



# 10-Year Treasury Yield

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## **Executive Summary**

The paper focuses on the function of the U.S. Department of Treasury, Treasury bills, notes and bonds, the 10-year Treasury note and yields, and the Federal Reserve's connection to the interest rate. This paper also compares the 10-year Treasury rate to the S&P 500, Consumer Price Index, 15-year Mortgage rate, Moody's Corporate Bond, and the government shutdown. The Function of the Treasury provides useful information on how the department handles the governments' finances and fiscal policy. Research on Treasury bills, notes, bonds, and the main subject of our report- the 10-year Treasury yield- gives insight into how the yield is calculated and how they are affected by the economy. The report and analysis studies whether the interest rates on the 10-year Treasury yield and asset classes and economic indices have a significant correlation.

Being the Benchmark of all other interest rates, the 10-year Treasury yield is considered one of the safest investments, giving its investors and traders the confidence in economic growth. Backed by the U.S. Government and sold by the Treasury, this popular security drives other rates down while providing financial growth in a time of need. The three basic types of yield curves demonstrate the promise corporations and individuals have in these rates, so that economic predictions and market strategies can be gathered. Ten-year Treasuries have also been introduced in the new Quantitative Easing program and the nomination of Federal Reserve chair Janet Yellin.

By analyzing the 10-year Treasury yield versus these variables, simple and multiple regressions were formed. With the amount of variance and error in the model, the biggest factor for the Treasury yield rates was the 15-year mortgage rate, while the worst was the government shutdown. Most variables created an appropriate model for the 10-year Treasury yield . We now have a better understanding of how debt in the U.S. economy works with strong regressions and analysis. The future of the 10-year Treasury yield will be monitored as new policies are created in order to grow the economy.

## **Function of The United States Department of Treasury**

The United States Department of Treasury, or the Treasury, is an executive department of the U.S. government established in 1789 by Congress. From the website of the U.S. Department of Treasury, their mission is “to maintain a strong economy and create economic and job opportunities.”<sup>1</sup> They do this by “promoting the conditions that enable economic growth and stability at home and abroad, strengthen national security by combating threats and protecting the integrity of the financial system, and manage the U.S. Government’s finances.”<sup>1</sup> The role of this department is to manage “Federal finances once the President, Congress and the Office of Management and Budget set fiscal policy.”<sup>2</sup> The Treasury has many functions, including coin and money creation, collecting federal taxes, supervising banks and thrift institutions, and advising “the Office of the President on financial, trade and tax policy.”<sup>2</sup> Another major function of the U.S. Department of Treasury is financing the United States’ debt by issuing Treasury bonds, notes and bills.<sup>2</sup>

## **Treasury Bonds, Bills and Notes**

Treasury bonds, bills and notes, which are sold by the U.S. Treasury department, are seen as the “safest investment in the world” due to the low risk of the U.S. defaulting on their debt, thus having lower interest rates than other investment opportunities.<sup>3</sup> These treasuries are sold at an auction both by the Treasury and on the secondary market. Treasury bills mature in one year or less.<sup>3</sup> Treasury bills are like zero-coupon bonds because they do not pay interest prior to maturity and instead are sold at a discount to their face value at auction. The discount on the bill becomes the positive yield at the time of maturity.<sup>4</sup> Treasury notes mature over a period of a year or more, and are issued in two, three, five and ten year terms. Treasury bonds were first introduced in 2006 and mature over a period of twenty or thirty years. Treasury notes and bonds pay a fixed coupon every six months plus the face value which is returned at

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<sup>1</sup> About. (2011, February 22). *Duties & Functions of the U.S. Department of the Treasury*. Retrieved December 8, 2013, from <http://www.treasury.gov/about/role-of-treasury/Pages/default.aspx>

<sup>2</sup> Amadeo, K. (n.d.). U.S. Department of Treasury. *About.com US Economy*. Retrieved December 8, 2013, from <http://useconomy.about.com/od/governmentagencies/p/Treasury.htm>

<sup>3</sup> Amadeo, K. (n.d.). What Are Treasury Bills, Notes and Bonds?. *About.com US Economy*. Retrieved December 8, 2013, from [http://useconomy.about.com/od/bondsfaq/f/Treasury\\_Bonds.htm](http://useconomy.about.com/od/bondsfaq/f/Treasury_Bonds.htm)

<sup>4</sup> Clark, K. (n.d.). T-Bills - Guide to U.S. Treasury T-Bills. *About.com Saving for College*. Retrieved December 9, 2013, from [http://collegesavings.about.com/od/typesofinvestments/a/Treasury\\_T\\_Bill.htm](http://collegesavings.about.com/od/typesofinvestments/a/Treasury_T_Bill.htm)

maturity. The minimum investment is \$100, so that they become very applicable to individual investors.<sup>3</sup> Treasuries are also bought by dealers and brokers, corporations and foreign and international investors.<sup>5</sup>

### **10-year Treasury Note**

The 10-year Treasury note is a loan to the U.S. government that matures over ten years. The 10-year Treasury note is important because the yield, or rate of return, on these treasuries is the “benchmark rate” meaning it affects all other interest rates. Sold at an auction, the 10-year Treasury rate displays confidence investors have in economic growth.<sup>6</sup> Backed by a powerful and safe U.S. government and sold by the U.S. Treasury Department, it is a widely used debt instrument, and offers very little risk of a debt default.<sup>3</sup> Low Treasury rates will drive bank lending rates and all other interest rates down, which provides greater liquidity right when the economy needs it. Treasury rates move opposite bond prices which will be further analyzed and explained later. Because of the safety of the 10-year Treasury note, yields are lower than interest rates for other loans and bonds.<sup>6</sup>

### **Treasury Yields**

Treasury yields are generally described as the amount of money an individual makes on a government note or bond. They are “the return on investment, expressed as a percentage, on the debt obligations of the U.S. Government.”<sup>7</sup> Each Treasury security has its own yield, and the computations of each yield “depend on the face value, purchase price, and maturity of the issue.” The return on a Treasury note is equal to the face value multiplied by the interest rate on the coupon.<sup>8</sup> As stated above, the U.S. Treasury Department sells treasuries in auctions at a fixed face value and interest rate in order to pay for the U.S. debt. If the investor is willing to accept any yield, a non-competitive bid is used to purchase the Treasury where the investor is guaranteed the note desired at the full amount.<sup>4</sup> However, if the investor is

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<sup>5</sup> Fleming, M. (n.d.). Who Buys Treasury Securities at Auction? - Federal Reserve Bank of New York. *Who Buys Treasury Securities at Auction? - Federal Reserve Bank of New York*. Retrieved December 9, 2013, from [http://newyorkfed.org/research/current\\_issues/ci13-1/ci13-1.html](http://newyorkfed.org/research/current_issues/ci13-1/ci13-1.html)

<sup>6</sup> Amadeo, K. (n.d.). 10-Year Treasury Note and Rate. *About.com US Economy*. Retrieved December 9, 2013, from <http://useconomy.about.com/od/fiscalpolicydefinitions/p/10-Year-Treasury.htm>

<sup>7</sup> Treasury Yield. (n.d.). *Investopedia*. Retrieved December 9, 2013, from <http://www.investopedia.com/terms/t/treasury-yield.asp>

<sup>8</sup> Estimating Yields on Treasury Securities. (n.d.). *Federal Reserve Bank of New York*. Retrieved December 9, 2013, from <http://www.newyorkfed.org/aboutthefed/fedpoint/fed28.htmlry-yield.asp>

seeking a specified yield, a competitive bid must be placed through a bank or a broker. In this case, the bid can be accepted in the full amount, accepted at a lower amount, or denied. When demand is low, treasuries are sold below face value as investors are receiving the treasuries at a discount therefore receiving a higher yield. On the contrary, when demand is high, treasuries are sold to the highest bidder above face value and the investor will receive a lower yield.<sup>3</sup> Treasury yields change every day because investors generally do not hold them for the entire term and are then sold on the open market.

