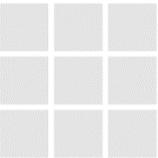




PAPERS 10th Annual Fall Workshop
**RETHINKING PUBLIC FUND
FIXED INCOME PORTFOLIOS
IN A LOW YIELD WORLD**

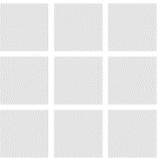
Terry A. Moore, CFA
Fixed Income Portfolio Specialist
November 15, 2016



Background

What is the role of fixed income in your plan's asset allocation?

- Return seeking? Liquidity for benefits? A hedge against equity volatility? Or all the above?
- What is the appropriate allocation structure and benchmark(s)?
- How should we protect our beneficiaries against the risk of rising interest rates and potential inflation?



Agenda

- Traditional Role of Fixed Income and the Risks of Today's Bloomberg Barclay's U.S. Aggregate Bond Index
- What are the Top 25 Public Plans Doing?
 - Fixed Income Allocation and Benchmark Research
- Solutions for Public Plans

What Role Has Fixed Income Traditionally Played in Asset Allocation?

1



INCOME

- Coupon is perhaps the most certain (least uncertain) source of investment return
- Providing regular cash flow income

2



DOWNSIDE RISK MANAGEMENT

- Infrequent periods of negative returns
- Losses should be limited in size
- No terrible surprises

3



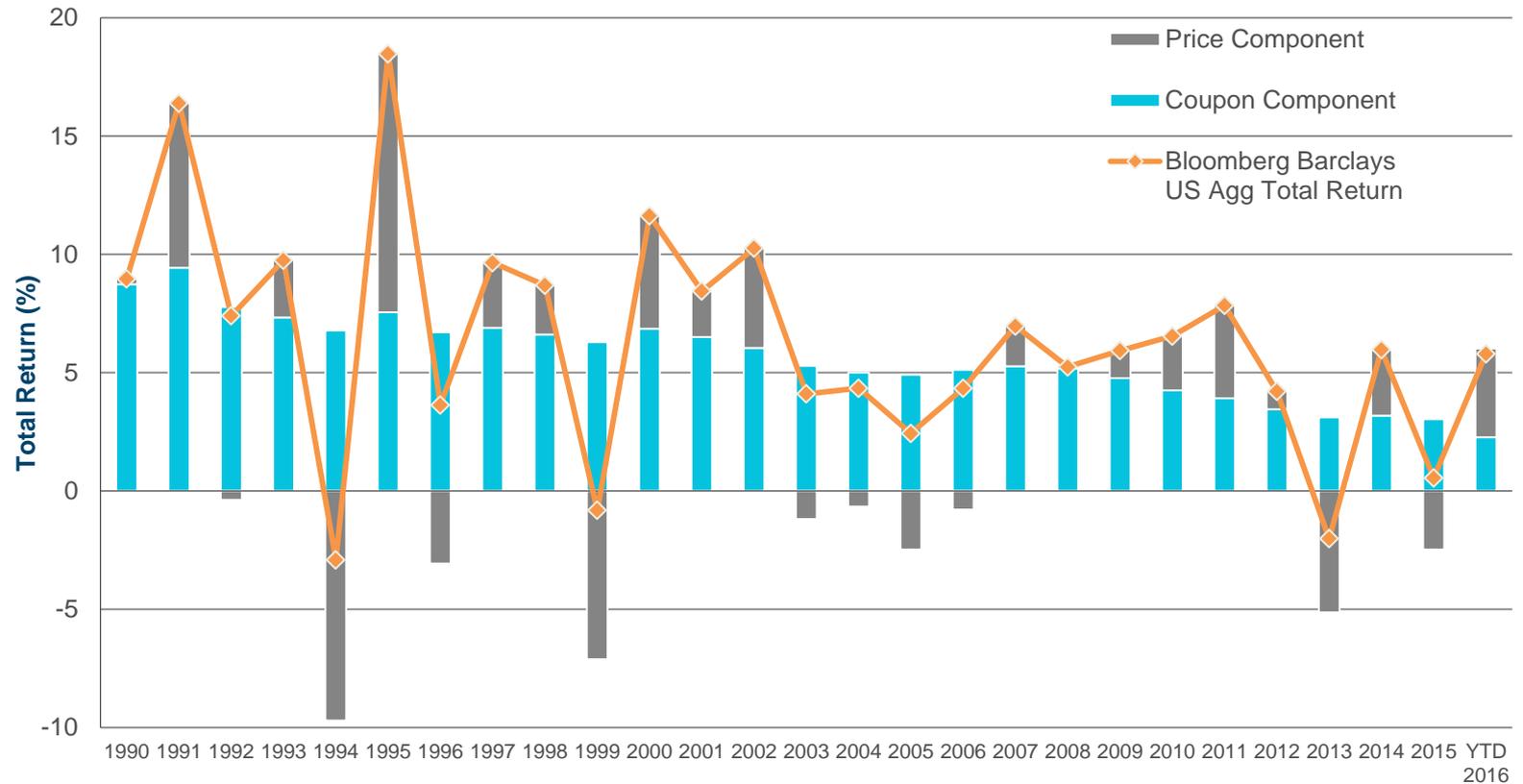
DIVERSIFICATION FROM EQUITIES

- Negative correlation with risk assets
- Provide a positive return to help offset equity market losses

