The S&P 500 P/E Ratio: A Historical Perspective

The S&P 500 has been up eight years in a row and remains up well into the ninth year. But, how long will this streak continue?

This is the first of a three-part white-paper series that will attempt to provide the reader with a framework to evaluate whether to be invested in the equity markets or on the sidelines in cash.

This first paper will focus on the discussion around the S&P 500 Price-Earnings (P/E) ratio. The second paper will discuss historical returns, return trends and streaks, and the probability of a tenth up year in the context of historical returns. The final paper will pull all of this together and discuss modeling portfolio returns and the trade-offs between varying portfolio weights between cash and equities.

Background

To understand what is driving changes in P/E ratios and what we can expect going forward, we must first understand the P/E ratio and the key drivers of it.

The P/E ratio can be described as the ratio between current share price and per-share earnings. Earnings in the S&P 500 are calculated using the 12-month earnings per share or "current" earnings. A higher P/E ratio suggests that investors expect higher earnings growth in the future.

Using the Gordon Growth Model[1], it is possible to show that the P/E ratio is a function of the dividend payout ratio (DPR), the growth rate (g), and the required rate of return (r) on the market.[2] This function is:

$$\frac{P_0}{E_0} = \frac{DPR \times (1+g)}{r-g} \qquad \textit{Equation 1}$$

Further, since the goal of this series is to understand S&P 500 returns, it is important to understand that returns can be estimated as changes in the P/E ratio and changes in earnings. This is important because the factors that drive changes in the P/E ratio will also drive returns.[3]

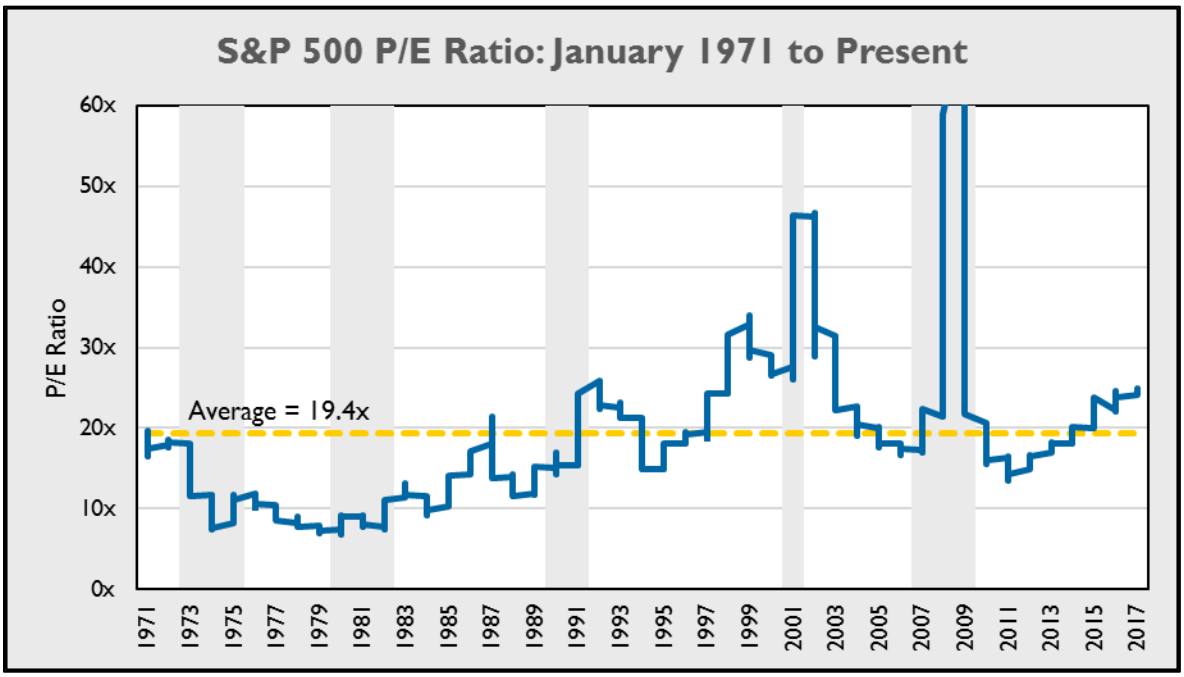
[1] Gordon, M.J. and Eli Shapiro (1956) "Capital Equipment Analysis: The Required Rate of Profit," Management Science, 3, (1) (October 1956) 102-110. Reprinted in Management of Corporate Capital, Glencoe, Ill.: Free Press of, 1959.[2]*Gordon, Myron J. "Dividends, Earnings and Stock Prices." Review of Economics and Statistics. The MIT Press.* ***41*** *(2): 99-105. JSTOR 1927792*

[2] The derivation of this function is contained within Appendix A.

