Equity Research

Global

Deutsche Banc Alex. Brown

Global Strategy

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Asset Valuation & Allocation Models

Dr. Edward Yardeni
Chief Investment Strategist
(+1) 212 469 5715
edward.yardeni@db.com

Amalia F. Quintana
Equity Strategy Analyst
(+1) 212 469 5713
mali.quintana@db.com

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- Introduction -

I. Fed's Stock Valuation Model

How can we judge whether stock prices are too high, too low, or just right? The purpose of this weekly report is to track a stock valuation model that attempts to answer this question. While the model is very simple, it has been quite accurate and can also be used as a stocks-versus-bonds asset allocation tool. I started to study the model in 1997, after reading that the folks at the Federal Reserve have been using it. If it is good enough for them, it's good enough for me. I dubbed it the Fed's Stock Valuation Model (FSVM), though no one at the Fed ever officially endorsed it.

On December 5, 1996, Alan Greenspan, Chairman of the Federal Reserve Board, famously worried out loud for the first time about "irrational exuberance" in the stock market. He didn't actually say that stock prices were too high. Rather he asked the question: "But how do we know when irrational exuberance has unduly escalated asset values, which then become subject to unexpected and prolonged contractions…."[1] He did it again on February 26, 1997.[2] He probably instructed his staff to devise a stock market valuation model to help him evaluate the extent of the market's 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.[3]

The Fed model was summed up in one paragraph and one chart on page 24 of the 25-page document (see following table). The chart shows a strong correlation between the S&P 500 forward earnings yield (FEY)—i.e., the ratio of expected operating earnings (E) to the price index for the S&P 500 companies (P), using 12-month-ahead consensus earnings estimates compiled by Thomson Financial First Call.—and the 10-year Treasury bond yield (TBY). The average spread between the forward earnings yield and the Treasury yield (i.e., FEY-TBY) is 29 basis points since 1979. This near-zero average implies that the market is fairly valued when the two are identical:

1) FEY = TBY

Of course, in the investment community, we tend to follow the price-to-earnings ratio more than the earnings yield. 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, and on average the two have been nearly identical. In other words, the "fair value" price for the S&P 500 (FVP) is equal to expected earnings divided by the bond yield in the Fed's valuation model:

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1 http://www.federalreserve.gov/boarddocs/speeches/1996/19961205.htm

2 "We have not been able, as yet, to provide a satisfying answer to this question, but there are reasons in the current environment to keep this question on the table." http://www.federalreserve.gov/boarddocs/hh/1997/february/testimony.htm

3 http://www.federalreserve.gov/boarddocs/hh/1997/july/ReportSection2.htm

2) FVP = E/TBY

> **Excerpt from Fed's July 1997 Monetary Policy Report:**
>
> 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.

The ratio of the actual S&P 500 price index to the fair value price shows the degree of overvaluation or undervaluation. History shows that markets can stay overvalued and become even more overvalued for a while. But eventually, overvaluation is 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. Undervaluation can be corrected by rising yields, lower earnings expectations, or higher stock prices.

The Fed's Stock Valuation Model worked quite well in the past. It identified when stock prices were excessively overvalued or undervalued, and likely to fall or rise:

1) The market was extremely undervalued from 1979 through 1982, setting the stage for a powerful rally that lasted through the summer of 1987.

2) Stock prices crashed after the market rose to a record 34% overvaluation peak during September 1987.

3) Then the market was undervalued in the late 1980s, and stock prices rose.

4) In the early 1990s, it was moderately overvalued and stock values advanced at a lackluster pace.

5) Stock prices were mostly undervalued during the mid-1990s, and a great bull market started in late 1994.

6) Ironically, the market was actually fairly valued during December 1996 when the Fed Chairman worried out loud about irrational exuberance.

7) During both the summers of 1997 and 1998, overvaluation conditions were corrected by a sharp drop in prices.

8) Then a two-month undervaluation condition during September and October 1998 was quickly reversed as stock prices soared to a remarkable record 70% overvaluation reading during January 2000. This bubble was led by the Nasdaq and technology stocks, which crashed over the rest of the year, bringing the market closer to fair value.

II. New Improved Model

The FSVM is missing a variable reflecting that the forward earnings yield is riskier than the government bond yield. 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. The FSVM is also missing a variable for long-term earnings growth. My New Improved Model includes these variables as follows:

3) $$\mathbf{FEY = CBY - b \cdot LTEG}$$

where CBY is Moody's A-rated corporate bond yield. LTEG is long-term expected earnings growth, which is measured using consensus five-year earnings growth projections. I/B/E/S International compiles these monthly. The "b" coefficient is the weight that the market gives to long-term earnings projections. It can be derived as -[FEY-CBY]/LTEG. Since the start of the data in 1985, this "earnings growth coefficient" averaged 0.1.

Equation 3 can be rearranged to produce the following:

4) $$\mathbf{FVP = E \div [CBY - b \cdot LTEG]}$$

FVP is the fair value price of the S&P 500 index. Exhibit 10 shows three fair value price series using the actual data for E, CBY, and LTEG with b = 0.1, b = 0.2, and b = 0.25. The market was fairly valued during 1999 and the first half of 2000 based on the consensus forecast that earnings could grow more than 16% per year over the next five years and that this variable should be weighted by 0.25, or two and a half times more than the average historical weight.

III. Back To Basics

With the benefit of hindsight, it seems that these assumptions were too optimistic. But, this is exactly the added value of the New Improved FSVM. It can be used to make explicit the implicit assumptions in the stock market about the weight given to long-term earnings growth. The simple version has worked so well historically because the long-term growth component has been offset on average by the risk variable in the corporate bond market.

IV. Stocks Versus Bonds

The FSVM is a very simple stock valuation model. It should be used along with other stock valuation tools, including the New Improved version of the model. Of course, there are numerous other more sophisticated and complex models. The Fed model is not a market-timing tool. As noted above, an overvalued (undervalued) market can become even more overvalued (undervalued). 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 overvalued (undervalued).

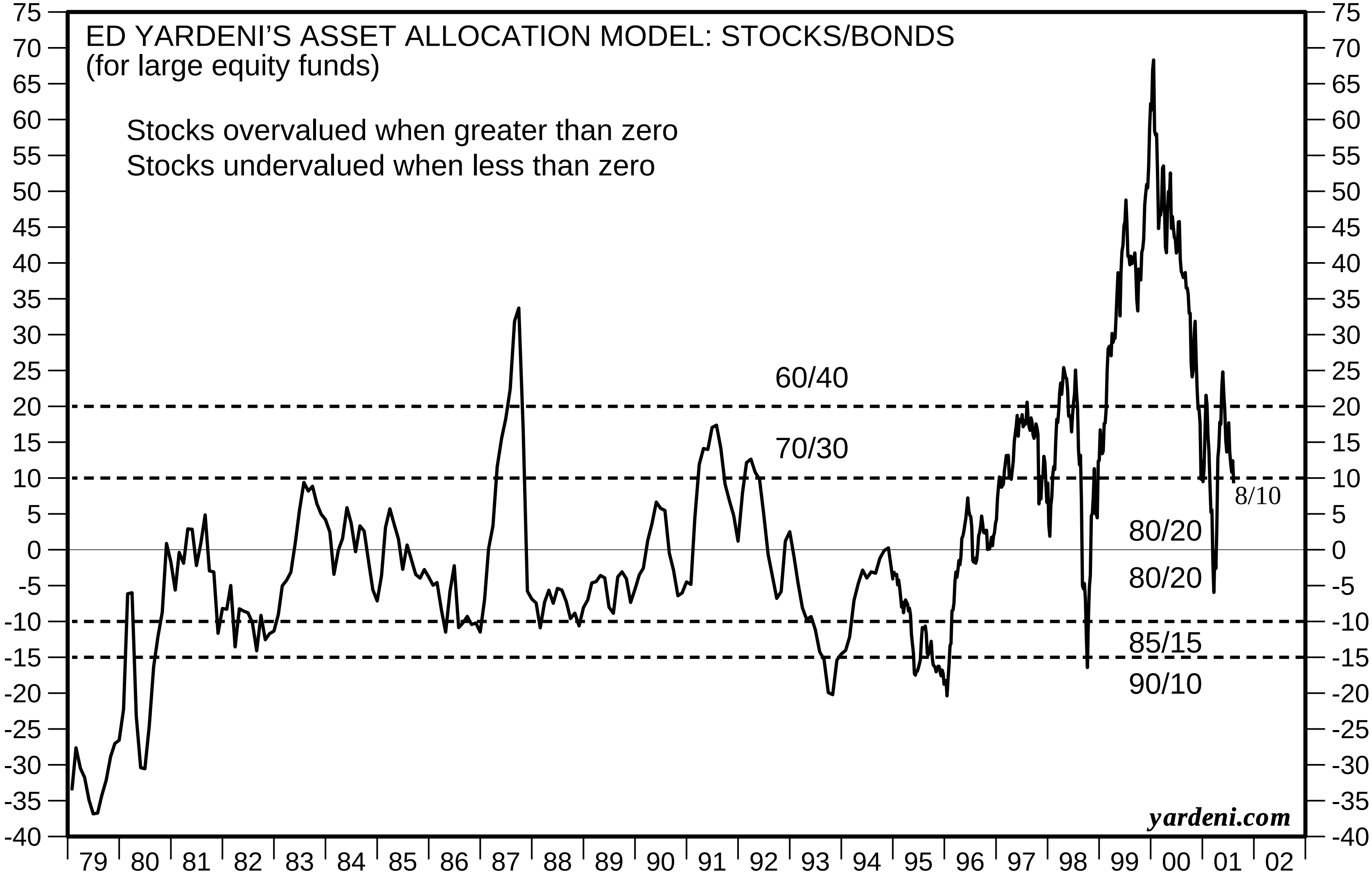
The next logical step is to convert the FSVM into a simple asset allocation model (Exhibit 1 on front cover). I've done so by subjectively associating the "right" stock/bond asset mixes with the degree of over/under valuation as shown in the table below. For example, whenever stocks are 10% to 20% overvalued, I would recommend that a large institutional equity portfolio should have a mix with 70% in stocks and 30% in bonds.

Stocks/Bonds Asset Allocation Model

More than 20% overvalued	60% stocks, 40% bonds
10% to 20% overvalued	70% stocks, 30% bonds
Less than 10% overvalued or undervalued	80% stocks, 20% bonds
10% to 20% undervalued	85% stocks, 15% bonds
More than 20% undervalued	90% stocks, 10% bonds

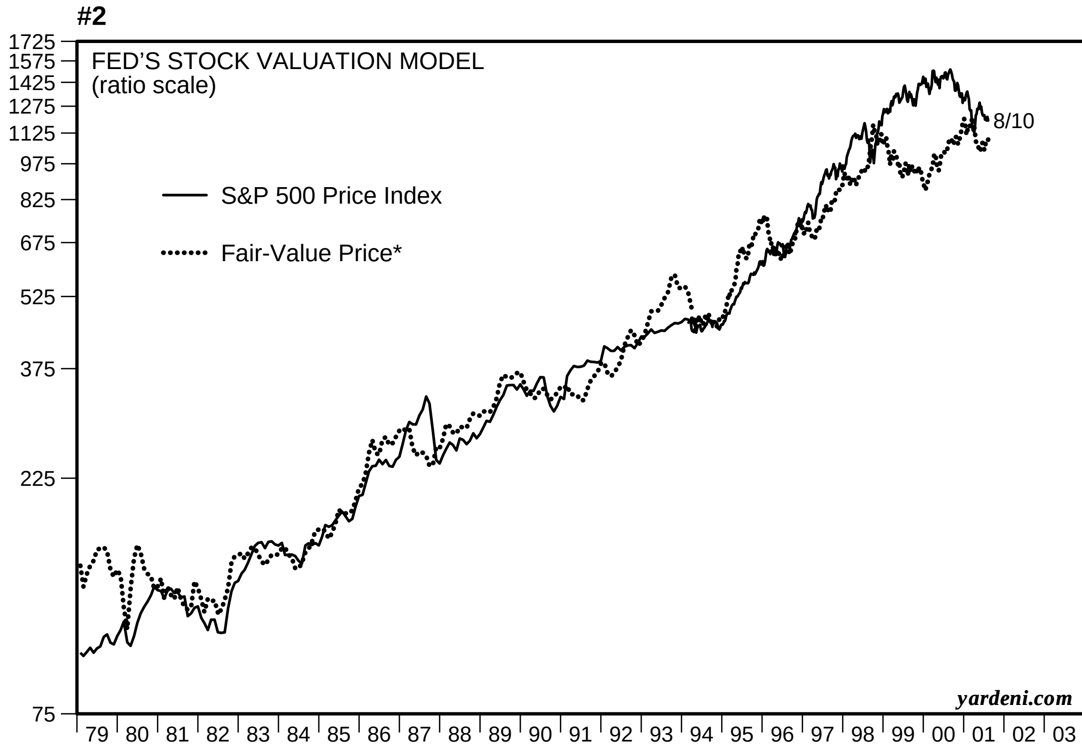
- Asset Allocation -

#1



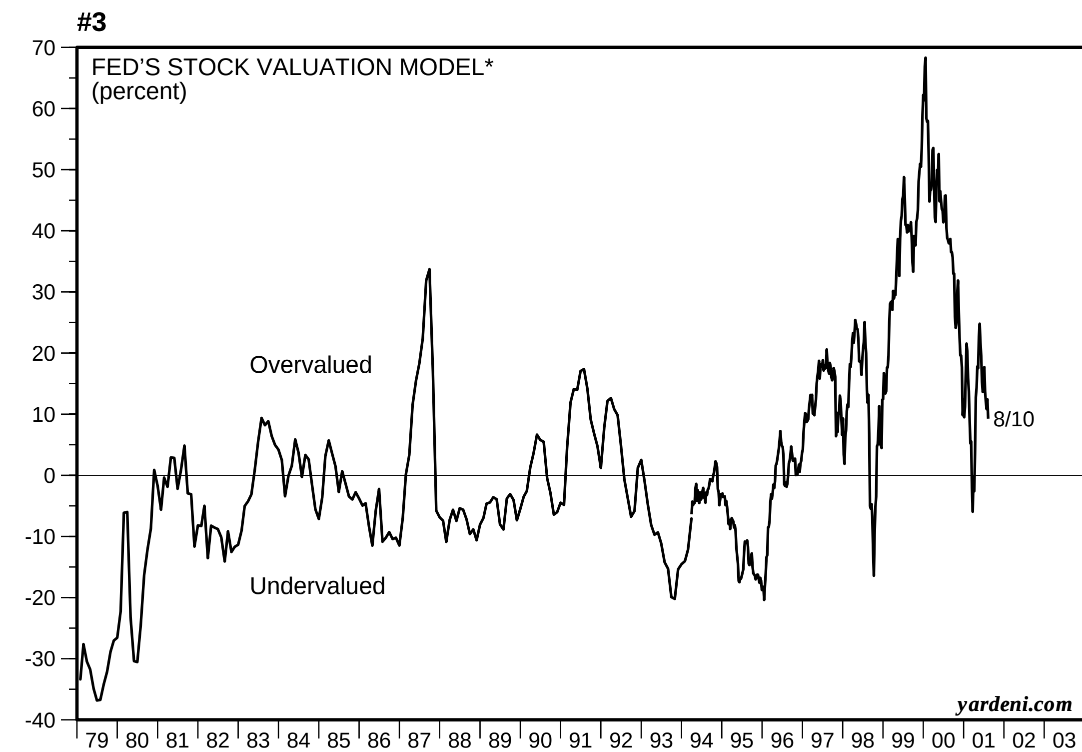
* Ratio of S&P 500 index to it's fair value (12-month forward consensus expected operating earnings per share divided by the 10-year US Treasury bond yield) minus 100. Monthly through March 1994, weekly after.
Source: Thomson Financial

- Valuation Model -



* 12-month forward consensus expected S&P 500 operating earnings per share divided by 10-year US Treasury bond yield. Monthly through March 1994, weekly after.
Source: Thomson Financial

According to the Fed model, when stock prices are overpriced, returns from stocks are likely to be subpar over the next 12-24 months. Better-than-average returns tend to come from underpriced markets.

