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ABSTRACT

This paper discusses the conduct and performance of U.S. monetary policy during the 1990s, comparing it to policy during the previous several decades. It reaches four broad conclusions. First, the macroeconomic performance of the 1990s was exceptional, especially if judged by the volatility of growth, unemployment, and inflation. Second, much of the good performance was due to good luck arising from the supply-side of the economy: Food and energy prices were well behaved, and productivity growth experienced an unexpected acceleration. Third, monetary policymakers deserve some of the credit by making interest rates more responsive to inflation than was the case in previous periods. Fourth, although the 1990s can be viewed as an example of successful discretionary policy, Fed policymakers may have been engaged in "covert inflation targeting" at a rate of about 3 percent. The avoidance of an explicit policy rule, however, means that future policymakers inherit only a limited legacy.

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"I'm baffled. I find it hard to believe....What I'm puzzled about is whether, and if so how, they suddenly learned how to regulate the economy. Does Alan Greenspan have an insight into movements in the economy and the shocks that other people don't have?"

Milton Friedman, May 2000

No aspect of U.S. policy in the 1990s is more widely hailed as a success than monetary policy. Fed Chairman Alan Greenspan is often viewed as a miracle worker. Many Americans share the admiration that Senator John McCain expressed during his presidential bid. When the senator was asked about Greenspan's conduct of monetary policy, McCain said that if anything were to happen to the Fed chairman, as president he would take the strategy followed in the movie Weekend at Bernie's: He would prop up the chairman's body, give him some sunglasses, and keep him on the job as long as possible.

Greenspan's tenure at the Fed has had its share of historic events, impinging on (as well as being affected by) the stance of monetary policy. In October 19, 1987, two months after Greenspan took office, the stock market fell 22 percent--a one-

day plunge larger than anything seen before or since. The Fed reacted by flooding the economy with liquidity, lowering interest rates and averting a recession. But soon inflation became the more pressing concern, and the Fed started raising interest rates. The federal funds rate rose from 6.7 percent in November 1987 to 9.8 percent in May 1989. This Fed tightening, together with other factors, pushed the economy into a recession the following year. More than any other single event, the recession set the stage for the economic policies of the 1990s: It helped Bill Clinton, a little-known governor from Arkansas, defeat George Bush, an incumbent president who, only a short time earlier, had enjoyed overwhelming popularity following the Gulf War.

The Clinton years brought their own challenges to monetary policymakers. International financial crises in Mexico in 1994-95 and in Asia in 1997-98, as well as the infamous failure of the hedge fund Long-Term Capital Management in 1998, put the world financial system in jeopardy and the Fed at center stage.

At the same time, the push for fiscal discipline, which turned the U.S. government budget from deficit to surplus, made the Fed's job easier. So did the acceleration of productivity growth, which most analysts attribute to the advances in information technology associated with the so-called "new

economy." Another (perhaps related) development was a gradual decline in the U.S. unemployment rate, without the inflationary pressures that normally accompany such a change. Explaining this happy but surprising shift, and deciding how to respond to it, remains a topic of debate among students and practitioners of monetary policy.

The purpose of this paper is to look back at these events. My goal is not to tell the story of U.S. monetary policy during the 1990s: Bob Woodward's widely read book, Maestro, already does that. Instead, I offer an analytic review of monetary policy during this period, which should complement more narrative treatments of the topic.

I proceed as follows. Section 1 compares the macroeconomic performance of the 1990s to other recent decades. Section 2 considers whether some of the good performance of the 1990s can be attributed to good luck rather than good policy. Section 3 examines how policy was different from earlier decades. Section 4 considers the legacy that the monetary policy of the 1990s leaves for the future. Section 5 summarizes the conclusions from this experience.

1. The Macroeconomic Performance of the 1990s

I begin by comparing the performance of the economy during

1990s with other recent decades. To do this, I concentrate on three standard time series: inflation, unemployment, and real growth. Economists, policymakers, and pundits watch these measures of the economy's performance more than any others. This is for good reason: If a nation enjoys low and stable inflation, low and stable unemployment, and high and stable growth, the fundamentals are in place to permit prosperity for most of its citizens.

1.1 The Level and Stability of Inflation

Inflation is the first piece of data to look at, in part because a central banker's first job is to keep inflation in check. There is no doubt that central bankers also influence unemployment and real growth and that they do (and should) keep an eye on these variables as well. But according to standard theories of monetary policy, central-bank actions have only a transitory effect on unemployment and real growth. By contrast, the effects of monetary policy on inflation continue in the long run--and indeed are strongest in the long run. So, if monetary policymakers take a long view of their actions, inflation is their first order of concern.

Table 1 shows the performance of inflation during the 1990s and the preceding four decades. The first row shows average

inflation for each of the decades. The second row shows the standard deviation, which is a common measure of volatility.

As judged by the average inflation rate, the 1990s were not exceptional. Inflation was lower in the 1950s and 1960s than it was in the 1990s. For those with shorter memories, however, the 1990s can be viewed as a low-inflation decade. There was substantially less inflation in the 1990s than there was in the 1980s and especially the 1970s.

This decline in inflation is largely the result of the tough disinflationary policies that Paul Volcker put into place in the early 1980s: Inflation fell from a peak of 14.8 percent in March 1980 to 3.6 percent three years later. As is almost always the case, this large and persistent decline in inflation was associated with temporarily declining production and rising unemployment. By most measures, the recession of the early 1980s was the most severe economic downturn since the Great Depression of the 1930s.

The 1990s look more exceptional once we look at the standard deviation of inflation. The second row of Table 1 shows that inflation was far more stable during the 1990s than during any other recent decade. The differences are substantial in magnitude. Inflation was only one-third as volatile during the 1990s as it was during the 1980s. It was 24 percent less

volatile during the 1990s than it was during the 1960s, the second-best decade as ranked by inflation volatility. There is no doubt that by historical standards the 1990s were a decade of remarkably stable inflation.

