

J. BRADFORD DELONG

University of California, Berkeley

Should We Fear Deflation?

DEFLATION IS BACK. In the six months from October 1998 to March 1999, some 438 articles about deflation appeared in major U.S. newspapers,¹ compared with only 36 in the first half of 1997 and 10 in the first half of 1990. For sixty years, ever since the middle years of the Great Depression, deflation was a nonissue. Next to no one worried about it. Next to no one viewed a general decline in the price level as even a remote possibility. Now people do. And now people worry about it.

One reason to worry about deflation is that today the rate of inflation in the United States is quite low, less than 2 percent per year. But that is not the whole story. The post–Korean War 1950s and the early 1960s saw measured rates of inflation as low as those of today (figure 1).² Yet back then people worried not about deflation, but about inflation.³ Why is it that, in the late 1990s, inflation of 2 percent per year or less calls forth the fear of deflation, where it did not in the 1950s and 1960s?

The principal reason why the low inflation of the 1950s and 1960s did not create fears of deflation was that economists in those days believed that economic institutions had a bias toward inflation, a legacy of the Keynesian revolution. Today that belief in an inflationary bias is gone, or at least greatly attenuated. What has happened to that belief, and to that built-in

I would like to thank Christopher Sims, Alan Blinder, Menzie Chinn, Barry Eichengreen, Robert Hall, Kenneth Kletzer, Michael Perelman, and David Romer, among others, for helpful comments and discussions.

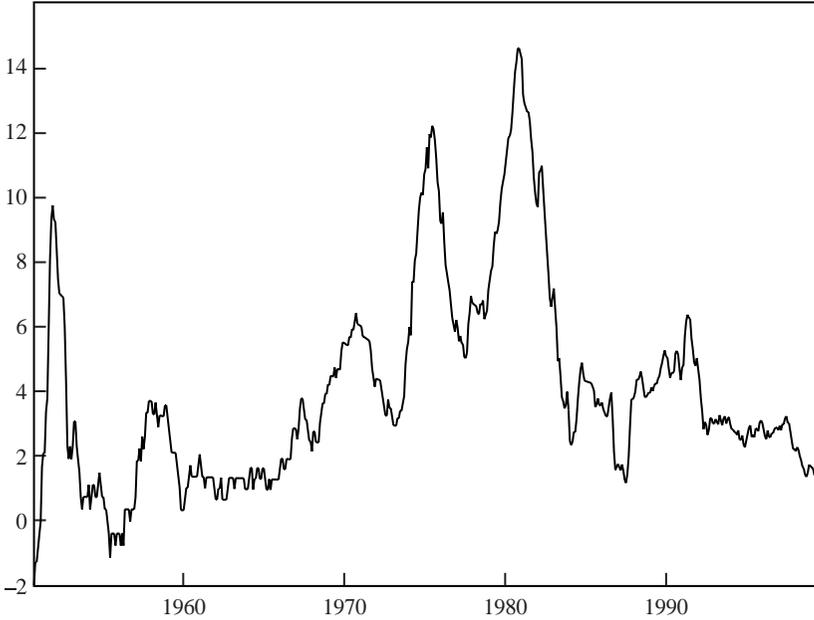
1. Based on a search for articles classified in Nexis's general news database under the keyword "deflation"; the search was restricted to "major newspapers" in the United States.

2. It is commonly but not universally agreed that government statistics such as the consumer price index overstate the true change in the cost of living. See Boskin and others (1998). I do not address such measurement issues here.

3. See Burns (1960).

Figure 1. Inflation as Measured by the Consumer Price Index, 1950–98^a

Percent



Source: Bureau of Labor Statistics World Wide Web site.

a. Change in the consumer price index over the previous twelve months (monthly data).

bias toward inflation?⁴ Could it be that the bias was never as strong as was believed, or that, if it was strong for a time, it has since been reduced or eliminated by the growth of countervailing forces?

Given that deflation is back on the radar screen, should it be feared? That depends on several things. It might be that the probability of deflation is infinitesimal and that therefore we should not waste time fearing it.⁵ Or it might be that deflation is more probable than that, but not especially damaging, and for that reason we should not waste time fearing it. Or it might be that the costs of inflation and deflation are roughly equal—that is, our social loss function might be symmetric around zero as a function of the deviation from price stability. Then we should indeed fear deflation,

4. See Viner (1936), Burns (1960), and Kydland and Prescott (1977).

5. Perry (1998) concludes that deflation, although very damaging, is also very unlikely.

but not relatively: we should fear renewed inflation more than deflation, for the price level is still rising.

I will argue that there is reason to fear deflation—and indeed to fear it more than inflation. The probability of serious deflation or of other chains of events that do the same kind of damage is indeed low. But it is above zero. And there appears to be good reason to fear that our social loss function is indeed asymmetric—that deflation does more macroeconomic damage than an equal and opposite amount of inflation.

At one level, the reason to fear deflation is that the nominal interest rate has a lower bound at zero. Deflation—even completely anticipated deflation—thus generates high real interest rates if prices fall rapidly, and large transfers of wealth from debtors to creditors if prices fall far. By contrast, *anticipated* inflation does not generate abnormally low real interest rates even if prices rise rapidly, and it does not generate large transfers of wealth even if prices rise significantly.⁶ (However, significant *unanticipated* inflation *is* associated with large transfers of wealth from creditors to debtors.)

The high real interest rates that follow from deflation depress investment, lower demand, and raise unemployment. Thus rapid deflation threatens to have destructive consequences. Deflation's transfer of wealth from debtors to creditors diminishes the economy's ability to keep the web of credit and financial intermediation functioning. Disruption of the financial system puts additional downward pressure on investment, demand, and unemployment. Here the likely size of the destructive effects depends not so much on the speed as on the magnitude of deflation.

