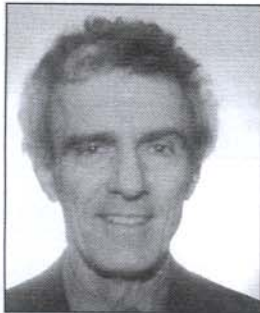


# Testing for a New Economy in the 1990s

THE STOCK MARKET ACCOUNTED FOR A MAJOR PART OF THE BOOM.

By Ray C. Fair



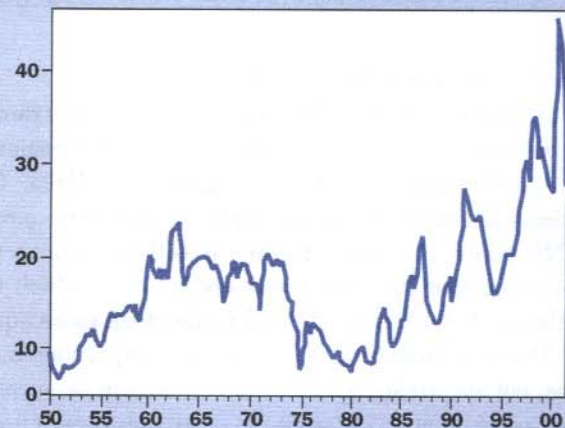
Ray C. Fair is a Professor of Economics at Yale University. The macroeconomic model that is used in this paper can be worked with on his website, <http://fairmodel.econ.yale.edu>, and various stock market experiments can be performed.

*This paper examines how much structural change there was in the U.S. economy in the last half of the 1990s. The results are consistent with the hypothesis that there was only one major structural change, namely the huge increase in stock prices relative to earnings. All other large changes can be explained by this change. There is no obvious reason for the large increase in stock prices relative to earnings. Increased productivity growth does not appear to be an answer since the data show that there was only a modest increase in long run productivity growth in the last half of the 1990s. Also, earnings growth and the share of earnings in the economy were not unusually large.*

There was much talk in the United States in the last half of the 1990s about the existence of a new economy or a “new age.” Was this talk just media hype or were there in fact large structural changes in the 1990s? One change that seems obvious is the huge increase in stock prices relative to earnings beginning in 1995. This can be seen in Figure 1, where the price-earnings (PE) ratio for the S&P 500 index is plotted.<sup>1</sup> The increase in the PE ratio beginning in 1995 is quite large. The mean of the PE ratio is 14.0 for the 1948.1–1994.4 period and 27.0 for the 1995.1–2002.3 period. This increase appears to be a major structural change, and an important question is

FIGURE 1

S&P 500 PRICE-EARNINGS RATIO  
1948:1-2002:3



<sup>1</sup>The data sources for all the variables discussed in this paper are presented in the appendix.



FIGURE 2

NIPA PERSONAL SAVING RATE  
1948:1-2002:3

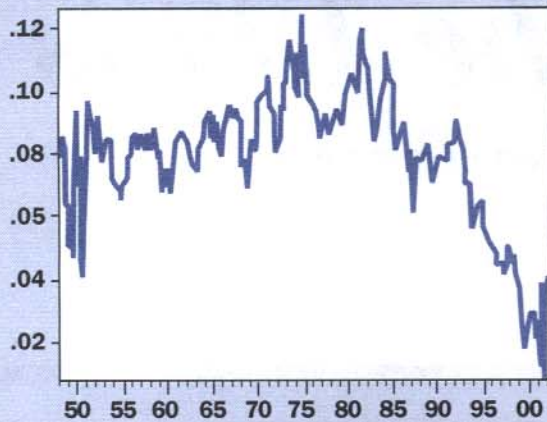


FIGURE 3

RATIO OF U.S. CURRENT ACCOUNT TO GDP  
1948:1-2002:3

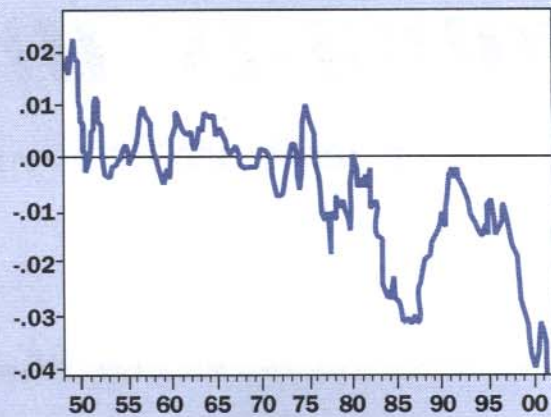


FIGURE 4

INVESTMENT-OUTPUT RATIO  
1948:1-2002:3

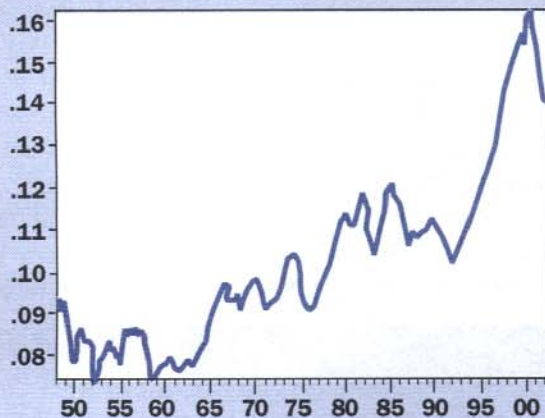
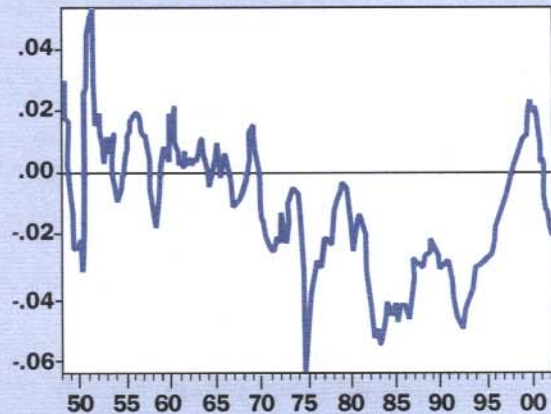


FIGURE 5

RATIO OF FEDERAL GOVERNMENT SURPLUS  
TO GDP 1948:1-2002:3



whether there were other such changes.

