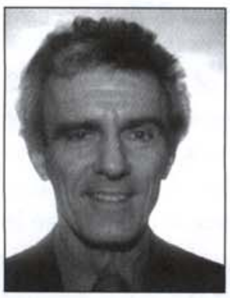
Fed Policy and the Effects of a Stock Market Crash on the Economy

IS THE FED TIGHTENING TOO LITTLE AND TOO LATE?

By Ray C. Fair



Ray C. Fair is a Professor of Economics at Yale University. The macroeconometric 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.

Businesses face the risk at the current time of a stock market crash. Profits will undoubtedly suffer if there is a crash and the economy goes into a recession. This paper shows that unless there has been a huge increase in the long run PE ratio, the current level of stock prices implies an unrealistically large share of profits in GDP in the future. The paper also suggests that the Fed does not have the power to prevent a recession from taking place if there is a crash.

A major risk that many, if not most, businesses face at the current time is a possible stock market crash. If there is a crash and the U.S. economy goes into a recession, profits will undoubtedly suffer. An important question to consider is whether the Fed has the power to offset most of the negative effects of a crash on the economy. The results in this article, using a macroeconometric model (to be called the "MC" model), suggest that the Fed does not have this power. The results show that the negative effects from the loss of wealth following a crash dominate the positive effects from the Fed lowering interest rates immediately after the crash, and a significant recession takes place.

This paper uses the MC model to consider three cases. The period examined is 1995:1–2004:4. At the time of this study actual data were available through 1999:2. The model was estimated through 1999:2, and a forecast from the model was made for the 1999:3–2004:4 period. The forecast is based on the assumption of no stock market crash and no further boom. The level of stock prices is assumed to grow from 1999:3 at the historically average rate. The first case, called "Base," consists of the actual data for 1995:1–1999:2 and a forecast for 1999:3–2004:4.

The second case, called "Crash," consists of the actual data for 1995:1–1999:2 and a forecast for 1999:3–2004:4 in which there is assumed to be a stock market crash in 1999:3. The level of stock prices is assumed to fall in 1999:3 to a value consistent with historical experience and then to grow at a historically average rate after that. The Fed is assumed to respond immediately to the crash by lowering the short-term interest rate to three percent and keeping it there. This is the case that shows (according to the model) that the Fed does not have the power to prevent a recession from taking place.

The third case, called "No Boom," consists of a simulation of the model for the entire 1995:1–2004:4 period in which it is assumed that there was no stock market boom. The level of stock prices is assumed to grow at a historically average rate over the entire period. The boom is assumed to be shut off by higher interest rates. Interest rates are raised for this simulation beginning 1995:1.

It will be seen that the loss in output comparing "Crash" to "Base" is about the same as the loss in output comparing "No Boom" to "Base." "No Boom" has less variability than does "Crash." If it had been possible to make a choice between these two cases ahead of time—and if they had been the only two choices—"No Boom" would have been preferred. More will be said about this later.

It is obviously difficult to know how overvalued the stock market is, if it is at all. If it is overvalued, the risk of a crash—and thus the risk of a case like "Crash" occurring—is obviously higher. Before considering the three cases, some simple arithmetic is presented in the next section that suggests that the current level of stock prices has unrealistic macroeconomic implications regarding the future share of profits in GDP. In this sense the stock market appears to be overvalued.

Stock Market Valuation and the Share of Profits in GDP

The major boom in stock prices began in 1995. Between December 31, 1994, and June 30, 1999, the S&P 500 index rose 198.9 percent (an annual rate of 27.5 percent), and capital gains on household financial assets totaled $10.876 trillion.[1]

The S&P 500 index was 1372.71 on June 30, 1999. Earnings[2] corresponding to this index are 41.10 for the four quarters ending June 30, 1999, which gives a PE ratio of 33.4. A PE ratio of 33.4 is historically very high. Robert Shiller's web site, http://www.econ.yale.edu/~shiller, contains monthly estimates of the S&P 500 PE ratio for the period January 1871–December 1998, and these estimates reveal how high the current PE ratio is. The largest PE value over the entire period prior to 1991 is 26.6 in January 1895. For the 1,452 months between January 1871 and December 1990, only 52 months (3.6 percent) have a PE ratio greater than 20. The average PE ratio over the whole period of the Shiller data (through December 1998) is 14.2. The average for the period since January 1952 is 15.1.