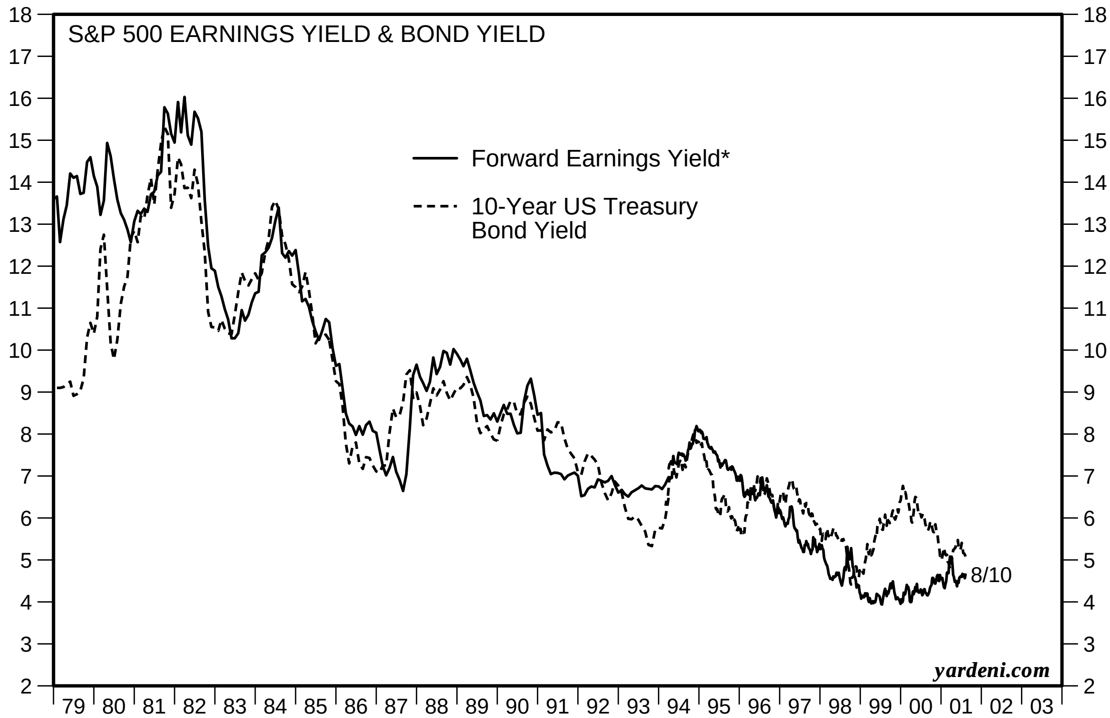


* Ratio of S&P 500 Index to its Fair-Value (52-week forward consensus expected operating earnings per share divided by the 10-year US Treasury bond yield) minus 100. Monthly through March 1994, weekly after.
Source: Thomson Financial

- Valuation Model -

This chart appeared in the Fed's July 1997 Monetary Policy Report to the Congress. It shows a very close correlation between the earnings yield of the stock market and the bond yield. Another, more familiar way to look at it follows.

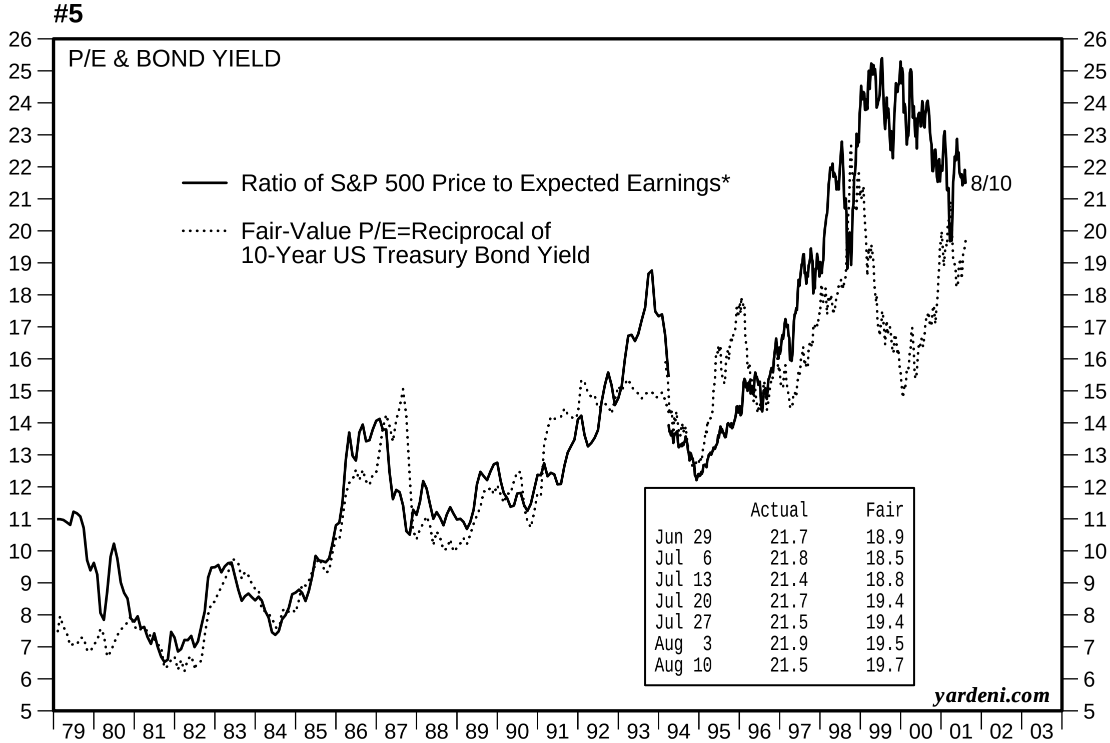
#4



* 12-month forward consensus expected S&P 500 operating earnings per share divided by S&P 500 Index. Monthly through March 1994, weekly after.
Source: Thomson Financial

The S&P 500 P/E (using expected earnings) is highly correlated with reciprocal of the bond yield.

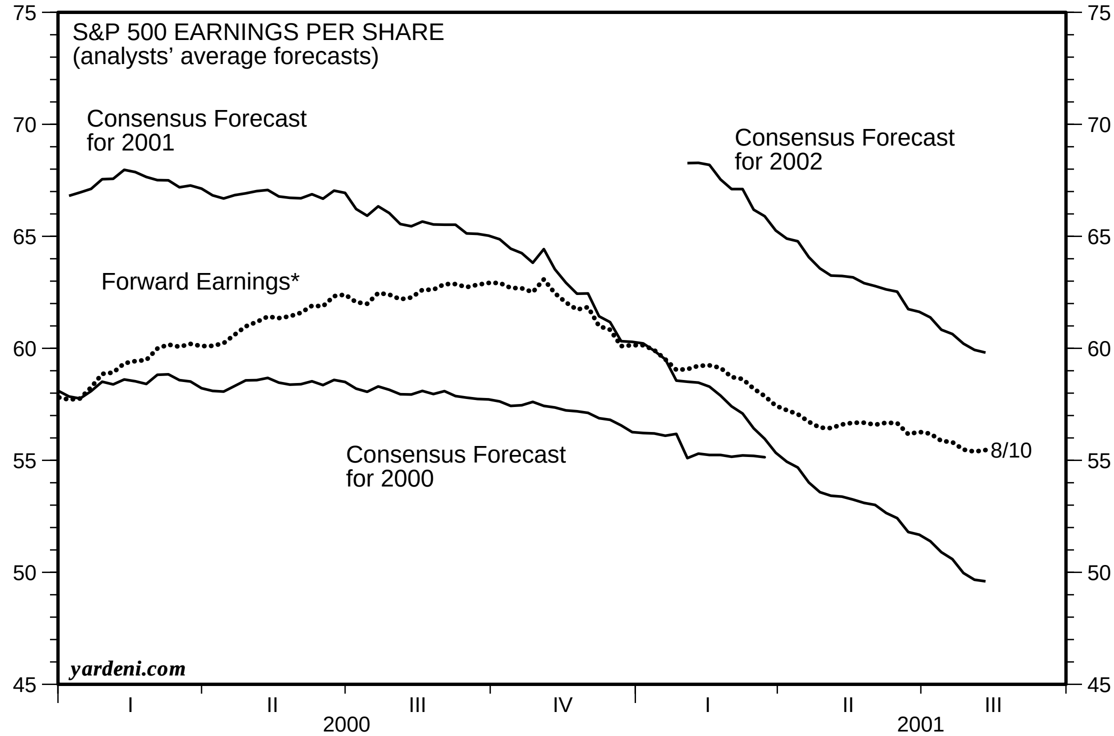
#5



* 12-month forward consensus expected S&P 500 operating earnings per share. Monthly through March 1994, weekly after.
Source: Thomson Financial

- Earnings -

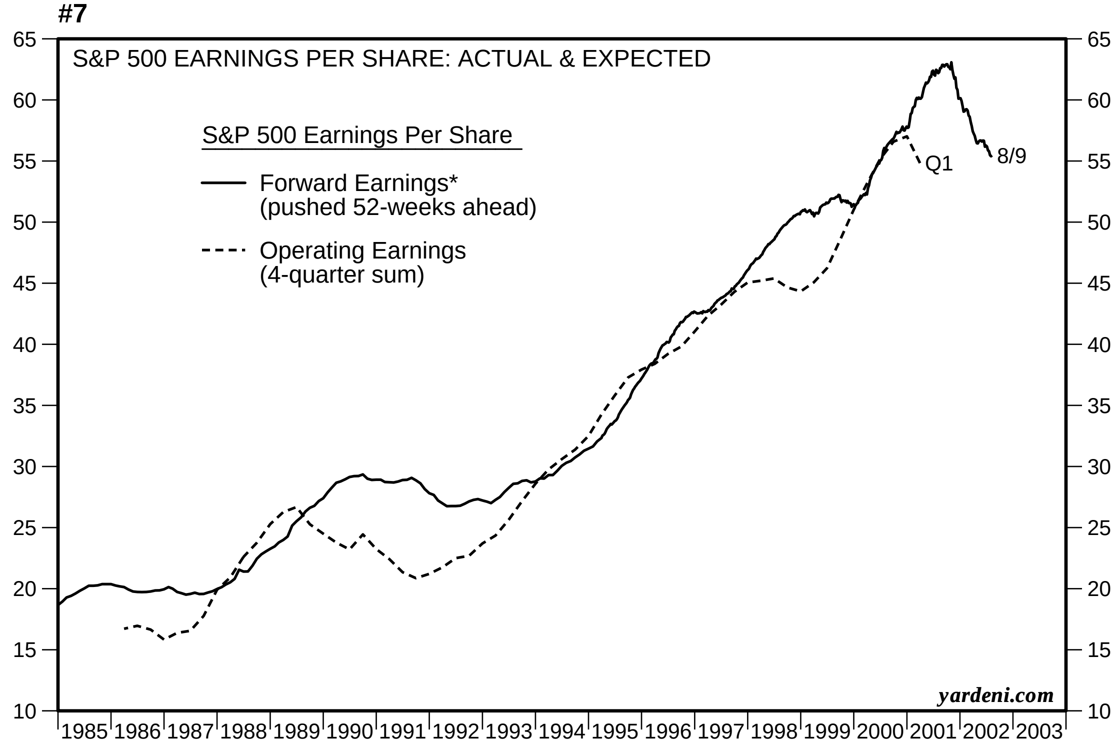
#6



* 52-week forward consensus expected S&P 500 operating earnings per share.
Source: Thomson Financial

Expected forward earnings is a time-weighted average of current and the coming years' consensus forecasts.

#7

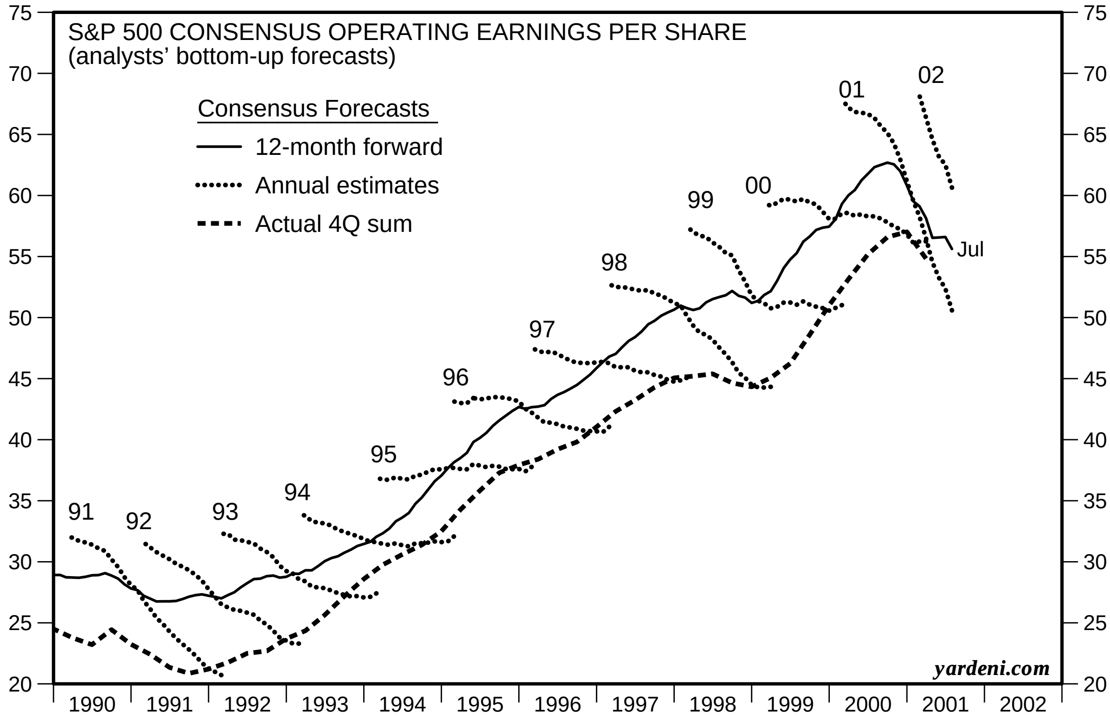


* 52-week forward consensus expected S&P 500 operating earnings per share. Monthly through March 1994, weekly after.
Source: Thomson Financial

Bottom-up 52-week forward expected earnings tends to be a good predicator of actual earnings, with a few significant misses.

