**Are Stock Prices High or Low?**

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Investors seek to buy when prices are low and sell when they are high. But how can one know whether the current price is low or high? Using five readily available variables that can be updated monthly, a model that predicts the movement of the cyclically adjusted prices of the S&P 500 stock index over the past half century with a high degree of accuracy is developed. In turn, the model provides a prediction for the cyclically adjusted price earnings ratio of the S&P 500, which can then be compared with the actual ratio to provide insight on whether current stock prices are high or low.

**Asset Values, Interest Rates, and Stock Prices**

The fundamental relationship between the expected future income stream and the present value of an asset provides the foundation for the price determination model of this paper. The present value of an asset is equal to the expected revenue stream generated by the asset discounted by the interest rate. Mathematically, the following relationship holds:

 $PV= \sum\_{t=1}^{T}\frac{E\_{t}}{(1+r)^{t}}$ (1)

Where the present value, *PV*, is equal to the sum of the expected earnings, *Et*, for each period, *t*, discounted each year by the interest rate, r.

As this formula indicates, an increase in future net earnings, the asset is expected to generate, will increase the current market value of the asset. On the other hand, higher interest rates will reduce the present value of the future income and therefore reduce the market value of the asset generating the income stream. Lower interest rates will exert the opposite impact. Thus, the market value of an asset will be directly related to the expected future net income stream generated by the asset and inversely related to the interest rate.

Applying the present value equation to stocks, the formula indicates that the price of a stock (or group of stocks) will depend on both the interest rate and the expected future earnings of the stock. The price-earnings ratio for a stock provides some information, but the ratio of price to current earnings is often a misleading indicator because of the fluctuations in corporate earnings over the business cycle. Corporate earnings generally fall sharply during a recession, and this will push the price-earnings ratio upward, making it look like stocks are really expensive. In turn, corporate earnings generally increase substantially during an economic boom. This will reduce the price earnings ratio, making it appear that stocks are cheap. Because of the fluctuations in corporate earnings over the business cycle, the current price-earnings ratio is often misleading. In many cases, it provides investors with precisely the wrong signal. Therefore, instead of focusing on the current price-earnings ratio, it makes sense to focus on the relationship between the stock price and earnings over a more lengthy time frame such as a decade.

This is precisely what Robert Shiller, the 2013 Nobel prize winner, has done. Schiller has popularized a cyclically adjusted price-earnings (CAPE) ratio (Campbell & Shiller 1988; Campbell & Shiller 1998; Shiller 2015). Shiller’s methodology averages the inflation-adjusted earnings figures over a ten-year period in order to minimize the distortions resulting from both business cycle and inflation effects. Schiller then compares the current price of a stock, or group of stocks such as the S&P 500 with the inflation-adjusted real earnings over the past ten years. Because the CAPE is adjusted for inflation and reflects earnings over a more lengthy time frame, it is a more reliable indicator of how the current price of a stock (or group of stocks) compares with earning potential.

Exhibit 1 presents Shiller’s cyclically-adjusted price-earnings ratio for the S&P 500 during 1881-2018. This CAPE ratio is a weighted average of the current stock price divided by the ten-year average of earnings adjusted for inflation of the 500 stocks in the S&P index. Other things constant, when this ratio is high, it indicates that stocks are relatively expensive. In contrast, when the ratio is low, it signals that stocks are relatively cheap.

(insert exhibit 1 about here)

During the past 138 years, the CAPE has risen above 30 only three times: 1929, 1997-2000, and July 2017 through October of 2018. The high level of 1929 preceded the stock market crash and declining stock prices of the Great Depression. Similarly, the high CAPE in the late 1990s was followed by the bursting of the Dotcom bubble and a more than 40 percent decline in stock prices during 2001-2002.

In contrast, a low CAPE ratio signaled that stocks were relatively cheap during 1918-1923, 1932, 1942-1944, and 1978-1984. Each of these periods was followed by a substantial move upward in stock prices.

Since July of 2017, the value of the CAPE ratio has been above 30. Compared to historic levels, this is an exceedingly high ratio. Does this mean that stock prices are high and therefore likely to fall substantially in the near future? Some analysts fear that this will be the case and the high CAPE ratio provides reason for caution.

However, there is also another potentially important factor to consider. Interest rates are low and they may continue to be low in the future. A recent paper by Walker (2016) argues that demographic changes in high-income developed economies have pushed, and will continue to push, interest rates well below historic levels. Walker shows that the share of population in developed countries age 50 to 75 years has increased relative to the share under age 50. Because the expanding age grouping tends to be net savers and the contracting group net borrowers, these changes are increasing the supply of loanable funds relative to the demand, thereby placing downward pressure on interest rates. The demographic trends increasing the size of the population in high saving age groupings relative to those with a strong demand for loanable funds are almost sure to continue for at least another decade.[[1]](#footnote-1) These forces elevate the importance of accurate information about the relationship between interest rates and stock prices.