There is no corresponding upper ceiling on nominal interest rates to generate the reverse of these distortions in a time of high inflation. Thus it seems hard to argue that our social loss function is symmetric, and that deflation is not to be especially feared. It is easier to argue that the chances of deflation coming to pass are low. Yet I suspect that they are not as low as we would like to believe. Monetary policy acts with long and variable lags, and the volatility of the price level since World War II has been relatively high. Taken all together, it is surely possible that an episode of deflation could take hold well before monetary policy could react to head it off.

6. Hence economists' perennial problem in finding social costs of moderate inflation high enough to justify the degree of aversion to it documented in Shiller (1997). One possible source of high costs to moderate inflation comes from the interaction of inflation and the tax system. See Feldstein (1983).

Where Has All the Inflationary Bias Gone?

From its beginning the Keynesian revolution raised fears of inflation. Even before the ink was dry on the first press run of Keynes's *General Theory of Employment, Interest, and Money*, Jacob Viner was warning that

[i]n a world organized in accordance with Keynes' specifications there would be a constant race between the printing press and the business agents of the trade unions, with the problem of unemployment solved if the printing press could maintain a constant lead. . . .⁷

A quarter century later, in his presidential address before the American Economic Association, Arthur Burns argued that Viner's fears had come true: that the post-World War II world had become one of constant wage-push inflation.⁸

The fears expressed by Viner and Burns have since been developed and sharpened by Finn Kydland and Edward Prescott. These authors pointed out that a benevolent central bank possessing discretion and the ability to induce unanticipated shifts in aggregate demand will be greatly tempted to try to take advantage of any short-run Phillips curve to boost employment and production.⁹ The resulting rational expectations equilibrium will be a dissipative one: workers and managers will come to expect such actions from the central bank, and in equilibrium production and unemployment will be unaffected but inflation will be higher than desirable.

The Kydland-Prescott framework suggests two ways to counter the institutional bias toward inflation created by a central bank possessed of discretion and concerned about high unemployment. The first is to make sure that central banks are bound by rules and do not possess discretion.¹⁰

7. Viner (1936), reviewing Keynes (1936). Viner also worried that Keynes's book would "have probably more persuasive power than it deserves."

8. Burns (1960) believed that the *General Theory* had had great influence, that as a result deep depressions and their high unemployment had become unthinkable, and that without the possibility of high unemployment to moderate workers' wage demands, cost-push inflation was inescapable.

9. Kydland and Prescott (1977).

10. It is not completely clear what it means for a central bank to be bound by rules. Does it mean that the Federal Open Market Committee should be replaced by an expert system programmed by a centrist macroeconomist and capable of running on a PC? Does it mean that central bankers should be told that their mission is to act *as if* they are bound by the optimal rule? Does it mean that we want to see central bankers immersed in a culture that strongly condemns any attempt to take advantage of the short-term Phillips curve as immoral? For an interesting discussion of what it means in practice for an *authority* to try to follow a *rule*, see Blinder (1998).

This is the approach favored by Kydland and Prescott themselves. The second—and this is a line of thought I associate with Kenneth Rogoff¹¹—is to appoint central bankers who will be unconcerned about high unemployment.

The pattern of economic policymaking in the 1990s suggests that both of these institutional approaches to diminishing inflationary bias have been adopted. The Federal Reserve today appears to follow the rule (in the sense of Alan Blinder, although perhaps not in the sense of Kydland and Prescott) of giving first priority to attaining near price stability.¹² The past decade has seen the flowering, and not just in the United States, of a common culture of central banking in which control of inflation comes first, and always taking the long view is applauded. And some central bankers at least appear to have been appointed with an eye toward their relative lack of concern with—or disbelief in their own power to affect—the level of unemployment. The result is a situation in which long-time inflation hawks criticize the European Central Bank (ECB) for pursuing an overly tight monetary policy,¹³ and in which the ECB president can announce—with inflation in the euro zone approaching 1 percent and unemployment approaching 10 percent—that the ECB “will act, *should the need arise...* to prevent either inflationary or deflationary pressures...” (italics added).

Thus it appears that attempts to reform institutions to eliminate inflationary bias have been successful. Or perhaps the bias toward inflation in the 1960s and 1970s was not so much the result (as Kydland and Prescott theorized) of a game-theoretic interaction between central bankers and the economy, or (as Burns theorized) of an absence of fear of high cyclical unemployment, but instead the result of painful misjudgments about the structure of the economy that were corrected after the 1970s.¹⁴

11. Rogoff (1989).

12. However, attaining near price stability is not the Federal Reserve’s only goal under its current chair. Consider the rapid loosening of monetary policy in the immediate aftermath of the stock market crash of 1987, in a successful attempt to prevent significant real repercussions, or the very low (less than zero) real interest rate policy pursued by the Federal Reserve in 1993, in part to provide support to legislative proposals for deficit reduction.

13. The *Economist’s* March 20, 1999, lead editorial condemned ECB head Wim Duisenberg’s claim “that [interest] rates are ‘historically low’... [as] true of nominal rates, but not of real ones—the kind of mistake (or attempt to mislead) you might expect of a politician, but not a central banker.”

14. See Sargent (1999), DeLong (1997b).

Why We Should Fear Deflation: Economic History

In the early 1920s most economists treated inflation and deflation as roughly symmetric

. . . evils to be shunned. The individualistic capitalism of today, precisely because it entrusts savings to the individual investor and production to the individual employer, *presumes* a stable measuring rod of value, and cannot be efficient—perhaps cannot survive—without one.¹⁵

Inflation was feared because of its effect on the distribution of income and wealth. Deflation was seen as dangerous because entrepreneurs necessarily held long positions in real assets and short positions in nominal assets:

. . . the business world as a whole must always be in a position where it stands to gain by a rise . . . and to lose by a fall in prices. . . . [The] *regime* of money-contract forces the world always to carry a big speculative position [that is, to be long real assets], and if it is reluctant to carry this position the productive process must be slackened. . . . The *fact* of falling prices injures *entrepreneurs*; consequently the *fear* of falling prices causes them to protect themselves by curtailing their operations; yet it is upon the aggregate of their individual estimations of the risk, and their willingness to run the risk, that the activity of production and of employment mainly depends. . . .¹⁶

