



Mark to Market

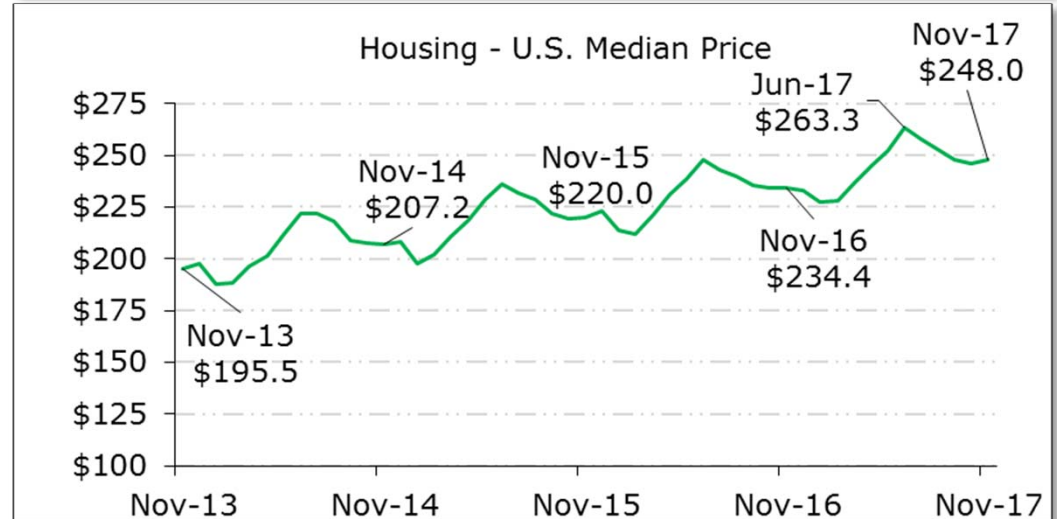
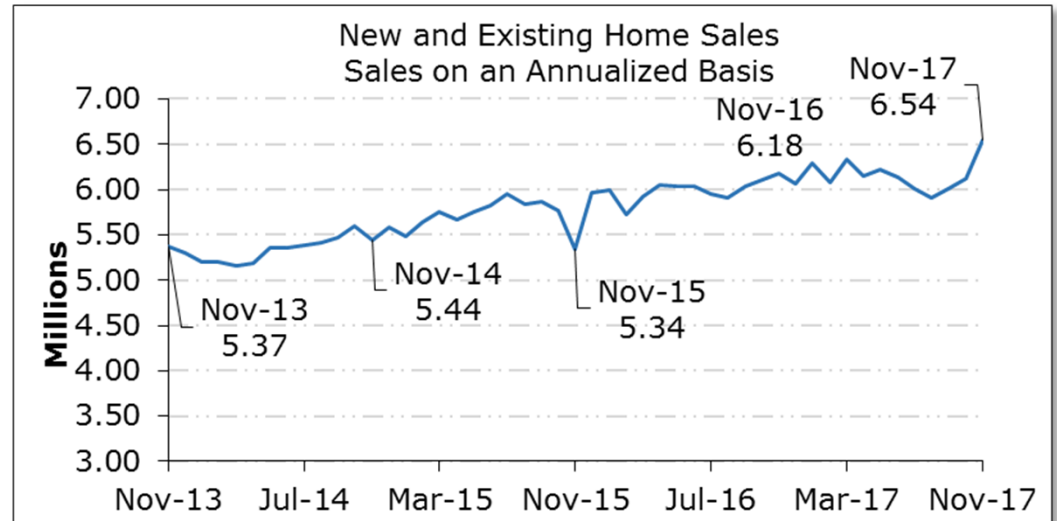
The Impact of Interest Rate Changes on Portfolio Market Value

John F. Grady III
Managing Director
February 2, 2018

Housing Market

- 30 year mortgage rates declined during the third quarter and remained at these low levels in the fourth quarter providing continued support for strong housing sales.

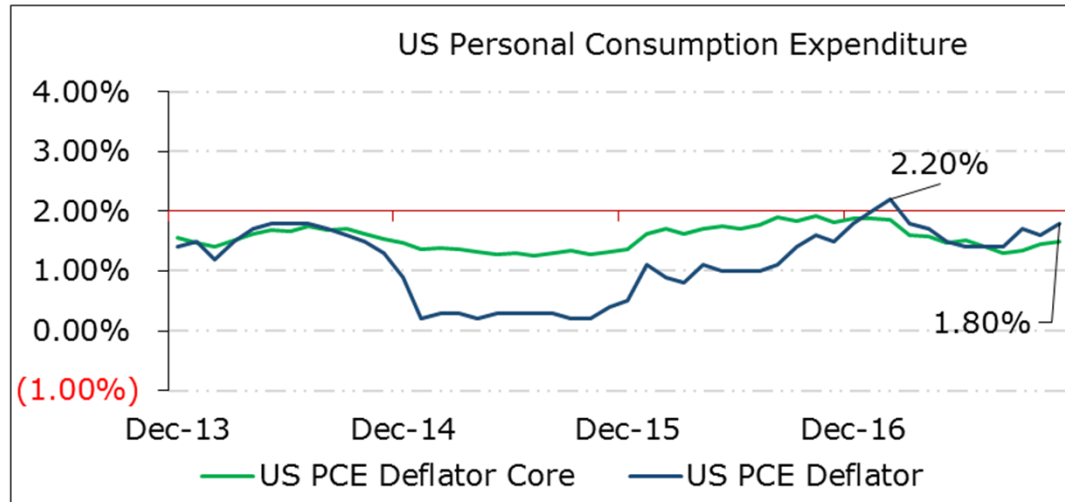
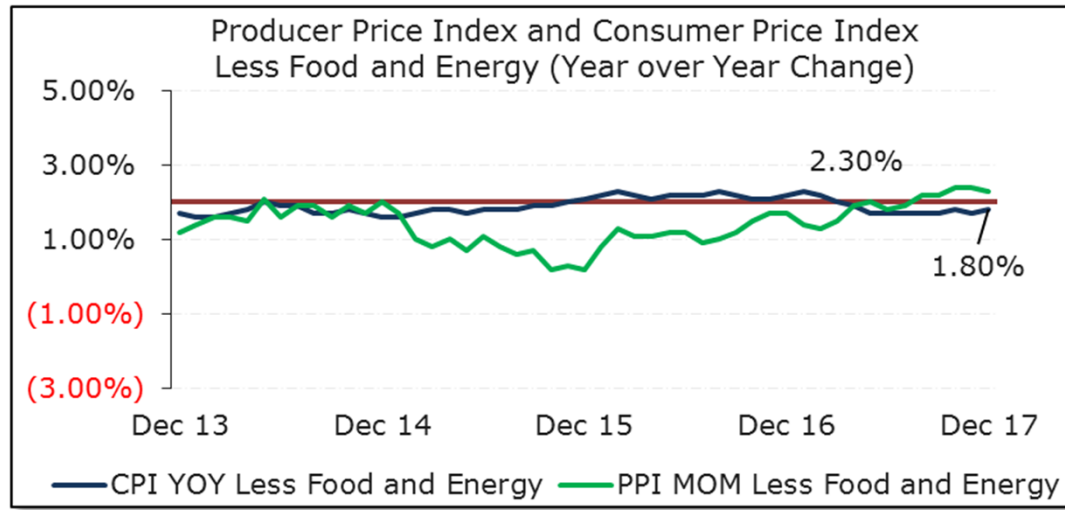
- Housing prices have declined from the summer peak, although this is a normal for the fall and winter months, while higher prices continue over the longer trend.



Source: Bloomberg

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Inflation Indicators

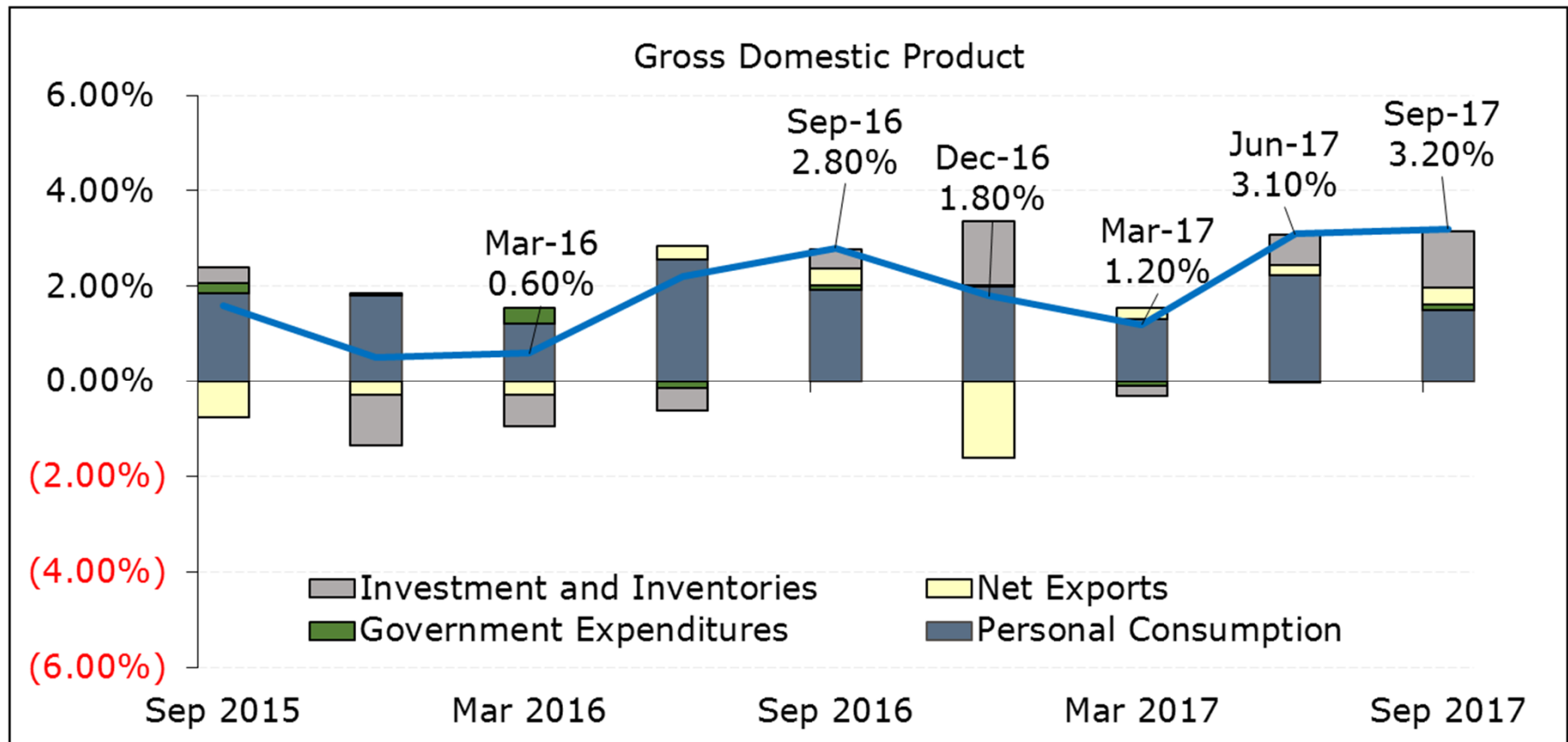


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Economic Growth and Inflation

- Third quarter GDP growth was the strongest in 3 years, and provided a 2nd consecutive quarter of +3% growth driven primarily by consumer spending and investment and inventories.



Source: Bloomberg

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Yield Curve Theory

Spot Rates

- ☰ Spot rates are the discount rates associated with a future payment (called the arbitrage free rate).
 - ☰ The arbitrage free valuation states that the total present value of each coupon cash flow and maturity cash flow should equal the Treasury bond itself otherwise there is an arbitrage opportunity to buy the pieces and package or buy the bond and break apart.

☰ Example 2 Year Security

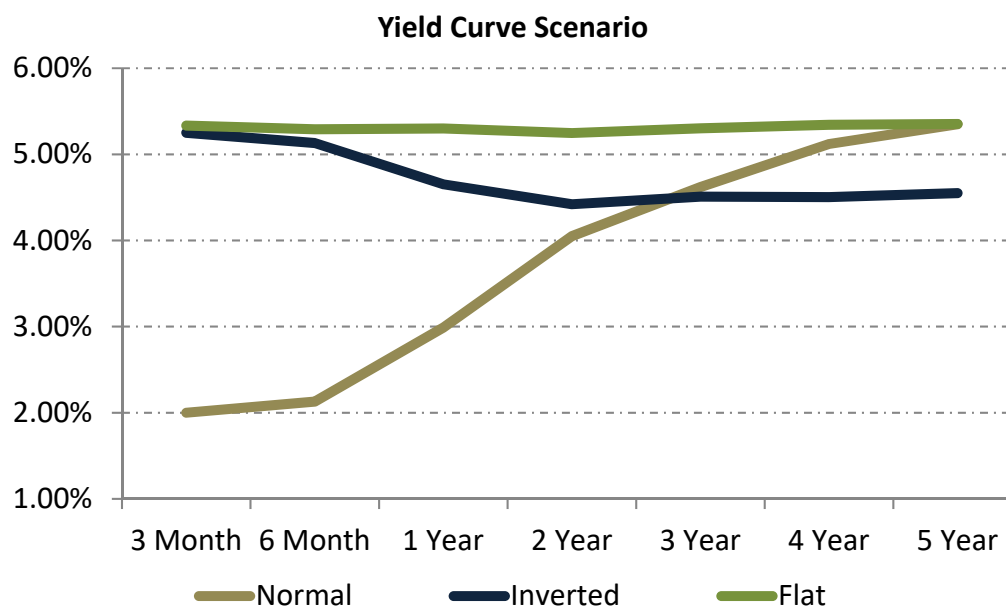
- ☰ Price \$1000
- ☰ 3% Coupon

$$PV = \frac{\text{Coup}}{(1+R1/2)^N} + \frac{\text{Coup}}{(1+R2/2)^N} + \frac{\text{Coup}}{(1+R3/2)^N} + \frac{\text{Coup+Mat}}{(1+R4/2)^N}$$

Two Year Bond Spot Rate Analysis				
Coupon	3%			
Par 1000	1,000.00			
	6 Months	1 Year	1.5 Years	2 Years
Period	1	2	3	4
Spot Rate	0.50%	1.00%	1.50%	2.00%
Cash Flow	\$15.00	\$15.00	\$15.00	\$1,015.00
Discount Factor	100.3%	101.0%	102.3%	108.2%
PV of Cash Flows	\$14.96	\$14.85	\$14.67	\$937.70
				\$982.18

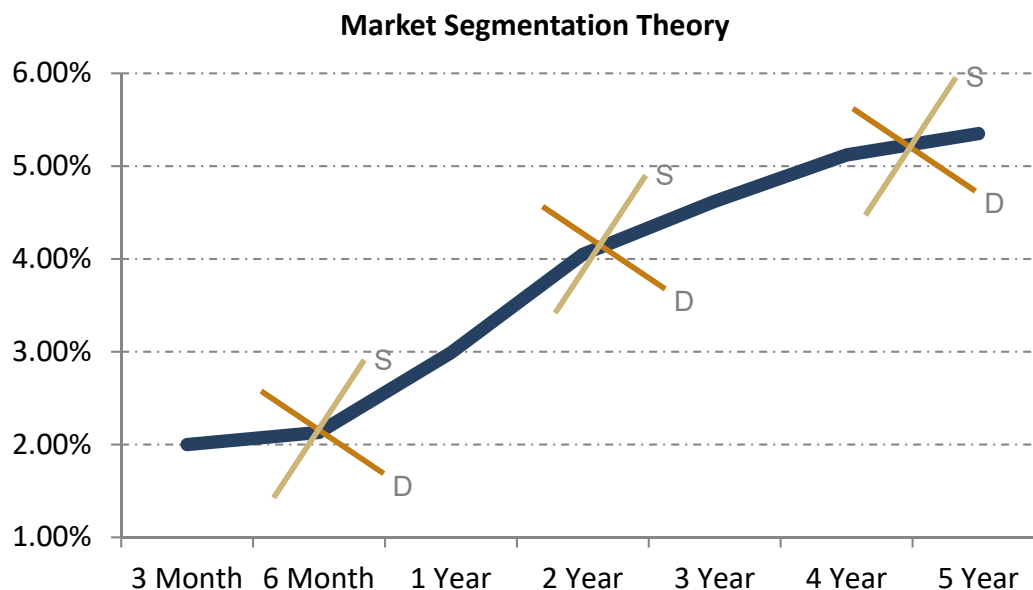
Pure Expectations Theory

- ☰ The theory explains the yield curve in terms of expected short-term rates.
 - ☰ It is an average of the expected short term rates in the future.
 - ☰ The shape of the yield curve with this theory is based short term rate expectations of higher (normal), same (flat), lower (inverted) rates in the future
 - ☰ A weakness is that this theory assumes investors have no preference when it comes to different maturities and the risks associated with them.



Market Segmentation Theory

- ❏ The theory states that investors and borrowers have specific preferences for the issuance and purchase of bonds in various maturity ranges.
 - ❏ Certain issuers have a short term need for debt (bank CP), and certain investors have a preference for longer term debt (pension funds).
 - ❏ Equilibrium rates (yields) are determined by supply and demand within each maturity range.