[3] Appendix A shows this mathematically.

Historical Distribution of the P/E Ratio

During the period January 1971 to June 2017, the S&P 500 P/E ratio averaged 19.4x, while the median P/E ratio was 17.7x. For the majority of this period, the P/E ratio was less than the 19.4x average, as shown below.

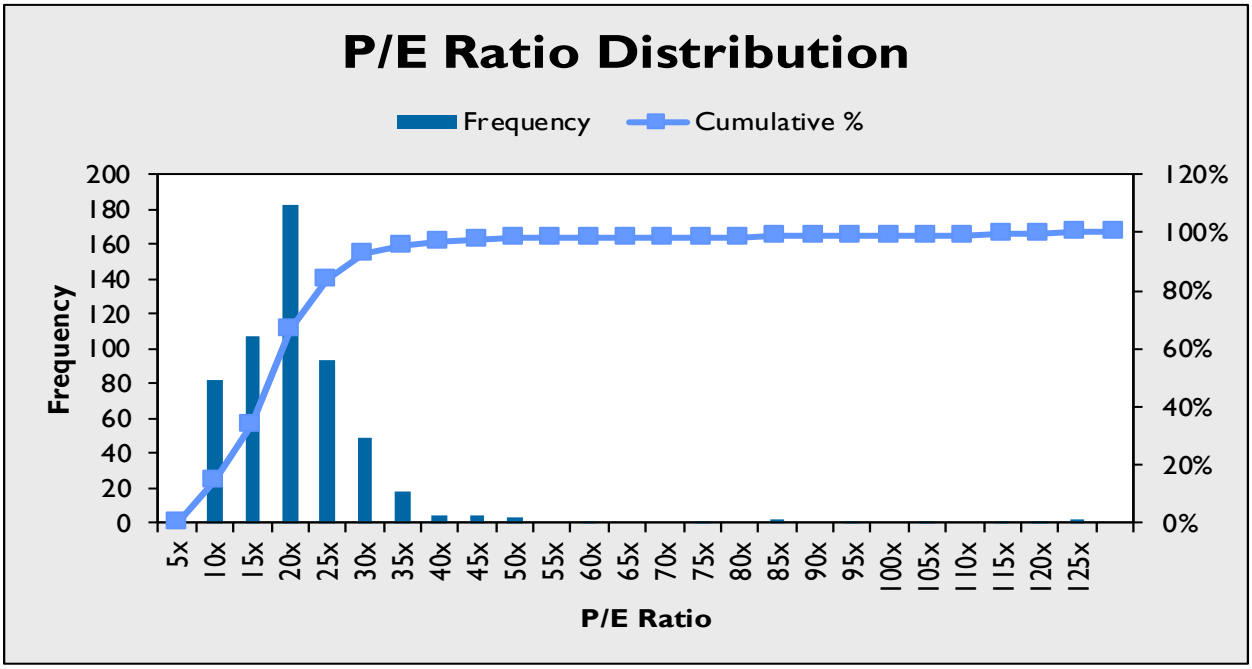


In fact, there were only five periods when the P/E ratio was above the average: 1) in 1987 following Black Monday, the largest one-day stock market crash in history, 2) during and immediately following the early 1990s recession, 3) in the late 1990s and the early 2000s, during the tech bubble, when the NASDAQ index was trading at 600 times earnings, 4) the 2008 and 2009 financial recession, and 5) the past 32 months. In May 2009, the P/E ratio reached a staggering 123.73x, the highest ratio in United States history. This was primarily due to the depressed earnings during the "Great Recession" and has been the only instance since 1970 in which the P/E ratio reached triple digits.

During the last fifteen years, with the exception of the "Great Recession," the P/E ratio has been generally centered around the average of 19.4x. Prior to 2003, there were periods where this was not the case. From 1973 to 1985, the P/E ratio tracked close to 10x. After 1985, the P/E ratio drifted upwards until 1992, reaching 25.93x before falling back to 14.89x in 1995.