- Earnings -

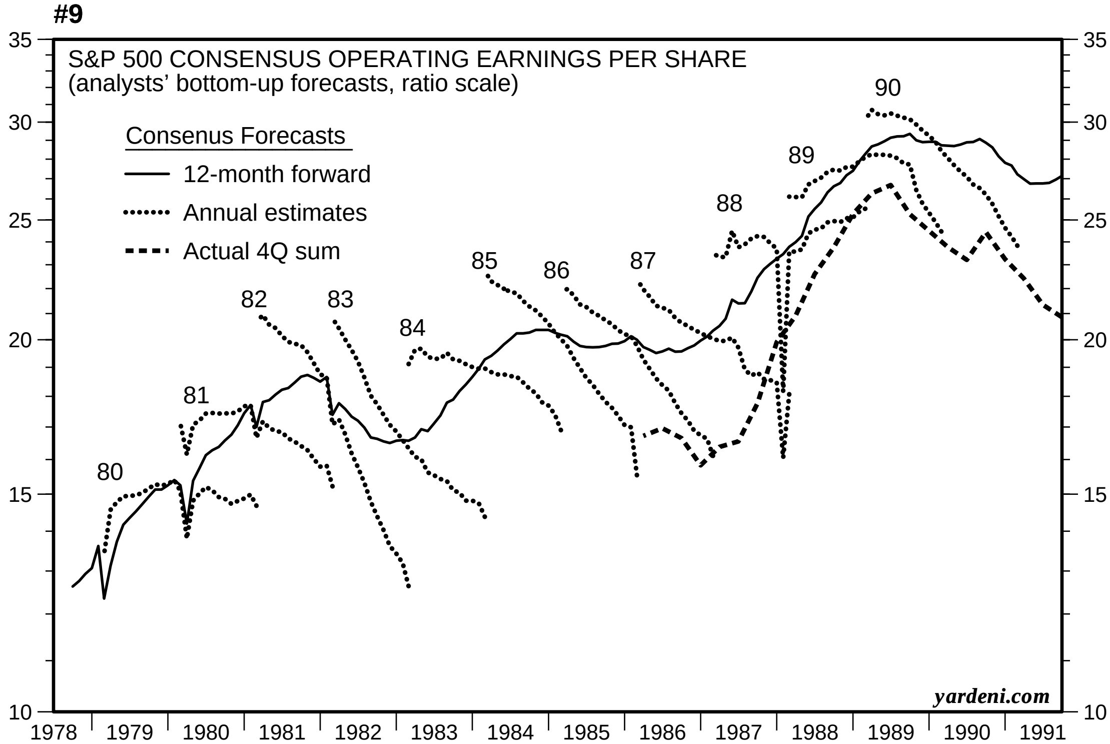
#8



Source: yardeni.com. Do not reprint without permission.

Analysts always start out too optimistic about the prospects for earnings.

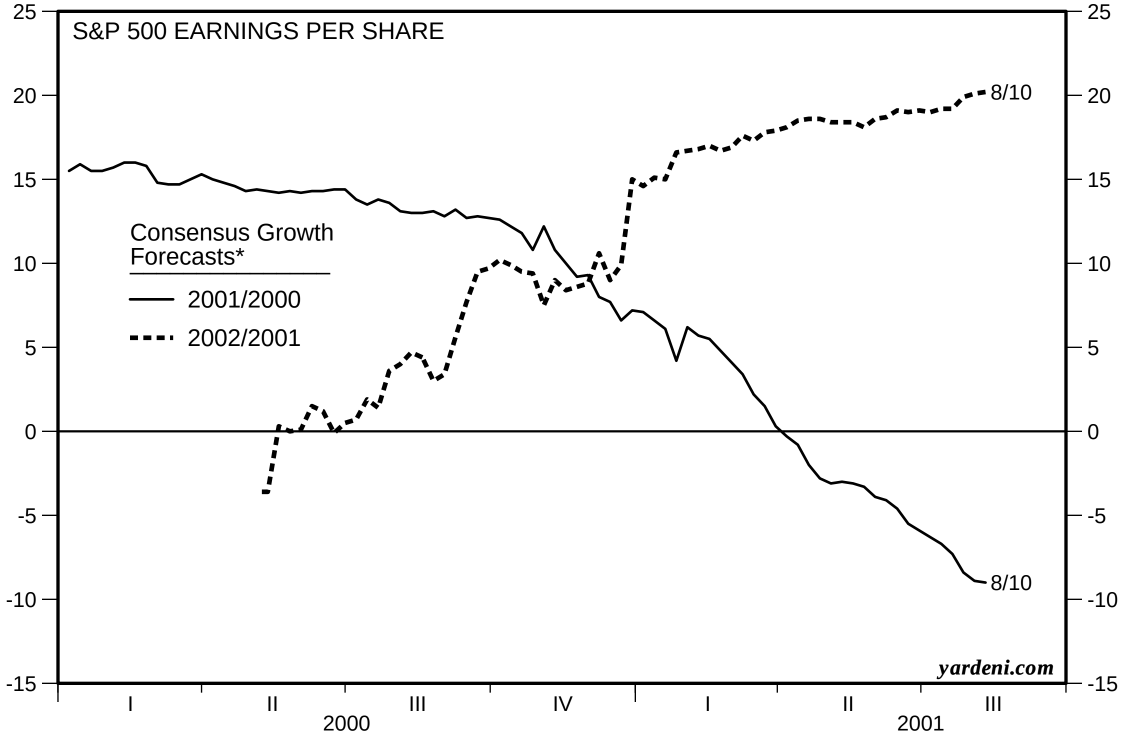
#9



Source: yardeni.com. Do not reprint without permission.

- Earnings -

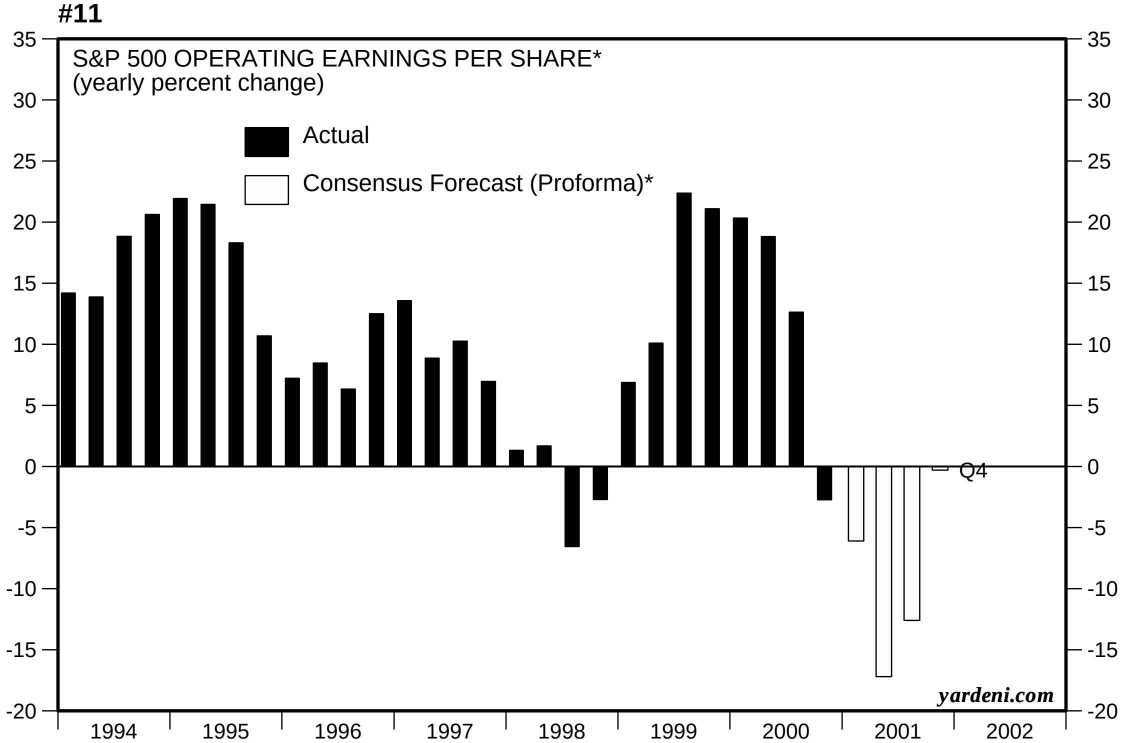
#10



* Based on consensus expected S&P 500 operating earnings for years shown.
Source: Thomson Financial

The data on consensus expected earnings can be used to derive consensus earnings growth forecasts.

#11



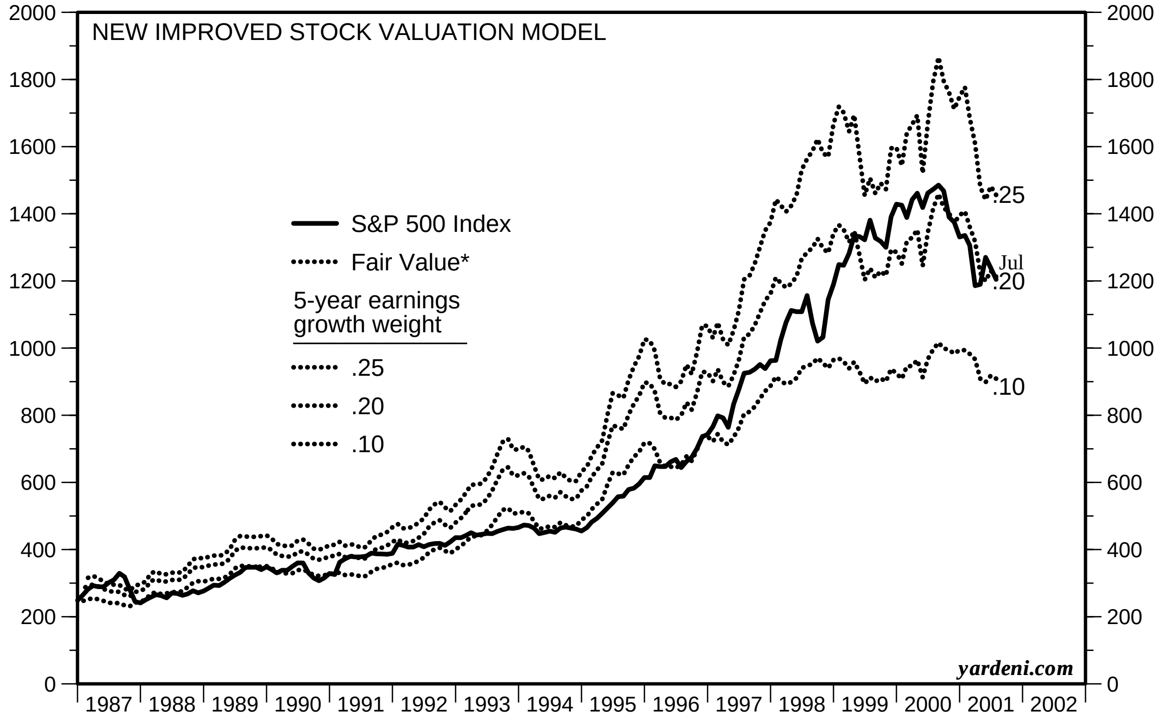
* S&P 500 composition is constantly changing. Actual data are not adjusted for these changes.
Proforma forecasts are same-company comparisions. Source: Thomson Financial

Earnings growth is highly cyclical.

- New Improved Model -

This New Improved Model builds on the simple one by adding variables for long-term expected earnings growth and risk.

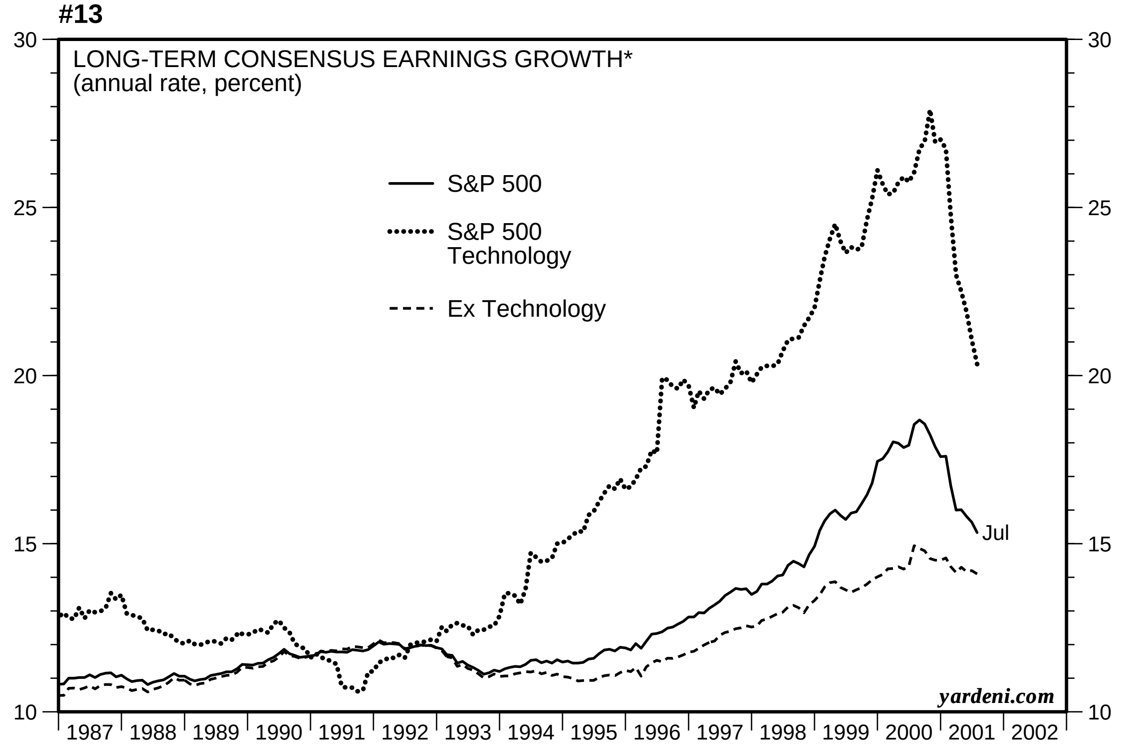
#12



* Fair Value is 12-month forward consensus expected S&P 500 operating earnings per share divided by difference between Moody's A-rated corporate bond yield less fraction (as shown above) of 5-year consensus expected earnings growth.
Source: Thomson Financial

Long-term earnings growth expectations rose sharply during 1990s. Now they are coming back down to the Planet Earth.