Declining Yields Reduced the Traditional Fixed Income Benefits

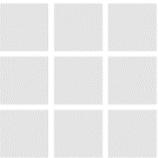
As of September 30, 2016

FALLING COUPONS LEAVE LESS OF A BUFFER TO ABSORB PRICE VOLATILITY



Source: Bloomberg Barclays.

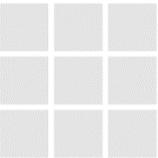
Past performance cannot guarantee future results.



What is the Risk of the Bloomberg Barclays U.S. Aggregate Bond Index?

As of September 30, 2016

- Yield-to-Maturity (YTM) is only 1.97%
- The interest rate duration (risk) of the Bloomberg Barclay's U.S. Aggregate Bond Index is 5.51 years
- Bond math: Interest rate increase of 1% \approx 5.5% price loss
- An interest rate increase of 0.36% \approx 1.98% loss, which offsets the YTM of 1.97%



What Are the Top 25 Public Plans Doing With Their Fixed Income Allocations?

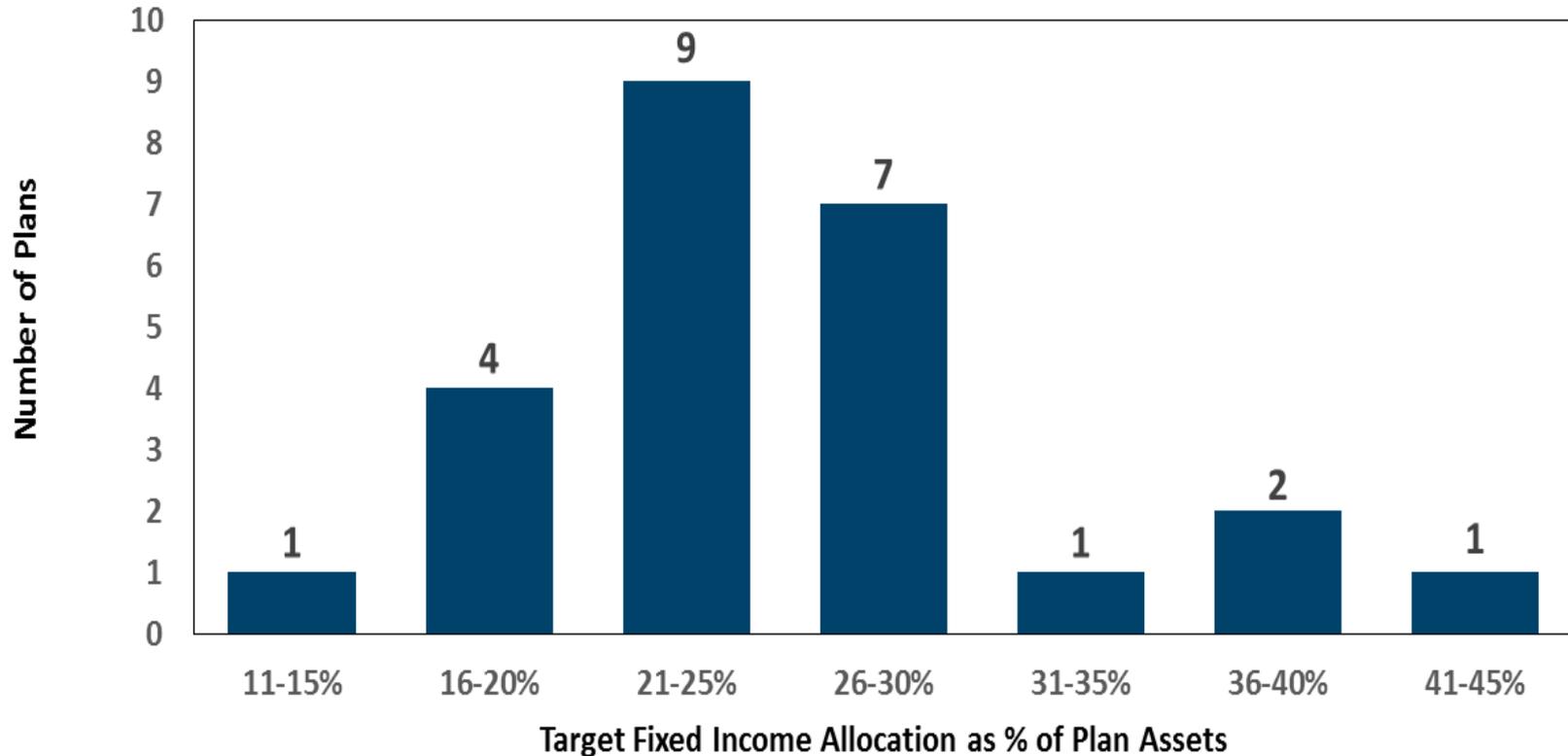
- We researched the 25 largest public US pension plans based on total defined benefit AUM as of 12/31/12
- We revisited the same 25 plans two years later to evaluate changes in fixed income allocations and strategies
- Target allocation, actual allocation and benchmarks are as of the dates used in their specific public filings at the time T. Rowe Price compiled this research