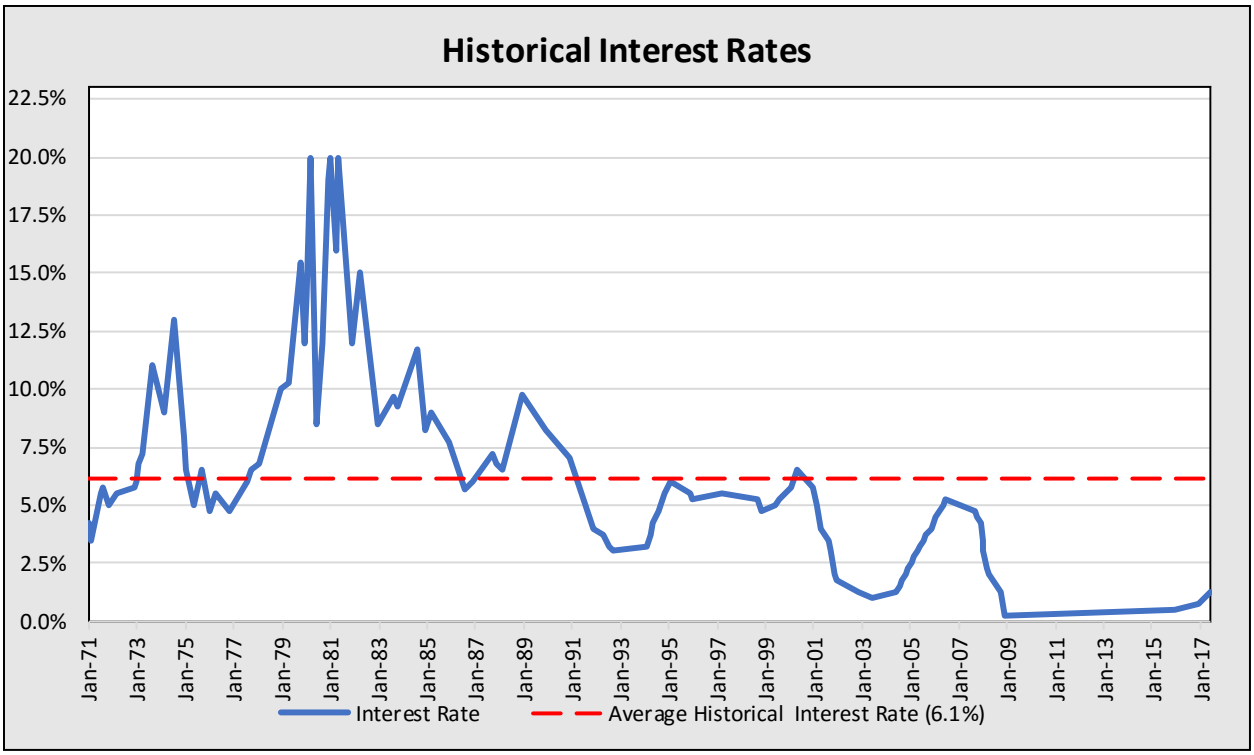
Current Status of the P/E Ratio

The S&P 500 P/E ratio as of June 1, 2017 was 25.7x, which is 32.47% higher than the historical average of 19.4x. This ratio is in the 84th percentile of the historical distribution and was only exceeded during the early 2000s and the 2008-2009 recession. While the current P/E ratio seems to be significantly higher than average, we believe the current situation is not yet excessive to the point that it would be called a "bubble."



Interest Rates Compared to P/E Ratios

From January 1971 to June 2017, the federal funds rate averaged 6.10% with a median interest rate of 5.25%. From 1973 until the end of 1990, interest rates were almost always above average. Most notably, in 1980 and 1981, the federal funds rate rose to 20.00% on four occasions over the two-year period, the highest interest rate in United States history. However, for the last 25 years, interest rates have remained below average, plummeting to 0.25% in 2001 after the 9/11 terrorist attacks. For the following seven years the interest rate remained at 0.25% and only began to increase in December of 2015 when the Federal Reserve decided that economic growth had stabilized. As of June 2017, the federal funds rate was 1.25%.



P/E ratios have demonstrated an inverse relationship to interest rates.[4] Given recent interest rate hikes and plans for the Fed to increase rates once more within the remainder of 2017,[5] P/E ratios are likely to decline; and even more so when considering that the current P/E ratio implies an earnings yield of 3.89% (= 1/25.7x).