Another way to look at the data is to examine how bad inflation was at its worst. The third line of Table 1 shows the highest annual inflation rate recorded over the 120 months of each decade. By this measure, inflation was lowest in the 1960s and 1990s. But there is an important difference between these two periods. In the 1960s, the highest inflation rate occurred at the end of the decade, representing the beginning of a problem that would persist into the 1970s. By contrast, in the 1990s, inflation peaked at the beginning of the decade and thereafter became tame. After January 1992, inflation remained in a remarkably narrow range from 1.34 percent to 3.32 percent.

Table 1:

The Inflation Experience, Decade by Decade

	1950s	1960s	1970s	1980s	1990s
Average Inflation	2.07	2.33	7.09	5.66	3.00
Standard Deviation of Inflation	2.44	1.48	2.72	3.53	1.12
Maximum Inflation	9.36	6.20	13.29	14.76	6.29
Date of Maximum Inflation	Feb 50	Dec 69	Dec 79	Mar 80	Oct 90

Note: In this and subsequent tables, the decade of the 1950s refers to the period from the first month (or quarter) of 1950 to last month (or quarter) of 1959, and so on. Inflation is the rate of change in the consumer price index over the previous 12 months.

Source: Department of Labor and author's calculations.

1.2 Judging the Inflation Experience

These comparisons of inflation over the past five decades bring up a classic question of economic theory: What costs does inflation impose on a society? Or, to focus the issue for the purposes at hand, is it more important for the central bank to produce low inflation or stable inflation? If low average inflation is the goal, then the monetary policymakers of the 1990s can be given only an average grade. But if stable inflation is the goal, then they go to the top of the class.

Textbook discussions of the costs of inflation emphasize both the level and stability of inflation. A high level of inflation is costly for several reasons: (1) Because inflation raises the costs of holding money, it diverts people's time and attention toward conserving their money holdings and away from more productive uses. (2) Inflation induces firms to incur more "menu costs"--the costs associated with changing prices and distributing the new prices to salesmen and customers. (3) Because price adjustment is staggered, inflation induces spurious volatility in the prices of some firms relative to others, which impedes the price system's ability to allocate resources efficiently. (4) Because the tax laws are not indexed, inflation raises the effective tax on capital income and thereby discourages capital accumulation and economic growth. (5)

Inflation makes economic calculation more difficult, because the currency is less reliable as a yardstick for measuring value.

All five of these costs indicate that low average inflation is desirable, but they suggest that the stability of inflation matters as well. Standard theory implies that these costs of inflation are "convex," meaning that the cost of incremental inflation rises with inflation itself. In other words, an increase in inflation from 4 to 6 percent is worse than an increase from 2 to 4 percent. If this is so, then these five benefits to low inflation also argue for stable inflation. The cost of steady 4-percent inflation is less than the average cost of inflation that fluctuates back and forth between 2 and 6.

In addition to these five costs, there is another cost associated directly with inflation volatility: (6) Because an unexpected change in the price level redistributes real wealth between debtors and creditors, highly volatile inflation creates unnecessary risk for all parties. As people avoid try to avoid these risks, long-term contracts using money as the unit of account become less tenable.

Although these six costs of inflation are widely accepted among economists, there is debate about whether the costs are large or small in total, and which are larger than others. Moreover, there is little direct evidence of convexity in the

costs of inflation. As a result, it is hard to compare quantitatively the benefits of low inflation with the benefits of stable inflation. The more weight is given to inflation stability as a policy objective, the more exceptional the monetary policy of the 1990s appears.

1.3 Two Arguments in Favor of Inflation

Some economists argue that there are some benefits to inflation, at least if the inflation is only moderate. These arguments are worth noting, in part because they are associated with some prominent policymakers of the 1990s.

In particular, long before he was U.S. Secretary Treasury, Lawrence Summers (1991) wrote, "the optimal inflation rate is surely positive, perhaps as high as 2 or 3 percent." Although Summers has never had direct control over monetary policy, Fed policymakers are well aware of the views of prominent Treasury officials. Moreover, nations that have adopted a policy of inflation targeting (which were numerous during the 1990s) have typically chosen a positive number, rather than zero, for their target. In this environment, claims that the Fed is aiming for "price stability" should perhaps not be taken too literally. The 3-percent inflation experienced during the 1990s may be close to the target policymakers had in mind.

1.3.1 The Possibility of Negative Real Interest Rates

One argument for a target rate of inflation greater than zero is that it permits real interest rates (that is, interest rates corrected for inflation) to become negative. Because individuals can always hold cash rather than bonds, it is impossible for nominal interest rates to fall below zero. Under zero inflation, real interest rates also can never become negative. But if inflation is, say, 3 percent, then the central bank can lower the nominal rate toward zero and send the real interest toward negative 3 percent. The ability to produce negative real interest rates gives the central bank more latitude to stimulate the economy in a recession.

Some economists point to Japan in the 1990s as an example of why some inflation is desirable. With inflation at about zero and nominal interest rates at zero, the Bank of Japan appears to have had little room to stimulate the economy. Japan is said to have been stuck in a "liquidity trap" when monetary policy loses its effectiveness. If Japan had inherited a tradition of more inflation, the argument goes, then when the Bank lowered nominal rates to zero, real rates would have become negative. A negative real rate would have stimulated spending and helped pull the economy out of its lingering recession.

This line of reasoning is controversial. Some economists dispute the claim that Japan was stuck in a liquidity trap. They argue that more aggressive Japanese monetary expansion would have lowered real rates by raising inflation expectations or that it would have stimulated exports by causing the yen to depreciate in foreign exchange markets.

Nonetheless, this argument for positive inflation may well have influenced U.S. monetary policy during the 1990s. Lawrence Summers endorsed this argument at the beginning the decade. Moreover, the Japanese experience in the aftermath of its stock market and real estate bubble was a warning flag of what might happen in the United States if the booming stock market were ever to suffer a similar collapse. The 3-percent inflation rate gave Fed policymakers the option to stimulate spending with negative real interest rates, if the need should ever have arisen.

