

**Bubbles and Busts:
The 1990s in the Mirror of the 1920s**

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“History is continually repudiated.”

-Glassman and Hassett (1999) The Dow 36,000

Stock market booms and busts command enormous attention, yet there is little consensus about their causes and effects. The soaring market of the 1990s was seen by many, but certainly not all, as the harbinger of a new age of sustained, rapid economic growth. Optimists saw the bull market as driven by fundamentals, although they differed over what these were; while skeptics warned that it was just a bubble, distorting consumption and investment decisions. Regardless of the boom’s origin, policy makers feared that a collapse would have real economic consequences and debated how to cope with the market’s retreat.

Although the sheer size of the run up in stock prices in the 1990s has obscured other bull markets in the popular eye, the boom shared many characteristics with previous episodes, notably the 1920s; and the explanations and policy concerns were similar. As in the 1990s, it was widely claimed that a “new economy” had taken root in the U.S. Technological and organizational innovations were viewed as raising productivity, increasing firms’ earnings and justifying the wave of new issues. In both periods, unemployment was low with stable prices in the twenties and very low inflation in the nineties. Participation in the market increased, as investing in the market seemed safer, with reduced macroeconomic risk and the seeming abundance of high return opportunities.

Just as the new heights of the 1990s market were often challenged as the product of “irrational exuberance,” so too there were critics of the fast surge in stock prices in 1928-1929. Policy makers were concerned about the distortions that the quick run up in stock prices would have on the economy. The potential presence of an asset bubble raised the question of the appropriate policy response---and in the 1920s the bull market helped to produce a grievously mistaken monetary policy.

As booms and crashes are relatively rare events, this paper offers a comparison of the 1920s and the 1990s to provide perspective on the question of whether the Federal Reserve should respond to booms and crashes. The answer to this question depends critically on the ability of policy makers to identify fundamental components in the stock market. Although considerable energy has been expended to justify stock price movement in terms of fundamentals and measure bubbles, it has proven to be an elusive effort. While this pre-empts a policy response to a boom, the Fed still has a critical role to play in preventing crashes from disrupting the payments system or sparking an intermediation crisis.

DEFINING BOOMS AND CRASHES?

Some stock market booms and crashes are well remembered; but in general, these events are imperfectly defined. While we typically think of the stock market as following a random walk, a boom is viewed as an improbably long period of large positive returns that is cast into sharp profile by a crash. The first questions to address are whether the twenties and nineties stand out in comparison to other booms and crashes and whether they shared similar characteristics?

To identify booms, we need to look for long periods of positive real stock returns. Figure 1 shows the annual real returns on the S&P 500 for 1871 to 2003.¹ Annual data provide the appropriate window to look for bull markets, as they are seen as long upward swings that dominate any brief retreat that might be picked up in data of a higher frequency. The bull market of 1995-1999 stands out, with returns of 27, 21, 22, 25 and 12%. If three consecutive years of returns over 10 percent is used as an approximate criterion, booms are relatively rare. The first boom for this data is 1921-1928, which had a long run of positive run returns of 20, 26, 2, 23, 19, 13, 32, and 39%. Next is 1942-1945, where returns were 11, 18, 15 and 30%. The 1950s also had a long bull market where there was a streak of positive returns: 18, 22, 15, 13, 2, 39, 25% from 1949 to 1956. The years 1963-1965 saw gains of 17, 13, and 9%, while 1982-1986 enjoyed returns of 22, 14, 4, 19 and 26%. Few contemporaries seemed concerned that the booms of the forties, fifties, or sixties left the market far out of alignment, and it is the fear of a crash that identifies a bull market that singles out the 1920s, 1980s, and 1990s.

Mishkin and White (2003) developed a simple method for identifying crashes, using the three most well known stock indices to capture the fortunes of different segments of the market: the Dow Jones Industrials, Standard and Poor's (S&P) 500 and its predecessor the Cowles Index, and the Nasdaq. Since October 1929 and October 1927 are universally agreed to be stock market crashes, they were used as benchmarks. In both cases, the market fell over 20 percent in one and two days' time. The fall in the market, or the depth, is only one characteristic of a crash. There was no similar sudden decline for the most recent collapse, but no one would hesitate to identify 2000 as the beginning of a major collapse. Thus, speed is another feature. To identify crashes, it is necessary to look at windows of one day, one week, one month and one year to capture other declines.

This net picked out 15 major stock market crashes in the twentieth century. These were 1903, 1907, 1917, 1920, 1929, 1930-1933, 1937, 1940, 1946, 1962, 1969-1970, 1973-1974, 1987, 1990, and 2000. These crashes are identified in Figure 1. Some were clearly driven by political or policy events, but only a few crashes happened after a prolonged boom: 1929, 1946, 1987, and 2000-2001. The crash of 1946 followed rather than anticipated the postwar recession, which hit bottom in October 1945. It generated relatively little concern among contemporaries, unlike the crashes of 1929, 1987, and 2000-2001, which came at the end of heady peacetime booms. The timing and magnitude of the crash 1987 closely matched 1929. But, the rapid recovery of the market, which disguises the crash in Figure 1, caused policy concerns to abate. The most natural comparison thus appears to be the booms of the twenties and nineties.

Figures 2 and 3 offer a more detailed comparison of these two episodes, displaying the Dow Jones Industrials, the S&P 500 and its predecessor the Cowles Index. Unfortunately, there is no equivalent for the Nasdaq in the 1920s. To capture some of the movement for smaller, newer firms, an equally weighted index for all common stocks listed on the New York Stock Exchange is included (Fisher, 1966). To make all series comparable, the indexes are set equal to 100 in their peak month. These figures highlight the similarities and differences of these two great bull markets. The boom market in 1929 was focused more on the larger companies. Both the Dow Jones and Cowles

¹ The most frequently used data for examining booms, crashes and bubbles are the series on Robert Shiller's webpage, <http://www.econ.yale.edu/~shiller/data.htm>, where the return is $\ln(1 + \text{real return})$, where the return includes dividends and the capital gain.

indices moved almost in lock step on the way up, although the boom is greater in the bigger Dow Jones companies. This aspect of the boom is highlighted by the equally weighted index, even though earlier years are missing. The rise is nowhere near as steep and the peak of the market---emphasizing the fate of smaller company stocks---is in February 1929. The crash of October 1929 sent both the Dow Jones and Cowles indices downwards to join the third index in the bumpy ride to the bottom. Table 1 shows the dimensions of the decline for the markets of the twenties, eighties and nineties. Although starting from different peaks, all indices for the 1920s lost over 80 percent. The recovery to peak was over a decade away emphasizing the role the Great Depression had in humbling the market.

Table 1
Characteristics of Booms and Busts
(End-of-month indices)

	Peak	Trough	Drop	Peak to Trough (months)	Recovery to Peak Date
1920s					
Dow Jones	Aug-29	Jun-32	-0.822	34	Nov-54
Cowles	Sep-29	Jun-32	-0.849	33	Nov-53
Equally-Weighted	Feb-29	May-32	-0.896	39	Sep-45
1980s					
Dow Jones	Aug-87	Nov-87	-0.302	3	Jul-89
S&P 500	Aug-87	Nov-87	-0.311	3	Jul-89
Nasdaq Composite	Aug-87	Dec-87	-0.299	4	Jun-89
1990s					
Dow Jones	Dec-99	Sep-02	-0.339	34	?
S&P 500	Aug-00	Sep-02	-0.463	26	?
Nasdaq Composite	Mar-00	Oct-02	-0.741	32	?