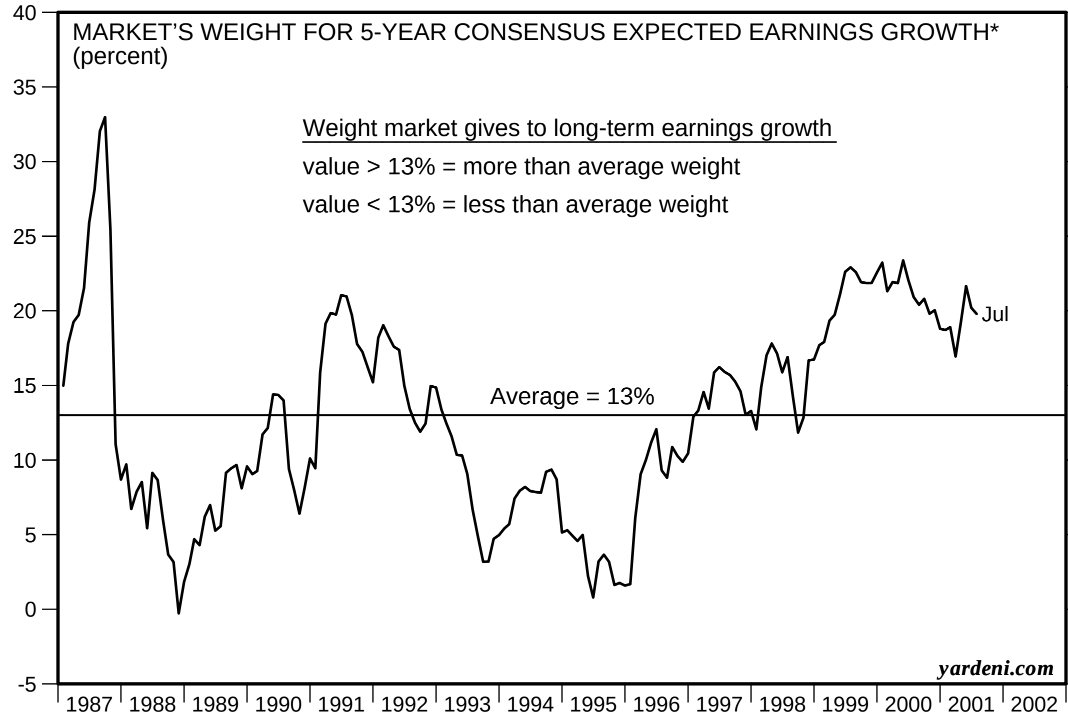
#13



* 5-year forward consensus expected S&P 500 earnings growth.
Source: Thomson Financial

- New Improved Model -

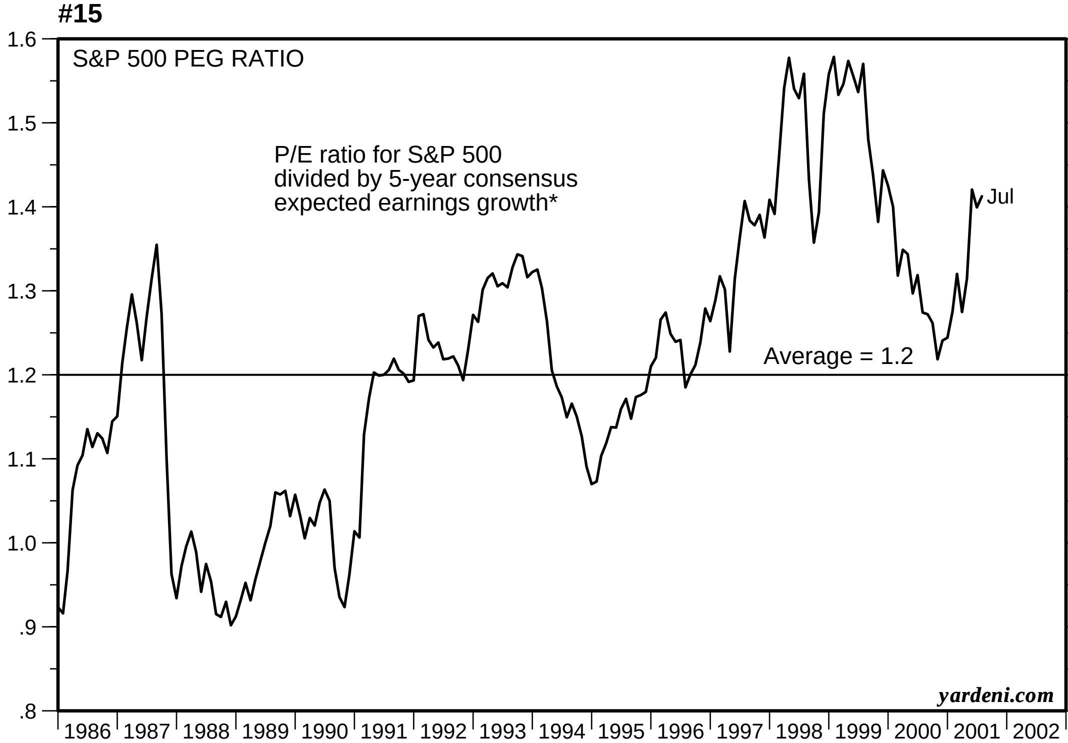
#14



* Moody's A-rated corporate bond yield less earnings yield divided by 5-year consensus expected earnings growth.

Investors have on average over time subtracted 13% of their long-term earnings growth expectations from the corporate bond yield to determine earnings yield.

#15

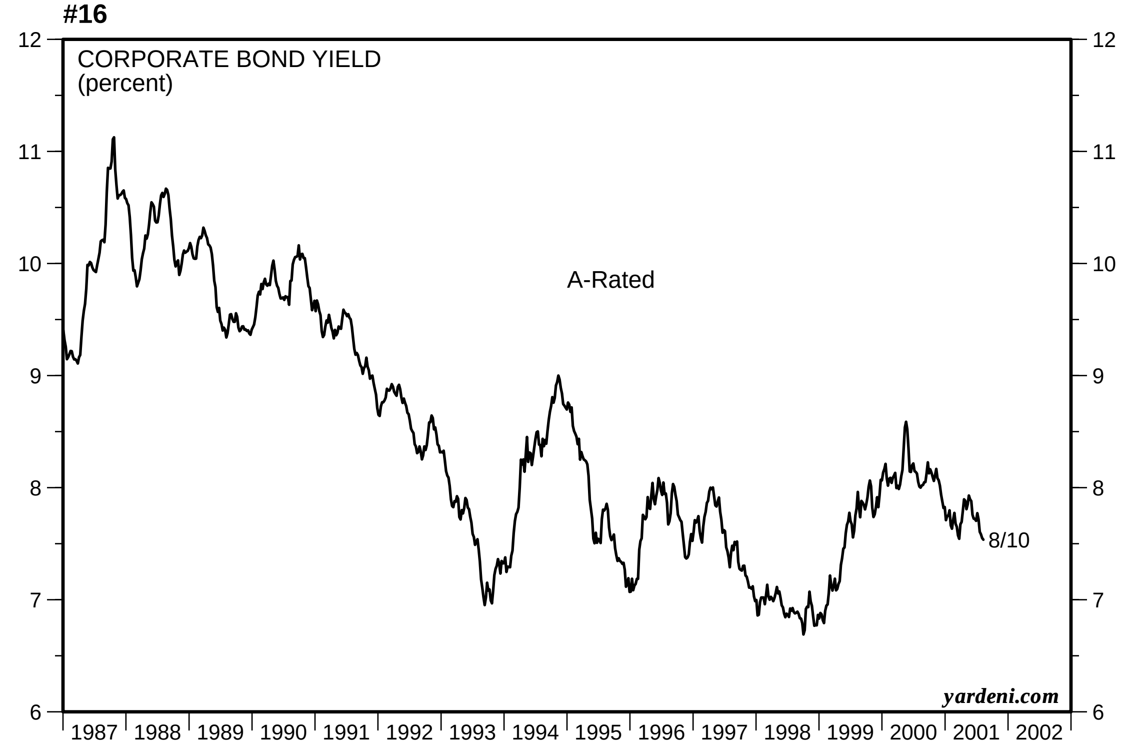


* P/E using 12-month forward consensus S&P 500 expected earnings and prices at mid-month.
Source: Thomson Financial

Historically, S&P 500 sold at P/E of 1.2 times long-term expected earnings growth, on average, with quite a bit of volatility.

- New Improved Model -

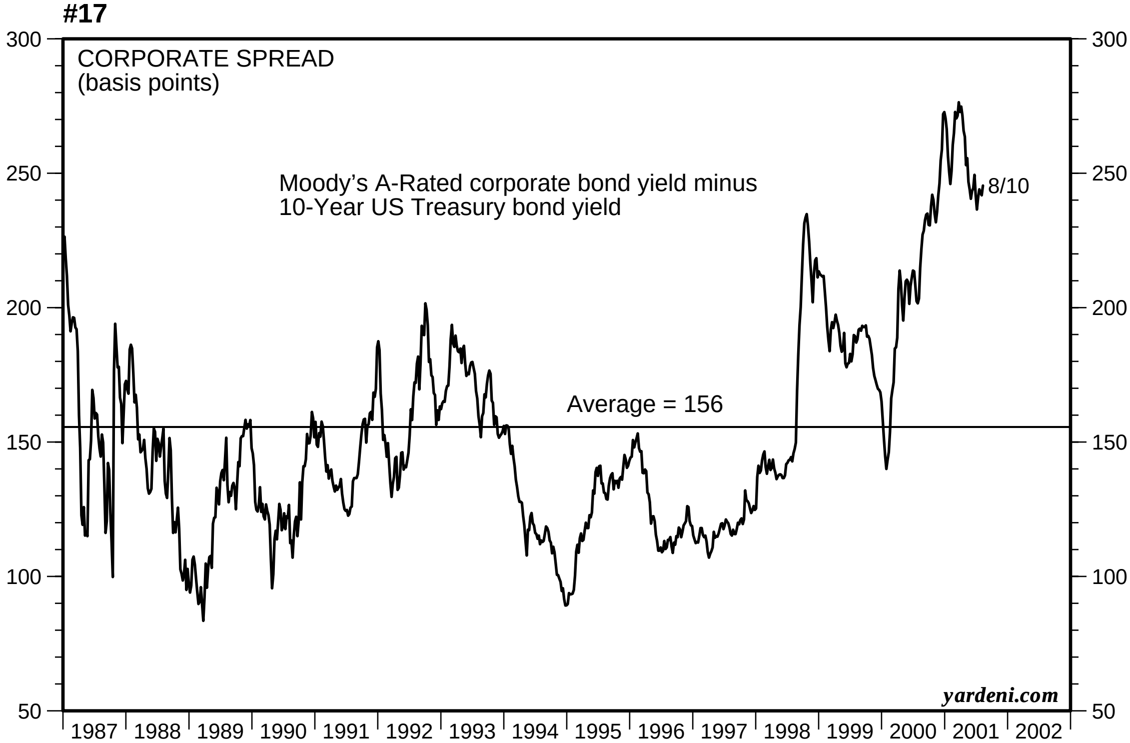
#16



* Source: Moody's Investors Service

Corporate bond yield variable in New Improved Model captures risk that earnings will be weaker than expected.