In other words, the fact of falling prices bankrupted entrepreneurs, and therefore the fear of falling prices led them to unwind their positions, close down productive operations, and reduce output and employment.¹⁷

15. Keynes (1923, p. 45).

16. Keynes (1923, pp. 40–42).

17. Although Keynes's position was the conventional wisdom, there were dissenters who did not fear deflation, some of whom indeed thought that it was a healthy economic process. Knut Wicksell argued that anticipated deflationary policy should have no real effects because it would have been taken into account *ex ante* in contracts (see Boianovsky, 1998). Wicksell hastened to admit that in the real world deflation *did* have real effects. He called for the Swedish government to take steps to index *all* contracts—including reserve deposits. It is not clear whether or how he proposed to index cash. Still others, including Lionel Robbins, Joseph Schumpeter, and U.S. Treasury Secretary Andrew Mellon, argued that periodic deflations were necessary for economic growth. Anyone could make money during a period of inflation. Only deflation could determine which entrepreneurs were unskillful. Their bankruptcy would release factors of production that could then be reemployed by other, more skillful entrepreneurs during the next boom, thus raising productivity and living standards (see Robbins, 1934). This line of thought had remarkably broad influence. Traces of it are evident in the passages of Jacob Viner's review of the *General Theory* in which Viner argues that Keynesian policies will retard long-run productivity growth by leading to large amounts of "low quality" employment (Viner, 1936). For a more general discussion of this line of argument see DeLong (1997a).

The coming of the Great Depression, however, shifted the balance of economists' fears from inflation toward deflation. After the depression a near consensus believed that deflation was deeply dangerous and to be avoided at all costs. Because nominal interest rates could not drop below zero, the economic system had too little flexibility to adjust to the kind of shocks that had caused the depression. What those shocks were remains in dispute, for economists' analyses of the root causes of the depression were (and remain) widely divergent. Nevertheless, almost every analyst placed general deflation—and the chain of financial and real bankruptcies that it caused—at or near the heart of the worst macroeconomic disaster the world has ever seen.

Their analyses focused on different channels. Irving Fisher stressed that past deflation meant bankruptcy or near bankruptcy for leveraged operating companies and nearly all financial institutions; he stressed the cumulative increase in real indebtedness that followed from deflation given that nominal interest rates could not fall below zero.¹⁸ Friedman and Schwartz stressed the harm to banks' balance sheets from the reduced nominal value of collateral and from debtors' diminished ability to service loans. The resulting financial sector bankruptcies and banking crises led to sharp rises in the ratios of reserves and of currency to deposits, lowering the money stock and aggregate demand in the absence of an adequate Federal Reserve response.¹⁹ Once again the disruption could be sidestepped if nominal interest rates could become negative, allowing a portion of *nominal* debt to be written off when prices fell.

Peter Temin focused on rising risk premiums on corporate debt between 1929 and 1933: a deflation-driven deterioration in corporate balance sheets increased risk and drove a wedge between low short-term interest rates on safe assets like government bonds and high long-term interest rates on corporate debt.²⁰ The fear that deflation had or would soon put debtor

18. Fisher (1926, 1933). Fisher's language also tells us incidentally how the working conditions of economics professors have changed: ". . . during the last three years in particular I have had at least one computer [in those days, a person hired to perform calculations] in my office working almost constantly on this problem. . . ." (Fisher, 1926, p. 497).

19. Friedman and Schwartz (1963). They thus place their emphasis on the occurrence of banking crises and on the failure of the Federal Reserve to stem them by conducting an appropriately expansive monetary policy, focusing on the decline in the nominal money stock rather than on the decline in prices and economic activity that destroyed bank balance sheets.

20. Temin (1974).

enterprises underwater and potentially trigger a scramble among creditors to be first in line upon liquidation made it hard for lenders to envision lending more to enterprises, even though extremely low interest rates on government debt had lowered the opportunity cost.

Barry Eichengreen added an international perspective, writing of the fear that countries would depreciate their currencies and how this fear forced country after country to adopt deflationary policies to reduce the price level and shrink the money supply.²¹ Since nominal interest rates for currencies perceived likely to appreciate could not fall below zero, interest arbitrage meant that nominal interest rates in countries perceived likely to depreciate had a lower bound at the expected rate of depreciation plus the risk premium. Charles Kindleberger wrote of how currency depreciation exerted deflationary pressures: a small country that reduced the value of its currency would discover that its businesses and banks that had borrowed abroad in gold could no longer service their debts. Even though depreciation did not lead the nominal home-currency price of a basket of domestic goods to fall, its foreign-currency or gold price did fall, with destructive consequences for those who had borrowed in foreign currencies or in gold.²² Christina Romer argued that even those who did not hold substantial long positions in equities found it advisable to cut back on spending and increase liquidity margins in the aftermath of the 1929 stock market crash.²³

All of these channels share common features. The first is that they all rest in one way or another on the lack of flexibility produced by the zero-nominal-interest-rate anchor. Because nominal interest rates could not fall below zero, banks could not respond to anticipated deflation by paying negative interest on deposits. The second is a focus on financial fragility. All the analysts cited share the belief that the interruption of the chain of financial intermediation had disastrous consequences for production and employment. The effects are the same whether the disruption occurs at the level of bank creditors (as in Friedman and Schwartz, in which it is

21. Eichengreen (1992). Eichengreen and Sachs (1985) showed that the earlier a country got off the gold standard and the further it got away from its previous gold parity, the better it tended to fare in the Great Depression.

22. See Kindleberger (1973). The same argument applies to leveraged positions secured by equities: a decline in the value of the stock market, although it is not, strictly speaking, a commodity price deflation, has the same qualitative effect on the stability of the financial system.

