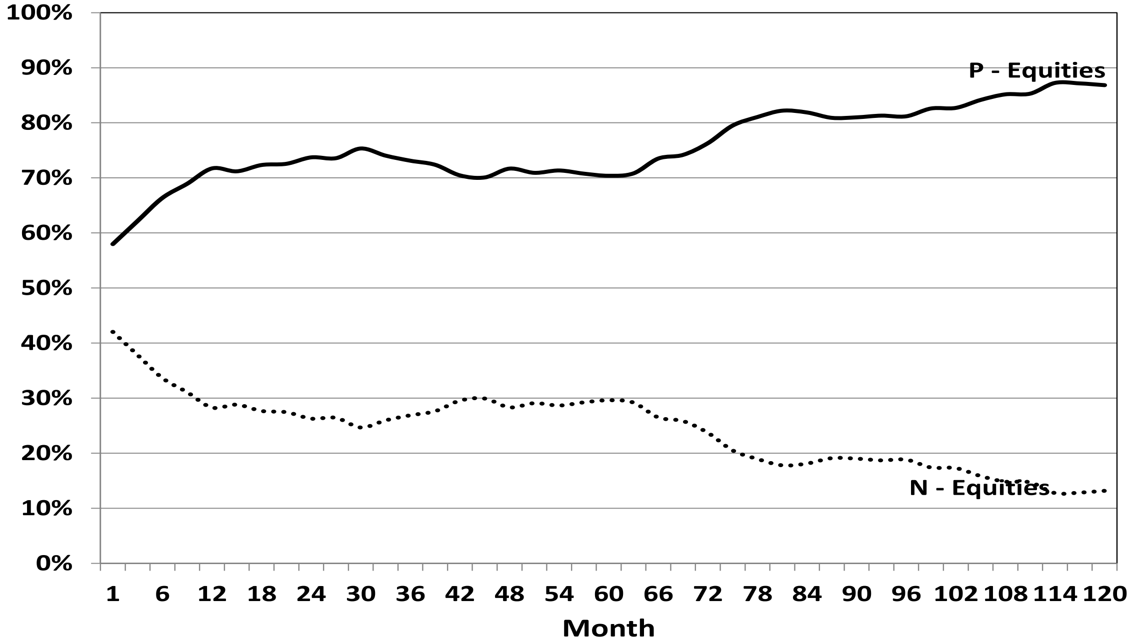
For illustrative purposes only. The above chart intends to demonstrate the cumulative effect that a series of gains or losses has on an original amount of capital over a period of time. Source: PanAgora.

Diversification Still Matters

Frequencies of positive and negative equity excess return over different horizons

- Greater than 10% chance that equities underperform cash over a 10-year horizon

Probability of equities (S&P 500) delivering positive (P - Equities) or negative (N – Equities) excess returns over a 10-year horizon*



*This graph represents the probability of equities offering excess returns versus a 3-month T-Bill over a 10-year cycle. As time passes, the probability of negative excess returns decreases (i.e. it is more likely that equities will underperform a 3-month T-Bill over 1 month than it is that they will underperform over a timeframe of 10 years). Total Return = Risk * Sharpe Ratio + Risk-Free Rate

The probabilities were calculated by determining the discrete probability of a positive (P – Equities) or negative (N – Equities) outcome at each point in time.

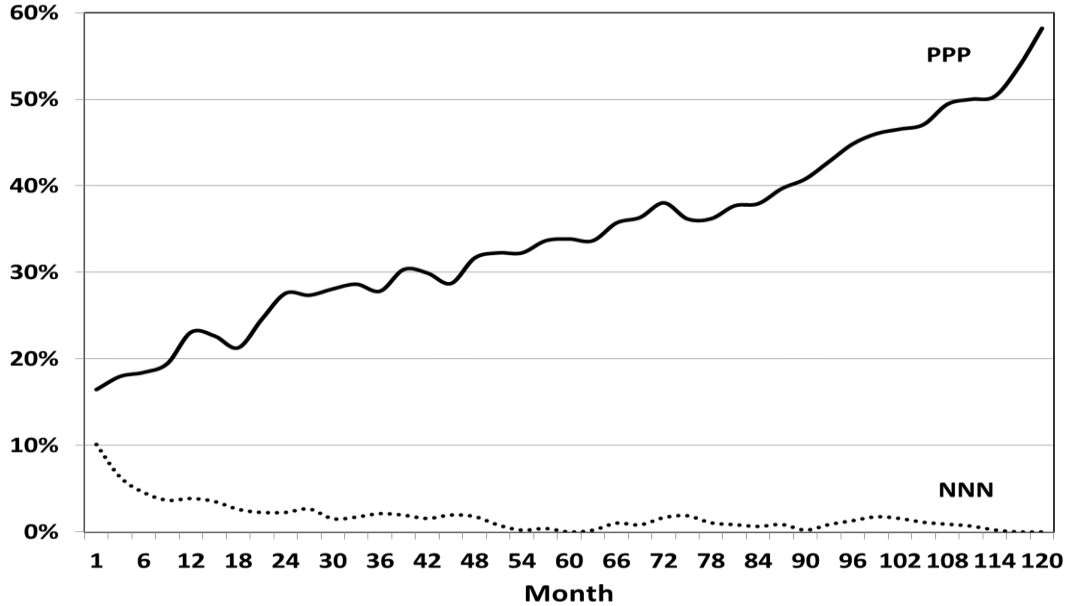
Hypothetical example for illustrative purposes only. No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to these shown. Please refer to the Appendix for the important hypothetical disclosure information. Source: PanAgora, MSCI, Bloomberg. As of August 2020.

Diversification Still Matters

Frequencies of positive and negative equity excess return over different horizons

- Very low (less than 1%) chance that stocks, bonds, and commodities all underperform cash for 10 years

Probability of equities (S&P 500), bonds (10 Year US Treasury) and commodities (GSCI Index) delivering positive (P) or negative (N) excess returns over a 10-year horizon*