Majority Target Fixed Income Allocation of 21-30% of Plan Assets

As of June 30, 2015

Range of Target Fixed Income Allocation

25 largest US Public Defined Benefit Plans



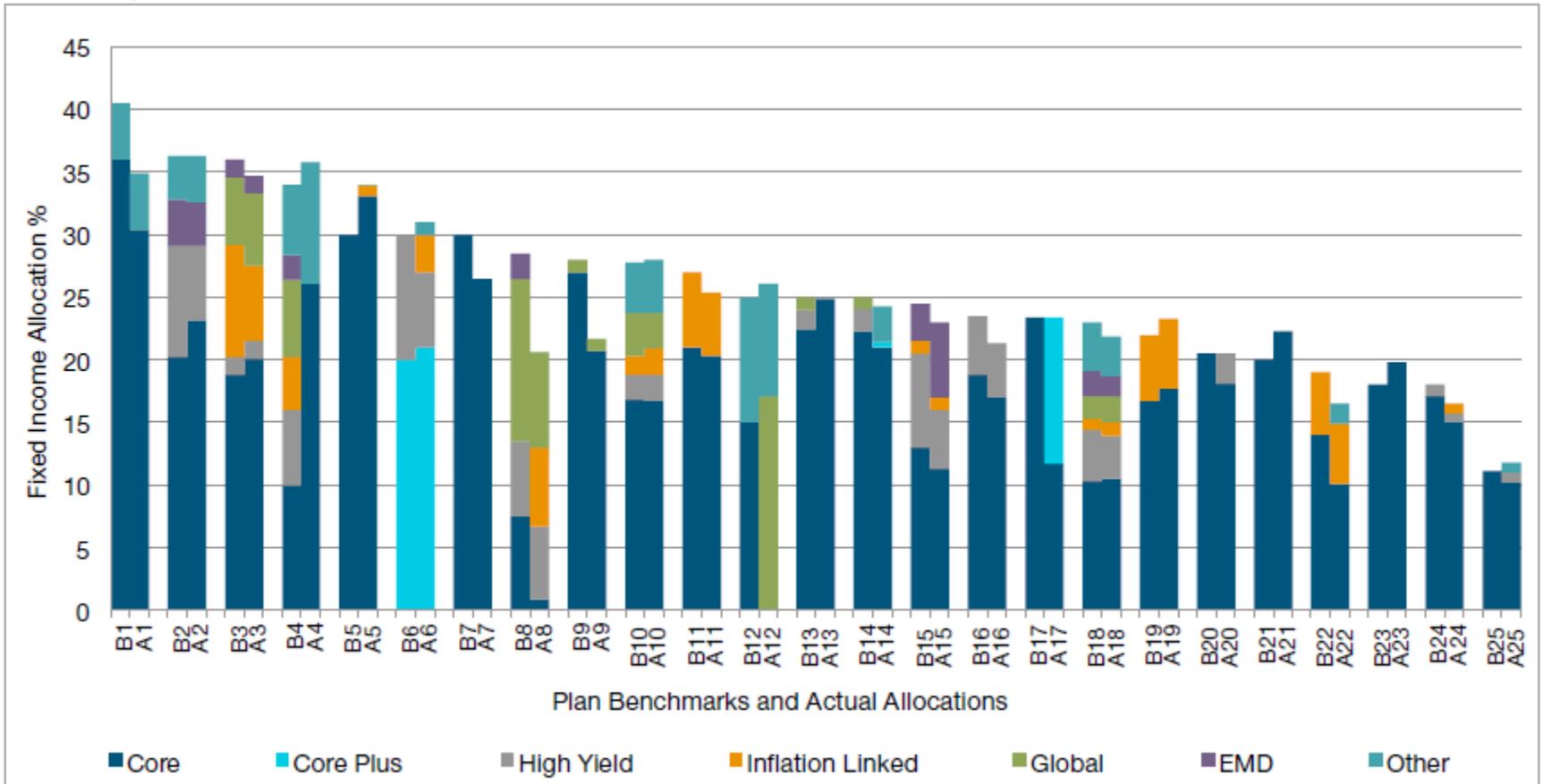
Source: Money Market Directory

Core Bonds Are Integral, But Many Diversify Into Plus, High Yield, Global, etc.