Fixed Income Investment Risks

Risks Defined

Market Risk: potential for loss of principal

- Ability to sell at a competitive price due to supply and demand constraints
- Volatility in the market and time to maturity
- Restrictions that result in redemption penalties
- Call and Put Options, Security Sector, Issuer

Risks Defined

Credit Risk:

Risk of default or decline in security value due to Issuer financial conditions

- ▣ Arguably the biggest issue in the current environment
- ▣ Measures the additional return required from an investor to lend money to the institution
- ▣ Increases or decreases with changes in ratings
- ▣ Regulatory actions can also impact the risk of an issuer

Risks Defined

Reinvestment Risk:

Interest and/or Principal will be reinvested at a lower rate of return than the current interest rate

- ❏ Short term securities have high reinvestment risk (MMF, Discount Notes)
- ❏ Securities with higher coupons have higher reinvestment risk than lower coupons
- ❏ Mortgage Backed Securities have higher reinvestment risk
- ❏ Callable Securities have high reinvestment risk

Key Investment Program Decisions

- ❏ Maintain an Updated Investment Policy
- ❏ Consider the results of the Cash Flow Analysis
- ❏ Determine Risk Tolerance
- ❏ Determine Appropriate Target Duration
- ❏ Evaluate Market Conditions and Economic Data
- ❏ Consider Historical Perspective and the Current Environment
- ❏ Understand Benefits (Enhanced Earnings, Dynamic Management Approach) and Risks involved with various Investment Strategies (Liquidity, Reinvestment, Credit)
- ❏ Assess the relative value of each maturity and sector
- ❏ Implement an Active and/or Passive Strategy for Core and Liquidity Funds based on Investment Management Goals and Objectives

Duration and Convexity

Duration

- Duration is used to estimate a bond's (portfolio's) sensitivity to interest rate risk.
- Specifically, duration measures a bond's change in value for a given change in interest rates.
 - Modified Duration utilizes Yield to Maturity
 - Effective Duration factors in convexity, utilizes YTM and accounts for the value of embedded options
- Duration is higher (other characteristics constant)
 - for bonds with lower market yields
 - for bonds with lower coupons
 - for bonds with longer maturities

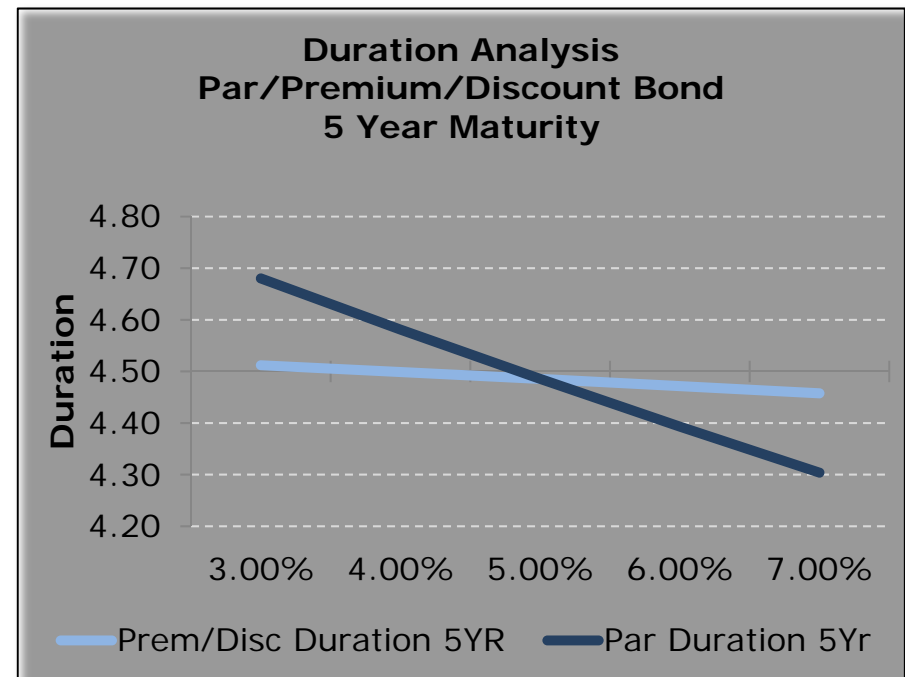
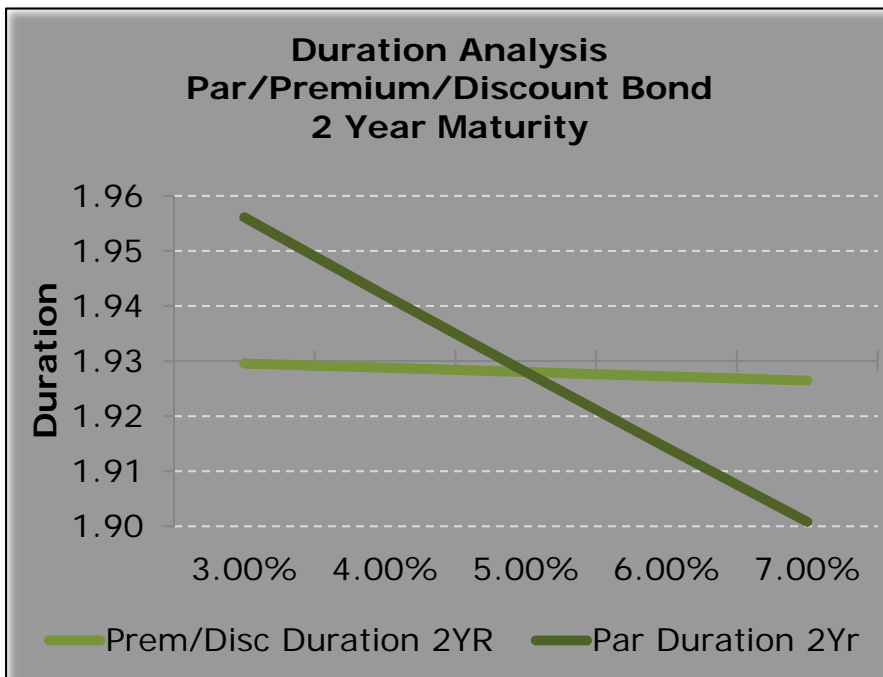
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$$\text{Effective Duration} = \frac{\text{Price w/ Yield Decline} - \text{Price w/Yield Increase}}{2 \times \text{Initial Price} \times \text{Change in Yield}}$$

Duration

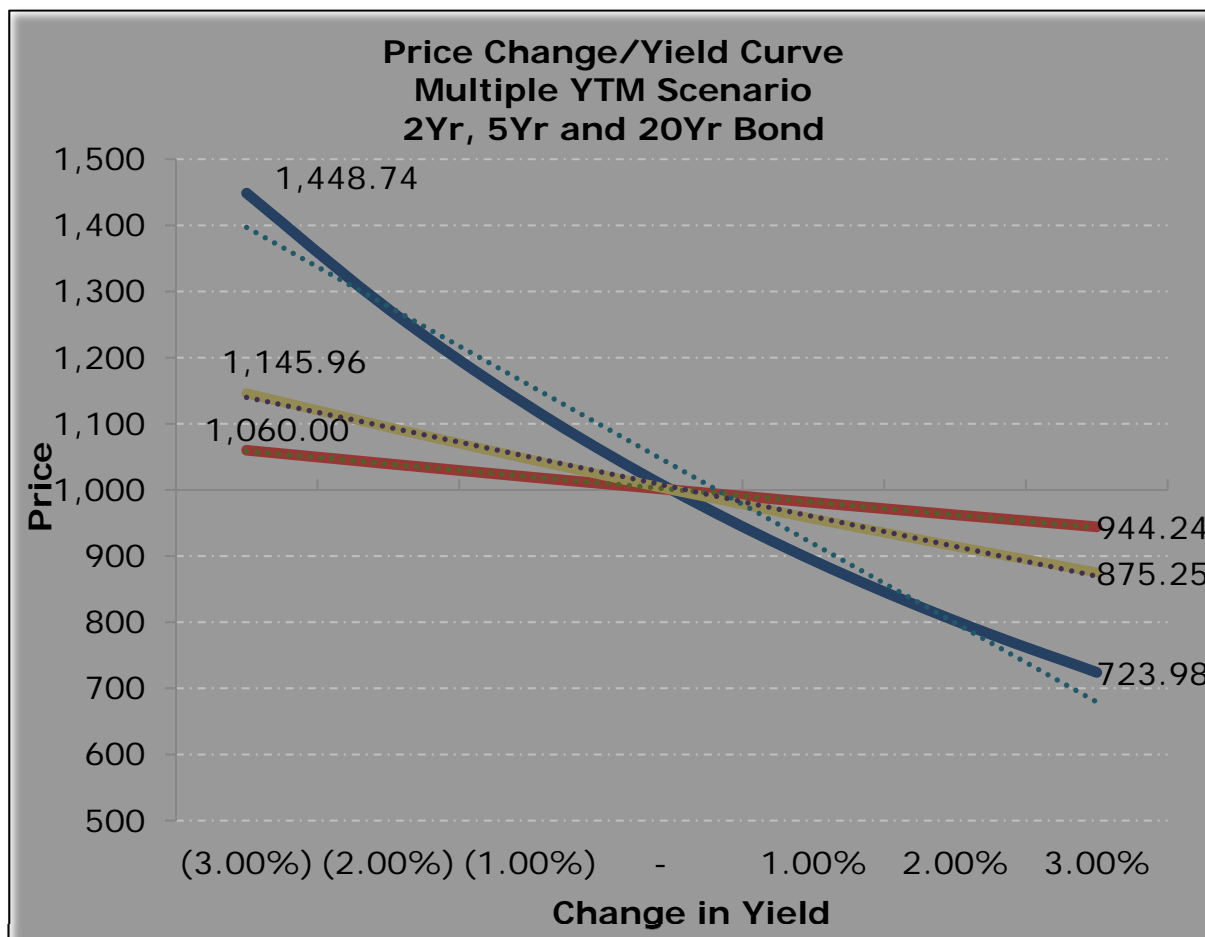
- Other bond characteristics equal, as yields increase, the duration of a bond will decrease
- As Coupons increase, the duration of a bond will decrease



Source: Public Trust. For informational purposes only.

Interest Rate Change and Convexity

- The price/yield curve is not linear for an option free bond



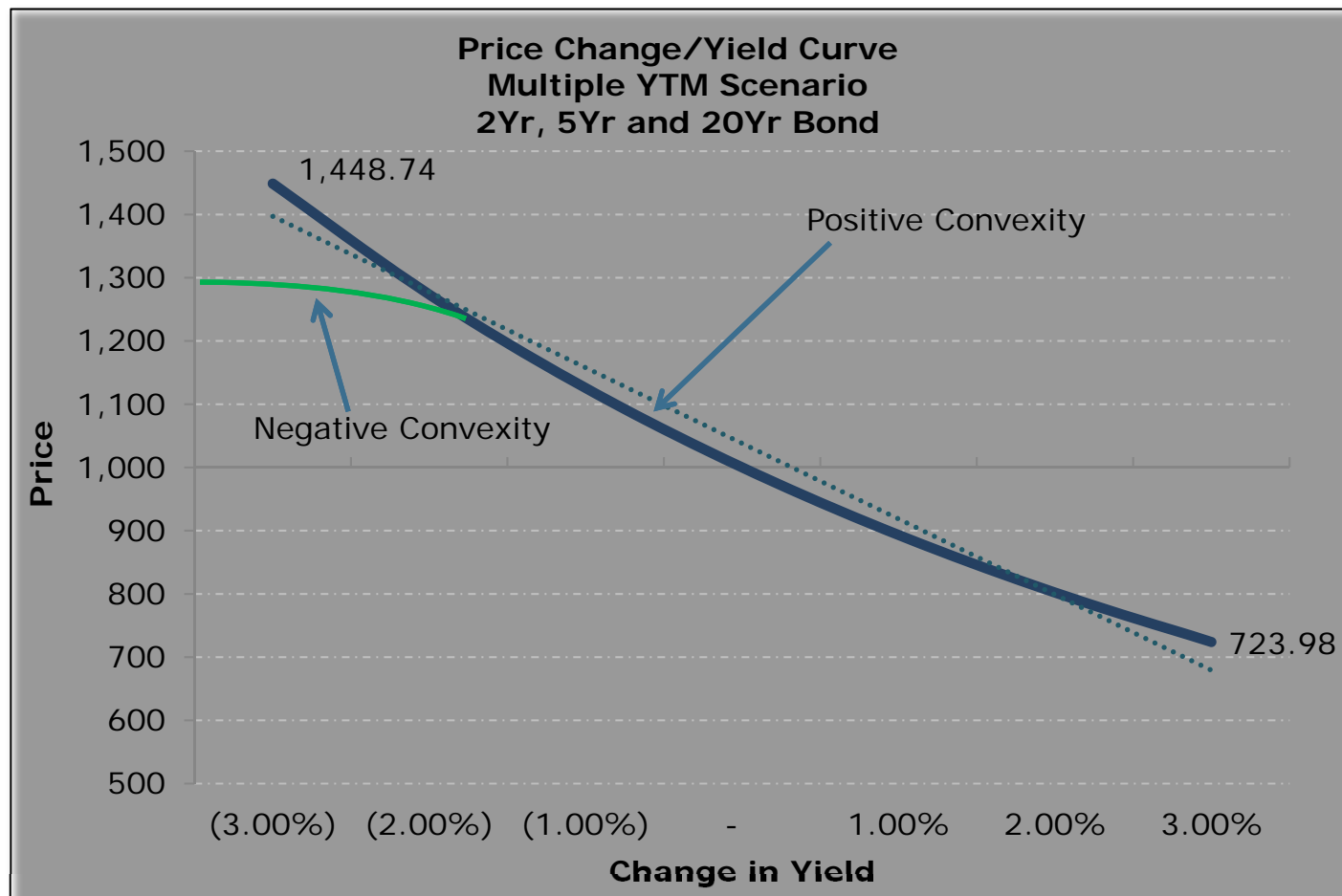
Dollar Change from Par			
Yld Change	2 Year	5 Year	20 year
(3.00%)	60.00	145.96	448.74
(2.00%)	39.50	94.71	273.55
(1.00%)	19.51	46.11	125.51
-	-	-	-
1.00%	(19.04)	(43.76)	(106.78)
2.00%	(37.62)	(85.30)	(197.93)
3.00%	(55.76)	(124.75)	(276.02)

Percentage Change from Par			
Yld Change	2 Year	5 Year	20 year
(3.00%)	6.00%	14.60%	44.87%
(2.00%)	3.95%	9.47%	27.36%
(1.00%)	1.95%	4.61%	12.55%
-	-	-	-
1.00%	(1.90%)	(4.38%)	(10.68%)
2.00%	(3.76%)	(8.53%)	(19.79%)
3.00%	(5.58%)	(12.47%)	(27.60%)

Source: Public Trust. For informational purposes only.

Convexity and Option Bonds

- ▮ Negative convexity is present for bonds with embedded options

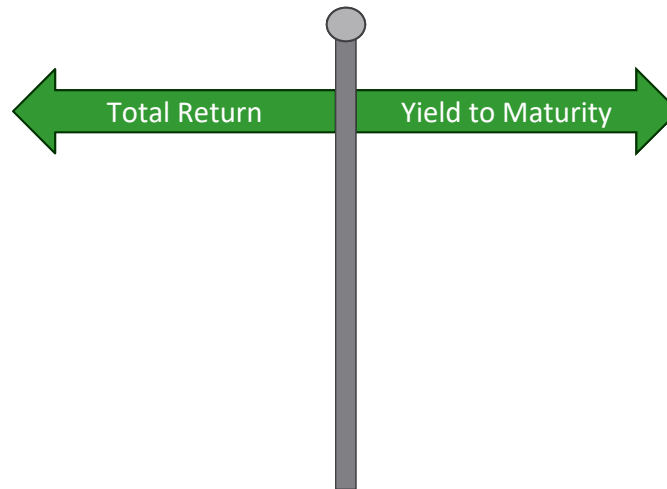


Source: Public Trust. For informational purposes only.

Total Return and Yield to Maturity

Yield to Maturity vs. Total Return

- YTM is a bond's internal rate of return based on the bond's projected cash flows, and price. Assumes all coupon payments are reinvested at the YTM.
 - YTM at Market
 - YTM at Book
 - YTM to Call
- Total return is the return of the bond (or portfolio) since settlement. This includes income earned, realized gains and losses and the change in market value.