In order to examine the implications of the current level of stock prices on the future share of profits in GDP, one first needs an estimate of the future growth rate of earnings that is implicit in a PE ratio of 33.4. This will be done using the following formula:

$$P = \frac{D(1+s)}{(1+r)} + \frac{D(1+s)^2}{(1+r)^2} + \cdots + \frac{D(1+s)^T}{(1+r)^T} + \frac{E(1+g)^T Z}{(1+r)^T} \quad (1)$$

where P is the S&P 500 stock price, D is the initial level of dividends, s is the growth rate of dividends, r is the discount rate, T is the length of the horizon, E is the initial level of earnings, Z is the PE ratio at end of the horizon, and g is the growth rate of earnings. The aim is to estimate g. The known values in the formula as of June 30, 1999, are P (1372.71), E (41.10), and D (16.45). Therefore, to estimate g, assumptions are needed for T, s, r, and Z. Table 1 lists the assumptions.

The values in Table 1 lead to a computed value of g of .142, i.e., an annual growth rate of earnings of 14.2 percent over the next ten years. This growth rate is considerably higher than the annual growth rate of S&P 500 earnings since 1952, which is 6.0 percent.

To see what an annual growth rate of earnings of 14.2 percent over the next ten years implies about the ratio of profits to GDP at the end of ten years, one needs an assumption about the future growth rate of GDP. Implicit in the government bond rate of six percent used above is an expected inflation rate of about two percent, and so the future inflation rate will be assumed to be two percent. An optimistic assumption about the growth rate of real GDP over the next ten years is that it will be four percent. To achieve this, one would need productivity growth to be between about 2.5 and 3.0 percent, depending on the growth of the labor force, which would be a very good performance. Using two percent inflation and four percent

TABLE 1

ASSUMPTIONS REGARDING T, r, s, AND Z

Value		Comments
T	10	Above normal growth for ten years; then return to normal.
s	.07	Average dividend growth since 1952 has been .056, so .07 is above average.
r	.08	Long-term government bond rate is about .06, so .08 assumes a risk premium of about .02.
Z	**17**	**Historical average PE ratio is about 15, so 17 is about 2 points above average.**

real growth, the growth rate of nominal GDP is six percent.

The ratio of after-tax corporate profits to nominal GDP in the National Income Accounts is currently .057. Since 1952 this ratio has ranged from .026 in 1986 to .068 in 1979. The largest ratio since the data began (1929) is .089 in 1929. Now, if earnings were to grow at 14.2 percent per year over the next ten years and nominal GDP were to grow at 6 percent, the ratio at the end of ten years would be .119. This is more than double the current ratio and nearly double the largest ratio since 1952.

A ratio of .119[3] is so far above what has ever been observed historically that it seems highly unlikely it would occur. Constraints on reaching this ratio would arise from social, political, and economic forces. In short, the macroeconomic implications of the earnings growth rate implicit in the current level of stock prices seem unrealistic.

This argument is, of course, based on the assumptions in Table 1. There are assumptions that do not lead to unrealistically large estimates of g. For example, if the long run PE ratio, Z, is assumed to be 30 rather than 17 and the other assumptions in Table 1 are unchanged, the estimate of g is .078 and the ratio of profits to GDP is .068 after ten years, which is not unrealistic. On the other hand, if the discount rate, r, is assumed to be .06 rather than .08 (which implies a zero risk premium), and the other assumptions in Table 1 are unchanged, the estimate of g is .119 and the ratio of profits to GDP is .098 after 10 years, which is still quite high. If one experiments with alternative assumptions, it will become clear that the crucial assumption is about Z.[4] In short, if there has been a sea change in stock market valuation, in that the *long-run* PE ratio is now in the mid 30s rather than somewhere below 20, the implied estimate of g does not have unrealistic macroeconomic consequences; otherwise it does.

