Split Rock Capital Management

James Bowerman
Managing Partner
(646) 543-6819
www.splitrockcap.com

January 29th, 2017

To: All Investors
Re: Annual Letter 2016, Letter to Investors

Dear Investors:

In 2016 Split Rock Capital Management returned 12.19% net of fees.[1] Our annualized return since inception is 11.12% vs 12.65% for the S&P 500 during the same time period.

Year	S&P 500[2]	Split Rock *(Gross)*	Split Rock *(Net)*[3]
2015[4]	1.18%	(0.42%)	(0.47%)
2016	11.96%	13.19%	12.19%
Cumulative Return Since Inception	**13.28%**	**12.71%**	**11.66%**
Annualized Return Since Inception	**12.65%**	**12.11%**	**11.12%**

Please refer to the disclosures (1, 2, 3, and 4) at the end of this letter as well as the disclaimer on the page 16
All results have not been audited

This letter will be longer than future letters, as it outlines our market view for the next decade or two. After this introductory letter, we will likely *not* publish detailed market commentary until the general economic conditions change significantly. Furthermore, we are unlikely to comment on specific stocks in our portfolio. We are value investors and we are usually 100% long U.S. equities (zero or very low cash position). The rare exception to this rule is in times of extreme market overvaluation or undervaluation. We have never used leverage and are unlikely to do so in the future.

Our goal is to outperform the S&P 500 over a full market cycle (usually 5 to 7 years) while minimizing the likelihood of a permanent loss of capital. We view results over anything less than a full market cycle as largely irrelevant. With that said, we believe the current market environment is neither extremely overvalued nor undervalued. We also note that the risks of a permanent loss of capital are not the same as short-term volatility. Our firm will gladly trade higher short-term volatility for higher long-term expected returns.

Finally, bond yield and stock market data/prices are from Dec. 31, 2016. Debt level and G.D.P. figures are from Q3 2016.

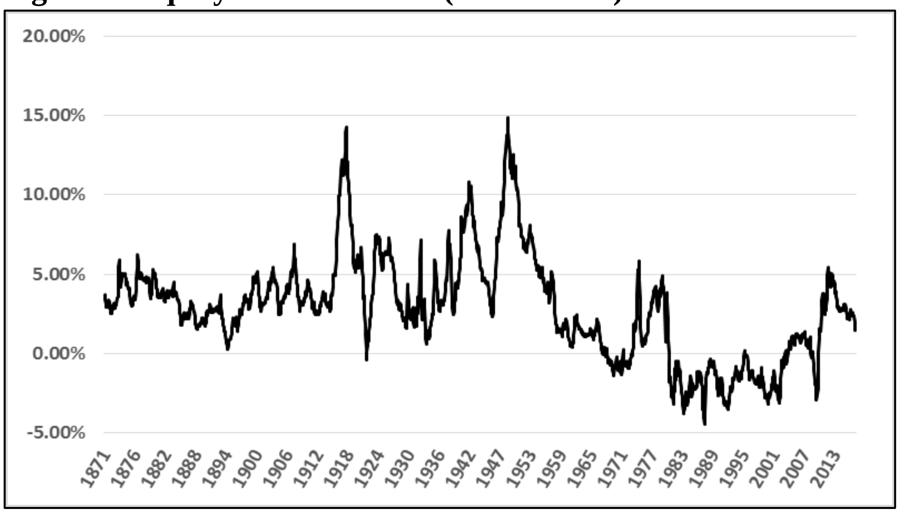
General Market Commentary

The stock market is currently in one of the longest bull markets in history. The general market commentary is that the current bull market has run its course and that stocks are overvalued. Absolute ratios such as price to earnings (P/E), price to book (P/B), and especially price to sales (P/S) all seem to indicate an expensive market in comparison to historical averages. We at Split Rock Capital Management take a slightly different view.

While looking at absolute metrics is important, we think a relative view of market valuations gives a more complete picture. Before explaining our rationale, we must first define some terms, the first of which is the "earnings yield" for the S&P 500. The earnings yield (E/Y) is defined as the inverse of the P/E ratio. As an example, given the current S&P 500 P/E ratio of about 26, the current S&P 500 E/Y is 1/26 = 3.85%. We should also note that, for a given level of earnings, *as stock values go up, E/Y goes down and vice versa*.

It is our view that the S&P 500 E/Y should be compared to the 10-year Treasury yield. Currently, 10-year Treasuries yield about 2.45%, and the spread between the E/Y and the Treasury yield is 3.85% - 2.45% = 1.4%. This spread is commonly referred to as the "equity risk premium". As this premium increases, stocks become relatively cheaper. As the premium decreases (and especially as it turns negative), stocks become relatively more expensive compared to bonds.[5] Figure 1 below, illustrates that the current stock market looks fairly valued compared to historical risk premiums.[6]

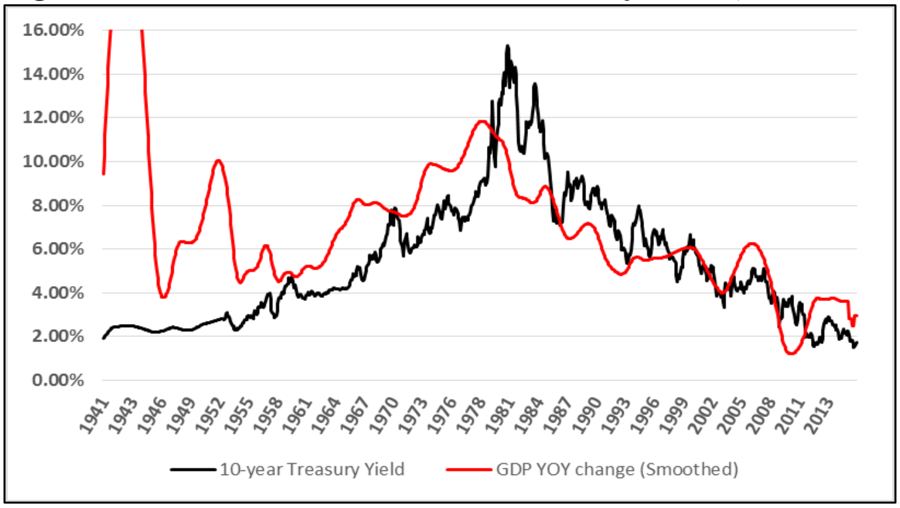
Figure 1: Equity Risk Premium (1871 – 2016)[7]



The astute reader will ask the next logical question: "What if interest rates rise in the near-term future? Assuming a relatively constant equity risk premium, if interest rates rise, won't stock prices have to drop?" We would answer in the affirmative to these questions and it is therefore a critical consideration in today's market environment. According to the above rationale, as interest rates rise, stock prices should fall.[8] For example, if Treasury rates rose from their current level of 2.45% to 20% over the next year, the likely result would be a collapse of stock prices (in order to maintain a relatively constant equity risk premium). Stated another way, it doesn't make sense for stocks to be earning 4% while a less risky Treasury bond is yielding 20%. In this scenario, stock prices must drop significantly and thereby increase the E/Y to a level where equity investors are compensated appropriately for the risks they are taking compared to investing in government bonds.

