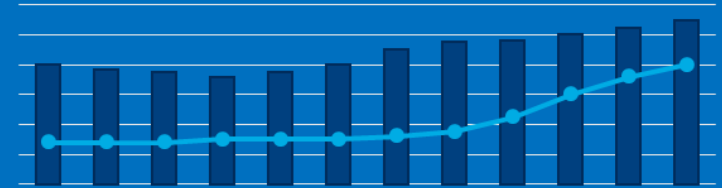


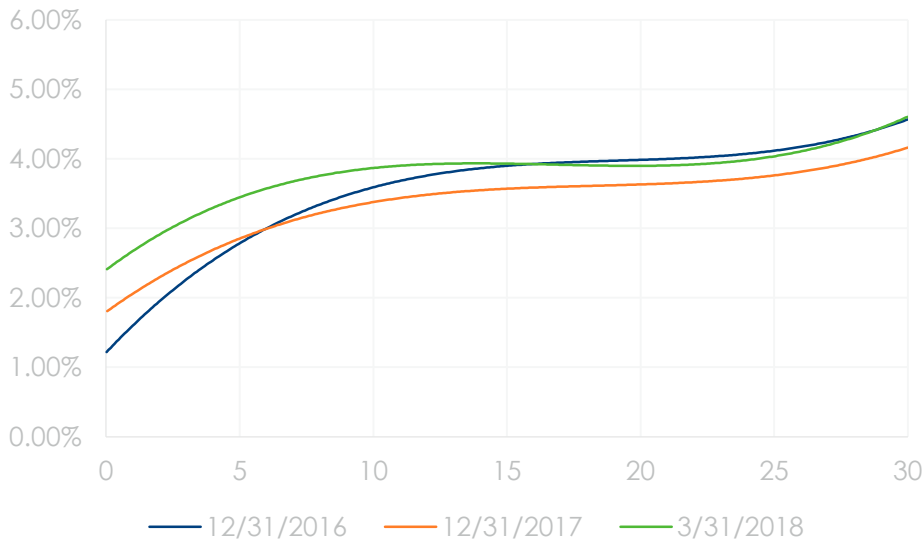
# MassMutual's defined benefit market update and commentary

March 31, 2018



## Market at a glance:

Fed has increased its interest rates again. Short term rates have risen in faster pace than the long term rates; essentially flattening the yield curve.



- Pension plans with equity centric investment allocation have seen great return in 2017. Many of these Plan Sponsors are looking to lock in this great return by moving more into liability driven investing with more fixed income allocations.
- With improvements in the funded status due to asset return in 2017, many Plan Sponsors are again revisiting their options around de-risking opportunities to reduce funded status volatility, PBGC premiums, and overall pension footprint.
- Recent stock market volatility is adding uncertainty in pension plan's funded status.
- As of March 31, 2018, S&P 500 fell 3.4% from its 12/31/2017 level. It fell 10% from its peak on January 26, 2018 during this quarter.

*Overall funded status of the pension plans should have improved, in general, due to favorable movements in discount rates during the quarter.*

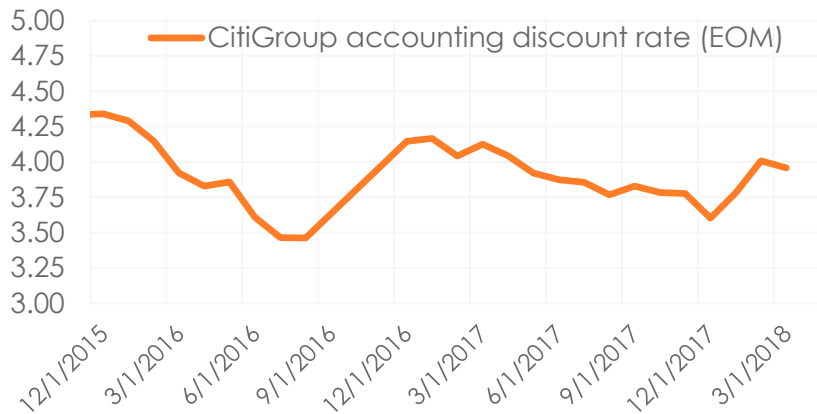
# Projected discount rates – US GAAP purposes

## Accounting Liability Discount Rates

Pension liabilities as defined for US accounting purposes are typically measured using discount rates. These discount rates are based on yields on high quality corporate bonds as of the measurement date.