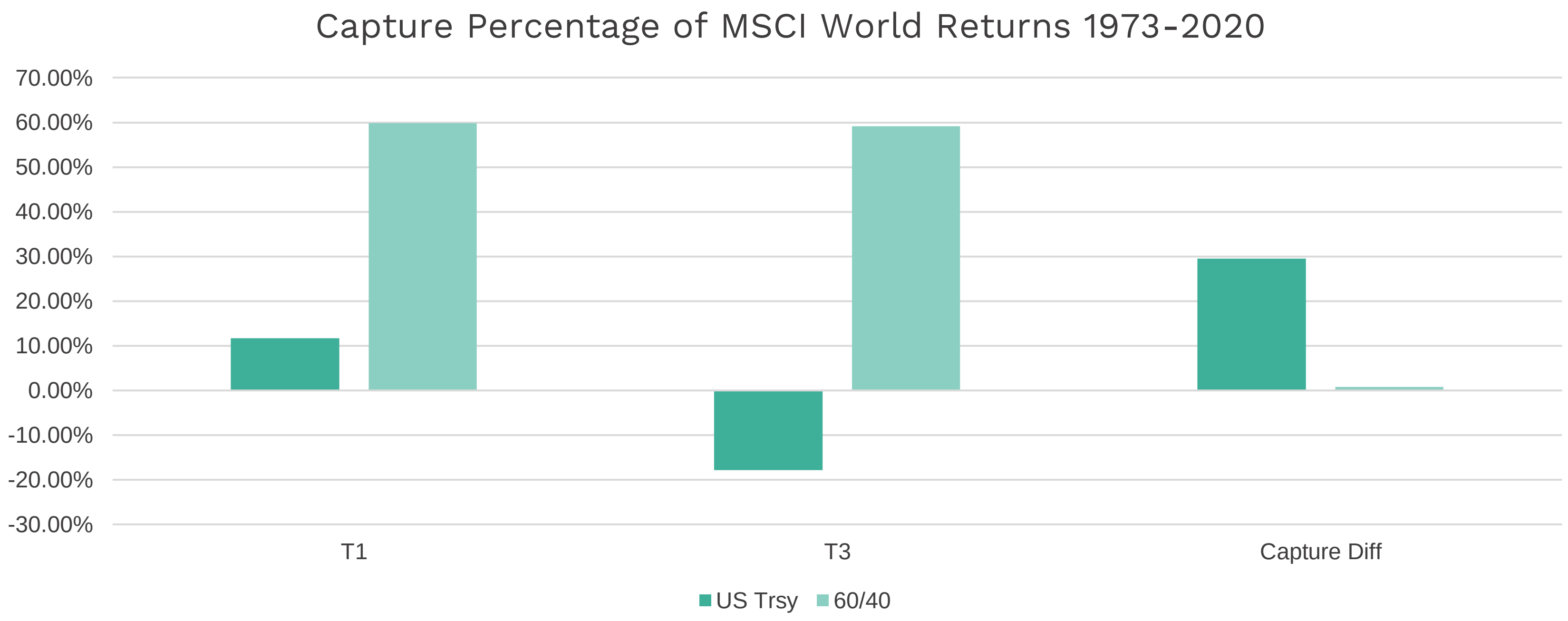
*This graph represents the probability of equities (as illustrated by the first “P” or “N” in the graph), bonds (as illustrated by the second “P” or “N” in the graph) and commodities (as illustrated by the third “P” or “N” in the graph) offering positive or negative excess returns versus a 3-month T-Bill over a 10-year cycle. As time passes, the probability of negative excess returns decreases (i.e. it is more likely that all three asset classes will have negative excess returns in in any one month than it is that they will underperform over a timeframe of 10 years). The probabilities were calculated by determining the discrete probability of a positive (P – Equities) or negative (N – Equities) outcome for each asset class at each point in time. Total Return = Risk * Sharpe Ratio + Risk-Free Rate

Hypothetical example for illustrative purposes only. No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to these shown. Please refer to the Appendix for the important hypothetical disclosure information. Source: PanAgora. As of August 2020.

Diversification Still Matters

Positive Convexity in bonds allows Treasuries to be conditionally correlated

- In the top tercile of monthly equity returns bonds are positively correlated with stocks
- In the bottom tercile of monthly equity returns bonds are negatively correlated with stocks
- Despite a 40% allocation to bonds, the 60/40 portfolio captures 60% of both the top and bottom terciles of equity returns



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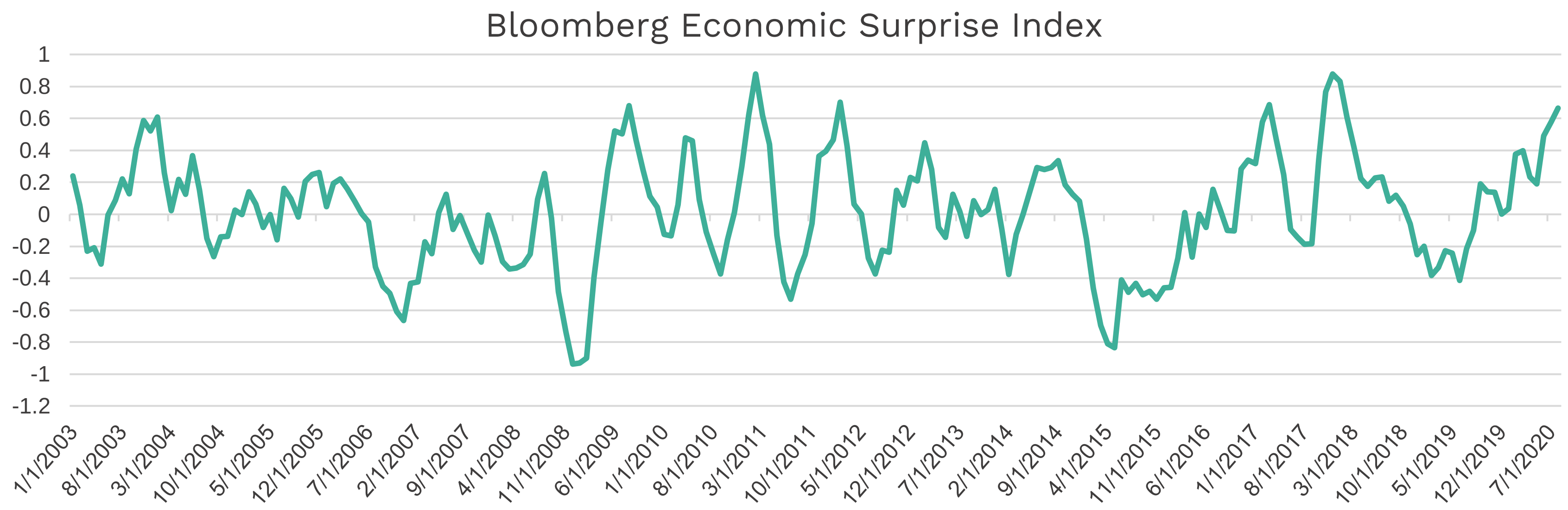
Diversification Still Matters

Risk Weighting unleashes the power of the convexity in stock/bond diversification

- HFR Risk Parity Index exhibits better consistency across positive and negative economic surprises



Jan 2003 – Aug 2020	HFR Risk Parity 10V Index	60/40
Positive Economic Surprises (98)	7.20%	9.40%
Negative Economic Surprises (90)	8.03%	4.62%
Source: MSCI, Bloomberg, PanAgora		

For Illustrative purposes only. 60/40 Index Portfolio consists of 60% MSCI World Hedged Index/40% Bloomberg Barclays Global Aggregate USD Hedged Index. Periods are defined using Bloomberg Economic Surprise Index. Source: Bloomberg, HFRI, PanAgora. Data as of 30 June 2020.

Haven’t We Seen Low Yields Somewhere Before?

Bond yields have been below 1% for a long time in many countries

- 10-year JGB has not yielded above 1% since 2011
- Most government bonds from the Eurozone have yielded below 1% for more than 5 years

Creating a hypothetical portfolio from sub-indices bifurcated by yield levels (“Low Yielder Index”)

- Bloomberg Barclays Global Treasury Index: 41 countries
- Low Yield Index country selection
  - Average Yield to Worst of country averaged below 1% for the past 5 years
  - Average weight in the Global Treasury Index exceeded 0.50% for the past 5 years
  - 7 Countries- Japan, Belgium, France, Germany, Ireland, Netherlands, Spain
  - Use Bloomberg Barclays Global Treasury index weights and normalize to 100%
- Global Treasury excluding Low Yielding countries
  - Remove 7 low yielding countries from the Global Treasury index (approximately 43% of the weight)
  - Normalize the index weights of the remaining countries to 100%