Total Return

- ❏ Converts the HPY into an annualized 360 day yield for money market rate comparison
- ❏ For measuring performance total return is the actual rate of return of an investment or a pool of investments over a certain period.
- ❏ Total return includes
 - ❏ Interest
 - ❏ Recognized gains/losses
 - ❏ Unrecognized gains/losses

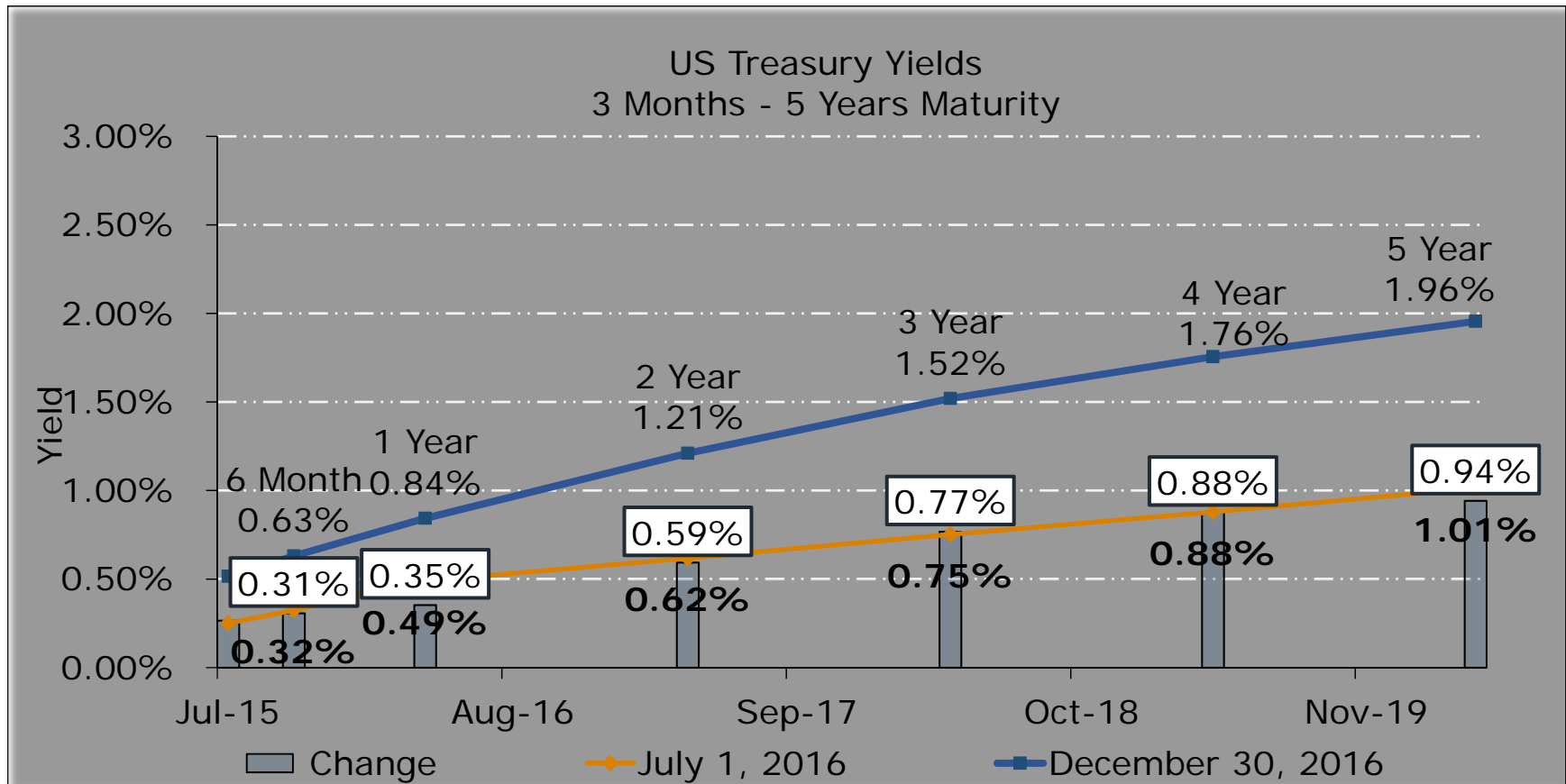
$$\text{Total Return} = (1+\text{HPY}) \times (1+\text{HPY}) \times (1+\text{HPY}) \times (1+\text{HPY}) - 1$$

Yield to Maturity

- YTM is a bond's internal rate of return based on the bond's projected cash flows, and price. Assumes all coupon payments are reinvested at the YTM.
- Same Components as Present Value Calculation
 - Settlement Date (Calc begins at settlement – not trade date)
 - Maturity Date
 - Yield
 - Coupon
 - Frequency (annual/semi-annual/zero coupon/discount)
 - Day Count Basis (UST vs Corp/Discount vs. Coupon)
 - Price (Par/Discount Bond/Premium Bond)

Historical Performance and Yield Curve Analysis

Yield Curve Brexit through Post Election

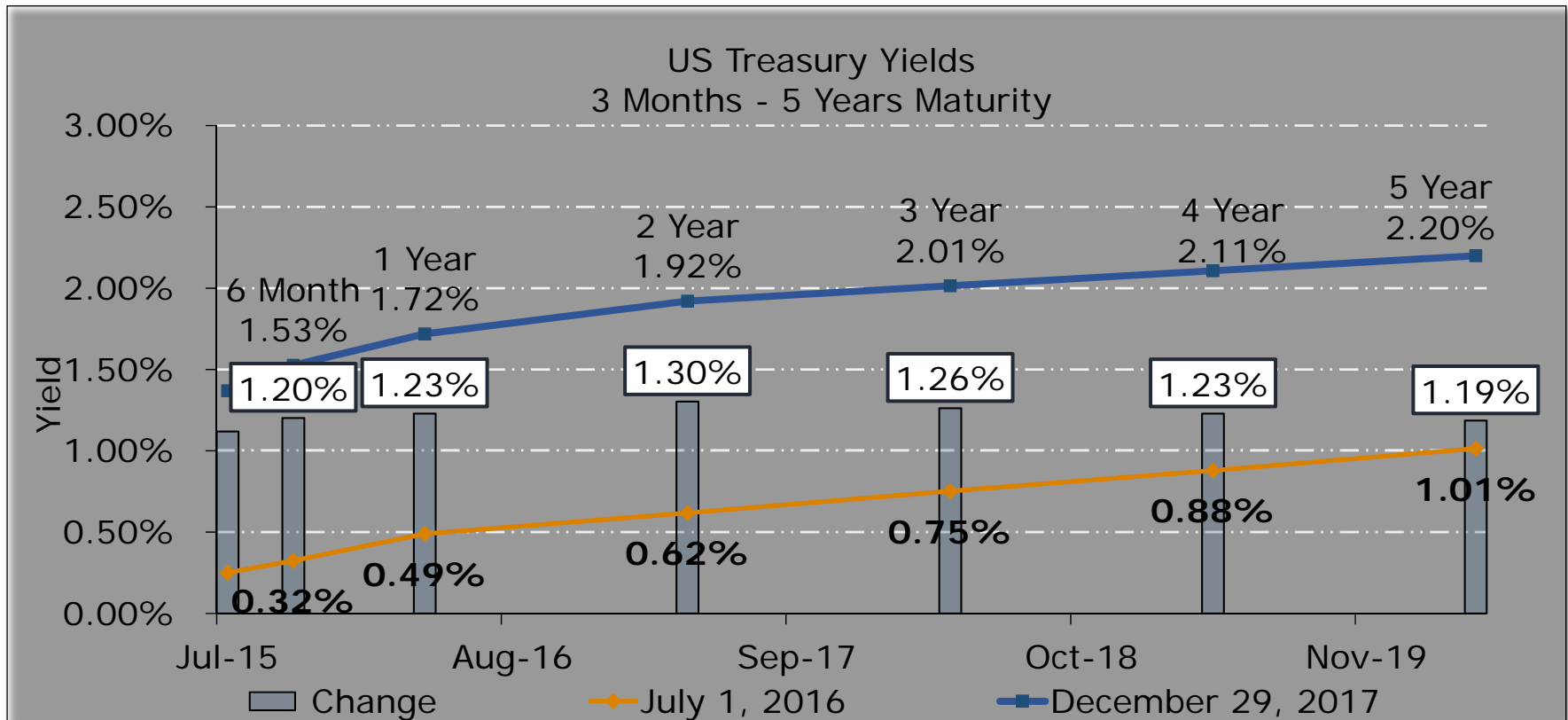


Source: Bloomberg

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Yield Curve July 1, 2016 vs. December 2017

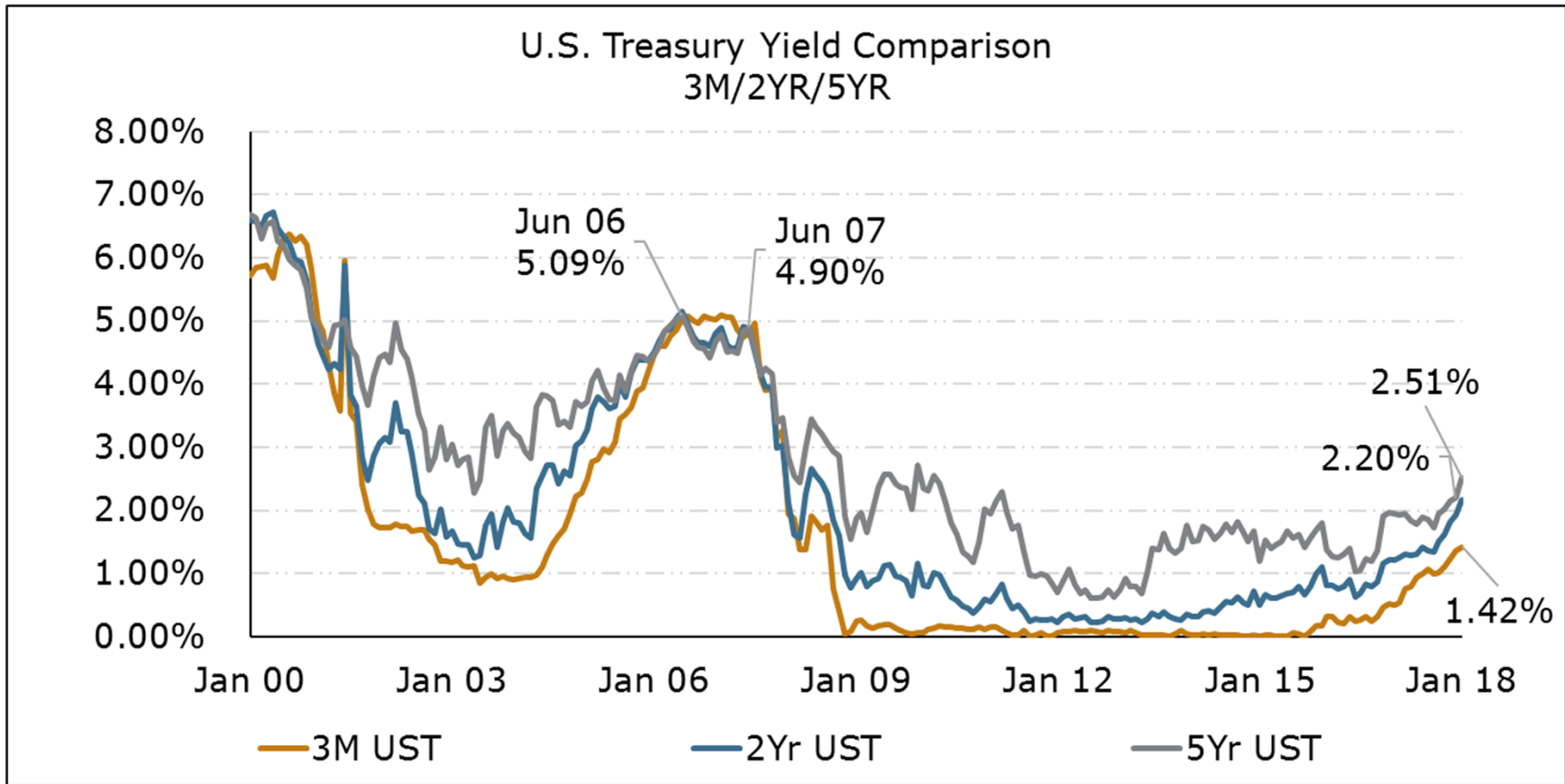
- Federal Funds rate increases and decreasing inflationary measures have resulted in a flatter yield curve.



Source: Bloomberg

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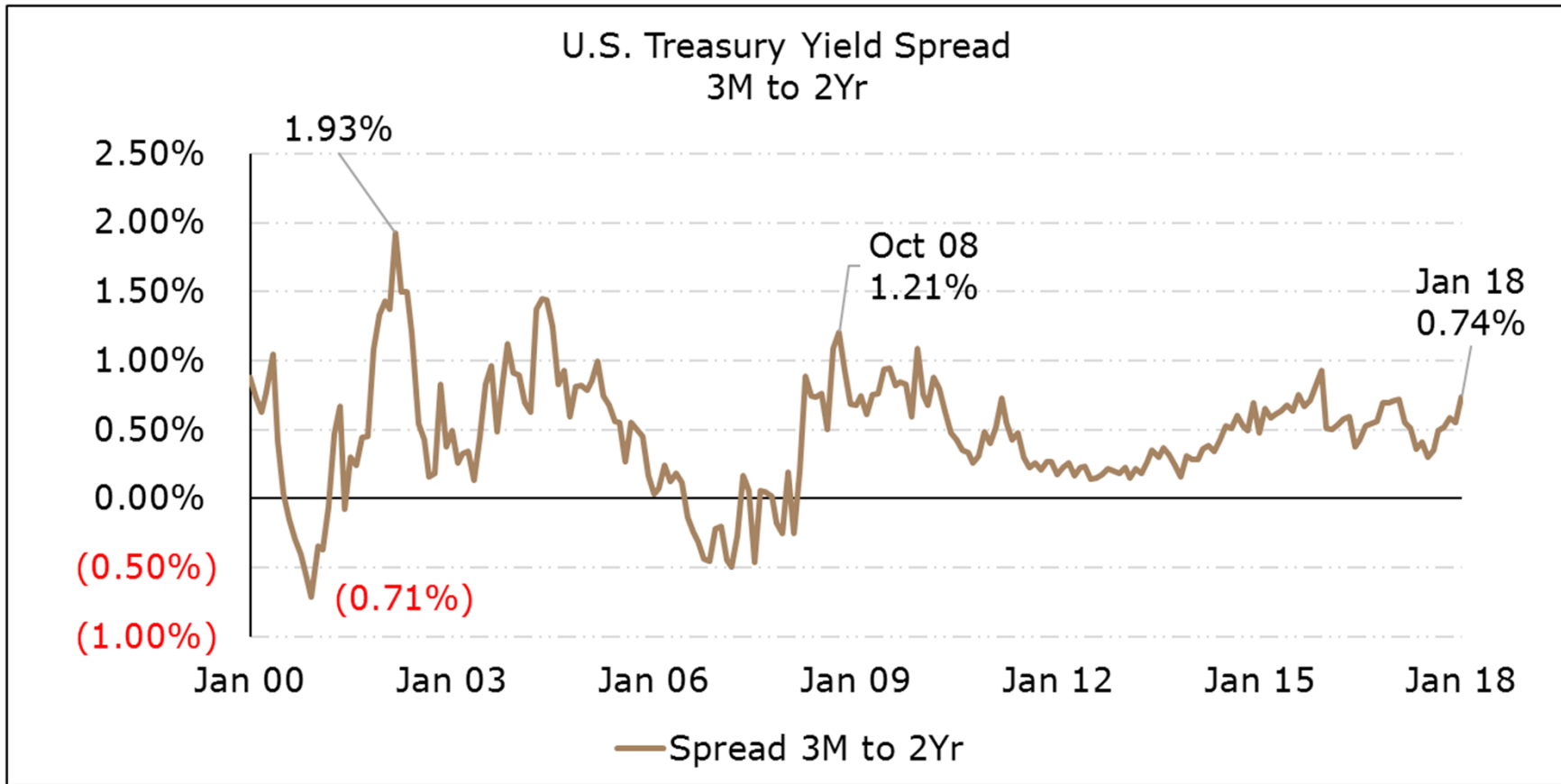
Historical Yield Comparison – 3M, 2Yr and 5Yr



Source: Bloomberg

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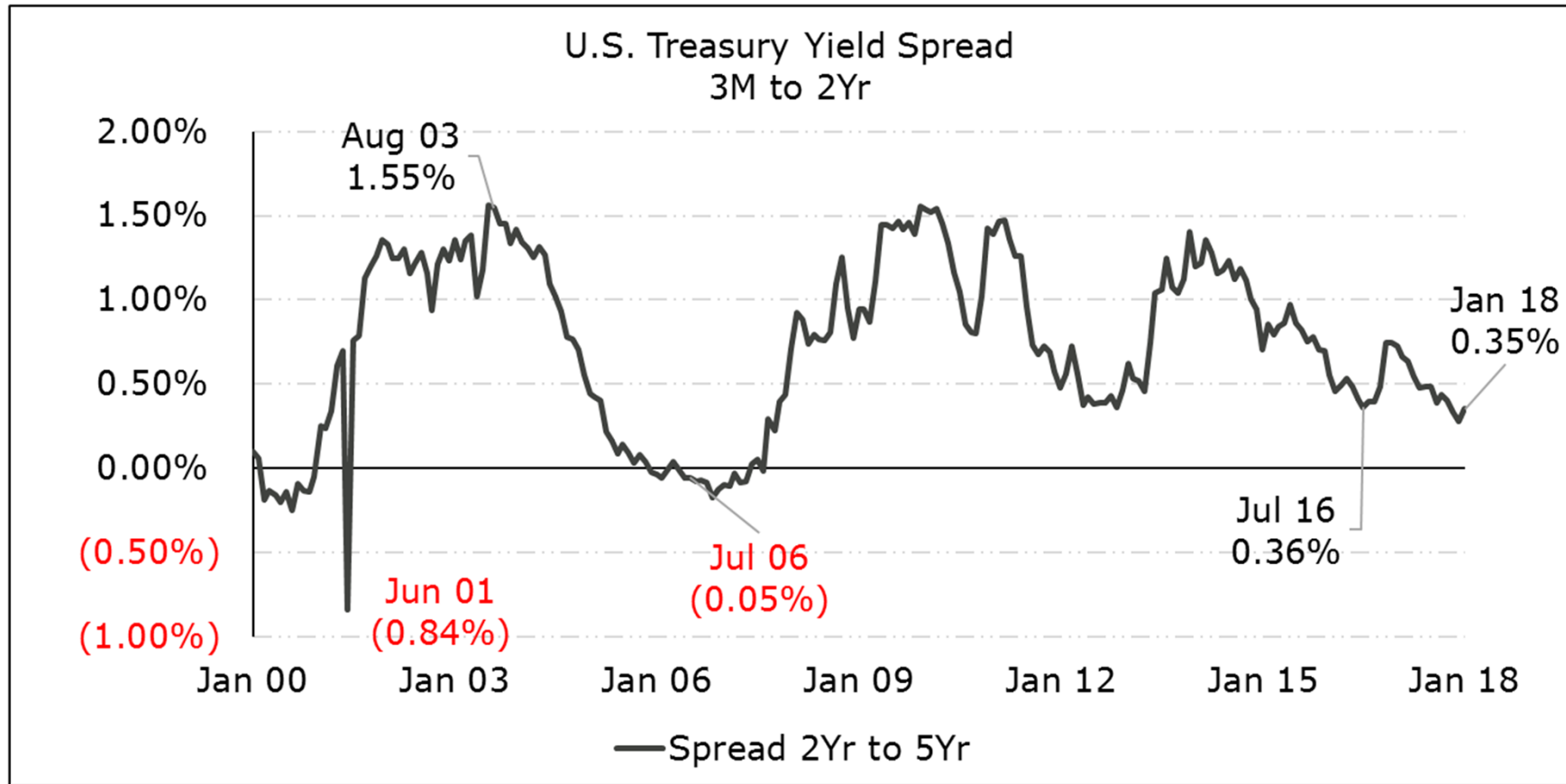
Historical Yield Comparison 3M vs 2Yr