In contrast to the 1920s, the 1980s boom appears to have been spread across the whole market. All indices crash at the same time, and their recovery is very similar. The 1980s upward rush and initial crash map very closely into the 1920s, in fact, it is easy to superimpose any two series. In mirror-like movement, the markets quickly recover from the shock. Then, they part company. By July 1989, nineteen months after the peak, the Dow has completely recovered, but at the same distance from the peak, July 1931, it was 64% below the peak.

The rising tide of the 1990s lifted all boats, but the high tech, small company stocks of the Nasdaq rode the crest. In comparison to the 1920s when large companies dominated the rising market or the 1980s when all rose together, the Nasdaq firms were the center of the boom, rising higher and falling further. The collapse of the “tech bubble” looks more like the busts of October 1929 and October 1987. From the peak in March 2000, the Nasdaq lost 20% within a month. The jagged slump from peak to trough produced a loss of 74%; the size and timing matching the collapse from 1929. In Table 1, the larger, more established companies represented by the Dow Jones and the S&P 500 experienced the same magnitude of loss as did the indices in 1987 and the

initial decline from August to November 1929; but it is slower and more gradual. By the end of 2003, all three indices had recovered partly but with markedly different success. The absence of a quick recovery à la 1987 and the magnitude of duration of Nasdaq's collapse make the twenties and nineties a natural comparison.

BUBBLES OR FUNDAMENTALS?

Discussion of booms and busts sharply divide observers. There are those who believe that fundamentals are solely responsible for the movements in stock prices and those who believe that stock prices are largely detached from fundamentals, moved by the fluctuating optimism and pessimism of investors.

Looking back on the boom and bust of the 1920s, Professor John B. Williams of Harvard wrote:

Like a ghost in a haunted house, the notion of a soul possessing the market and sending it up or down with a shrewdness uncanny and superhuman, keeps ever reappearing....Let us define the investment value of a stock as the present worth of all the dividends to be paid upon it (Williams, 1938).

Viewing the same period, John Maynard Keynes chose to differ:

A conventional valuation which is established as the outcome of the mass psychology of a large number of ignorant individuals is liable to change violently as the result of a sudden fluctuation of opinion which do not really make much difference to the prospective yield.....the market will be subject to waves of optimistic and pessimistic sentiment, which are unreasoning (Keynes, 1936).

On the threshold of the great bull market, the divide remained. Robert Shiller observed:

I present here evidence that while some of the implications of the efficient markets hypothesis are substantiated by data, investor attitudes are of great importance in determining the course of prices of speculative assets. Prices change in substantial measure because the investing public en masse capriciously changes its mind (Shiller, 1991).

In contrast, John Cochrane expounded:

We can still argue over what name to attach to residual discount-rate movement. Is it variation in real investment opportunities not captured by current discount model? Or is it "fads?" I argue that residual discount-rate variation is small (in a precise sense), and tantalizingly suggestive of economic explanation. I argue that "fads are just a catchy name for the residual (Cochrane, 1991).

These extreme positions can be maintained because of the observational equivalence in any empirical test between a market driven by a bubble and one where it is driven by fundamentals but there are omitted factors (Flood and Hodrick, 1990). Most models of market behavior are based on rational expectations, which assumes that (1) individuals have rational information processing and (2) individuals have a correct model of the fundamental structure of the economy. Bubbles or manias may arise if either condition is violated. If the first is violated, there will be an irrational bubble or mania; and if the second is violated, there will be a rational bubble. With either violation, asset prices will deviate from fundamentals (Blanchard and Watson, 1982). In rational bubbles, market participants may have rational expectations but prices may differ from fundamentals because the sequence of prices in rational expectations models may be indeterminate. Bubbles will be rational as long as the bubble component in the stock price is the expected discounted value of the future bubble. In an irrational bubble, market participants may focus on “noise” instead of fundamentals. Some noise or unsophisticated traders in a market may overwhelm rational or sophisticated investors if the time horizons for arbitrage are finite (De Long, Shleifer, Summers and Waldman, 1990). If share prices are moved by a bubble, it will induce distortions into the market, mis-directing investment, policy intervention may be required.

FUNDAMENTALS AND EMPIRICAL REGULARITIES

What were the driving fundamental factors behind the great bull markets of the 1920s and 1990s? Even if one believes that a bubble or investor euphoria was the key factor, the natural starting point is how to measure the contribution of fundamentals to prices. Fundamentals require that stock prices equal the present discounted value of expected future dividends. The simplest approximation to this fundamentals-based valuation is the Gordon growth model, which underlies many studies and much popular discussion. While expected future dividends and interest rates may vary considerably, the simple Gordon model assumes constant values for all parameters. Dividends are assumed to grow at a rate g and investors are assumed to require a return of a r , composed of a risk free rate and an equity premium.² Usually framed in terms of the aggregate price level of the stock market, P , the Gordon model is:

$$(1) \quad P = (1+g)D/(r-g)$$

While changes in the payout rate and the risk free rate may have contributed some to upsurges in the market, it is technological change, increasing productivity and leading to higher dividend growth, and changes in the equity premium that are believed to have been the prime movers.

The Gordon model neatly outlines the simple fundamental relationship, yet explaining stock price movements has proved frustratingly difficult. The problem is that to be rational prices should be wholly forward looking, representing the expected future course of dividends appropriately discounted. In a classic article, Shiller (1981) found that stock prices moved far more than was warranted by the movement of dividends,

² If a constant fraction of earnings, E , are paid out as dividends, where b is the proportion of reinvested earnings, then $D = (1-b)E$.

where the ex post rational price was equal to the discounted value of the future stream of realized dividends. Even if there were deviations in what was expected from what was realized, the fit should have been good over his long period of observation, 1871-1979; yet the variation of prices exceeded the variation in fundamental prices violating any reasonable test.³

While it has proven difficult to explain the behavior of prices in terms of the movement of future dividends and discount rates, a very different literature has found empirical regularities, explaining the behavior of current prices in terms of past fundamentals. This predictability is surprising, given that prices should be forward looking; and it provides a further instrument for analyzing the unusual behavior of prices during stock market booms. Fama and French (1988) found that both the lagged dividend yield and the lagged earnings yield had explanatory power for stock returns.⁴ Lamont (1998) has argued that high dividends predict high future returns because dividends measure the permanent component of stock prices, reflecting the dividend policy of managers. The payout ratio (dividend-earnings ratio) forecasts returns because the level of earnings is a measure of current business conditions.⁵ It is generally observed that investors required high stock returns in recessions and low returns in booms, and risk premia on stocks covary with the business cycle. As earnings vary with the business cycle, current earnings forecasts future returns, thus both dividends and earnings have information for stock returns. However, the variation explained by these models is very modest.