Now that we have shown the importance of future interest rates on stock prices, we will lay out our best *guess* as to the future trend of long-term interest rates. Over the long run, interest rates tend to track with G.D.P. growth. Since 1910, nominal G.D.P. growth has averaged about 6.5% per year. Interest rates over the same time frame have averaged about 4.9%. Figure 2, illustrates this correlation. For a further explanation of the components that make up nominal G.D.P., please see Appendix C.

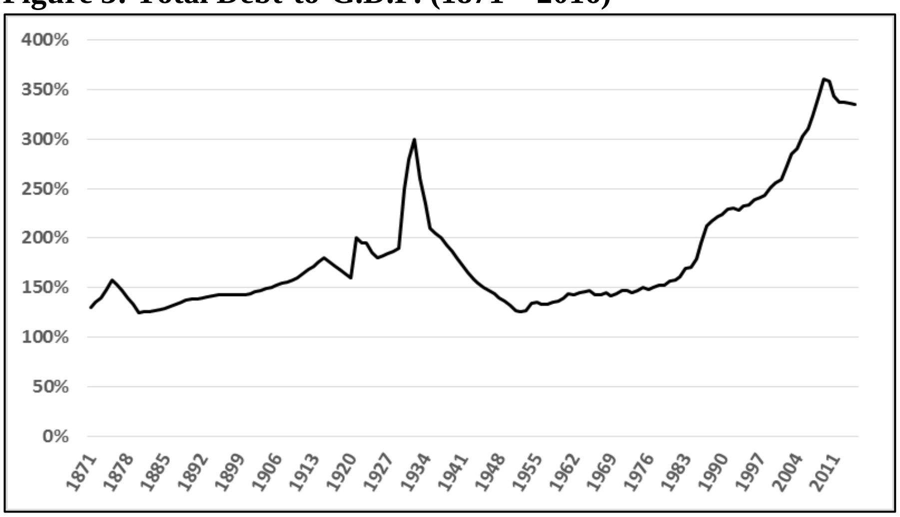
Figure 2: G.D.P. Growth vs. 10-Year Treasury Yield (1941 – 2016)[9]



While we cannot give any *definitive* answers as to what interest rates or G.D.P. growth will be in the future, we can explore *possible* shorter-term interest rate scenarios and how they might impact equity market valuations. We will list out three possible scenarios below, in order of most likely to least likely: 1) interest rates remain around or below 3% for the next 10 to 30 years; 2) interest rates rise slowly to around 4% to 5% over the next 10 to 30 years; and 3) interest rates quickly rise above 6% in the next year or two.

Scenario 1: Interest rates remain around or below 3% for the next 10 to 30 years -- our most likely scenario. The crux of this scenario centers on the long-term debt cycle. By focusing on both private and public debt as a percentage of G.D.P., the reader notices an approximately 50 to 70 year cycle. There are long periods of rising debt-to-G.D.P. followed by long periods of falling or stagnant levels of debt-to-G.D.P. We have shown in Figure 3 below, the historical values for the sum of private and public debt (i.e., "total debt") to G.D.P. since 1871.

Figure 3: Total Debt-to-G.D.P. (1871 – 2016)[10]



It is immediately obvious that the U.S. reached peak debt levels most recently in 2009, and before that in 1932 (during the depths of the Great Depression). While much could be written about these debt cycles, our main takeaway is that when debt is rising in relation to G.D.P., it tends to coincide with higher consumer confidence and increasing prosperity. Conversely, the deleveraging part of the cycle (i.e. decreasing debt-to-G.D.P.) tends to coincide with less consumer confidence, lower inflation (or even deflation) and a general preference for safe assets (bonds). Since 2009, the US has been in a moderate deleveraging cycle. Risk aversion has pushed up the prices of fixed income assets and has therefore lowered yields for bonds. At least historically, this risk aversion has had a prolonged psychological impact on investors.

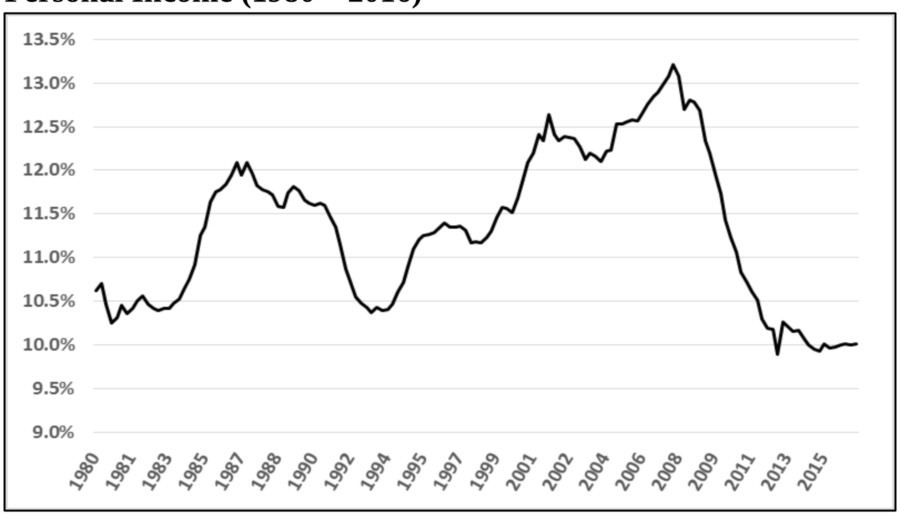
While the relationship cannot be calculated precisely, a correlation certainly exists between a change in debt and a change in G.D.P. When debt is rising in relation to G.D.P., it tends to increase G.D.P. growth and alternatively, as a society deleverages, it tends to have lower G.D.P. growth. Again, it is difficult to calculate exactly what G.D.P. growth would have been if we had not been deleveraging, but we are certain, as a result of the reduction in debt since 2009, at least some (and likely significant) negative impact to G.D.P. growth has occurred.