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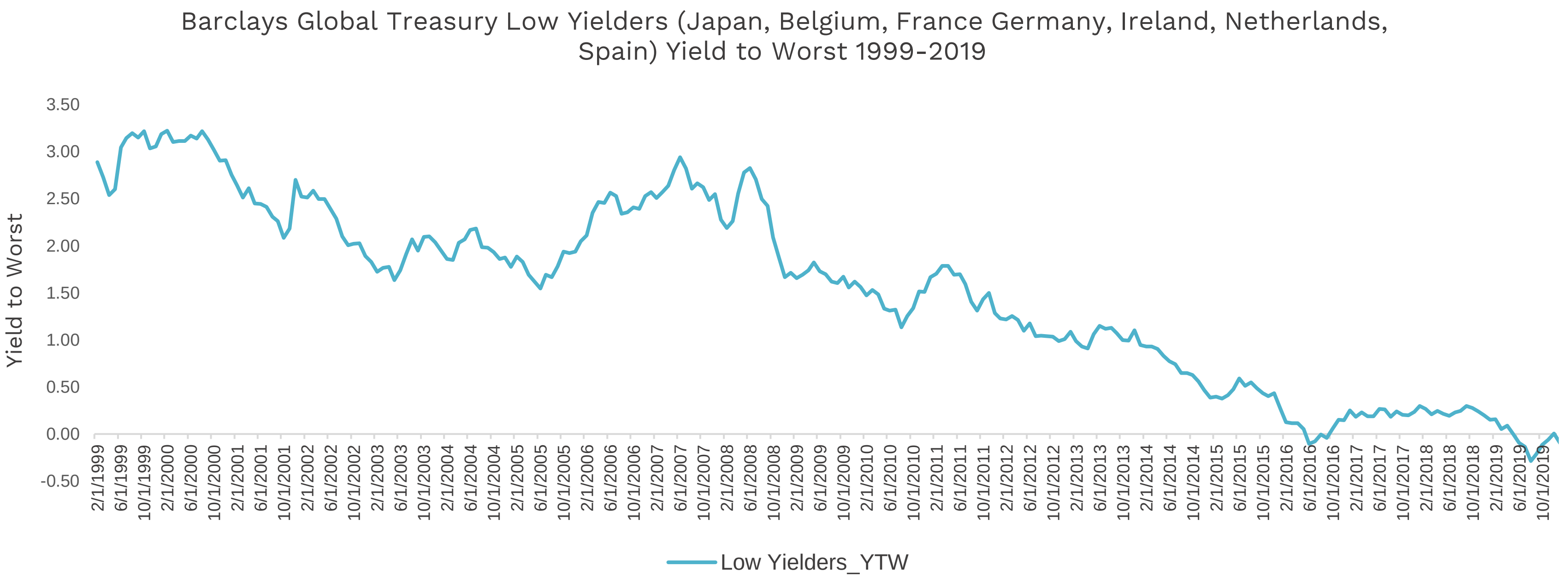
Diversification Still Matters

Backtested Yield to Worst of Low Yielding Global Treasuries

- Barclays Global Treasury constrained only to countries with yields below 1% for the past 5 years
  - Japan, Belgium, France, Germany, Ireland, Netherlands, Spain
- Low Yielder index drops below 1% in May 2012
- Low Yielder index drops below 0% in June 2016



Hypothetical backtested results for illustrative purposes only. No representation is being made that any account, product, or strategy will or is likely to achieve profits, losses, or results similar to those shown. Hypothetical backtested results have several inherent limitations. Unlike an actual performance record, backtested results do not represent actual performance and are prepared with the benefit of hindsight. As with any investment there is a potential for profit as well as the possibility of loss. Above information is based on the Barclays Global Treasury January 1999 to December 2019. Source: Bloomberg, PanAgora.

Diversification Still Matters

Low Yielder portfolio's backtested results perform well despite low yields

- Low Yielder portfolio delivered 100 basis points higher return and a better Sharpe ratio in the second half of the sample even though the index's yield was significantly lower
- The Low Yielder portfolio outperformed a 3-month T-bill even when bond yields turned negative and hovered around zero

Low Yielder Portfolio	Jan 99 – Apr 12	May 12 – Dec 19	June 16 – Dec 19
Excess return vs. 3 Mo. T-Bill	1.79%	2.79%	1.12%
Risk	2.34%	2.43%	2.45%
Sharpe Ratio	0.76	1.15	0.46
Average YTW	2.12%	0.40%	0.12%

Source: Bloomberg, PanAgora. Excess return vs. 3 Month T-Bill. All returns are annualized and gross of fees.

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Diversification Still Matters

Diversification Benefit Remains Meaningful

- Low Yielder hypothetical portfolio demonstrates negative correlation to global equities
- Break monthly returns into high and low months based on MSCI World (top half of return distribution becomes "high" and bottom half becomes "low")
  - Correlation between stocks and bonds is lower in months with lower equity returns and higher in months with higher equity returns

Correlation to MSCI World	Low Yielders (LY)
January 1999 – April 2012	-0.30
May 2012 – December 2019	-0.17
June 2016 – December 2019	-0.25

Correlation to MSCI World	Low Yielders (LY)
January 1999 – April 2012 (High)	-0.12
January 1999 – April 2012 (Low)	-0.22
May 2012 – December 2019 (High)	0.18
May 2012 – December 2019 (Low)	-0.26

Source: MSCI, Bloomberg, PanAgora.

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Barclays Global Treasury Index and MSCI World Index January 1999 to December 2019. The Low Yielder and Ex Low Yielder indices are derived from the Bloomberg Barclays Global Treasury Index. The Low Yielders index represents all countries with an average yield to worst below 1% for the past 5 years and an index weight greater than 0.50%. The Ex Low Yielders index removes the Low Yielding countries from the Bloomberg Barclays Global Treasury Index.. Source: MSCI, Bloomberg, PanAgora.

Summary

We believe Risk Balanced portfolios are uniquely equipped to handle today's challenges

- Risk balanced portfolios are scalable to higher levels of risk
  - More risk taking is needed today to compensate for the loss of a return on cash

- Risk balanced portfolios achieve higher risk through diversified leverage rather than asset allocation
  - Our research indicates no change from the diversification characteristics from the lower risk portfolio

- Risk balanced portfolios are professionally managed under a risk management lens
  - Position sizing is adaptive to changing market conditions
  - Seek to target asset classes that we believe represent the most liquid public market betas

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Appendix: Bibliography & Team Biographies

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Multi Asset Investment Team Relevant Experience

			Years of experience	
Name	**Title**	**Area of focus**	**Industry**	**With PanAgora**
Edward Qian, Ph.D., CFA	Chief Investment Officer, Multi Asset Investments	Architect of Risk Parity framework, oversight of Multi Asset team, research and implementation	24	22
Bryan Belton, CFA	Managing Director, Multi Asset Investments	Fixed income, currency and commodities research and implementation	23	15
Nicholas Alonso, CFA	Director, Multi Asset Investments	Equity research and implementation	14	10
Jonathan Beaulieu, CFA	Director, Multi Asset Investments	Fixed income, currency and commodities research and implementation	25	9
David Liddell	Director, Multi Asset Investments	Equity implementation	31	31
Kun Yang, Ph.D., CFA	Director, Multi Asset Investments	Fixed income, currency, commodities and equity research and implementation	14	14
William Zink	Director, Multi Asset Investments	Equity implementation	45	32
Anthony Borthwick, CFA, CMT	Senior Portfolio Manager, Multi Asset Investments	Fixed income, currency and commodities research and implementation	32	28
Randall Yarlas	Portfolio Manager, Multi Asset Investments	Equity implementation	27	20
Vic Malla, CFA	Analyst, Multi Asset Investments	Fixed income, currency and commodities research and implementation	10	2
Ryan Zhao	Analyst, Multi Asset Investments	Multi Asset research	1	1
Timothy Doyle	Portfolio Analyst, Multi Asset Investments	Portfolio Implementation	16	14
James Alberto	Senior Architect, Multi Asset Data Sci. & Tech.	Investment software application developer	30	12
Justin Neal	Architect, Multi Asset Data Sci. & Tech.	Investment software application developer	23	8

Team as of September 2020.