This paper uses the end-of-sample stability test developed in Andrews (2003) to test 30 U.S. macroeconomic equations for structural change beginning in 1995. The equations are part of a multicountry econometric model (the MC model discussed below). It will be seen in the next section that the only major equation for which the hypothesis of stability is rejected is the stock price equation. The rejection for the stock price equation is, of course, not surprising, given Figure 1. It may be surprising, however, that there were no other major rejections, since a number of macroeconomic variables have large changes beginning about 1995. Four such variables are plotted in Figures 2–5. They are 1) the personal saving

rate (lower after 1995), 2) the U.S. current account as a fraction of GDP (lower after 1995), 3) the ratio of nonresidential fixed investment to output (higher after 1995), and 4) the federal government budget surplus as a percent of GDP (higher after 1995). The results in this paper suggest that all four of these unusual changes are caused by the stock market boom. The following is a brief outline of the results.

There are three U.S. consumption equations in the MC model, each of which includes wealth as an explanatory variable; and, as just noted, the stability hypothesis is not rejected for any of these. In other words, conditional on wealth, the behavior of consumption does not seem unusual. A wealth effect on consumption also explains the deficit



in the U.S. current account because some of any increased consumption is increased consumption of imports. Similarly, conditional on a low cost of capital caused by the stock market boom, the behavior of investment does not seem unusual according to the stability test of the investment equation. Finally, the rise in the federal government budget surplus is explained by the robust economy fueled by consumption and investment spending.

A counterfactual experiment is also performed in this paper, using the MC model. The experiment is one in which the stock market boom is eliminated. The results in the third section show that had there been no stock market boom, the behavior of the four variables in Figures 2—5 would not have been unusual.

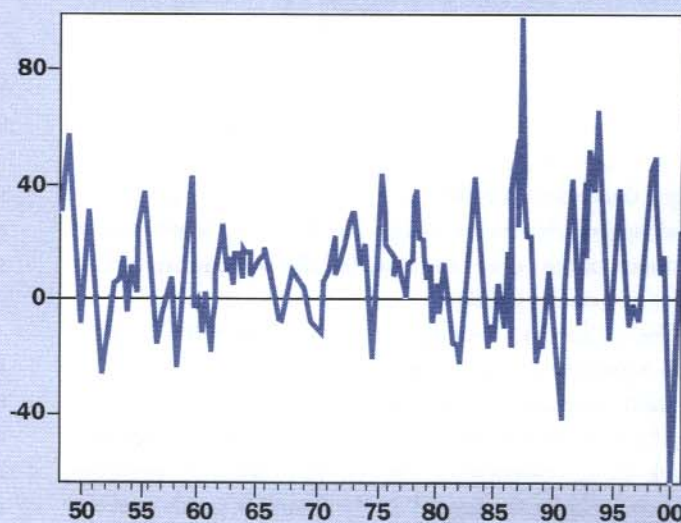
The story so far is thus quite simple: the only main structural change in the last half of the 1990s was the stock market boom. All other unusual changes can be explained by it. What is not simple, however, is finding a reason for the stock market boom in the first place. The possibility that the degree of risk aversion of the average investor fell in the last half of the 1990s is tested in Fair (2002) using data on companies that have been in the S&P 500 index since 1957. The evidence suggests that risk aversion has not fallen: there is no evidence that more risky companies have had larger increases in their price-earnings ratios since 1995 than less risky companies.

If earnings growth had been unusually high in the last half of the 1990s, this might have led investors to expect unusually high growth in the future, which would have driven up stock prices relative to current earnings. Figures 6 and 7, however, show that there was nothing unusual about earnings in the last half of the 1990s. Figure 6 plots the four-quarter growth rate of S&P 500 earnings, and Figure 7 plots the ratio of NIPA after-tax profits to GDP.

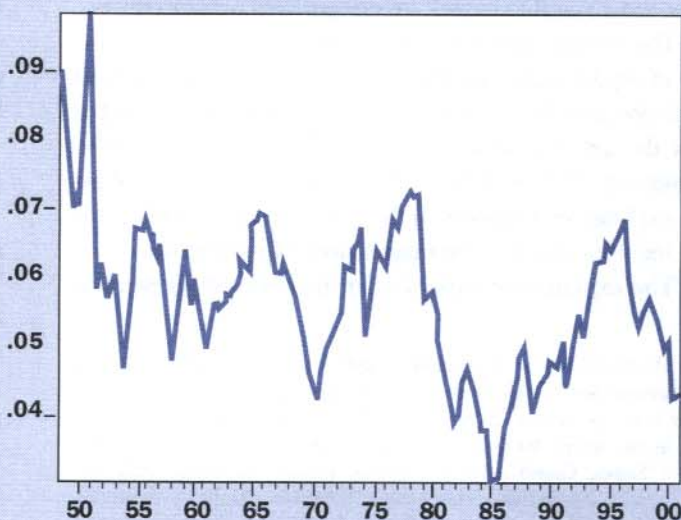
Much of the new economy talk has been about productivity growth, and the fourth section examines productivity growth. It will be seen that using 1995 as the base year to measure productivity growth, which is commonly done, is misleading because 1995 is a cyclically low productivity year. If 1992 is used instead, the growth rate in the last half of the 1990s for the total economy less general government is only slightly higher than earlier (from 1.49 percent to 1.81 percent per year). Thus, there is thus nothing in the productivity data that suggests a huge increase in stock prices relative to earnings. The huge increase in PE ratios beginning in 1995 thus remains a puzzle.