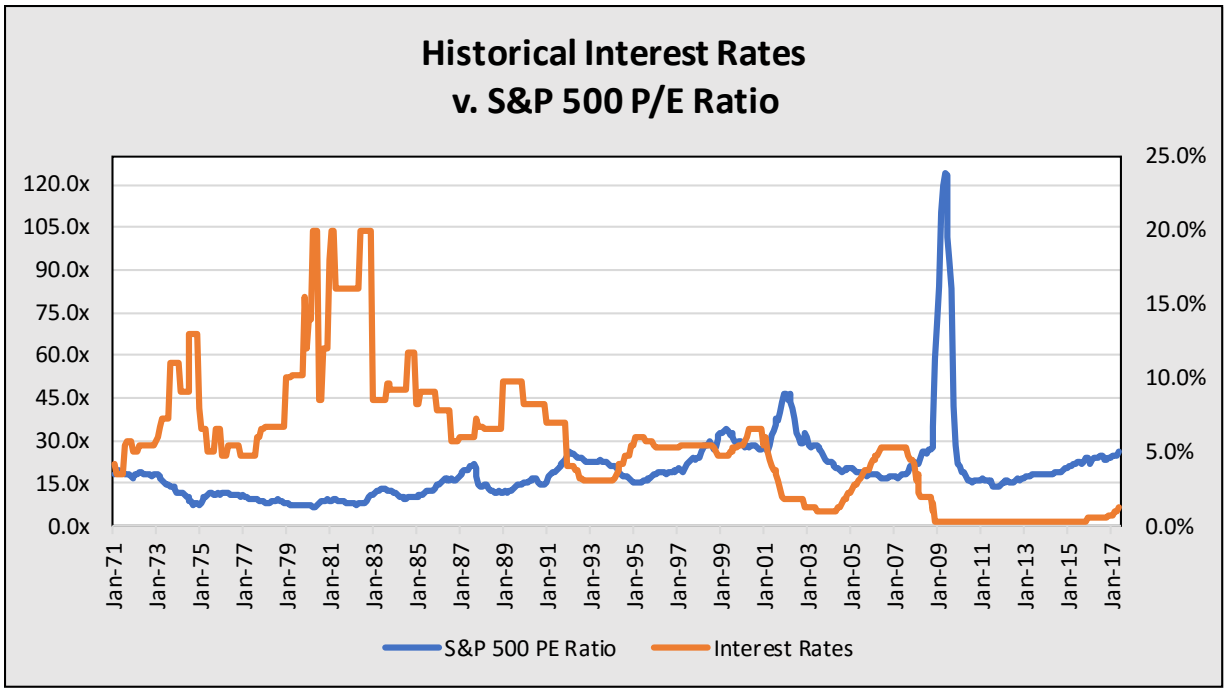
However, only 19.71% of the variability in P/E ratios can be explained by the following regression with interest rates, where interest rates (i) are the independent variable and P/E ratios are the dependent variable:

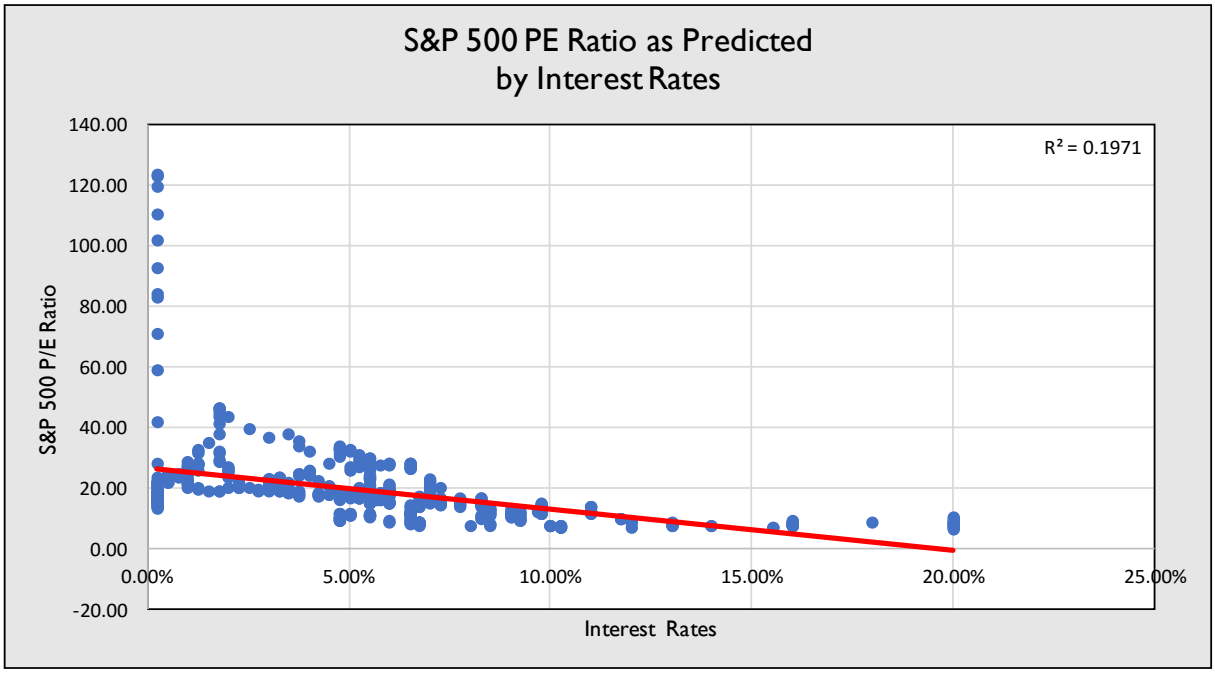
$$P/E = (-134.63)i + 26.76 \quad \textit{Equation 2}$$