As of June 30, 2015

Strategy Composition of Fixed Income Benchmarks and Actual Allocations

25 largest Public Defined Benefit Plans, Data as of June 30, 2015



Core: components of Bloomberg Barclays U.S. Aggregate Bond Index, Cash, Stable Value, Diversified Fixed Income, Indexed; **Core Plus:** includes Core Plus Limited; **Inflation Linked:** includes TIPS, Global Active Inflation Linked; **High Yield:** includes Mezzanine Debt, Bank Loans

Source: Money Market Directory and Public Filings

Analysis: T. Rowe Price

Public Plans Have Diversified Allocations

As of June 30, 2015

BASED ON FIXED INCOME ASSETS UNDER MANAGEMENT (AUM)

Sector Allocation	12 Largest Plans	13 Smallest Plans
Core Only	25% (3)	15% (2)
Core and Inflation Linked	17% (2)	0% (0)
Core and High Yield	0% (0)	15% (2)
Core and Global	8% (1)	0% (0)
Core and Other	8% (1)	8% (1)
Global and Other	0% (0)	8% (1)
3 Sectors	17% (2)	23% (3)
4 or more Sectors	25% (3)	31% (4)

Source: Money Market Directory and Public Filings

Analysis: T. Rowe Price

Benchmark and Allocation Results

As of June 30, 2015

- Traditional benchmarks are still most common
 - U.S. Core is the predominant benchmark
 - 32% of the Top 25 plans include Global Fixed Income in their benchmarks
- A greater number of benchmarks are used by significantly more plans in 2015 than in 2013
- 36% of plans have out-of-benchmark allocations

	1 Benchmark	2 Benchmarks	3 Benchmarks	4+ Benchmarks	TOTAL
# of Plans (2013)	14	7	3	1	25
# of Plans (2015)	7	9	2	7	25

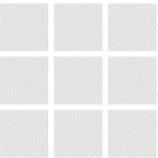
Source: Public Filings.
Analysis: T. Rowe Price.

Benchmark Sector Diversification Excluding Core and Core Plus

As of June 30, 2015

	Benchmark (2013)	Actual (2013)	Benchmark (2015)	Actual (2015)
High Yield	12	10	12	11
Inflation Linked	5	9	8	11
International	1	2	0	0
Global	7	1	8	7
EMD	2	6	6	4
Opportunistic	0	4	1	4
Distressed Debt	0	2	1	1
Hedge Funds	0	2	2	3
Real Return	0	2	2	2
Other – Other	1	1	0	0

Source: Public Filings.
Analysis: T. Rowe Price.