FIGURES 6 & 7

FOUR-QUARTER GROWTH RATE OF S&P 500 EARNINGS 1948:1-2002:3



RATIO OF NIPA PROFITS TO GDP 1948:1-2002:3



### End-of-Sample Stability Tests

#### *The 30 Equations*

A stability hypothesis is tested in this section for 30 U.S. macroeconomic equations. The hypothesis is that the coefficients in an equation are the same both before and after 1995:1. The equations are the stochastic equations in the U.S. part of the MC model in Fair (1994). The latest estimates are on the website,



<http://fairmodel.econ.yale.edu>. The equations are estimated by two-stage least squares (2SLS) for the 1954:1—2002:3 period, a total of 195 observations. The estimation accounts for possible serial correlation of the error terms. The first stage regressors are the main predetermined variables in the model. There are about 40 first stage regressors per estimated equation.<sup>2</sup>

The equations are specified under the assumption that households maximize utility and firms maximize profits. The theory is used to guide the choice of explanatory variables. Lagged dependent variables are used to pick up expectation and lagged adjustment effects. The following is only a brief discussion of the equations. Detailed discussions are in Fair (1994) and on the website.

The explanatory variables in the four household expenditure equations (service, nondurable, and durable consumption and housing investment) include after-tax income, lagged wealth, and interest rates. They also include variables to pick up age distribution effects. The consumer durables equation includes the lagged stock of durable goods, and the housing investment equation includes the lagged stock of housing. The explanatory variables in the four household labor supply equations (labor force of males 25-54, females 25-54, all others 16+, and moonlighters) include the real wage and a variable to pick up discouraged worker effects.

The nonresidential fixed investment equation has two cost of capital variables. One is an estimate of the real AAA bond rate, and the other is a function of stock price changes. It is through the second variable that stock prices affect investment. This equation also includes output variables. The explanatory variables in the inventory investment equation include sales and the lagged stock of inventories.

The explanatory variables in the demand for workers

and demand for hours per worker equations include output and the amount of excess labor on hand. There are price and wage equations, where the price equation includes as explanatory variables the wage rate, the price of imports and the unemployment rate; and the wage equation includes the price level and a productivity term.

There is a demand for money equation for the household sector, one for the firm sector, and a demand for currency equation. The explanatory variables in each of these equations include a transaction variable and an interest rate. There is a stock price equation where the value of capital gains or losses on stocks held by the household sector depends on the change in earnings and the change in the bond rate.

There is an estimated interest rate rule of the Fed, where the explanatory variables include the rate of inflation, the unemployment rate, and the lagged growth of the money supply. The AAA bond rate and a mortgage rate are explained by term structure equations, where the explanatory variables are current and lagged values of the short term interest rate.

The demand for imports depends on a domestic activity variable and the ratio of the domestic price level to the import price level. The remaining equations explain overtime hours, dividends, interest payments of the firm sector, interest payments of the federal government sector, inventory valuation adjustment, depreciation for the firm sector, bank borrowing from the Fed, and unemployment benefits.

### The Tests

The null hypothesis is that the coefficients in an equation are the same over the entire 1954:1—2002:3 period. The alternative hypothesis is that the coefficients are different before and after 1995:1. There are 195 total observations and 31 observations from 1995:1 on. If the potential break point were earlier in the sample period, the methods in Andrews and Fair (1988) could be used to test the hypothesis. These methods cover the 2SLS case. However, given that there are only 31 observations after the potential break point, these methods cannot be used because there are in general more first stage regressors than observations. In other words, most equations cannot be estimated using only the 1995:1—2002:3 period, which the methods require. The end-of-sample stability test developed in Andrews (2003) can be used when there are fewer observations after the potential break point than regressors. The test used here is what Andrews calls the  $P_b$  test. In the present context this test is as follows (the estimation method is 2SLS):

1. Estimate the equation to be tested over the whole period 1954:1—2002:3 (195 observations). Let  $d$

<sup>2</sup>The MC model has been extensively tested, including tests for rational expectations, and it appears to be a good approximation of the economy. These tests are in Fair (1994) and on the website. There are 38 countries in the model for which stochastic equations are estimated: the United States, Canada, Japan, Austria, France, Germany, Italy, the Netherlands, Switzerland, the United Kingdom, Finland, Australia, South Africa, Korea, Belgium, Denmark, Norway, Sweden, Greece, Ireland, Portugal, Spain, New Zealand, Saudi Arabia, Venezuela, Colombia, Jordan, Syria, India, Malaysia, Pakistan, the Philippines, Thailand, China, Argentina, Chile, Mexico, and Peru. There are 31 stochastic equations for the United States and up to 15 each for the other countries. The total number of stochastic equations is 365, and the total number of estimated coefficients is 1,670. In addition, there are 1,111 estimated trade share equations. The total number of endogenous and exogenous variables, not counting the trade shares, is about 2,000. Trade share data were collected for 59 countries, and so the trade share matrix is 59 times 59. The 21 other countries that fill out the trade share matrix are Brazil, Turkey, Poland, Russia, Ukraine, Egypt, Israel, Kenya, Bangladesh, Hong Kong, Singapore, Vietnam, Nigeria, Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, the United Arab Emirates, and an all other category. The estimation periods begin in 1954 for the United States and as soon after 1960 as data permit for the other countries.



denote the sum of squared residuals from this regression for the 1995:1—2002:3 period (31 observations).

2. Consider 134 different subsets of the basic 1954:1—1994:4 sample period. For the first subset estimate the equation using observations 16—164, and use these coefficient estimates to compute the sum of squared residuals for the 1—31 period. Let  $d_1$  denote this sum of squared residuals. For the second subset estimate the equation using observations 1 and 17-164, and use these coefficient estimates to compute the sum of squared residuals for the 2—32 period. Let  $d_2$  denote this sum of squared residuals. For the last (134th) subset estimate the equation using observations 1—133 and 149—164, and use these coefficient estimates to compute the sum of squared residuals for the 134-164 period. Let  $d_{134}$  denote this sum of squared residuals. Then sort  $d_i$  by size ( $i = 1, \dots, 134$ ).
3. Observe where  $d$  falls within the distribution of  $d_i$ . If, say,  $d$  exceeds 95 percent of the  $d_i$  values and a 95 percent confidence level is being used, then the hypothesis of stability is rejected. The p-value is simply the percent of the  $d_i$  values that lie above  $d$ .