A corollary to the absolute levels of debt in a society is the cost of servicing this debt and how debt servicing costs can cause economic turmoil. As a simple example, the debt service payments on $100,000 in debt at 2% are much higher than on $100,000 in debt at 6%. As debt servicing costs reach higher and higher levels, interest rates usually have a cap on which they can rise. As soon as interest rates rise, debt servicing costs begin to consume a higher percentage of income and rates drop as economic activity slows (this is a self-correcting mechanism on rates assuming debt levels remain high). Conversely, we note that the high interest rates of the 1970s and early 1980s occurred when debt-to-G.D.P. ratios were low, therefore making the overall debt payments somewhat more manageable.

In Figure 4 below, we list the debt servicing costs for households since 1980. While this graph does not include all debt payments in the economy, it does give a *relative* look at how debt servicing costs have changed overtime. In the 1980s, debt levels were low but interest rates were high. In 2017, debt levels are high but interest rates are low. The result is that household debt servicing costs as a percentage of disposable income are approximately the same now as they were in 1980. 2007 was a perfect storm of unsustainably *high* debt servicing costs; that is high debt levels were combined with relatively high interest rates.

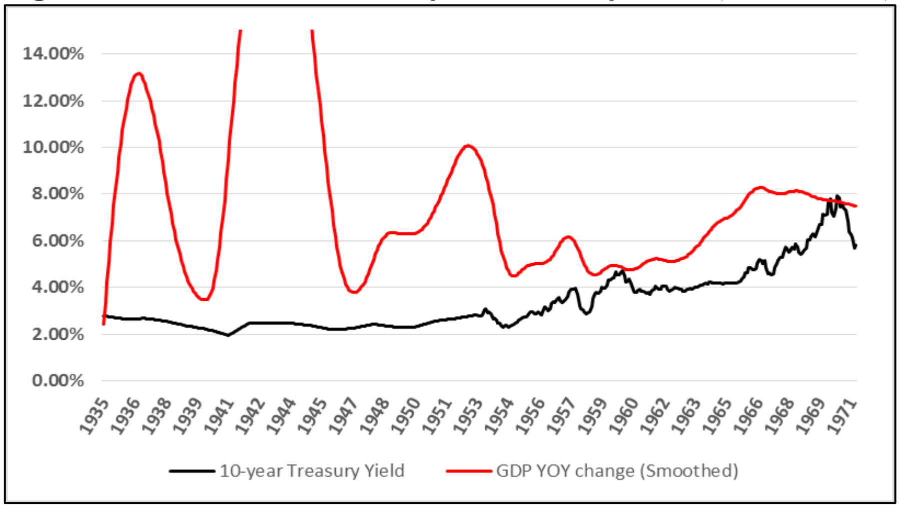
We also note that the current debt servicing costs are relatively low compared to the 1987, 2001 and 2007 peaks. This implies there is room for either rates to rise, debt-to-G.D.P. to rise, or some combination of both. With that said, the debt-to-G.D.P. ratio is about the same now as it was in 2006. The only difference is that in 2006, interest rates were about 5% vs. 2.45% today. Rates of approximately 3% to 4% are possible; rates consistently above 6% seem unsustainable at these debt levels.[11]

Figure 4: Household Debt Service Payments as a Percent of Disposable Personal Income (1980 – 2016)[12]



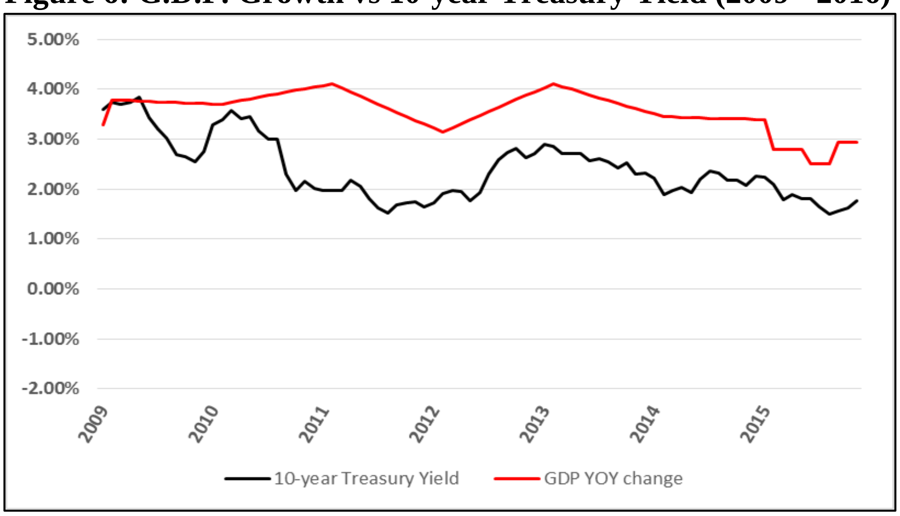
As a final note, we see in Figure 5 below, that 10-year Treasury yields stayed well below annual G.D.P. growth for nearly *40 years* after the Great Depression. Furthermore, Treasuries averaged less than 2.5% from 1941 to 1948, despite inflation of about 7% per year and G.D.P. growth of about 9% per year during the same time frame.[13] Real interest rates (defined as the 10-year Treasury yield minus the 36-month moving average of inflation) were negative for most of the 1941 to 1948 time period. Again, deleveragings tend to have lasting psychological impacts and tend to keep interest rates below what they otherwise would be for a given level of G.D.P. growth.