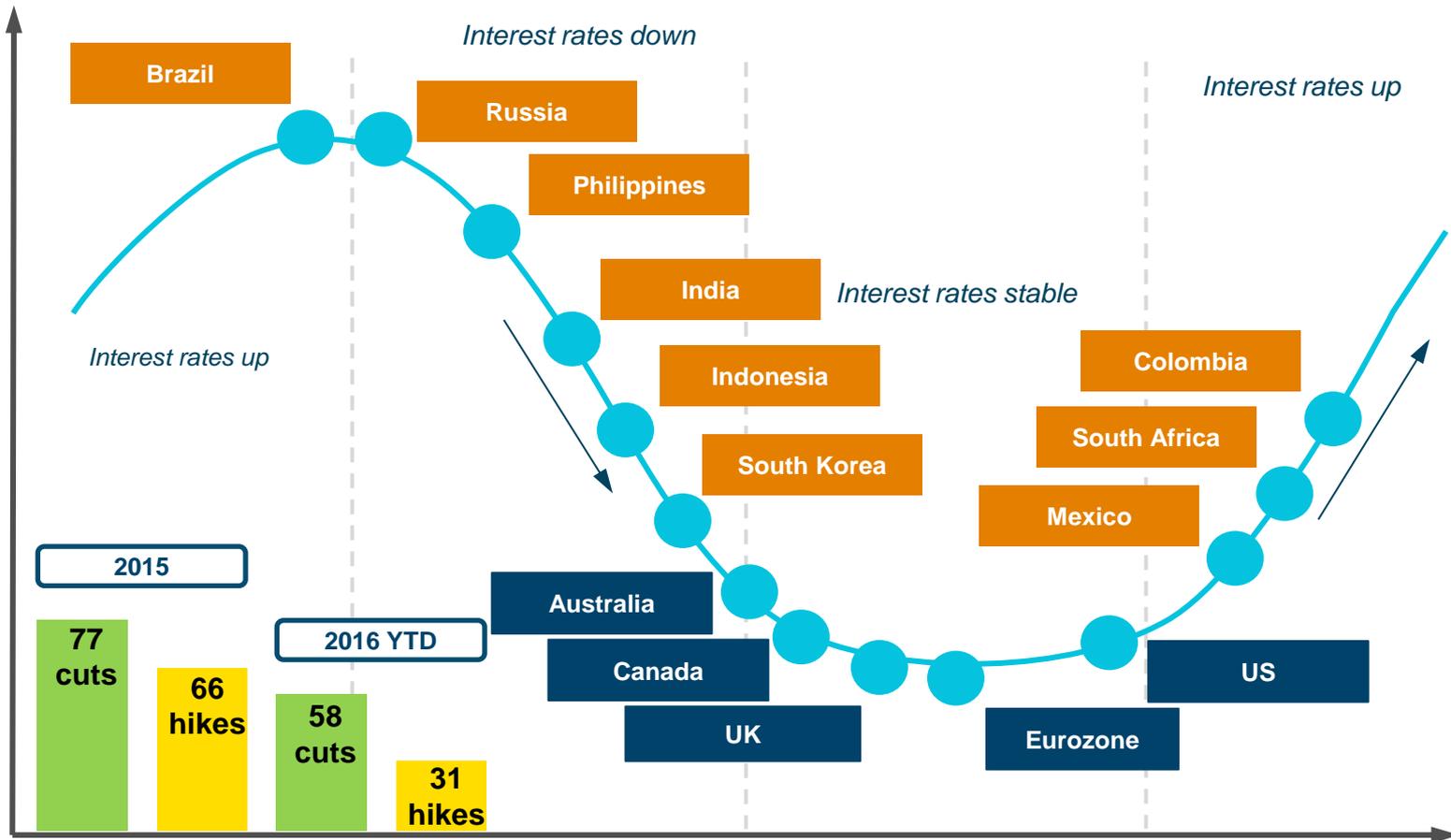
So What Now?

- The Bloomberg Barclay's U.S. Aggregate Bond Index has interest rate risk and a low yield
- Many of the largest public plans are moving away from this index. What are the pros and cons of seeking higher yields?
- Are there investment opportunities which are less affected by the