Note in step 2 that each of the 134 sample periods used to estimate the coefficients includes half (rounded up) of the observations for which the sum of squared residuals is computed. This choice is ad hoc, but a fairly natural finite sample adjustment. The adjustment works well in Andrews' simulations.

For the results below two stability tests were performed per equation. The first, as discussed above, uses the sample period 1954:1—2002:3, with the potential break at 1995:1. The second uses the sample period 1954:1—2000:4, with again the potential break at 1995:1. In other words, the second test does not include what happened in 2001 and 2002.

## The Results

The p-values for the 30 equations are presented in Table 1.<sup>3</sup> A value of 1.000 means that  $d$  computed in step 1 is smaller than all of the  $d_i$  values computed in step 2. A value of 0.000 means that  $d$  is larger than all of the  $d_i$  values. At a 95 percent confidence level, any p-value less than .05 is a rejection of the hypothesis of stability.

TABLE 1

### STABILITY TEST RESULTS FOR THE 30 EQUATIONS

Eq.	Dependent Variable	end 2002:3 p-value	end 2000:4 p-value
1	Service consumption	1.000	1.000
2	Nondurable consumption	0.858	0.957
3	Durable consumption	0.119	0.504
4	Housing investment	0.716	0.844
5	Labor force, men 25-54	0.567	0.482
6	Labor force, women 25-54	0.866	0.929
7	Labor force, all others 16+	0.440	0.766
8	Moonlighters	1.000	1.000
9	Demand for money, h	0.112	0.106
10	Price level	1.000	0.972
11	Inventory investment	0.881	0.943
12	Nonresidential fixed investment	0.261	0.206
13	Workers	0.649	0.610
14	Hours per worker	0.739	0.624
15	Overtime hours	0.976	1.000
16	Wage rate	0.507	0.390
17	Demand for money, f	0.440	0.369
18	Dividends	0.500	0.447
19	Interest payments, f	0.000	0.000
20	Inventory valuation adjustment	0.134	0.149
21	Depreciation, f	0.500	0.475
22	Bank borrowing from the Fed	0.806	0.667
23	AAA bond rate	0.396	0.362
24	Mortgage rate	0.410	0.340
25	Capital gains or losses	0.000	0.000
26	Demand for currency	0.000	0.000
27	Imports	0.933	1.000
28	Unemployment benefits	0.955	1.000
29	Interest payments, g	0.784	1.000
30	Fed interest rate rule	0.903	0.993

- h = household sector, f = firm sector, g = federal government sector.
- First overall sample period: 1954:1—2002:3 except 1956:1—2002:3 for equation 15.
- Second overall sample period: 1954:1—2000:4 except 1956:1—2000:4 for equation 15.
- Break point tested: 1995:1.
- Estimation technique: 2SLS.

<sup>3</sup>Dummy variables that take on a value of 1.0 during certain quarters and 0.0 otherwise appear in a few of the 30 equations. For example, there are four dummy variables in the U.S. import equation that are, respectively, 1.0 in 1969:1, 1969:2, 1971:4, and 1972:1 and 0.0 otherwise. These are meant to pick up effects of two dock strikes. A dummy variable coefficient obviously cannot be estimated for sample periods in which the dummy variable is always zero. This rules out the use of the end-of-sample test if some of the sample periods that are used in the test have all zero values for at least one dummy variable. To get around this problem when performing the test, all dummy variable coefficients were taken to be fixed and equal to their estimates based on the entire sample period.



The results show that using a 95 percent confidence level the hypothesis of stability is rejected for only three equations. One is, not surprisingly, the equation explaining capital gains or losses on stocks (equation 25). The explanatory variables in this equation include the change in earnings and the change in the bond rate, and neither of these variables has values in the last half of the 1990s that would predict a huge increase in stock prices.

The other two rejected equations are not important equations in the model. One (equation 26) is the demand for currency equation, which is not important because of the use of the interest rate rule (equation 30). The other rejected equation (equation 19) links the NIPA interest payments data of the firm sector to interest rates and the

flow of funds data on the net financial liabilities of the firm sector. This link is not very tight, and the estimated equation does not have good properties, including end-of-sample stability.

Overall, the results in Table 1 are strongly supportive of the view that there were no major structural changes beginning in 1995:1 except for the stock market boom. The equations for which the stability hypothesis was not rejected include all the aggregate demand equations (consumption, investment, imports), the price and wage equations, the labor supply and demand equations, and the estimated interest rate rule of the Fed. The next section estimates what the economy would have been like had there been no stock market boom.