**Model and Data**

The formula indicating that the present value of an asset reflects the expected future stream of net revenue discounted by the interest rate provides the foundation for our model. Shiller’s CAPE for the S&P 500 is the dependent variable of the model. Five independent variables are included: (1) the interest rate, (2) growth of real GDP during the past five years, (3) the index of leading indicators, (4) a short-term index of investor sentiment, and (5) a long-term index of investor sentiment. Increases in the last four variables will increase the size of the expected future income stream generated by stocks. Therefore, they are expected to exert a positive impact on the projected CAPE. Of course, higher interest rates will reduce the value of future income. Thus, the interest rate will exert a negative impact on the projected CAPE. We now turn to a more detailed description for each of the five independent variables.

1. **Interest rate.** The interest rate measure is the five-year treasury bill interest rate. The data set includes this rate on the first business day of each month. Because of the inverse relationship between the present value of an asset and interest rates, this variable is expected to exert a negative impact on the CAPE.
2. **Growth of real GDP.** The quarterly real GDP annual growth rate data from the Bureau of Economic Analysis are used to construct a five-year moving average. The average annual real growth rate is then applied to each month of the quarter. Thus, the three months of each quarter have the same average real GDP growth figure. Given, the delay in the reporting of quarterly real GDP, the data is lagged by one quarter. When the real growth rate is higher, this will exert a positive impact on the expected growth of future earnings. Of course, higher future earnings will increase asset values. Thus, this variable is expected to exert a positive impact on the CAPE.
3. **Index of leading indicators.** The Conference Board’s (2018) index of Leading Economic Indicators (LEI) provides data on the expected future direction of economic growth. The index is comprised of ten components that generally lead the business cycle. Because the components are collected with a slight delay, the variable is lagged by one month. Upward movement in the index forecasts stronger growth of real GDP, while a decline in the index implies weakness in future earnings. Thus, the index is expected to be positively related to the CAPE.
4. **Short-run investor sentiment index.** The investor sentiment measure of Baker and Wurgler (2006) is used as a component in the short-run measure of investor sentiment. This index is comprised of five sub-components: the dividend premium, the average closed end fund discount, the equity share of new issues, the gross number of IPOs, and the average first day return on IPOs. This index is derived monthly. The original data series of Baker and Wurgler (2006) was updated to the present by the authors using data from a Bloomberg terminal. This short-run investor sentiment measure is then averaged with the Index of Consumer Sentiment (ICS) from the University of Michigan (2018) and the nine-month percentage change in the S&P 500 to create the short-run sentiment measure. The figures are lagged one month so the data for the past month are available on the first day of the following month. A higher level of short-term optimism will increase the demand for stocks, pushing their price upward. Thus, this variable is expected to exert a positive impact on the CAPE ratio.
5. **Long-run investor sentiment index.** The long-term investor sentiment measure is the total percentage change in the inflation adjusted S&P 500 index during the past ten years, also retrieved using a Bloomberg terminal. The initial base period in the percentage calculation is the five-year average of the S&P 500 centered on the month ten years earlier. The use of the five-year average for the initial benchmark year was used in order to prevent a sharp decline in stock prices during a month (or few months) during the earlier period from biasing the ten-year percentage change upward. When the stock market has performed at a high level over a lengthy time period such as a decade, this positive long-term performance will cause investors to become more optimistic, which will lead to higher current stock prices. In contrast, lengthy periods of poor stock market performance will breed pessimism, which will place downward pressure on the current price of stocks. Thus, this variable is expected to exert a positive impact on the CAPE.

The data for the CAPE and the five independent variables of the model were compiled on the first day of each month for the period June 1965 through October 2018. The CAPE variable is included in the model in logarithmic form. Thus, the data cover a time frame of 53 years and four months, containing 640 monthly observations.

**Results**

Exhibit 2 presents the results of the regression model for the entire period. All of the independent variables have the expected sign and they are significant at the 99 percent level. The interest rate (t-ratio of more than 39 in the model) and the long-term sentiment (t-ratio of more than 33) exert a particularly strong impact on the CAPE. Remarkably, the regression model explains slightly more than 95 percent of the variation in the CAPE during the past 53 plus years. This provides powerful evidence that the five variable model is an excellent predictor of the CAPE ratio. In addition, the model was also analyzed over different time frames during 1965-2018 and the high level of explanatory power of the model was essentially unchanged.[[2]](#footnote-2)

(Insert exhibit 2 about here)

The coefficient for the interest rate variable indicates that the low interest rates of recent years are a major reason why the current CAPE is so high. If the five-year Treasury bill rate was at the mean of the entire period, the projected CAPE ratio in the fall of 2018 would have been approximately 7 units lower. Clearly, our analysis indicates that the interest rate exerts a sizeable impact on the CAPE.