Source: Bloomberg

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Historical Yield Comparison 2Yr vs 5Yr

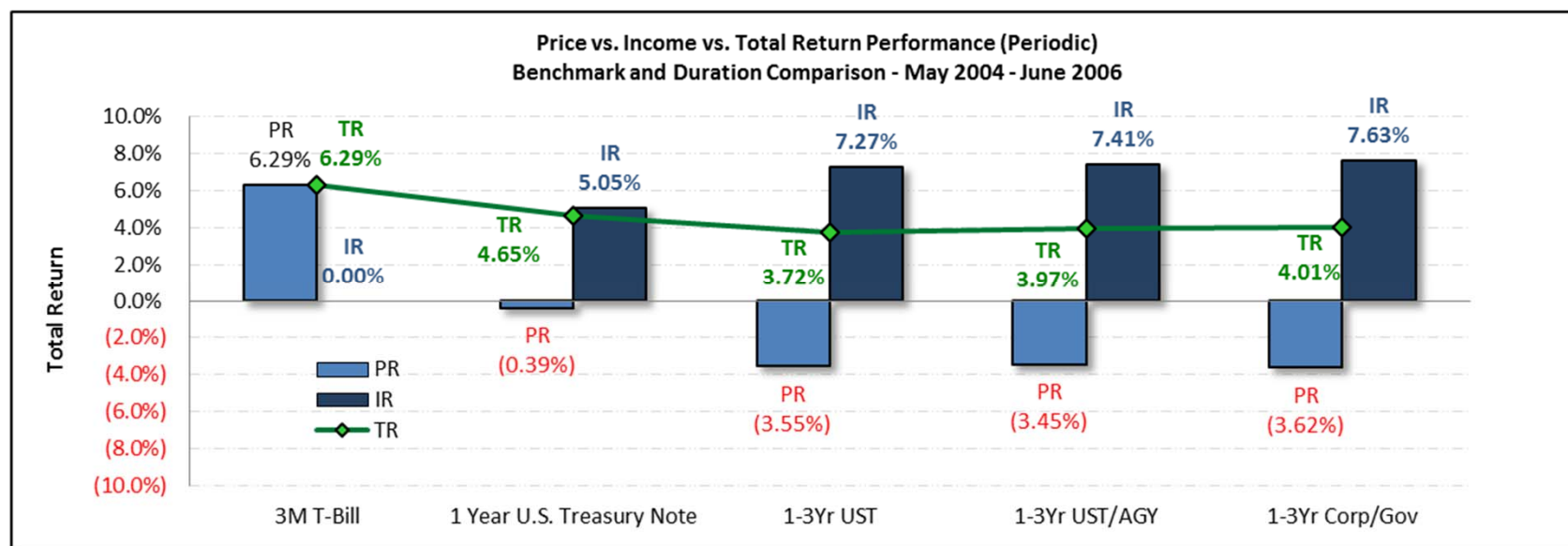


Source: Bloomberg

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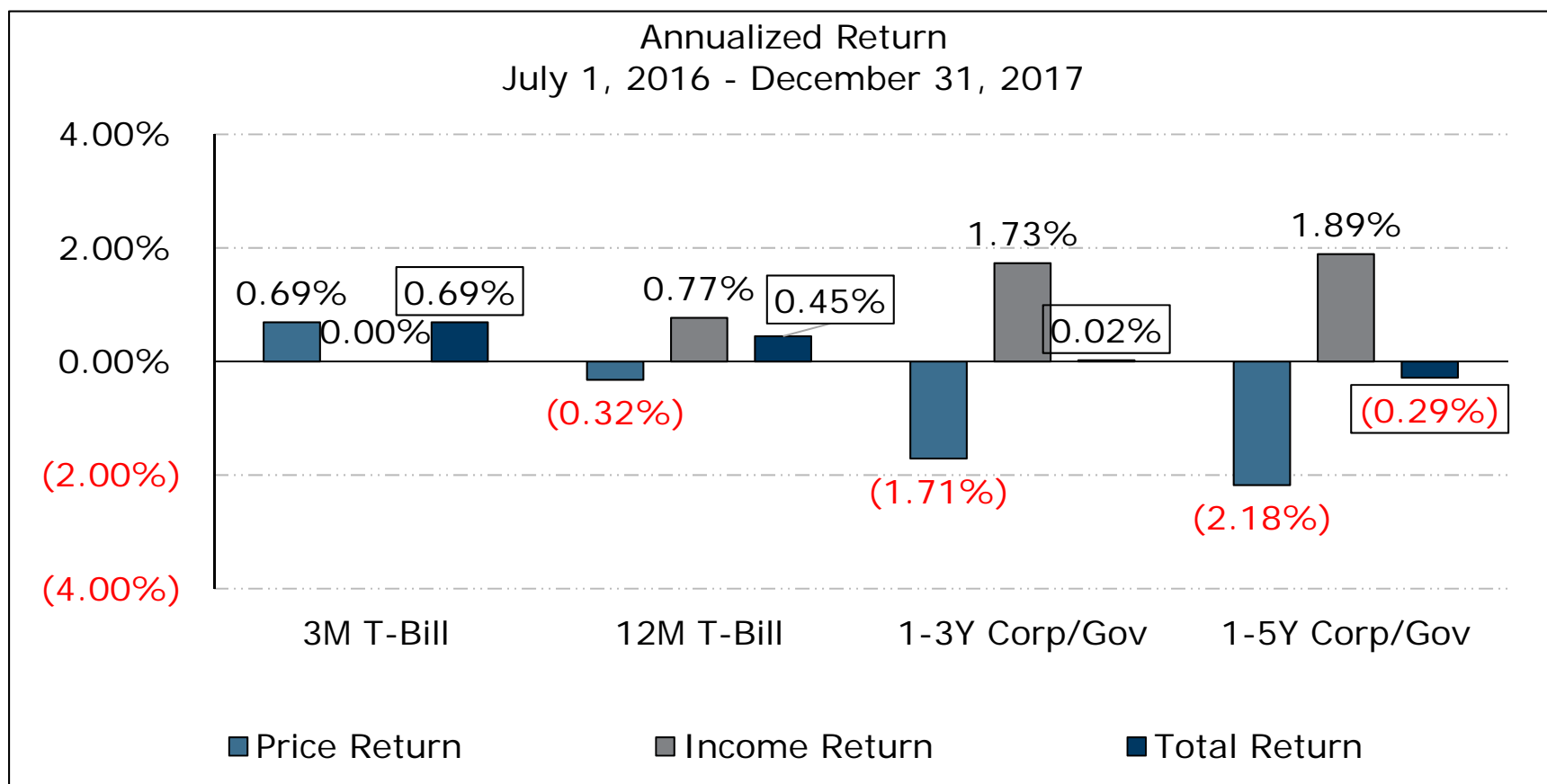
Income and Total Return

- In periods of rising interest rates, such as the period of May 2004 – June 2006, longer term strategies may experience lower total return, but the income component may provide additional income versus short term investments. Price return volatility may be managed by limiting realized losses during the period.
- The chart shown below presents total return for various investment strategies and the components of income return and price return.



Source: Bloomberg – The charts above represent Bank of America Merrill Lynch index data available from Bloomberg and are intended for informational purposes only and not a recommendation. Past performance is not indicative of future performance.

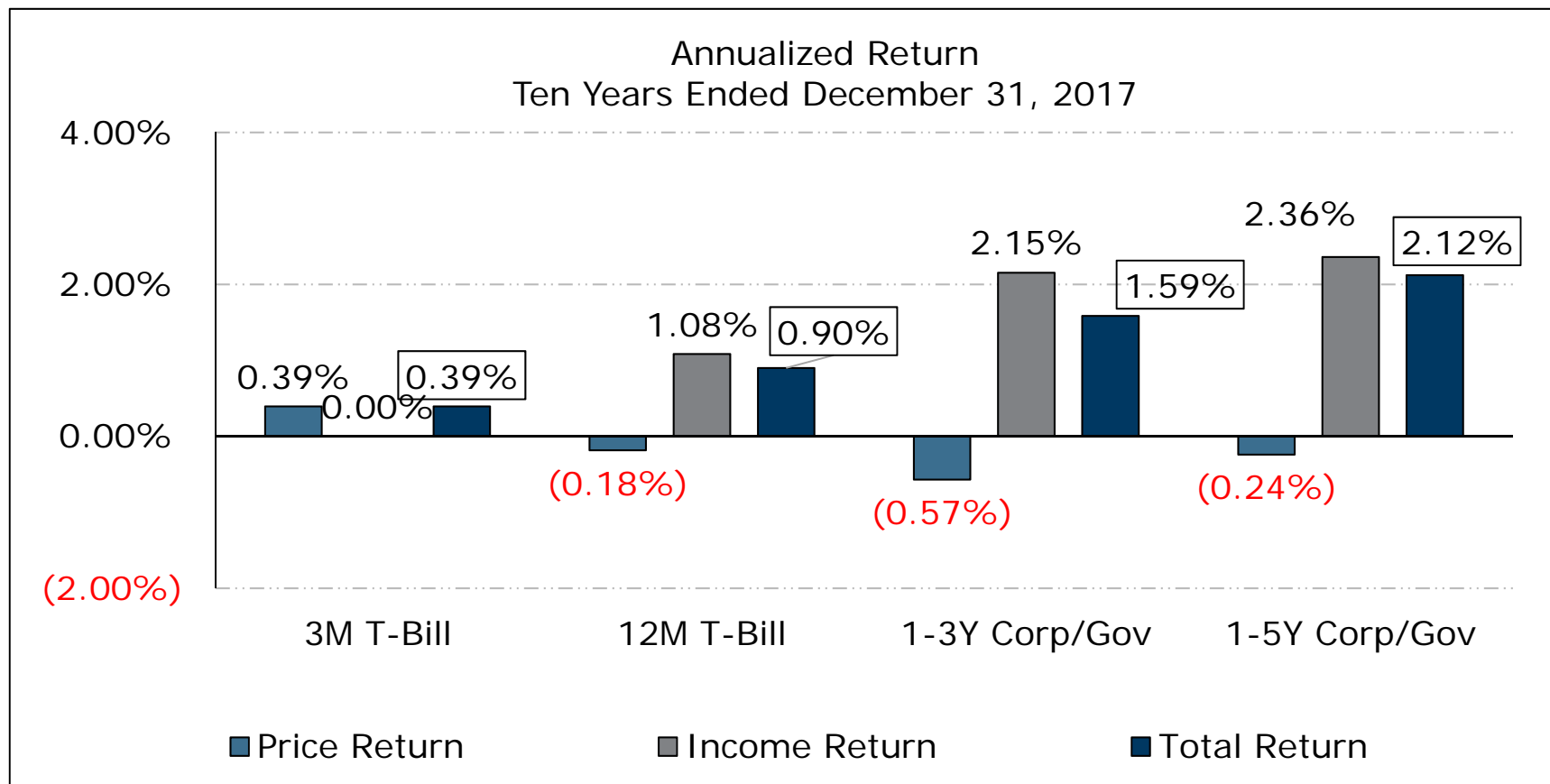
Total Return – Rising Interest Rate Environment



Source: Bloomberg

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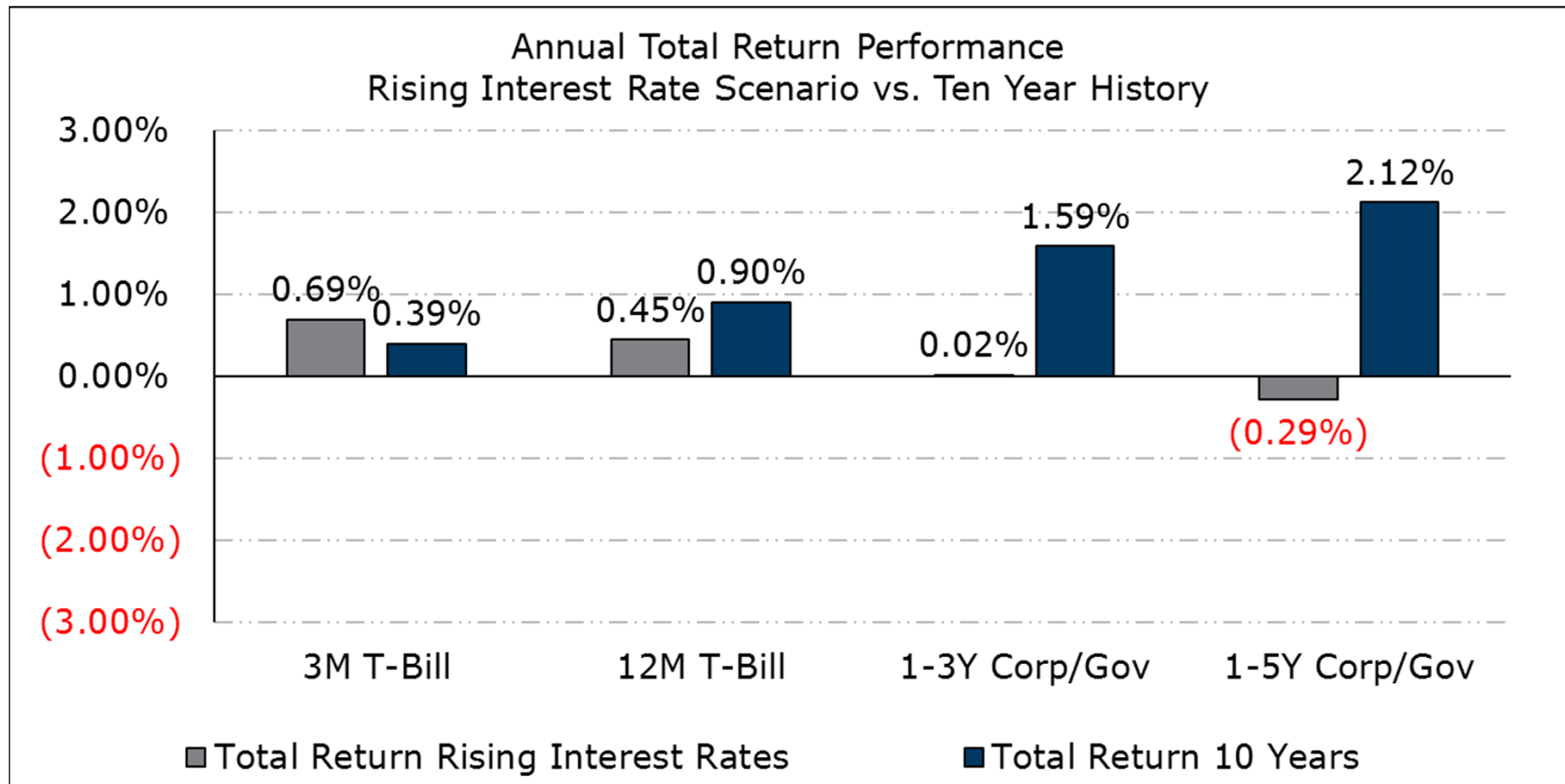
Total Return – 10 Year History



Source: Bloomberg

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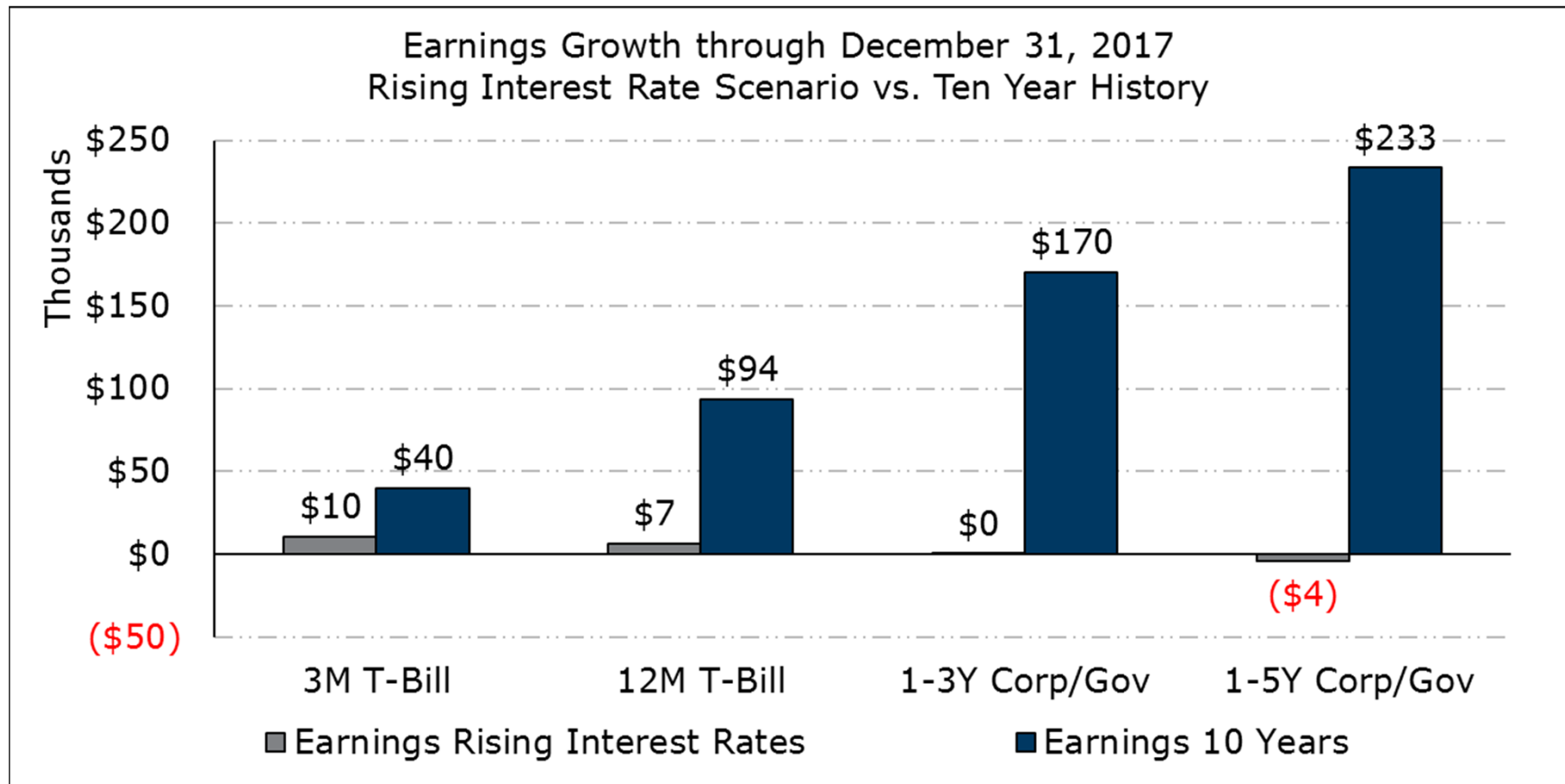
Historical Performance Long Term vs Short Term