1.3.2 Greasing The Wheels of Labor Markets

A second argument for moderate inflation starts with the observation that cuts in nominal wages are rare. For some reason, firms are reluctant to cut their workers' nominal wages, and workers are reluctant to accept such cuts. A 2-percent wage cut in a zero-inflation world is, in real terms, the same as a

3-percent raise with 5-percent inflation, but workers do not always see it that way. The 2-percent wage cut may seem like an insult, whereas the 3-percent raise is, after all, still a raise. Empirical studies confirm that nominal wages rarely fall.

This fact suggests that inflation may make labor markets work better. Here's the argument. The supply and demand for different kinds of labor is always changing. Sometimes an increase in supply or decrease in demand leads to a fall in the equilibrium real wage for a group of workers. If nominal wages can't be cut, then the only way to cut real wages is to allow inflation to do the job. Without inflation, the real wage will be stuck above the equilibrium level, resulting in higher unemployment.

For this reason, some economists argue that inflation "greases the wheels" of labor markets. Only a little inflation is needed: An inflation rate of 2 percent lets real wages fall by 2 percent per year, or 20 percent per decade, without cuts in nominal wages. Such automatic reductions in real wages are impossible with zero inflation.

There is reason to suspect that this argument for positive inflation also influenced U.S. monetary policy in the 1990s. Once again, Lawrence Summers endorsed this view at the beginning

of the decade when he proposed a target rate of inflation of 2 to 3 percent. Subsequently, the case was advanced by a Brookings research team that included George Akerlof, husband to Janet Yellen, a Clinton appointee to the Federal Reserve.¹ These facts suggest that some U.S. monetary policymakers during the 1990s may have been skeptical about the desirability of pushing inflation all the way down to zero. The 3-percent inflation realized during this period may have been exactly what they were aiming for.

1.4 Real Economic Performance: Unemployment and Growth

The other key aspect of macroeconomic performance beyond inflation is the real economy, which is most often monitored by unemployment and growth in real GDP. Keep in mind that monetary policy is not the most important determinant of these economic variables. Indeed, according to standard theory, the Fed has no ability at all to influence unemployment and real growth in the long run.

What determines the long-run rates of unemployment and real growth? Unemployment is determined by labor-market features, institutions, and policies, such as the demographic structure of the work force, the bargaining power of unions, minimum-wage laws, unemployment-insurance policies, and the mechanisms

available for matching workers and jobs. These factors also influence real economic growth (for lower unemployment means higher production), but the primary determinant of real economic growth in the long run is the rate of technological progress. Notice that when discussing the long-run forces setting unemployment and real growth, monetary policy is far in the background.

Yet monetary policy influences unemployment and growth in the short run. What the "short run" means is a subject of some dispute, but most economists agree that the central-bank actions influence these variables over a period of at least two or three years. This means that the central bank can potentially help stabilize the economy. (And if policy is badly run, it can destabilize it--the Great Depression of the 1930s being a prominent example). In the jargon of economics, monetary policy is neutral in the long run, but not in the short run. The practical implications of this textbook theory are the following: The average levels of unemployment and growth over long periods are beyond the central bank's powers, but the volatility of these series from year to year is something it can influence.

Table 2 presents summary statistics on unemployment and real growth for each of the last five decades of the twentieth

century. It presents both the average level over the decade and the standard deviation as a measure of volatility.

As the table shows, the average level of unemployment during the 1990s was lower than it was during the previous two decades (although still higher than 1950s and 1960s). There is no consensus among economists on the reasons for this decline in the normal level of unemployment. It could, for instance, be related to the aging of the work force, as the baby boom reaches middle age. Older workers tend to have more stable jobs than younger workers, so it is natural to expect declining unemployment as the work force ages. Alternatively, as I discuss later, the decline in normal unemployment during the 1990s could be related to the acceleration in productivity growth due to advances in information technology. But whatever the cause for the long-run decline in unemployment, few economists would credit monetary policy.

Data on real economic growth shows that average growth during the 1990s was similar to that experienced during the 1980s and substantially lower than that experienced during the 1950s and 1960s. This fact might seem surprising in light of the great hoopla surrounding the so-called "new economy." The explanation is that the acceleration of economic growth occurred in the middle of the decade. Once the rapid growth in the

second half of the decade is averaged with the recession and slow growth in the first half, overall growth during the 1990s is no longer impressive.

What's important for evaluating monetary policy, however, are not the averages in Table 2 but the standard deviations. Here the numbers tell a striking story: Unemployment and economic growth were more stable during the 1990s than during any recent decade. The change in the volatility of GDP growth is large. The economy's production was 27 percent less volatile during the 1990s than it was during the 1960s, the second most stable decade.

These statistics suggest amazing success by monetary policymakers during the 1990s. As we saw earlier, the economy enjoyed low volatility in inflation. One might wonder whether this success came at a cost. That is, did the Fed achieve stable inflation by giving less weight to the goals of stable employment and growth? The answer appears to be no: The economy became more stable in every dimension.

Of course, improvement in economic stabilization does not necessarily mean that policymakers are doing a better job. Perhaps they were just lucky.

Table 2:

Unemployment and Real Economic Growth, Decade by Decade

	1950s	1960s	1970s	1980s	1990s
<u>Unemployment</u>					
Average	4.51	4.78	6.22	7.27	5.76
Standard Deviation	1.29	1.07	1.16	1.48	1.05
<u>Real GDP growth</u>					
Average	4.18	4.43	3.28	3.02	3.03
Standard Deviation	3.89	2.13	2.80	2.68	1.56

Note: Unemployment is the monthly seasonally-adjusted percentage of the labor force without a job. Real GDP growth is the growth rate of inflation-adjusted gross domestic product from four quarters earlier.

Source: Department of Labor, Department of Commerce, and author's calculations.

2. The Role of Luck

The Fed's job is to respond to shocks to the economy in order to stabilize output, employment, and inflation. Standard analyses of economic fluctuations divide shocks into two types.

Demand shocks are those that alter the overall demand for goods and services. Supply shocks are those that alter the prices at which firms are willing and able to supply goods and services.