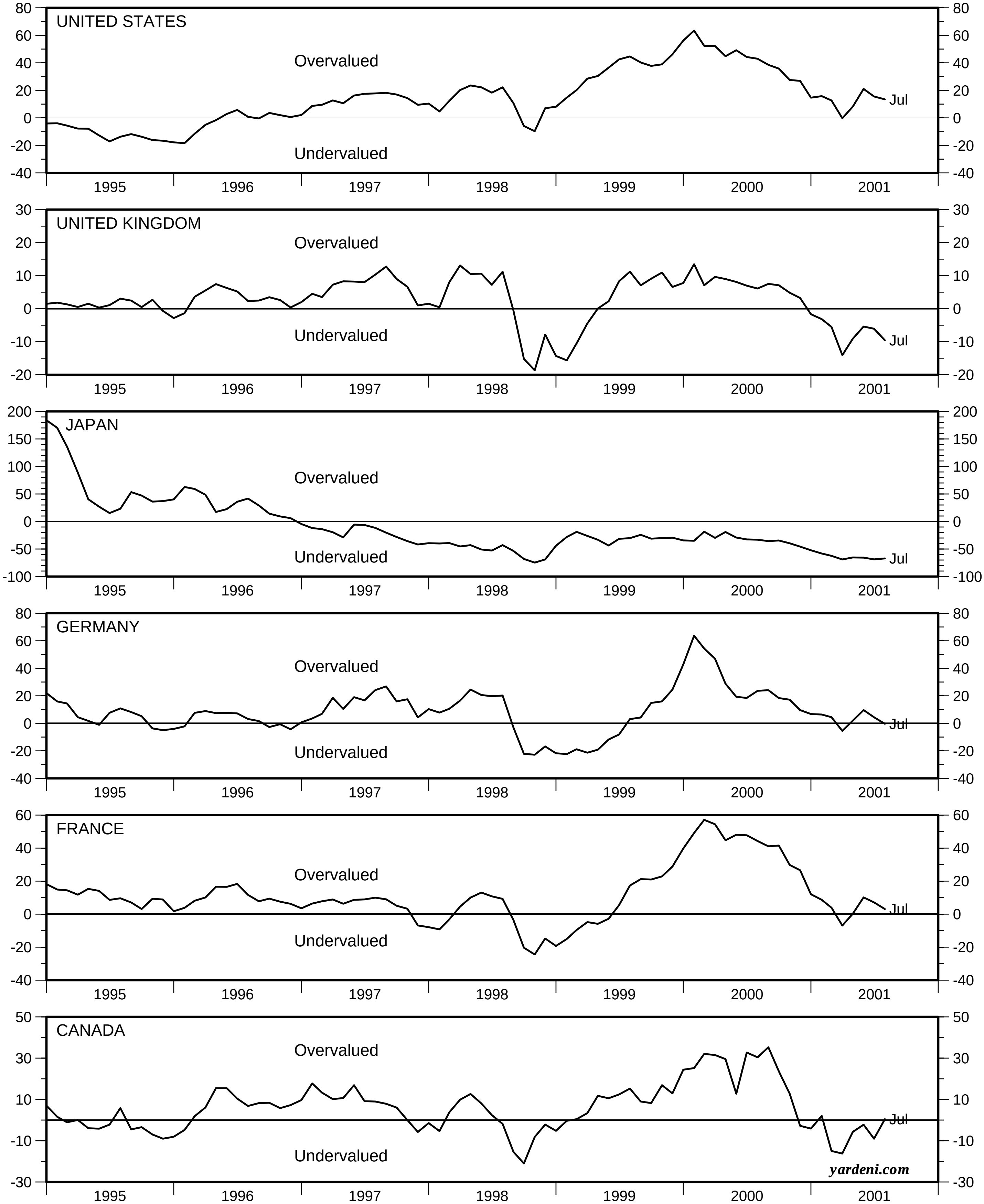
#17



Source: Moody's Investor Service

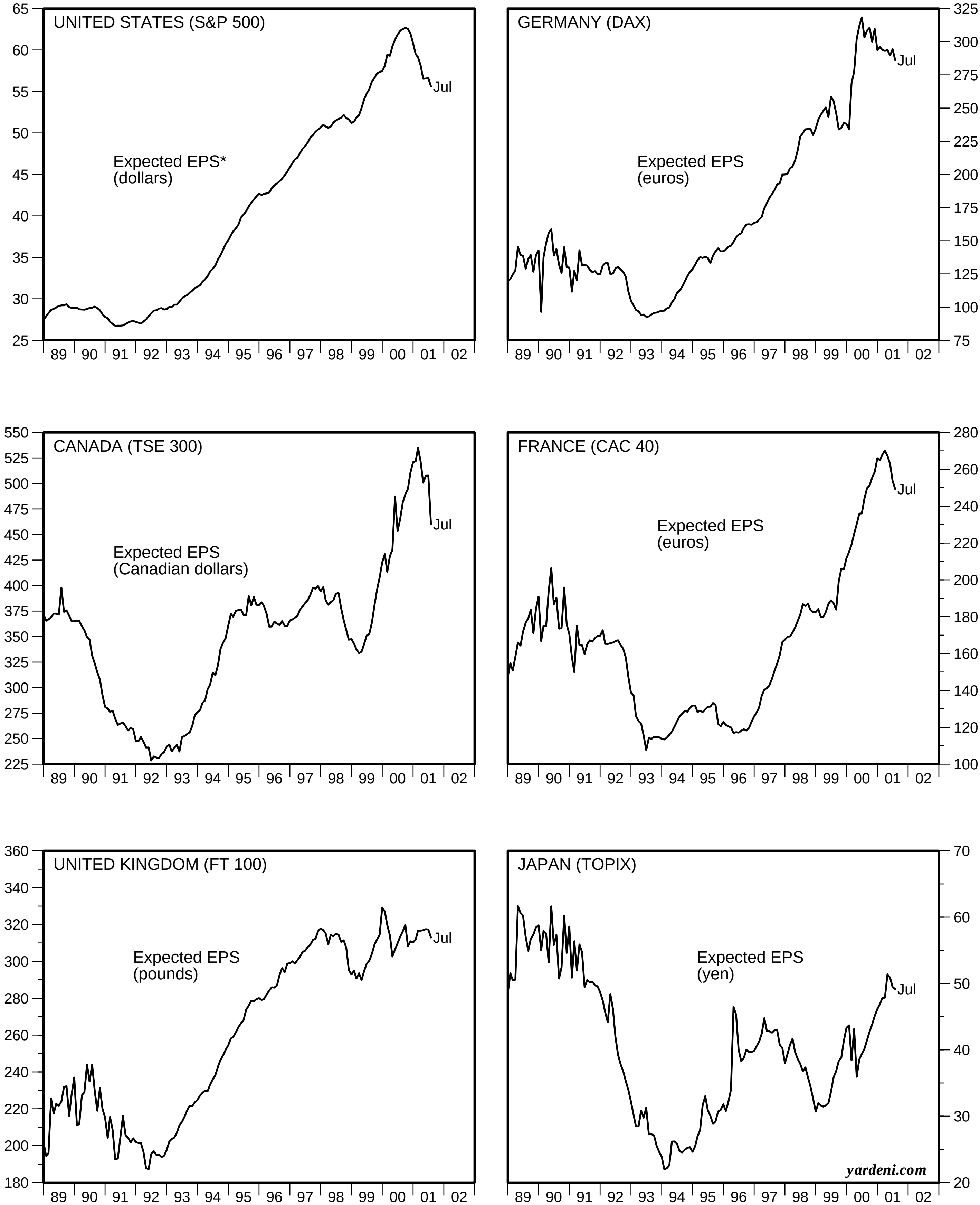
- Global: Stock Valuation -

#18



- Global: Expected Earnings* -

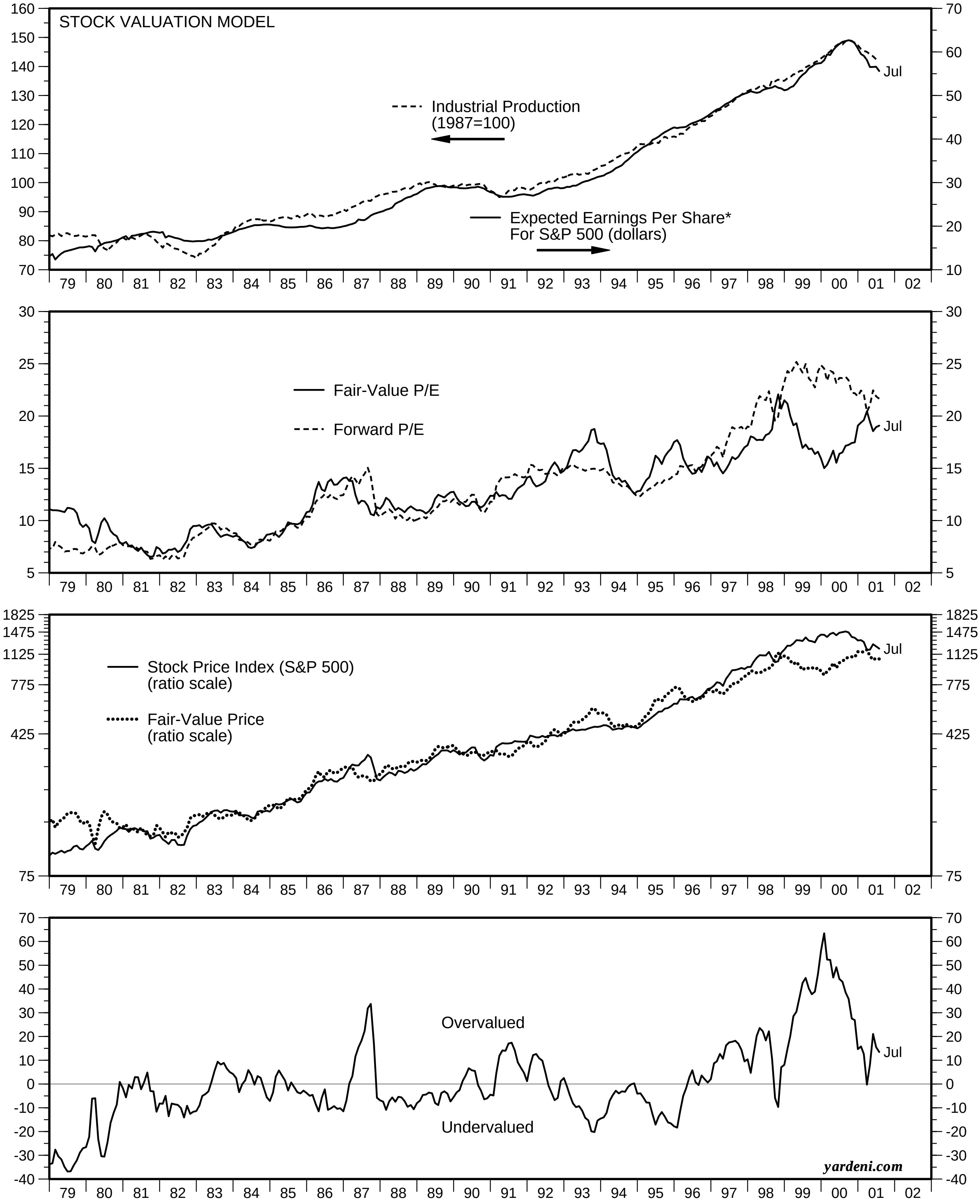
#19



* 12-month forward consensus expected operating earnings per share. Source: Thomson Financial