Table 2 gives a closer look at the key ratios for each of the boom periods. Real dividends and earnings climbed to historic highs in 1928-1929, but the market rose so much that the dividend yield and earnings to price ratio fell below traditional levels, and the payout ratio moved back to an earlier level. If these two years represented a new era, with higher earnings paying out higher dividends but with a greater share being reinvested, then optimists would seem to have had good cause for paying higher stock prices. Yet, from the empirical regularities, we would anticipate that the fall in the dividend yield would reduce future returns, with the falling earnings price ratio mitigating it to some degree. For the 1990s, the picture was somewhat different. Real earnings per share jumped, but little was paid out in dividends. Again, the market's surge caused both measures to collapse to unprecedented lows; and the abrupt rise in the market was not anticipated empirically by the changes in the key ratios.

In a telling out-of-sample exercise at the outset of the nineties, Lamont (1998) forecast the cumulative return of buying stocks on December 31, 1994. For his sample period (1947-1994), the unconditional mean excess return over a five year period was 33%. But using a VAR regression with a starting point of December 31, 1994, the out-of-sample forecast was one percent below total Treasury bills returns to 2000! Even with a potential total forecast error of 21 percent this was well below the performance of the market. His conclusion was that in the mid-1990s, U.S. stock prices were very high relative to any benchmark. The surprising failure of stock prices to conform to some

³ Critics attacked the small sample properties of Shiller's tests and his methods of detrending (Flavin, 1983; Kleidon, 1986) but in a survey West (1988) concluded that Shiller's results were reasonably robust against these and other criticisms.

⁴ See also Campbell and Shiller (1988).

⁵ One concern about using dividends to forecast returns is if stock repurchases replace dividends then past history of dividend yields and payout ratios will not be a good guide to stock returns.

simple rational model or the empirical regularities requires a closer examination of the fundamentals components of the Gordon model.

Table 2
The Dividend Yield, Earnings to Price Ratio and Payout Ratio
in Two Booms

	Real Dividends	Dividend Yield	Real Earnings	Earnings To Price	Payout Ratio	Real Price
1900-1909	7.6	4.6	12.7	7.6	60.4	173.1
1910-1919	8.0	5.9	13.5	10.1	62.4	149.6
1920-1924	5.3	6.3	7.6	8.8	81.9	83.5
1925	6.1	5.7	12.7	11.8	48.0	110.9
1926	7.1	5.5	12.8	9.8	55.6	128.1
1927	8.1	5.7	11.6	8.3	69.4	138.8
1928	9.0	4.8	14.6	7.9	61.6	183.7
1929	10.3	3.9	17.1	6.5	60.2	263.6
1930	11.2	4.5	11.1	4.5	101.0	230.2
1931	10.4	5.1	7.7	3.8	134.4	182.2
1932	7.0	6.0	5.8	4.9	122.0	105.2
1933	6.0	6.2	6.0	6.2	100.0	99.6
1970-1979	13.2	4.1	29.4	9.4	45.5	360.9
1980-1989	13.5	4.6	28.1	9.5	48.6	321.5
1990-1994	15.9	3.2	27.6	5.4	59.8	521.7
1995	16.2	3.0	39.9	7.3	40.6	561.2
1996	17.0	2.4	44.1	6.3	38.5	721.5
1997	17.4	2.0	44.6	5.2	39.0	873.1
1998	17.9	1.7	41.6	3.9	43.0	1080.8
1999	17.9	1.3	51.7	3.9	34.6	1378.0
2000	16.8	1.1	51.8	3.5	32.5	1531.2
2001	16.1	1.2	25.3	1.9	63.8	1378.1
2002	15.8	1.4	30.3	2.7	52.1	1167.3

Source: Robert Shiller's webpage, <http://www.econ.yale.edu/~shiller/data.htm>

EXPLANATION: TECHNOLOGICAL CHANGE

In both the 1920s and the 1990s, many bulls heralded the arrival of a “new” economy. They saw a higher rate of technological change as the driving force behind a faster growing economy and a rapidly rising stock market. Surging initial public offerings, many based on technological or managerial innovations, flooded the markets in both periods. Technological innovations were viewed as improving the marginal product of capital, increasing earnings and hence dividend growth. A wave of innovations, sometimes characterized as a new general purpose technology was believed to have placed the economy on a higher growth path.

In *New Levels in the Stock Market* (1929), Charles Amos Dice Ohio State argued that higher stock prices were the product of higher productivity. Dice identified increased expenditure on research and development and the application of modern

management methods as prime factors behind the boom. Irving Fisher (1930) saw the stock market boom as justified by the rise in earnings, driven by the systematic application of science and invention in industry and the acceptance of the new industrial management methods of Frederick Taylor. But not everyone was so sanguine. A.P. Giannini, head of Bancitaly (the future Bank of America) stated in 1928 that the high price of his bank's stock was unwarranted given the planned dividends. Management of some high flying companies, including Canadian Marconi and Brooklyn Edison, also became alarmed and announced that their shares were overvalued (Patterson, 1965).

As suggested by the relatively stronger performance of the largest companies in the stock indices in Figure 2, the boom of the 1920s was centered on large-scale commercial and industrial enterprises that took advantage of continuous-process technologies. These were coordinated by the emerging system of modern management that produced more efficient vertically-integrated enterprises, capturing economies of scale and scope (Chandler, 1977). Among the "new" industries were automobiles. The Ford Motor Company had pioneered mass production techniques, but General Motors developed a diversified line of production and a more advanced management and organization system, becoming the industry leader. GM's president predicted that its stock price would rise from 180 to 225 and he promised to return 60 percent of earnings to stockholders.

Other new technology industries included radio, movies, aircraft, electric utilities and banking. Like many fast-growing companies, RCA did not pay dividends but reinvested its earnings. Other prominent new technology companies were Radio-Keith Orpheum, the United Aircraft and Transport Corporation, and the Aluminium Company of America. Central to many of the new technologies was the electricity industry, which was transformed in the 1920s. Utilities had been local industries, but there were now technological opportunities to gain economies of scale in production and transmission, providing incentives to consolidate the industry. In a wave of mergers, banks expanded and acquired other types of financial institutions to provide a wide range of services, yielding advantages of scale and scope. Stock indices available for utilities and banking outstripped the Dow Jones and S&P500 indices, much as the tech company stock indices of the 1990s did.

Some students of the 1920s have sought to explain the boom as primarily driven by technological change raising dividends. Sirkin (1975) applied a version of the Gordon model to Dow Jones stocks in the 1920s to see if price-earnings ratios could have been justified by a temporarily higher growth of earnings. Price-earnings ratios had ranged between 12 to 15 before the bull market, while the mean and median at the peak in 1929 were 24.3 and 20.4. Assuming a fixed discount rate of 9%, Sirkin calculated the higher earnings growth and number of years that would be needed to justify peak price earnings ratios. In his best case, if the higher growth rate of 8.9% typical of 1925-1929 had been sustained for ten years, a price-earnings ratio of 20.4 would have been justified or over justified; thus he concluded that the market was not overvalued.

Although simple, Sirkin's study is fairly typical of many non-nested exercises devised to explain the booms of the 1920s and 1990s, which focus on one variable. Sirkin's results are also sensitive to the selection of 1925-1929 as a time frame for high sustainable earnings. If the years 1927-1929 were selected to measure reasonable future earnings growth, all price-earnings ratios he examined would have been justified. This

point reflects the fact that earnings are highly variable, compared with the permanent component of dividends.

