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Topical Study #44

New, Improved  
Stock Valuation Model



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## I. Valuation & Efficient Markets

Investment strategists are fond of using stock valuation models. Some of these are simple. Some are complex. Data on earnings, dividends, interest rates, and risk are all thrown into these black boxes to derive a “fair value” for the stock market. If the stock market’s price index exceeds this number, then the market is overvalued. If it is below fair value, then stocks are undervalued. Presumably, investors should buy when stocks are undervalued, and sell when they are overvalued.

I’ve been using a very simple model, namely the Fed’s Stock Valuation Model (FSVM), since the summer of 1997 (see Appendix A). In early July, it showed that the S&P 500 price index was nearly 50% overvalued.<sup>1</sup> This is the most extreme overvaluation reading since January 1979, the first data point available using the model. The prior record was an overvaluation reading of 34% during September 1987, just before the market’s infamous free-fall. This prior record overvaluation level was breached during May of this year. The FSVM suggested that the market was once again dangerously overvalued at that time, and was vulnerable to another drop. Instead, the overvalued market became even more overvalued.

Other more sophisticated and complicated valuation models have also been flashing warning signals, which have been false ones so far, or at least very premature. So, is it time to put all the black boxes in a black box and bury them? I don’t think so. Instead, I propose to improve the simple version of the FSVM by adding explicit variables to measure risk and long-term earnings expectations. My analysis will demonstrate that the market’s assumptions about risk, and especially about long-term earnings growth may be unrealistically optimistic, leaving it vulnerable to a big fall.

On the other hand, I think it is time to bury the notion that the stock market can be undervalued or overvalued. The stock market is a very efficient market. Efficient markets are always “correctly” valued. All buyers and all sellers have access to exactly the same information. They are completely free to act upon this information by buying or selling stocks as they choose. So the market price is always the correct price, reflecting all available information. In his June 17, 1999 Congressional testimony, Federal Reserve Chairman Alan Greenspan soliloquized about valuation:

The 1990s have witnessed one of the great bull stock markets in American history. Whether that means an unstable bubble has developed in its wake is difficult to assess. A large number of analysts have judged the level of equity prices to be excessive, even taking into account the rise in “fair value” resulting from the acceleration of productivity and the associated long-term corporate earnings outlook. But bubbles generally are perceptible only after the fact. To spot a bubble in advance requires a judgment that hundreds of thousands of informed investors have it all wrong. Betting against markets is usually precarious at best.<sup>2</sup>

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<sup>1</sup> For a daily update of the model see [www.yardeni.com/stocklab.html](http://www.yardeni.com/stocklab.html).

<sup>2</sup> <http://www.bog.frb.fed.us/BOARDDOCS/TESTIMONY/1999/19990617.htm>

Of course, individually, we can all have our own opinions about whether stocks are cheap or expensive at the going market price. I propose that we replace the terms “undervalued” and “overvalued” with “underpriced” and “overpriced,” respectively. I think in this way, we acknowledge that the stock market is efficient and that the market price is objectively always the fair value. At the same time, the new terminology allows us to devise valuation models to formulate subjective opinions about market prices. If my model shows that the market is overpriced, I am simply stating that I disagree with the weight of opinion that has lifted the market price above my own assessment of the right price.

## **II. The Price Is Right**

Now let’s formulate a new, improved FSVM that more explicitly identifies the variables that together determine the value of the stock market. If the simple model shows that stocks are 30%, 40%, or even 50% overpriced, we need to add variables that can explain why the aggregate of all buyers and sellers believe that the price is right, i.e., why they believe the market is not overpriced.

Let’s build on the foundation of the FSVM. In this model, the fair value for the S&P 500 is derived by dividing expected earnings by the bond yield. The only good source of historical data on expected earnings for the S&P 500 is I/B/E/S International Inc. This organization has been compiling 12-month forward consensus forecasts for operating earnings since January 1979, based on the projections of Wall Street’s industry analysts.<sup>3</sup> Dividing this series by the 10-year Treasury bond yield creates a new series, which is the fair value of the S&P 500 index in the FSVM. If the actual index is greater than (less than) this fair value, the market is overpriced (underpriced). Exhibits 1 and 2 display the model.

This version of the model is based on an alternative, but identical model, that was briefly mentioned in the July 1997 Monetary Policy Report submitted to Congress by Mr. Greenspan, along with his semi-annual Humphrey-Hawkins testimony (see insert on page 5 and Appendix A). The “current earnings yield” of the market is calculated as the ratio of 12-month forward expected earnings to the S&P 500 index. This yield is then compared to the 10-year Treasury bond yield. The stock market is overpriced (underpriced), when the current earnings yield is less than (greater than) the Treasury bond yield (Exhibits 3 and 4).

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<sup>3</sup> Weekly data of 52-week forward earnings are available starting in March 1994. See *Earnings Forecast Weekly*, <http://www.yardeni.com/subscriber/ee.pdf>.