- Global: United States (S&P 500) -

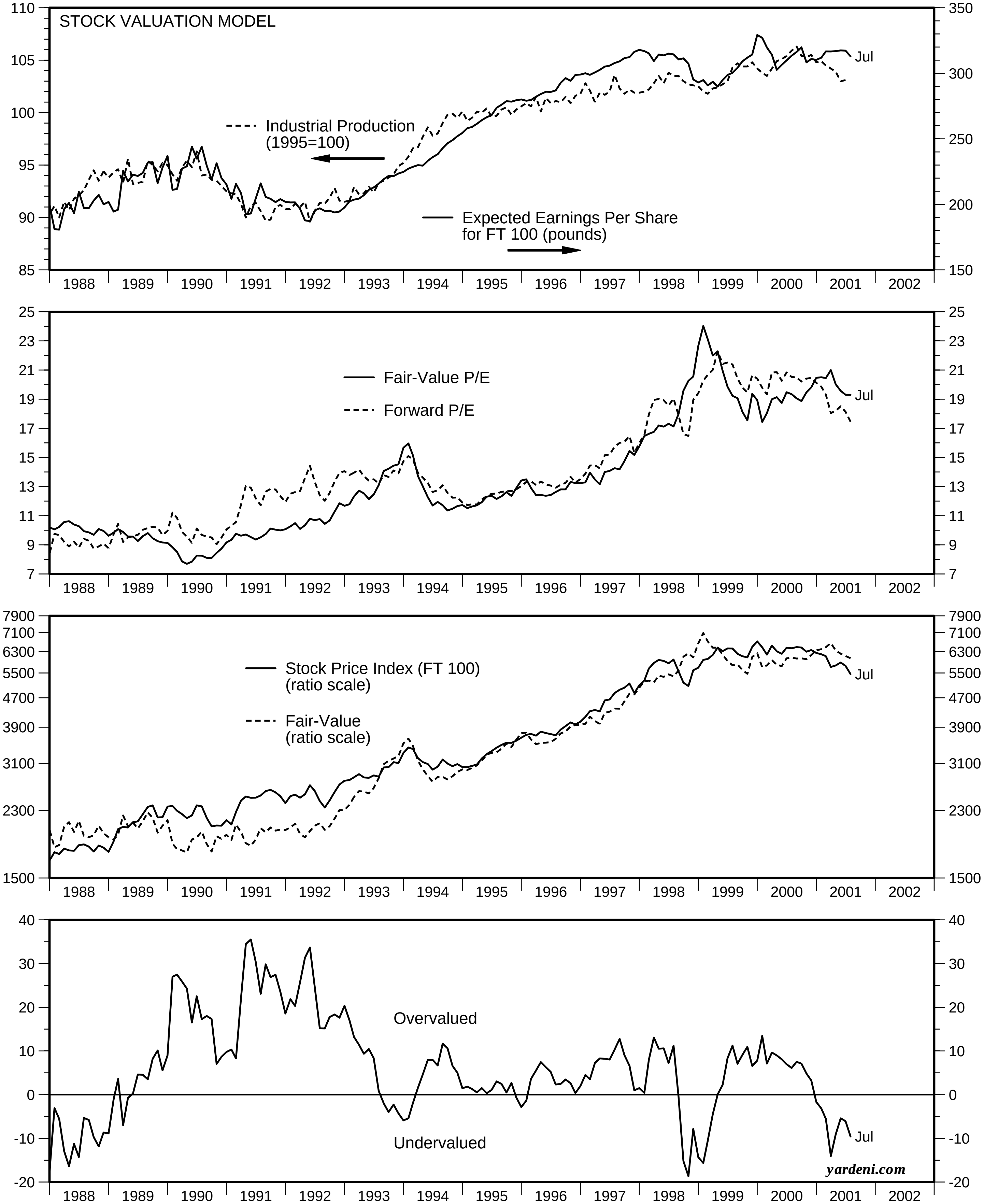
#20



* Source: Thomson Financial

- Global: United Kingdom (FT 100) -

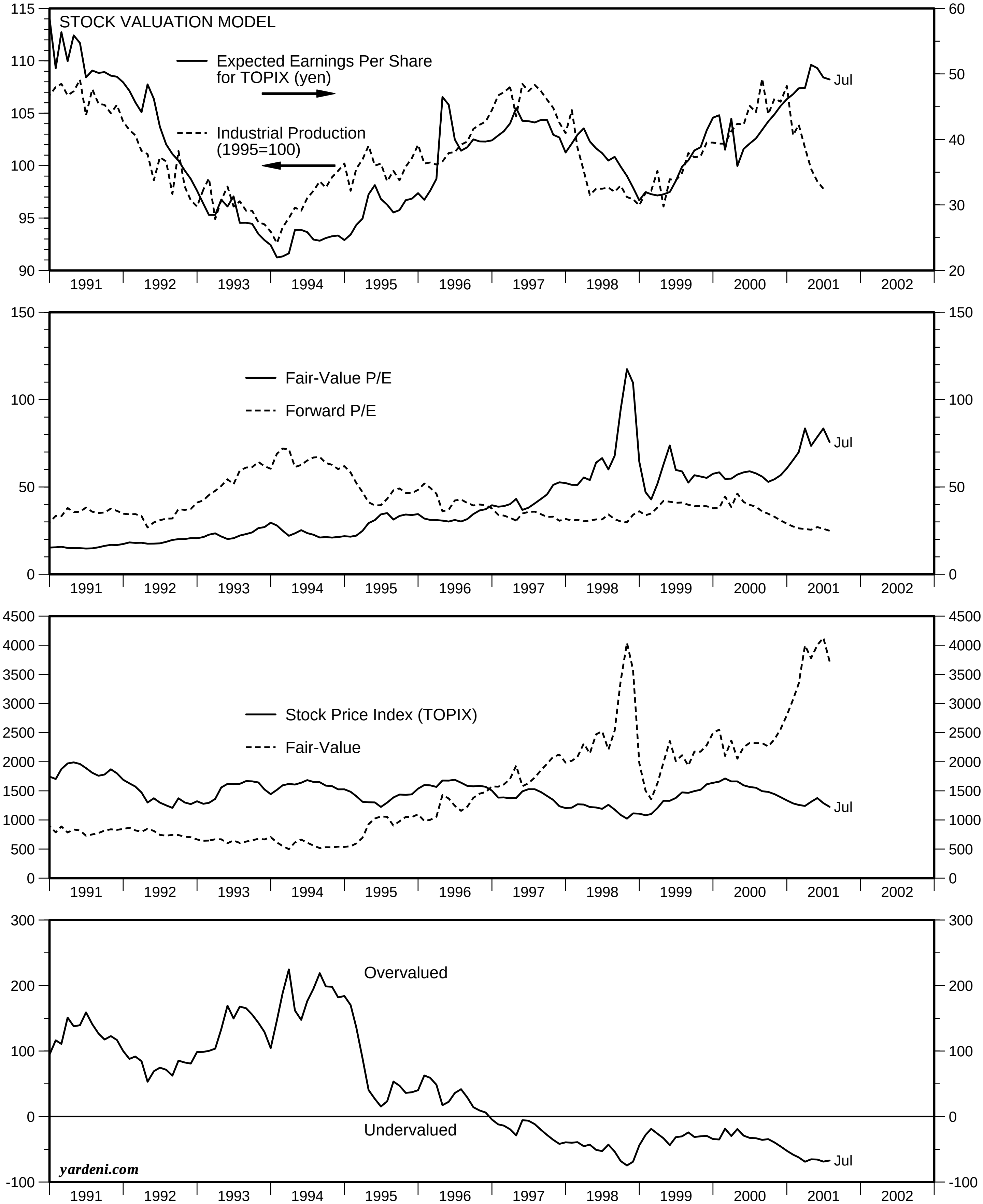
#21



* Source: Thomson Financial

- Global: Japan (TOPIX) -

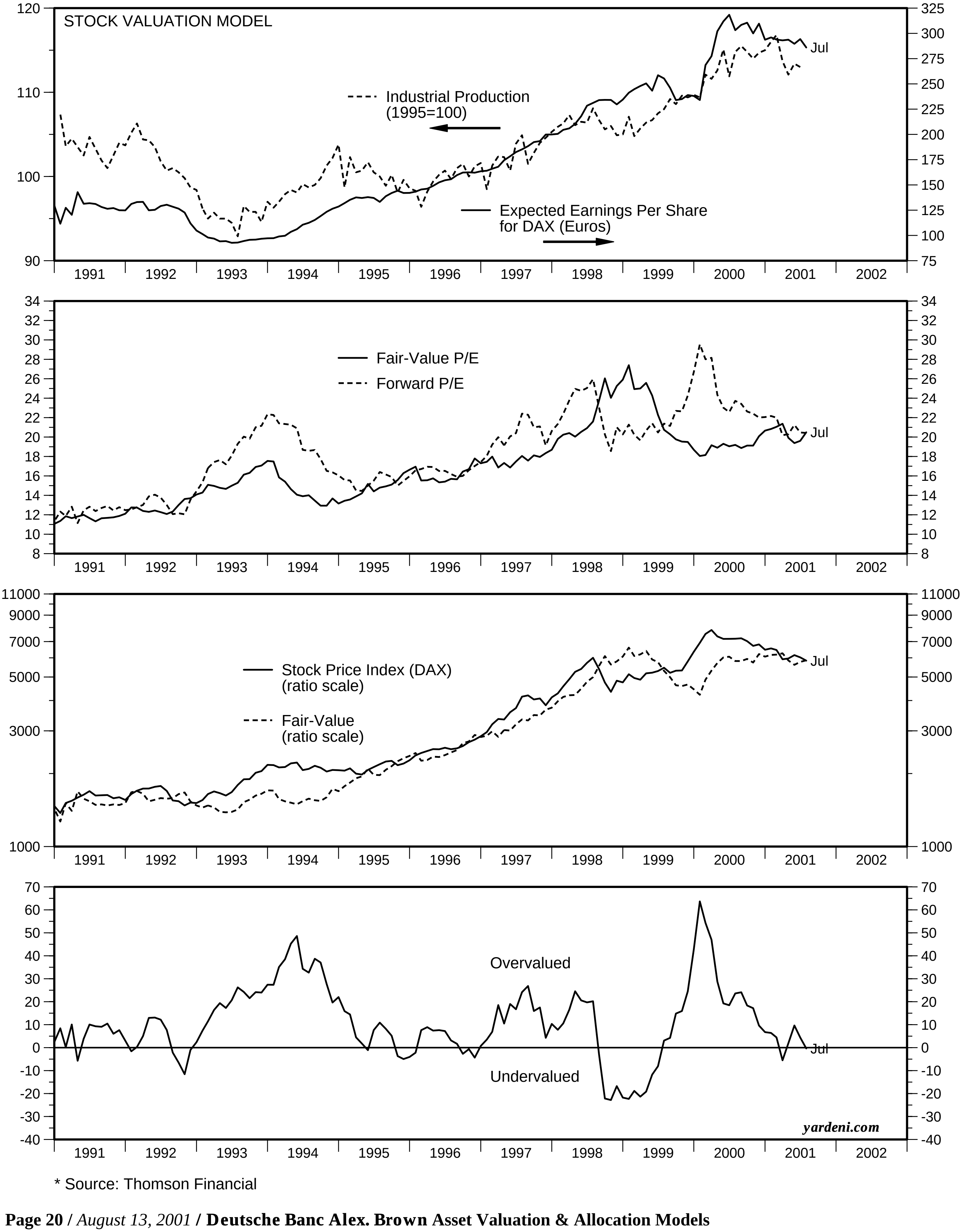
#22



* Source: Thomson Financial

- Global: Germany (DAX) -

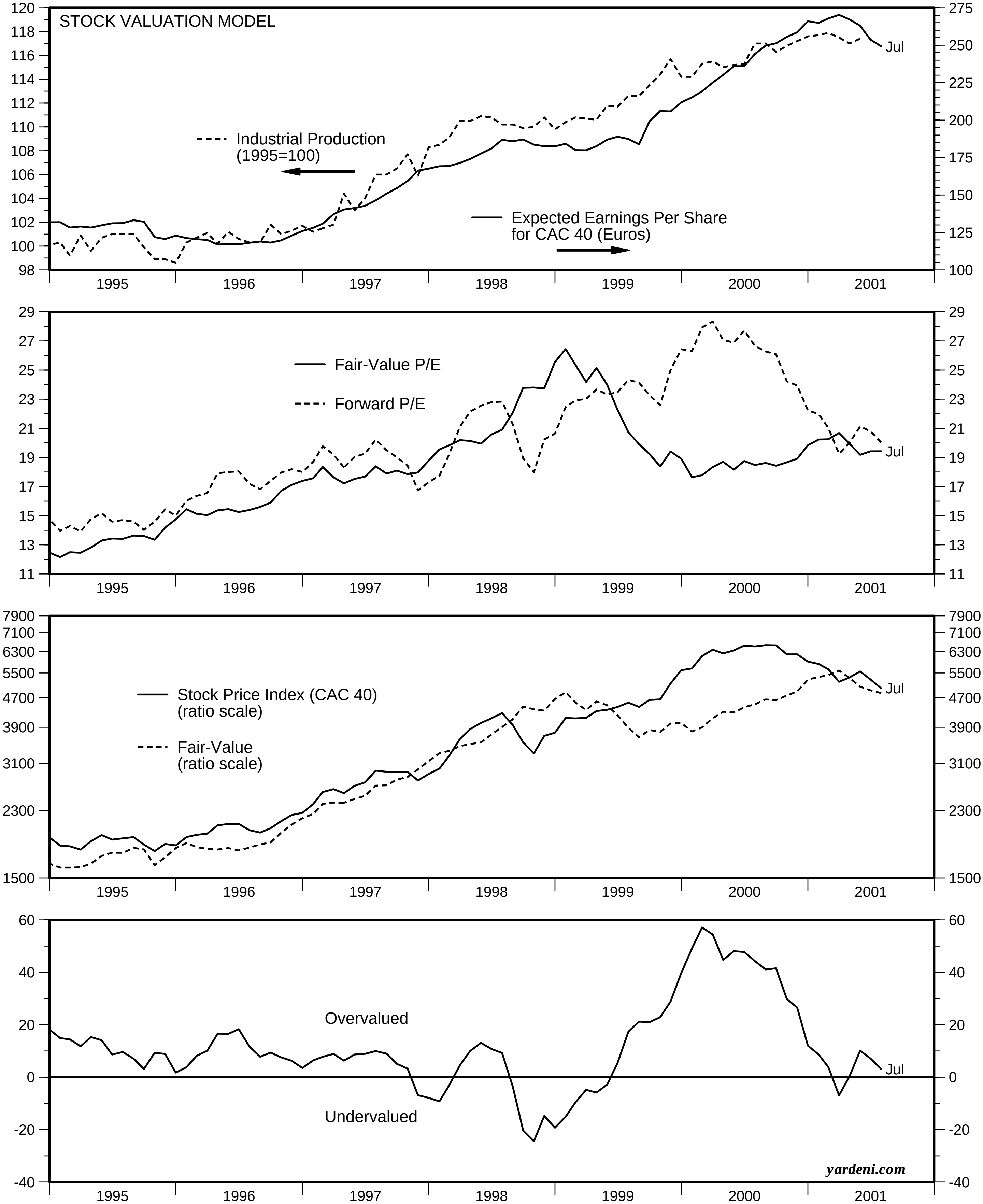
#23



* Source: Thomson Financial

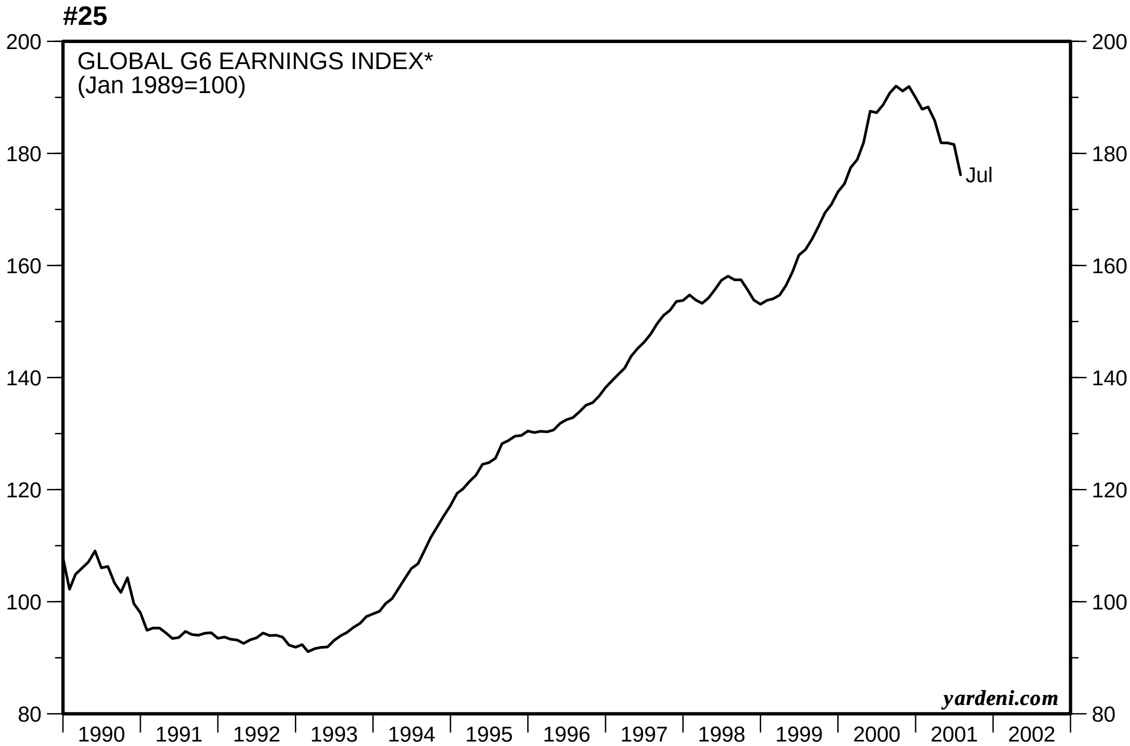
- Global: France (CAC 40) -

#24



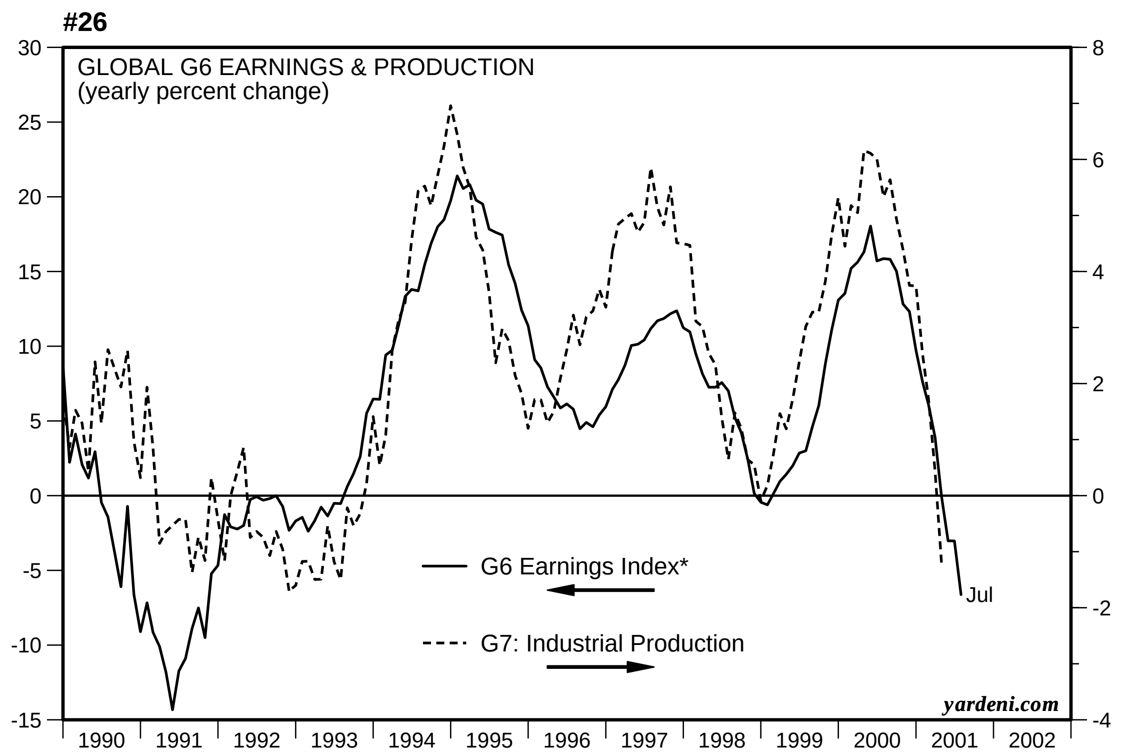
* Source: Thomson Financial

- Earnings & Output: G6 -



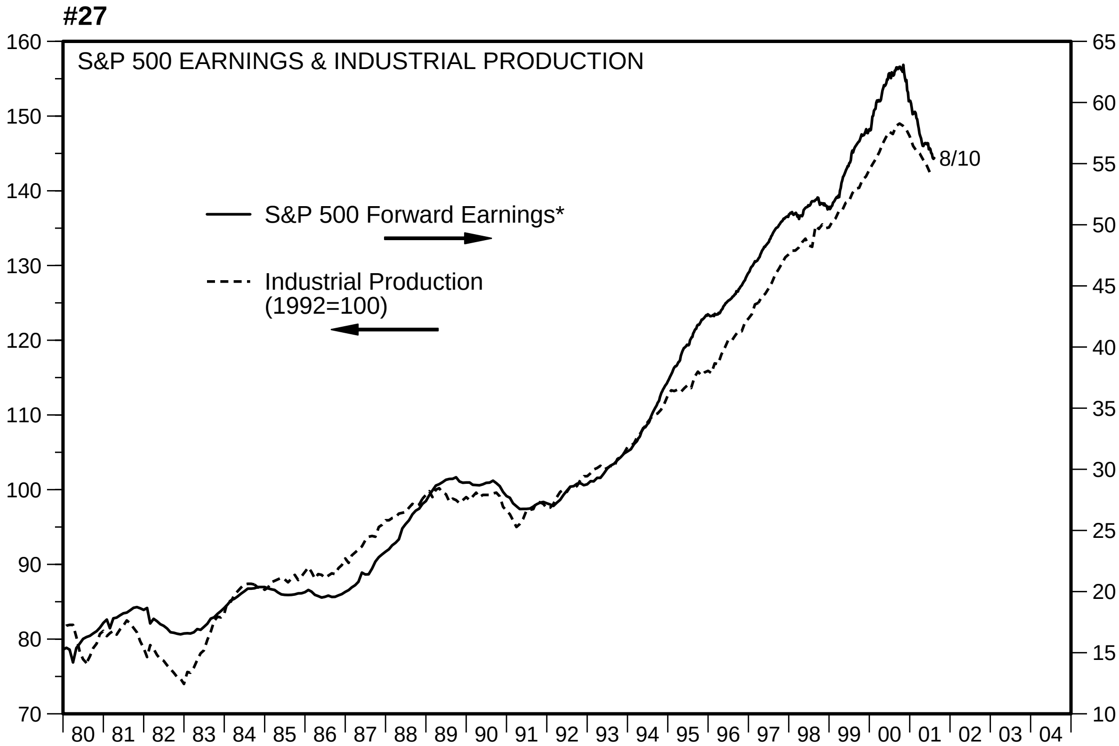
* Half US and half G5 (Canada, France, Germany, Japan and United Kingdom) 12-month forward consensus expected operating earnings.

The yearly percent change in our Index of Global G6 Earnings is highly correlated with the growth of G7 industrial production.



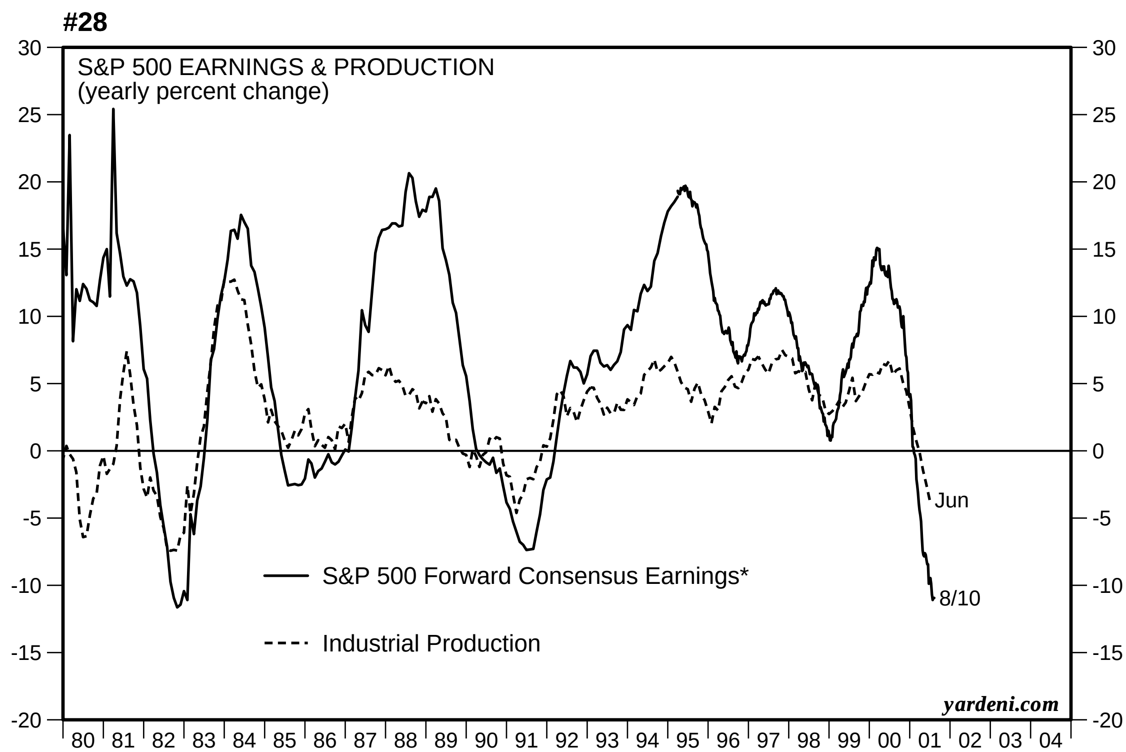
* Half US and half G5 (Canada, France, Germany, Japan and United Kingdom) 12-month forward consensus expected operating earnings.