Donaldson and Kamstra (1996) sought a similar explanation for the 1929 boom and bust, focusing on changes in the expected growth of dividends. In the simple Gordon growth model, dividend growth cannot explain the price peak. Prices moved far away from their fundamentals, and simple tests show that one cannot reject the presence of a bubble. However, using pre-1920 dividend data, Donaldson and Kamstra estimated a non-linear ARMA-ARCH model for discounted dividend growth and found that out-of-sample forecasts produce a fundamental price series with a similar time pattern to the actual S&P index. The fit is so close that it is hard to reject expected dividend growth as the driving factor. Yet, the discount rate plays no significant role. While Donaldson and Kamstra used alternatively a constant discount rate and a variable one, they do not allow for any significant variation in the equity premium, a key feature of the boom. Close inspection of their charts reveals that their fundamental peak follows the actual peak, suggesting that the fit may partly reflect the highly persistent behavior of dividends.

In contrast to Sirkin and Donaldson and Kamstra, Barrie Wigmore (1985) saw no evidence in earnings that could justify the run up in stock prices. In his detailed survey of the behavior of individual stocks, he pointed out that at the market's peak stock prices average 30 times 1929 earnings up from 10 and at most 20 before the boom. Although 30 was the average, many stocks fell in the 30-50 range, with a number over 100. He concluded that "such stock prices were clearly dependent on further price rises rather than on the income generated and distributed by companies...as the low returns on equity show, these high valuations placed little emphasis on earnings."⁶

The idea of a new technological age played a key role in the mind of the 1990s' bull market. The rapid changes in computer/information technology and biotechnology were heralded as placing the economy of a higher trajectory. This "new era" vision was supported by some economists. Comparing the computer revolution to the introduction and spread of electricity and internal combustion, Jovanovic and Rousseau (2002) projected that this general purpose technology would have an even greater impact on productivity growth. Prices for electricity and automobiles had declined sharply in the 1910s and 1920s, and most quickly after 1924, suggesting a key role for technology in the boom of the 1920s. But, price declines for information technology produces have been much faster, promising higher levels of growth and consumption.

Yet, this rosy future is not strongly supported by more general studies of productivity growth. In a reassessment of long-term multi-factor productivity (MFP) growth, Gordon (June 2000) painted a broad picture of slow growth in the nineteenth century. From an average annual growth rate of 0.39% for 1870-1891, MFP began to climb, hitting 1.14% for 1890-1913. After World War I, it continued its upward movement, rising to 1.42% for 1913-1928 before cresting at 1.90% in 1928-1950. Gordon argued that this peak of MFP growth was attributable to a cluster of four inventions: electricity, the internal combustion engine, petrochemicals-plastics-pharmaceuticals, and communications-entertainment (telegraph, telephone, radio, movies, television, recorded music and mass-circulation newspapers and magazines). These were all well established before World War II, except for television, and their diffusion and improvements thus contributed to the peak of MFP growth of 1928-1950.

⁶ Wigmore, p. 382.

MFP growth subsided to 1.47% for 1950-1964 and then plummeted to 0.89% for 1964-1972, hitting bottom at 0.16% for 1972-1979. The recovery to 0.59% in 1979-1988 and 0.79% for 1988-1996 remained far below the peak, leading Gordon to conclude that the contributions from the four earlier general purpose technologies dwarfed today's technology information computer/chip-based IT revolution. Gordon (August 2000) found the most recent increase in MFP for 1995-1999 to be 1.35%, consisting of a 0.54 unsustainable cyclical effect and 0.81% in trend growth which he attributed wholly to the computer-IT sector. For the remainder of the economy, MFP did not revive, and outside of durables it actually decelerated.⁷ The differences in productivity growth in the late 1990s between IT industries and the rest of the economy look like a potentially good explanation for the greater buoyancy of the Nasdaq compared to the rest of the market. Certainly, it would explain investor response to developments in the IT industry. However, the boom outside of the new economy appears surprising without a major increase in productivity growth, giving skeptics ammunition.

The implications of the modest increase in productivity growth for the value of stocks is found in Heaton and Lucas' (1999) study, which parallels Sirkin's exercise for the 1920s. They calculated the growth rates that would be needed to justify the peak price-dividend using Shiller's annual data (1872-1998). For this 126 year period, the average price-dividend ratio was 28 and real earnings growth rate was 1.4%, implying a discount rate of 5%.⁸ To match the 1998 ratio of 48 with required returns of 5% or 7% would demand growth rates of 2.9% or 4.9% growth of earnings---huge historical leaps, a doubling of productivity growth, something not evident in the data. Consequently, Heaton and Lucas are skeptical of any explanation of the 1990s can be principally based on technological change. Like the 1920s, the conclusion for the 1990s is fairly clear: expected dividend growth was not a major factor driving the boom.

EXPLANATION: CHANGES IN THE EQUITY PREMIUM

The stock yield or return required for holding stocks has been seized upon by others as the fundamental factor driving stock market booms. Composed of a risk free rate and an equity premium, the stock yield is believed to be moved primarily by the latter, as the risk free rate is held to be relatively constant. In the Gordon stock valuation model, where there is a constant expected growth of future dividends, the stock yield is

$$(2) \quad r_t = E(D_{t+1} / P_t) + g$$

The equity premium is then calculated as the difference between the stock yield and a measure of the risk free rate. This simple formulation points to the fact that the equity

⁷ Contrasting this skepticism of the IT revolution, Nordhaus (2002) believed that IT provided only a modest contribution to the revival of labor productivity, which was more broad-based. Using income-side GDP measures and four measures of labor productivity, Nordhaus found that manufacturing productivity growth increased by 1.61% from 1977-1989 to 1995-2000, of which the "new economy" contributed 0.29%. However, Gordon (2002) doubted this finding and recalculated Nordhaus' labor productivity growth with the result that the computer-IT sector accounted for virtually all the increase.

⁸ They point out that at higher discount rates of 7% to 9% percent that were usually presumed to have prevailed, very high growth rates of 3.4% to 5% would have been required.

premium is largely driven by share prices, as movements in the growth rate of dividends are relatively small compared to price movements.

Figure 4 graphs a measure of the equity premium and the stock yield. The stock yield is based on the S&P500, while the risk free rate is composed of three series spliced together: the 10 year constant maturity U.S. government bond rate for 1941-2003, high grade industrial bonds for 1900-1940, and high grade railroad bonds for 1871-1899.⁹ The estimated stock yield is equal to the dividend yield and the average growth of dividends. The nominal and real rate of growth of dividends was 3.9% and 1.7%.¹⁰

After a long period of relatively constancy in the nineteenth century, the equity premium rose to over 6% after World War I. During the 1920s, it declined back to its previously level, then during the boom fell to its lowest point yet. If measured on a monthly basis, the equity premium hit an unprecedented 2% during the bull market of 1928-1929. The Great Depression elevated the premium to an historic high. By the 1960s, it returned to the nineteenth century level. The brief period where there appears to be an equity discount is not the result of any decline in the dividend yield but of the unexpected rise in interest rates in the early 1980s. However, since the late 1980s, the equity premium appears to have collapsed.¹¹

The perception that equities are less risky and hence the equity premium should decline was a common explanation for the nineties boom. Among the most bullish of the bulls were Glassman and Hassett whose book The Dow 36,000 (1999) proclaimed a “paradigm shift”:

Stocks *should* be priced two to four times higher---today. But it is impossible to predict how long it will take for the market to recognize that Dow 36,000 is perfectly reasonable. It could take ten years or ten weeks. Our own guess is somewhere between three and five years, which means that returns will continue to average about 25 percent per year. (p.13)

Their optimism was predicated on equation 2, assuming a real long term bond rate of 2% and a 2.3% real growth rate of dividends, permitting a dividend yield of 1.5% to fall to 0.5% with a tripling of stock prices.¹² Glassman and Hassett argued that a diversified portfolio of stocks was no more risky than an investment in U.S. government bonds. Once investors fully appreciated this fact, the equity premium would vanish as stock prices were bid up. To support their argument, they pointed to the fact that transactions costs had been greatly lowered by mutual funds, 401(k) plans, internet trading, computerization and other innovations that permitted investors to more easily acquire information to diversify their portfolios.