**Excerpt from Federal Reserve's Monetary Policy Report to Congress (July 1997):**

The run-up in stock prices in the spring was bolstered by unexpectedly strong corporate profits for the first quarter. Still, the ratio of prices in the S&P 500 to consensus estimates of earnings over the coming twelve months has risen further from levels that were already unusually high. Changes in this ratio have often been inversely related to changes in long-term Treasury yields, but this year's stock price gains were not matched by a significant net decline in interest rates. As a result, the yield on ten-year Treasury notes now exceeds the ratio of twelve-month-ahead earnings to prices by the largest amount since 1991, when earnings were depressed by the economic slowdown. One important factor behind the increase in stock prices this year appears to be a further rise in analysts' reported expectations of earnings growth over the next three to five years. The average of these expectations has risen fairly steadily since early 1995 and currently stands at a level not seen since the steep recession of the early 1980s, when earnings were expected to bounce back from levels that were quite low.

<http://www.bog.frb.fed.us/boarddocs/hh/1997/july/fullreport.htm>

This simple version of the FSVM is missing some variables, which might explain why the current earnings yield diverges from the Treasury yield. We clearly need to account for variables that differentiate stocks from bonds. If the government guarantees that stock earnings will be fixed for the next 10 years, then the price of the S&P 500 would be at a level that equates the current earnings yield to the 10-year Treasury bond yield. But there is no such guarantee for stocks. Earnings can go down. Companies can lose money. They can also go out of business. On the other hand, earnings can also go up. We need variables to capture: 1) business risk to earnings, and 2) earnings expectations beyond just the next 12 months.

The new, improved valuation model reflecting these variables should have the following structure:

$$(1) \quad \mathbf{CEY} = \mathbf{a} + \mathbf{b} \cdot \mathbf{TBY} + \mathbf{c} \cdot \mathbf{RP} - \mathbf{d} \cdot \mathbf{EGP}$$

**CEY** is the current earnings yield defined as 12-month forward earnings of the S&P 500 divided by the S&P 500 price index. **TBY** is the 10-year bond yield. **RP** is the risk premium and **EGP** is the long-term expected earnings growth proxy, i.e., for earnings beyond the next 12 months. My presumption is that **a** = 0, **b** = 1, **c** = 1, and **d** = 1. In other words, stock investors should demand a current yield that fully includes the riskless bond yield plus a risk premium less a factor for earnings growth.

### III. Risk

How should we measure risk in the model? An obvious choice is to use the spread between corporate bond yields and Treasury bond yields. This spread measures the market's assessment of the risk that some corporations might be forced to default on their bonds. Of course, such events are very unusual, especially for companies included in the S&P 500. However, the spread is only likely to widen during periods of economic distress, when bond investors tend to worry that profits won't be sufficient to meet the debt-servicing obligations of some companies. Most companies won't have this problem, but their earnings would most likely be depressed during such periods. So the new improved model can be represented as follows:

$$(2) \quad \mathbf{CEY} = \mathbf{a} + \mathbf{b} \cdot \mathbf{TBY} + \mathbf{c} \cdot (\mathbf{CBY} - \mathbf{TBY}) - \mathbf{d} \cdot \mathbf{EGP}$$

**CBY** is the corporate bond yield. Which corporate bond yield should we use in the model? We can try Moody's composites of the yields on corporate bonds rated Aaa, Aa, A, or Baa. I believe the spread between the A-rated corporate composite yield and the Treasury bond yield fits best (Exhibit 5). This spread averaged 151 basis points since 1979. It tends to widen most during "flight-to-quality" credit crunches, when Treasury bond yields tend to fall fastest. For example, in 1998, the T-bond yield fell 143 basis points from its April high to its October low. Over this same period, the risk spread widened by 96 basis points, so the A-rated corporate bond yield fell only 47 basis points at that time.

### IV. Earnings Growth Expectations

The final variable included in the new, improved FSVM is one for expected earnings growth beyond the next 12 months. I don't know of any direct way to measure this variable. If we can reasonably assume that the constant coefficient—**a** in equation (2)—is zero and that **b**, **c**, and **d** are all equal to one, then:

$$(3) \quad \mathbf{EGP} = \mathbf{CBY} - \mathbf{CEY}$$

The earnings growth proxy is simply the difference between the corporate bond yield and the current earnings yield. If **EGP** is positive—as it is likely to be when investors are optimistic about future earnings prospects—they will accept a current earnings yield that is less than the corporate bond yield. Exhibit 6 shows that the earnings growth proxy has averaged 113 basis points since 1979, with a low of minus 362 basis points in 1979 and a high of 360 basis points in July 1999, almost matching the September 1987 record high.

It is fascinating to observe that the average risk premium (151 basis points) has slightly exceeded the average earnings growth factor (113 basis points) since 1979. Excluding the outlying data of 1979 shows that the risk spread exceeded the expected earnings growth proxy by only 18 basis points. This explains why the stripped-down FSVM seems to work so well, using the Treasury bond yield rather than the A-rated corporate bond yield. In other words, the current earnings yield tends to equal the Treasury bond yield because the risk premium tends to equal the earnings growth factor. This is not an iron law of

economics, of course. It is simply the empirical reality for the available data period. If it is the law, the stock market currently is breaking the law with earnings expectations far exceeding risk assessments.

On a cyclical basis, earnings growth expectations are likely to be mostly influenced by monetary policy variables, especially short-term interest rates. If the Treasury bill rate is falling, investors are likely to become increasingly optimistic about the outlook for earnings beyond the next 12 months. If interest rates are rising, they are likely to become more cautious. The shape of the yield curve may be another important monetary variable influencing earnings expectations. An ascending curve, with short-term interest rates below the long-term yield, suggests that bond investors expect that economic growth will be strong and that inflation will rise—a bullish scenario for earnings. An inverted yield curve should be bearish for earnings expectations.