U.S. interest rate cycle and which help your plan achieve its goals?

Divergence Between Countries Will Continue to Offer Opportunities

As of 31 August 2016

ILLUSTRATIVE INTEREST RATE CYCLE



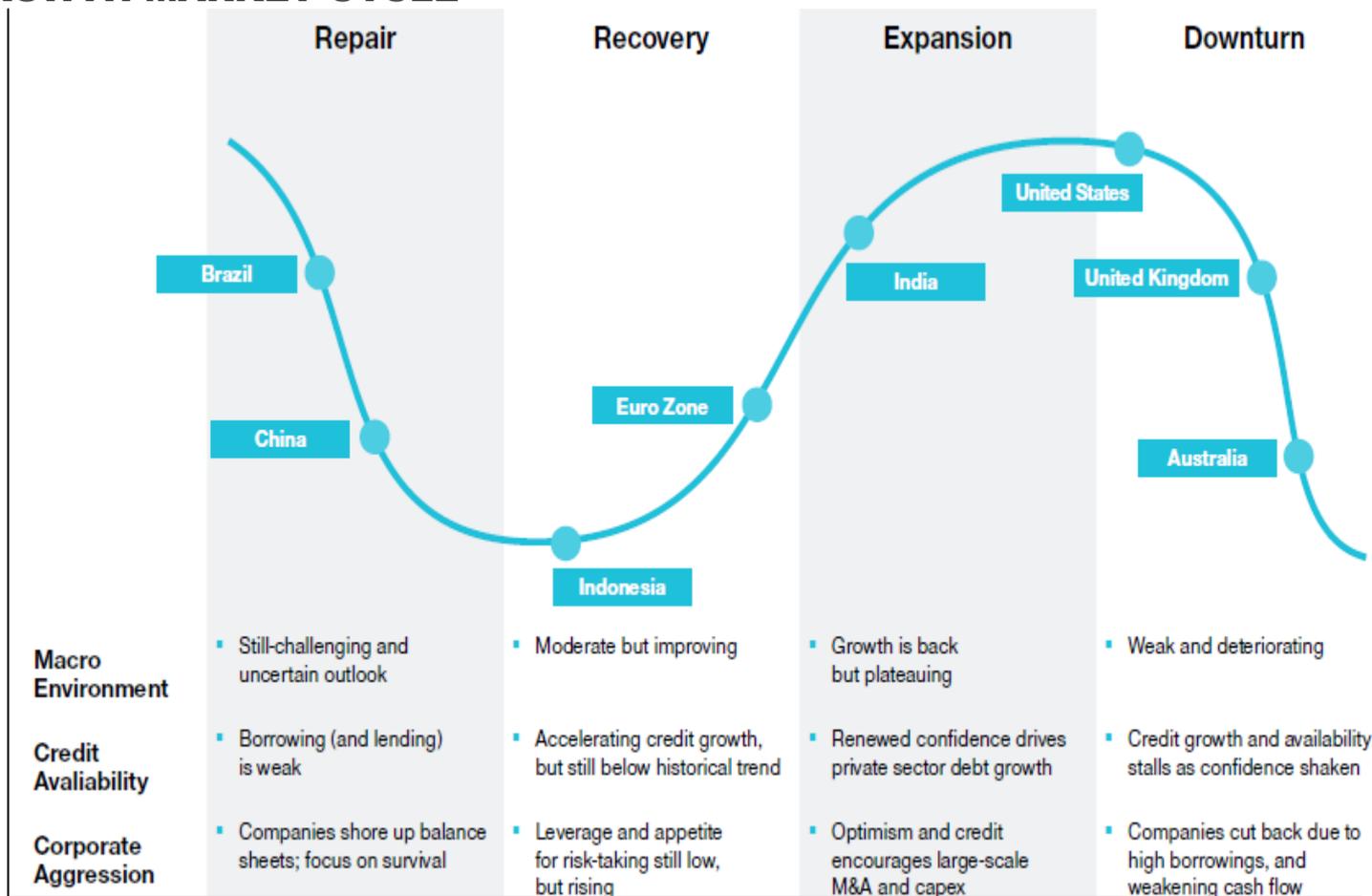
The 2 columns of cuts vs hikes are the actual cuts and hikes that have happened across countries worldwide.