Demand shocks are the easier type for the Fed to handle because, like monetary policy, they push output, employment, and inflation in the same direction. A stock market crash, for instance, reduces aggregate demand, putting downward pressure on output, employment, and inflation. The standard response is for the Fed to lower interest rates by increasing the money supply.

If well timed, such an action can restore aggregate demand and offset the effects of the shock on both inflation and the real economy.

Supply shocks pose a more difficult problem. An increase in the world price of oil, for instance, raises firms' costs and the prices they charge. This tends to raise inflation and, for given aggregate demand, push the economy toward recession. The Fed then has a choice between contracting policy to fight inflation and expanding policy to fight recession. In the face of supply shocks, the Fed cannot stabilize inflation and the

real economy simultaneously. Supply shocks force upon the Fed a tradeoff between inflation stability and employment stability.

Yet during the 1990s the U.S. economy enjoyed stability of both kinds. One possible reason is dumb luck. Perhaps the economy just did not experience the supply shocks that caused so much turmoil in earlier decades.

2.1 Food and Energy Price Shocks

The most significant supply shocks in recent U.S. history are the food and energy shocks of the 1970s. These shocks are often blamed as one proximate cause of the rise in inflation that occurred during this decade not only in the United States but also around the world. So a natural place to start looking for supply shocks is in the prices of food and energy.²

Table 3 shows some summary statistics on these shocks. They are measured here as CPI inflation minus core inflation, where core inflation is based on the consumer price index excluding food and energy. This measure is positive when food and energy prices are rising relative to other prices in the economy.

The first two rows of the table show the average shock and the standard deviation of the shocks in each decade. The 1990s were lucky time. The low standard deviation shows that large supply shocks were not common. Moreover, the negative value for

the average shock indicates that good shocks were more common than bad shocks.

The third row of the table shows the worst shock that the Fed had to deal with during each decade. Not surprisingly, the worst shock in the entire period was in the 1970s: Because of adverse shocks to food and energy, CPI inflation rose 4.64 percentage points more than core inflation during the twelve months ending February 1974. By contrast, the worst shock of the 1990s was less than one-fourth as large. This shock occurred in 1990 as a result of the Gulf War. For the rest of the decade, there was no adverse food and energy shock as large as a full percentage point.

Given these data, it is hard to escape the conclusion that the macroeconomic success of the 1990s was in part due to luck.

Food and energy prices were unusually well behaved, and the economy reaped the benefit of this stability.

Table 3

Food and Energy Price Shocks, Decade by Decade

	1960s	1970s	1980s	1990s
Average Shock	-0.12	0.61	-0.51	-0.22
Standard Deviation of Shocks	0.45	1.41	0.97	0.50
Worst Shock	1.34	4.65	2.26	1.02
Date of Worst Shock	Feb 66	Feb 74	Mar 80	Oct 90

Note: The shock here is measured as the CPI inflation rate over 12 months minus the core CPI inflation rate over the same period. The core CPI is the index excluding food and energy.

Source: Department of Labor and author's calculations.

2.2 Productivity

Another potential source of supply shocks is the rate of technological advance. This is a natural hypothesis to explain the good macroeconomic performance of the 1990s. During these years there was much discussion of the so-called "new economy" and the increasing role of information technology.

Table 4 shows data on the productivity growth in the nonfarm business sector. The pickup in productivity growth is evident in these data. It is even clearer if the 1990s are split in half: Productivity growth was higher in the second half of the decade than in the first. While the productivity speed-up is a fortuitous development, its importance should not be overstated.

Compared to the data from the 1950s and 1960s, the average rate of productivity growth during the 1990s is not unusual.

What is more anomalous is the low volatility of productivity growth, as shown in the second row of the table. To the extent that productivity reflects technological progress, the 1990s were a decade of smooth advances in technology. It is possible that this might explain the low volatility in other macroeconomic variables. Yet it is also possible that the tame business cycle led to low volatility in productivity, rather than the other way around.

The productivity data suggest an intriguing observation: The

1990s were in many ways the opposite of the 1970s. The 1970s saw a large increase in the price of a major intermediate good--oil. At the same time, productivity growth decelerated, while unemployment and inflation rose. The 1990s saw a large decrease in the price of a major intermediate good--computer chips. At the same time, productivity growth accelerated, while unemployment and inflation fell.

Economists do not fully understand the links among productivity, unemployment, and inflation, but one hypothesis may help explain the 1990s. If workers' wage demands lag behind news about productivity, accelerating productivity may tend to lower the natural rate of unemployment until workers' aspirations catch up. If the central bank is unaware of the falling natural rate of unemployment, it may leave more slack in the economy than it realizes, putting downward pressure on inflation. Thus, even if the average rate of productivity growth was not exceptional during the 1990s, the surprising acceleration from the poor productivity growth of the 1970s and 1980s may have acted like a lucky shock to aggregate supply.³

Table 4:

Productivity Growth, Decade by Decade

	1950s	1960s	1970s	1980s	1990s
Average Productivity Growth	2.80	2.84	2.05	1.48	2.07
Standard Deviation of Productivity Growth	4.29	4.20	4.30	2.91	2.62

Note: Productivity growth is the quarterly change in output per hour in the nonfarm business sector, expressed at an annual rate.

Source: Department of Commerce and author's calculations.

2.3 The Stock Market

It would be an oversight in any discussion of luck in the 1990s to neglect the stock market. For investors in the stock market, this decade was extraordinarily lucky.

Table 5 shows the average return and the standard deviation of returns for each of the past five decades. It also shows the ratio of the average return to the standard deviation, which is commonly used as a measure of how much reward an investor gets for taking on risk. The table shows that the 1990s were exceptional. Returns were high, and volatility was low. There was never a better time to be in the market.

To a large extent, the performance of the stock market is just a reflection of the macroeconomic events we have already seen in other statistics. Low volatility in the stock market reflects low volatility in the overall economy. The high return reflects the surprising acceleration in productivity growth, which helped fuel growth in corporate profits. If the stock market is merely a mirror being held up to the economy, then it has little independent role in the conduct or analysis of monetary policy.