The Wealth Effect in the MC Model

The MC model is discussed in Fair (1994) and on the website mentioned in the biographical paragraph. For present purposes the key property of interest is the size of the effect of a change in U.S. equity values on U.S. consumption, i.e., the size of the wealth effect. In this section the MC model is briefly outlined and then the wealth effect is discussed.

There are thirty-eight countries in the MC model for which stochastic equations are estimated.[5] There are thirty-one stochastic equations for the United States and up to fifteen each for the other countries. The total number of stochastic equations is 363, and the total number of estimated coefficients is 1,650. In addition, there are 1,050 estimated trade share equations. The total number of endogenous and exogenous variables, not counting the trade shares, is about 4,500. Trade share data were collected for fifty-nine countries, and so the trade share matrix is 59 x 59.[6]

The estimation periods begin in 1954 for the United States and as soon after 1960 as data permit for the other countries. They end between 1996 and 1999. The estimation technique is two stage least squares except when there are too few observations to make the technique practical, where ordinary least squares is used. The estimation accounts for possible serial correlation of the error terms. The variables used for the first stage regressors for a country are the main predetermined variables in the model for the country. A list of these variables is available from the website.[7]

There are four household expenditure equations in the U.S. part of the model, and each of these includes a household wealth variable. They explain expenditures on (1) services, (2) nondurable goods, (3) durable goods, and (4) housing investment. The explanatory variables in each equation include income, an interest rate, and wealth. There is a lagged dependent variable in each equation to pick up partial adjustment effects. In addition, the lagged stock of durable goods is in the durable goods equation, and the lagged stock of housing is in the housing investment equation. There are also "age" variables in the first three equations to pick up effects of the changing U.S. age distribution on consumption. The theory behind the specification of these equations is discussed in Fair (1994) and on the website, and this discussion will not be repeated here.

The four estimated equations are presented in Table 2. The equations are in real per capita terms, and the first two are in log form. The wealth variable AA is total net financial assets of the household sector deflated by a price deflator plus the real value of the housing stock. Capital gains on stocks are included in net financial assets (although capital gains are not included in the value of the housing stock). The wealth variable is highly significant in all but equation 1, where it has a t-statistic of 1.23, and so there is strong evidence that wealth affects household expenditures.

The size of the "wealth effect" in the model depends on what is held constant. If the complete model is used, then an increase in stock prices increases AA, which increases household expenditures, which then leads to a multiplier effect on output and at least some increase in inflation. There is an estimated interest rate rule of the Fed in the model, and if this rule is used, then the Fed responds to the expansion by raising interest rates, which slows down the expansion, and so on. The rest of the world also responds to what the United States is doing, which then feeds back on the United States. The size of the wealth effect with nothing held constant thus depends on many features of the model, not just the properties of the household expenditure equations.

One can focus solely on the wealth-effect properties of the household expenditure equations by taking income, prices, and interest rates to be exogenous. An experiment was performed in which these variables were taken to be exogenous and household wealth was decreased from the base case by $1 trillion in 1999:3. The results are compared to the base case forecast from the MC model above. In the first four quarters after the change household expenditures fell by $22.2 billion, and in each of the next set of four quarters expenditures fell between about $31 and $32 billion. The size of the wealth effect measured this way is thus about three percent. This is at the low end of the range usually cited for macroeconometric models, but remember that it does not reflect any multiplier effects.