Sources: Central Reserve Bank Rates and T. Rowe Price

Diverging Credit Cycles Also Create Opportunities

As of 31 August 2016

GROWTH MARKET CYCLE



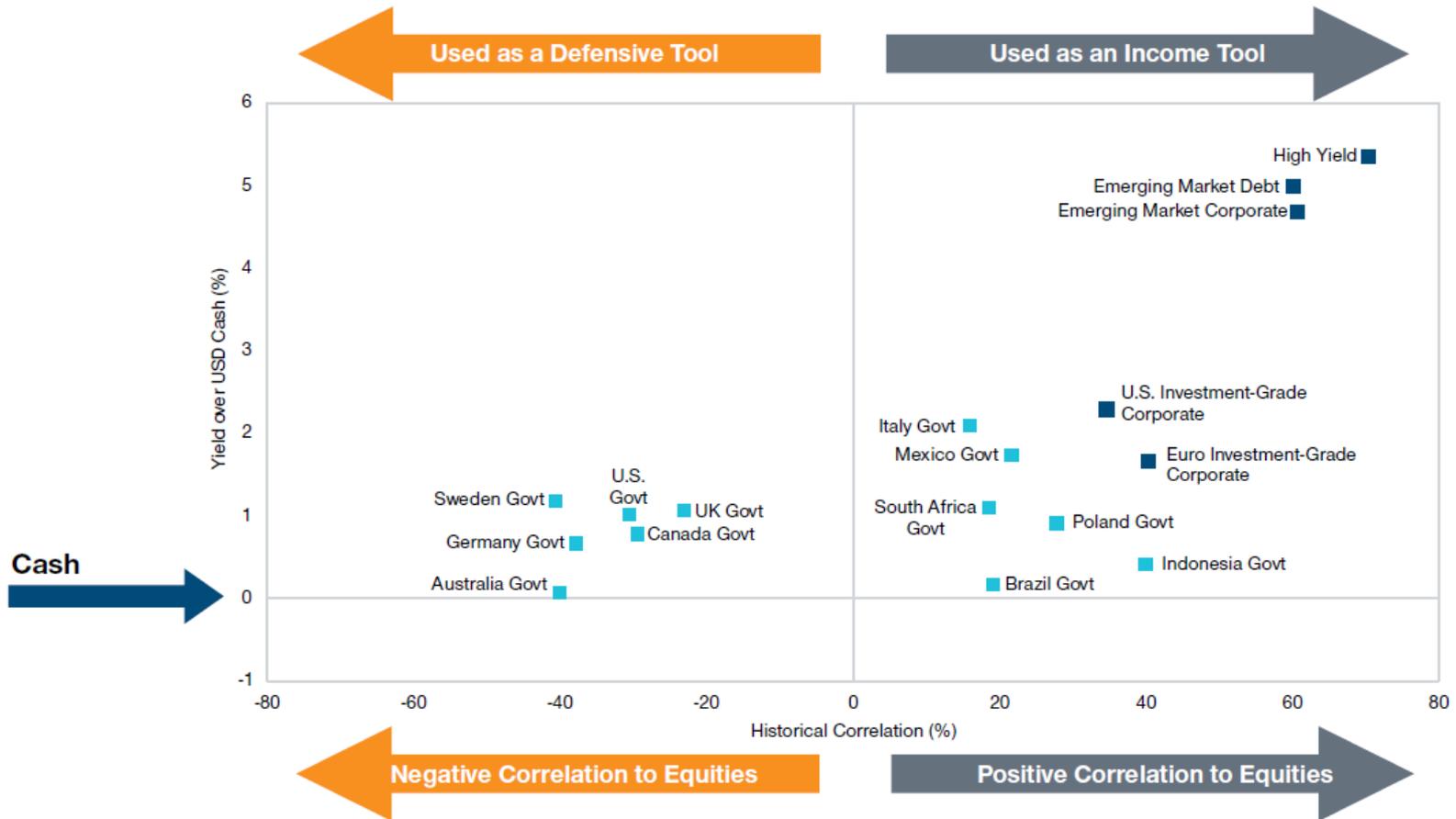
Source: T. Rowe Price

Past performance cannot guarantee future results.

How Does Fixed Income Behave During Times of Market Stress?

As of 30 June 2016

CURRENT YIELD ABOVE USD CASH VS. HISTORICAL CORRELATION
LAST 10 YEARS

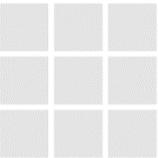


Past performance is not a reliable indicator of future performance..

Source: UBS, Bloomberg Barclays, J.P. Morgan, Bank of America/Merrill Lynch, S&P, MSCI, and T. Rowe Price.

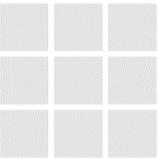
Representative benchmarks used for proxy performance: BofA Merrill Lynch US High Yield Index; J.P. Morgan EMBI Global Index; J.P. Morgan CEMBI Broad Index; Bloomberg Barclays US Credit Corp Index; Bloomberg Barclays Euro Credit Corp Index; various Gov't Bond Indices sourced from J.P. Morgan

Yield shown is on a hedged basis in U.S. Dollars. Volatility is based on the monthly returns of each asset class hedged into U.S. Dollars.



How to Think About Potential Solutions

- The U.S. Aggregate has interest rate risk and a low yield
- Developing a bond portfolio allocation based upon the role of fixed income in your overall portfolio is important
- The use of additional sectors and global countries and companies may diversify risk to the U.S. interest rate cycle
- Model various fixed income allocations to meet the objectives of your policy portfolio and enhance a Core allocation



Case Study 1 – Custom International Multi-Sector Bond Strategies

As of November 30, 2014

- Client sought to diversify existing U.S. – centric fixed income allocation (core, core plus, high yield) with an opportunistic allocation to non-U.S. global fixed income markets
- T. Rowe Price proposed three sample portfolios with varying risk profiles to highlight risk/return trade-offs to help determine best fit within existing fixed income allocation

Case Study 1 – Custom International Multi-Sector Bond Strategies

As of November 30, 2014

Custom International Multi-Sector Bond Strategies			
	Lower Risk	Moderate Risk	Higher Risk
Benchmark	Barclays US Aggregate Bond Index		
Opportunity Set	Non-U.S. global fixed income universe		
Target performance over benchmark	150 – 250 bps over benchmark	200 – 300 bps over benchmark	225 – 325 bps over benchmark
Target ex-post tracking error vs. benchmark	225 – 375 bps	300 – 450 bps	350 – 500 bps
Characteristics	<ul style="list-style-type: none"> ▪ Broad latitude across country and sector positioning ▪ High conviction security selection approach, utilizing global research platform ▪ Access currencies as potential source of added value 		

The information provided above reflects data for a hypothetical Custom Strategy as of 30 November 2014 and reflected T. Rowe Price's current thinking at that time for the characteristics of an International Multi-Sector Bond strategy, which was not based on any actual managed account. This information is not static and will vary over time and may differ from the characteristics of a managed account based on an account's investment objectives and securities holdings.