Source: Bloomberg

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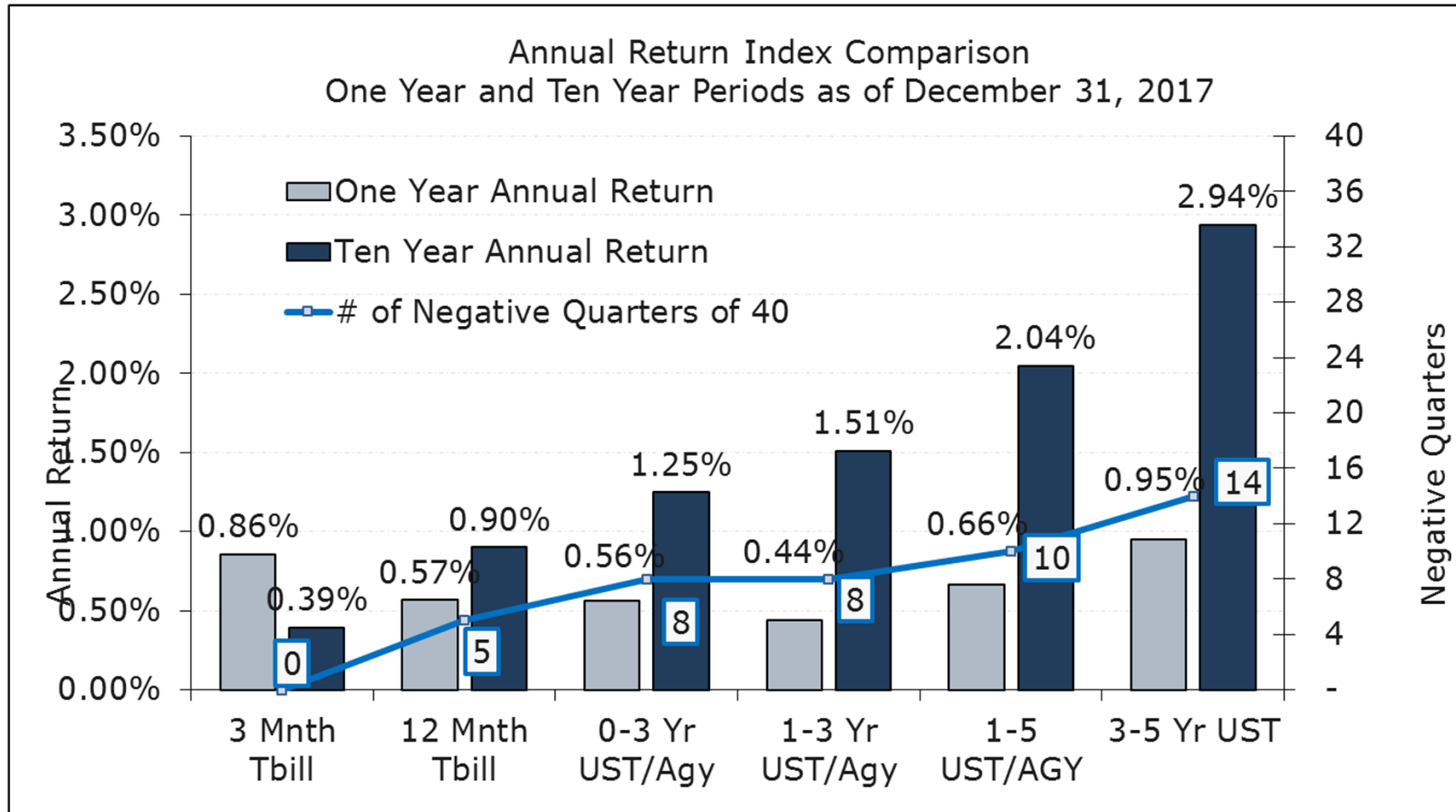
Earnings Growth Scenario



Source: Bloomberg

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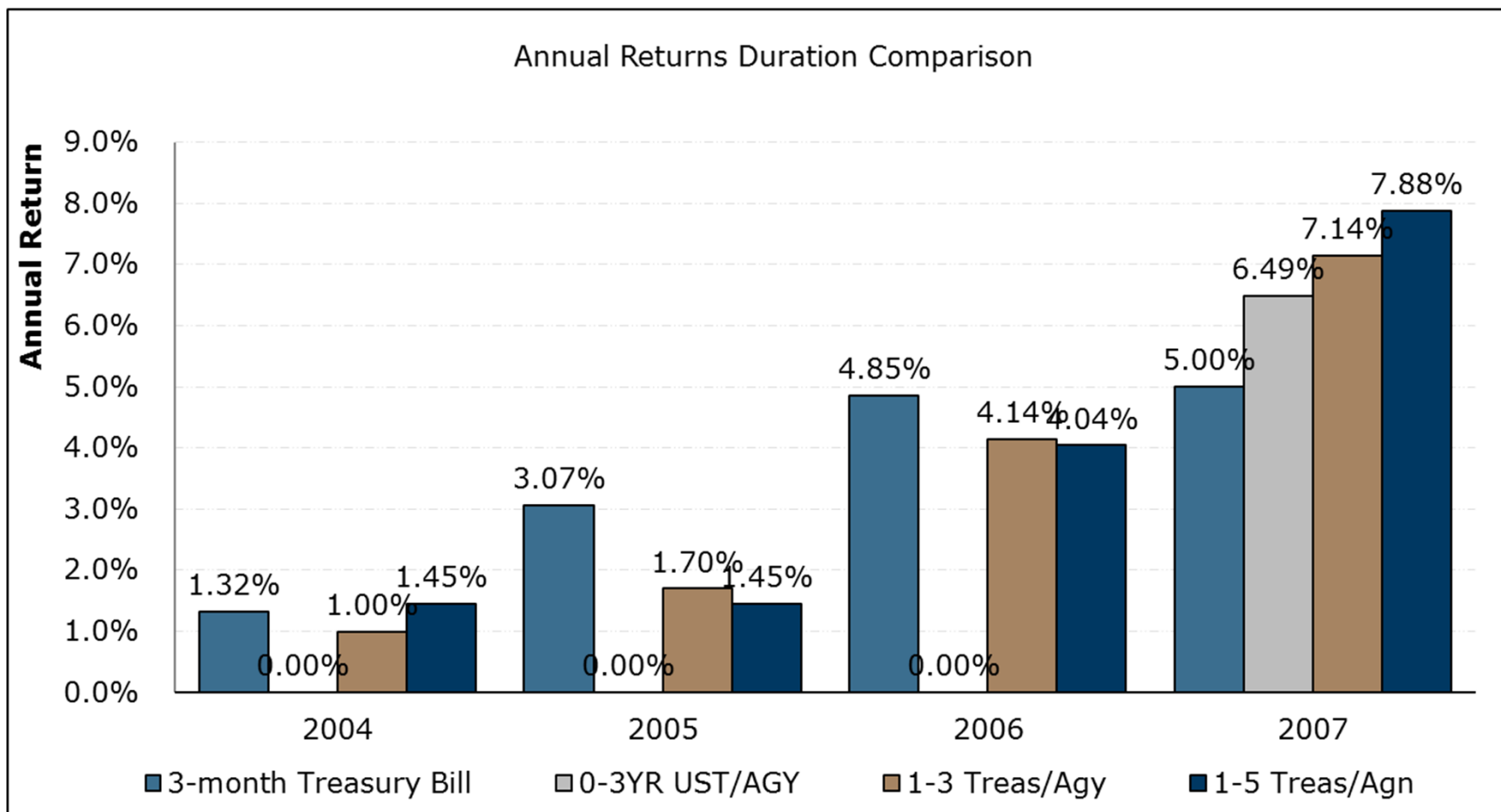
Historical Performance



Source: Bloomberg

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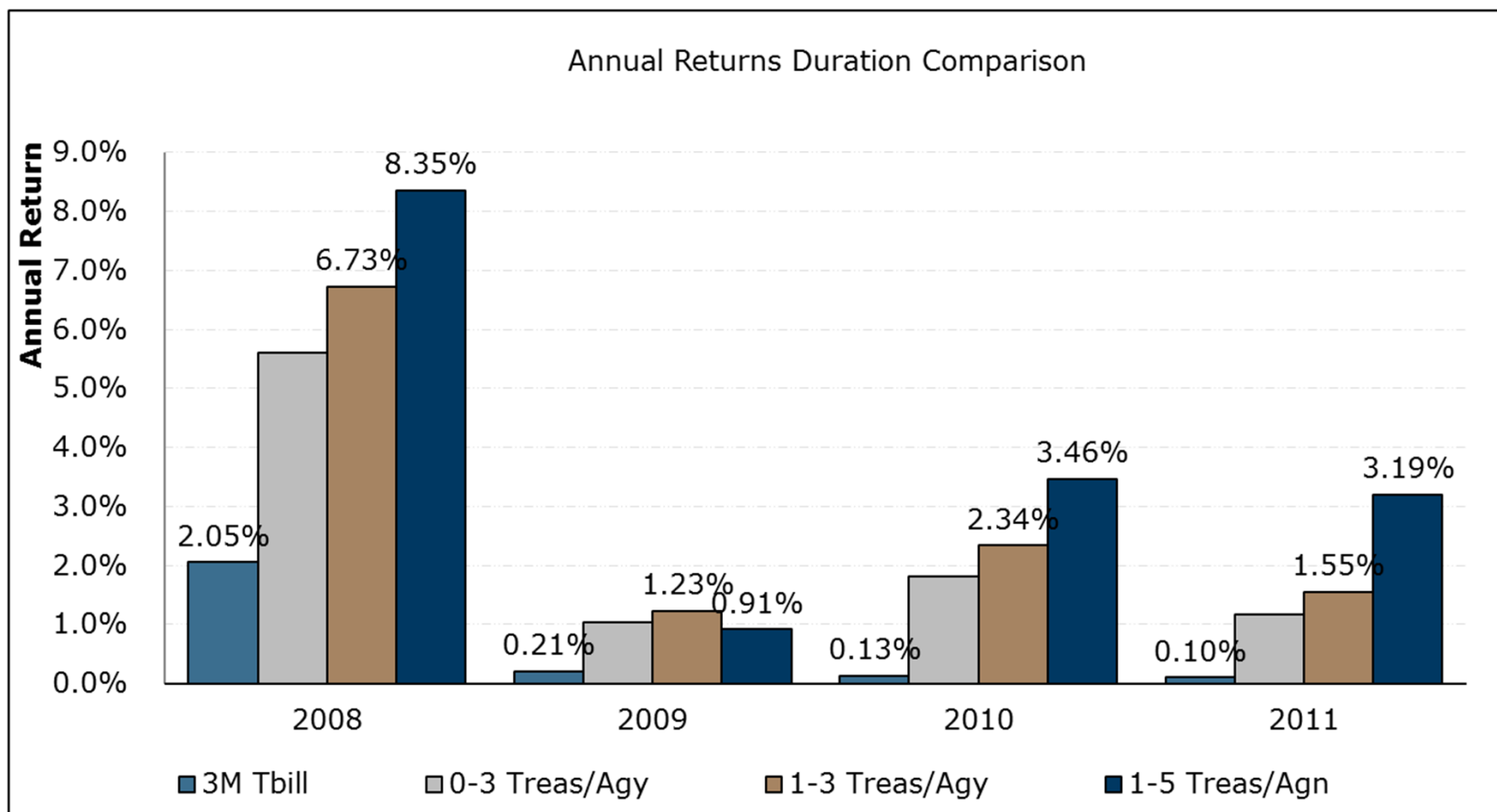
Annual Total Return – Duration Comparison