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BERNSTEIN

September 2020

Portfolio Strategy

New Paradigm for Investing

- Expect low returns across asset classes…
- Asset owners need to take more risk – despite all time high valuations
- Private equity set to disappoint, no such thing as alts
- Take more risk but smarter risk (more, true diversification)
- The only alpha worth paying for therefore is idiosyncratic alpha
- How to replace fixed income?
- This suggests a new approach to asset allocation

Source: Bernstein analysis

S&P 10-yr forward target: 4000 or 8000?

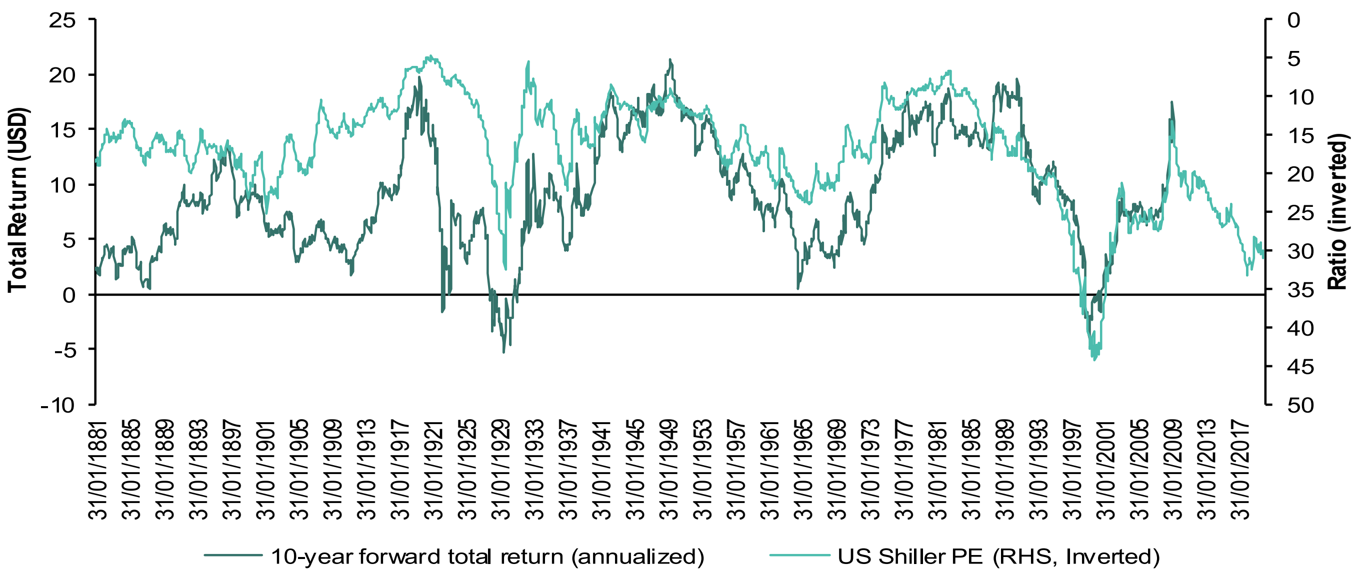
Why returns will be low

- Shiller PE 29x implies 4%pa return next 10 years
- Household equity allocation at 70 year max
- DY+real gth per capita + population gth =0.6+1.0+0.6=3.4% [or 5.6% with buybacks]

Why returns will NOT be low

- Shiller PE has been wrong for 10 years
- Corporate buying 10x investor flows
- Equities have been the best inflation hedge last 140 years – so investors need to buy more

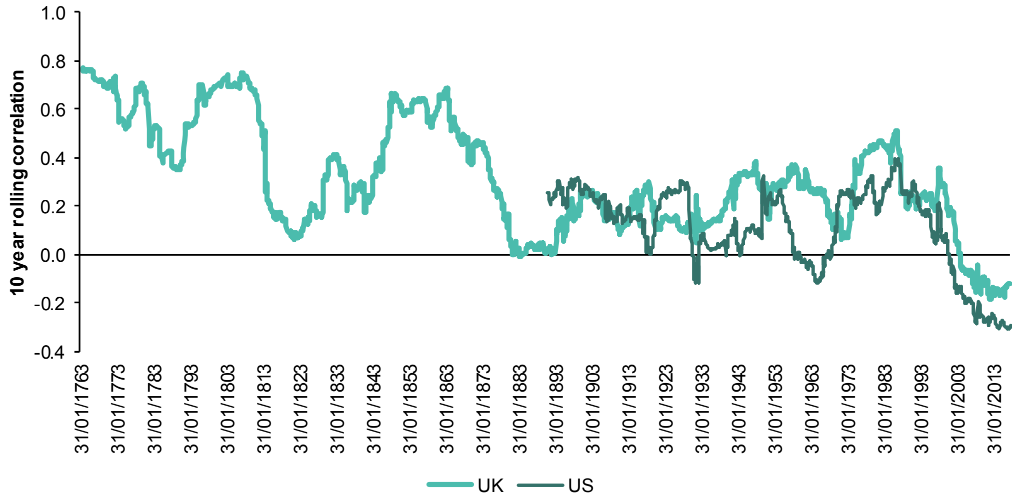
Shiller PE and 10 year forward returns



Shiller PE defined as price divided by 10 year average inflation-adjusted earnings.
Source: Robert Shiller's database, Global Financial Data, Bernstein analysis: Global Financial Data, Bernstein analysis

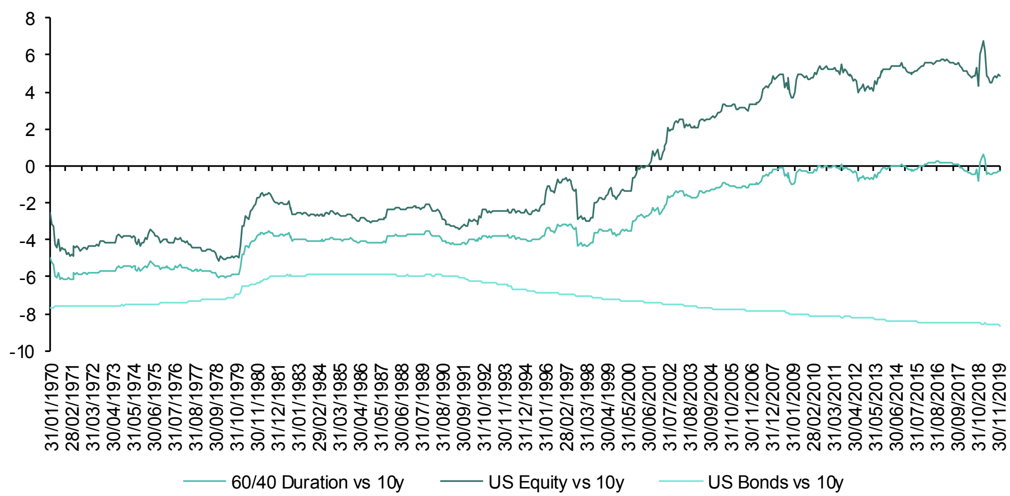
The diversifying power of bonds likely to reduce… and increase risk of 60:40

Stock-bond correlation has recently been more negative than prior 250 years… unlikely to persist



Rolling 10 year correlation between stock and bond returns.
Source: Datastream, Global Financial data, Bernstein analysis