When we test the current interest rate value of 1.25%, our equation predicts a P/E ratio of 25.08 – very close to the current P/E ratio. If the P/E ratio was solely dependent on interest rates, the federal funds rate would need to rise to more than 5.5% for the P/E ratio to drop to the historical average. Therefore, the current high P/E ratio of 25.7x is only partially explained by the low federal funds rates.

[4] Required rates of return (r) on the market are a function of interest rates, and as seen in Equation 1, as required rates of return drop, the P/E ratio increases.

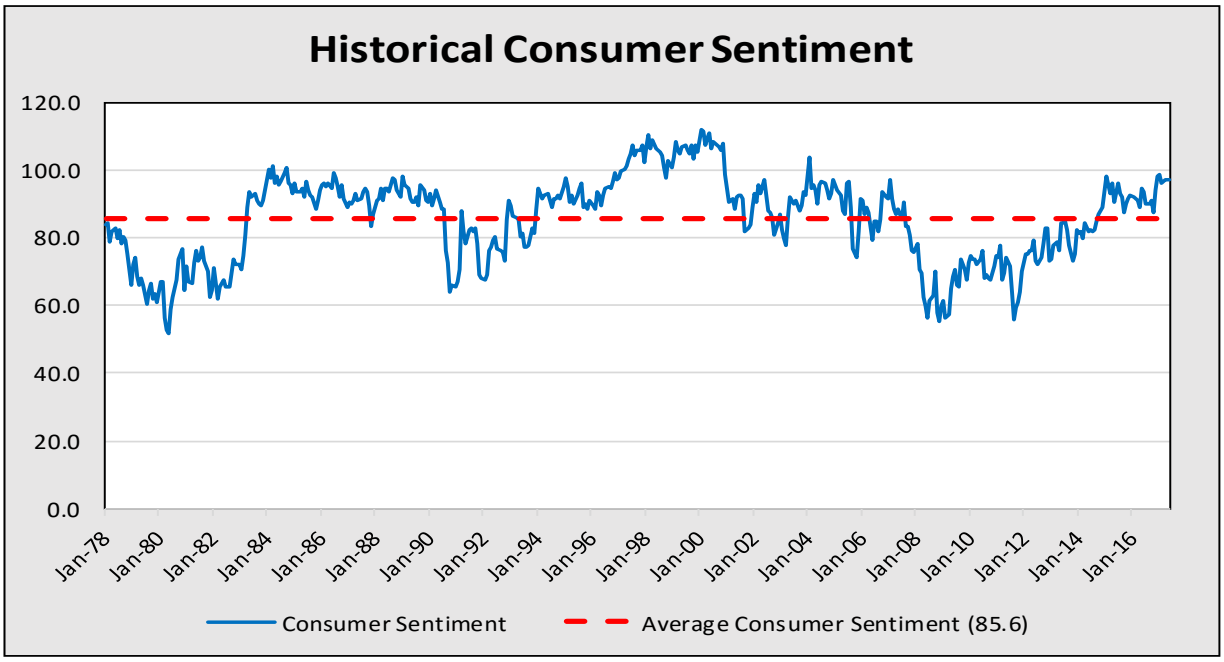
[5] "Federal Reserve Bank of San Francisco President John Williams said three interest rate increases this year makes sense as the central bank takes gradual steps to tighten monetary policy and shrink its balance sheet to prevent the economy from overheating." https://www.bloomberg.com/news/articles/2017-05-29/fed-s-williams-seeks-gradual-tightening-for-goldilocks-economy The Fed has increased rates twice this year, once in March and once in June.