FIGURE 8

NIPA PERSONAL SAVING RATE  
1995:1-2002:3

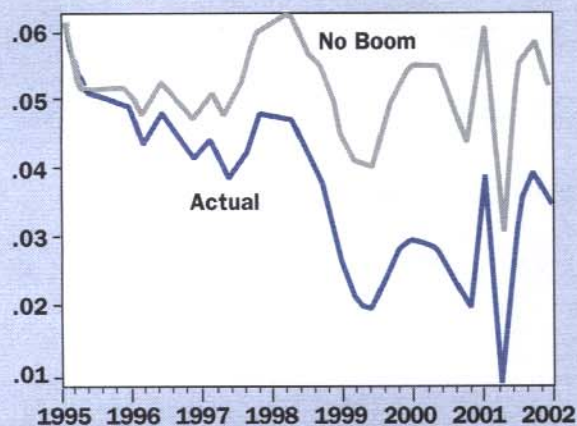


FIGURE 9

RATIO OF U.S. CURRENT ACCOUNT TO GDP  
1995:1-2002:3

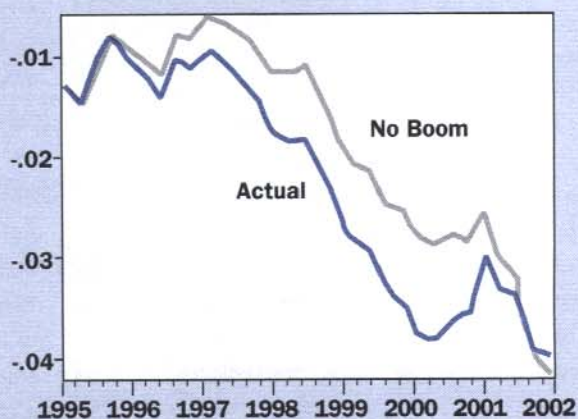


FIGURE 10

INVESTMENT-OUTPUT RATIO  
1995:1-2002:3

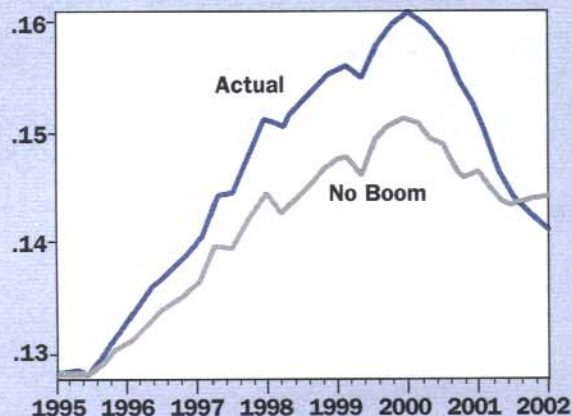


FIGURE 11

RATIO OF FEDERAL GOVERNMENT SURPLUS  
TO GDP 1995:1-2002:3

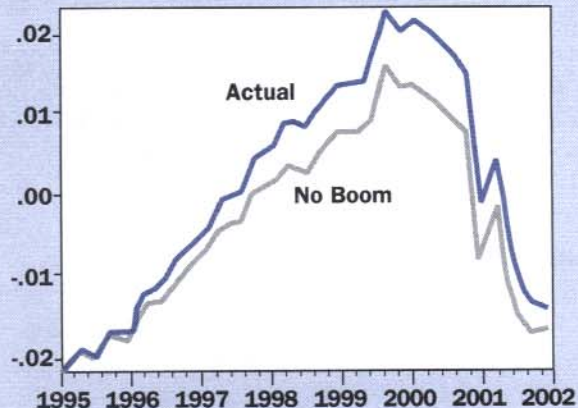




FIGURE 12

FOUR-QUARTER GROWTH RATE OF REAL GDP 1995:1-2002:3

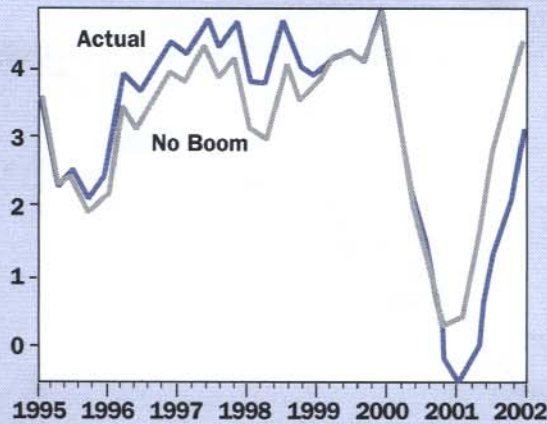


FIGURE 13

THE UNEMPLOYMENT RATE 1995:1-2002:3

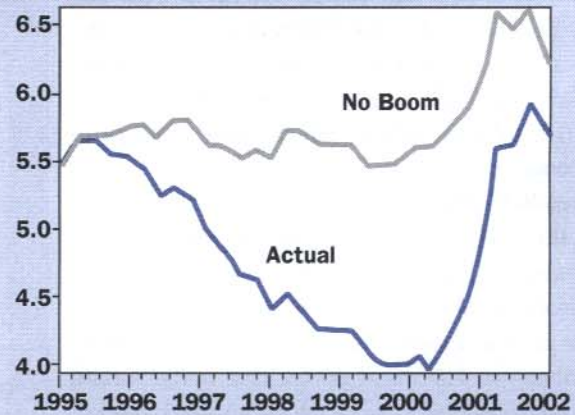


FIGURE 14

FOUR-QUARTER PERCENTAGE CHANGE IN PNF 1995:1-2002:3

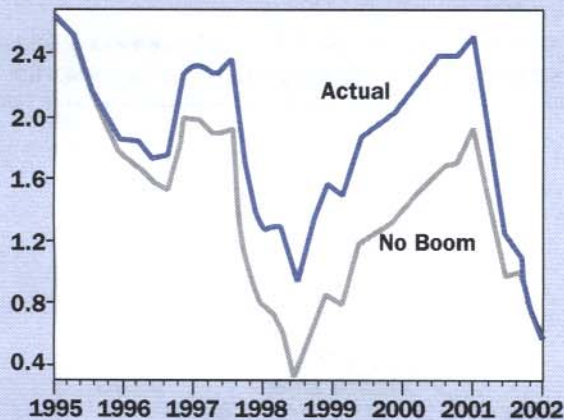
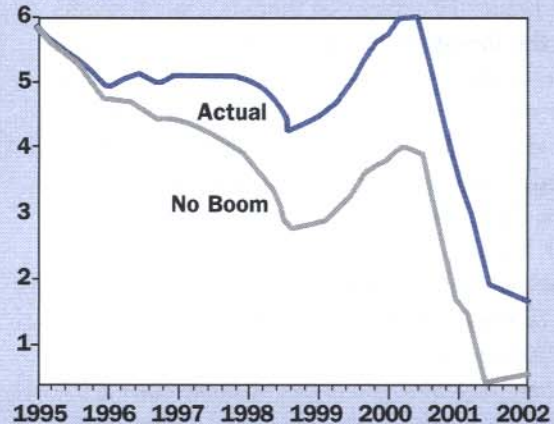