When there is high demand for Treasury products, the Treasury yields go down, so the bond values move in opposite directions of the yield. A higher demand means a price going above the face value, which lowers the yield. Yields also move opposite the bond prices. If bond prices drop, there is a low demand for treasuries.<sup>9</sup>

Corporate and individual interest rates increase directly with Treasury yields. An ultra-safe investment would be considered a fixed return on a bond, so a guarantee backed by the U.S. government makes a U.S. Treasury a safe investment. A high yield on a bond can attract an investor, as higher Treasury yields can also increase the value of the dollar by forcing the Treasury Department to pay for the higher rates. But for an individual dealing with Treasury yields, the greatest impact falls on fixed rate mortgages. As interest rates increase, bankers ask for more money on mortgages and Treasury yields rise. Once banks and lenders charge more, housing can become less affordable, which in turn depresses the economy and possibly a lower GDP.<sup>9</sup> Higher yields also correlate to a longer time frame on a Treasury product, and investors require a higher return because their money is tied up for a longer period of time. The higher the yield on 10 and 30 year treasuries, the more optimistic investors and traders become in the market. For instance, a much higher percent on a 30 year Treasury bond compared to a 1 year note shows that investors are optimistic about the product and economy, but also shows a positive sloping yield curve. Though predictions have noted that the yields could jump over 3 percent, this is still historically low.<sup>9</sup>

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<sup>9</sup> Amadeo, K. (n.d.). Treasury Yields. *About.com US Economy*. Retrieved December 9, 2013, from <http://useconomy.about.com/od/economicindicators/p/Treasuries.htm>

Internationally, foreign countries are a factor in keeping Treasury yields low. Big oil-producing countries and powerful nations like China and Japan buy Treasury products to keep economies operating. Buying treasuries affects the value of the dollar because if the U.S. cannot repay their foreign investors, fewer treasuries might be purchased.<sup>9</sup> Last year, the 10-year yield hit a low of 1.442 percent, its lowest since the early 1800s and occurred when investors moved money out of Europe into the stock market. During the 2008 financial meltdown, the 1 year note listed a yield of 4.38 percent, while the 10-year yield was 4.37, which depicts an inverted yield curve, and a prediction of a recession.<sup>9</sup> The reason why people tended to ignore the curve was because mortgage rates were still very low and housing remained appealing and affordable.

### **Treasury Yield Methodology**

The 10-year Treasury yield actually works through a Treasury yield curve methodology. The constant maturity Treasury rates include all the securities from the daily yield curve. The curve takes the security's time to maturity and relates it to "closing market bid yields on active traded securities in the over-the-counter market."<sup>10</sup> Obtained by the Federal Reserve Bank of New York, these market yields are calculated and read from the yield curve at the following maturities: 1, 3 and 6 months and 1, 2, 3, 5, 7, 10, 20, and 30 years. These four bills are taken from the 3:30 PM close of each trading day and the inputs are "their bond equivalent yields."<sup>11</sup> This certain method helps provide for a 10-year maturity even if a security does not even have 10-years remaining to maturity.<sup>10</sup> The methodology behind the Treasury yield curve explains that the curve is derived from a cubic spline function. The input is an on-the-run security, which typically trade close to par, is the knot of the algorithm, and the result is a par curve.<sup>11</sup> An on-the-run security is the most popular and frequently traded security, which are the most liquid and

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<sup>10</sup> Resource Center. (n.d.). *Daily Treasury Yield Curve Rates*. Retrieved December 8, 2013, from <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield>

<sup>11</sup> Resource Center. (2009, February 26). *Treasury Yield Curve Methodology*. Retrieved December 9, 2013, from <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/yieldmethod.aspx>

offer a slight premium.<sup>12</sup> There can be additional bid yields, but different bills, notes, and the 30 year bond are the most current inputs.<sup>11</sup>

There are three basic types of yield curves in the Treasury Department. A normal yield curve has a positive slope, which portrays investor's confidence in the economy.<sup>13</sup> Mortgage rates and other loans follow the yield curve, as a shorter mortgage can be a better solution as higher yield rates grow much steeper. A flat yield curve indicates slow growth and little changes in the Treasury rates across the graph. Flat yield curves might tell an investor that a longer mortgage is worth the investment. Lastly, an inverted yield curve occurs when shorter yields have higher percentages than longer yields. Investors demand more yield for the bills than the notes and bonds, which forecasts a recession.<sup>13</sup> Exhibit 1 further shows the slopes of the three yield curves on the same graph. The yield curve is important because it can help determine "the value that investors place today on nominal payments at all future dates" which is a "fundamental determinant of almost all asset prices and economic decisions." U.S. treasuries can be used to manage "interest rate risk, to hedge other interest rate exposures, and to provide a benchmark for the pricing of other assets."<sup>14</sup>

### **The Federal Reserve and the Treasury**

For the first week in the month of November, treasuries rose as Federal Reserve chairman nominee Janet Yellen said she would back the stimulus program as long as the economy remains "sluggish", which in turn will boost demand for debt.<sup>15</sup> The senate.gov website states that according to the "recent Treasury figures, the gross debt has increased \$6.1 trillion since 2009."<sup>16</sup> Yellen's view states

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<sup>12</sup> On-The-Run Treasuries. (n.d.). *Investopedia*. Retrieved December 9, 2013, from <http://www.investopedia.com/terms/o/on-the-runtreasuries.asp>

<sup>13</sup> Amadeo, K. (n.d.). Treasury Yield Curve. *About.com US Economy*. Retrieved December 9, 2013, from <http://useconomy.about.com/od/glossary/g/Treasury-Yield-Curve.htm>

<sup>14</sup> Gurkaynak, R., Sack, B., & Wright, J. (2007). The U.S. Treasury Yield Curve: 1961 To The Present. *Journal of Monetary Economics*, 54(8), 2291-2304.