Strictly speaking, my empirical proxy for expected earnings growth is just a residual, i.e., the difference between Moody's composite for the A-rated corporate bond yield and the current earnings yield. Obviously, other variables, besides monetary ones, that presumably influence earnings growth expectations might explain the gap between the corporate bond yield and the current earnings yield.

Nevertheless, my measure of the **EGP** is very cyclical and highly inversely correlated with both the level and the yearly percent change in the three-month Treasury bill rate (Exhibits 7 & 8). Interestingly, **EGP** tends to lead and is highly correlated with the yield curve spread, as measured by the difference between the Treasury bond yield and the Treasury bill rate (Exhibit 9).

## **V. Priced For Perfection**

Actually, I/B/E/S does compile data on consensus long-term earnings growth for the S&P 500. The monthly data start in 1985 and are based on industry analysts' projections for the next five years. The earnings growth proxy is highly correlated with this series (Exhibit 10). In July, the consensus forecast earnings growth was 14.9% per year for the foreseeable future. This is the highest long-term growth rate forecast recorded since the start of the data.

The stock market is clearly priced for perfection. If perpetual prosperity continues uninterrupted, then perhaps the market's exuberant expectations will be realized. I, however, see more potential for disappointment, given the extreme optimism about long-term earnings growth embedded in current market prices.

Let's not forget that the current earnings yield is calculated using consensus earnings for the next 12 months. Twelve-month forward earnings hit a record high of \$55.28 per share in mid-July. They are expected to be \$51.05 and \$59.50 in 1999 and 2000, respectively, implying growth rates of 15.2% and 16.6%, respectively. If these estimates are too high, then the current yield would be lower, requiring even more optimistic assessments of long-

term earnings prospects and lower assessments of risk to justify the current level of the stock market.

## **Appendix A: Background On The Fed's Stock Valuation Model**

On December 5, 1996, Federal Reserve Board Chairman Alan Greenspan worried out loud for the first time about “irrational exuberance” in the stock market. He did it again on February 25, 1997. He probably instructed his staff to devise a stock market valuation model to help him evaluate the extent of this irrational exuberance. Apparently, they did so and it was made public, though buried, in the Fed's Monetary Policy Report to the Congress, which accompanied Mr. Greenspan's Humphrey-Hawkins testimony on July 22, 1997.

The Fed model was summed up in one paragraph and one chart on page 24 of the 25-page document. (See insert on page 4.) The Report's chart shows a strong inverse correlation between the ratio of S&P 500 expected *operating* earnings—using 12-month-ahead consensus earnings estimates compiled by I/B/E/S International Inc.—and the 10-year Treasury yield. Of course, in the investment community, we tend to follow the Price/Earnings ratio more than the Earnings/Price ratio. The ratio of the S&P 500 price index to expected earnings (P/E) is highly correlated with the reciprocal of the 10-year bond yield. In other words, the “fair value” price is equal to expected earnings divided by the bond yield in the Fed's valuation model.

The ratio of the actual S&P 500 price index to the fair value price shows the degree to which the market is overpriced or underpriced. History shows markets can stay overpriced and become even more overpriced for awhile. But eventually, such extremes are corrected in three ways: 1) falling interest rates, 2) higher earnings expectations, and of course 3) falling stock prices—the old fashioned way to decrease values. A market that is underpriced can be corrected by rising yields, lower earnings expectations, or higher stock prices.

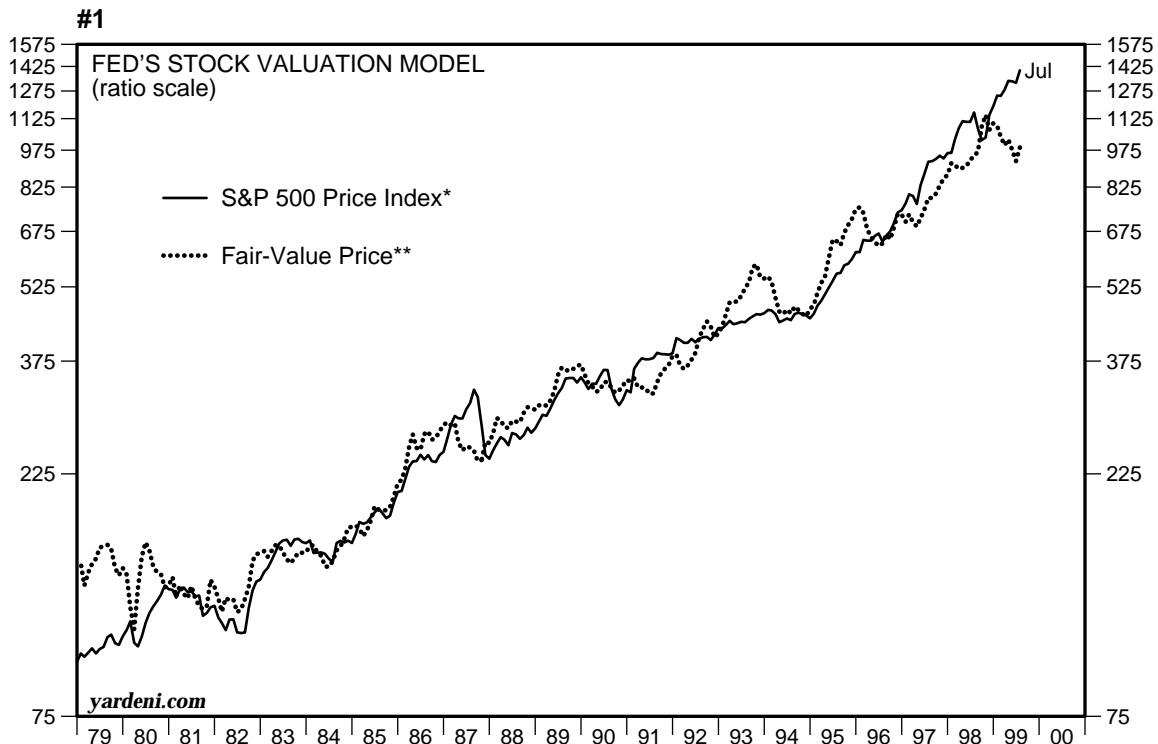
Interestingly, the Fed model shows that stocks were fairly valued at the end of 1996, not irrationally overpriced. Stocks were 21% and 25% overpriced in the summers of 1997 and 1998, respectively. In September 1987, just prior to the October crash, stocks were 34% above fair value. Immediately after the crash, stocks were about 10% underpriced. They were consistently underpriced from 1993 through 1995.