Source: Bloomberg

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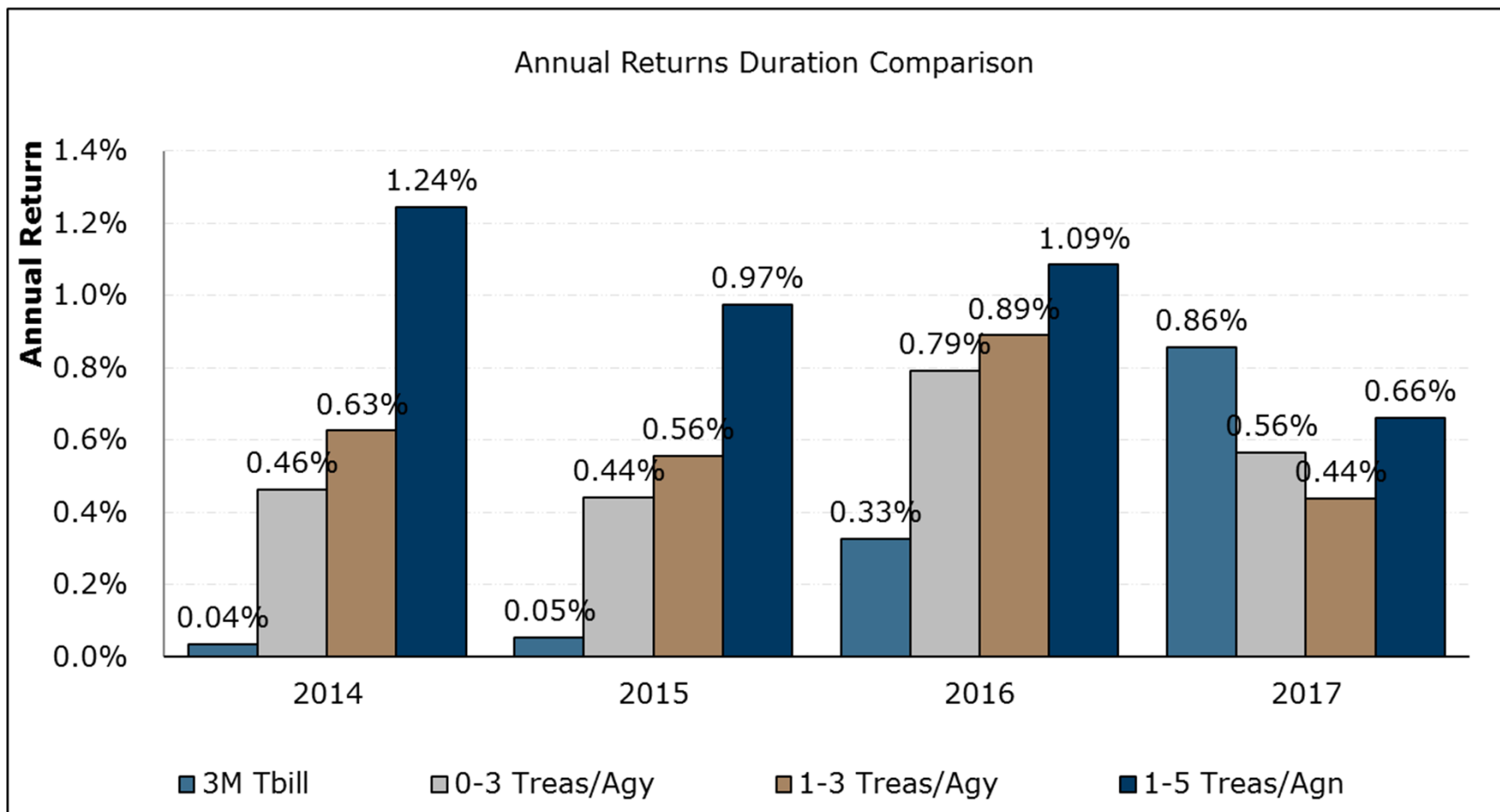
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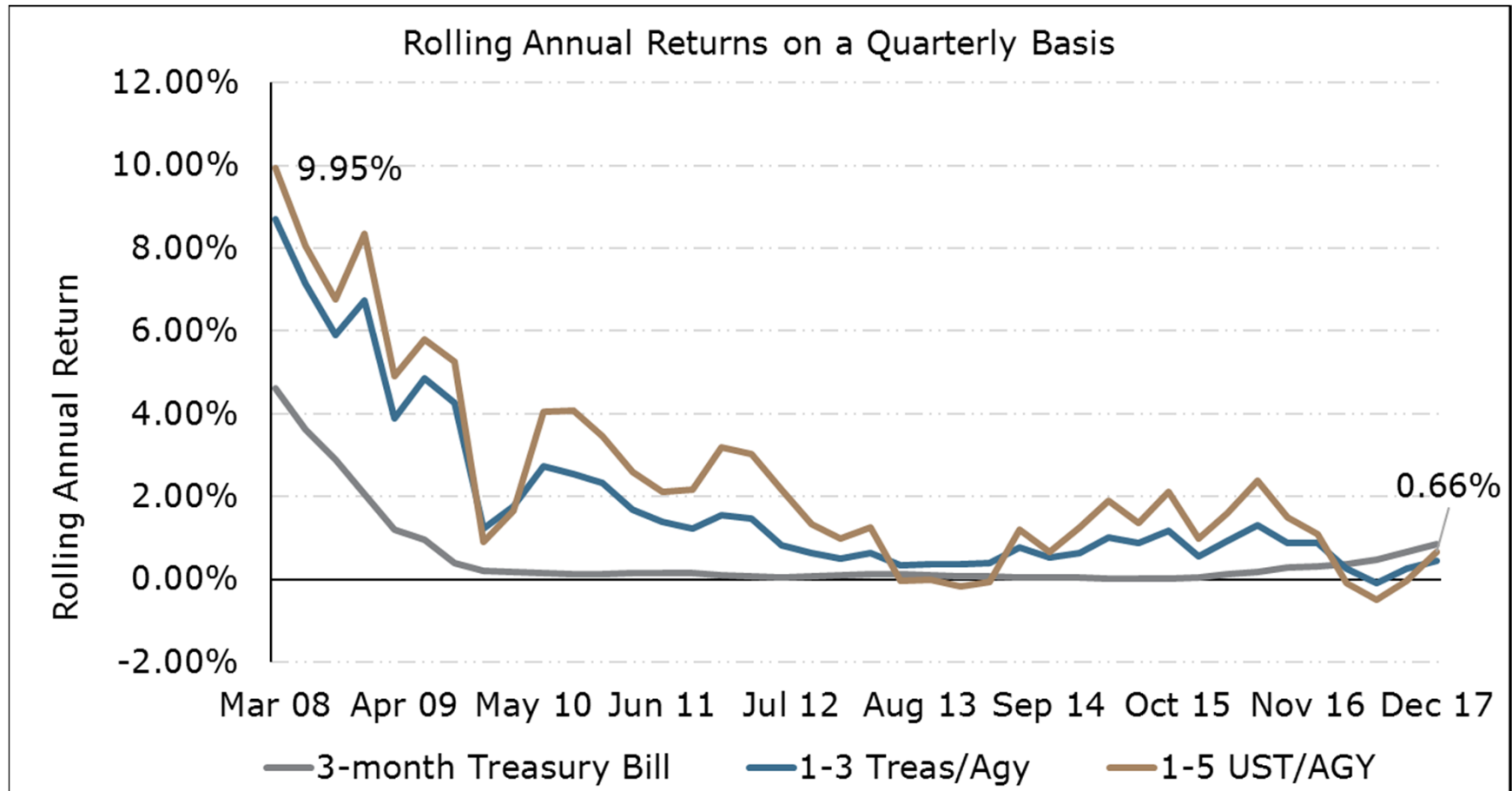
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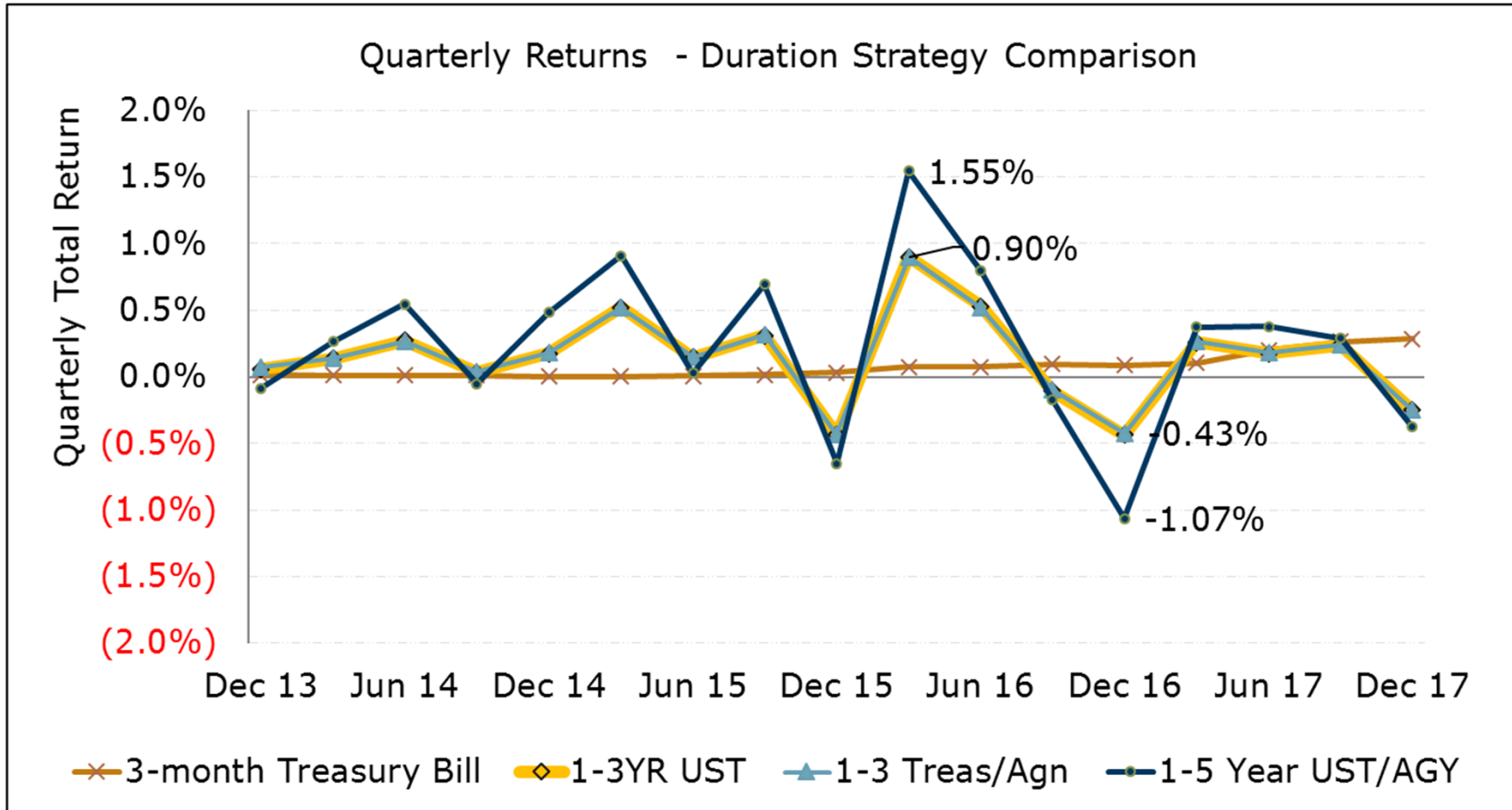
Rolling Annual Returns



Source: Bloomberg

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Quarterly Returns

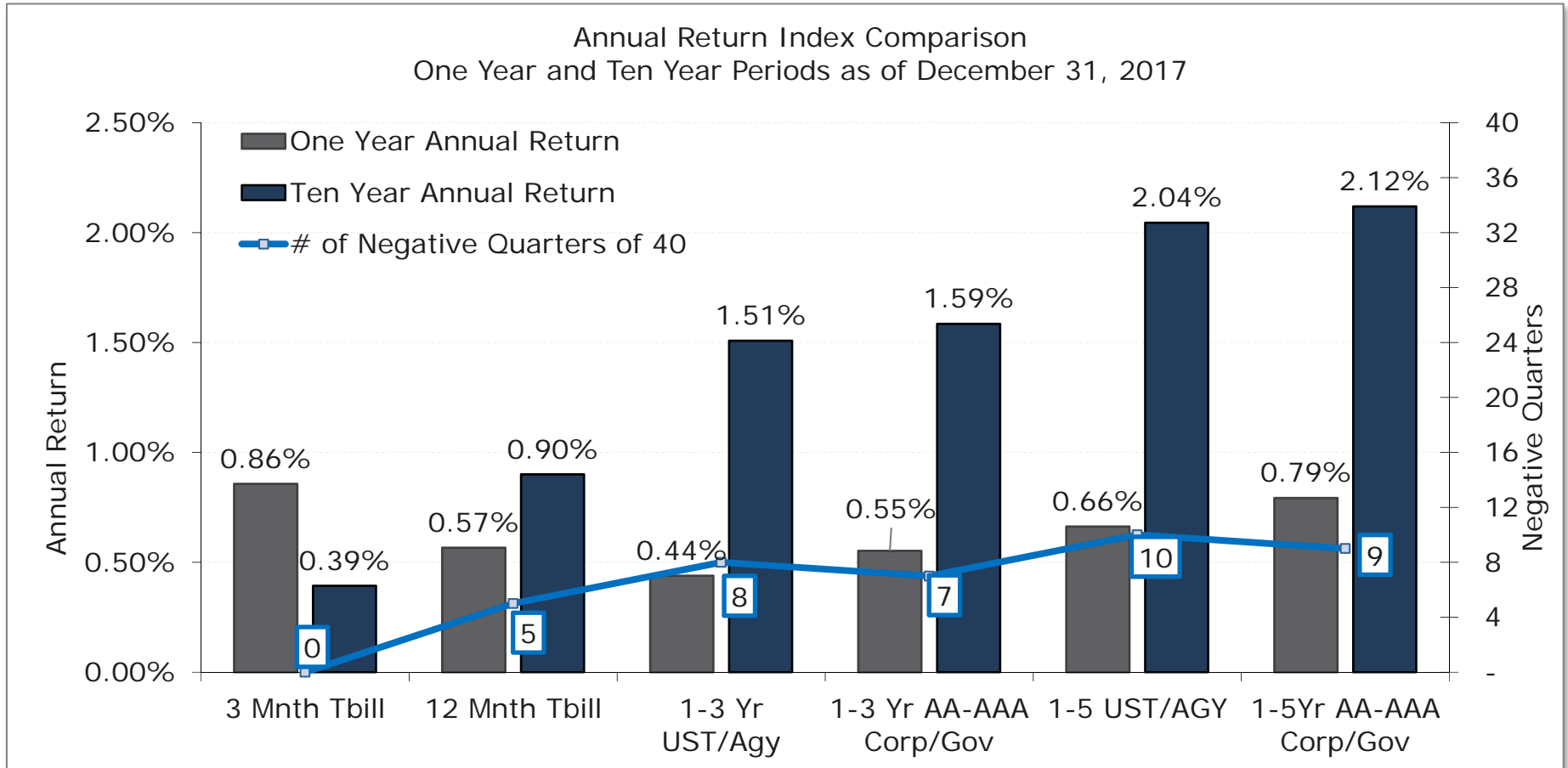


Source: Bloomberg

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Historical Performance

- Historically, longer term duration investment strategies have provided higher annual returns over longer investment horizons, although with more volatility.

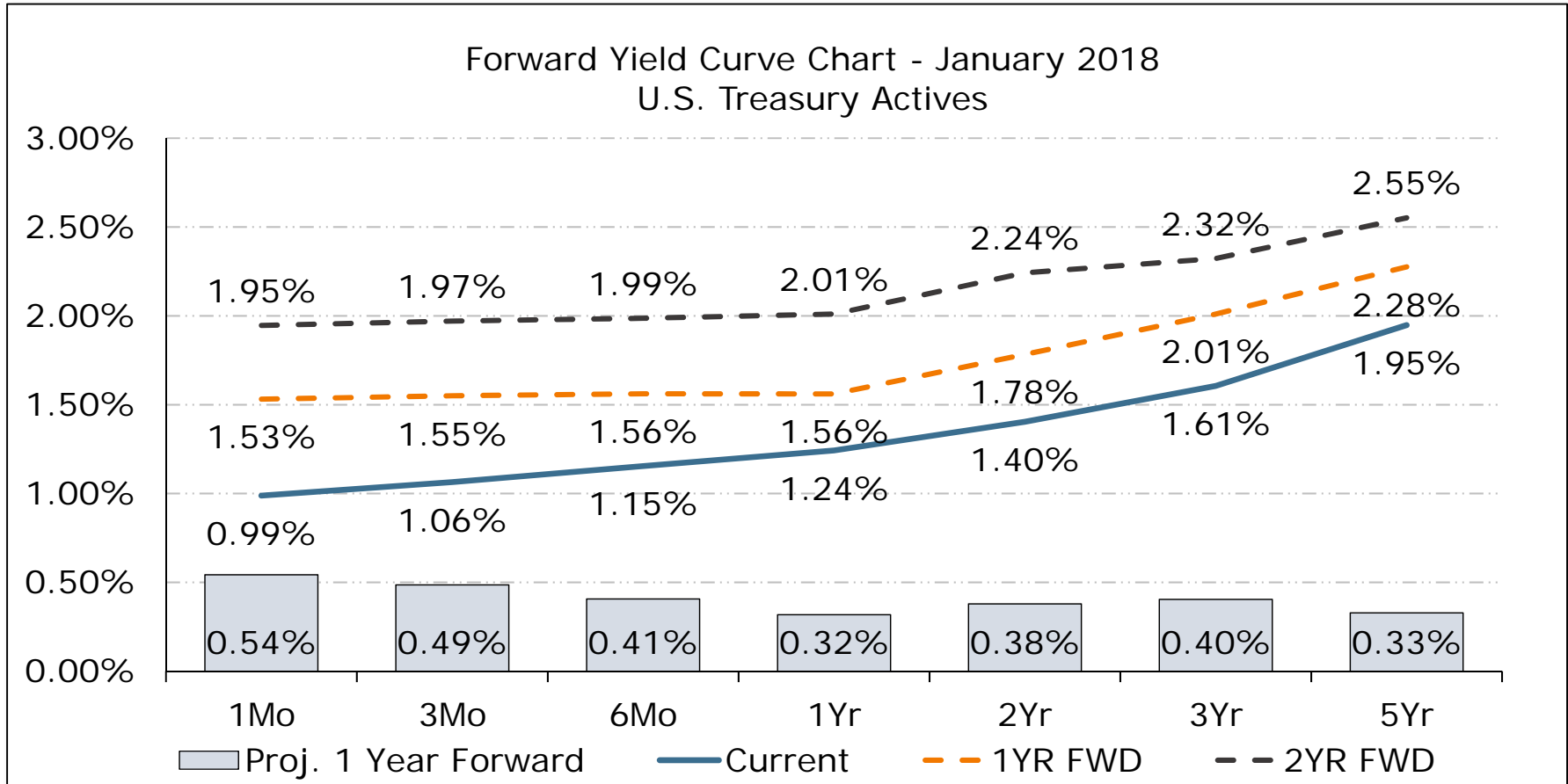


Source: Bloomberg

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Projected Interest Rates

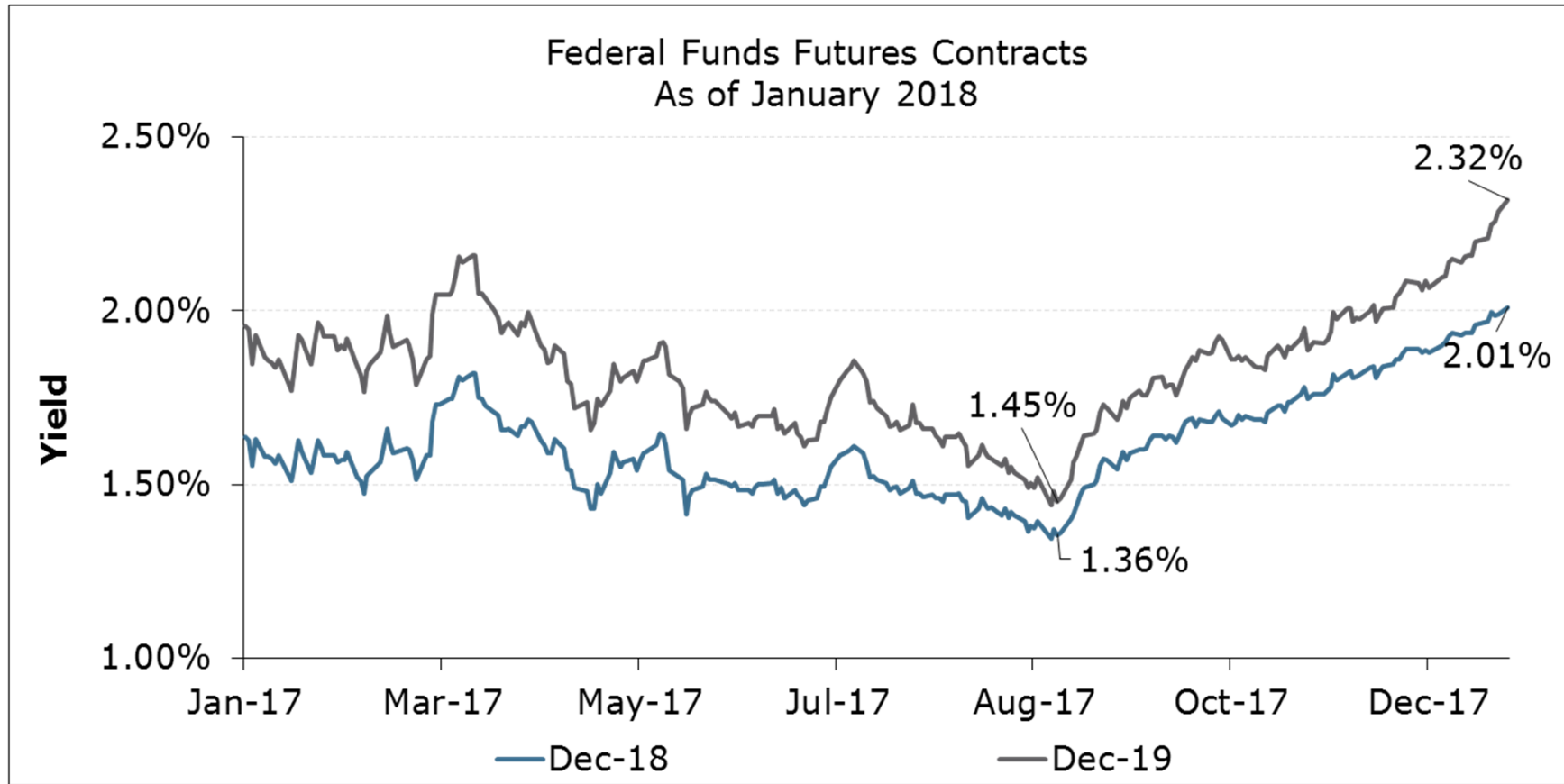
Current projections indicate higher rates with a flatter yield curve.