23. Romer (1990).

the increases in currency and reserve ratios that do the work), of operating companies (as in Keynes's or Fisher's stories of entrepreneurs unhedged against price-level declines), of the banks themselves (as in Temin, for whom the deterioration of bank debtors' balance sheets is the first domino), of companies with foreign liabilities (as in Kindleberger), or of consumers who no longer dare to be short in nominal terms to finance their purchases of durable assets (as in Romer).²⁴ In all of these channels a sharp deterioration in debtors' balance sheets leads to a desire on the part of both debtors and creditors to unwind their positions and boost their liquidity, and thus to sharp reductions in business investment and consumer spending.

Economic theory tells us that when borrowers' balance sheets are impaired, debt contracts no longer work. An impaired balance sheet means that equity owners and managers have little if any net worth left, and thus little incentive as agents to act in the interest of their creditors. But there is no theoretical reason why such contracts should be written in potentially unstable units of account, or why they should not include conditions for changes in observed macroeconomic variables. Nevertheless, debtors do borrow and creditors do lend in nominal terms—whether it is consumers financing purchases of durables, banks taking deposits from households, real estate developers pledging land or other property as collateral, or companies borrowing from banks.

But in an environment of *nominal* debt contracts, nominal deflation has the same consequences as poor managerial performance: the resulting difficulty in servicing or repaying the loan sends the same signal of managerial failure and triggers the same steps toward restructuring or liquidation. Yet in this case the reason the loan goes unserviced is not that managers need to be replaced or the enterprise restructured, but simply that the price level has declined.

Why We Should Fear Deflation: Present Vulnerability

Deflation was clearly dangerous in the 1930s. How dangerous is it today? We do not know. We do not know how financially fragile the U.S. economy is today, either in terms of the vulnerability of entrepreneurial net worth in the financial or the nonfinancial sector to deflation, or in terms

24. See Bernanke (1983).

of the reduction in aggregate demand that impairment of balance sheets in either sector would cause. The U.S. economy has not experienced deflation since World War II. We know that economic historians blame the channels of debt-deflation and financial fragility for the greatness of the Great Depression. But we have no reliable evidence on the strength of these channels today.

Alternative Channels That Impair Balance Sheets

If the danger of deflation springs from its effect on net worth and depends on the degree of financial fragility in the economy, then economies may well have more to fear than a decline in broad goods-and-services price indices alone. If securities and real estate holdings have been pledged as collateral for debt contracts, then a large-scale asset price decline will have effects similar to those of a fall in goods-and-services price indices. Both severely reduce equity net worth and the managerial stake in the enterprise. Both produce the same possibility of dissipative bankruptcy proceedings and the same reluctance on the part of lenders to further extend credit to possibly impaired enterprises that makes deflation feared.²⁵

Is the United States today potentially vulnerable to large-scale asset price declines in this way? In real estate, probably not; in the stock market, yes. Perhaps fundamental patterns of equity valuation have truly changed, as investors have recognized that the equity premium over the past century was much too large. In that case stock prices have reached (as Irving Fisher incautiously declared in the summer of 1929) a permanent and high plateau.²⁶ But the risk seems more substantial of a stock

25. Indeed, the deflationary consequences of such asset price declines is one of the explanations offered for Japan's economic stagnation today. In Japan, money is essentially free (in nominal terms) to safe and secure borrowers, investment is depressed, businesses report that no one will lend to them on reasonable terms, and financial institutions report that no one will borrow from them on reasonable terms. But economists' understanding of Japan's current economic situation is shaky.

26. See Galbraith (1954). Attribution of recent stock market rises to reductions in equity risk premiums faces the problem that few if any investors holding long positions in stocks today anticipate lower returns than have been realized on average over the past century. Attribution of recent stock market rises to increases in expected earnings growth faces the problem that the increases in aggregate productivity growth needed to support faster long-run earnings growth are not in evidence.

market decline on the order of 50 percent, back to Campbell-Shiller fundamentals.²⁷

The Limits of Monetary Policy

Moreover, a deflation in broad goods-and-services prices may not be as unlikely as we hope. The Federal Reserve's ability to offset shocks to the price level over a one- or two-year horizon is very limited. And once investors expect a deflationary shock to take hold, the fact that nominal interest rates must be positive greatly limits the Federal Reserve's ability to lower real interest rates as well.²⁸

How adept is monetary policy at controlling the price level? The answer has always been—or at least since Milton Friedman stated that monetary policy works with “long and variable lags”—not very.²⁹ Modern estimates of the impact of changes in monetary policy on production, employment, and the price level continue to bear out this assessment. Authors like Christiano, Eichenbaum, and Evans are very pleased when they find substantial agreement on the qualitative impact of changes in monetary policy (as measured by the short-term interest rates that the Federal Reserve actually controls) “in the sense that [the] inference is robust across a large subset of the identification schemes that have been considered in the literature.”³⁰ But the confidence intervals surrounding their point estimates are large.

Moreover, the delay in the effect of a change in monetary policy is large as well: not until some eight quarters after the initial interest rate shock has the impact of a change in interest rates had anything near its long-run effect on the rate of inflation (or deflation). Using the model of Christiano, Eichenbaum, and Evans, I calculate that a 1-percentage-point upward shock to the federal funds rate is associated with a decrease in the price