FIGURE 15

THREE-MONTH TREASURY BILL RATE 1995:1-2002:3



### Counterfactual: No Stock Market Boom

For the 10-year period prior to 1995 (1985:1—1994:4), the capital gain on household financial assets (almost all of this gain is on corporate equities held by the household sector) was \$5.248 trillion, an average of \$131.2 billion per quarter. The gain for the next 5 years (1995:1--1999:4) was \$13.560 trillion, an average of \$678.0 billion per quarter.<sup>4</sup> During the next 11 quarters (2000:1--2002:3) the loss was \$7.040 trillion, an average of \$640.0 billion per quarter. The total capital gain over the entire 1995:1--2002:3 period was thus \$6.520 trillion, an average of \$210.3 billion per quarter.

The counterfactual experiment assumes that the cap-

ital gain for each quarter of the 1995:1—2002:3 period was \$131.2 billion, which is the average for the prior 10-year period. This gives a total capital gain of \$4.067 trillion, which is about \$2.5 trillion less than the actual value of \$6.520 trillion. The timing, of course, is quite different than what actually happened, since the experiment does not have the huge boom up to 2000 and then the large correction after that.

The MC model is used for the experiment. The experiment can be duplicated on the website, <http://fairmodel.econ.yale.edu>. The experiment is for the 1995:1-2002:3 period. The estimated residuals are first added to all the stochastic equations. This means that when the model is solved using the actual values of all the exogenous variables, a perfect tracking solution is obtained. The actual

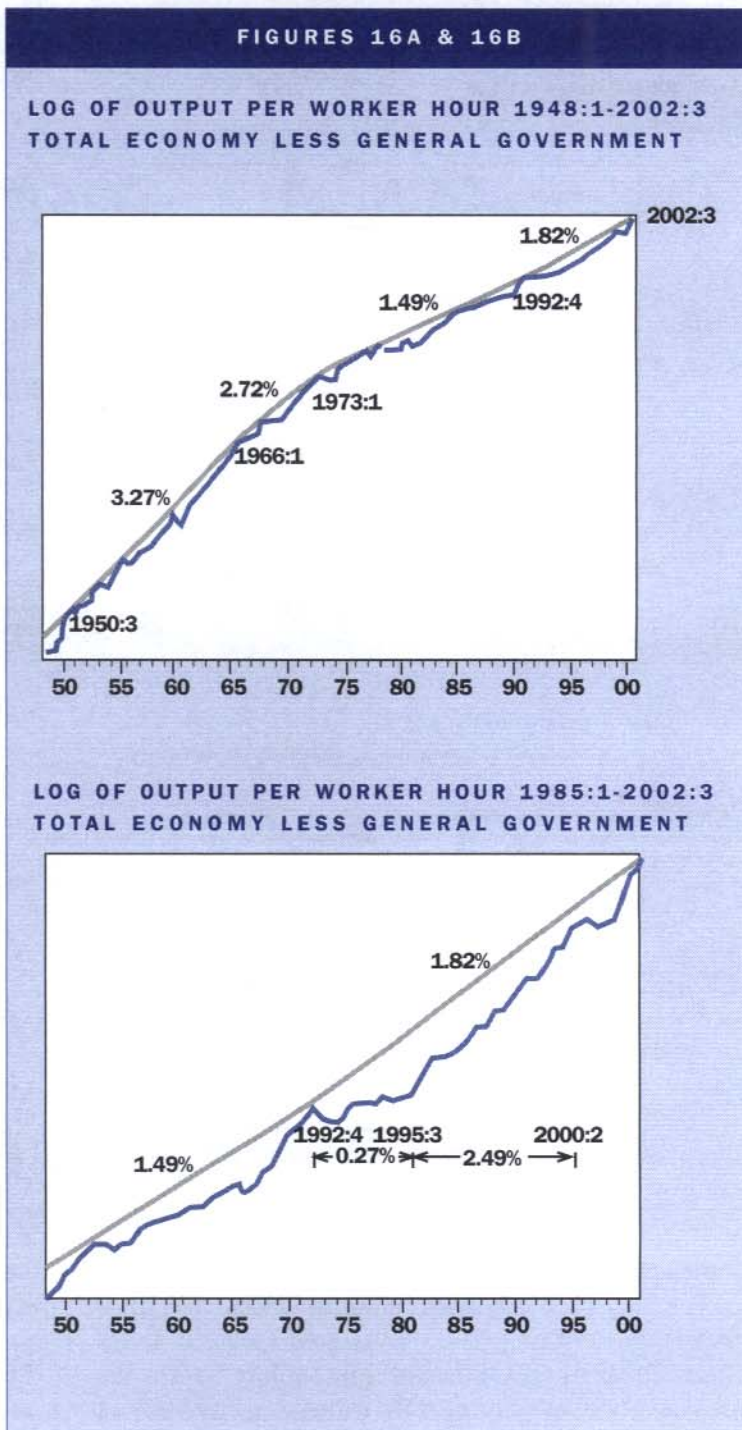
<sup>4</sup>The data cited in this section are from the U.S. Flow of Funds Accounts.



values are thus the base values. The capital gains equation 25, which explains CG, the capital gains or losses on financial assets held by the household sector, is then dropped from the model, and the value of CG in each quarter is taken to be \$131.2 billion. The model is then solved. The difference between the solution value and the actual value for each endogenous variable for each quarter is the effect of the CG change. The solution values will be called values in the "no boom" case.