Source: Bloomberg

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Fed Funds Futures Contracts

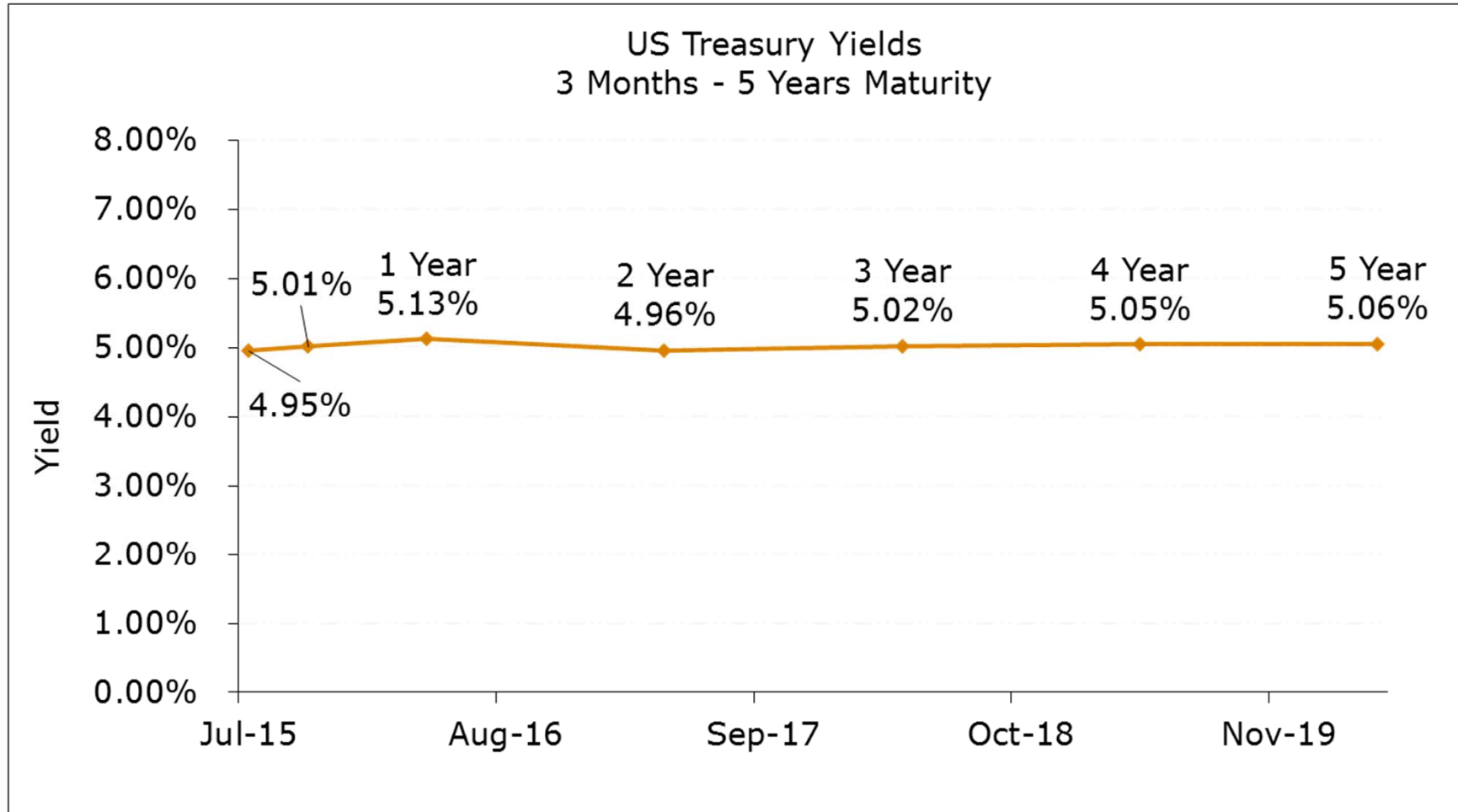


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Portfolio Characteristics

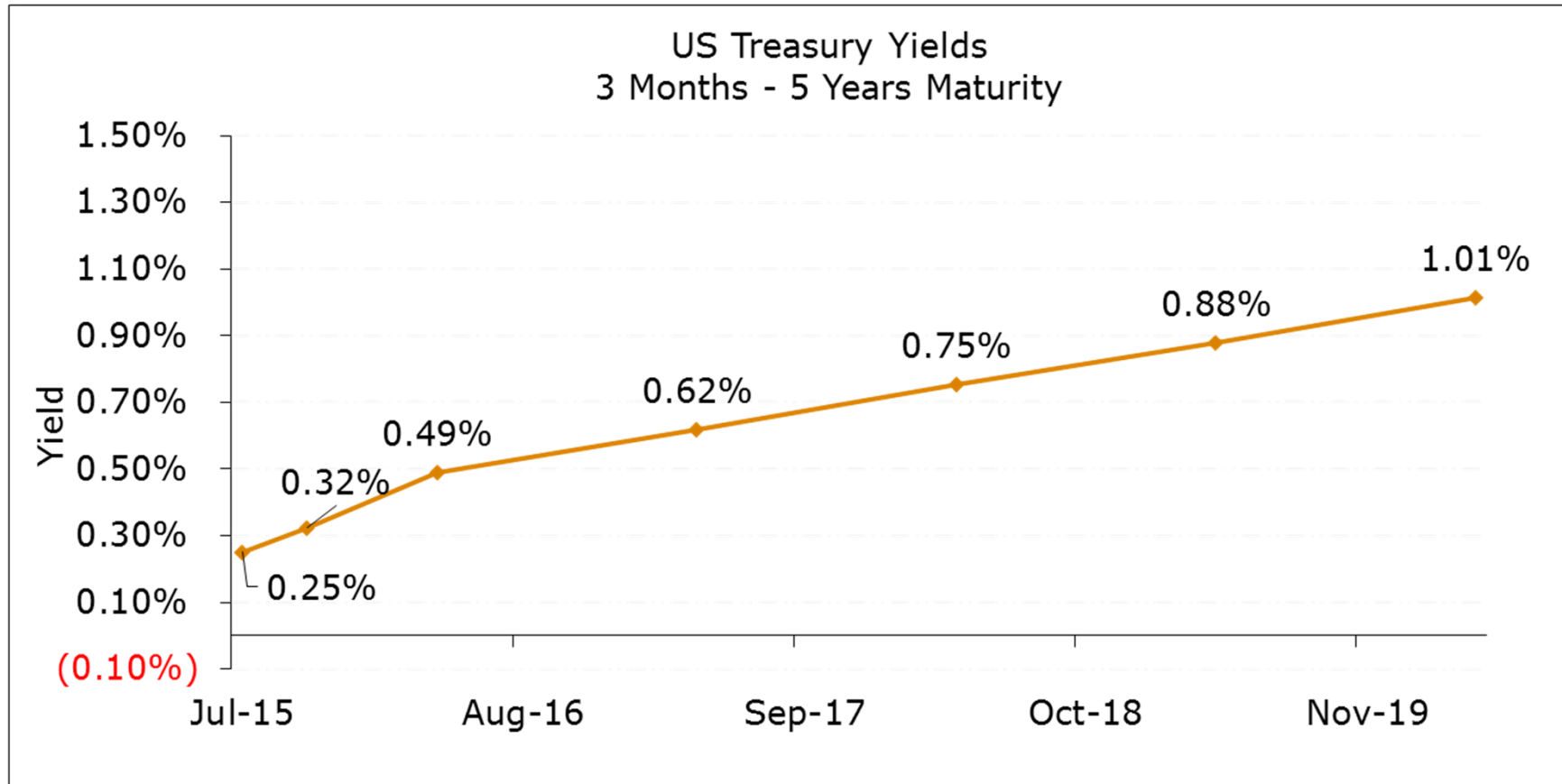
Investment Decisions – Flat Yield Curve Scenario 1



Source: Bloomberg

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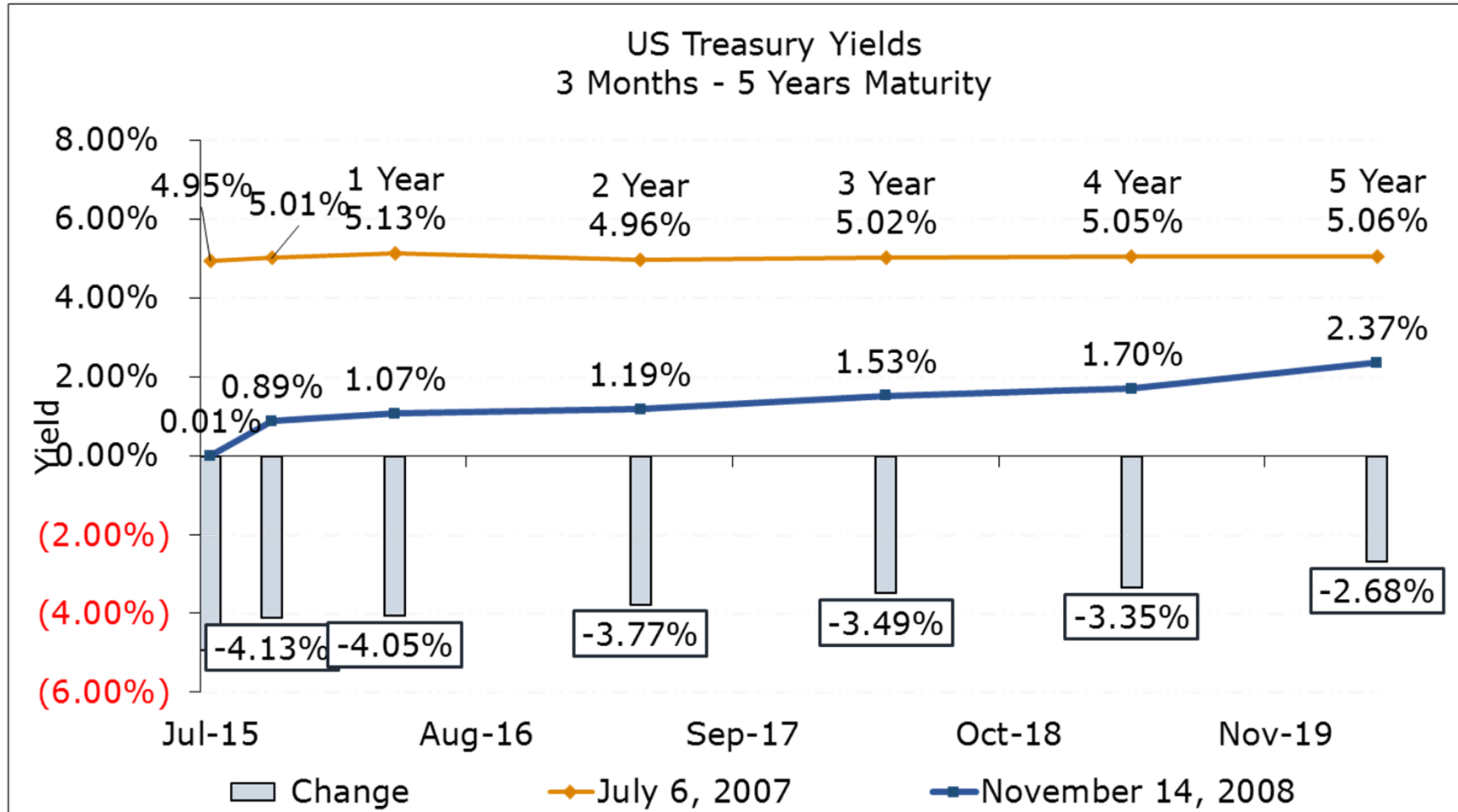
Investment Decisions – Flat Yield Curve Scenario 2



Source: Bloomberg

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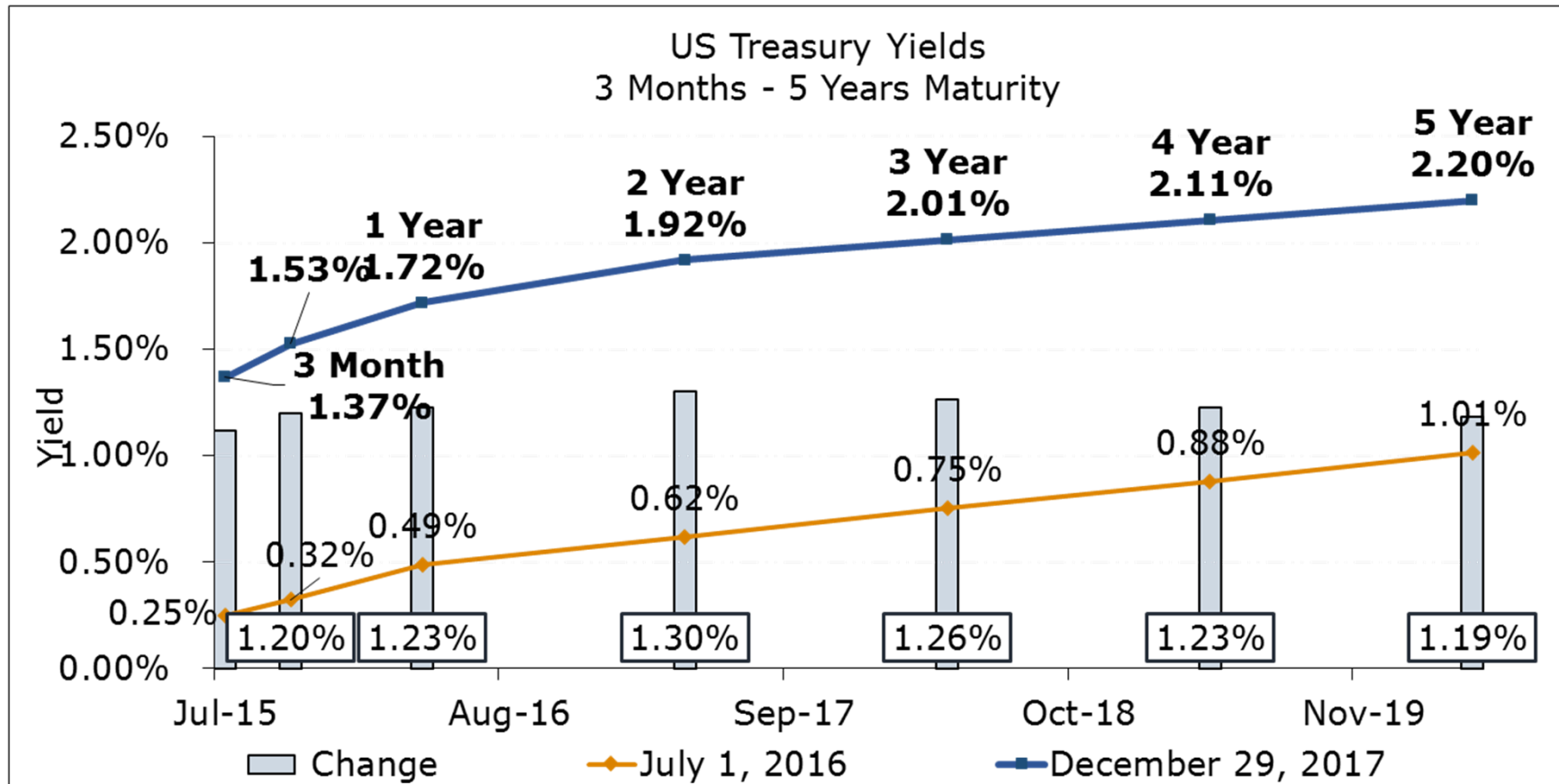
Investment Decisions – Flat Yield Curve Scenario 1



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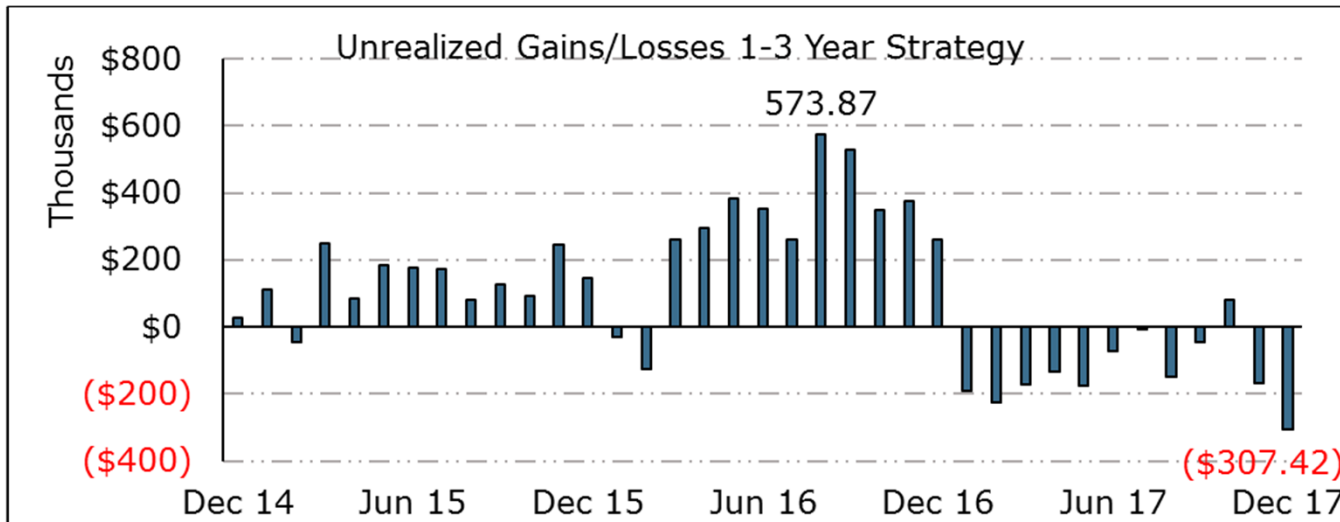
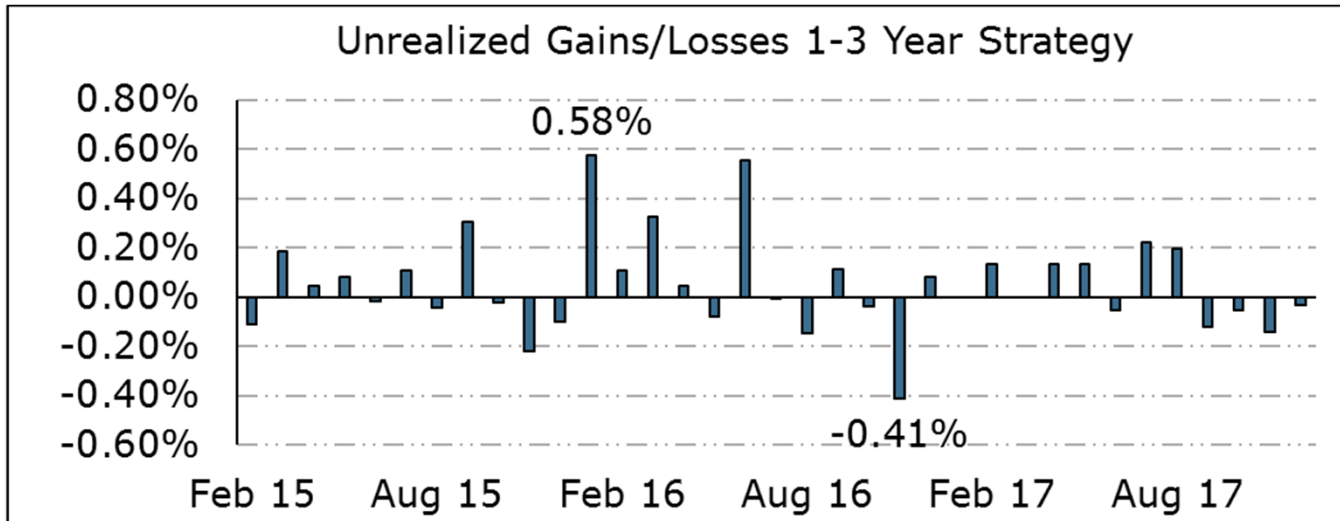
Investment Decisions – Flat Yield Curve Scenario 2