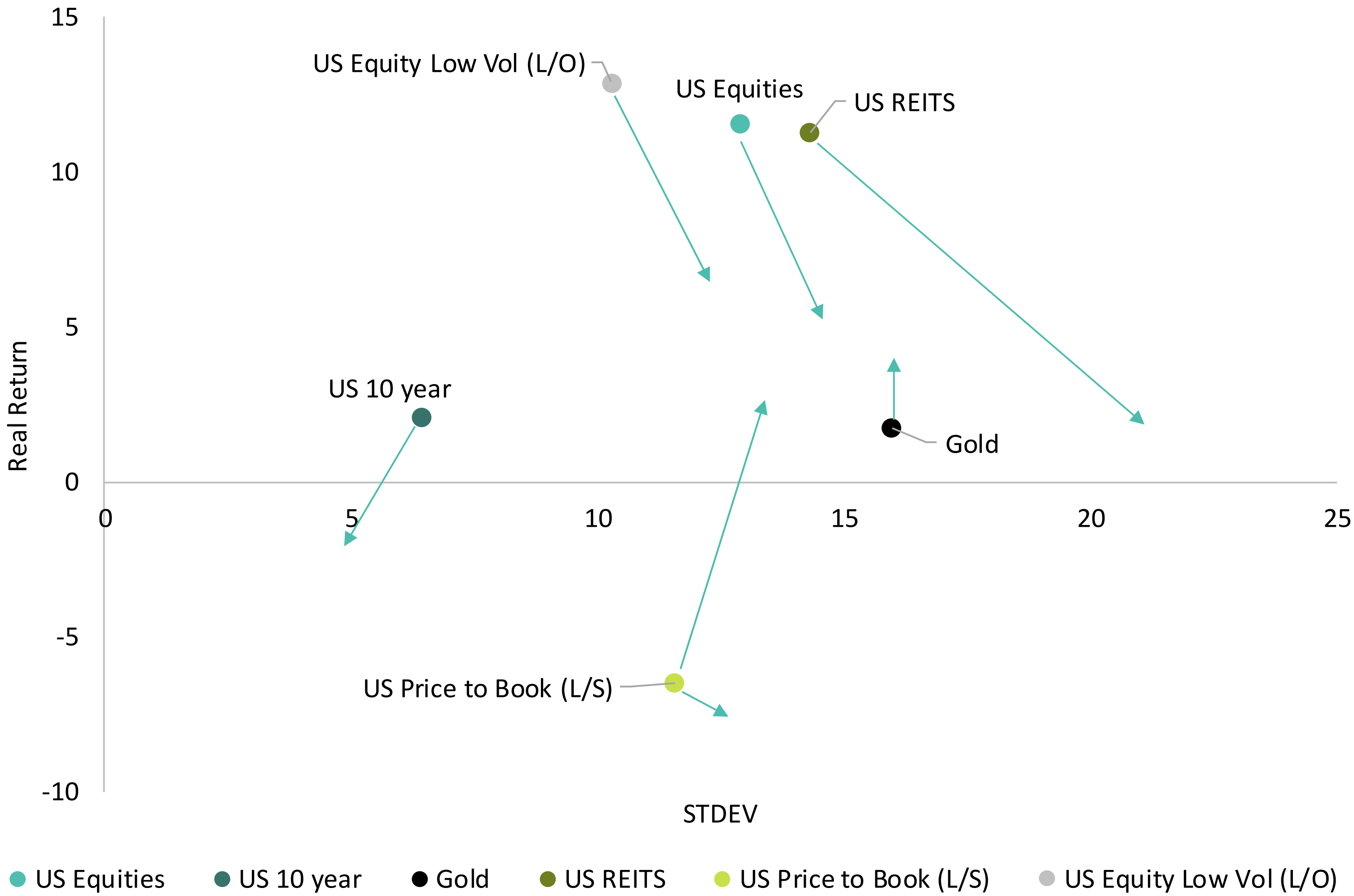
The duration risk of 60:40 has been kept down by negative stock bond correlation… this risk is set to rise



Note: Duration is calculated running a regression of Bond, Equity, 60/40 monthly returns against the monthly change in US 10y yield on a 10 year rolling basis
Source: Datastream, Robert Shiller's database, Global Financial Data, Bernstein analysis

Asset owners have no choice but to take on more risk

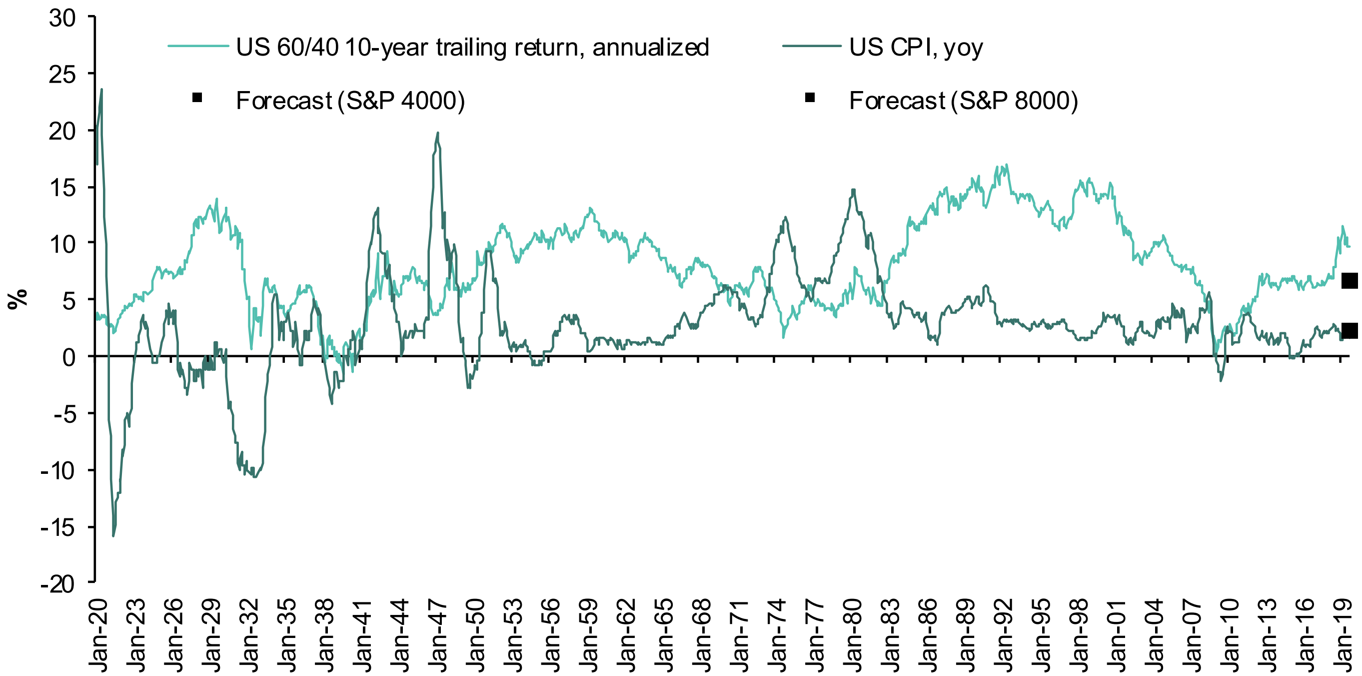
Return and vol trade-off for most assets likely to get worse



Dots indicate return and vol over last decade with arrows indicating how we expect these to evolve.
Source: Global Financial data, Datastream, AQR, Ken French database, FRED, Bernstein analysis