Figure 5: G.D.P. Growth vs 10-year Treasury Yield (1935 – 1971)[14]



While the discrepancy is less pronounced than in the years following the Great Depression, we notice that, since 2009, Treasuries have again consistently yielded *less* than the annual G.D.P. growth rate. This is another indicator of the aversion to risk that exists amongst investors today. As investors rush to buy safe assets such as bonds, they push bond yields lower. *The hangover from the financial crisis continues.*

Figure 6: G.D.P. Growth vs 10-year Treasury Yield (2009 - 2016)[15]



If the current cycle follows that of the Great Depression, we can expect moderate G.D.P. growth and low interest rates for years to come.[16] Under this scenario, we expect market multiples to remain around current levels or potentially increase. Assuming a 0% equity risk premium, 3% interest rates imply a P/E ratio of 1/.03 = 33![17] This simple model begins to break down as interest rates go lower, but it illustrates the potential expansion in multiples that is possible in an extended low interest rate environment.[18] If interest rates remain low, it is our view that a market P/E ratio of above 30 is not outside of the realm of possibilities at some point in the next decade or two.

Scenario 2: Interest rates rise slowly to around 4% to 5% over the next 10 to 30 years. Typically for rates to rise to the 4% to 5% level, we would expect G.D.P. growth to increase proportionally. Furthermore, an important consideration in a rising G.D.P. growth rate environment is the increase in earnings growth that typically accompanies a rise in G.D.P. growth. Therefore, while stock market multiples may fall as G.D.P. and interest rates rise, the absolute level of earnings of the S&P 500 (i.e., denominator of the P/E ratio) may rise just as quickly and thereby offset any decrease in stock market multiples. This may allow for satisfactory returns for the S&P 500 investor.[19]

As an illustration, the S&P 500 has current earnings per share of about $86 and a P/E ratio of 26. If over the next 10 years earnings were to increase at 5% per year and multiples were to *contract* from 26 to 20, the S&P 500 return from Jan. 1, 2017, to Jan. 1, 2027, would be approximately 23% (≈2% per year).[20] Adding in 2% per year from dividends gets us to about 4% per year total returns for the S&P 500. This hypothetical scenario shows that, while markets are not *under*valued, the expected market returns are comparable to other asset classes (i.e., 10-year Treasuries currently yielding less than 3%).

Scenario 3: Interest rates quickly rise above 6% in the next year or two. Although we view this as the least likely of the three scenarios, if interest rates were to quickly rise above 6%, it is likely that equity returns would be negative over the next few years. Under this scenario, it is likely that market multiples would contract at a much faster rate than the rate of earnings increase. This would be one of the worst-case scenarios for equity investors. We should note however, that in the two (and only) previous examples of 3.25% or lower U.S. 10-year Treasury yields, it took more than 20 years in the first instance (1899 to 1921) and more than 30 years in the second instance (1933 to 1966) for rates to rise above 5%! See Appendix B for a further look at previous rising interest rate environments and how unprecedented it would be for rates to rise quickly above 6%.

In summary, we note that the current equity risk premium gives equity investors a significant margin of safety. A cushion exists for either market multiples to increase or interest rates to rise before equity valuations begin to appear expensive.

It should also be noted that our general thesis is long-term in nature (10+ years), and that significant drawdowns are likely to occur in our portfolio over the next decade. We expect and welcome these drawdowns as it allows us to purchase securities at a cheaper price than would otherwise be possible.

As always, if you have any questions about our investment process or the explanations set forth in this letter, please feel free to reach out to me by email at bowermanj@splitrockcap.com or by phone at 646-543-6819.

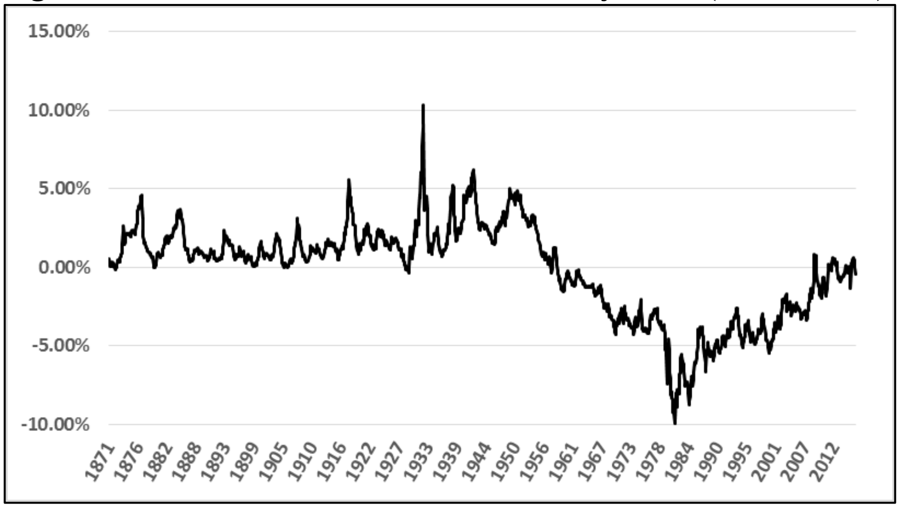
Sincerely,

James Bowerman
Managing Partner
Split Rock Capital Management, LLC
www.splitrockcap.com

Appendix A: Further Evidence of Cheap Equities? Dividend Yield vs 10-Year Treasury Yield

While our preferred metric for equity valuations is the spread between the E/Y and 10-year Treasury yields, we believe it is beneficial to examine a similar metric: the spread between the S&P 500 *dividend yield* and the 10-year Treasury. This metric shows that in the years following 2008, the S&P 500 dividend yield has been *higher* than the 10-year Treasury yield. The last time this occurred was in 1958!

Figure 7: Dividend Yield – 10-Year Treasury Yield (1871 – 2016)[21]