MassMutual has developed its own custom yield curve using high quality corporate bonds. Many plan sponsors are still using readily available CitiGroup discount rate. We have quantified the movement in discount rates using both MassMutual Yield Curve as well as CitiGroup Curve for three

### Yield curve trends



sample plans by matching their cash flows with the yields from those curves. The table below provides the tracking of rate movements for month-to-month basis as well as year-to-date comparison.

The pension economics dictates that the lower the discount rate, the higher the liability. You can have a general idea of the movement in the interest rates from the table below:

### Market commentary:

- Discount rates for pension purposes went up from 12/31/2017
- Short and medium term rates have increased, but long term rates didn't increase that much
- MM yield curve is one option that Plan Sponsors may consider as an alternative yield curve method
- Adoption of Spot Rate method may help managing pension expense

CitiGroup yield curve

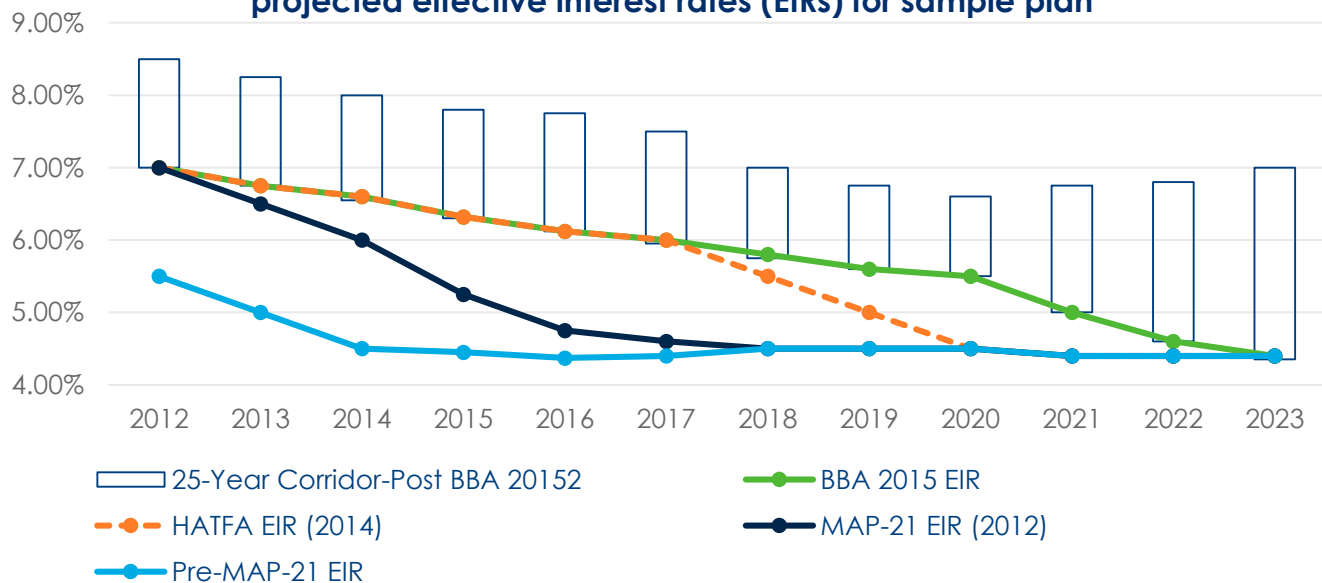
MassMutual yield curve

Sample plan	Duration	Last quarter	Previous quarter	Prior year end	12 Months ago	Last quarter	Previous quarter
Frozen	12.9	3.84%	3.45%	3.45%	3.89%	4.06%	3.81%
Closed	15.2	3.89%	3.52%	3.52%	3.98%	4.11%	3.92%
Active	16.9	3.92%	3.56%	3.56%	3.96%	4.14%	4.01%

# Projected discount rates – ERISA funding purposes

Funding interest rates are historically tracked and projected forward reflecting the PPA funding rates, MAP-21, HATFA and BBA rates from 2012 and projected till 2023 assuming the underlying rate for the current month remains constant into the future for the sample pension plan.