<sup>15</sup> Walker, S. (2013, November 15). Treasuries Gains as Yellen Supports Bond-Buying Stimulus Plans. *Bloomberg.com*. Retrieved December 9, 2013, from <http://www.bloomberg.com/news/2013-11-15/treasuries-set-for-weekly-advance-as-yellen-boosts-stimulus-bets.html>

<sup>16</sup> Newsroom. (2013, October 13). Minority Press Releases\*. *United States Senate Committee on Banking, Housing and Urban Affairs : Newsroom*. Retrieved December 9, 2013, from [http://www.banking.senate.gov/public/index.cfm?FuseAction=Newsroom.MinorityNews&ContentRecord\\_id=A2B49](http://www.banking.senate.gov/public/index.cfm?FuseAction=Newsroom.MinorityNews&ContentRecord_id=A2B49)

that it is important not to remove support in a time where the economy is fragile and short term interest rates are close to zero.<sup>15</sup> 10-year Treasury rates went down by 2.75% from October 2013 to November 2013.<sup>17</sup> Yellen noted that she expected the interest rates to eventually rise, as rising rates mean lower bond prices. Because the current 10-year Treasury note is so low, “interest payments won’t be enough to ease the pain.” The bond market tends to be a less risky and painful road than stocks, therefore, they last for a long time.<sup>18</sup> The history of the 10-year Treasury yield can be seen on a timeline in Exhibit 2 with historical information that affected changes in the yield. Interest rates rose dating back from the Great Depression until 1981, when the 10-year Treasury note hit its highest yield at 15.84%, and were known as certificates of confiscation (17). One source, Andrew Wilson of Goldman Sachs asset management in London, projects to see the 10-year yields moving higher throughout the course of next year. Wilson noted that they might even grow as much as 100 basis points. The Fed has already purchased \$85 billion worth of treasuries and mortgage-back securities each month since the third quantitative easing to keep borrowing costs low.<sup>17</sup> Since the Fed announced that they will begin adjusting the Quantitative Easing policy, they, like always, use the ability to buy and sell treasuries to affect issues in the economy.<sup>18</sup> Quantitative Easing affects the 10-year Treasury because it increases lending and liquidity to grow the economy. The printing of money is used “directly and indirectly to purchase U.S. Government treasuries and Mortgage-backed securities.”

In Exhibit 3, the chart takes the 10-year U.S. Treasury yields with the duration of the four QE programs. The results show that the beginning programs led to increases in the Treasury yields.<sup>19</sup> However, Yellen noted in the Senate Banking Committee that in response to the QE’s overall ineffectiveness, she “defended the program, saying it had ‘made a meaningful contribution to economic growth and improving the outlook.’” The longer the program persists, the more the Fed must monitor

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14B-983B-C483-01C6-A2815EF96172

<sup>17</sup> Wall Street Journal- Marketwatch. (2013, December 8). 10 Year Treasury Note. *10\_YEAR Bond Quote*. Retrieved December 9, 2013, from [http://www.marketwatch.com/investing/bond/10\\_year](http://www.marketwatch.com/investing/bond/10_year)

<sup>18</sup> Waggoner, J. (2013, November 14). First Take: What's ahead in the Yellen years. *USA Today*. Retrieved December 9, 2013, from <http://www.usatoday.com/story/money/markets/2013/11/14/yellen-confirmation-hearing-analysis/3526773/>

<sup>19</sup> The Effect of Quantitative Easing - Advanced Wealth Advisors, LLC. (n.d.).*Academic Wealth Advisors*. Retrieved December 8, 2013, from <http://awadvisors.com/2013/02/11/the-effect-of-quantitative-easing/>

certain risks.<sup>20</sup> The graph shows that “government’s buying of treasuries made their prices fall.” It is relevant to note that Treasury yields decreased rapidly “during periods when the Federal Reserve wasn’t ‘in-the-market buying.’” QE3 has had little effect on Treasury yields. To conclude, QE can increase Treasury yields, and more buying of treasuries can lower their price.<sup>19</sup>

In expansionary policy the Fed buys Treasury notes and bonds which causes interest rates to fall, this increases investment spending, which allows for aggregate demand to rise, the result of this is real GDP rising and job growth. When the government uses contractionary monetary policy they sell Treasury, causing interest rates to rise so investment spending decreases, then causing aggregate demand decreases which leads to prices falling, so that inflation can decline.<sup>21</sup> The 10-year Treasury is a tool that Fed uses to help issues with the economy. Below we use regressions to test how other types of indices and economic data correlates with Treasury note yield.

### **Regression Analysis Overview**

This report analyzes the variables that influence the response of the interest rates for the 10-year Treasury note to other asset classes, and economic indices. The variables that are being tested are the S & P 500 index, the yield on Moody’s triple A bond index, the 15 year mortgage rate, the consumer price index, and whether or not there was a government shutdown within 6 months. The data is collected from monthly since March 1990. There are 266 months that are used in the data set because certain months were removed that could not be matched between all variables. The data analyzes whether the interest rate on 10-year treasuries can be accounted for by the variables. By analyzing the regression and the correlation of each variable with the response of interest rates we can try to understand how the variables relate to interest rates.

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<sup>20</sup> Cassidy, J. (2013, November 14). The Yellen Doctrine: Robust Growth Is the Priority, but Bubbles Matter. *The New Yorker*. Retrieved December 9, 2013, from <http://www.newyorker.com/online/blogs/johncassidy/2013/11/the-yellen-doctrine-robust-growth-is-the-priority-but-bubbles-matter.html>

<sup>21</sup> Campbell R. McConnell, Stanley L. Brue and Sean Flynn: *Macroeconomics*, 19th edition, Irwin McGraw-Hill, New York, 2011

We can measure the accurateness of the model by analyzing the amount of variance and error in the model. After concluding the effectiveness of the entire model we can determine what the most important factor that influences interest rates of the 10-year Treasury note. A quantitative test of the robustness of the model will tell us if there is “no relationship” and effectively giving us information on whether or not interest rates on the 10-year are affected by the variables.

### Simple Regression

For simple regression we are testing the relationship between each of the variables separately and the 10-year Treasury note interest rate. The first relation we will look at is the S&P index versus 10-year Treasury rate. To understand if the relationship is significant since 1990 we will first look at the relation since 1900. We used the Level of the S&P 500 even though it does not account for inflation as opposed to the return because the return does not follow a trend over time while the level does. That is why after analyzing the data since 1900 we start at 1990 for the rest of our model so that price level is not as much of an influential factor. The regression since 1900 can be seen below.

### Regression Analysis: Treasury Rate versus S&p

The regression equation is:

$$\text{Rate} = 0.0449 + 0.000006 \text{ S\&p}$$

Predictor	Coef	SE Coef	T	P
Constant	0.044919	0.003449	13.03	0.000
S&p	0.00000570	0.00000511	1.12	0.267

$$S = 0.0247119 \quad R\text{-Sq} = 1.1\% \quad R\text{-Sq}(\text{adj}) = 0.2\%$$

The R-sq value reveals that the amount of variation that can be explained by the model is only 1.1%. Based on this value one may conclude that the S&P and 10-year Treasury have no relationship and as one variable moves up or down the other has an unrelated path.

However, in our multivariable regression which is analyzed in a later section S&P has a p-value of .007 while here it has a much higher p-value of .267. A lower p-value close to 0 reveals that in the multivariable regression there is a higher correlation between S&P and the 10-year Treasury note from 1990 to 2012. We hypothesized that the relationship between the S&P and the 10-year Treasury must

have changed or that price level disrupts the results for the regression when it is created from 1900. That is why below we found the model for the S&P versus the Treasury since 1990.