There are, however, two reasons why the stock market may have a role to play. The first is that the stock market may be an indicator of things to come. According to the "efficient

markets" theory, stock-market investors are rationally looking ahead to future economic conditions and constantly processing all relevant information. Thus, news about the economy might show up first in the stock market. The 1990s are a case in point. The bull market preceded the acceleration in productivity growth by several years, suggesting the possibility that Wall Street knew about the "new economy" long before it showed up in standard macroeconomic statistics.

A second reason why the stock market may be relevant to monetary policy is that it can be a driving force of the business cycle. John Maynard Keynes suggested that movements in the market are driven by the "animal spirits" of investors. Alan Greenspan reprised this idea during the 1990s when he questioned whether investors were suffering from "irrational exuberance." Such exuberance could push stock prices higher than their fundamental value and make households feel richer than they truly are.

Under either theory, monetary policymakers might react to a rise in the stock market by setting interest rates higher than they otherwise would. This is the other side of the coin to the Fed's policy in October 1987, when it responded to a stock market crash by increasing liquidity and cutting interest rates.

Regardless of whether the movements in the stock market are

rational, they alter the aggregate demand for goods and services, which make them of interest to monetary policymakers.

Indeed, the decline in the personal saving rate during the 1990s was mostly due to the booming stock market, for the "wealth effect" was a potent stimulus to consumer spending.

Of course, saying that monetary policy might react to the stock market is different from saying that it did. As I discuss below, there is scant evidence that the booming stock market of the 1990s played a large, independent role in monetary policy during this period.

Table 5:

Stock Market Returns, Decade by Decade

	1950s	1960s	1970s	1980s	1990s
Average Return	21.46	9.55	6.05	18.58	18.83
Standard Deviation of Return	15.88	12.30	16.36	17.09	12.04
Ratio of Average Return to Standard Deviation	1.35	0.78	0.37	1.09	1.56

Note: Calculations are based on monthly data on total returns on the S&P 500 index over the previous 12 months.

Source: Standard and Poors and author's calculations.

3. The Role of Policy

Let's now turn to looking directly at policy to see how, if at all, it was different in the 1990s than in earlier decades. I look at two standard gauges of monetary policy--the money supply and interest rates.

Before doing so, let's clear up a potential confusion. Although a central bank can control both the money supply and the level of interest rates, it would be wrong to view these two variables as distinct policy instruments. The reason is that the central bank influences interest rates by adjusting the money supply. In essence, interest rates are the price of money. The central bank affects the price of money by controlling the quantity of money.

As a first approximation, the central bank's only policy lever is the supply of high-powered money (currency plus bank reserves), which it controls through open-market operations and, to a lesser extent, lending at its discount window. It can use this single lever to target a broad monetary aggregate, such as M1 or M2, an interest rate, an exchange rate, or the price of bananas. But once it chooses one intermediate target, the game is over: The central bank has used up its power over economic conditions.

3.1. The Demise of Monetary Aggregates

There once was a time when critics of Fed policy thought the key to good monetary policy was stable growth in the money supply. If the Fed would only keep M1 or M2 growing at a low, stable rate, the argument went, the economy would avoid high inflations, painful deflations, and the major booms and busts of the business cycle. Milton Friedman was the most prominent proponent of this so-called "monetarist" view.

It is easy to see how such a viewpoint arose. The two most painful macroeconomic events of the twentieth century were the Great Depression of the 1930s and the Great Inflation of the 1970s. Both calamities would likely have been avoided if the Fed had been following the Friedman prescription of low, stable money growth.

In the early 1930s, high-powered money continued to grow at a moderate rate, but the collapse of the banking system caused broader measures of the money supply to plunge. Worries about bank solvency caused households to hold more money in the form of currency rather than demand deposits and banks to hold more deposits in the form of reserves rather than bank loans. Both actions reduced the amount of bank lending; the creation of inside money by the banking system went in reverse. As measured by currency plus demand deposits, the quantity of money fell by

25 percent from 1929 to 1933. If the Fed has been committed to stable growth in the broader monetary aggregates, it would have pursued a more expansionary policy than it did, and the Great Depression would have been less severe.

Generals are said to often make the mistake of fighting the last war, and the same may be true of central bankers. Perhaps because of the memory of its insufficient expansion during the 1930s, the Fed was too expansionary during the 1970s. The proximate cause of the Great Inflation was not monetary policy: The fiscal expansion due to the Vietnam War in the late 1960s and the OPEC oil shocks of 1973-74 and 1979-81 deserve much of the blame. But monetary policy accommodated these shocks to a degree that ensured persistent high inflation. The money supply grew rapidly throughout the 1970s, and inflation reached some of its highest levels on record. How best to handle supply shocks is a topic about which economists disagree. But there is no doubt that if Fed had kept money growth to a slower rate during the 1970s, it would have better contained the inflationary pressures.

With these two formative episodes as the historical background, one might have expected subsequent improvements in monetary policy to be associated with increased concern at the Fed to maintain low, stable money growth. Indeed, increased

reliance on target ranges for the monetary aggregates was allegedly part of Paul Volcker's 1979 change in the direction of monetary policy, which helped set the stage for the 1990s.⁴ If the improved macroeconomic performance of the 1990s went hand in hand with greater stability in the money supply, monetarists could have claimed intellectual victory.

Alas, it was not to be. Table 6 shows the average growth rate and the standard deviation of the growth rate for M1 and M2, the two most commonly used measures of the money supply. (I omit the 1950s here because the Fed's consistent data on monetary aggregates start in 1959.) One clear fact is that the 1990s saw slower money growth than the 1970s and 1980s. The basic lesson of the quantity theory of money--that slower money growth and lower inflation go hand in hand--receives ample support from this decade.

Yet the data give no support for the monetarist view that stability in the monetary aggregates is a prerequisite for economic stability. The standard deviation of M2 growth was not unusually low during the 1990s, and the standard deviation of M1 growth was the highest of the past four decades. In other words, while the nation was enjoying macroeconomic tranquility, the money supply was exhibiting high volatility.