The death of 60:40

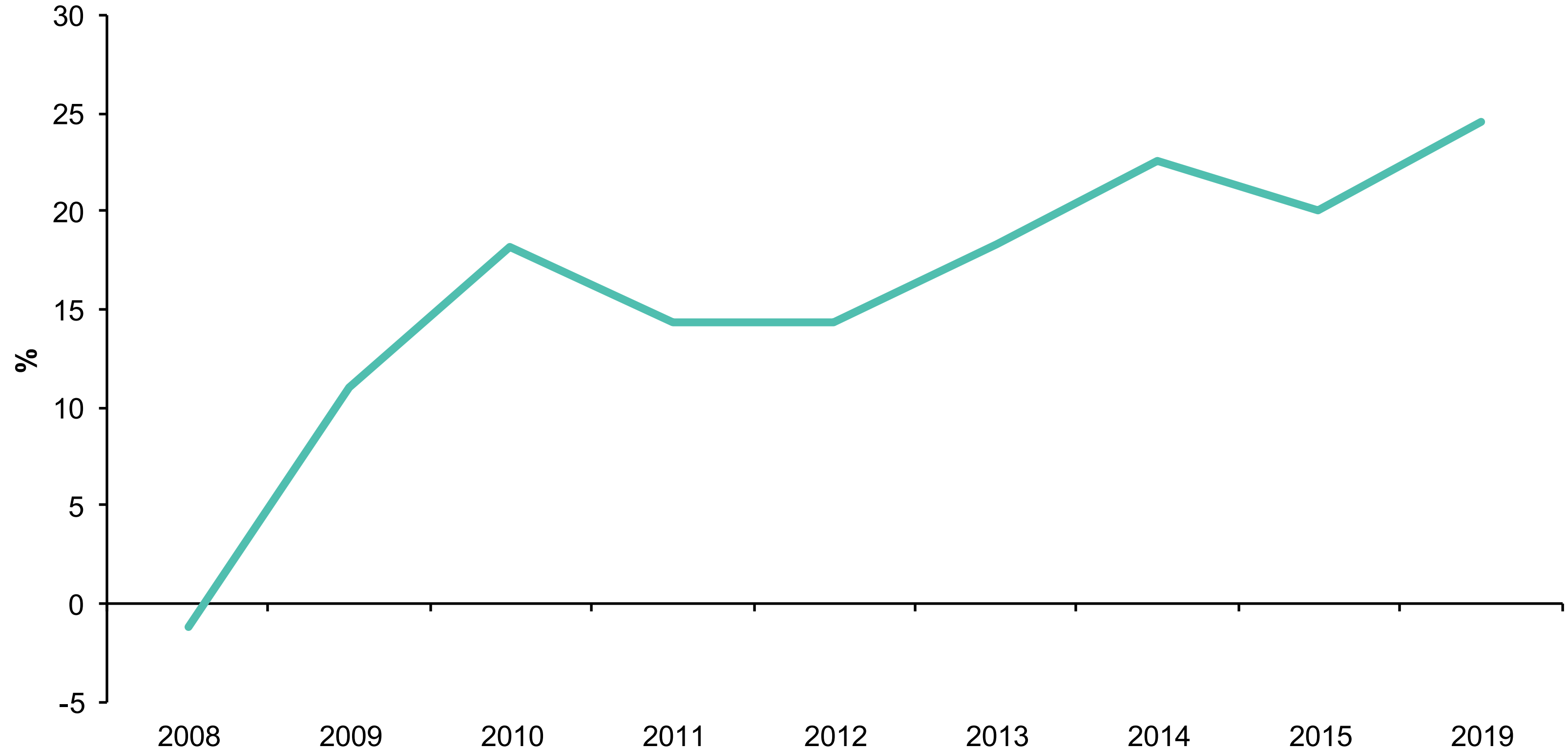
- 60:40 has beaten inflation for 40 years, but in future the return of 60:40 likely to decline… … and the policy response to Covid likely increases inflation. So real returns sharply lower
- And the risk of 60:40 is increasing
- Even with S&P at 8000 we think nominal returns of 60:40 only 6%pa next decade
- S&P at 4000 implies nominal returns of just 1.5%pa
- Inflation could well hit 3% or more



The black squares represent two possible scenarios for 60:40 returns based on the outlook for equities. In the first scenario S&P 500 is projected to reach 4000 in the next 10 years, and in the second scenario it is projected to reach 8000. In both cases the forward returns to Bonds is assumed to be equal to the current rate of US 10 year yield.
Source: Datastream, Bernstein analysis

Private equity Set to Disappoint

Implicit required return from alternative investments (% pa, net of fees)

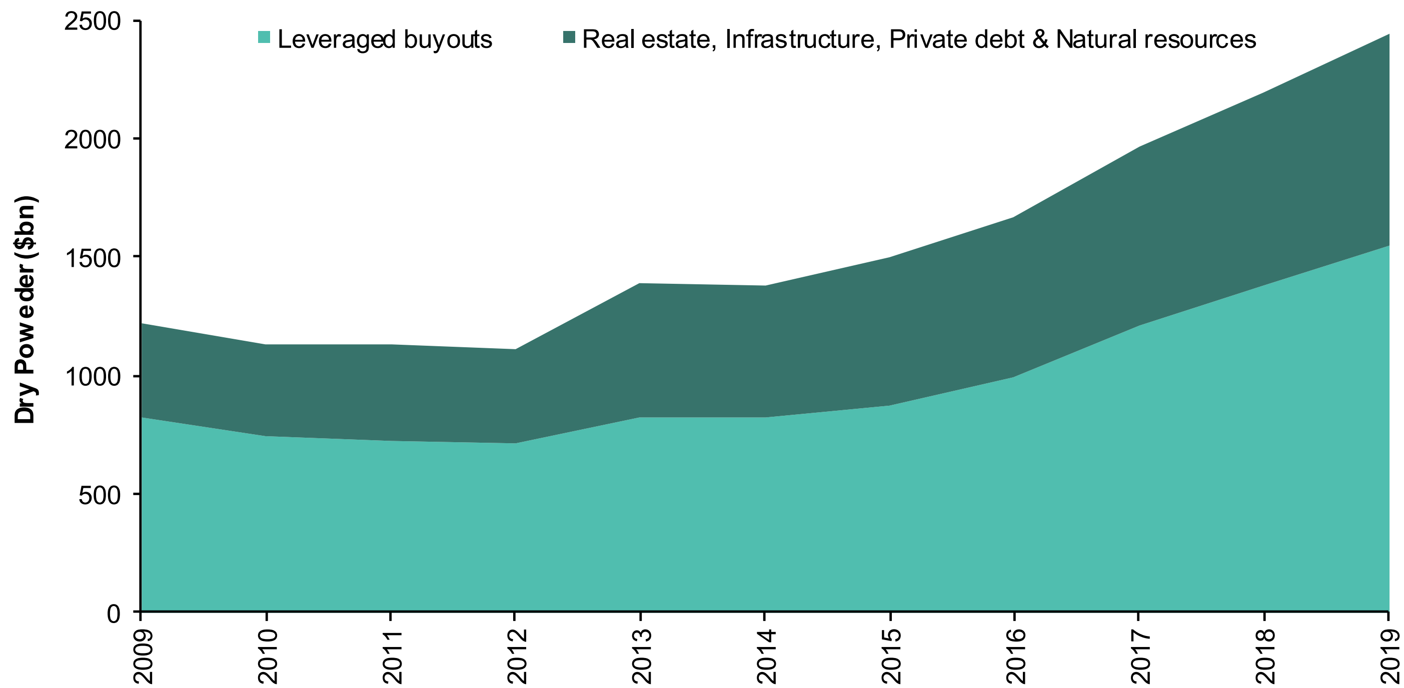


Note: Exhibit shows what we believe is the implicit expected return on alternatives by US pension plans. We assume that it is easier to predict the future returns on equities and bonds than it is for alternatives, thus we use our long run expected return forecasts for equities and bonds, the known expected return on plan assets that pension funds target and their asset allocation to back out what the alternative allocation would need to deliver in order to hit the expected return.
Source: Bernstein analysis

Private equity Set to Disappoint II

- Dry powder at record level, bids up entry prices and hence downward pressure future returns
- PE has relied on cheapening access to credit last 20 years, credit quality now lowest ever
- Private markets cannot disconnect from public markets in long run – exit strategy
- Wide distribution of returns across PE providers … it needs a passive alternative
- Don't confuse stale prices with diversification!