A recent study estimating the size of the wealth effect is discussed in Ludvigson and Steindel (1999). They conclude (p. 30) that "a dollar increase in wealth likely leads to a three-to-four-cent increase in consumption in today's economy," although they argue that there is considerable uncertainty regarding this estimate. Their approach is simpler and less structural than the present one. For example, their level of disaggregation is less; they do not consider expenditures on housing investment; they do not have an interest rate in their equation; and they do not take into account possible simultaneous equations bias. Nevertheless, the size of their estimate is similar to that obtained above. Starr-McCluer (1998) uses survey data to examine the wealth effect, and she concludes that her results are broadly consistent with a modest wealth effect. The three percent estimate obtained here thus seems consistent with results from other approaches, and so the results below are not based on an unusual estimate.

TABLE 2

THE FOUR U.S. HOUSEHOLD EXPENDITURE EQUATIONS

	1	2	3	4
	$\log \frac{CS}{POP}$	$\log \frac{CN}{POP}$	$\frac{CD}{POP}$	$\frac{IH}{POP}$
LDV	.917 (29.68)	.657 (16.32)	.751 (13.75)	.534 (9.25)
$\log \frac{YD}{POP}$ or $\frac{YD}{POP}$	.091 (2.88)	.184 (7.04)	.097 (4.45)	.060 (2.57)
R	-.0010 (-4.40)	-.0020 (-4.68)	-.0022 (-1.11)	-.0294 (-5.51)
$\log \frac{AA}{POP_{-1}}$ or $\frac{AA}{POP_{-1}}$	.0062 (1.23)	.0560 (5.10)	.0011 (4.26)	.0013 (3.04)
$\log \frac{KD}{POP_{-1}}$ or $\frac{KH}{POP_{-1}}$	-	-	-.010 (-1.72)	-.056 (-4.00)
R^2	999	.998	.996	.965
DW	1.85	1.86	1.95	2.03

Notes:
Estimation period: 1954:1–1999:2
Estimation technique: 2SLS
Not presented:
estimate of constant term in all equations
estimates of age variables in equations 1-3
estimate of dependent variable lagged twice in equation 2
estimates of first and second order serial correlation coefficients of the error term in equation 4
AA = Real net financial assets plus real value of housing stock
CD = Real expenditures on durable goods
CN = Real expenditures on non durable goods
CS = Real expenditures on services
IH = Real expenditures on housing investment
KD = Real stock of durable goods
KH = Real stock of housing
LDV = Lagged dependent variable
POP = Population
R = After-tax bill rate for equation 1, after-tax long term rate for equations 2-4
YD = Real disposable income

The Base Forecast: "Base"

As noted earlier, the MC model was used to make a forecast for the 1999:3–2004:4 period. It is important to note that this forecast is simply used as a base for the other two cases, and so the forecast itself is not of much importance. For example, say that a base forecast is made and then a new forecast is made where the only change is a change in one of the exogenous tax rates. For a given endogenous variable and period the difference between the new forecast value and the base value is an estimate of the effect of the tax rate change on this variable for this period. If a different base forecast were made and then the same tax rate change were made from this base, the differences between the new and base forecast values would not change much. For a linear model they would not change at all, and for a nonlinear model like the MC model they generally change very little. This is fortunate because it means that the following comparisons do not depend on the accuracy of the base forecast. Basically, any errors made in the base forecast will also be made in the changes from the base forecast, and so these errors will cancel out.

There is an estimated equation explaining capital gains in the U.S. part of the model, but this equation has not been used. Capital gains have been taken to be exogenous. Between 1985:1 and 1994:4 the total capital gain on household financial assets was $5.213 trillion, which is an average of $130.32 per quarter.[8] The base forecast assumes that the capital gain per quarter between 1999:3 and 2004:4 is this value ($130.32 billion). The forecast is thus based on the assumption of a historically average growth rate of asset values in the future, but no further boom.

There is an estimated interest rate rule of the Fed in the model, and this rule was used for the forecast. The interest rate that the Fed is assumed to control is the three-month Treasury bill rate.[9] The rule is one in which the Fed is estimated to "lean against the wind." The interest rate responds positively to output and to the rate of inflation. Table 3 presents the actual values of the bill rate for 1995:1–1999:2 and the forecast values for 1999:3–2004:4. The Fed is forecast to increase the bill rate from 4.45 percent in 1999:2 to 5.83 percent in 2002:1 and then to decrease it to 4.44 percent by 2004:4.