- Earnings & Output: US -



* 52-week forward consensus expected operating earnings per share. Monthly through March 1994, weekly after.
Source: Thomson Financial

Strong correlation between US industrial production and S&P 500 forward earnings.

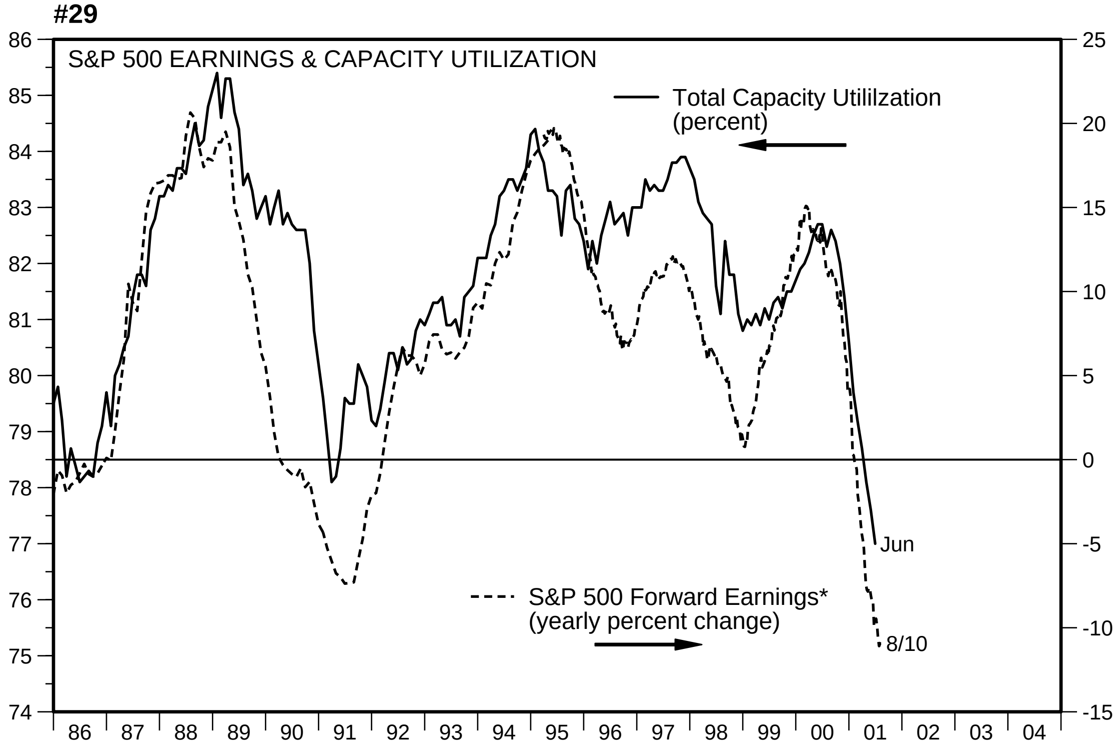


* 52-week forward consensus expected earnings. Monthly through March 1994, weekly after.
Source: Thomson Financial First Call

- Earnings & Output: US -

Growth in S&P 500 forward earnings highly correlated with US capacity utilization rate. Profits tend to increase (decrease) whenever utilization rate is above (below) 79%.

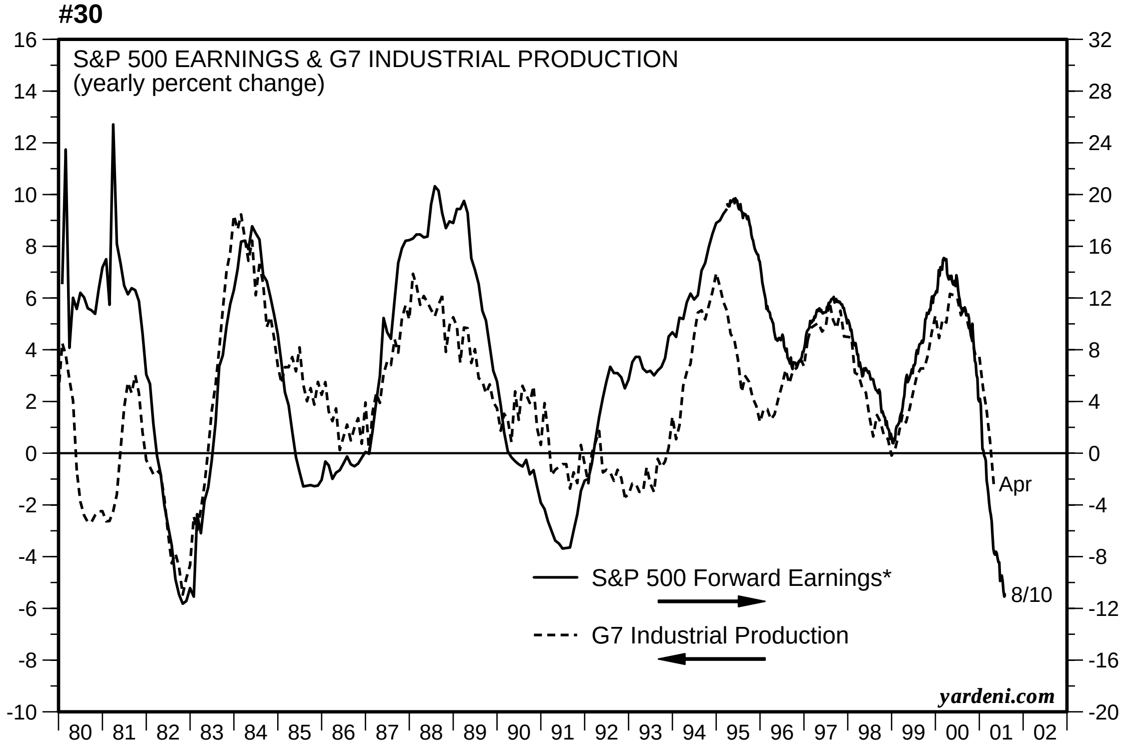
#29



* 12-month forward consensus expected operating earnings per share. Monthly through March 1994, weekly after.
Source: Thomson Financial.

2-to-1 is the unusual ratio between growth in S&P 500 forward earnings and growth in G7 production.

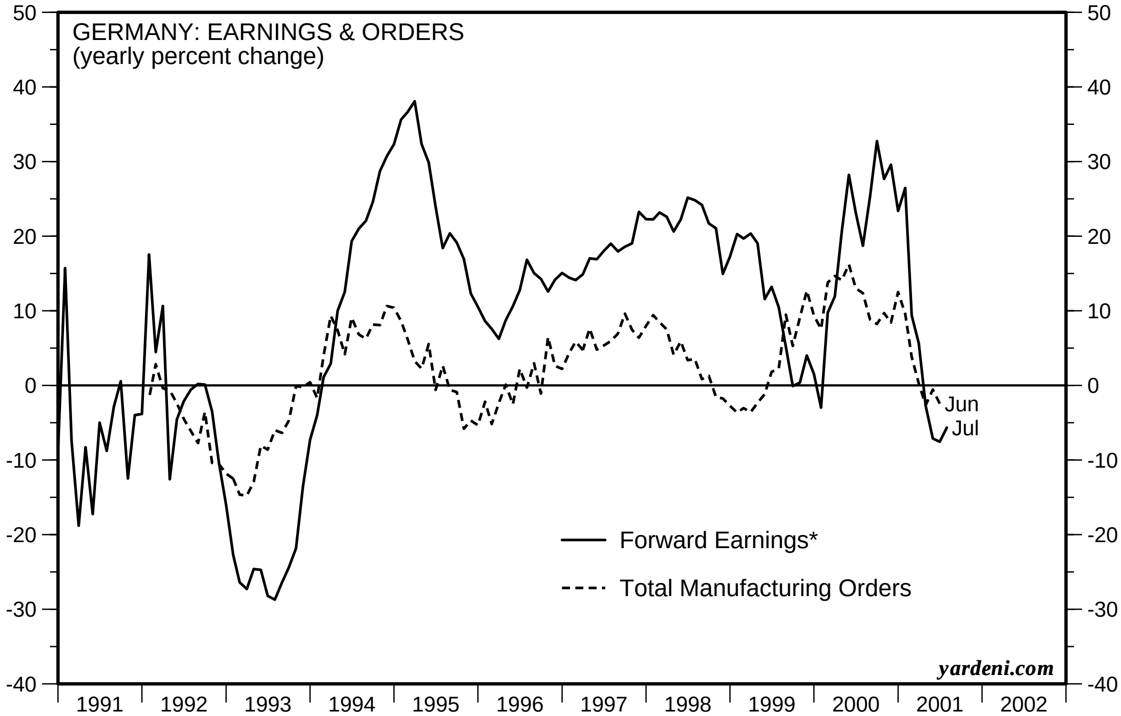
#30



* 12-month forward consensus expected operating earnings per share. Monthly through March 1994, weekly after. Source: Thomson Financial