From the standpoint of economic theory, this is not a

puzzle. The money supply is one determinant of the overall demand for goods and services in the economy, but there are many others, such as consumer confidence, investor psychology, and the health of the banking system. The view that monetary stability is the only ingredient needed for economic stability is based on a narrow view of what causes the ups and downs of the business cycle. In the end, it's a view that is hard to reconcile with the data.

This lesson was not lost on monetary policymakers during the 1990s. In February 1993, Fed chairman Alan Greenspan announced that the Fed would pay less attention to the monetary aggregates than it had in the past. The aggregates, he said, "do not appear to be giving reliable indications of economic developments and price pressures."⁵ It's easy to see why he might have reached this conclusion when he did. Over the previous 12 months, M1 had grown at an extremely high 12-percent rate, while M2 had grown at an extremely low 0.5-percent rate. Depending on how much weight was given to each of these two measures, monetary policy was either very loose, very tight, or somewhere in between.

Henceforth, the Fed would conduct policy by setting a target for the federal funds rate, the short-term interest rate at which banks make loans to one another. It would adjust the

target interest rate in response to changing economic conditions, but it would permit the money supply to do whatever necessary to keep the interest rate on target. If the subsequent performance of the economy is any guide, this policy of ignoring data on the monetary aggregates has proven a remarkably effective operating procedure.

Table 6:

Growth in the Money Supply, Decade by Decade

	1960s	1970s	1980s	1990s
<u>M1</u>				
Average	3.69	6.35	7.78	3.63
Standard Deviation	2.15	1.61	4.10	5.42
<u>M2</u>				
Average	7.05	9.49	7.97	4.04
Standard Deviation	1.63	3.22	2.29	2.39

Note: Calculations are with monthly data. The growth rate is calculated from 12 months earlier.

Source: Federal Reserve and author's calculations.

3.2. Interest Rate Policy: The End of the Inflation Spiral

Choosing the short-term interest rate as an intermediate target for Fed policy is only the first step to conducting monetary policy. The next, more difficult step is to decide what the target rate should be and how the target should respond to changing economic conditions.

There is a long tradition of concern among economists that a central bank's reliance on interest-rate targets could prove inflationary. The argument runs as follows. Imagine that some event--an accidental overheating of the economy, an adverse supply shock, or a sudden scare about impending inflation--starts to drive up expectations of inflation. If the central bank is targeting the nominal interest rate, the rise in expected inflation means an automatic fall in the real interest rate. The fall in the real interest rate stimulates the aggregate demand for goods and services, which in turn puts upward pressure on prices. The rise in prices confirms and reinforces the inflationary expectations that began the process. Thus, expected inflation begets actual inflation, which in turn begets even higher expected inflation. The central bank, committed to its interest-rate target, ends up increasing the money supply at an ever more rapid rate. Inflation spirals out of control.

Fortunately, there is a simple way to avoid this problem: A central bank should raise its interest-rate target in response to any inflationary pressure by enough to choke off that pressure. How much is enough? Economic theory suggests a natural benchmark: If the central bank responds to a one-percentage-point increase in inflation by raising the nominal interest rate by more than one percentage point, then the real interest rate will rise, cooling off the economy. In other words, it is not sufficient that the central bank raise nominal interest rates in response to higher inflation; it is crucial that the response be greater than one-for-one.

These theoretical insights go a long way to explaining the success of monetary policy in the 1990s, as well as its failures in previous decades. The first line of Table 7 shows how much the federal funds rate typically responds to changes in core inflation. These numbers are based on a simple statistical analysis of the data on interest rates, unemployment, and inflation (described in the note to the table).

The key result in this table is that the responsiveness of interest rates to inflation has been rising over time. In earlier decades, the response was less than one-for-one. In the 1960s, for instance, when inflation rose by 1 percentage point, the federal funds rate rose by only 0.69 of a percentage point.

The theory of spiraling inflation may be the right explanation for the Great Inflation of the 1970s. In other words, this episode was the result of the inadequate response of interest-rate policy to the inflationary pressures arising first from the Vietnam War and later from the OPEC oil shocks.

The situation was just the opposite during the 1990s. Each rise in the inflation rate was met by an even larger rise in the nominal interest rate. When inflation rose by 1 percentage point, the federal funds rate typically rose by 1.39 percentage points. This substantial response prevented any incipient inflation from getting out of control.

Although the 1990s saw high responsiveness of interest rates to inflation, it was not a decade of volatile interest rates. The second line in Table 7 shows that the federal funds rate, in fact, exhibited low volatility by historical standards. High responsiveness and low volatility may seem a paradoxical combination, but they are easy to reconcile: The more the Fed responds to inflationary pressures when they arise, the less of a problem inflation becomes, and the less it has to respond to later.

Overall, the U.S. experience with monetary policy during the 1990s teaches a simple lesson. To maintain stable inflation and stable interest rates in the long run, a central bank should

raise interest rates substantially in the short run in response to any inflationary threat.⁶

Table 7:

The Federal Funds Rate, Decade by Decade

	1960s	1970s	1980s	1990s
The typical response of the federal funds rate to a 1-percentage point increase in core inflation	0.69	0.85	0.88	1.39
Standard deviation of the federal funds rate	1.78	2.54	3.38	1.39

Note: These numbers are computed using 120 months of data for each decade. The first line is derived from an ordinary least squares regression of the federal funds rate on a constant, the unemployment rate, and the core inflation rate over the previous 12 months; the table reports the coefficient on core inflation.

Source: Federal Reserve, Department of Labor, and author's calculations.

3.3. A Simple Way to Set Interest Rates Like A Pro

Consider the following simple formula for setting the federal funds rate:

$$\text{Federal funds rate} = 8.5 + 1.4 \times (\text{Core inflation} - \text{Unemployment})$$

Here "core inflation" is the CPI inflation rate over the previous 12 months excluding food and energy, and "unemployment" is the seasonally-adjusted unemployment rate. For example, if core inflation is at 3 percent and unemployment is at 5 percent, the federal funds rate should be set at 5.7 percent. The parameters in this formula were chosen to offer the best fit for data from the 1990s.