Historical Interest Rates
v. S&P 500 P/E Ratio
120.0x
105.0x
90.0x
75.0x
60.0x
45.0x
30.0x
15.0x
0.0x
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Jan-71
Jan-73
Jan-75
Jan-77
Jan-79
Jan-81
Jan-83
Jan-85
Jan-87
Jan-89
Jan-91
Jan-93
Jan-95
Jan-97
Jan-99
Jan-01
Jan-03
Jan-05
Jan-07
Jan-09
Jan-11
Jan-13
Jan-15
Jan-17
S&P 500 PE Ratio
Interest Rates

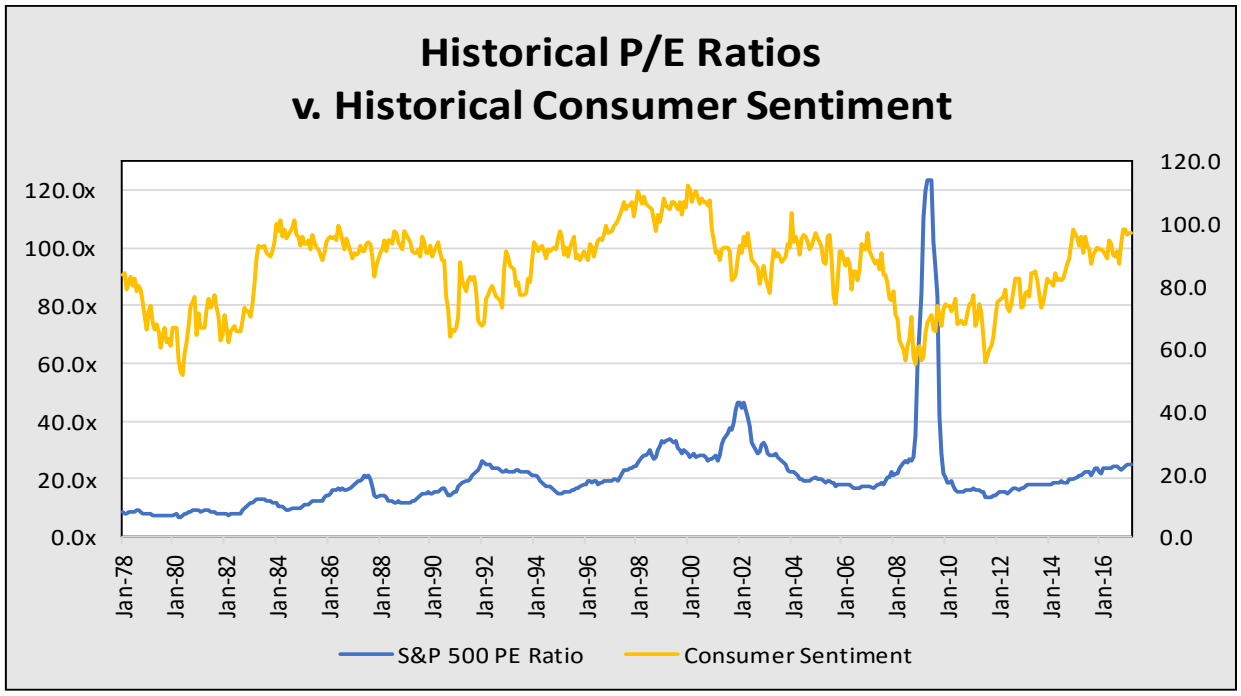

S&P 500 PE Ratio as Predicted
by Interest Rates
R² = 0.1971
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
-20.00
S&P 500 P/E Ratio
0.00%
5.00%
10.00%
15.00%
20.00%
25.00%
Interest Rates

Consumer Sentiment Compared to P/E Ratios

From January 1978 to June 2017, the Consumer Sentiment Index averaged 85.6 and had a median of 89.1. Higher values in the Consumer Sentiment Index represent consumers with increased optimism regarding the state of the economy, as shown through their spending and saving habits. The highest Consumer Sentiment value in recent history was 112.0 in January of 2001, when President George W. Bush was inaugurated for the first time. The lowest Consumer Sentiment Index value since 1971 was 51.7 in May of 1980 when the federal funds rate was at 20.00%. The most recent Index value from May 2017 places Consumer Sentiment at 97.1. Since 1978, the Consumer Sentiment has consistently fluctuated just around the mean.



We see very little relationship between Consumer Sentiment Index and the P/E ratio. There is not adequate evidence to suggest that a change in Consumer Sentiment causes the P/E ratio to increase or decrease. None of the variability in the S&P 500 P/E ratios can be explained by regression with Consumer Sentiment.