Estimated Effects of a Stock Market Crash: "Crash"

The "Crash" case is based on the assumption that market participants suddenly lower their estimates of fundamental stock values and drive stock prices down. It is assumed that in response to this the Fed immediately lowers the bill rate to three percent. The lowering of interest rates, other things being equal, is likely to have a positive effect on stock prices, and so if the Fed behaved this way, stock prices would likely fall less than otherwise in response to the change in views about the fundamentals. On the other hand, if the initial fall in stock prices leads the economy to contract, stock prices might fall even further. It is assumed for the "Crash" case that the net effect of these forces on stock prices is negative. The assumed size of the fall in equity values is discussed next.

Remember from the previous section that it is assumed for the base forecast for 1999:3–2004:4 that the capital gain per quarter on household financial assets is $130.32 billion, the average for the 1985:1–1994:4 period. If this average had also been true for the 1995:1–1999:2 period, which would have meant no stock market boom, the total capital gain for this period would have been $2.346 trillion instead of the actual capital gain of $10.876, which is a difference of $8.530 trillion. For the crash case this "extra" capital gain is assumed to be eliminated in 1999:3, which means that the capital loss for this quarter is $8.530 - $0.130 = $8.400 trillion. The capital gain from 1999:4 on is assumed to be unchanged from the base forecast value of $130.32 billion per quarter. Again, this capital loss should be thought of as factoring in both the Fed's lowering of the bill rate to three percent and the future negative effects on the economy. The bill rate was lowered by dropping the estimated interest rate rule of the Fed from the model and taking the bill rate to be three percent from 1999:3 on. These interest rate values are listed in Table 3, and the deviations of these values from the base values are plotted in Figure 1.

The simulation for the "Crash" case is for the 1999:3–2004:4 period. The differences between the solution values and the base values for real GDP are presented in Table 4 and plotted in Figure 2. Annual differences are presented in the table, and quarterly differences are plotted in the figure. Table 4 shows that the output deviations rise to 4.9 percent by