Of course, theoretically, stock prices are equal to the present discounted value of future earnings (adjusted for risk), not just 12-month forward earnings. The Fed model assumes that the market overwhelmingly weights expected earnings immediately ahead, and that earnings growth beyond the next 12 months is offset completely by risk assessments. As demonstrated in this Topical Study, this is an empirically sound assumption.

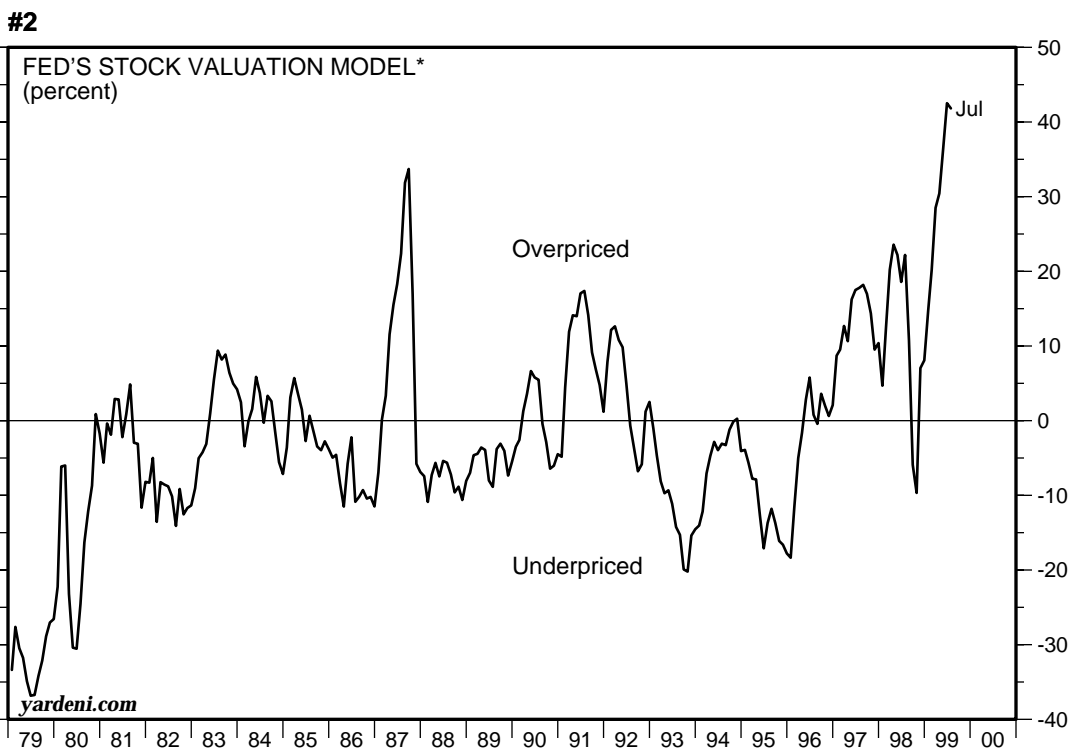
The Fed's Stock Valuation Model is a very simple one. It should be used along with other stock valuation tools. Of course, there are numerous other more sophisticated and complex models. The Fed model is not a market-timing tool. As noted above, an overpriced (underpriced) market can become even more overpriced (underpriced). However, the Fed model does have a good track record of showing whether stocks are cheap or expensive. Investors are likely to earn below (above) average returns over the next 12-24 months when the market is overpriced (underpriced).