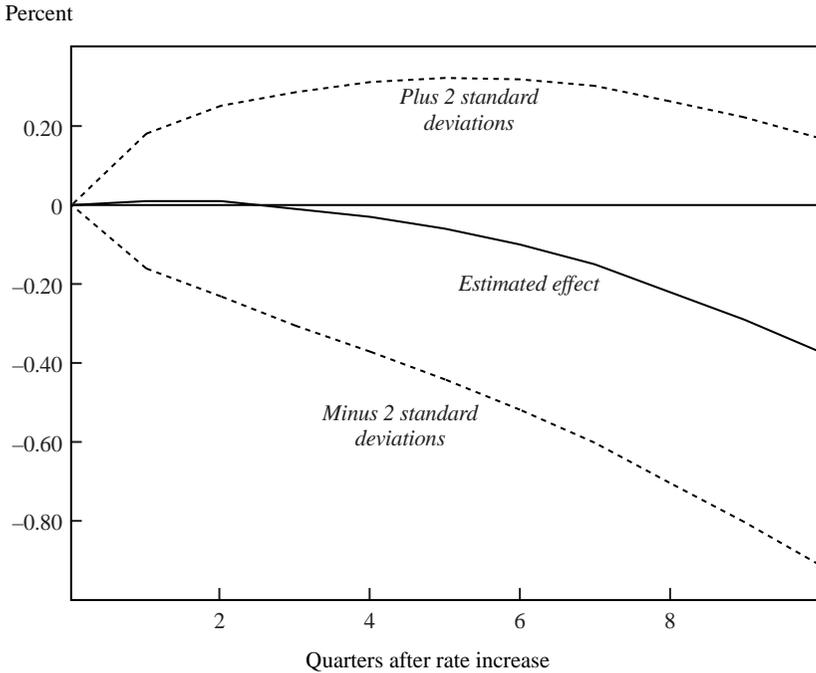
27. See Shiller (1989). How much of current U.S. equity positions are held by people who have used them as collateral of one form or another? How many financial institutions would be bankrupted by a drop in the stock market back to Campbell-Shiller fundamentals? (Campbell-Shiller fundamentals are calculated by regressing ex post fundamental values on price-dividend and price-earnings ratios and long lags of dividends and earnings.) How closely have financial institutions been monitoring those that have borrowed from them? We do not know. The lack of creditor monitoring of the hedge fund Long-Term Capital Management and its bankruptcy in the summer of 1998 do not build confidence.

28. See DeLong and Summers (1992).

29. See Gordon (1974).

30. Christiano, Eichenbaum, and Evans (1998).

Figure 2. Cumulative Effect on the Price Level of a 1-Percentage-Point Increase in the Federal Funds Rate



Source: Author's calculations based on Christiano, Eichenbaum, and Evans (1998).

level of only about one-third of a percent ten quarters later (figure 2). This VAR calculation allows for typical responses of both the economy and the Fed to each other. A sustained change in the funds rate would be expected to raise this effect to roughly -0.6 percent.

Even so, monetary policy remains the tool of choice for stabilization policy. The lags associated with fiscal policy—presidential and congressional changes in spending plans and tax rates and their effects—are even longer and more variable than those associated with monetary policy. But if, in the United States today, monetary policy has no appreciable effect on the rate of price change for a year and a half, and nothing close to its full long-run effect until two and a half years have passed, one cannot have great confidence in its ability to forestall a deflationary episode.

Monetary policy has more rapid effects on output. This means that the Federal Reserve perhaps has more ability to lower interest rates to offset

the output effects of a deflationary shock than it has to head off the deflationary shock itself. But in a situation where investors and financial markets already expect a fall in the price level, the fact that nominal interest rates cannot drop below zero significantly limits the stimulative effect on output that monetary policy can have.

There are also important recognition and formulation lags in the making of monetary policy. The Federal Open Market Committee's reliable information flow is at least one quarter old. Moreover, the committee is one that moves by consensus, guided by its chair, and committees that move by consensus rarely act quickly.³¹

How Large Are Price-Level Shocks?

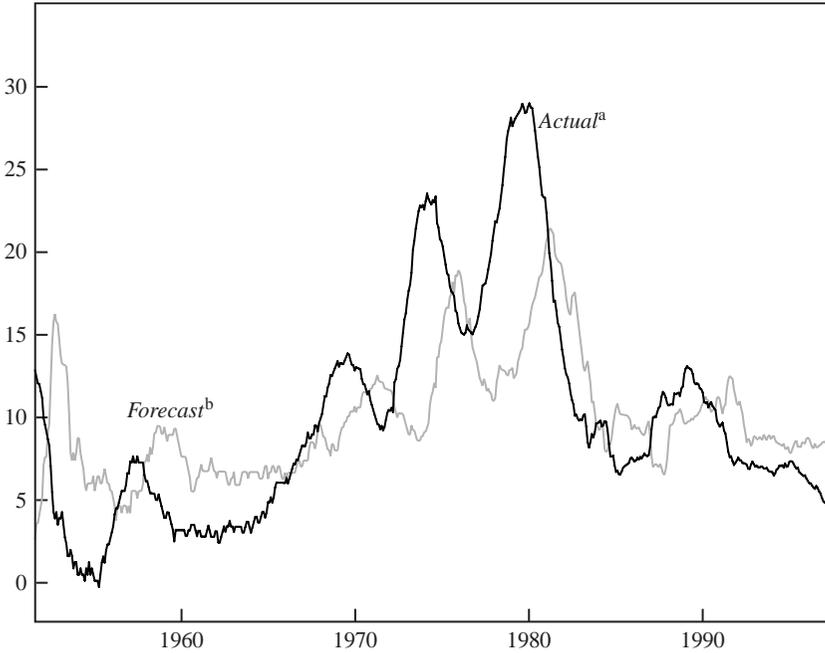
Long and variable lags in the working of monetary policy would not be as worrisome if central bankers today could reliably and precisely forecast what the price level will be two and a half years hence. But they cannot (figure 3). The standard deviation of the price level two and a half years hence is 6.6 percent for the period since 1950 (table 1). A small amount of this variation can be attributed to systematic policy. Conditioning on the level of inflation today (as measured by the consumer price index, or CPI) accounts for less than a third of the variance and reduces the standard error of the price level two and a half years out only to 5.5 percent. Conditioning on both inflation and unemployment reduces the standard error only to 5.4 percent. And conditioning on inflation, unemployment, and current nominal interest rates reduces it only to 4.8 percent.