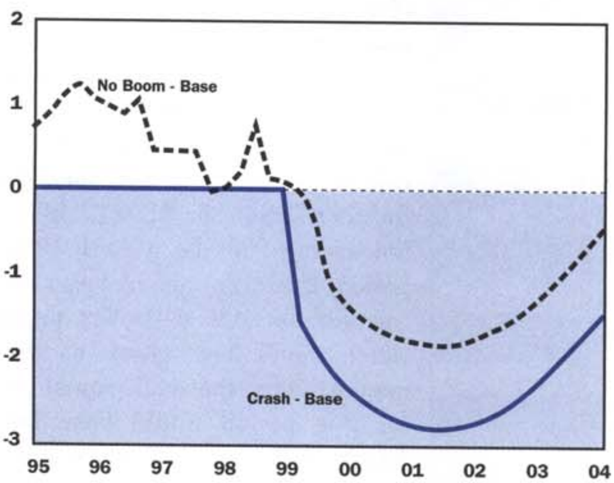
TABLE 3

BILL RATE VALUES

QTR.	BASE	NO BOOM	CRASH
1995.1	5.78	6.5	
1995.2	5.62	6.5	
1995.3	5.38	6.5	
1995.4	5.27	6.5	
1996.1	4.95	6.0	
1996.2	5.04	6.0	
1996.3	5.14	6.0	
1996.4	4.97	6.0	
1997.1	5.06	5.5	
1997.2	5.07	5.5	
1997.3	5.06	5.5	
1997.4	5.09	5.5	
1998.1	5.05	5.0	
1998.2	4.98	5.0	
1998.3	4.82	5.0	
1998.4	4.25	5.0	
1999.1	4.41	4.5	
1999.2	4.45	4.5	
1999.3	4.55	4.5	3.0
1999.4	4.80	4.5	3.0
2000.1	5.07	4.0	3.0
2000.2	5.31	4.0	3.0
2000.3	5.48	4.0	3.0
2000.4	5.60	4.0	3.0
2001.1	5.69	4.0	3.0
2001.2	5.75	4.0	3.0
2001.3	5.80	4.0	3.0
2001.4	5.83	4.0	3.0
2002.1	5.83	4.0	3.0
2002.2	5.82	4.0	3.0
2002.3	5.77	4.0	3.0
2002.4	5.70	4.0	3.0
2003.1	5.61	4.0	3.0
2003.2	5.49	4.0	3.0
2003.3	5.35	4.0	3.0
2003.4	5.20	4.0	3.0
2004.1	5.03	4.0	3.0
2004.2	4.84	4.0	3.0
2004.3	4.64	4.0	3.0
2004.4	4.44	4.0	3.0

FIGURE 1

BILL RATE DEVIATIONS FROM BASE (PERCENTAGE POINTS)



2001 and then decrease after that. By 2004 real output is still a little over \$100 billion below the base. The total decrease in output over the five and one half years is \$1.4328 trillion.

The results in Table 4 and Figure 2 thus show that the decrease in the bill rate to three percent is not nearly enough to offset the negative effects on output from the decrease in wealth. There are two features of the MC model that lead to a smaller interest rate effect on output than one might otherwise think. The first concerns the monetary authorities of other countries. There are estimated interest rate rules for the monetary authorities of other countries, and the authorities are estimated to respond to U.S. interest rates. For example, when the Fed lowers the U.S. interest rate, interest rates in other countries fall. The value of the dollar relative to other currencies responds to interest rate differentials, and, for example, when the U.S. interest rate falls relative to other interest rates, the dollar depreciates. The depreciation in turn raises exports and lowers imports, which expands output. This effect is, however, mitigated when the other monetary authorities respond because the increase in the interest rate differentials is smaller. The dollar depreciates less than it would if the monetary authorities did not respond.

The second feature concerns the income effect of an interest rate change. The U.S. household sector owns a large amount of short-term securities, and when short-term interest rates change, interest income changes. Interest income is part of disposable income, and so when, for example, short-term interest rates fall, there is a decrease in disposable income from the interest income decrease, which, other things being equal, has a negative effect on household expenditures.

Estimated Effects Had There Been No Stock Market Boom: "No Boom"

The "No Boom" case is a simulation over the entire 1995:1-2004:4 period. For this case the capital gain per quarter is assumed to be \$130.32 over the entire period. This means that the total capital gain for the 1995:1-1999:2 period is \$2.346 trillion instead of the actual value of \$10.876 trillion. The total capital gain for the 1999:3-2004:4 period is the same as that for the base forecast.

For this case the estimated interest rate rule of the Fed was dropped from the model, and the bill rate was taken to be 6.5 percent for 1995, 6.0 percent for 1996, 5.5 percent for 1997, 5.0 percent for 1998, 4.5 percent for 1999, and 4.0 percent thereafter. These interest rate values are listed in Table 3, and the deviations of these values from the base values are plotted in Figure 1. The values are larger than the base values for 1995–1997, about the same for 1998–1999, and lower thereafter. The larger values at the beginning are assumed to be enough to have stopped the stock market boom.

This case is run by first setting the residuals equal to their actual values for the 1995:1–1999:2 period. This means that when the model is solved using the actual val-

TABLE 4

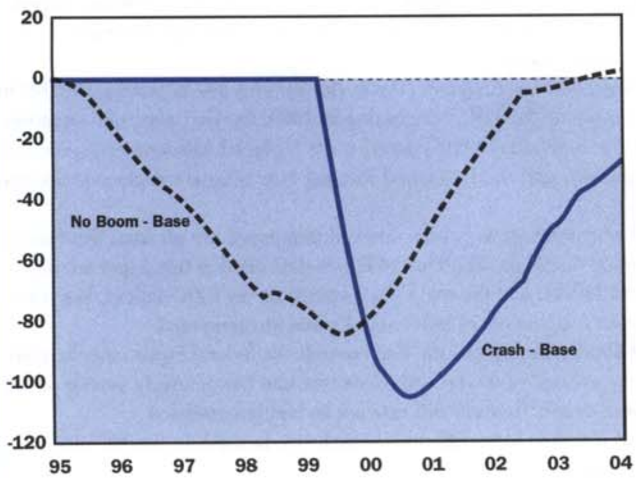
REAL OUTPUT DIFFERENCES: PREDICTED MINUS BASE