Figures 8-15 plot some of the results. Each figure presents the actual values of the variable and the solution values. Figure 8 shows that the personal saving rate is considerably higher in the no boom case. No longer are the values outside the range of historical experience in 1999 and 2000. This is the wealth effect on consumption at work. With no stock market boom, households are predicted to consume less. Figure 9 shows that the current account deficit through 2000 is not nearly as bad in the no boom case: imports are lower because of the lower consumption. Figure 10 shows that there is a much smaller rise in the investment-output ratio in the no boom case. Investment is not as high because the cost of capital is not as low and because output is lower. Figure 11 shows that the federal government budget is not as good, which is due to the less robust economy.

Figure 12 plots the percentage change in real GDP, and Figure 13 plots the unemployment rate. Both show, not surprisingly, that the real side of the economy is worse in the no boom case, especially through 2000. In the fourth quarter of 1999, for example, the unemployment rate in the no boom case is 5.6 percent, which compares to the actual value of 4.1 percent. Figure 14 plots the private nonfarm deflator (PNF). It shows that the rate of inflation is lower in the no boom case (because of the higher unemployment rate), although in neither case would one consider inflation to be a problem. Figure 15 plots the three-month Treasury bill rate, which is the rate determined by the estimated interest rate rule of the Fed. The figure shows that the bill rate is lower in the no boom case. The Fed is predicted to respond to the more sluggish economy by lowering rates. In the fourth quarter of 1999, the bill rate is 3.2 percent in the no boom case, which compares to the actual value of 5.0 percent. It is interesting to note that this amount of easing of the Fed is not enough to prevent the unemployment rate from rising, as was seen in Figure 13. Note from Figure 12, however, that by the end of 2000 the growth rate is higher in the no boom case. This is partly due to the lower interest rates in



the no boom case.

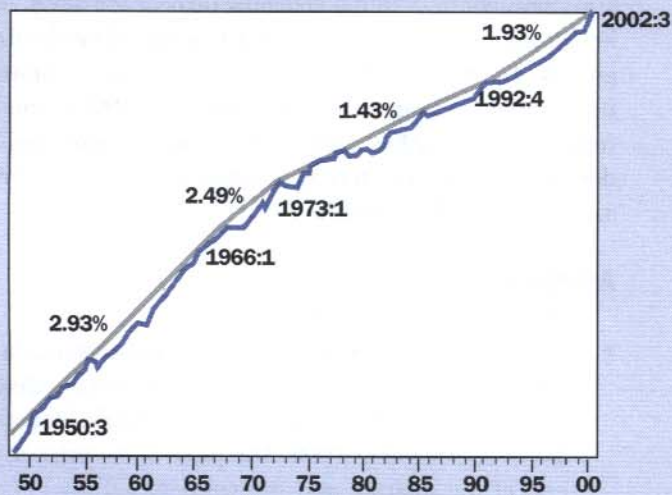
It is thus clear from the figures in this section that according to the MC model the U.S. economic boom in the last half of the 1990s was fueled by the wealth effect and cost of capital effect from the stock market boom. Had it not been for the stock market boom, the economy would have looked more or less normal.

As noted in the introduction, much of the new economy talk has been about productivity growth. For the

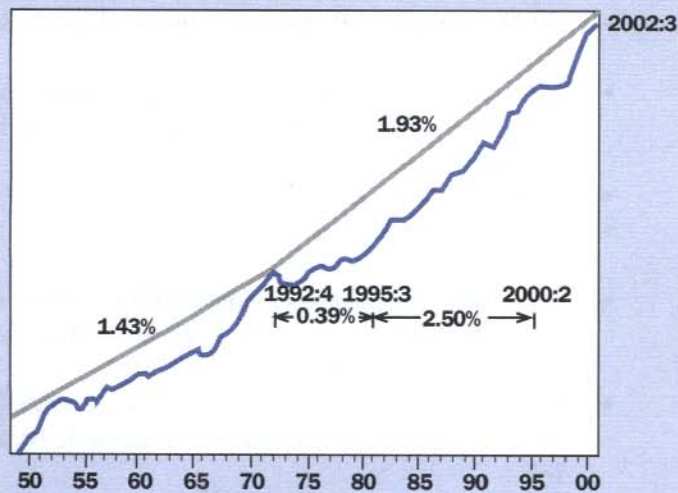


FIGURES 17A & 17B

LOG OF OUTPUT PER WORKER HOUR 1948:1-2002:3  
NONFARM BUSINESS



LOG OF OUTPUT PER WORKER HOUR 1985:1-2002:3  
NONFARM BUSINESS



experiment in this section long run productivity growth is exogenous: the MC model does not explain long run productivity growth. This issue will now be addressed.

### Aggregate Productivity

Figure 16a plots output per worker hour for the total economy less general government for 1948:1--2002:3. Also plotted in the figure is a peak-to-peak interpolation line, with peaks in 1950:3, 1966:1, 1973:1, 1992:4, and

2002:3. The annual growth rates between the peaks are 3.27, 2.72, 1.49, and 1.82 percent, respectively. Figure 16b is an enlarged version of Figure 16a for the period from 1985:1 on.<sup>5</sup>

An interesting feature of Figure 16a is the modest increase in the peak-to-peak productivity growth rate after 1992:4: from 1.49 to 1.82 percent. This difference of 0.33 percentage points is certainly not large enough to classify as a movement into a new age.

It can be seen in Figure 16b why some were so optimistic about productivity growth in the last half of the 1990s. Between 1995:3 and 2000:2 productivity grew at an annual rate of 2.49 percent, which is a noticeable improvement from the 1.49 percent rate between 1973:1 and 1992:4. What this overlooks, however, is that productivity grew at an annual rate of only 0.27 percent between 1992:4 and 1995:3, so 1995 is a low year to use as a base. Under the assumption that the interpolation line measures cyclically adjusted productivity, the 2.49 percent growth rate between 1995:3 and 2000:2 is composed of 1.82 percent long run growth and 0.67 percent cyclical growth.