The most significant improvement in forecasting the price level two and a half years out results from conditioning on the identity of the chairman of the Federal Reserve. This reduces the standard error to 3.8 percent. But fitting a step function to any process will improve the fit. It is hard to imagine what differences in the views or character of Arthur Burns and Alan Greenspan would lead the replacement of the first by the second to generate an immediate 9 percent fall in the estimate of the price level two

31. In addition, the committee appears to believe that short-term interest rates should be smoothed: changes in short-term interest rates should, except in the rarest of circumstances, be made in quarter-percentage-point increments. From an economist's perspective this makes little sense. The short-term interest rate looks like a control variable in an intertemporal maximization problem, and such control variables can and should be adjusted rapidly and sharply when conditions change.

Figure 3. Actual and Thirty-Month-Ahead Forecast of Inflation, 1950–96^a

Percent



Source: Author's calculations from Federal Reserve data.

a. Seasonally adjusted.

b. Fitted from a regression of thirty-month-ahead changes in the seasonally adjusted consumer price index on the past twelve months' inflation, the unemployment rate, and the federal funds rate.

Table 1. Standard Errors in Thirty-Month-Ahead Forecast of Inflation^a

<i>Variables included in the forecast regression</i>	<i>Standard error of the equation (percent)</i>
None	6.6
Past twelve months' inflation rate	5.5
Past twelve months' inflation rate, capacity utilization rate	5.4
Past twelve months' inflation rate, unemployment rate	5.3
Past twelve months' inflation rate, unemployment rate, federal funds rate	4.8
Past twelve months' inflation rate, unemployment rate, ten-year Treasury rate	4.8
Past twelve months' inflation rate, unemployment rate, identity of Federal Reserve chair	3.8

Source: Author's calculations from Federal Reserve data.

a. Residual standard errors from a regression (using monthly data) in which the thirty-month-ahead percentage change in the consumer price index was the dependent variable.

and a half years out. It strains credulity to believe in a 26 percent effect on the price level from any Fed chairman, even G. William Miller.

Nevertheless, even a standard deviation of 3.8 percent tells us that—if in fact the assumption of a normal distribution applies to these data—there is one chance in twenty that the price level two and a half years hence will be more than $7\frac{1}{2}$ percentage points higher or lower than currently forecast. At current rates of inflation, an unanticipated fall in the price level of more than 5 percentage points (that is, well into deflationary territory) before the Federal Reserve can react seems to be an event that would happen once every forty years. Is this a high risk of a serious deflation? No, but it is large enough to be worrisome.

Reasons for Confidence

Is such instability enough to make a debt-deflation spiral set in motion by unanticipated commodity price declines a serious threat? Probably not, for several reasons.

First, it may well be that it takes a bigger economic shock to induce a certain amount of deflation than to induce the same amount of accelerating inflation or of disinflation.³² If so, calculations of price-level variability from an era of accelerating inflation followed by disinflation would be an unreliable guide to the potential for deflation. It would then take a greater contractionary impulse to cause deflation than to cause disinflation. Attempts to estimate curvature in empirical Phillips curves tend to produce evidence of asymmetry that is convincing only to those who already believe in such asymmetry. But such tests have relatively low power.

Second, a large part of the post-1960 variance in changes in the rate of inflation comes from the relatively narrow period of the turbulent 1970s. The years between 1971 and 1983 inclusive—one-third of the sample—account for 90 percent of the squared deviations of CPI inflation around its mean. Since 1984 the standard deviation of two-and-a-half-year-ahead changes in CPI inflation is only a third of the full-sample standard deviation.³³ Perhaps episodes of increased variability like the 1970s oil shocks

32. Akerlof, Dickens, and Perry (1996).

33. In addition, the distribution of potential changes in prices has a positive skew: a large part of the variance may be contributed by a small chance of a large increase in the rate of inflation. In the time path of changes in the CPI, the two oil shocks contribute influential observations, suggesting that there may be such a positive skew. But 1982 saw inflation come down very rapidly. It is an influential observation in the other direction.

and the breakdown of confidence in the Federal Reserve's commitment to price stability will not happen again, either because of increasing knowledge about how to conduct monetary policy or because price shocks are inherently asymmetric. Surely there is reason to believe that the 1970s were a unique episode, and that the price shocks on the upside experienced in that decade could almost never happen in reverse.

It is easy to make the argument that the skill with which monetary policy is conducted has greatly increased in the United States, where monetary policymakers have been both skillful and astonishingly lucky over the past decade. It is, however, harder to make this argument from policy-making competence elsewhere in the world. In Japan producer prices were 5 percent lower in the first quarter of 1999 than in the first quarter of 1998, and over the past three months they have fallen at an annualized rate of 10 percent. Estimates of the output gap relative to potential in Japan today range between 8 and 25 percent of current GDP. In the euro zone, as already noted, inflation is less than 1 percent per year, and unemployment is approaching 10 percent. These macroeconomic problems are different from those of the 1970s. They are not less serious. And they do not appear to be consistent with greatly increased skill in the making of monetary policy.

Conclusion

Our ability to forecast and control the price level over a time horizon that corresponds with the effective range of monetary policy is low. Our policy instruments are powerful, but they are imprecise and subject to long and variable lags. Moreover, other sets of circumstances than a general decline in goods-and-services prices alone—in particular, a sharp decline in asset prices—could set in motion the economic processes that we fear from deflation.

Thus there seems to be reason to be afraid of deflation. But there is no reason—at least not yet—to be very afraid. The institutional structures of our labor market provide us with insurance against debt-deflation, as Akerlof, Dickens, and Perry have shown.³⁴ But this insurance comes at a substantial price: in their model the natural rate of unemployment rises

34. Akerlof, Dickens, and Perry (1996).

substantially as the inflation rate hits zero. The relatively high price-level variability of the 1970s may truly be a thing of the past, not something to fear in the future.

But if the volatility of the 1970s should come again, and if deflation is not much harder to cause than disinflation, and given that monetary policy is an imprecise instrument that works with long and variable lags, what then? If the social loss function is asymmetric—if moderate deflation is much more damaging than moderate inflation—and if the variance of outcomes around targets is large, the conclusion is obvious: good monetary policy should aim for a rate of change in the price level consistently on the high side of zero.