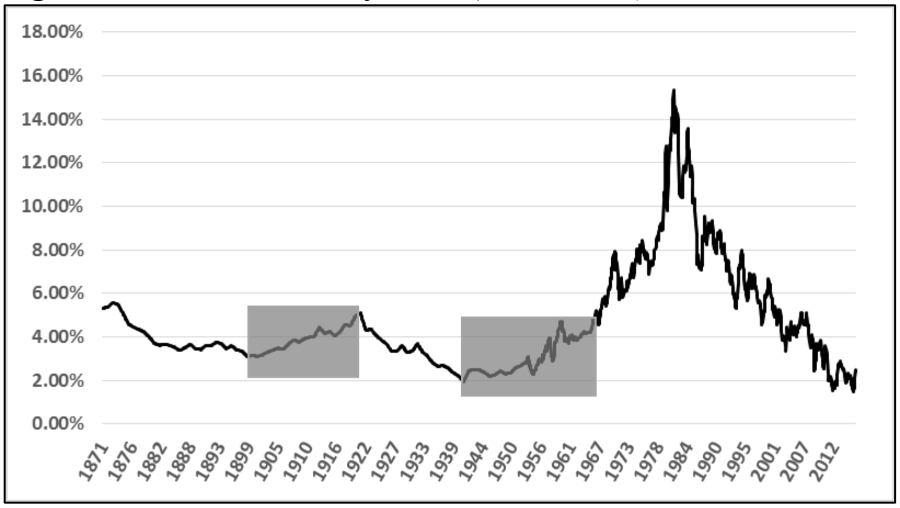


While the S&P 500 dividend can drop, we view any potential drop as temporary. The S&P 500 per share dividend dropped from $28.85 in September, 2008 to a low of $21.91 in March, 2010. However, the rebound was quick: the S&P 500 dividend was back to $28.32 in June, 2012 and is currently at about $45. If an investor is willing to wait 5 to 10 years, it is likely that stocks will return more than Treasuries. Volatility will likely be higher in the short-term, but investors are rewarded with higher expected long-term returns. This illustrates one of our central investing philosophies: we are perfectly willing to sacrifice short-term volatility for higher long-term expected gains.

Appendix B: A Historical Look at Past Interest Rate Rises

In this section we will examine various rising rate cycles for the 10-year Treasury. To begin, we present a historical view of interest rates in the United States since 1871. In addition, we have highlighted the two rising interest rate cycles we will examine in further detail later in this appendix.

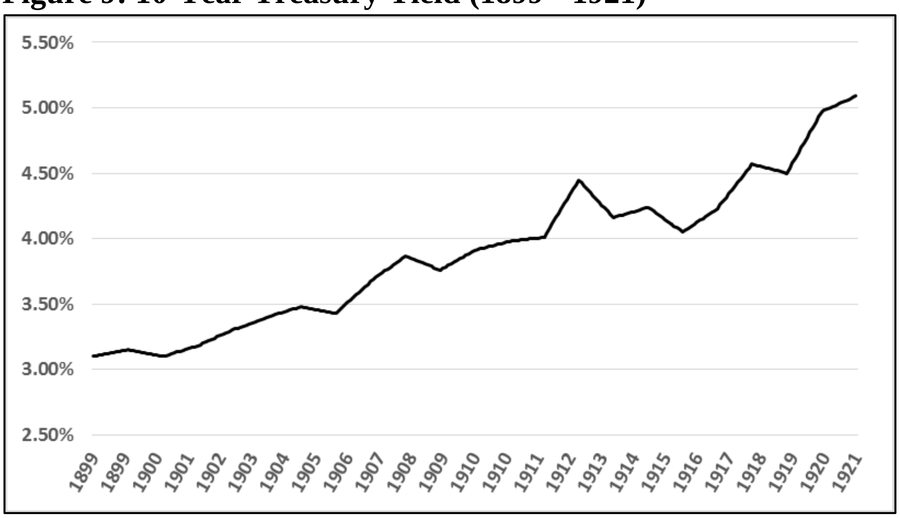
Figure 8: 10-Year Treasury Yield (1871 – 2016)[22]



Low Interest Rate Cycles:

1) ***1900 to 1921 Rising Interest Rate Cycle.*** From Figure 9 below, we note that interest rates reached a bottom of 3.10% in January of 1899. From this low, interest rates rose slowly to an intermediate cycle peak of 4.45% in January of 1913. Following this, interest rates dropped for a few years and then proceeded to rise to the cycle peak of 5.09% in January of 1921.[23]

Figure 9: 10-Year Treasury Yield (1899 – 1921)[24]

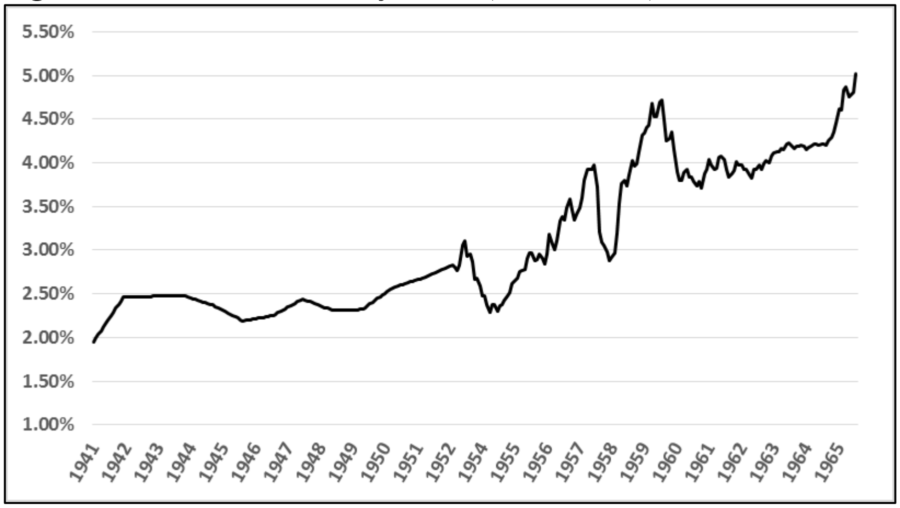


<u>It took more than 20 years for rates to rise less than two percentage points!</u> Of further note, the current bottom for interest rates for the post 2009 cycle is 1.37%. If a similar pattern to the 1899 to 1921 period were to occur today, it is likely that the future peak in yields would be around 4%, reaching this level sometime around 2030.

2) ***1941 to 1966 Rising Interest Rate Cycle.*** A low interest rate of 1.95% was reached in January of 1941. From this low, rates remained relatively flat and only briefly rose above 3% in 1953. From there, rates

dropped again for a few years only to begin a gradual uphill climb to above 5% in 1966. It should also be noted that, in the time period preceding this graph, interest rates consistently remained below *3.25%* for 23 years from 1933 to 1956!

Figure 10: 10-Year Treasury Yield (1941 - 1966)[25]



Furthermore, rates stayed consistently below *5%* for over 45 years from 1921 to 1966![26] This cycle is more analogous to the current cycle, as the bottom of rates during the post-depression era is closer to the current post-2009 low: 1.95% in 1941 vs 1.37% in 2016. Again, if a similar pattern to the 1941 to 1966 period were to occur today, it would imply that rates would not rise above 5% until 2041!