3.3.1. The Case for the Interest Rate Formula

The logic behind such an interest-rate formula is straightforward. The Fed raises interest rates in response to higher inflation to cool the economy. As we just discussed, the response is more than one-for-one to avoid spiraling inflation.

In addition, the Fed responds to high unemployment by cutting interest rates to stimulate aggregate demand.

There are two reasons why the Fed might want to respond to unemployment. First, employment stability may be a goal in

itself. At times, legislation has been proposed that would give the Fed single-minded concern about price stability. But the Fed's actual Congressional mandate has always been much broader.

Second, unemployment is a leading indicator of future inflation. Low unemployment tends to put upward pressure on wages, which in turn raises production costs and the prices of goods and services. Although some observers have suggested that the combination of low unemployment and low inflation in the late 1990s casts doubt on the "Phillips curve" tradeoff between these variables, careful statistical analyses suggest that unemployment and related variables are among the most useful data for forecasting inflation.⁷ Other things equal, a Fed that wants to keep inflation in check will respond to low unemployment by raising interest rates.

3.3.2 What the Formula Says About Monetary Policy During the 1990s

Figure 1 shows the federal funds rate predicted by this simple interest-rate formula and the actual federal funds beginning from 1958. Comparing these two series leads to several conclusions about the conduct of monetary policy.

The first, important observation is that during the 1990s, the two series in Figure 1 move closely together. According to

a standard measure of goodness of fit (the R^2 statistic), the formula explains 85 percent of movements in the federal funds rate during this time. This tight fit has profound implications for understanding monetary policy. It means that the interest-rate policy during the 1990s can be viewed as largely a response to the contemporaneous levels of inflation and unemployment.⁸

A corollary to this conclusion is that the many other issues that dominated public debate over monetary policy during the 1990s must be of secondary importance. The media spent much time discussing the Fed chairman's broad interests, including the stance of fiscal policy, the "irrational exuberance" of the stock market, the productivity gains of the "new economy," the financial crises in Mexico and Asia, and sundry obscure economic data. Apparently, these did not exert a great influence over interest rates. If they had, the formula would not be able to track actual interest rates so well.

A second, important observation is that the two series in Figure 1 move at about the same time. There was much discussion during the 1990s of the need for the Fed to be preemptive, to respond to economic pressures before they showed up in inflation and unemployment. Being preemptive makes sense, if forecasting is good enough to make the task feasible, because monetary policy influences the economy with a lag typically estimated to

be 6 to 12 months. But the strong contemporaneous correlation in Figure 1, and the absence of any tendency for the actual interest rate to move before the formula indicates, suggests that policy was not in fact preemptive at all.

3.3.3 What the 1990s Teach Us About Earlier Monetary Policy

Figure 1 can also be used to make some judgments about monetary policy of the past. We can view the interest-rate formula as a rough approximation to the Greenspan Fed. By comparing the two series, we can see how the Greenspan Fed might have responded to the economic circumstances facing monetary policymakers of the past.

One conclusion is that the Greenspan Fed of the 1990s would likely have averted the Great Inflation of the 1970s. From the late 1960s to the early 1970s, the formula interest rate in Figure 1 is consistently several percentage points above the actual interest rate. The same is true, to a less extent, in the late 1970s. This is consistent with the result presented in Table 7: Fed policymakers of the 1990s responded more to rising inflation than did their predecessors.

A second conclusion from Figure 1 is that the Greenspan Fed would have been much more expansionary in the early 1980s. As the economy experienced the deepest recession since the Great

Depression, the Fed would have cut interest rates much more aggressively. (Taken literally, the interest-rate formula says interest rates should have become negative, which is of course impossible.) The disinflation would have been less rapid, but some of the very high unemployment would have been averted.

3.4 The Role of the White House

So far, this paper has said little about the Clinton administration. In some ways, this is to be expected: Monetary policy is made by the Federal Reserve, which is independent of the executive branch. But the administration did influence monetary policy in several important ways.

The most obvious is the reappointment of Alan Greenspan. In retrospect, this decision may seem like a no-brainer, but at the time it was less obvious. When Greenspan came up for reappointment during Clinton's first term, his reputation was not as solid as it would become: Some observers (including some members of the administration of the elder George Bush) blamed Greenspan for the recession of 1990-91. Moreover, Greenspan was a conservative Republican. It would have been natural for Clinton to want to put a more Democratic stamp on the nation's central bank. That he chose not to do so is notable. To the extent that Greenspan's Fed has been a success, the Clinton

administration deserves some of the credit.

The Clinton administration also influenced monetary policy with its other appointments to the Board of Governors. These included Alan Blinder, Ned Gramlich, Lawrence Meyer, Alice Rivlin, and Janet Yellen. Compared to the typical appointment to the Fed by other presidents, the Clinton appointees were more prominent within the community of academic economists. Some observers may applaud Clinton for drawing top talent into public service (while others may decry the brain drain from academia). Whether this had any effect on policy is hard to say.

In addition to appointments, the administration also made a significant policy decision: Throughout its eight years, it avoided making public comments about Federal Reserve policy. Given the great influence the Fed has on the economy and the great influence the economy has on presidential popularity, presidents and their subordinates usually have a tough time remaining silent about monetary policy. Yet the Clinton administration avoided this temptation.

A large academic literature indicates that more independent central banks produce lower and more stable inflation without greater volatility in output or employment. One contributor to this literature was Lawrence Summers, who would later spend eight years as a high Treasury official in the Clinton

administration, culminating in the position of Treasury Secretary.⁹ Thus, it is hardly an accident that the Clinton administration was unusually respectful of the Fed's independence. What effect this had on policy is hard to gauge.

Perhaps the administration's restraint made it easier for the Fed to raise interest rates when needed without instigating political opposition. It may also have made it easier for the Fed to cut interest rate when needed without sacrificing credibility in the fight against inflation. In this way, the administration's respect for Fed independence may have contributed to the increased responsiveness of interest rates to inflation. If so, the White House again deserves some credit for the Fed's success.