⁹ U.S. government constant maturity bonds yields are found on www.freelunch.com. The high grade industrials (series 13026) and McCaulay’s railroad bonds (series 13019a) were obtained from the NBER website.

¹⁰ The real rate is calculated using the consumer price index. Blanchard (1993) measures the equity premium where the growth of dividends is not fixed, however is very similar.

¹¹ The disappearance of a substantial equity premium seems to bear out Mehra and Prescott’s (1985) claim that at reasonable levels of risk aversion, it is not possible to justify risk premium any larger than 0.25 percent in the absence of market imperfections.

¹² Glassman and Hassett, p. 72-73.

The same factors---increased participation and diversification---that have been used to explain the recent decline in the equity premium were also present in the 1920s. Traditionally, investing in the stock market was restricted to the well-to-do but the wider public entered the market in the 1920s. Smaller investors were brought into the market as innovations made it easier for them to diversify their portfolios. One important development was the expansion of the investment trusts---precursors to today's mutual funds, which grew from 40 in 1921 to 750 in 1929. After the stock market collapse of 1929 and the prolonged depression, the market was deserted by the small investors who returned only slowly. By the end of the twentieth century, mutual funds facilitated the re-emergence of small investors. Between 1990 and 2002, the number of these funds climbed from 2,338 to 7,267 and the number of accounts and net assets rose from 61 million with \$1,065 billion to 251 million with \$6,392 billion.¹³

An increase in the stock market participation rate could decrease the required risk premium on stocks because it would spread market risk over more of the population. The Survey of Consumer Finances showed that the number of shareholders in the U.S. rose from 52.3 million in 1989 to 69.3 million in 1995, with people entering the market at younger ages (Heaton and Lucas, 1999). In addition, stockholders seem to be more diversified, which would allow holders to demand a lower rate of return. Whereas, few very investors had more than ten stocks in the 1960s, (Friend and Blume, 1978), the potential for diversification has increased by mutual fund ownership, yet risk tolerance seems only to have increased slightly from 1989 to 1995. Heaton and Lucas (1999) suggest that individuals who already own stocks are more risk-tolerant than those who do not, implying that the addition of new stockholders might lower the average level of risk tolerance, reducing the effect of wide ownership on the equity premium.

To examine the effects of increased participation and diversification, Heaton and Lucas (1999) calibrated an overlapping generations model where only some households hold equity and there is aggregate and idiosyncratic income risk. They found that substantial changes in participation rates have only a small effect on the equity premium. Diversification is more potent, but this factor has not increased as much as popularly perceived. Mutual funds may have mushroomed, but as late as 1995 only 16.5% of equity was owned through mutual funds. Furthermore, households that held stock had almost half invested in their employing company (Vissing-Jorgensen, 1999). Thus, increased participation and diversification may only explain a limited part of the downward trend in the equity premium.

The sharp decline in the equity premium may also be explained by the inflation. Using independent measures of equity risk from cross sectional data, Campbell and Vuolteenaho (2004) found inflation explained half of the movement in the dividend yield. The falling dividend yield of the late 1920s was attributable to a drop in risk. The increase in the dividend yield in the 1930s and 1940s was dominated by the increase in risk, which overwhelmed the effect of deflation that would have lifted prices. The declining dividend yield of the 1950s and early 1960s was moved primarily by the falling measures of equity risk. But rising inflation from the late 1960s through the 1970s raised the dividend yield. By the late 1980s and 1990s, it was falling again, this time because both risk and inflation were declining. Campbell and Vuolteenhao contend that higher inflation was not correlated with any subjective measure of risk that would imply rational

¹³ Investment Company Institute (2003).

pricing. Instead inflation increased expected long-term real dividend growth because investors formed subjective growth forecasts by extrapolating past nominal growth rates without taking inflation into consideration. The result was that stocks tended to be overpriced when inflation was low and underpriced when inflation was high. They blamed this “mis-pricing” of stocks by the persistent use of the “Fed model” by many contemporary investment professionals who counseled investors to compare the yield on stocks (the dividend yield) with the yield on Treasury bonds plus a risk factor. Use of this model produces some inflation illusion.¹⁴ They concluded that at the end of 1999, when dividend growth and the risk measures justified a dividend price ratio of 3.3, it was observed to be 1.2.

While a huge effort has been expended by financial economists to explain the movement of stock prices in terms of fundamentals, it has had a very limited success. Changes in earnings growth and the discount rate cannot fully account for the buoyant markets of the 1920s and 1990s. As Campbell (1999) bleakly explained: “The recent run-up in stock prices is so extreme relative to fundamental determinants such as corporate earnings, stock-market participation, and macroeconomic performance that it will be very hard to explain using a model fit to earlier historical data.”

If there were bubbles in 1929 and 1999, they would have distorted consumption and investment. A boom in stock prices would raise household wealth helping to drive consumption, and new investment would look more attractive because soaring stock prices would raise market value to book value in Tobin’s q . In addition, the improvement in the value of collateral would have allowed more firms to borrow. Firms might also switch to equity finance from debt finance because of a lower equity premium. Rising stock prices by increasing investment would have driven up the observed real growth rate, making the apparent productive capacity of the economy greater. If stock prices do not reflect fundamentals, some investments should not have been undertaken because they did not really have had positive internal rates of return. The result will be overinvestment and unusable capacity. Romer (1990) compared the behavior of consumer spending and stock market wealth for the crashes of 1929 and 1987. She found that the relationship between stock price variability and consumer spending were similar for both periods, although the continued high level of volatility after 1929 was greater. In the boom and bust, wealth had its strongest effect on consumer durables, raising purchases during the bull market then drastically reducing consumption after the crash. Eichengreen and Mitchener (2003) estimated an investment equation, where the doubling of Tobin’s q that occurred between 1926 and 1929, produced an 18% increase in investment and the collapse afterwards yielded a greater effect.

If fundamentals drive the market then there is no unwarranted consumption or investment. Yet, studies of fundamentals cast doubt on whether stock market booms are entirely attributable to fundamentals, suggesting that if one could measure the deviations from fundamentals, there would be a role for incorporating asset prices or some measure of asset mis-pricing into the Federal Reserve’s decision-making.

¹⁴See also Campbell and Cochrane (1999)..