There are other factors that may keep U.S. interest rates low for the foreseeable future. Many of the world's largest economies, including China, Japan and the European Union have high debt levels and in many cases have lower future population growth estimates than the U.S. In the ideal scenario that the U.S. is able to successfully delever from current debt levels, the low population growth and high leverage still existing in the rest of the world would likely continue to put downward pressure on U.S. interest rates. The government bonds of the world's largest economies are in competition with one another. Unless a significant portion of these economies are able to delever simultaneously, any one country that reduces its debt burden is still likely to see lower than normal interest rates on its bonds. The global nature of the bond market and the reach for yield amongst fixed income investors around the world will likely create a ceiling on interest rates, even for countries that are able to lower their debt levels.

As a final note, we acknowledge that interest rates rose tremendously from 1966 to 1981, however this was only after a very slow rise in rates during the previous 25 years from 1941 to 1966. If a similar pattern were to occur today, we would expect interest rates to rise from 6% in the early 2040s to a peak of above 10% in the late 2050s. This would certainly not be ideal for equity investors, but it is far enough in the future that the 35 years of earnings growth that is almost certainly to occur from now until the early 2050s would outweigh any temporary contraction in P/E ratios that might happen a few decades from today.

Appendix C: Components That Make Up Nominal G.D.P.

The three main drivers of economic growth over the long run are 1) population growth, 2) productivity growth (commonly measured as "real G.D.P. per capita"), and 3) inflation. Figures 11 to 14 below illustrate that, on an annualized basis since 1910, population growth has averaged 1.2%, productivity growth has averaged 2.3%, and inflation has averaged 3.0%. Adding these three numbers together gives us our final graph: 6.5% nominal G.D.P. growth per year.[27]

Figure 11: Population (Thousands)

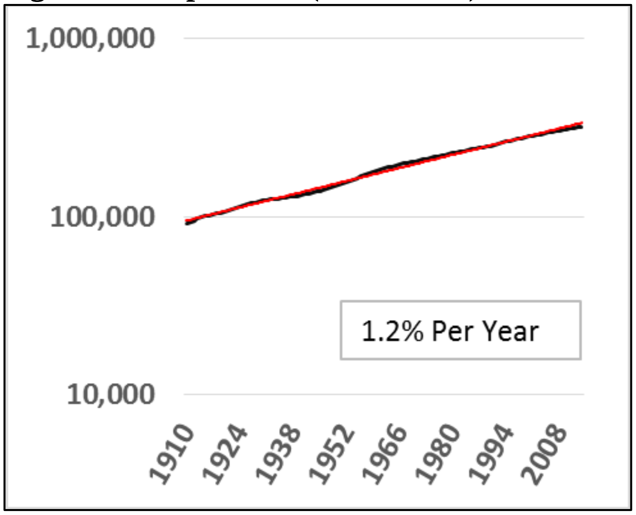


Figure 12: Inflation (Index)

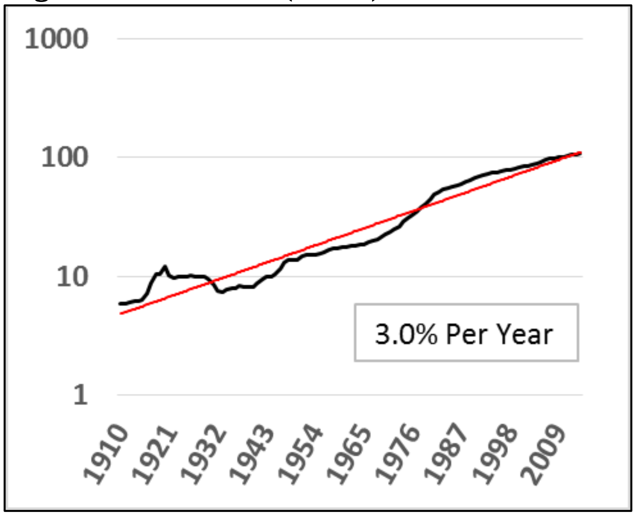


Figure 13: Real G.D.P. per Capita (2009 Dollars)

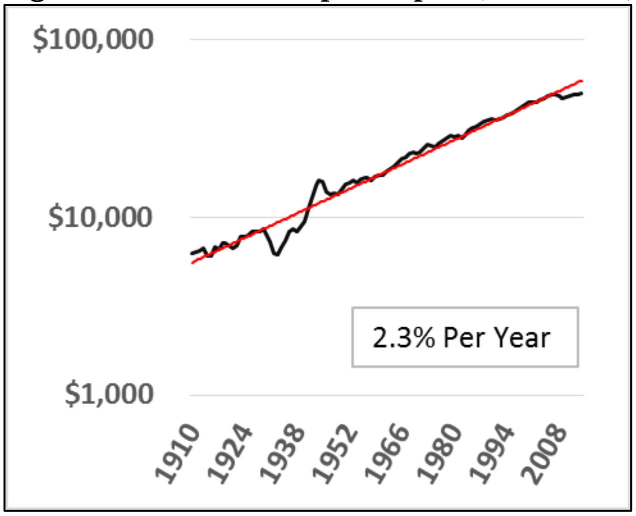
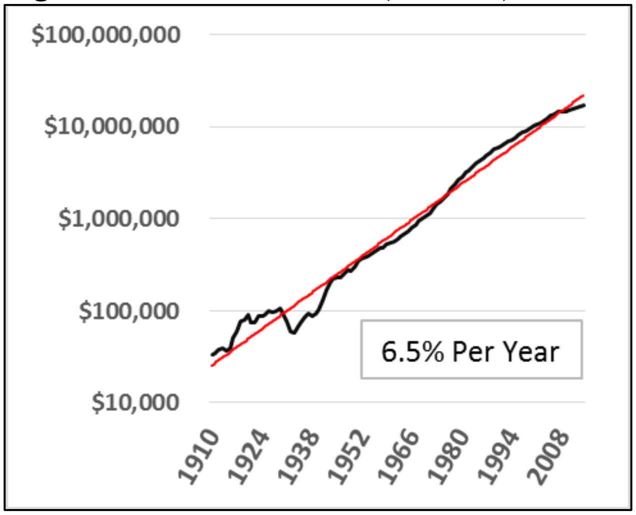


Figure 14: Nominal G.D.P. (Millions)[28]



The following are a few predictions on the future growth rates of the above graphs:

We guess that population growth will be in the 0.75% to 1% per year range going forward. Birth rates in the United States and around the world are predicted to be lower in the future. The United States could offset this decline in birth rates with a rationale immigration policy, but it remains to be seen whether rationale immigration policies will be implemented or whether harmful protectionist policies will be employed which would keep immigration rates low. In addition, an aging population will result in lower working age population growth going forward.