Historical P/E Ratios
v. Historical Consumer Sentiment
120.0x
100.0x
80.0x
60.0x
40.0x
20.0x
0.0x
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Jan-78
Jan-80
Jan-82
Jan-84
Jan-86
Jan-88
Jan-90
Jan-92
Jan-94
Jan-96
Jan-98
Jan-00
Jan-02
Jan-04
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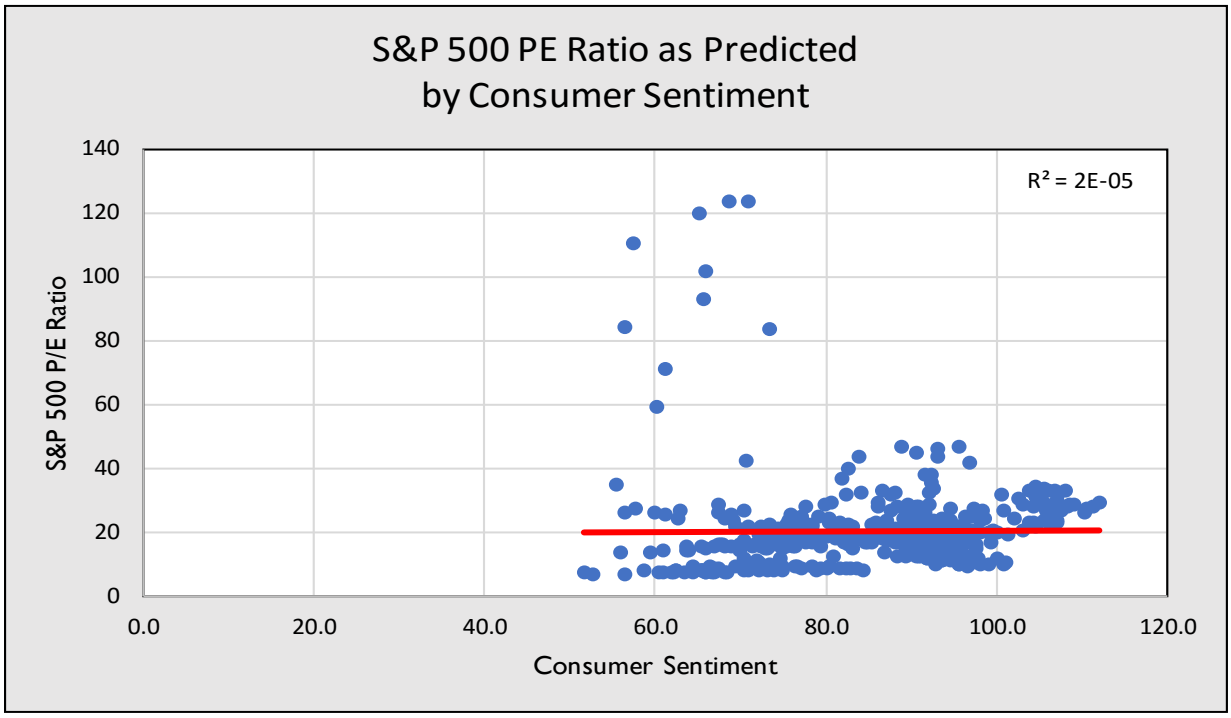
Jan-08
Jan-10
Jan-12
Jan-14
Jan-16
S&P 500 PE Ratio
Consumer Sentiment


S&P 500 PE Ratio as Predicted
by Consumer Sentiment
R² = 2E-05
S&P 500 P/E Ratio
140
120
100
80
60
40
20
0
0.0
20.0
40.0
60.0
80.0
100.0
120.0
Consumer Sentiment

Effects of Trump's Proposed Tax Cuts

The relationship between P/E ratios and interest rates or Consumer Sentiment is less certain when considering the proposed tax cuts under the Trump Administration. While the precise effects are muddled due to factors such as the difference between the corporate and effective tax rate, these cuts will undoubtedly lead to an increase in after-tax earnings. Therefore, it would be reasonable to assume that the P/E ratio, which has increased by more than two points since the 2016 election (from 23.35x to 25.7x), has been influenced by this mindset. If the anticipated rise in earnings does, in fact, come to fruition from these tax cuts, then the earnings portion of the P/E ratio will be able to "catch up" and effectively lower the ratio back to a more normalized level.

During the 2016 election season, Trump presented a proposal to reduce corporate taxes to a rate between 15% and 20%. If such a change does occur, the effect of a lowered corporate tax could lead to a dramatic increase in after-tax earnings.

However, the companies in the S&P 500 are affected by a variety of different effective tax rates. Almost all the companies measured in the index are taxed between 10% and 45% after deductions and credits.[6] No sector in the S&P 500 averages an effective tax rate above 31.08%.[7] Due to the drastic variance in tax rates, it is safe to assume that a corporate tax cut will affect all sectors in the S&P 500 differently. The most recent weighted average effective tax rate for the S&P 500 as a whole was 24.11%.

Despite the various effective tax rates, we can still make predictions as to how increased after-tax earnings could impact the P/E ratio. Let us first look at a scenario where all companies in the S&P 500 are being taxed at 24.11% and the S&P price is equal to the value provided on June 1, 2017.[8] In an ideal situation, after the corporate tax cut, companies in the S&P 500 would be taxed at the given rate, and we would experience changes in the P/E ratio as described below.