### Regression Analysis: 10-year Treasury versus S&P

The regression equation is:

$$\text{Value} = 8.26 - 0.00324 \text{ SP}$$

Predictor	Coef	SE Coef	T	P
Constant	8.2631	0.2022	40.87	0.000
SP	-0.0032385	0.0001902	-17.03	0.000

$$S = 1.22403 \quad R\text{-Sq} = 50.7\% \quad R\text{-Sq}(\text{adj}) = 50.5\%$$

With a new R squared value of 50.7% we see an increase of about 50%. While 50.7% is not an extremely high level of explanation for the amount of variance in this new model the more significant aspect to pay attention to is the change in percent value. Over the past 113 years there has been no relationship between S&P and the 10-year Treasury. More recently the relationship between the two variables has increased. With a negative intercept value of -.00324 we can tell that there is a negative correlation between S&P and the 10-year Treasury, thus they are tending to move in opposite directions from each other. The conclusion we can make from these results is that over the past twenty years the model reveals that there more of a relationship between the two. As the interest rate rises less is invested into stocks and vice versa. While the model is not accurate enough to accept this as a general rule it is interesting to note. Exhibit 6 shows the S&P 500 dividend yield for 2013 compared to the 10-year Treasury note. For the first time this year, the yield on the 10-year Treasury note was at least equal to the S&P 500 dividend yield, until the bonds reversed and the yields went down. It is important to note that an event like this could possibly draw back investors in to Treasuries.<sup>22</sup>

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<sup>22</sup> Wall Street Journal- Marketwatch. (n.d.). 10-year Treasury yield matches S&P 500 dividend yield. *The Tell RSS*. Retrieved December 9, 2013, from <http://blogs.marketwatch.com/thetell/2013/05/29/10-year-treasury-yield-matches-sp-500-div>

## Consumer Price Index

Consumer price index measures the change in price of goods from the perspective of the consumer. CPI is used as one of the ways the government measures inflation. The monthly CPI can reveal how the buying power of the dollar has changed.<sup>23</sup> The regression below creates a model for how the 10-year Treasury rate response to CPI.

### Regression Analysis: 10-year Treasury rate versus CPI

The regression equation is:

$$\text{Value} = 14.5 - 0.0524 \text{ CPI}$$

Predictor	Coef	SE Coef	T	P
Constant	14.5280	0.2358	61.60	0.000
CPI	-0.052403	0.001286	-40.76	0.000

S = 0.663968    R-Sq = 85.5%    R-Sq(adj) = 85.4%

With an R-Squared value 85.5% we can see that 85.5% of the regression can be explained by the model. The intercept value says that for every decrease in CPI of .0524 the rate increased by 14.5%. The reason why inflation moves down as interest rates move up are due to the ways that the government uses monetary policies to control inflation. When the fed is using contractionary monetary policy the fed sells bonds which causes interest rates to rise. This decreases investment spending, causing aggregate demand to decrease which eventually leads to prices falling so inflation is decreased.<sup>21</sup>

### 15 Year Mortgage Rate

The mortgage market is another option for investors. Mortgage backed securities are a riskier option that may offer a higher return. While they are two different markets, yields on fixed mortgages vary depending on similar determinants to the Treasury yields. As seen in Exhibit 5, the 15-year fixed rate mortgage average in the U.S. has varied with that of the 10-year Treasury rate, both showing negative slopes. The r squared value of 94.8% further shows that the model created to test the response of 10-year Treasury interest rates based on mortgage rates a very good one. As the mortgage rate has increased by

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<sup>23</sup> CPI News Releases. (n.d.). U.S. Bureau of Labor Statistics. Retrieved December 6, 2013, from <http://www.bls.gov/cpi/>

.991% the 10 yield increases by 1%. Exhibit 5 displays how the two rates have moved in the same direction and how both interest rates and mortgage rates have fallen since 2008.<sup>24</sup>

### Regression Analysis: Treasury yield versus 15yr fixed mortgage rate

The regression equation is

Value = - 1.10 + 0.991 15yr fixed mortgage

266 cases used, 18 cases contain missing values

Predictor	Coef	SE Coef	T	P
Constant	-1.10181	0.08799	-12.52	0.000
15yr fixed mortgage	0.99094	0.01425	69.53	0.000

S = 0.355402 R-Sq = 94.8% R-Sq(adj) = 94.8%

### Moody's AAA Corporate Bond

Moody's AAA bond is used as an index to measure the change in interest rates for all of Moody's AAA corporate bonds. The government is able to set the interest rates for its Treasury bonds and influence the rate once they are on the market by buying and selling them but all of the corporate bonds with a Moody AAA rating are set by the corporations that are selling the bonds. Exhibit 4 compares Moody's AAA corporate bond yield to the 10-year Treasury Constant Maturity rate from 1990 to present and shows that the two rates vary directly with one another. The bonds in the Moody's AAA are considered to have little risk of default which makes them safe investments. The 10-year Treasury note has always been considered a safe investment because it is backed by the United States government. The regression for interest rates on the 10-year versus Moody's AAA has an r squared value of 94.2% which reveals that Moody's has been a good indicator for the 10-year Treasury note. However, since the United States has been in a recession, faith in the government and the bonds that the United States issues has changed. When looking at the regression for 2008-2012 the R-squared value has dropped to 86.5%. The 8% drop signifies that while before Moody's index could be used as an extremely reliable indicator because both display yields of safe bonds but during the recession a Model using Moody's is not as explanatory as it

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<sup>24</sup> Amadeo, K. (n.d.). What Is the Relationship Between Treasury Notes and Mortgage Rates?. *About.com US Economy*. Retrieved December 8, 2013, from [http://useconomy.about.com/od/economicindicators/f/Relationship\\_Between\\_Treasury\\_Notes\\_and\\_Mortgage\\_Rates.htm](http://useconomy.about.com/od/economicindicators/f/Relationship_Between_Treasury_Notes_and_Mortgage_Rates.htm)

has been in the past. Exhibit 4 displays how close the gap between Moody's AAA and the Treasury yield is from 2005-2008, then the two separate drastically and has stayed more separated since.

### **Regression Analysis: 10-year Treasury Value versus Moodys AAA Since 1990**

The regression equation is:

$$\text{Value} = - 2.48 + 1.17 \text{ Moodys}$$

Predictor	Coef	SE Coef	T	P
Constant	-2.4756	0.1139	-21.74	0.000
Moodys	1.17003	0.01727	67.74	0.000

$$S = 0.419438 \quad R\text{-Sq} = 94.2\% \quad R\text{-Sq}(\text{adj}) = 94.2\%$$

### **Regression Analysis:10-year Treasury rate versus Moodys AAA corporate bond index Since 2008**

The regression equation is:

$$\text{Treasury} = - 1.69 + 0.958 \text{ Moodys}$$

Predictor	Coef	SE Coef	T	P
Constant	-1.6935	0.2435	-6.96	0.000
Moodys	0.95837	0.04971	19.28	0.000

$$S = 0.287022 \quad R\text{-Sq} = 86.5\% \quad R\text{-Sq}(\text{adj}) = 86.3\%$$

### **Effect of a Government Shutdown**

To test if a government shutdown in the United States can be used as an indicator for 10-year Treasury Yield we used a dummy variable. A 1 was added to the data for the months within six months of the shutdown and 0's were used for the rest of the data. The regression analysis reveals an r-squared value of only 1.9%. After evaluating the insignificant results this model revealed we did more research and were able to discover why this model is not appropriate.