The United States has averaged about 3% annualized inflation since the founding of the Federal Reserve in 1913. We don't foresee any major change in this trend going forward and stay with a 3% per year inflation prediction over a multi-decade time frame. However, future inflation is the most unpredictable of the three metrics.

<u>Real G.D.P. per capita is a proxy for human ingenuity. It is the per-person wealth in a society that truly matters, and we are very bullish on human ingenuity going forward.</u> It is the most important of the four metrics listed. We predict this metric will average around 2% going forward, as it has for the last 200 years in the United States.

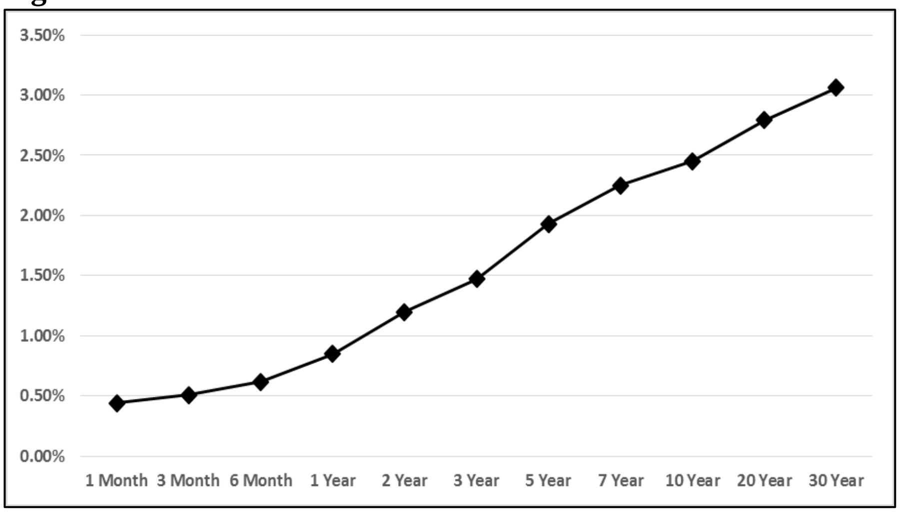
Adding these predictions together, we get a predicted long-term nominal *U.S. G.D.P.* growth rate of about 6%. Again, this is a long-term, 50 to 100 year prediction and is not a shorter-term G.D.P. forecast (10 to 30 years).

<u>Appendix D: The Federal Reserve Does Not Have Much Control over Long-Term Interest Rates</u>

One idea discussed by today's financial pundits is the notion that the Federal Reserve has significant control over Treasury yields. It is our view that, while the Federal Reserve does control short duration rates, it has little control over longer duration government bonds. Instead, we believe the market is in control of these longer-term Treasury yields.

As a quick background, the Treasury market consists of bonds of varying duration and yields. The graph of these durations and yields is commonly referred to as the "yield curve", an example of which is shown in Figure 15.

Figure 15: US Yield Curve[29]



As displayed above, the common pattern of rising yields for longer duration bonds is referred to as a "steep" yield curve. Under normal market conditions, an investor will demand a higher yield in return for locking up his money for a longer period of time. The only rate that the Federal Reserve explicitly sets is the "federal funds rate," which is a short duration, overnight bond rate. It has no explicit control over any other part of the yield curve (QE being an exception — more on that below).

Does the federal funds rate dictate yields across the yield curve? Specifically, can the Fed control long duration Treasury yields? While raising the federal funds rate would influence the short end of the yield curve (three-month treasuries, for example), it has progressively less impact as one moves further out on the yield curve. Rising short-term rates does not necessarily raise rates on the long end of the curve. This lack of connection between short rates and long rates was recently on display when, in late 2015, the Federal Reserve *raised* the federal funds rate from 0% to 0.25%, yet over the following six months the 10-year Treasury yield *dropped* from 2.24% to 1.37%.[30] Again, long-term bond yields are largely the result of projected future growth rates and debt levels, not the result of Fed policy. Instead it is the Fed that must usually follow the market, not the other way around.

This example also illustrates one of the central risks facing the market: that the Fed will raise short-term rates too quickly, which could result in a "flat" or even "inverted" yield curve. A "flat" or "inverted" yield curve occurs when short-term rates are equal to or *higher* than long-term rates. It is critical that the cost of money (as measured by short-term treasury rates) is appropriate for the current economic conditions. Rates that are too low relative to economic conditions will tend to cause inflation. Conversely, rates that are too high relative to economic conditions tend to cause recessions. It is our hope that the Fed is prudent about raising rates. We believe that the risks facing the market are currently asymmetric: the potential damage of a too-high fed funds rate is much greater than the potential damage of a too-low fed funds rate. Stated another way: <u>we are more worried about deflation than inflation</u>. Furthermore, we worry that the Federal Reserve does not fully appreciate the importance of private debt and its impact on the 50 to 70 year debt-to-G.D.P. cycle discussed earlier. The discussion of a strict, rules-based Fed policy concerns us because, as it stands currently, this rules-based policy would be unlikely to incorporate one of the most important economic indicators available. By ignoring both private debt and the long-term debt cycle, as well as treating the 2009 recession in a similar fashion to the more common 5 to 7 year business cycle recessions, the Fed's rules-based policy could raise rates too quickly. This could potentially trigger an unnecessary recession. The recession of 2009 and the depression of 1932 were caused by a contraction in total debt (also known as balance sheet recessions) and require interest rates to remain lower and for longer than in a standard business cycle recession.