Comment and Discussion

Christopher A. Sims: This paper takes up an important set of issues. I agree with its main point, that deflation is a danger that is newly worrisome and deserves our attention. I disagree with some of its specifics, however.

DeLong argues that inflation has become less of a danger in good part because policy has focused on controlling it, and that this focus carries with it an increased risk of deflation. I agree with this argument. In an environment of near-zero interest rates, deflation, and low or declining real activity, policy instincts developed for an inflationary environment can become counterproductive. I can think of three ways this can arise.

One, obviously, is that proportionate interest rate changes are no longer important. Cutting the short-term interest rate from 1 percent to $\frac{1}{2}$ percent has negligible effects, because short-term, interest-bearing government liabilities and cash have become nearly interchangeable. If monetary policy continues nonetheless to focus on manipulating interest rates, it is likely to be ineffective.

A second way, the other side of the first, is that control of monetary quantities is no longer distinct from control of interest-bearing debt. The two have become close substitutes, and control of their aggregate is fundamentally a fiscal matter, even if the central bank is taking the action. Open market operations exchanging “money” for “interest-bearing” government debt become pointless. Open market operations in which private debt or equity securities are purchased are far from pointless, but these involve government purchases of private assets, with the usual political ramifications of fiscal policy. If private loans are purchased, certain people and not others are getting money for less than perfectly secure promises to pay. They may be seen as being bailed out. If equity is purchased, the

government is acquiring partial control of private companies. Central bankers normally take pains to discount only the soundest of securities, precisely because they wish to avoid any risk of requiring fiscal backing in the event of losses on their investments or otherwise becoming politically controversial. They may even tighten their lending and discounting criteria in hard times for this reason, thereby precluding effective expansionary policy actions. And the risks they are concerned about are real, as we have seen in Mexico, where the central bank has recently experienced difficulties related to its discounting of private loans during a previous financial crisis. To take effective action against severe deflation, a central bank needs to be able to take risks, confident that it has the fiscal backing to do so. It is worth noting that this kind of central bank strength, stemming from confidence in fiscal backing, is distinct from and perhaps even undermined by simple independence from political influence or legislative connections. Monetary authorities may hesitate to act because they see the fiscal implications of effective monetary policy measures in a deflationary environment, just as fiscal authorities may hesitate to act because they cling to the notion that control of the price level is the domain of monetary policy.

The third way in which deflation may confound monetary policy derives from the fact that, in a deflationary environment, “credibility” changes its sign, although not its fundamental meaning. To convince investors that government nominal liabilities are not as good an investment as real capital, the central bank and the fiscal authorities, acting together, must make them believe that future primary surpluses will be insufficient to provide a high return on those liabilities. This is certainly a credibility problem, in the sense that it requires that the public believe assertions about the future path of policy. But when a central bank is credible only in the sense that it is believed to be firm in opposition to inflation, it may find it difficult or impossible to promise convincingly that its expansionary actions will be sustained rather than later reversed. Japan’s central bank may now be facing this sort of lack of credibility.

These factors imply real dangers. It may be that monetary policy authorities are used to thinking of their role as limited to that of adjusting the interest rate in response to inflationary or deflationary pressures. It may be that designers of monetary institutions (as in Europe), in the name of promoting independence from the fiscal authorities, have weakened the fiscal backing that a central bank needs in a deflationary environment. And

it may be that legislatures have learned too well the lesson that controlling inflation should be left to the central bank. In a low-inflation environment, a disturbance that lowers the real rate of return on real assets or creates a period of substantially declining prices could therefore trigger a disastrous set of policy reactions and inactions.

Having underlined my agreement with DeLong's main point, let me take issue with him on some of the details. The paper at several points assumes that inflation and deflation have impacts on income distribution of known sign. Unemployment, of course, is especially harmful to workers, particularly lower-income workers. But inflation and unemployment are only tenuously linked. Although a Phillips curve can be coaxed out of strictly bivariate U.S. data sets as a reduced-form relationship, it is a most unreliable statistical relationship. It does not exist in most other countries and is not a good forecasting tool even in the United States. Unemployment and inflation very often move in the same direction, as they did during the 1970s oil crises and as they have done in the last few years. Monetary contraction probably does tend to increase unemployment temporarily. But monetary contraction is more likely to occur because of the need to end high inflation than as a spontaneous policy error at low inflation rates that leads to rapid outright deflation.

Inflation itself harms people who hold long positions in nominal assets and helps those who are short nominal assets. Mortgage holders benefit, for example, whereas retirees with fixed nominal pensions are hurt. Both inflation and deflation produce real shifts of wealth, but these are not very strongly associated with income level.

The paper argues that monetary policy does not have tight control over the inflation rate. It displays, in figure 2, structural vector autoregressive (VAR) impulse responses with the associated error bands, to show that the effects of monetary policy on the price level are slow, small, and uncertain. This is correct but perhaps misleading. What the figure shows is the reaction of the price level to a typical surprise monetary contraction. It shows that such a contraction that initially raises interest rates by 1 percentage point leads to an imprecisely estimated 0.35 percent decline in prices over the next two and a half years. But such surprise contractions tend to be short-lived, and the model is tracing out a typical path for interest rates subsequent to the initial rise. The figure shows the effect not of a sustained 1-percentage-point rise in the interest rate, but rather of a rise of that magnitude that within a few months has been almost completely

reversed. The model implies that a sustained 1-percentage-point rise would likely have much stronger (although still delayed) effects.

Since 1947 we have had isolated periods during which inflation as measured by the consumer price index (CPI) has been negative. These episodes, in the immediate postwar years and in the 1980s, did not last more than a few months, and in the 1980s they were not accompanied by near-zero interest rates. Dangerous deflation is deflation that is expected to persist and is therefore accompanied by very low nominal interest rates. Over longer spans of time, monetary policy can determine the average rate of inflation more precisely than it can the inflation rate on a monthly or quarterly basis from year to year. True, there is a danger of sustained, accelerating deflation. But it would require a major disturbance to the economy, reinforced by monetary and fiscal policy errors. Although possible, such a scenario is quite a bit less likely than the kind of isolated episode of negative inflation, unaccompanied by very low interest rates, that a complete multivariate model would imply is likely.