Given the values of the five independent variables, the model can be used to compare the actual value of the CAPE with the value predicted by the model. Exhibit 3 presents the actual and predicted values of the CAPE for the 1965-2018 time frame. Interestingly, the current (October 2018) projected CAPE is 33.77, compared to the actual CAPE of 33.47. In contrast with the unadjusted CAPE (see Exhibit 1), our model does not imply that current stock prices are substantially over-valued. In fact, our model indicates that the S&P 500 stock prices are at the approximate level one would expect.

It is highly revealing to compare the actual and projected CAPE throughout these 53 years. During 1985-1989, 1992-1993, 2002-2003, 2009, and 2015-2016 the model predicted much higher CAPE ratios than were present at the time, indicating an undervalued market. Indeed, the market performed well in the years following these periods. In addition, there were also periods of overvaluation. The periods 1971-1973, 1999-2000, and 2005-2008 were all periods where the actual CAPE ratio was much higher than what the model predicts. Not surprisingly, the performance of stocks was poor in the years following these overvaluations. The following section will take a closer look at how the relationship between the actual and projected CAPE impacts the rate of return on stock market investments.

 (Insert exhibit 3 about here.)

**The Buy, Sell, and Hold Signals and the Rate of Return**

Comparisons between the actual and predicted CAPE can be used to construct buy, sell, and hold signals for stocks. When the actual CAPE is low relative to the predicted value of the model, this signals that the S&P 500 stocks are cheap and therefore it would be an attractive time to buy. In contrast, when the actual CAPE is high relative to the value predicted by the model, this signals that the S&P stocks are expensive and therefore one might want to consider selling. Finally, when the two ratios are in a similar range, normal returns from stocks can be expected. Therefore, this can be thought of as a signal to hold.

Exhibit 4 presents the one-year, two-year, three-year, and five-year historic annual real returns for the buy, sell, and hold signals during 1965-2018.[[3]](#footnote-3) The upper frame of the exhibit displays the returns when a one standard deviation (1.76 units) cutoff is used for the buy and sell signal. If the predicted CAPE is more than one standard deviation above the actual CAPE ratio, this is designated a buy signal. Similarly, if the actual CAPE ratio exceeds the predicted CAPE by more than one standard deviation, this is designated a sell signal. When the two ratios are within plus or minus one standard deviation range of each other, this is considered a signal to hold. Given the one standard deviation threshold, the hold signals account for two-thirds of the monthly observations.

The lower frame of the exhibit displays the real annual returns when a threshold of 0.8 of a standard deviation (1.41 units) is used. Because the threshold is lower, there are now more months when either the buy or sell signal is present and fewer months (now approximately 55 percent of the time, down from two-thirds for the one standard deviation threshold) when a hold signal is present.

(Insert exhibit 4 about here.)

There was a consistent pattern of the real returns over the various time frames for the buy, sell, and hold signals. The returns when the buy signal was present were larger than those of the hold signal and the returns of the hold signal were larger than those of the sell signal. The real annual returns for the one, two, three, and five-year periods when the one standard deviation buy signal was present were 11.2, 11.0, 11.7, and 10.8 percent, respectively. This shows that during the past 53 years, investors purchasing when the buy signal was present, on average, earned more than ten percent annual real returns. Moreover, if the stock was held for two or three years, every buy observation resulted in positive returns. In contrast, future real returns when stocks were purchased during a sell signal were much lower. During the one, two, three, and five-year time frames, the annual returns earned on stock purchases during a month when a sell signal was present were -2.5, -2.7, 0.7, and 2.7 percent, respectively.

There were four periods of overvaluation during 1965-2018 that lasted 10, 19, 20, and 26 months. As these figures indicate, periods of overvaluation seldom last longer than 2 years. Therefore, as exhibit 4 illustrates, buying and holding a stock when a sell signal is present results in a low average annual real rate of return. Further, compared to the returns for purchases when a buy signal was present, the returns for stocks purchased when a sell signal was present were at least eight-percentage points lower for each of the four time frames. The difference in the one-year return was quite large; more than 13.5 percentage points.

The real returns for stocks purchased during months when the one standard deviation hold signal was present were between those of the buy and sell signals. The real annual returns for the three and five year time frames during the hold months were 7.5 percent and 7.7 percent, returns similar to those of the S&P index when held for lengthy time periods, such as a century.

The bottom frame of exhibit 4 contains the average annual real returns using the lower buy/sell threshold of 0.8 of a standard deviation. Although these results were for a slightly lower threshold, the pattern of the annual real returns was the same. The real annual returns for the buy signal ranged from 10.0 percent to 11.5 percent, while the returns for the sell signal were quite low, ranging from -1.4 percent to 3.4 percent. When the 0.8 standard deviation threshold was used, the average real annual returns were 6.5 percentage points or more higher when the buy signal was on than when the sell signal was present.