WHAT IS THE OPTIMAL POLICY?

If a consensus had been reached in macroeconomics at the end of the twentieth century, it was that monetary policy should have as its primary goals price stability and growth with no significant role for asset prices. Thus, Alan Greenspan's 1996 warning that the market was possessed with an "irrational exuberance" astonished many schooled in the history of the Federal Reserve. It had been long held as an article of faith that the Fed had erred critically in 1929 when it focused on the buoyant stock market. Tight policy, partly induced by its concern for the market, is generally viewed as having made a mild recession worse, initiating the Great Depression of the 1930s. Greenspan's jawboning was eerily reminiscent of the Federal Reserve Board's policy in early 1929 and opened a debate on whether monetary policy should respond to asset markets.

The question whether the central bank should respond to asset booms and busts is relatively new. The current standard framework for policy is inflation-targeting (Bernanke and Mishkin, 1997). Publicly announced medium-term inflation targets are used to set a nominal anchor for monetary policy, allowing the central bank limited flexibility to stabilize the real economy in the short-run. In a small calibrated macroeconomic model, Bernanke and Gertler (2000, 2001) found that an inflation-targeting rule stabilizes inflation and output when asset prices are volatile, driven either by a bubble or technology shock. They concluded that there was no additional gain from responding directly to asset prices because although a response to stock prices can lower the variability of the output gap, it may increase the variability of inflation. Additionally, they believe it is that it is more difficult to identify the fundamental component of stock prices than it is the output gap. In their view, any attempt to address asset volatility runs the risk of imparting instability to prices and output, especially if measurement of fundamentals is flawed.

Yet, some have argued that asset prices ought to be directly incorporated into inflation targeting. Cecchetti, Genberg, Lipsky, and Wadhvani (2000) proposed that a central bank should adjust monetary policy not only in response to forecasts of future inflation and the output gap but also to asset prices, developing procedures to identify asset price "misalignments." They believed that it is no more difficult to measure stock price misalignments than it is the output gap or the equilibrium value of the real interest rate.¹⁵ Cecchetti et. al. estimated the warranted risk premium in 2000 to be 4.3%, which would have justified a S&P500 level less than half of the observed level. Their model suggested that by 1997, the Federal Funds rate should have been 10.35% as opposed to the actual 5.51%. This rate would have kept inflation at under 3%, with a small output gap and a risk premium of just under 3%.

Bordo and Jeanne (2002) also make a case for pre-emptive monetary policy with a Taylor rule model where productivity shocks can cause large price reversals. Boom-bust episodes are identified with a simple filter where the three year growth of real stock prices exceeds a critical value. They are concerned that during a boom, rising stock prices raise the price of collateral, inducing firms to borrow; while a bust creates financial instability by quickly lowering the value of collateral, yielding a collateral-induced credit

¹⁵ Bernanke and Gertler (2001) are highly critical of Cecchetti and argue his policy rule requires that the central bank know that the boom is driven by no-fundamentals and the exact time when the bubble will burst.

crunch. In their view, a central bank should carry out monetary policy in terms of insurance, trading off the loss in output and price stability against the probability of a costly credit crunch and a fall in real output. Bordo and Jeanne found that such a policy, responding to a bull market, sometimes dominates a simpler Taylor rule in its sacrifice of current output against the risk of a credit crunch.

This literature is new and growing, though the consensus remains that the Fed should not incorporate asset prices directly into its policy considerations. While an optimal policy rule may or may not include intervention in response to asset prices, the Fed has been accused of incorrectly responding to the booms of the 1920s and 1990s.

THE ROLE OF THE FEDERAL RESERVE

How did policy makers in the twenties and nineties confront the booming markets? Did their policies hinder or aggravate the booms? These issues were part of the debates of both decades.

The bull market of the twenties had its origins in the long post-World War I economic boom. Immediately after the high wartime inflation, the economy experienced a boom and hard recession. It was a wrenching experience for financial intermediaries, with numerous bank failures. But, the economy quickly stabilized and began to grow rapidly, with two brief contractions in 1923-1924 and 1926-1927. Overall, between 1922 and 1929, GNP grew at a rate of 4.7% and unemployment averaged 3.7%. Anchored by the gold standard, prices varied but there was no trend inflation.¹⁶ The end of the war freed the Federal Reserve from its obligation to assist the Treasury's financing of the war; and the government balanced its budget, cutting expenditures and taxes. Once released from keeping interest rates artificially low, the Fed accommodated seasonal demands for credit and the close coincidence in the timing of the actions of the Fed and the turns in the business cycle, imply that it helped to smooth economic fluctuations.

Some argued that the initial stock market boom of 1928-1929 was fueled by expansionary monetary policy driven by international considerations. Having returned to gold at an over-valued prewar parity, Britain was suffering from high unemployment and a balance of trade deficit. In the spring of 1927, Germany raised interest rates intensifying the pressure on the British balance of payments. At the same time, the Bank of France attempted to halt the appreciation of the franc by selling francs for sterling, which it then attempted to covert into gold at the Bank of England. When at a secret Long Island conference in July 1927, the Reichsbank and the Bank of France offered only minor concessions to address this threat to the newly restored gold standard, the Fed took the lead and eased monetary policy. Further influenced by the slowdown in the U.S. economy, the Fed cut the discount rate and purchased securities. But the minutes of the Open Market Investment Committee make it clear that the majority worried about how the stock market would react to this policy. One Board member, Edmund Platt spouted: "Lower [the discount rate] in New York first and to hell with the stock market." (quoted in Clarke, 1967, p. 127).

While this shift in Fed policy was unexpected, it is difficult to see how it could have had a big impact on the stock market. The interest cut was small and brief, as a

¹⁶ Historical Statistics, p. 135 and 226.

contractionary policy was initiated in January 1928 with the discount rate ascending from 3 ½ to 5 percent by August 1928. In addition, there were heavy open market sales. Although the discount rate remained unchanged for another year, monetary policy has been characterized generally as tight for the remainder of stock market boom. In 1928 and 1929, high-powered money and the consumer price index fell and M1 grew only slightly in 1929. In spite of this evidence, many, including Strong felt that this tightening was begun too late, to halt the advance of the stock market (Clarke, 1967).

Although concerned about protecting international gold reserves, the Federal Reserve was obsessed with the stock market and what it regarded as the excessive expansion of credit for speculation. Following the “real bills doctrine,” the founders of the Fed had hoped that the bank’s discounting activities would channel credit away from “speculative” and towards “productive” activities. Even in the early 1920s, many members of the Board and banks were frustrated by the amount of credit that the stock market seemed to absorb and looked for some way to reduce the volume of brokers’ loans. Almost all Fed officials agreed about this issue but they were split over the appropriate policy; and policy inaction, after the August 1928 increase in the discount rate, reflected an intense struggle.