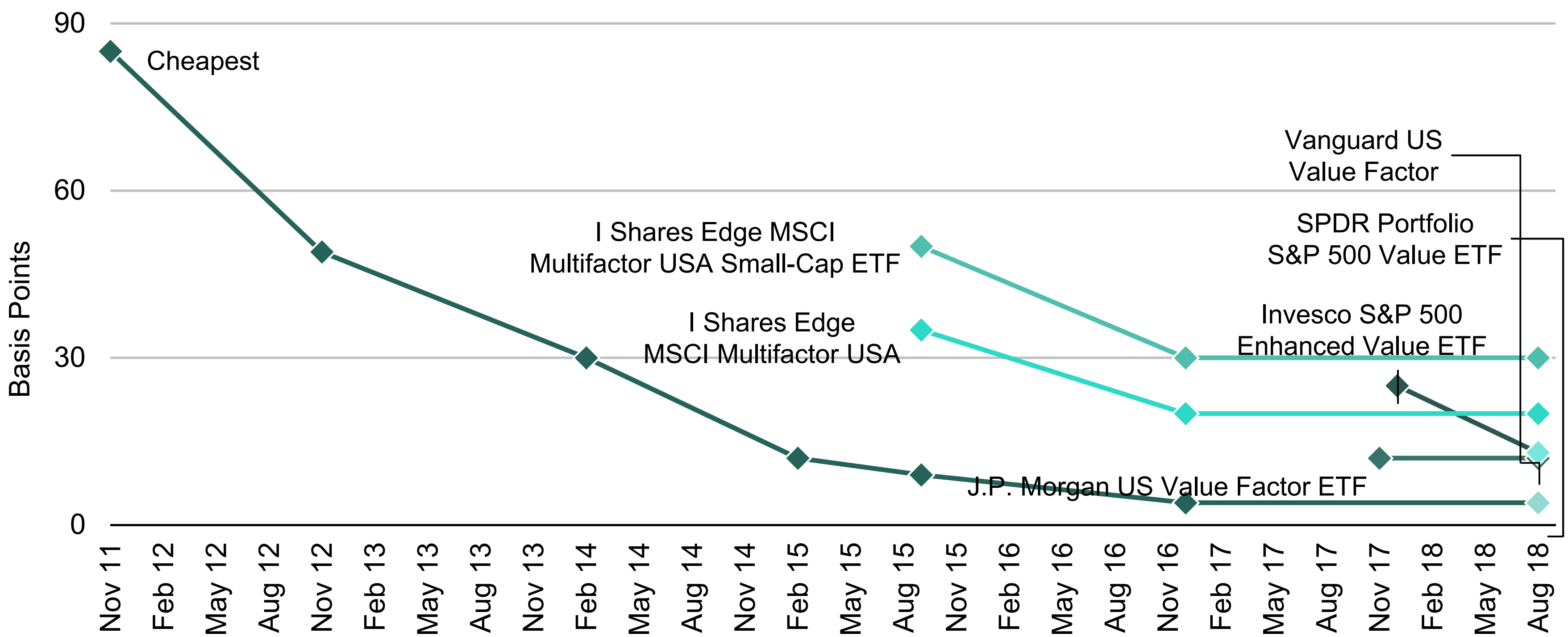
Private equity "dry powder" at historically high levels



Source: Preqin Private Equity Online, Bernstein analysis

Beta and Alternative Beta Getting Cheaper

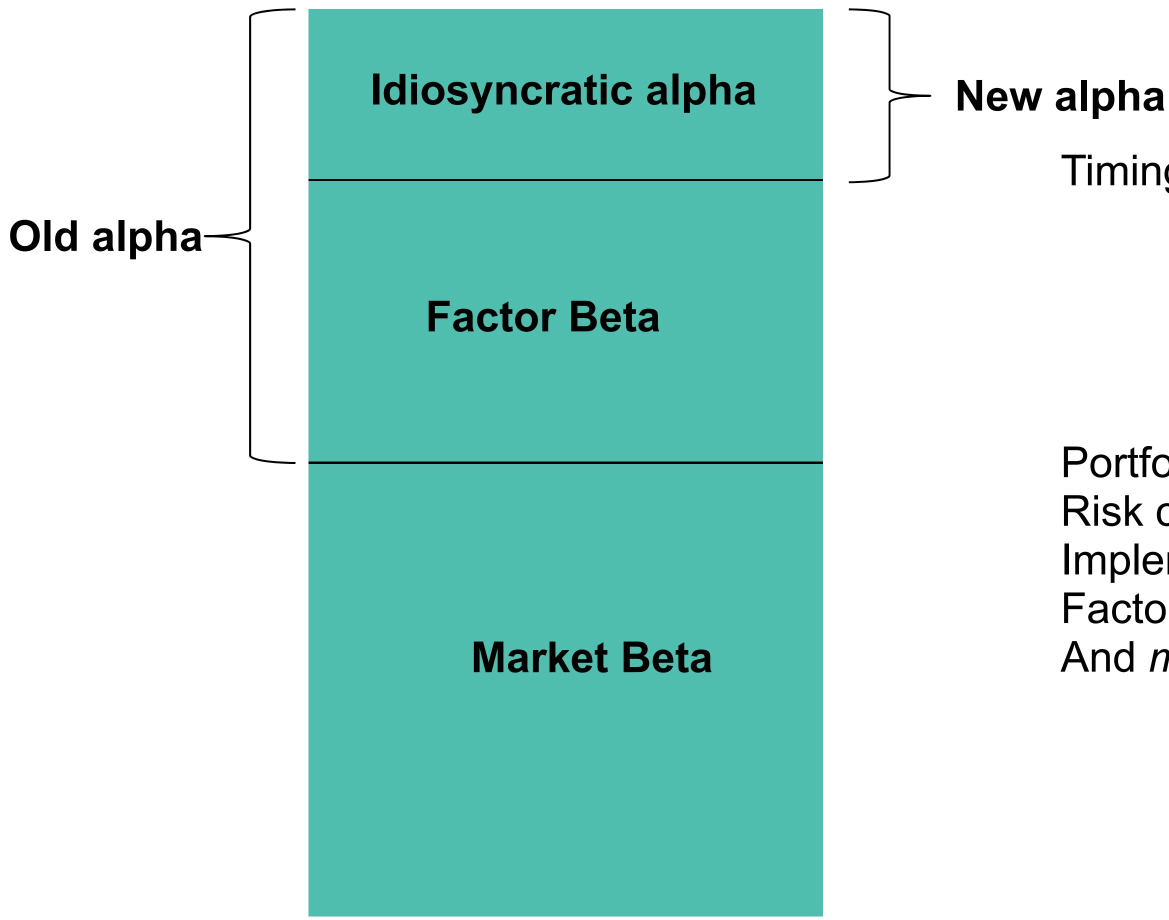
The Lower Boundary for Smart Beta Fees Could Drop Below Zero