**Conclusion**

Three major implications follow from our analysis. First, the high CAPE ratio of 2017-2018 is less troublesome than the historic figures suggest. The low interest rates of recent years are a major contributing factor to the current historically high CAPE. Once the impact of the low interest rates is taken into account, the 2017-2018 CAPE values are high, but not unprecedented. Clearly, this is an important time to keep a close eye on interest rates. If interest rates continue at the current low levels, the projected CAPE is likely to continue to be high compared to historical levels. In contrast, sharply higher interest rates, should they occur, are likely to trigger a major stock market correction.

Second, our model provides valuable information for those investing within a time frame of 1 to 5 years. If undertaken when the actual CAPE is 0.8 or more standard units below the projected CAPE, investments in a broad set of stocks such as the S&P 500 are highly likely to yield an attractive return. Moreover, the risk of significant loss is minimal. In contrast, if undertaken when the actual CAPE is 0.8 or more standard units above the projected CAPE, stock investments are likely to yield a low return during the next five years.

Third, those making regular payments into long-term stock holdings such as retirement plans can derive a higher return by making larger payments when the S & P 500 is under-valued and smaller payments when it is over-valued. When followed over a lengthy time period, this strategy could increase the value of one’s stock investments by a sizeable amount.

The model presented here is updated monthly and the actual and projected CAPE available during the first week of each month at <http://myweb.fsu.edu/jdgwartney/peratio.html>. While this tool is not a silver bullet, it provides information that could help both short- and long-term investors earn higher returns.

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**Exhibits**

**Exhibit 1: Shiller’s CAPE Ratio, 1881-2018**

1929 stock

market peak

Dotcom bubble

**Exhibit 2: Regression Results of CAPE Ratio Model, 1965-2018**

|  |
| --- |
| **Dependent Variable: Natural Log of CAPE Ratio** |
| **Independent Variables** | **Coef.** | **t-value** |
| 5-Year T-Bill Rate | -0.0681\*\*\* | 39.42 |
| Ave Growth of RGDP | 0.0395\*\* | 8.35 |
| Index of LEI | 0.0949\*\* | 14.83 |
| Investor Sentiment | 0.0688\*\* | 9.25 |
| Long-Run Sentiment | 0.0032\*\* | 33.42 |
| Intercept | 3.0690\*\* | 193.69 |
| No. of Obs. | 640 |   |
| Adj. R2  | 0.9527 |  |

**Exhibit 3: Actual and Predicted CAPE Ratios, 1965-2018**



**Exhibit 4: Average Annual Real Return of the S&P 500 Using the Buy, Sell, and Hold Signals of the Model, 1965-2018**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **1-Year Ave.Return** | **2-Year Ave.Annual Return** | **3-Year Ave.Annual Return** | **5-Year Ave.Annual Return** |
| **Buy/Sell Threshold = 1 standard deviation (1.76)** |
| Buy (undervalued) | 11.2% | 11.0% | 11.7% | 10.8% |
| Sell (overvalued) | -2.5% | -2.7% | 0.7% | 2.7% |
| Hold | 8.5% | 8.8% | 7.7% | 7.5% |
| **Buy/Sell Threshold = 0.8 standard deviation (1.41)** |
| Buy (undervalued) | 11.5% | 10.6% | 10.6% | 10.0% |
| Sell (overvalued) | -1.4% | 0.1% | 2.3% | 3.4% |
| Hold | 8.9% | 8.9% | 7.8% | 7.7% |
| Notes: For the 1 std. dev. threshold, the 1, 2, 3, and 5 year returns of the Buy had 92, 92, 83, and 74 observations. For the Sell there were 112 observations for each period. For the Hold there were 424, 413, 410, and 395 observations. For the 0.8 std. dev. threshold, the 1, 2, 3, and 5 year returns of the Buy had 130, 130, 119, and 108 observations. For the Sell there were 155 observations for each period. For the Hold there were 343, 332, 331, and 318 observations. |

1. By 2020, the share of the population from age 50 to 75 compared to those below the age of 50 will be above 60 percent in Japan and Italy. It will be above 45 percent for the United States, France, Spain, and the U.K. The pattern is the same for the other high income countries and the trend toward an aging population will continue for at least another decade. For more information see Gwartney et. al. 2017, pg. 298. [↑](#footnote-ref-1)
2. We also used robust standard errors to allow for heteroscedasticity and the results were the same. [↑](#footnote-ref-2)
3. The returns in exhibit 4 are the total returns as they include dividends. The returns are annual and constructed by computing the 12-month percentage change of the S&P 500 price index and then adding the 12-month dividend yield. [↑](#footnote-ref-3)