\* \* \*

# - Fed's Stock Valuation Model -



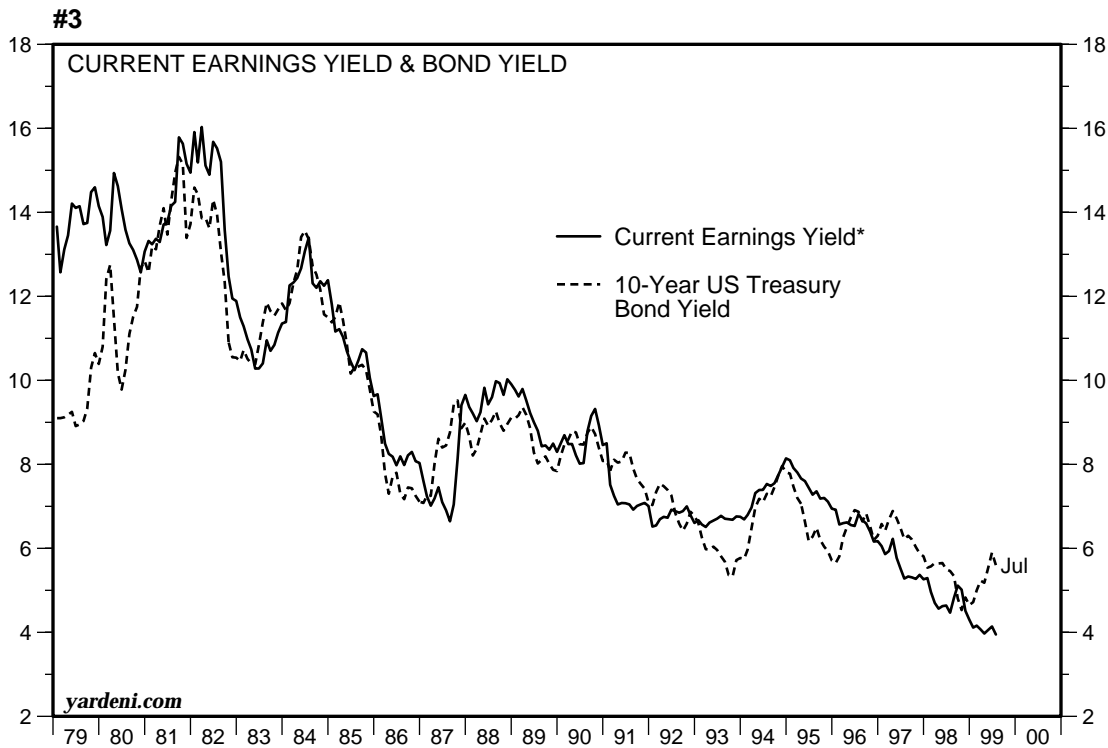
Fed's Stock Valuation Model shows stock market is extremely overpriced.



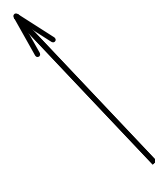
\* Ratio of S&P 500 Index to I/B/E/S consensus estimates of earnings over the coming 12 months divided by the 10-year US Treasury bond yield minus 100.



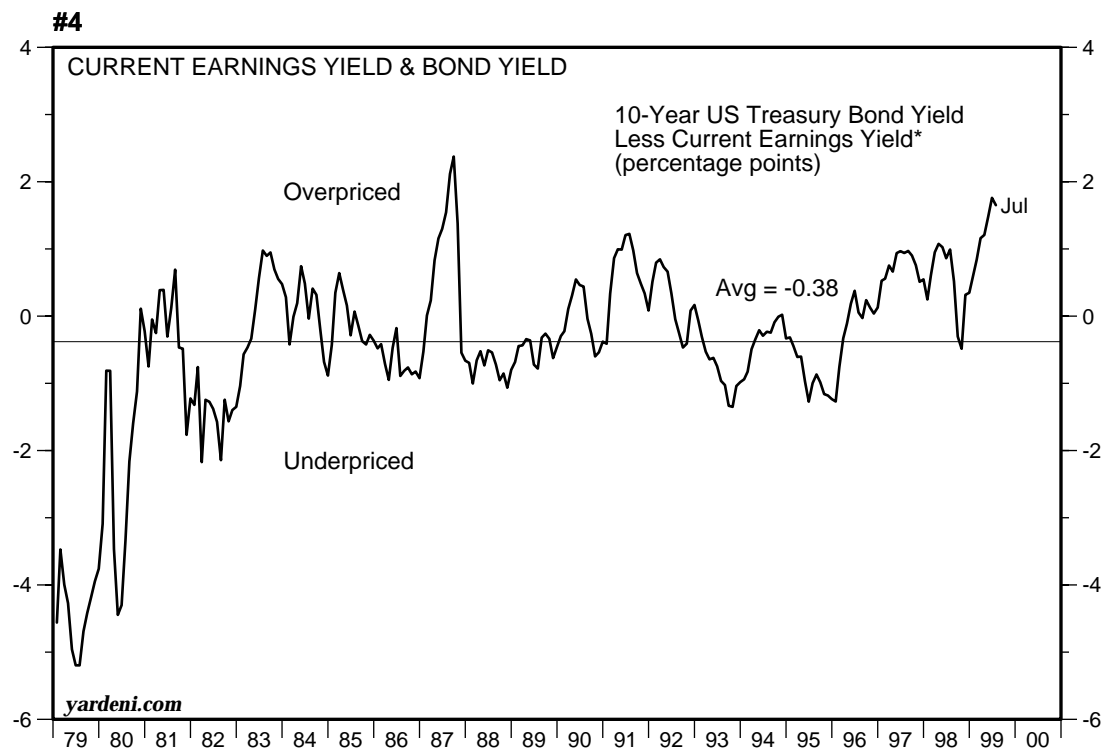
# - Earnings & Bond Yields -



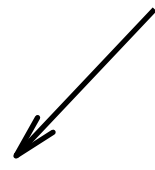
\* I/B/E/S consensus of S&P 500 earnings over the coming 12 months divided by S&P 500 Index.