The data we used was responding to the fact that, "investors responded in unexpected ways the last time the government approached the debt ceiling in 2011. Back then, investors flocked to Treasury bonds as a safe haven, despite the fact that the turmoil was caused by concern about the future of those same bonds."<sup>25</sup> However because of the recent nervousness around the United States government this time people did not see U.S. Treasury bonds as so attractive so demand went down. We believe that there are

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<sup>25</sup> Popper, N. (2013, September 30). DealBook. *DealBook Markets Assess the Impact of a Federal Shutdown Comments*. Retrieved December 9, 2013, from [http://dealbook.nytimes.com/2013/09/30/markets-assess-the-impact-of-a-federal-shutdown/?\\_r=0](http://dealbook.nytimes.com/2013/09/30/markets-assess-the-impact-of-a-federal-shutdown/?_r=0)

many other lurking variables that affect the how people feel about the Treasury yield during certain times and that will predict how the demand is affected during a government shutdown.

### Regression Analysis: Treasury Yield versus Government Shutdown

The regression equation is:

$$\text{Treasury Yield} = 5.01 + 0.941 \text{ Government Shutdown}$$

Predictor	Coef	SE Coef	T	P
Constant	5.0073	0.1068	46.88	0.000
Government Shutdown	0.9407	0.4039	2.33	0.021

S = 1.74209 R-Sq = 1.9% R-Sq(adj) = 1.5%

### Multiple Regression

#### Regression Analysis: Value versus CPI, Shutdown, 15yr Fixed Mortgage, Moody's and S&P

The regression equation is:

$$\text{Value} = 0.962 - 0.00648 \text{ CPI} + 0.205 \text{ Shutdown} + 0.721 \text{ 15yr fixed mortgage} + 0.157 \text{ Moodys} - 0.000238 \text{ SP}$$

266 cases used, 18 cases contain missing values

Predictor	Coef	SE Coef	T	P
Constant	0.9616	0.5233	1.84	0.067
CPI	-0.006476	0.001925	-3.36	0.001
Shutdown	0.20513	0.09045	2.27	0.024
15yr fixed mortgage	0.72148	0.04896	14.74	0.000
Moodys	0.15654	0.06331	2.47	0.014
S&P	-0.00023806	0.00008793	-2.71	0.007

S = 0.302955 R-Sq = 96.3% R-Sq(adj) = 96.2%

### Multiple Regression

The multiple regression uses all of the variables to create one model of best fit for the response of the 10-year Treasury rate. This model follows the movement of six variables in correlation to the 10-year Treasury rate. Earlier in this analysis we explained how the Treasury rate is set by the government and how once it is in the market they buy and sell it to try to deal with issues in the economy. However the government is not able to set any rate they want because demand adjusts the rate once the note is being sold. That is why we tested other variables that we believe may affect rate of 10-year Treasury note.

While we know that the regression cannot tell us if the variables are what cause the change in Treasury, having information about the correlation of these variables with the Treasury can be valuable information

on how the Treasury moves in relation to other aspects of the U.S. economy. With an R-Square value of 96.2% our model does a good job of explaining the variance in the Treasury yield. The corresponding p-values reveal which variables can most confidently reject that there is no relationship between the variable and Treasury Yields. In our model the 15 year mortgage rate has a P-value of 0.00 which proves it is the most significant variable in our model while the shutdown dummy variable has the highest P-value of .024 suggesting that it cannot say that there is no relationship between it and the Treasury. The multivariable analysis becomes a powerful tool because five of the six of variables change in the United States as our economy changes and we originally believed the sixth being whether or not there is a government shutdown would correlate with the faith/demand in the Treasury bond. With 2008 recession just beginning to find relief we wanted to see how certain variables relate to a variable that is very central to our economy. By creating a model with all of the above variables together we are able to see how all of these variables are able to explain variation and with an R-squared value of 96.3% we believe our model provides well.

## Conclusion

This report provides both information and research analysis on the 10-year Treasury yield. To give an overall perspective of this security, the report reviews the United States Department of Treasury, Treasury bills, notes, and bonds, Treasury yields, the yield curve methodology and the effect on Treasury rates by Federal Reserve action. Data regarding the 10-year Treasury note can be a significant tool because it not only serves as a safe investment, but it shows how rates change through supply and demand, bond prices, and the value of the dollar. Through the exhibits, we can compare treasury yields with certain economic indices and what may have caused the rates to change, as well as determining the slope of the yield curve. Because the Treasury yield is a key percentage, analyzing its correlation with other variables can help to understand its relationship with other interest rates. The S&P 500 Index Price, the Consumer Price Index, the 15 year mortgage rate, Moody's AAA corporate bond rate, and whether or not there was a government shutdown were all tested versus the 10-year Treasury rate. With an R-squared value of 96.3% we conclude that using a collection of other asset classes and indices creates an appropriate model for the rate. Therefore, by understanding the U.S. debt and interest rate movements, these variables can provide valuable insight. The 15-year mortgage rate and the 10-year Treasury rate move in the same direction, and show that as interest rates rise, bankers ask for more money on mortgages which homeowners cannot afford. While approaching the debt ceiling in 2011, Treasury notes were less attractive, which led to a decrease in demand, but ultimately was not an appropriate model for regression. The 10-year Treasury yield remains low, risk averse and unattractive; however, the economy is encouraged to increase investment spending so that aggregate demand and GDP can grow. This yield is a useful contribution to the growth of the economy and even shows signs of rising yield rates as new quantitative easing policies are introduced.

## References

- 10-Year Treasury Constant Maturity Rate (DGS10). (2013, December 8). *FRED Economic Data- St. Louis Fed*. Retrieved December 9, 2013, from <http://research.stlouisfed.org/fred2/series/DGS10>
- About. (2011, February 22). *Duties & Functions of the U.S. Department of the Treasury*. Retrieved December 8, 2013, from <http://www.treasury.gov/about/role-of-treasury/Pages/default.aspx>
- Amadeo, K. (n.d.). What Are Treasury Bills, Notes and Bonds?. *About.com US Economy*. Retrieved December 8, 2013, from [http://useconomy.about.com/od/bondsfaq/f/Treasury\\_Bonds.htm](http://useconomy.about.com/od/bondsfaq/f/Treasury_Bonds.htm)
- Amadeo, K. (n.d.). U.S. Department of Treasury. *About.com US Economy*. Retrieved December 8, 2013, from <http://useconomy.about.com/od/governmentagencies/p/Treasury.htm>
- Amadeo, K. (n.d.). Treasury Yields. *About.com US Economy*. Retrieved December 9, 2013, from <http://useconomy.about.com/od/economicindicators/p/Treasuries.htm>
- Amadeo, K. (n.d.). 10-Year Treasury Note and Rate. *About.com US Economy*. Retrieved December 9, 2013, from <http://useconomy.about.com/od/fiscalpolicydefinitions/p/10-Year-Treasury.htm>
- Amadeo, K. (n.d.). Treasury Yield Curve. *About.com US Economy*. Retrieved December 9, 2013, from <http://useconomy.about.com/od/glossary/g/Treasury-Yield-Curve.htm>
- CPI News Releases. (n.d.). *U.S. Bureau of Labor Statistics*. Retrieved December 6, 2013, from <http://www.bls.gov/cpi/>
- Cassidy, J. (2013, November 14). The Yellen Doctrine: Robust Growth Is the Priority, but Bubbles Matter. *The New Yorker*. Retrieved December 9, 2013, from <http://www.newyorker.com/online/blogs/johncassidy/2013/11/the-yellen-doctrine-robust-growth-is-the-priority-but-bubbles-matter.html>
- Clark, K. (n.d.). T-Bills - Guide to U.S. Treasury T-Bills. *About.com Saving for College*. Retrieved December 9, 2013, from [http://collegesavings.about.com/od/typesofinvestments/a/Treasury\\_T\\_Bill.htm](http://collegesavings.about.com/od/typesofinvestments/a/Treasury_T_Bill.htm)
- Estimating Yields on Treasury Securities. (n.d.). *Federal Reserve Bank of New York*. Retrieved December 9, 2013, from <http://www.newyorkfed.org/aboutthefed/fedpoint/fed28.htmlry-yield.asp>