	CRASH		NO BOOM	
	\$ BILLION	PCT.	\$ BILLION	PCT.
1995	0	0	-17.1	-0.25
1996	0	0	-103.5	-1.48
1997	0	0	-179.9	-2.48
1998	0	0	-268.2	-3.55
1999	-22.8	-0.29	-313.1	-3.99
2000	-320.3	-3.94	-312.4	-3.84
2001	-410.0	-4.90	-201.0	-2.40
2002	-324.0	-3.78	-85.1	-0.99
2003	-223.7	-2.56	-15.4	-0.18
2004	-132.0	-1.48	4.8	0.05
TOTAL	-1432.8		-1491.0	

Notes:
\$ billion = billions of 1992 dollars
pct. = percent deviation in percentage points

FIGURE 2

QUARTERLY OUTPUT DEVIATIONS FROM BASE (BILLIONS OF 1992 DOLLARS)



ues of all the exogenous variables, a perfect tracking solution is obtained. With the residuals added, the base values are then the actual values through 1999:2 and the forecast values thereafter. The model is then solved using the different capital gains values and the different interest rate values. No other changes are made. For each quarter the difference between the solution value from this simulation and the base value for a given variable is the model's estimate of the effect of the changes on the variable. Note that the use of the actual values of the residuals means that the same shocks are assumed to occur as actually occurred historically.

The differences for real GDP for each year are presented in Table 4 and plotted in Figure 2. The output deviations rise to about four percent by 1999 and then decrease after that. By 2004 real output is back to the base. One reason real output comes back to the base is that from 1999:3 on, the bill rate is lower in the "No Boom" case than in the "Base" case (see Table 3 and Figure 1). Another reason is that there are stock effects in the model that have countercyclical effects. As the economy contracts, stocks of capital, housing, and durable goods rise less than otherwise, and eventually this has a positive effect on business investment, housing investment, and expenditures on durable goods. The total decrease in output over the ten years is $1.491 trillion.

An interesting question for the "No Boom" case is how much of the initial fall in output from the case is due to the higher initial interest rates and how much is due to the smaller capital gains. One cannot see this from Table 4, but the following simulation was run to examine this question. The simulation is the same as that for the "No Boom" case except that the values of the bill rate were not changed from the base values. In other words, this simulation included only the capital gains changes. For this simulation, the output deviation in 1996 was $85.1 billion compared to $103.5 billion in Table 4. Therefore, only $18.4 billion of the 1996 deviation in Table 4 is attributable to the change in interest rates. This simulation is another way of showing that the wealth effect is large relative to the direct interest rate effect. This is, of course, a *ceteris paribus* statement. All of the change in output in the "No Boom" case is attributable to the change in interest rates if it is assumed that the change in capital gains was caused by the change in interest rates.

Conclusion

The three main conclusions of this study are:

1. Unless there has been a huge increase in the long-run PE ratio, the current level of stock prices implies an unrealistically large share of profits in GDP in the future.
2. "Crash" versus "Base:" The Fed does not have the power through interest rate changes to prevent a recession from taking place if the level of stock prices falls to a value consistent with a historically average growth of stock prices since 1995.
3. "No Boom" versus "Crash:" If the stock market boom since 1995 had been cut off by higher interest rates, and the level of stock prices had grown by only a historically average rate, then the total loss in output from the base case is estimated to be about the same as the total loss in output from a future stock market crash.