- Earnings & Output: Europe -

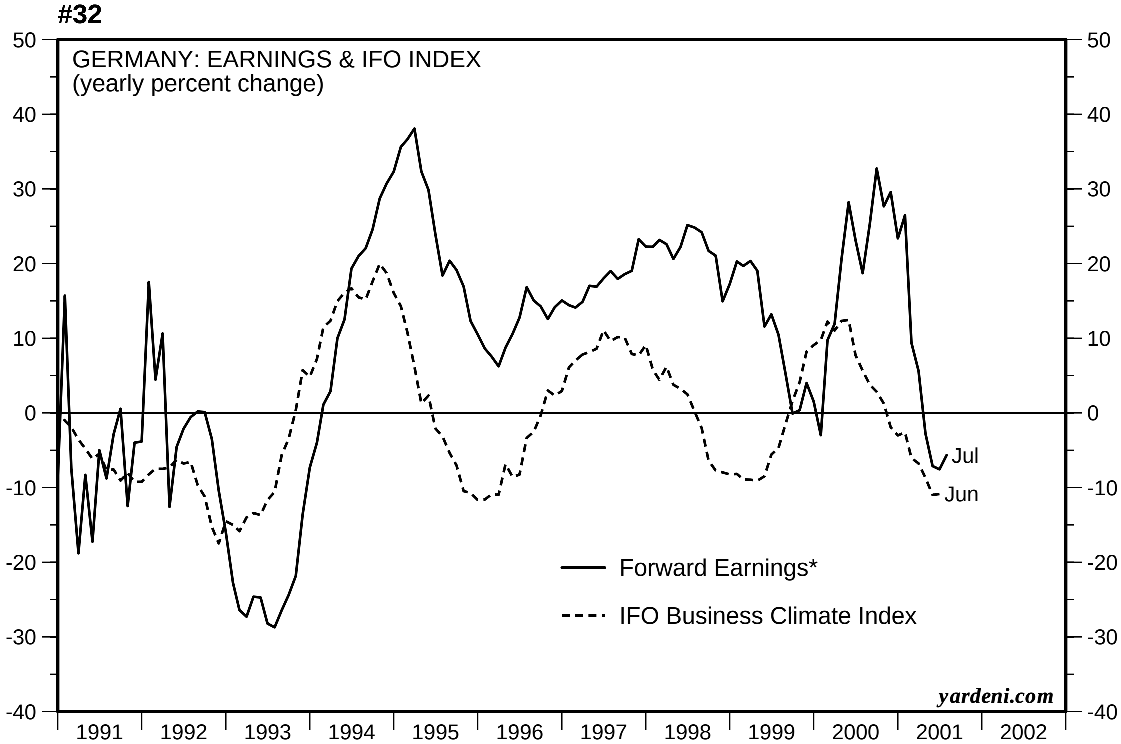
#31



* 12-month forward consensus expected operating earnings per share for DAX.
Source: Thomson Financial

German corporate profits highly correlated with factory orders and business confidence.

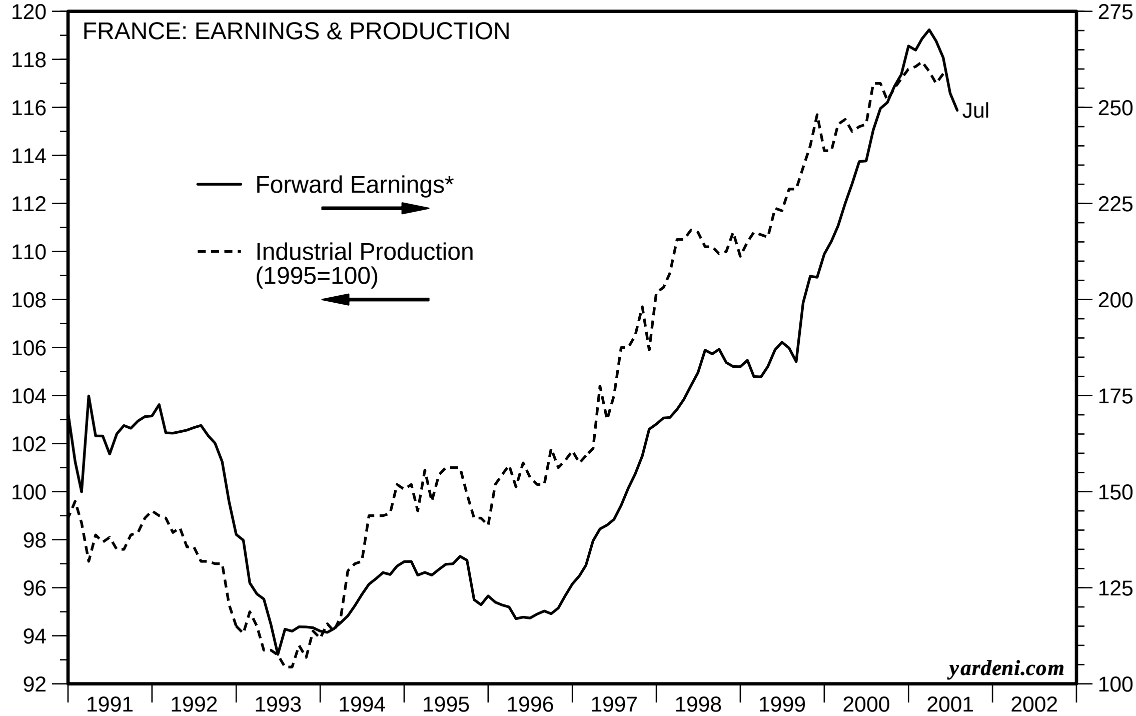
#32



* 12-month forward consensus expected earnings per share for DAX.
Source: Thomson Financial

- Earnings & Output: Europe -

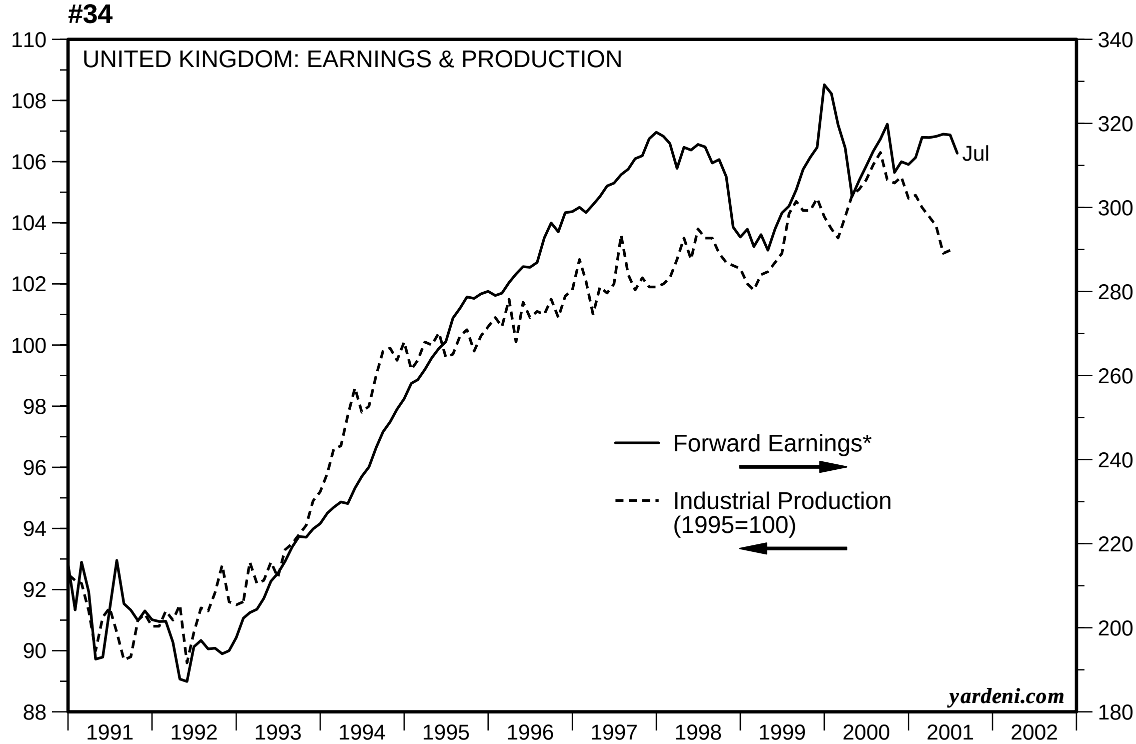
#33



* 12-month forward consensus expected earnings per share for CAC 40.
Source: Thomson Financial

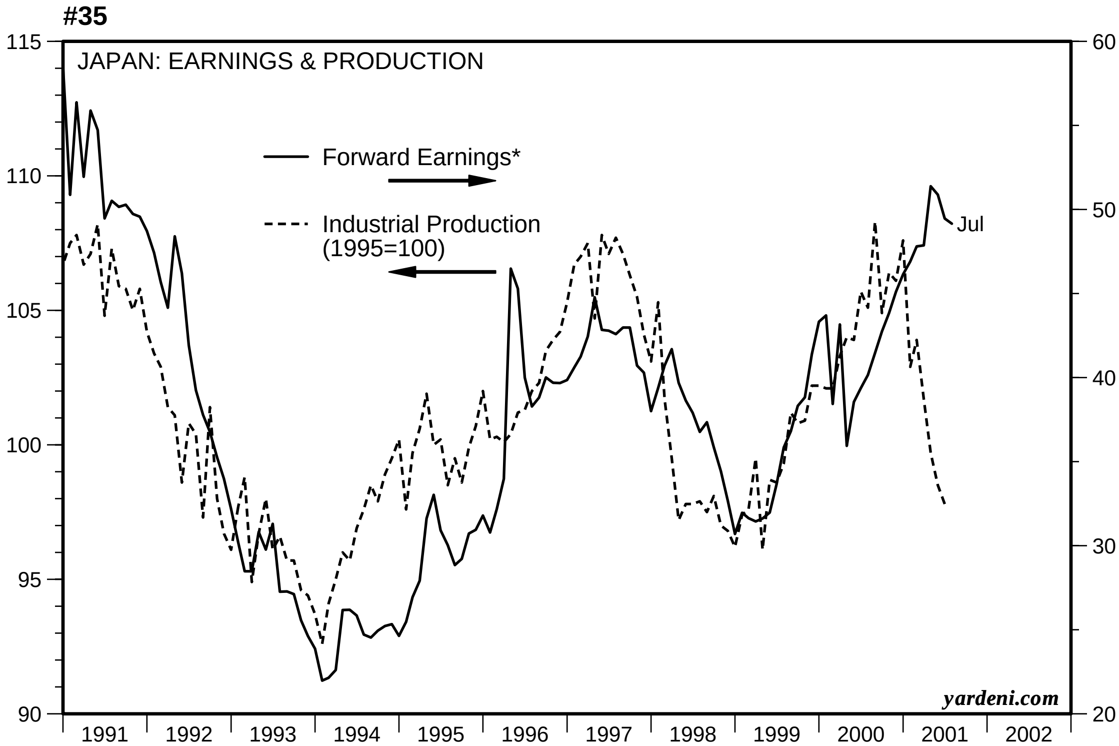
Industrial production is key variable driving profits in France and UK.

#34



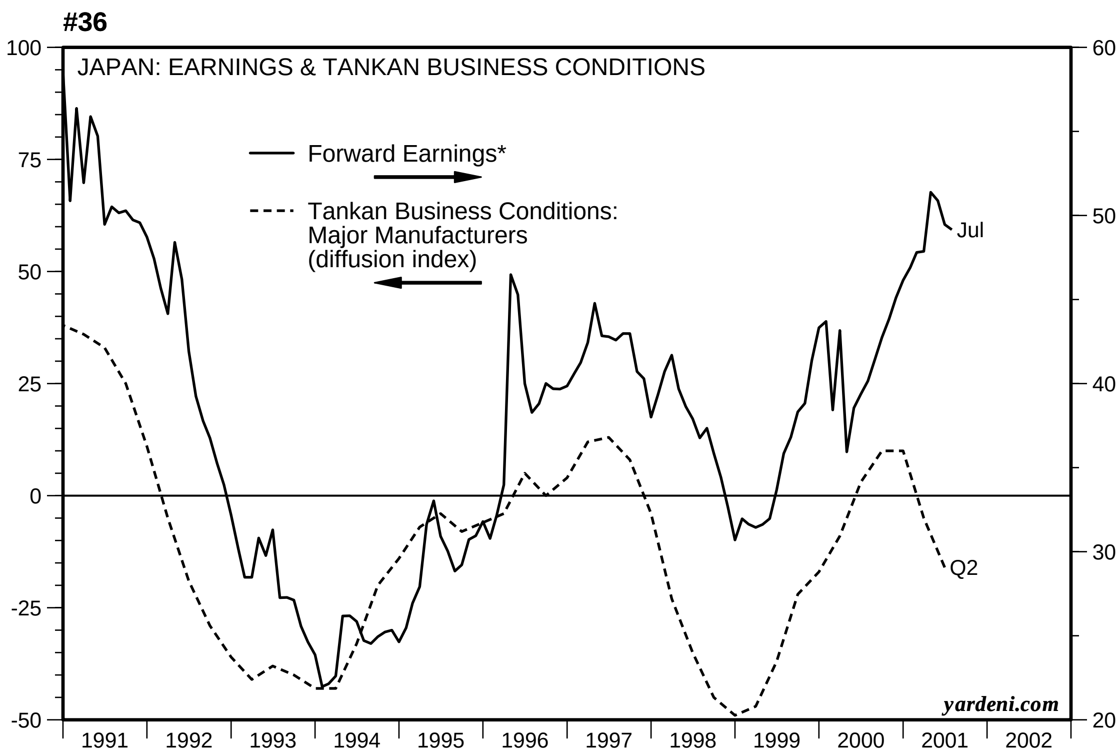
* 12-month forward consensus expected earnings per share for FT 100.
Source: Thomson Financial

- Earnings & Output: Japan -



* 12-month forward consensus expected operating earnings per share for TOPIX.
Source: Thomson Financial

Japan is falling into recession again. Weak yen boosts exporters' earnings. But profits are likely to weaken along with economy.



* 12-month forward consensus expected earnings per share for TOPIX.
Source: Thomson Financial

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