**BBA 2015 interest rate and projected effective interest rates (EIRs) for sample plan**



## IRS valuation interest rate stabilization

- In general, pension funding rules require smoothing of interest rates (over 24 months), compared to spot rates used for accounting
- MAP-21, signed into law in 2012, added further smoothing by requiring 24-month average rates to be within corridors around the 25-year average of segment rates
- HATFA, signed into law in 2014, further extends corridors beginning in 2014
- BBA, signed into law in 2015, further extends corridors beginning in 2018
- As a result, there are significant differences between IRS funding and GAAP ASC 715 plan funded status

- The funding relief is going to expire in 2022 unless the Congress acts otherwise
- The funding relief artificially reduces the liability to enable IRS giving less tax credit to plan sponsors
- 2023 and onward the funding liability will “balloon” up in absence of any further relief
- Plan sponsors need to plan for integrated funding, contribution and investment strategies

# Investment returns – 3/31/18

## Asset market returns

In this report, we are using a few popular asset allocation strategies we commonly see in our defined benefit market space and compare their returns in three asset return columns. This will help you having a general idea about where your asset performance is heading to and give you a rough idea of your funded status in conjunction with the interest rates movement we are showing in the next section.

Index performance				Pension plan returns			
	Last Quarter	Previous quarter	Year to Date	Generalized portfolio	Last quarter	Previous quarter	Year to date
<b>Equity</b>				<b>60% Equity / 40% fixed income</b>			
S&P 500 (U.S. Large Cap)	-0.76%	6.64%	-0.76%	Traditional focus	-1.01%	3.57%	-1.01%
Russell Mid Cap (U.S. Mid Cap)	-0.46%	6.07%	-0.46%	Liability Driven Investing (LDI) focus	-1.69%	4.34%	-1.69%
Russell 2000 (U.S. Small Cap)	-0.08%	3.34%	-0.08%				
MSCI - ACWI, Ex. US (International)	-1.18%	5.00%	-1.18%	<b>50% Equity / 50% fixed income</b>			
				Traditional	-1.07%	3.02%	-1.07%
				Liability Driven Investing (LDI) focus	-1.92%	4.00%	-1.92%
<b>Fixed income</b>				<b>40% Equity / 60% fixed income</b>			
BBbBarc US Govt/Credit 1-5 Year	-0.50%	-0.30%	-0.50%	Traditional	-1.10%	2.46%	-1.10%
BBgBarc US Aggregate Bond	-1.46%	0.39%	-1.46%	Liability Driven Investing (LDI) focus	-2.14%	3.64%	-2.14%
BBgBarc US Long Credit Index	-3.83%	3.18%	-3.83%				
BBgBarc US Government Long	-3.22%	2.34%	-3.22%	<b>0% Equity / 100% fixed income – LDI</b>			
				12 duration	-3.01%	2.23%	-3.01%

Source: Morningstar

## Movement in funded status during the quarter

Sample plan	Duration	MassMutual discount rate last quarter	MassMutual discount rate Previous quarter	60:40 Asset return last quarter	60:40 Asset return previous quarter	Liability growth quarter to quarter	Asset growth quarter to quarter	Change in funded status (Asset-Liab.)
Frozen plan 100% funded	13.6	4.06%	3.81%	-1.01%	3.57%	-3.40%	-1.01%	2.39%
Closed plan 100% funded	16.0	4.11%	3.92%	-1.01%	3.57%	-3.04%	-1.01%	2.03%

# Definitions

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## Mock portfolios

\*60/40 reflects a diversified allocation of 60% Equity (28% Large Cap, 7% Mid, 5% Small, 20% Int.) and 40% Fixed (6% Short Term Bond, 34% Aggregate).

\*60/40 LDI reflects a diversified allocation of 60% Equity (28% Large Cap, 7% Mid, 5% Small, 20% Int.) and 40% Fixed (2% Short Term Bond, 10% Aggregate, 24% Long Duration bond, 4% Extended Duration bond). Target Duration is 12.

\*50/50 reflects a diversified allocation of 50% Equity (24% Large Cap, 5% Mid, 4% Small, 17% Int.) and 50% Fixed (7.5% Short Term Bond, 42.5% Aggregate).

\*50/50 LDI reflects a diversified allocation of 50% Equity (24% Large Cap, 5% Mid, 4% Small, 17% Int.) and 50% Fixed (2.5% Short Term Bond, 12.5% Aggregate, 30% Long Duration bond, 5% Extended Duration bond). Target Duration is 12.

\*40/60 reflects a diversified allocation of 40% Equity (19% Large Cap, 4% Mid, 3% Small, 14% Int.) and 60% Fixed (11% Short Term Bond, 49% Aggregate).

\*40/60 LDI reflects a diversified allocation of 40% Equity (19% Large Cap, 4% Mid, 3% Small, 14% Int.) and 60% Fixed (3% Short Term Bond, 15% Aggregate, 36% Long Duration bond, 6% Extended Duration bond). Target Duration is 12.