Very wide spread between Treasury bond yield and current earnings yield. Bond yield would have to fall to 4% to justify current level of stock prices according to Fed's Stock Valuation Model.

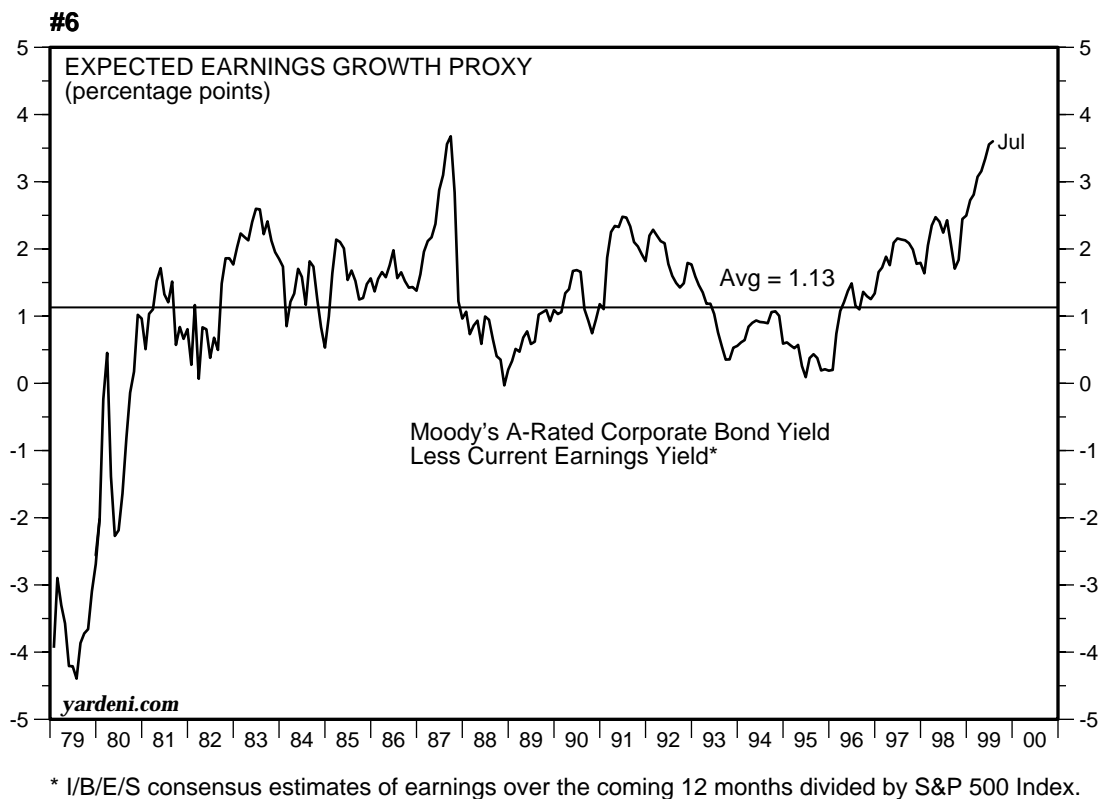
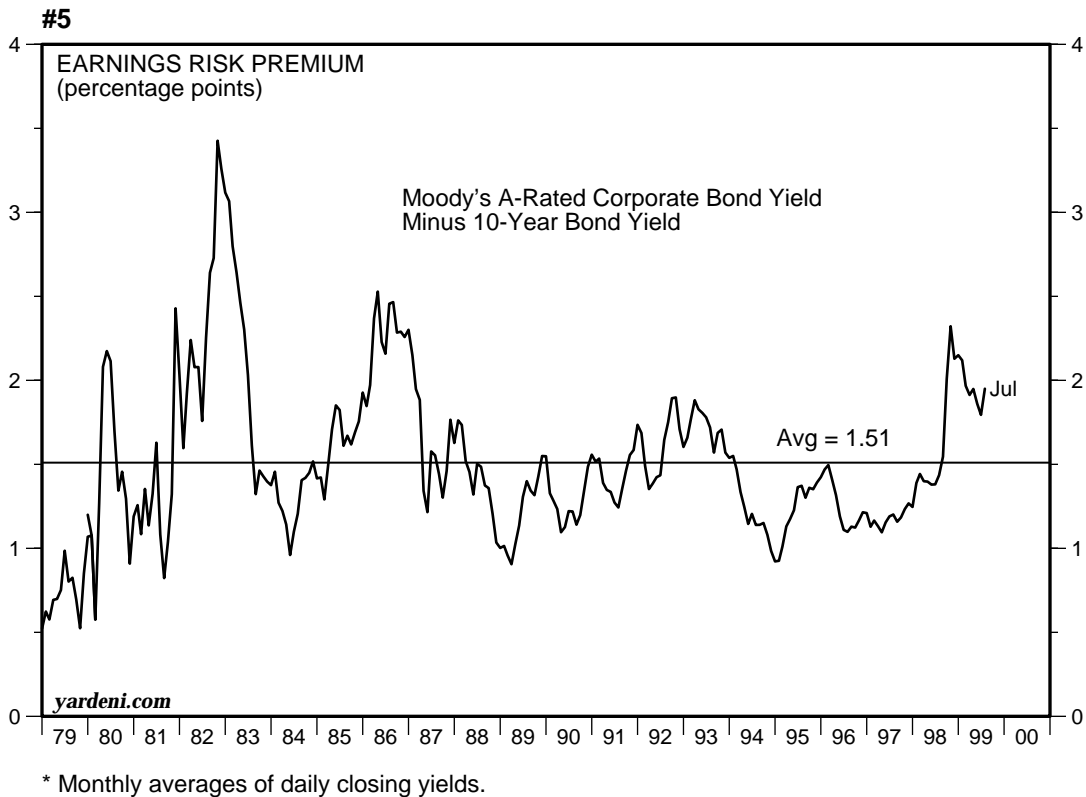
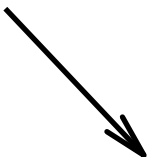
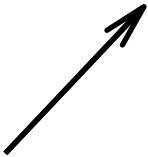