The Federal Reserve Board believed that “direct pressure” or jawboning could be used to channel credit away from speculation. The Board also wanted the Federal Reserve banks to deny access to the discount window to member banks making loans on securities. In February 1929, the chairman Roy Young spoke out against speculation and issued a letter to all Federal Reserve banks, instructing them to limit "speculative loans." Brokers' loans by member banks did not increase after this date, but the market was supplied instead by non-member banks, corporations and foreigners. In contrast, the Federal Reserve Bank of New York contended that it could not refuse to discount eligible assets and that it was impossible to control credit selectively. It argued that speculation could only be reduced by raising the discount rate. The Board was not persuaded. Between February and August 1929, it refused New York’s eleven requests to raise the discount rate (Friedman and Schwartz, 1963). According to Clarke (1967, p. 155), the New York Fed believed that if the Fed could break the boom early, the adverse effects on the U.S. would be small compared to the “disastrous consequences for both the domestic and international economies that would result from a prolongation of speculative excesses and from the inevitable and violent collapse of the speculative bubble.” Only in August 1929, did the New York Fed finally prevail. Unfortunately, the discount rate was raised from 5 to 6% just as the economy was reaching its cyclical peak.

The market, declining since early September, collapsed on Black Thursday, October 24, and Black Tuesday, October 29. Margin calls and distress sales of stock prompted a further plunge; while lenders withdrew their loans to brokers, threatening a general disintermediation. The New York Fed promptly encouraged the New York City banks to increase their loans to brokers, made open market purchases, and let its member banks know that they could freely borrow at the discount window. The direct effects of the crash were thus confined to the stock market. The Fed’s prompt action ensured that there were no panic increases in money market rates and no threat to the banks from defaults on brokers’ loans. While the New Fed’s response has been recognized in hindsight as the correct response, the Board disapproved and censured the New York Fed. In spite of the recession, the Board maintained its tight monetary policy,

aggravating the economy's slide and provoking a further decline in the market. The fall in the stock market, by reducing household wealth and the value of collateral added to the monetary shock that stunned the economy (Friedman and Schwartz, 1963).

The Fed's experience in the 1920s raises three policy questions. The first is whether the Fed's looser policy in 1927 exacerbated the boom at a time when it could have been restrained. Board member Adolph Miller and many critics after the crash blamed the New York Fed for permitting an excessive credit expansion (Meltzer, 2003). Some modern students, including Eichengreen (1992), have concluded that the Fed erred in loosening its policy, it is difficult to find a plausible reason for a tighter policy. Although contemporaries worried about speculative excess in the market, mid-1927 precedes the conventional date of the boom's beginning---early 1928. In fact, monetary growth for the year was quite modest, at a little over 1% (Meltzer, 2003), and the economy had hit its peak in October 1926. Most contemporary indicators suggested to the Fed that policy should be eased not tightened; the same holds true for a Taylor rule; and Bordo and Jeanne's (2002) measure of excessive asset growth does not identify a boom in mid-1927. Finally an augmented Taylor rule (Cecchetti, 2000) does not recommend a policy change as the equity premium for 1927 was near its historic average.

The second policy question is how the Fed should have reacted to the crash. New York's prompt intervention in 1929 to prevent the shock spreading to the rest of the financial system is regarded as a canonically correct response (Friedman and Schwartz, 1963). The third policy question is whether the Fed focused too much on the stock market boom after 1928, ignoring the fact that the economy was entering a recession. The scholarly consensus here is that policy was excessively preoccupied with speculation after the crash, inducing the Fed to continue a restrictive policy long after the economy was in a steep decline.

The lessons learned from the experience of the 1920s have strongly conditioned central bankers' responses to subsequent crashes. Like 1929, the financial system in 1987 came under enormous stress as brokers needed to extend a huge amount of credit to their customers who were hit by margin calls. Specialists and traders in stock index futures also found it difficult to obtain credit. Fearful that there would be a collapse of securities firms, with ramifications for the clearing and settlements system, the Open Market desk increased bank reserves by 25% and the Fed pushed commercial banks to supply broker-dealers and others with credit. While interest rate spreads widened at the beginning of the crisis, they quickly diminished. Finally the Fed withdrew most of the high-powered money that it had provided as the crisis subsided. In contrast, the slower collapse of the 1990s market produced no calls for intervention as intermediation and the payments system were not threatened. In general, the conclusion that the Fed was mistaken to focus on the stock market after the 1929 crash has convinced most central bankers to take a position of "benign neglect" vis-à-vis asset bubbles.

Thus, it is primarily the first question---should a central bank intervene in an asset price boom---that still appears to be open. A comparison of the 1990s with the 1920s is consequently useful, as there appear to be strong parallels in economic developments and policy debates. Like the 1920s, the 1990s saw a long period of rapid growth after a period of severe disruptions. The unanticipated inflation of the 1970s and the Fed's decision to wring out inflation in 1979 contributed to a wave of bank and saving and loan failures, cresting in the mid-1980s. By the beginning of the new decade, banks had

increased their capital accounts and strengthened their balance sheets. After a sharp recession in 1990-1991, the economy experienced its longest expansion on record from March 1999 to March 2001. Real gross domestic product grew at 3.3% and unemployment averaged 5.5%. In many respects, the nineties was the most stable post-World War II decade (Mankiw, 2003).

In 1993, the chairman of the Federal Reserve Board, Alan Greenspan announced that the Fed would pay less attention to monetary aggregates than it had in the past, as their behavior did not appear to give a very reliable policy guide. The Fed shifted to interest rate targeting, and in particular the Federal funds rate. Most observers believe that the Fed followed some approximation to a Taylor rule, focusing on inflation and growth and leaving other issues that inflamed public debate, including fiscal policy, “irrational exuberance,” and international financial crises, to negligible roles (Mankiw, 2003). One of the few exceptions to this consensus is Cecchetti (2003) who claimed that as equity prices boomed, the FOMC adjusted its interest rate targets. Examining the FOMC minutes and transcripts from 1981 to 1997, he measured the relative occurrence of references to the securities markets and found that it rose just as the equity premium was falling. Estimating an augmented Taylor rule with additional variables---the equity premium for the presence of a bubble and a measure of banking system leverage for financial distress---he found that the FOMC adjusted interest rates to changes in the equity premium.¹⁷

Whether or not the Fed factored the stock market into its policy, independent of inflation and growth objectives, it boldly voiced concerns about the behavior of the market. Well before the IT-Nasdaq boom, the bull market raised alarms at the Fed, just as it had in 1927-1928. While the price-earnings ratio was increasing, all measures of productivity growth in the early 1990s showed little reason for expecting a future surge in earnings and dividends. In 1996, Federal Reserve Board Chairman Alan Greenspan castigated the stock market as exhibiting “irrational exuberance.” Yet, this jaw-boning, seeming to mimic the actions of early 1929, was not followed by any effort to tame the market. The lesson of the 1920s’ intervention may have may have restrained the Fed, and the it certainly would have been wary about trying to deflate one group of stocks in the technology sector without affecting the whole market. The verbal berating of the market diminished later in the decade when evidence of a productivity upsurge gave the Fed less cause to fear that its low interest rate policy would lead to inflation.