Conclusion 2 would not change if a value of the bill rate smaller than three percent were used for the "Crash" case. As discussed at the end of the previous section, the wealth effect is much larger than the interest rate effect. Similarly, conclusion 3 would not change if for the "No Boom" case somewhat larger values of the bill rate were used in 1995–1998 (under the assumption that larger values would have been needed to ward off the stock market boom). Finally, conclusions 2 and 3 are not likely to change if the crash were put in later than 1999:3 or were spread out over more than one quarter. The size of the crash matters much more than the timing.

An implicit assumption of this article is that the Fed has the power to affect the stock market. It seems clear that the Fed has little influence on the market by simply talking about it. For example, in December 1996 Alan Greenspan made his famous "irrational exuberance" statement, and although he quickly dropped this phrase, he has mentioned high equity prices many times after that. None of these statements seemed to have much affect on the market.

The Fed's interest rate policy, on the other hand, does seem to affect stock prices. Stock market analysts are fixated on every word Greenspan says, looking for clues as to what the next interest rate announcement will bring. In Fair (2000) fifty-eight events were identified between 1982 and 1999 that led to a change in the price of the S&P 500 futures contract larger than 0.75 percent in absolute value within five minutes. Of these fifty-eight events, at least forty-one are directly or indirectly related to monetary policy. The event that led to the largest change was the Fed's announcement at 3:14 pm on October 15, 1998, of a twenty-five basis point cut in the federal funds rate. This announcement was not part of a normal FOMC meeting, and within five minutes the price of the S&P 500 futures contract increased 4.74 percent. It thus does not seem unreasonable to assume that the Fed can affect stock prices by changing interest rates.

With hindsight Fed policy since 1995 will clearly look good if there is no stock market crash. This is the "Base" case. On the other hand, if there is a crash, one could argue that the Fed should not have allowed the stock market boom since 1995 to have taken place. Since "Crash" and "No Boom" have roughly the same size real output losses compared to "Base," "No Boom" would probably have been preferred because it has lower variability.[10]

Did the Fed let a speculative frenzy get out of hand, or has there in fact been a large increase in the long run PE ratio? Only time will tell. ■

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I am indebted to Sharon Oster for helpful comments. The three cases in this paper can be duplicated amd analyzed on the website.

ENDNOTES

[1]This number is computed from data in the Flow of Funds Accounts. It is computed by taking the change in total financial assets of the household sector, which includes both capital gains and saving flows, and subtracting from this change the saving flows.

[2]The values for earnings and dividends that correspond to the S&P index were obtained directly from Standard and Poor's.

[3]It is implicitly assumed in this analysis that the growth rate of profits in the National Income Accounts is the same as the growth rate of S&P 500 earnings. In practice this is roughly the case because the S&P 500 index includes most U.S. stocks by market value.

[4]The website mentioned in the introductory footnote allows one to make different assumptions from the ones in Table 1 and see what this implies for earnings growth g and the share of profits in GDP.

[5]The thirty-eight countries are 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.

[6]The twenty-one 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.

[7]Some of the equations in the model are changed beginning in 1999 to incorporate the EMU. Beginning in 1999, the exchange rate equations of the individual EMU countries are replaced with one exchange rate equation, and the individual interest rate rules are replaced with one rule.

[8]The capital gains values cited in this paper are all from the Flow of Funds Accounts. The Flow of Funds data cited in this paper are in current dollars, and the real output values are in 1992 dollars. See note 1 for an explanation of how capital gains are computed.

[9]Although in practice the Fed controls the federal funds rate, the quarterly average of the federal funds rate and the quarterly average of the three month Treasury bill rate are so highly correlated that it makes little difference which rate is used. In the MC model the bill rate is used.

[10]If output losses are discounted, so that an output loss in, say, 1997, is more serious than the equivalent loss in 2003, then the increased variability of "Crash" compared to "No Boom" is somewhat offset by the fact that the output losses come later for "Crash." The net effect could go either way depending on the size of the discount rate and the weight one attaches to variability.

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