\*100% Fixed Income LDI is a portfolio spread across various duration segments with a target of 12 duration (5% Short Term Bond, 25% Aggregate, 60% Long Duration bond, 10% Extended Duration bond).

\* The MassMutual yield curve help plan sponsors determine an appropriate discount rate to measure liabilities for their pension and other post-retirement benefit obligations. MassMutual's curve, which meets the pension and post-retirement benefit obligation requirements set by the Financial Accounting Standards Board (FASB) and the Securities and Exchange Commission (SEC), offers plan sponsors and their auditors an alternative solution with greater transparency than similarly available benchmarks in the market.

# About this report

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As a defined benefit plan sponsor, movements in the interest rate, regulatory changes in the pension space, and the general asset market performance have a deep impact on the risk and performance of your pension plan. Many plan sponsors, particularly those having deep interest in the balance sheet and profit/loss numbers (ie. CFO, controllers, and treasurers of the company, etc.), may want to keep track of funded status of the pension plan. In particular, any upcoming contribution requirement, as well as the risk and volatility of the pension plan in general may be of great interest to you.

With a constantly changing market, this tracking report may help you to have an integrated investment and actuarial policy around your plan. Using this quarterly market overview, you may want to:

- Have an idea around most recent market return, recent trends in the market and interest rates, impact on pension funding rates and accounting discount rates.
- Understand the potential impact of the economic environment on your DB plan in relation to the particular status of your pension plan (active, closed, or frozen pension

plan) and the underlying volatility impact on your current asset allocation due to interest rate movement.

- Review your plan's current asset allocation in collaboration with your actuary and investment consultant to reduce volatility in your plan's funded levels.
- Recent movements in the pension accounting discount curve for both MassMutual's own custom yield curve as well as the CitiGroup curve for sample pension plans.
- Interest rate trends in IRS prescribed interest rates for funding purposes under few regulatory changes and its upcoming impact on your pension plan.

Even without a forecast table particularly customized around your plan, you'll find this pension market monitor useful to estimate the impact of economic changes on your plan.

Our actuaries and investment professionals at MassMutual keep an eye on all these aspects in the market related to defined benefit pension plans. This commentary is one of those attempts to spread awareness of our effort in the market.

MassMutual Defined Benefit Market Update and Commentary is designed to support our clients and prospects in the ongoing financial management of their U.S. defined benefit plans. If you have any questions or comments about this report, please contact Sumit Kundu, ASA, EA, CFA at [skundu@massmutual.com](mailto:skundu@massmutual.com) or Kenneth Stapleton [KStapleton09@MassMutual.com](mailto:KStapleton09@MassMutual.com).

# Significant Defined Benefit experience and expertise



## MassMutual commitment

- Core business for 70+ years
- 2,600 Defined Benefit plans serviced
- 200+ dedicated employees

## Flexible service models

- Bundled: integrated investments, actuarial, administration, communications, record-keeping and administration
- Semi-Bundled: investments, administration and communications working with outside actuary
- Core: Investment management and retiree services

## Other Services

- Pension Risk Transfer/Buy-out: full administrative services and guaranteed payments
- Total Retirement Approach: fully integrated Defined Benefit and Defined Contribution Programs

# How can MassMutual help you?

## Partner with a proven leader

We have built our reputation serving institutional retirement plans by earning our clients' trust and delivering long-term, customized defined benefit solutions to meet their unique financial needs.

Experience our consultative, client-focused approach to creating innovative, tailored solutions to help drive better outcomes for defined benefit plans.

MassMutual's financial strength ratings<sup>1</sup> are among the highest of any company in the industry.

- Meeting promises for over 160 years
- Leading asset management capabilities
- Diversified but focused business strategy
- Fortune 100 company<sup>2</sup>

**BARINGS**

**MassMutual Funds**



<b>A.M. BEST</b>	A + + (Superior, top category of 15)
<b>FITCH RATINGS</b>	A A + (Very Strong, second category of 21)
<b>MOODY'S INVESTORS SERVICE</b>	A a 2 (Excellent; third category of 21)
<b>STANDARD &amp; POOR'S</b>	A A + (Very Strong, second category of 21)

<sup>1</sup> Financial strength ratings are as of February 1, 2018. Ratings are for MassMutual (Springfield, MA 01111) and its subsidiaries, C.M. Life Insurance Co. and MML Bay State Life Insurance Co. (Enfield, CT 06082). Ratings are subject to change.

<sup>2</sup> Fortune Magazine: June 2017