In an economy of higher growth in the late 1990s, the Fed’s policy has been characterized as one of “forbearance” (Blinder, 2002). However, the Fed did not hesitate when inflationary pressures appeared. Between February 1994 and February 1995, it raised interest rates 3%, after a rapid expansion following the 1990-1991 recession, securing a recession-less “soft landing.” Afterwards, policy was largely neutral until the September 1998 collapse of Long-Term Capital Management (LTCM), a \$100 billion hedge fund, which followed the Asian crisis. Fearing its demise would panic financial markets, the Fed strong-armed the leading New York banks to assist with an orderly liquidation and cut the Fed funds rate three times. Some critics have asserted that this action left policy too loose and allowed the boom in the stock market to take off in its final phase. They have argued that it was too late when the Fed finally began to raise

¹⁷ If true, this behavior would represent a major change in policy, though the equity premium may be a proxy for aspects of inflation and output growth not captured by the variables in a standard Taylor rule.

interest rates in June 1999. Yet, the decline of less than 100 basis points in the Fed funds rate and the 10 year bond rate were not seen at the time as wildly inflaming the boom. Measured by all three indices in Figure 2, the market had retreated in August 1998 and was largely flat until December 1998-January 1999 when it resumed its ascent; and there was no signal from the dividend yield or price-earnings ratios. Like the loosening of policy in 1927, this action came at a time when the market was quiescent. Given the similar rise in the market when policy was neutral, this action may have been a minor fillip at best.

CONCLUSION

This survey of fundamentals-based equity valuations reveals the enormous difficulty of identifying fundamentals in forward looking assets. At the same time, little evidence can be mustered to support Shiller's (2000) assertion that the markets are almost exclusively driven by waves of optimism or pessimism. Estimates that apportion the degree to which bubbles determine asset prices relative to fundamentals are at best fragile. Perhaps, it is not surprising that "benign neglect" is typically the accepted policy by both those who favor fundamental and bubble explanations.

The Fed has been blamed for contributing to stock market booms. Two instances—in 1927 when the Fed helped Britain stay on the gold standard and in 1998 when the Fed responded to the collapse of LTCM—are sometimes used to argue that the Fed should have pursued a tighter policy earlier. However, it is hard to regard these relatively modest stimuli as central to an explanation of the subsequently soaring markets. Furthermore, this criticism has a 20-20 hindsight quality, as measures of a bubble that should have alerted policy only appeared later in 1928 and 1999.

Fortunately, the Fed in the 1990s was not fixated on speculative credit, as was the Fed of the 1920s and 1930s, saving it from dangerous deviations from the appropriate policy targets of price stability and full employment. The Fed has a limited but vital role in responding to stock market crashes. When the abruptness of the crash threatens the payments system and intermediation, a classic lender of last resort is appropriate as occurred in 1929 and 1987. In addition, even if the market's descent is slower and the financial system has weak balance sheets, intervention may be appropriate to prevent a broader financial crisis. But in both cases, it is a brief intervention that is required, not a shift in the Fed's intermediate or longer-term goals.

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Figure 1
Real S&P Returns 1871-2003
and Twentieth Century Crashes

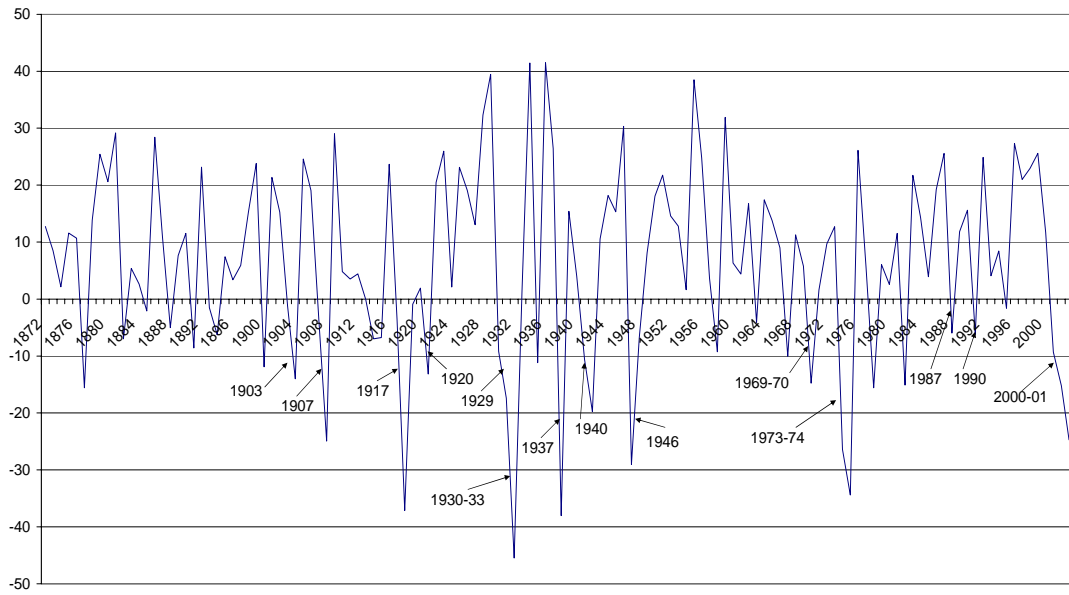


Figure 2
Boom and Bust 1920-1933

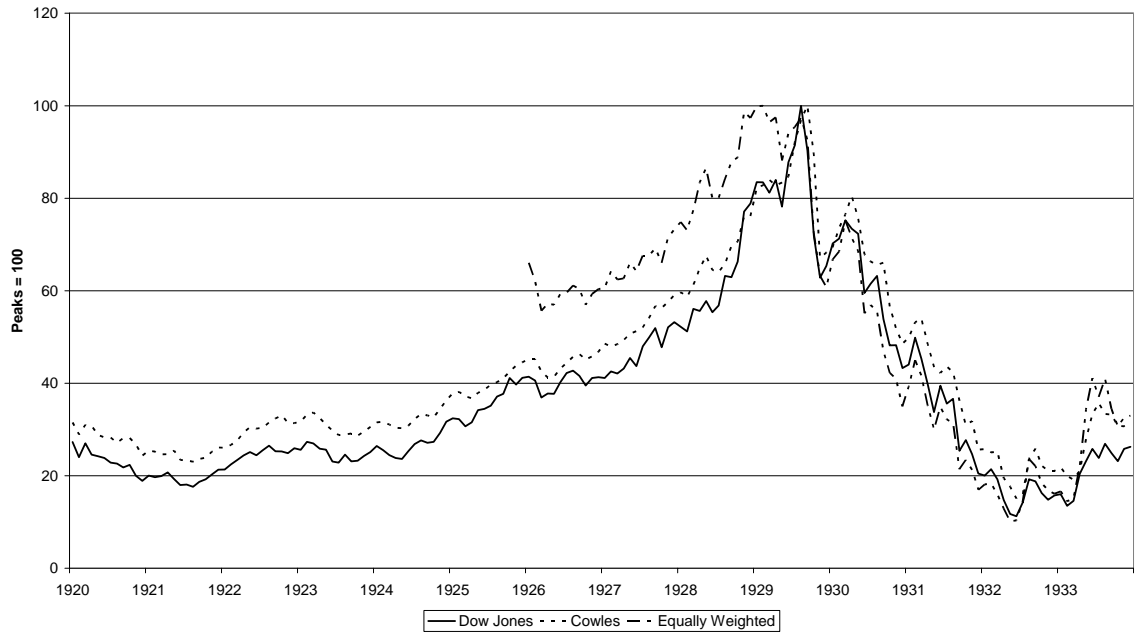


Figure 3
Boom and Bust 1990-2003



Figure 4
Stock Yield and Equity Premium
1871-2003