Productivity data are also available for the nonfarm business sector, and it is of interest to see if the above results are sensitive to the level of aggregation. In 2001 real GDP (total output) less general government output accounted for 89.4 percent real GDP and nonfarm business output accounted for 83.8 percent. (Nonfarm business output excludes output from farms, households, and nonprofit institutions in addition to output from general government.) Figures 17a and 17b are for the nonfarm business sector.

There is only a modest change in moving from Figures 16a and 16b to Figures 17a and 17b. The increase in long run productivity growth beginning in 1992:4 is now 0.50 percentage points (from 1.43 percent to 1.93 percent) rather than 0.33 (from 1.49 percent to 1.82 percent). The actual growth rate from 1992:4 to 1995:3 is now 0.39 percent rather than 0.27 percent, and the actual growth rate from 1995:3 to 2000:2 is now 2.50 percent rather than 2.49 percent.

Again, under the assumption that the interpolation line

<sup>5</sup>In the MC model potential productivity is taken to lie on the interpolation line, from which a measure of firms' holdings of excess labor is computed for each quarter. The amount of excess labor on hand (lagged one quarter) is then an explanatory variable in the labor demand equations (demand for workers and demand for hours per worker) of the firm sector. The amount of excess labor on hand is estimated to have a negative effect on labor demand. Long run productivity is exogenous in the model because the interpolation line does not change as a function of anything in the model.



measures cyclically adjusted productivity, the 2.50 percent growth rate between 1995:3 and 2000:2 is composed of 1.93 percent long run growth and 0.57 percent cyclical growth for the nonfarm business sector.

Regarding other studies of productivity growth in the 1990s, Blinder and Yellen (2001) test for a break in productivity growth beginning in 1995:4, and they find a significant break once their regression equation is estimated through 1998:3. This is not surprising, given the rapid productivity growth between 1995:4 and 1998:3. Again, however, 1995:4 is a misleading base to use. Oliner and Sichel (2000) compare productivity growth in 1990—1995 to that in 1996—1999 and do not adjust for cyclical growth. This is also true in Nordhaus (2000), who compares productivity growth in 1990-1995 to that in 1996-1998.

Gordon (2000a, 2000b) argues that some of the actual productivity growth after 1995 is cyclical. He estimates in Gordon (2000b, p. 219) that of the actual 2.82 percent productivity growth in the nonfarm business sector between 1995:4 and 1999:4, 0.54 is cyclical and 2.28 is long run. This estimate of 0.54, which is backed out of a regression, is remarkably close to the 0.57 figure estimated above for the 1995:3—2000:2 period using the interpolation line in Figure 17b. Gordon's actual number of 2.82 percent is larger than the actual number of 2.50 percent in Figure 17b. This difference is primarily due to the fact that Figure 17b uses revised data. The data revisions that occurred after Gordon's work had the effect of lowering the estimates of productivity growth.

Gordon's results and the results from Figure 17b are thus supportive of each other. Although Gordon estimates long run productivity growth to be 2.28 percent, Figure 17b suggests that this number is less than 2 percent based on the revised data. The message of Figure 17b is thus that productivity growth has increased in the last half of the 1990s, but only by about 0.4 to 0.5 percentage points.

## Conclusion

The results in this paper are consistent with the simple story that the only major structural change in the last half of the 1990s was the huge increase in stock prices relative to earnings. The only major U.S. macroeconomic equation in the MC model for which the hypothesis of end-of-sample stability is rejected is the stock price equation. The counterfactual experiment using the MC model in which the stock market boom is turned off shows that were it not for the boom the behavior of variables like the saving rate, the U.S. current account, the investment output ratio, and the federal government budget would not have been historically unusual. Also, the data on aggregate productivity do not show a large increase in trend productivity growth

in the last half of the 1990s: there is no evidence in the data of a new age of productivity growth.

None of the results in this paper provide any hint as to why the stock market began to boom in 1995. In fact, they deepen the puzzle, since there appear to be no major structural changes in the economy (except the stock market) and there is no evidence of a new age of productivity growth. In addition, Figures 6 and 7 show no unusual behavior of earnings in the last half of the 1990s, and the results in Fair (2002) suggest that risk aversion has not decreased. In short, there is no obvious fundamental reason for the stock market boom.

## APPENDIX

The data sources are as follows.

- The S&P 500 data on stock prices and earnings were taken from the website, [www.spglobal.com/earnings.html](http://www.spglobal.com/earnings.html), and from Standard and Poor's Statistical Service, December 1998. The price is the price at the end of the quarter, and the value of earnings is the sum of earnings in the quarter just ended and in the previous three quarters. Earnings are reported earnings (not operating earnings) and are after tax. (Figures 1 and 6)
- NIPA nominal GDP: Table 1.1, line 1. (Figures 3, 5, 9, and 11)
- NIPA U.S. current account: nominal exports (Table 1.1, line 14) minus nominal imports (Table 1.1, line 17). (Figures 3 and 9)
- NIPA real GDP: Table 1.2, line 1. (Figure 12)
- NIPA real nonresidential fixed investment: Table 1.2, line 8. (Figures 4 and 10)
- NIPA nonfarm business deflator (PNF): Table 1.7, line 3, minus Table 3.1, line 4, all divided by Table 1.8, line 3. (Figure 14)
- NIPA total output less general government: Table 1.8, line 1, minus Table 1.8, line 10. (Figures 4, 10, and 16)
- NIPA nonfarm business output: Table 1.8, line 3. (Figure 17)
- NIPA after-tax profits: Table 1.14, line 24. (Figure 7)
- NIPA personal saving rate: Table 2.1, line 35. (Figures 2 and 8)
- NIPA federal government budget surplus: Table 3.2, line 28. (Figures 5 and 11)
- Three month Treasury bill rate: Board of Governors of the Federal Reserve System. (Figure 15)
- Worker hours for the economy less general government, worker hours for nonfarm business, the unemployment rate: Bureau of Labor Statistics. (Figures 13, 16, and 17)



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