\* I/B/E/S consensus of S&P 500 earnings over the coming 12 months divided by S&P 500 Index.



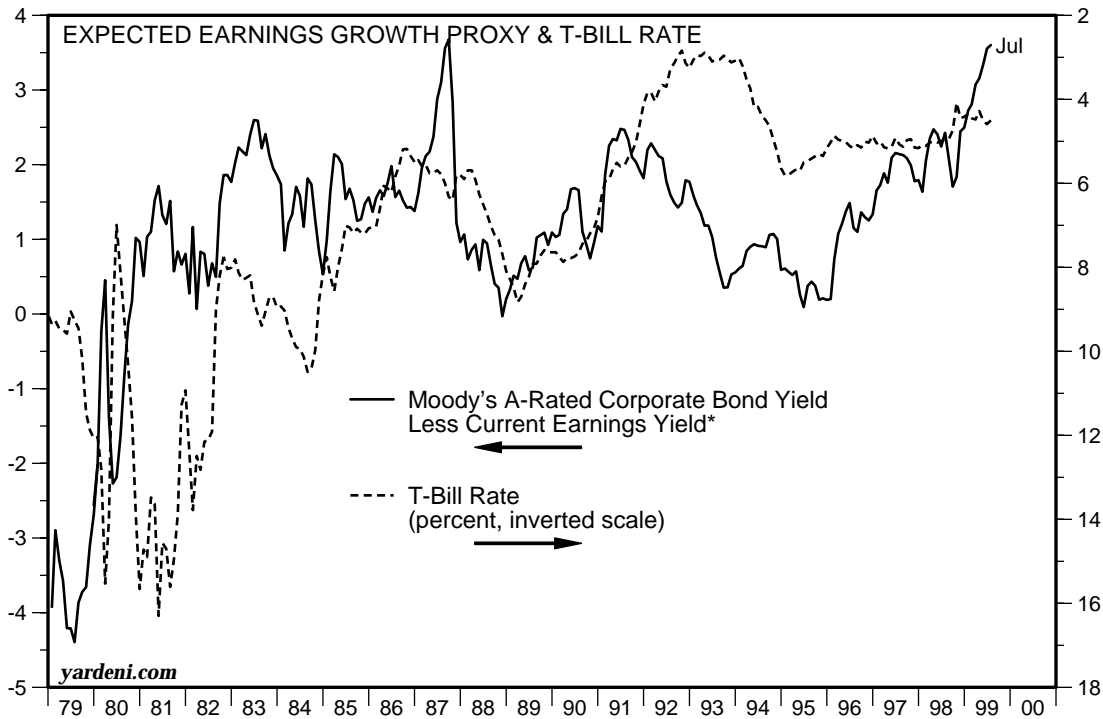
# - Risk & Expected Earnings -

Historically, i.e. since 1979, average earnings risk premium has more than offset long-term expected earnings growth. This explains why the spread between the current earnings yield and the Treasury bond yield has averaged only 0.38 percentage points.