Case Study 1 – Custom International Multi-Sector Bond Strategies

As of November 30, 2014

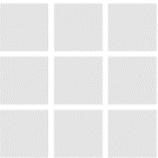
PROPOSED CUSTOMIZED GLOBAL MULTI-SECTOR BOND STRATEGY: MODERATE RISK

		Target Market Weight %	Average Moody's Rating	OAS	OAD	Yield-to-Worst
Liquidity	Global Sovereign Ex-U.S. (USD Hedged)	20	Aa3	39	4.48	1.89
	Global Securitized Ex-U.S. (USD Hedged)	5	Aa2	42	4.78	0.68
High Grade Credit	Global Corporate Ex-U.S. (USD Hedged)	15	Baa2	206	4.82	2.37
Return Seeking	Emerging Markets Corporate (\$)	15	Ba2	457	5.64	6.46
	Emerging Markets Sovereign (\$)	16	Ba2	472	6.91	6.84
	Emerging Markets Local (USD Hedged)	20	Baa2	116	5.18	2.85
	European High Yield (USD Hedged)	9	B2	415	4.79	6.04
	TOTAL	100	Baa2	245	5.28	3.94

Numbers may not total due to rounding.

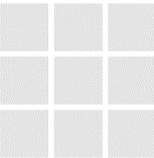
Sources: Bloomberg Barclays and T. Rowe Price.

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Case Study 2 – Custom Opportunistic Credit Strategy

- Client sought to diversify existing 100% U.S. Core Investment Grade fixed income allocation with an opportunistic credit allocation to high yield bonds, bank loans and emerging market bonds
- T. Rowe Price proposed sector and geographic diversification to mitigate concentration risk and a design to allow flexibility across sector, quality, duration and country exposure



Case Study 2 – Custom Opportunistic Credit Strategy

As of February 29, 2016

PROPOSED GUIDELINES EXAMPLE

Active Management Premium (Per Annum)	100 – 150 bps
Target Tracking Error	100 – 300 bps
Currency	Up to 10% Unhedged
Duration	Typically +/- 2 years of Custom Benchmark
Leverage	Not Permitted
Derivatives	Permitted for the purpose of risk management, curve and currency positioning
Minimum Quality	Customized to Client target

PROPOSED CUSTOM BENCHMARK

Index	Weight %
Barclays U.S. High Yield	33.3
LSTA S&P 100 Loans	33.3
J.P. Morgan Emerging Markets Bond Index Global Diversified	33.3

The information provided above reflects data for a hypothetical Custom Strategy as of 29 February 2016 and reflected T. Rowe Price's current thinking at that time for the characteristics of an Opportunistic Credit strategy, which was not based on any actual managed account. This information is not static and will vary over time and may differ from the characteristics of a managed account based on an account's investment objectives and securities holdings.

Case Study 2 – Custom Opportunistic Credit Strategy

As of February 29, 2016

Proposed Customized Opportunistic Credit Strategy

		Range %	Rating	Tactical Weights %	OAD	OAS	Yield-to-Worst
Global High Yield	U.S. High Yield	0-40	B2/B3	24	4.13	630	7.83
	Euro High Yield	0-20	B2/B3	8	3.11	708	7.57
	Convertibles	0-20	A2/A3	2	1.19	375	5.25
Bank Loans	Leveraged Loans	0-30	B1/B2	25	0.08	460	5.31
Emerging Markets	Emerging Local Bonds	0-20	Baa2/Baa3	5	4.96	418	2.75
	Emerging USD Sovereign	0-30	Ba1/Ba2	7	5.45	513	6.70
	Emerging USD Corporate	0-30	Ba2/Ba3	22	6.58	606	8.05
Other	Global Sovereigns	0-50	A1/A2	3	8.91	98	2.31
	RMBS	0-20	Ba2/Ba3	2	0.97	279	3.47
	CMBS	0-20	Ba1/Ba2	2	3.54	401	5.03
	Liquid Investment Grade	0-50		0			
	Total		Ba3	100	3.72	537	6.53

Numbers may not add due to rounding

Source: Bloomberg Barclays and T. Rowe Price.

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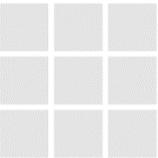
Historical Diversification Benefits During Periods of Rising Treasury Yields

TIME PERIODS WHEN TREASURY YIELDS ROSE 100 BPS+

		Total Return (One Year)
12-Months Ended	10 Year Treasury Yield Move (bps)	
Dec 31, 1999	+179	
May 31, 2004	+130	
Jun 30, 2006	+120	
Dec 31, 2009	+162	
Sep 30, 2013	+140	

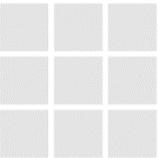
Sources: J.P. Morgan Chase & Co., Bloomberg Barclays, and S&P/LSTA.

Past performance cannot guarantee future results.



Rethinking Fixed Income

- Given historically low yields and greater interest rate risk in the U.S., many pension plans have expanded their investment set beyond the U.S. and across the capital structure
- Develop a bond portfolio allocation based upon the role of fixed income in your overall portfolio
- Model various fixed income allocations to meet the objectives of your policy portfolio and ultimately your plan beneficiaries



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2016-US-27526