- FRED Graph. (n.d.). - *FRED*. Retrieved December 8, 2013, from [http://research.stlouisfed.org/fred2/graph/?utm\\_source=research&utm\\_medium=website&utm\\_campaign=data-tools](http://research.stlouisfed.org/fred2/graph/?utm_source=research&utm_medium=website&utm_campaign=data-tools)
- Fleming, M. (n.d.). Who Buys Treasury Securities at Auction? - Federal Reserve Bank of New York. *Who Buys Treasury Securities at Auction? - Federal Reserve Bank of New York*. Retrieved December 9, 2013, from [http://newyorkfed.org/research/current\\_issues/ci13-1/ci13-1.html](http://newyorkfed.org/research/current_issues/ci13-1/ci13-1.html)
- Fournier, H. (2013, May 19). Tag Archives: High Yield Bonds. *Bull Bear Barometer*. Retrieved December 9, 2013, from <http://bullbearbarometer.com/tag/high-yield-bonds-2/>
- Gurkaynak, R., Sack, B., & Wright, J. (2007). The U.S. Treasury Yield Curve: 1961 To The Present. *Journal of Monetary Economics*, 54(8), 2291-2304.
- Kimberly, A. (n.d.). What Is the Relationship Between Treasury Notes and Mortgage Rates?. *About.com US Economy*. Retrieved December 8, 2013, from [http://useconomy.about.com/od/economicindicators/f/Relationship\\_Between\\_Treasury\\_Notes\\_and\\_Mortgage\\_Rates.htm](http://useconomy.about.com/od/economicindicators/f/Relationship_Between_Treasury_Notes_and_Mortgage_Rates.htm)
- Newsroom. (2013, October 13). Minority Press Releases\*. *United States Senate Committee on Banking, Housing and Urban Affairs : Newsroom*. Retrieved December 9, 2013, from [http://www.banking.senate.gov/public/index.cfm?FuseAction=Newsroom.MinorityNews&ContentRecord\\_id=A2B4914B-983B-C483-01C6-A2815EF96172](http://www.banking.senate.gov/public/index.cfm?FuseAction=Newsroom.MinorityNews&ContentRecord_id=A2B4914B-983B-C483-01C6-A2815EF96172)
- On-The-Run Treasuries. (n.d.). *Investopedia*. Retrieved December 9, 2013, from <http://www.investopedia.com/terms/o/on-the-runtreasuries.asp>
- Results and Solutions. (2013, December 8). The Department of the Treasury. *Home*. Retrieved December 9, 2013, from <http://www.perc.net/profile/department-treasury/>
- Popper, N. (2013, September 30). DealBook. *DealBook Markets Assess the Impact of a Federal Shutdown Comments*. Retrieved December 9, 2013, from [http://dealbook.nytimes.com/2013/09/30/markets-assess-the-impact-of-a-federal-shutdown/?\\_r=0](http://dealbook.nytimes.com/2013/09/30/markets-assess-the-impact-of-a-federal-shutdown/?_r=0)

Reference for Business. (2013, December 8). *U.S. Treasury Bills*. Retrieved December 9, 2013, from <http://www.referenceforbusiness.com/encyclopedia/Thir-Val/U-S-Treasury-Bills.html>

Resource Center. (n.d.). *Daily Treasury Yield Curve Rates*. Retrieved December 8, 2013, from <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield>

Resource Center. (2009, February 26). *Treasury Yield Curve Methodology*. Retrieved December 9, 2013, from <http://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/yieldmethod.aspx>

Ro, S. (2013, April 23). CHART: An Annotated History Of The 10-Year US Treasury Note Since 1790. *Business Insider*. Retrieved December 9, 2013, from <http://www.businessinsider.com/the-10-year-us-treasury-note-since-1790-2013-4>

Steiner, S. (2010, June 18). Investing Blog. *The yield curve and what it means for CDs* Â« *Bankrate, Inc.*. Retrieved December 9, 2013, from <http://www.bankrate.com/financing/investing/the-yield-curve-and-what-it-means-for-cds/>

Treasury Yield. (n.d.). *Investopedia*. Retrieved December 9, 2013, from <http://www.investopedia.com/terms/t/treasury-yield.asp>

Wall Street Journal- Marketwatch. (n.d.). 10 Year Treasury Note. *10\_YEAR Bond Quote*. Retrieved December 9, 2013, from [http://www.marketwatch.com/investing/bond/10\\_year](http://www.marketwatch.com/investing/bond/10_year)

Wall Street Journal- Marketwatch. (2013, December 8). 10 Year Treasury Note. *10\_YEAR Bond Quote*. Retrieved December 9, 2013, from [http://www.marketwatch.com/investing/bond/10\\_year](http://www.marketwatch.com/investing/bond/10_year)

Wall Street Journal- Marketwatch. (n.d.). 10-year Treasury yield matches S&P 500 dividend yield. *The Tell RSS*. Retrieved December 9, 2013, from <http://blogs.marketwatch.com/thetell/2013/05/29/10-year-treasury-yield-matches-sp-500-dividend-yield-turning-tables-on-hunt-for-yield/>

Waggoner, J. (2013, November 14). First Take: What's ahead in the Yellen years. *USA Today*. Retrieved December 9, 2013, from <http://www.usatoday.com/story/money/markets/2013/11/14/yellen-confirmation-hearing-analysis/3526773/>

Walker, S. (2013, November 15). Treasuries Gains as Yellen Supports Bond-Buying Stimulus Plans. *Bloomberg.com*. Retrieved December 9, 2013, from <http://www.bloomberg.com/news/2013-11-15/treasuries-set-for-weekly-advance-as-yellen-boosts-stimulus-bets.html>

Walstad, W. B., & McConnell, C. R. (2012). *Macroeconomics*. New York, NY: McGraw-Hill/Irwin

WRDS. (n.d.). The Center for Research in Security Prices (CRSP). Retrieved December 8, 2013, from <http://wrds-web.wharton.upenn.edu.ezproxy.babson.edu>

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## Exhibits

Exhibit 1:

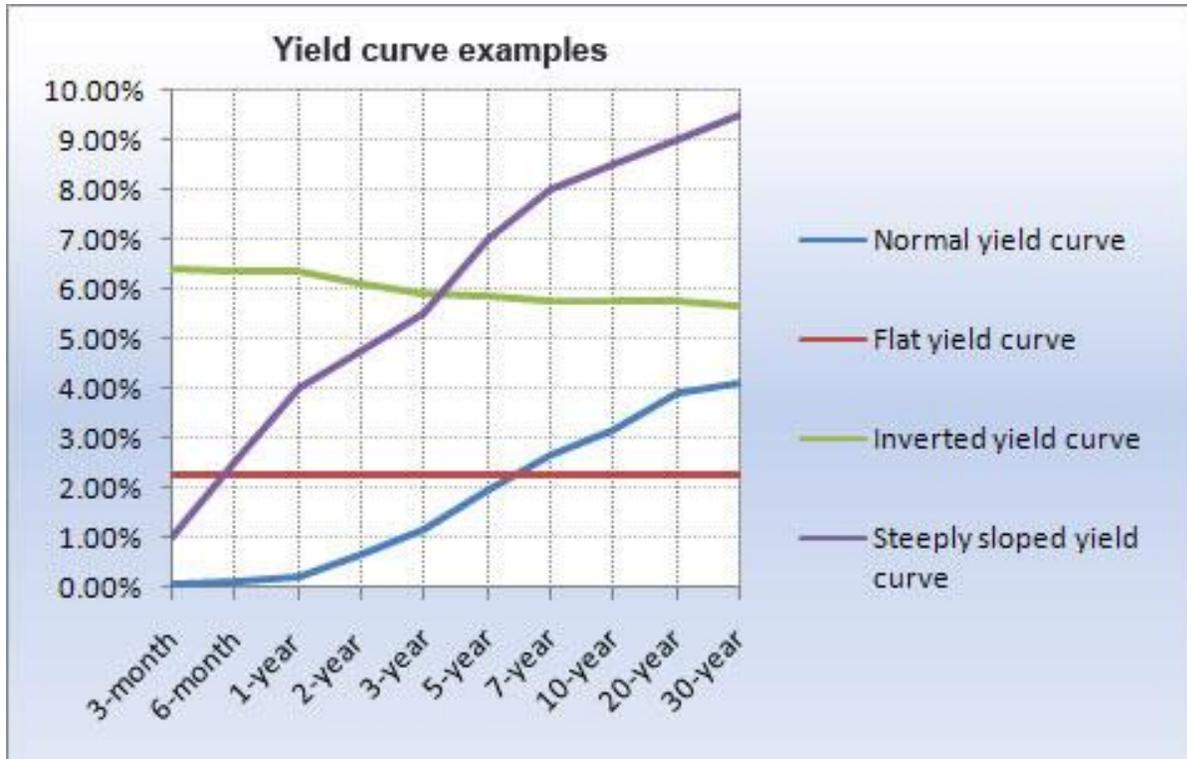
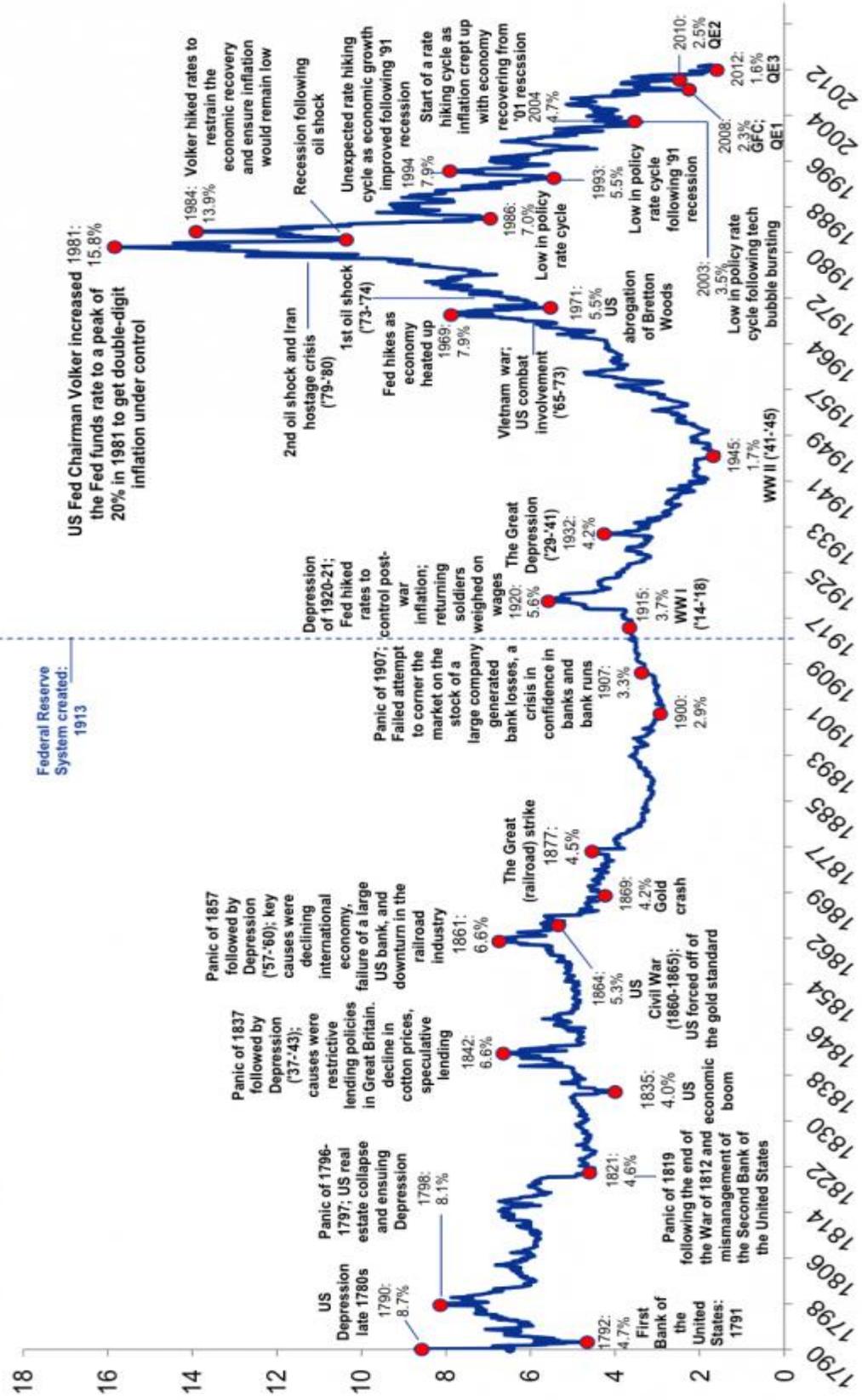


Exhibit 2:

# The long history of long (10-year US treasuries) yields



Source: Global Financial Database, Goldman Sachs Global ECS Research. Special thanks to Jose Ursua.