What about Fed's "manipulation" of the bond market via QE? The idea that quantitative easing *permanently* reduced yields, even after the Fed stopped buying securities, doesn't make much sense to us. While QE did *temporarily* reduce long duration yields below what they otherwise would have been, we don't believe the lasting impact on yields was significant. QE3 ended in October 2014. If the market truly demanded higher yields, wouldn't two years be enough time for the market to normalize rates to a higher level? In fact, we saw the exact opposite: when QE3 ended in October of 2014 the 10-year Treasury yield was 2.30%. Over the next 21 months, the 10-year Treasury yield *dropped* to a cycle low of 1.37% in July of 2016. Our thesis is that rates are low, not because of QE or Fed manipulation, but instead because of the high levels of debt existing throughout the U.S. and world economies.

Footnotes and Sources:

[1] Assumes a 1% annual management fee. Not included in these calculations is an approximately $200 charge per account per year for fixed costs (minimum account fees, trading commissions, etc.).
[2] Includes dividends.
[3] Assumes a 1% annual management fee. Not included in these calculations is an approximately $200 charge per account per year for fixed costs (account fees, trading commissions, etc.)
[4] Partial year only; from inception date of 12/15/2015 to 12/31/2015.
[5] A unique and interesting case would occur if interest rates dropped to say 1% or even 0%. This would imply that, based on the equity risk premium, stocks should potentially trade at a P/E ratio of 100 or above. While this is correct in theory, it is our view that there are practical limits to this idea. While imprecise, we view the practical limits as somewhere between P/E ratios of 30 to 50. A further scenario to be aware of with low rates is the increasing impact on P/E ratios as rates get lower. If interest rates rise from 5% to 6% the implied P/E change (assuming 0% equity risk premium) goes from 20 to 16.6, or a 17% drop. However, if interest rates rise from 2% to 3% the implied P/E goes from 50 to 33.3, or a 33% drop! Rates rising from 1% to 2% would imply a 50% drop in the P/E ratio! These examples illustrate the substantial risks present in a low interest rates environment. A 1% rise in interest rates will impact prices much more if interest rates are low rather than high.
[6] This graph also shows that stocks are undervalued compared to bonds, when using data from the last 60 years. It may be more relevant to look at more recent data since the dynamics of stock market investing have significantly changed compared to the pre-1920's era. Stocks are more easily accessible than in past and therefore the equity risk premium may be lower going forward compared to the historical average.
[7] Data through 12/31/2016. Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls
[8] This assumes constant earnings. For simplicity, we will assume constant earnings for the remainder of this letter when performing similar calculations.
[9] G.D.P. figures use the past 36 month moving average ("smoothed"). Data through 9/30/2016. Sources: http://www.econ.yale.edu/~shiller/data/ie_data.xls ; https://www.measuringworth.com/usG.D.P./
[10] Source: http://finance.townhall.com/columnists/mikeshedlock/2013/10/11/how-does-us-debt-stack-up-globally-n1720978
[11] Technically, rising interest rates wouldn't have a direct impact on already existing debts. However, digging deeper into the structure of existing debts we see the average duration of federal debt is about 6 years and therefore every year, approximately 16% of current debt would be rolled over at the higher current rates. It would take a while, but rising rates would impact debt payments (unless debts are not rolled over or are paid down, both of which are massively deflationary). Source: http://www.numbernomics.com/nomicsnotes/?p=7375 ; https://www.treasury.gov/_layouts/SPDynamicResources/DownloadS3File.aspx?s3filename=current_production/current_TreasuryPresentationToTBAC.pdf&x=1485634556877
[12] Data through 12/31/2016. Source: https://fred.stlouisfed.org/series/TDSP
[13] Inflation measured by CPI. Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls
[14] G.D.P. figures use the past 36 month moving average ("smoothed"). Sources: https://fred.stlouisfed.org/series/G.D.P.A ; https://fred.stlouisfed.org/series/GS10
[15] Sources: https://fred.stlouisfed.org/series/G.D.P.A ; https://fred.stlouisfed.org/series/GS10
[16] It should be noted that G.D.P. growth after the great Depression experienced a large boost as the result of massive increase in military spending during World War 2. We are hopeful that we will avoid another war of such magnitude, and therefore expect G.D.P. growth going forward to be considerably less than the growth experienced during World War 2.
[17] A 0% equity risk premium is also known as the Fed Model. See more here: https://en.wikipedia.org/wiki/Fed_model
[18] As an example of this breakdown, if interest rates were 0%, the implied P/E ratio would be ∞, which clearly has no basis in reality.
[19] There is an interesting interplay between earnings growth, economic growth and interest rates. Earnings growth tends to rise with economic growth and therefore tends to move in the opposite direction as interest rates. However future stock returns are largely determined by earnings growth and market multiples (which we've seen are largely driven by interest rates). If interest rates rose, that would tend to suggest higher earnings growth. Therefore, even if market multiples contract from present levels because of higher interest rates, it would possibly be offset by a

corresponding rise in earnings growth; this could potentially lead to satisfactory and positive total returns for the S&P 500 going forward.

[20] Uses "SPTR500" ticker, and assumes approximately 2.1% dividend yield reinvested over the time frame

[21] Data through 12/31/2016. Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls

[22] Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls

[23] Inflation from 1899 to 1916 averaged slightly over 2%, however was quite volatile, with annual inflation ranging from -12% to 16%. As a result of military expenses for World War 1, inflation increased considerably after 1916 and averaged over 10% annually from 1917 to 1920. G.D.P. growth from 1899 to 1914 averaged about 4.5% annually. G.D.P. growth increased significantly starting in 1915, averaging over 10% annually from 1915 to 1921. For reference, from 2009 to 2016, average annual inflation was less than 1.5% and average annual G.D.P. growth was approximately 3.5%. Sources: http://www.econ.yale.edu/~shiller/data/ie_data.xls ; https://fred.stlouisfed.org/series/G.D.P.A : https://www.measuringworth.com/usG.D.P./

[24] Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls

[25] Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls

[26] Based on only first of month data. Source: http://www.econ.yale.edu/~shiller/data/ie_data.xls

[27] All growth rates are annualized, exponential trendline growth rates.

[28] Sources for Figures 11 – 14: https://www.measuringworth.com/usG.D.P./

[29] Yield curve data as of 12/30/2016. Source: https://www.treasury.gov/resource-center/data-chart-center/interest-rates/Pages/TextView.aspx?data=yield

[30] This may be an example of how the Fed can raise rates too quickly which in turn 'snuffs' out any economic recovery and therefore actually *lowers* long-term growth rates. Stated another way, this is a good example of how raising short-term interest rates can *lower* long-term interest rates

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