# - Expected Earnings & T-Bill Rate -

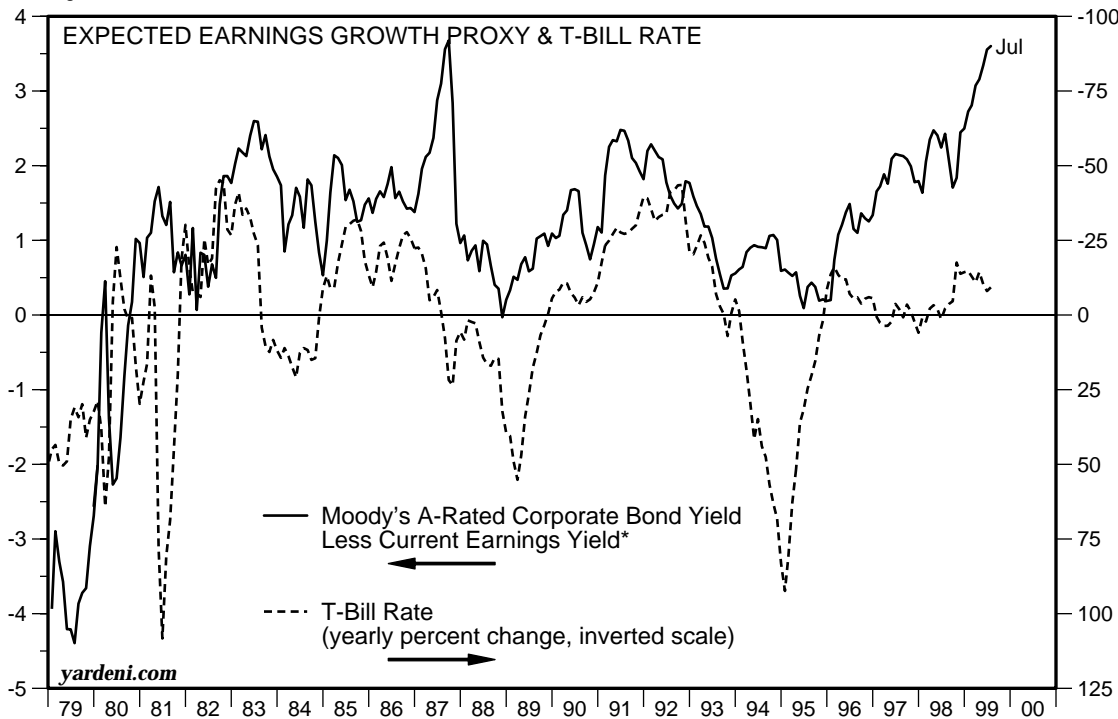
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\* I/B/E/S consensus estimates of earnings over the coming 12 months divided by S&P 500 Index.

Expected earnings growth proxy is highly and inversely correlated with both the level and the yearly percent change in the T-bill rate.

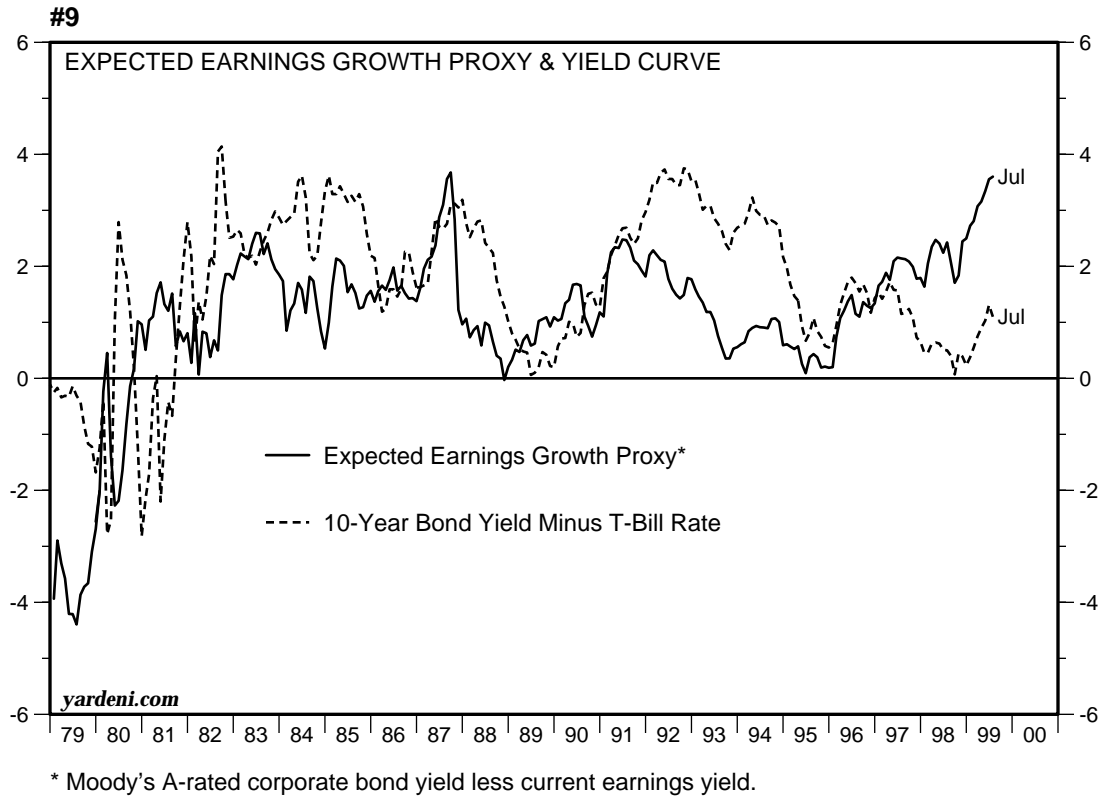
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\* I/B/E/S consensus estimates of earnings over the coming 12 months divided by S&P 500 Index.

# - Long-Term Earnings Expectations -

Expected Earnings Growth Proxy highly correlated with yield curve spread. Actually, it tends to lead the yield curve, which tends to lead industrial production growth.



Expected Earnings Growth Proxy highly correlated with consensus expectations for long-term earnings growth rate.