4. Is There a Greenspan Legacy?

In May 1964 the Journal of Finance published a short paper by a young economist named Alan Greenspan. It was called "Liquidity as a Determinant of Industrial Prices and Interest Rates." Greenspan began his summary of the paper as follows: "I have endeavored to integrate several theoretical approaches to the forecasting of prices, with special emphasis on its relation to interest rates."

The paper was a sign of things to come in several ways.

First, and most obviously, it showed Greenspan's early interest in liquidity, inflation, and interest rates--topics that are the essence of monetary policy. Second, the paper demonstrated his interest in looking intensely at the data to try to divine upcoming macroeconomic events. According to all staff reports, this has also been a hallmark of his time at the Fed.

Third, the desire to integrate various points of view shows a lack of dogma and nimbleness of mind. Without doubt, these traits have served Greenspan well in his role as Fed chairman. They have made it easier to get along with both Republican and Democratic administrations and to forge a consensus among open-market committee members with their differing theoretical perspectives. They have also made it easier for him to respond to economic circumstances that are changing, unpredictable, and sometimes inexplicable even after the fact.

But there may also be a fourth, less favorable way in which Greenspan's paper presaged the author's later career: It left no legacy. According to the online Social Science Citation Index, the paper was cited in the subsequent literature exactly zero times. This raises the question of whether the monetary policy of the 1990s faces a similar fate. Will Greenspan's tenure as Fed chairman leave a legacy for future monetary policymakers, or will the successful policy of the Greenspan era leave office

with the man himself?

Imagine that Greenspan's successor decides to continue the monetary policy of the Greenspan era. How would he do it? The policy has never been fully explained. Quite the contrary: The Fed chairman is famous for being opaque. If a successor tries to emulate the Greenspan Fed, he won't have any idea how. The only consistent policy seems to be: Study all the data carefully, and then set interest rates at the right level. Beyond that, there are no clearly stated guidelines.

There is a great irony to this. Conservative economists like Milton Friedman have long argued that discretionary monetary policy leads to trouble. They claim that it is too uncertain, too political, and too inflationary. They conclude that monetary policymakers need to be bound by some sort of monetary policy rule. This argument is the economic counterpart to John Adam's famous aphorism that "we are a nation of laws, not of men."

These views, together with the great inflation of the 1970s, have influenced central banks around the world. Although no country has yet replaced its central bankers with computers programmed to an automatic monetary rule, as the most extreme critics suggest, there has been movement away from giving central bankers unconstrained discretion. During the 1990s,

many nations adopted some form of inflation targeting. In essence, inflation targeting is a commitment to keep inflation at some level or within some narrow range. It can be viewed as a kind of soft rule, or perhaps a way of constraining discretion.¹⁰

Despite this environment, and the fact that a prominent conservative headed the U.S. central bank, the Fed during the 1990s avoided any type of commitment to a policy rule. Conservative economists are skeptical about policies that rely heavily on the judgments of any one man. But that is how monetary policy was made over this decade, and it was hailed as a success by liberals and conservatives alike.

As a practical matter, Fed policy of the 1990s might well be described as "covert inflation targeting" at a rate of about 3 percent. That is, if the Fed had adopted an explicit inflation target at the beginning of the 1990s, the rest of the decade might not have been any different. The virtue of eschewing such a policy framework is that it kept options open--as unconstrained discretion always does. The downside is that it makes it harder for subsequent Fed chairmen to build on the legacy of the 1990s, because it is hard to know what that legacy is.

5. The Lessons of the 1990s

This paper has covered a lot of ground. So I finish by summarizing four key lessons for students of monetary policy.

1. The macroeconomic performance of the 1990s was exceptional. Although the average levels of inflation, unemployment, and real growth were similar to what was experienced in some previous decades, the stability of these measures is unparalleled in U.S. economic history.

2. A large share of the impressive performance of the 1990s was due to good luck. The economy experienced no severe shocks to food or energy prices during this period. Accelerating productivity growth due to advances in information technology may also have helped lower unemployment and inflation.

3. Compared to previous eras, monetary policy during the 1990s adjusted interest rates more aggressively in response to changes in core inflation. This prevented spiraling inflation. Increased stability in monetary aggregates played no role in the improved macroeconomic performance of this era.

4. The low inflation and economic stability of the 1990s shows that discretionary monetary policy can work well. Yet it leaves

only a limited legacy for future policymakers. U.S. monetary policymakers during the 1990s may well have been engaged in "covert inflation targeting" at a rate of about 3 percent, but they never made that policy explicit.

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ENDNOTES

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1. See Akerlof, Dickens, and Perry (1996).
 2. Blinder (1979) offers a classic analysis of the stagflation of the 1970s, emphasizing the role of supply shocks related to food and energy.
 3. Some of these ideas are explored in a recent paper by Laurence Ball and Robert Moffitt (2001).
 4. I say "allegedly" because it is not obvious whether Volcker's professed interest in the monetary aggregates was genuine or just a political feint to distract attention from the very high interest rates he needed to disinflate.
 5. "Greenspan Upbeat on U.S. Economy," Financial Times, February 20, 1993.
 6. My discussion of interest rates in this section and the next one builds on John Taylor's seminal work on monetary policy rules. See, for instance, Taylor (1999).
 7. See Stock and Watson (1999).
 8. The Greenspan Fed deviated from this formula during the late 1980s, when interest rates rose substantially more than the formula recommended. Arguably, the formula did the better job, and the actual policy was the mistake leading to the 1990-91 recession.
 9. The Greenspan Fed deviated from this formula during the late 1980s, when interest rates rose substantially more than the formula recommended. Arguably, the formula did the better job, and the actual policy was the mistake leading to the 1990-91 recession.
 10. See Bernanke and Mishkin (1991) for a discussion of inflation targeting.

Figure 1.
Federal Funds Rate: Actual and Hypothetical Formula