Source: Bloomberg

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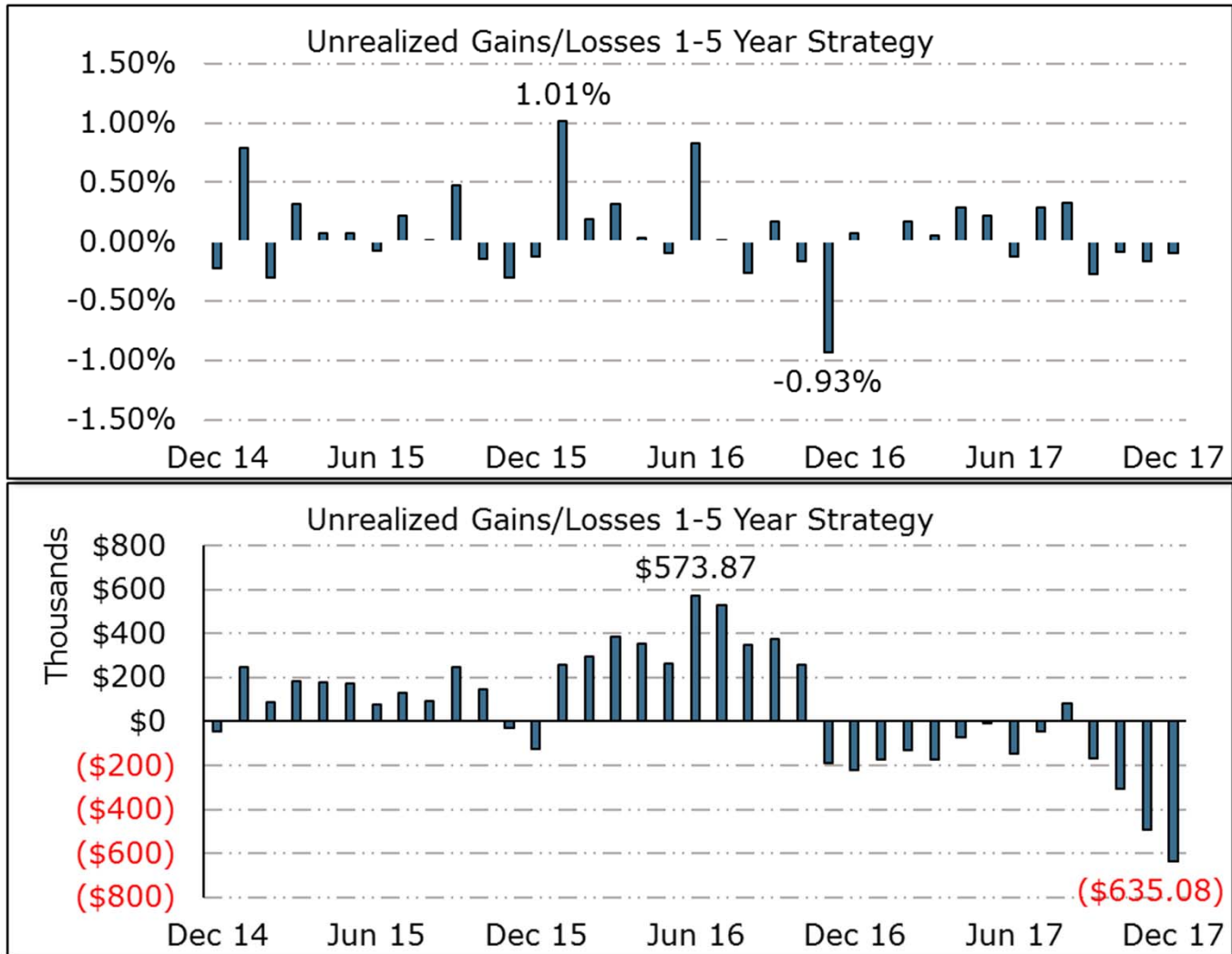
Mark to Market 1-3 Year Scenario



Source: Bloomberg

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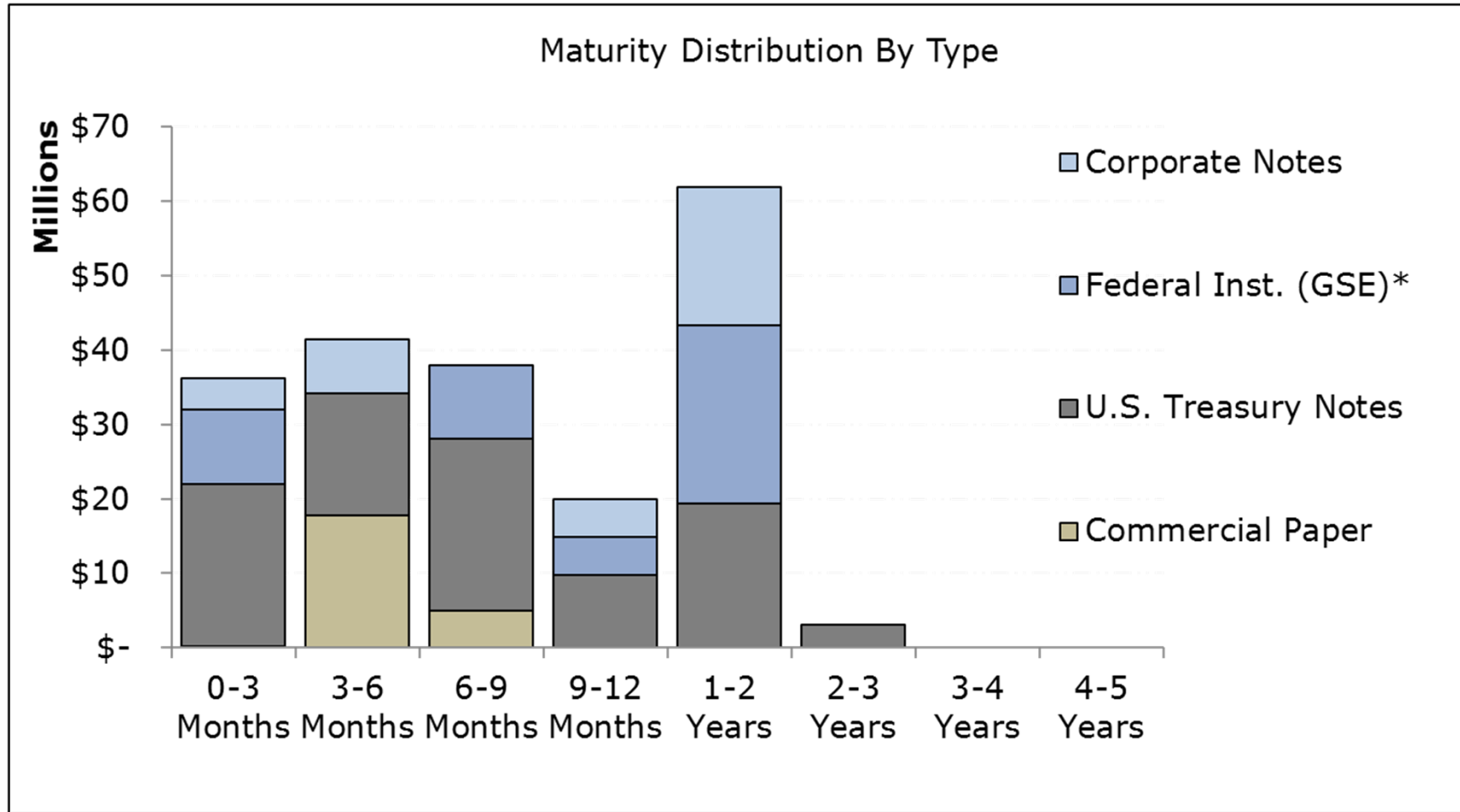
Mark to Market 1-5 Year Scenario



Source: Bloomberg

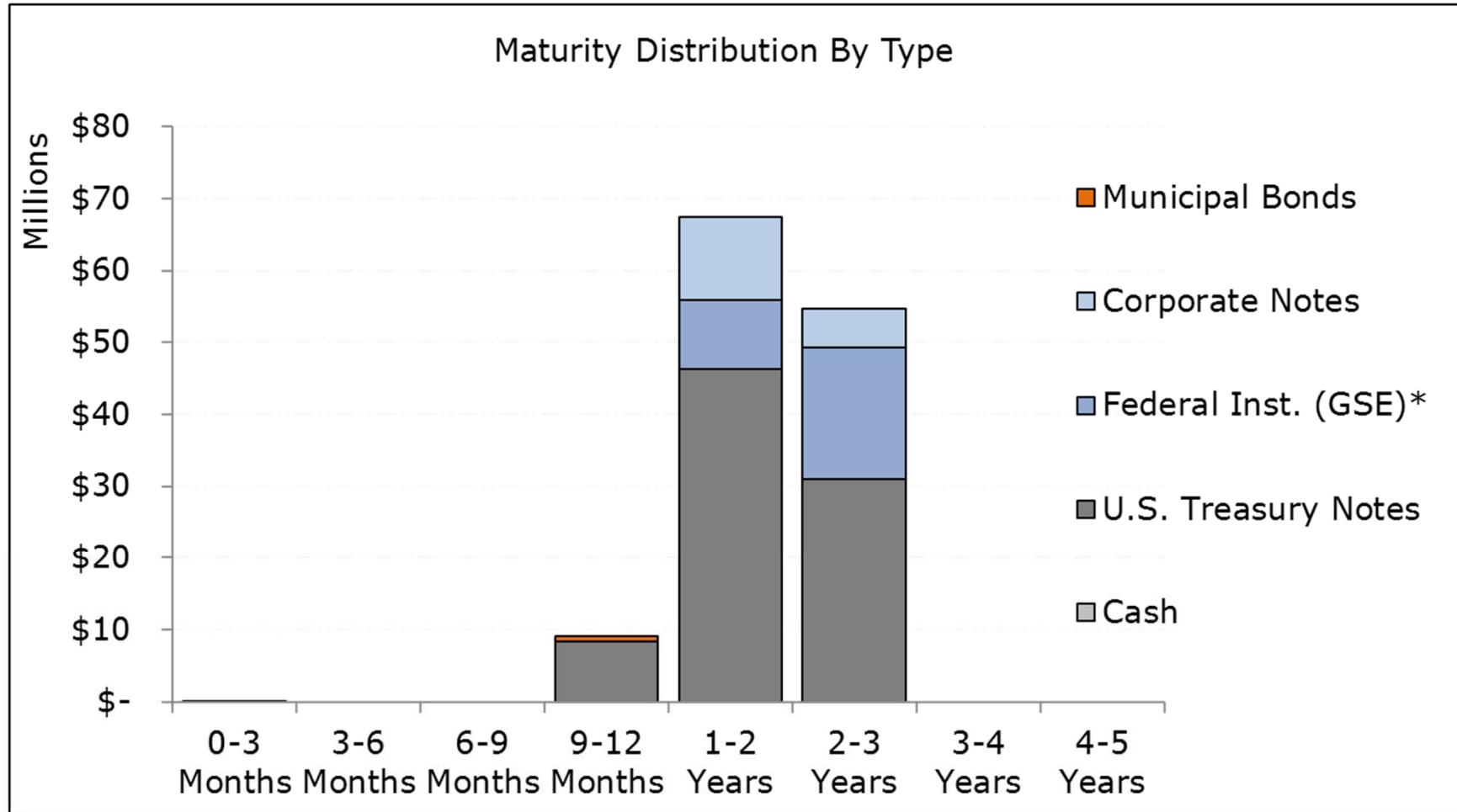
Benchmarks are provided for illustrative purposes only. Comparisons to benchmarks have limitations because benchmarks have volatility and other material characteristics that may differ from the portfolio. Also, performance results for benchmarks do not reflect payment of investment management/incentive fees and other fund expenses. Because of these differences, benchmarks should not be relied upon as an accurate measure of comparison.

Enhanced Cash Sample Portfolio



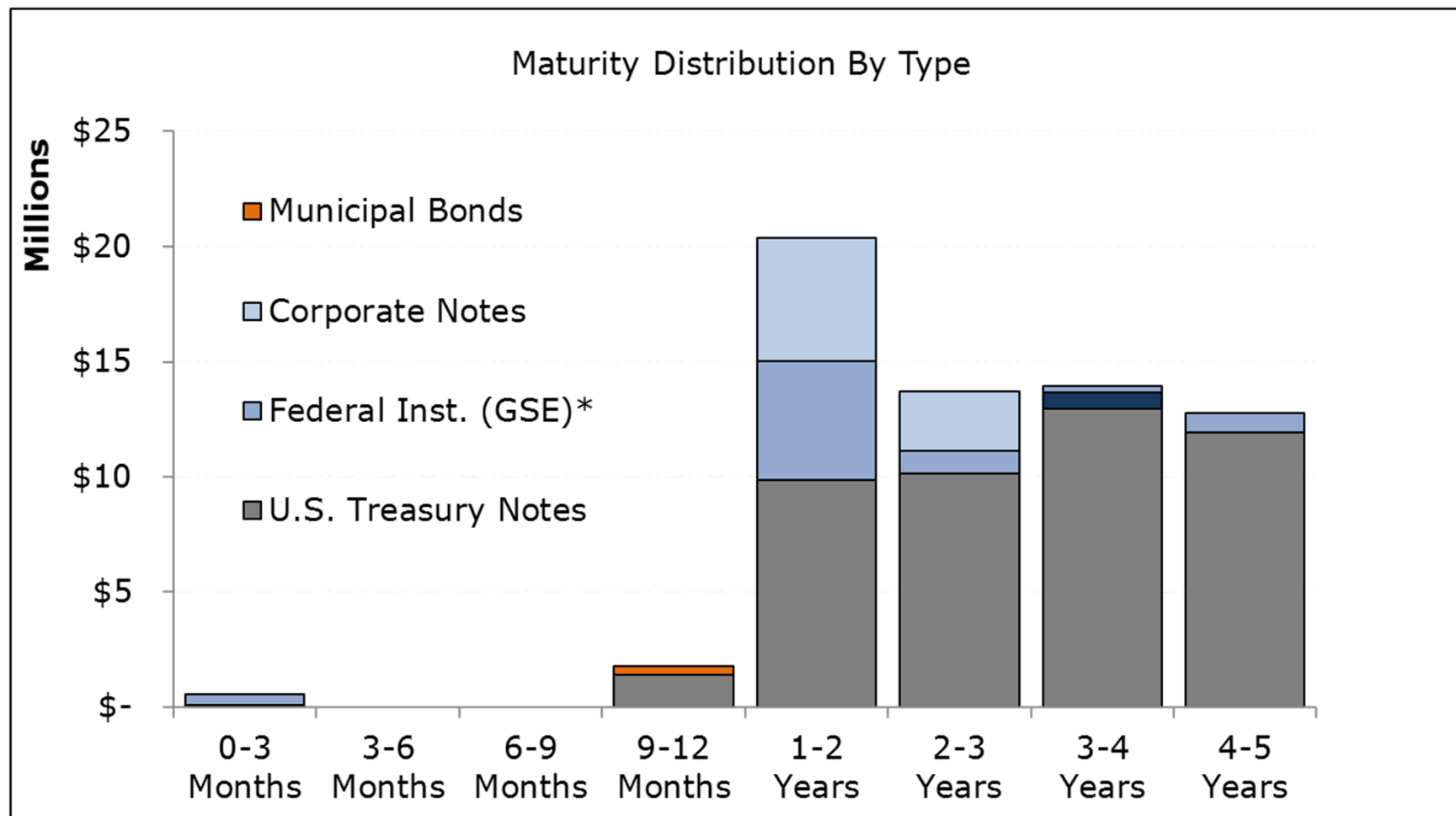
Sample portfolios are provided for illustrative purposes only. Comparisons to actual portfolios benchmarks have limitations because portfolios have volatility and other material characteristics that may differ from another portfolio. Also, performance results for benchmarks and/or portfolios do not reflect payment of investment management/incentive fees and other fund expenses. Because of these differences, benchmarks should not be relied upon as an accurate measure of comparison.

1-3 Year Sample Portfolio



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1-5 Year Sample Portfolio



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