Exhibit 3:



Exhibit 4:

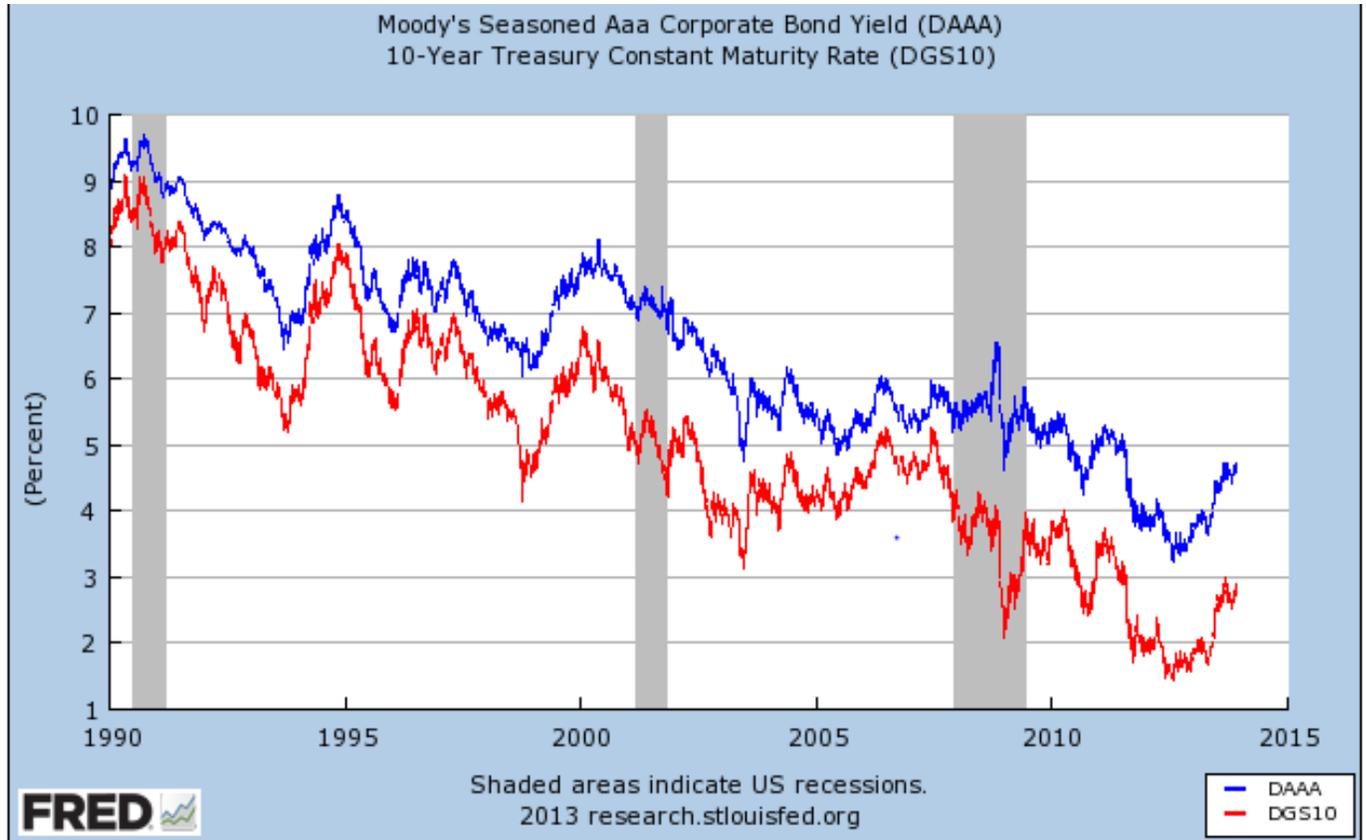


Exhibit 5:

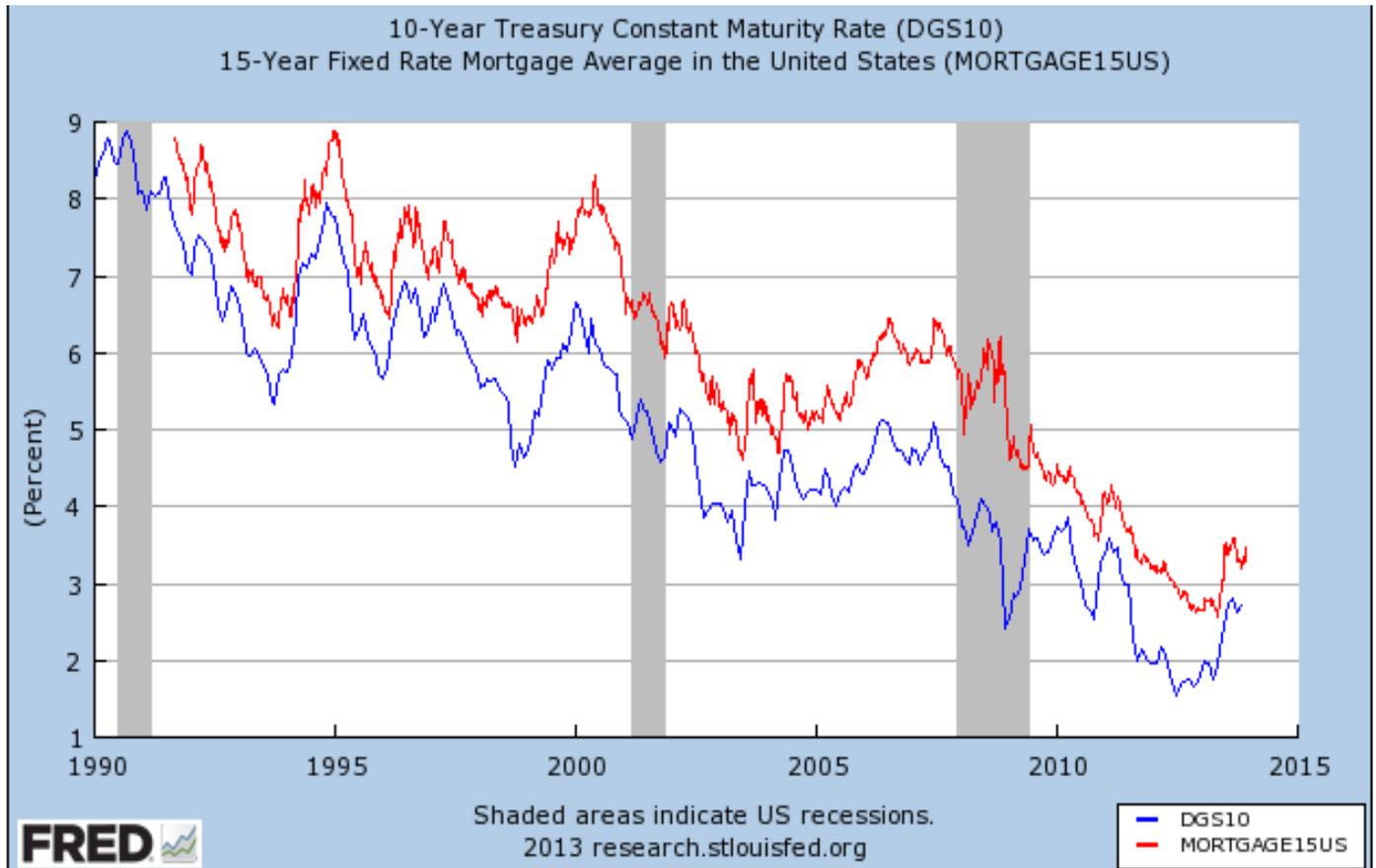


Exhibit 6:

## Yield switch

10-year Treasury note yield matches S&P 500 dividend yield for first time in 2013



Source: FactSet