Constant Price					
Pre-Tax Earnings	Tax Rate	After-Tax Earnings, (E)	Effect of Tax Cut	Price, (P)	P/E Ratio
$ 124.59	24.11%	$ 94.55	N/A	$2,430.06	25.70
$ 124.59	20.00%	$ 99.67	5.42% increase in after-tax earnings	$2,430.06	24.38
$ 124.59	18.00%	$ 102.16	8.05% increase in after-tax earnings	$2,430.06	23.79
$ 124.59	15.00%	$ 105.90	12.00% increase in after-tax earnings	$2,430.06	22.95

However, before Trump's proposed corporate tax cuts, some companies were already being taxed at an average rate that was more than 10% less than the corporate tax rate after deductions. Lowering corporate taxes to a rate between 15% and 20% could mean that companies in the S&P 500 would be affected by even lower effective tax rates, further increasing after-tax earnings and reducing the P/E ratio.

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[6] Cheng, Evelyn. "*Winners and Losers of Trump's Tax Reform.*" CNBC, December 2, 2016.
[7] Imbert, Fred. "*Trump's Tax Plan May Not Be Quite so 'Phenomenal' for the S&P 500 as People Think.*" CNBC, February 13, 2017.
[8] http://www.multpl.com/s-p-500-historical-prices/table/by-month

On the other hand, if instead we look at a scenario where the P/E ratio is kept constant, we would see a noticeable increase in price as the tax rate decreased.

Constant P/E Ratio					
Pre-Tax Earnings	Tax Rate	After-Tax Earnings, (E)	Effect of Tax Cut	Price, (P)	P/E Ratio
$ 124.59	24.11%	$ 94.55	N/A	$2,430.06	25.70
$ 124.59	20.00%	$ 99.67	5.42% increase in after-tax earnings	$2,561.53	25.70
$ 124.59	18.00%	$ 102.16	8.05% increase in after-tax earnings	$2,625.57	25.70
$ 124.59	15.00%	$ 105.90	12.00% increase in after-tax earnings	$2,721.63	25.70

Is the S&P overvalued? If the tax cuts are enacted in a short timeframe, there is a reasonable basis to believe that P/E ratios will fall as after-tax earnings increase. However, if the tax cuts are not enacted, analysis of the historical levels of the S&P P/E ratio would suggest the market may be overvalued, indicating that prices may pull back.

Appendix A: Foundations of the P/E Ratio

Continuously compounded returns (r) are calculated as the natural logarithm of the price relative:

$$r = \ln\left(\frac{P_1}{P_0}\right) = \ln(P_1) - \ln(P_0) = d(\ln P_1) \quad 1$$

Note: after a little algebra, you can see the P_1 is calculated as:

$$P_1 = P_0 \times e^r \quad 2$$

Price can be broken down into two components, the P/E ratio and earnings (E):

$$P_0 = \frac{P_0}{E_0} \times E_0 \quad 3$$

Substituting this in to the return calculation yields the following:

$$r = \ln\left(\frac{P_1}{E_1} \times E_1\right) - \ln\left(\frac{P_0}{E_0} \times E_0\right) = \ln\left(\frac{P_1}{E_1}\right) - \ln\left(\frac{P_0}{E_0}\right) + \ln(E_1) - \ln(E_0)$$

$$r = d\left(\ln\left(\frac{P_1}{E_1}\right)\right) + d(\ln(E_1)) \quad 4$$

The P/E ratio component of returns can be broken down further by incorporating the Gordon Growth Model (GGM), which relates the current price of a security (P_0) to the next period dividends (D_1), a constant required rate of return (r) and a constant growth rate (g), as below:

$$P_0 = \frac{D_1}{r-g} \quad 5$$

Since $D_1 = D_0 \times (1+g)$, we can reformulate GGM as:

$$P_0 = \frac{D_0(1+g)}{r-g} \quad 6$$

A security's dividends can be calculated as a function of earnings and the security's dividend payout ratio (DPR), which we will assume to be constant over time:

$$D_0 = E_0 \times DPR \quad 7$$

Substituting this into GGM yields:

$$P_0 = \frac{E_0 \times DPR \times (1+g)}{r-g} \quad 8$$

We can then reformulate the GGM to calculate the P/E ratio by dividing both sides by E_0:

$$\frac{P_0}{E_0} = \frac{DPR \times (1+g)}{r-g} \quad 9$$

The P/E ratio equation (9) can easily be substituted into return equation (4) to show that returns are a function of changes in the required rate of return, changes in growth rate, and changes in earnings.