Note: We have created this time series of smart beta fees from data on the pricing of some of the most popular smart beta products for large cap US equities.
See Fund Management Strategy: Zero fee future - Is anything NOT going to zero fee in fund management? for sources of all funds used.
Source: Financial Times and Bernstein analysis

The need for idiosyncratic returns: find and pay for true diversificaton

What counts as true alpha is shrinking



Timing:

- -Market
- -Themes
- -Factors
- -Countries
- -Sectors

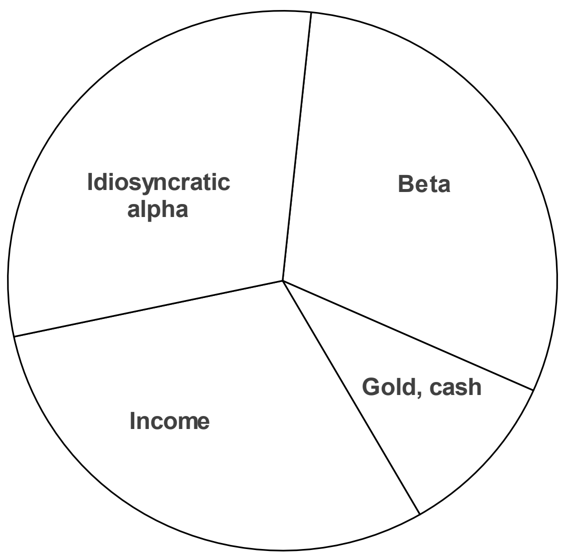
Portfolio construction
Risk control
Implementation (trading)
Factor combination (for quants)
And *maybe* stock selection

Source: Bernstein analysis

There is no such thing as passive asset allocation - The future of ACTIVE asset allocation

- Benchmark should be inflation +, to preserve purchasing power
- The true divide is idiosyncratic alpha vs beta, not asset classes and public/private
- Asset class betas lower, so have to include factor betas alongside assets…
- … this also allows ability to seek out diversification
- Only pay active fees for idiosyncratic alpha
- No separate buckets for alternatives or private equity
- Income is no longer fixed income but needs a broader set of assets

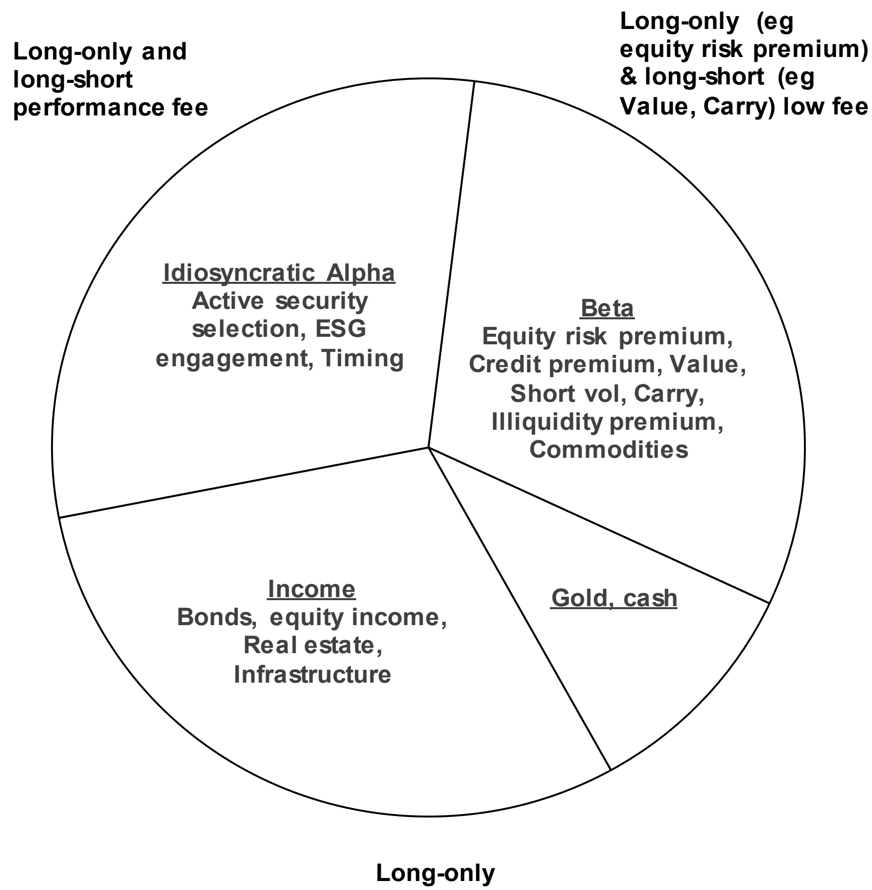
The building blocks for asset allocation



Source: Bernstein analysis

The future of ACTIVE asset allocation

The building blocks for asset allocation II



Source: Bernstein analysis

Replacing fixed income requires a portfolio of assets

There is a trade-off between income, duration risk and diversification from equities

- Stable yielding equities
- Real Estate
- Infrastructure
- TIPS
- FX Carry
- FX Momentum
- Bond Carry
- Gold

Summary results

Historic	TIPS	Gold	Real Estate	Infrastructure	Stable Yield	FX Momentum	FX Carry	Bond Carry	US Bonds
Return (%, ann.)	5.32	2.15	13.76	12.13	9.98	0.85	3.04	1.67	7.45
Risk (%, ann)	6.55	16.85	17.58	17.78	16.12	8.42	7.97	9.34	8.17
IR	0.81	0.13	0.78	0.68	0.62	0.10	0.38	0.18	0.91
Correlation with US Equities	-0.01	0.02	0.62	0.57	0.53	-0.04	0.29	0.08	0.03
Duration	-5.72	-1.53	-2.26	2.51	3.14	0.18	0.88	0.18	-6.42

Last 10 years	TIPS	Gold	Real Estate	Infrastructure	Stable Yield	FX Momentum	FX Carry	Bond Carry	US Bonds
Return (%, ann.)	3.91	3.33	12.46	11.10	10.78	-1.58	0.56	3.94	4.45
Risk (%, ann)	5.65	15.91	14.39	19.16	10.98	6.25	7.29	8.94	6.51
IR	0.69	0.21	0.87	0.58	0.98	-0.25	0.08	0.44	0.68
Correlation with US Equities	-0.08	0.04	0.63	0.73	0.90	0.05	0.64	0.25	-0.47
Duration	-5.84	-7.41	-1.54	8.12	4.43	-0.33	3.19	1.62	-8.69

Note: Historic returns start at 1980, except for TIPS (2002), Infrastructure (1996) and Stable Yield (1999).
Duration is calculated by regressing monthly returns against monthly change in US 10 year bond yield
Source: Global Financial Data, Datastream, Factset, Bernstein research

What would we do?

- Key challenge for asset owners is to preserve purchasing power
- Expect low returns across asset classes and less diversification
- 60:40-type strategies will lock in underperformance (vs inflation)
- Asset owner need to take more risk (even if valuations are high). Take advantage of longer horizons, assess governance structure
- Private Equity set to disappoint
- Replace fixed income with set of return streams
- Seek true diversification / true alpha and allocate fees accordingly
- Utilize new approaches to asset allocation to meet required returns

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Source: Bernstein analysis

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What's Next

- **1st Quarter 2021**
  - Education session on potential enhancements to Asset Allocation
  - Potential Increase in Risk Tolerance
  - Adjustments to Asset Allocation Targets
- **March/April 2021**
  - Investment Committee/Board adopt Revised Risk Budget to include Asset Allocation Enhancements

PERA

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