Although it displays the response of inflation to policy-generated interest rate changes as found in a structural VAR model, the paper characterizes uncertainty in forecasts of the price level using much more naive models. It tells us that the standard error of thirty-month-ahead forecasts in the natural log of the price level is 6.6 percent and that this forecast error comes down only to 4.8 percent in a regression using lagged inflation, unemployment, and current interest rates. It reports that this standard error can be brought down to 3.8 percent if a dummy variable for the identity of the Federal Reserve chairman is included. But in fact it can be brought down to 2.8 percent if a more or less standard VAR formulation—thirteen lags each, plus a constant term, of the interest rate on commercial paper, the CPI, industrial production, and a commodity price index—is used. I doubt that the implied thirty-month-ahead forecast standard error for prices in the Christiano, Eichenbaum, and Evans paper underlying figure 2 is notably higher. The model on which this assertion is based was fit to the period from January 1950 through October 1997, and the forecast standard error takes into account the need to forecast future values of the right-hand-side variables with the VAR system.

Putting these two points together—that the price level is quite a bit easier to predict than DeLong's naive regressions suggest, and that the effect of policy on the price level is quite a bit stronger than his figure 2 would suggest—we can conclude that the Fed's ability to predict and con-

control inflation is better than an initial reading of DeLong's paper suggests. If sustained deflation does occur, it will more likely reflect policy mistakes than any inability of the Fed to counteract deflationary disturbances.

The paper provides several arguments that deflation is more dangerous or deleterious than inflation. These arguments are not essential to the paper's main point. Hyperinflations have occurred and their consequences have been severe. Deflationary depressions have occurred as well, also with severe consequences. Luckily, it is unlikely that policymakers at any given time will have to choose one or the other.

In some ways the consequences of inflation and deflation seem about equal:

—Anticipated inflation or deflation can be adapted to, so long as the rate of price change is stable and exceeds minus the real rate of return on real capital.

—Hyperinflations, in which significant portions of the economy are forced into barter transactions, are very costly, as are deflations so rapid that the anticipated real return on money moves above that on real capital.

There are some ways in which inflation is worse:

—There is a classic argument that, by reducing transactions costs, slow and predictable deflation produces good effects.

—It seems that high rates of inflation are harder to sustain as predictable.

—Severe deflations, by making government liabilities more valuable, deliver the policy instruments by which they can be ended: fiscal policy that steadily pumps nominal liabilities into the hands of the public becomes a powerful tool to increase private spending. Severe inflations are less likely to be self-limiting. They are likely to reflect and reinforce lack of confidence in the government's fiscal resources and can be ended only by politically difficult fiscal reform.

And there is at least one way in which deflation is worse:

—At modest rates of deflation there is a danger that the real rate of return will shift and cause a previously sustainable deflation rate to become disruptive.

So there are certainly asymmetries. But to my mind they do not all run in one direction, and they may well balance out toward inflation as ultimately the greater danger.

Although the paper does not suggest that monetary policy should attempt to control stock market speculation, it does suggest in passing

that the financial consequences of a stock market crash could be similar to those of a severe deflation in the price level. This may or may not be true. As DeLong points out, it depends on the degree to which equity assets are standing behind nominal liabilities.

But even if it is true, that fact does not imply a case for monetary policy to attempt to stabilize the value of the stock market. Monetary and fiscal policies that produce a real return on money exceeding that on real assets are unsustainable, regardless of what we assume about price stickiness or asset market imperfections. While such a policy persists, the fact that it is unsustainable creates uncertainty that is a further source of disruption. Rapid declines in the real values of assets accompanied by no change in the price level, on the other hand, have negative consequences only because of market imperfections; monetary policy that stabilizes nominal asset values could have good or bad effects, depending on the nature of those imperfections.

If monetary policy stabilizes the stock market, it does so by transforming some of what would otherwise be asset price deflation into price level inflation. At one extreme, it might be that this is all to the good. If entrepreneurs have loan liabilities only because of agency problems and fail to index their loans to aggregate conditions only by convention, then monetary policy that makes nominal loans or bonds change in value with the stock market provides a service, in effect providing the missing indexation to aggregate conditions.

But at the other extreme, it might be that most loan contracts are between agents with different attitudes toward risk and return, with the amount of leverage in portfolios chosen deliberately. In that case, the amount of leverage in portfolios is endogenous, and policy that makes the return on bonds begin to mimic that on stocks will simply bring forth greater leverage, without in the end doing anything to stabilize the financial system. And of course, to the extent that there is stickiness in wages and commodity prices, shifting some of the variability in real asset prices from nominal asset prices to the general price level will be disruptive.

General discussion: Robert Gordon argued that the paper needed to place greater emphasis on the difference between anticipated and unanticipated changes in prices. He saw unexpected price changes as the major reason for financial disintermediation, with the major episodes of disintermediation in the postwar period having taken place in times of high inflation. In

a similar vein, Laurence Ball argued that people with nominal assets and liabilities are primarily concerned about unexpected price changes. He noted that, empirically, the variance of inflation is lower at low rates of inflation, suggesting that low inflation may decrease risks. Gordon was also puzzled that the paper dwelled on the possibility of a stock market crash in a world of deflation. Recently we have seen the opposite correlation: a decline in commodity prices, allowing the Federal Reserve to keep interest rates low, and a stock market boom.

Gordon suggested that the paper would benefit from organizing the discussion of various shocks, such as asset price deflation or depreciation of the currency, within a conventional demand-and-supply framework. He noted that the economy can go into deflation either with a negative demand shock and higher unemployment or with a positive supply shock and lower unemployment. He believed that favorable supply shocks are part of the explanation of recent favorable developments in the United States, just as an unfavorable supply shock was responsible for the fall in output, decline in the stock market, and massive commodity price inflation in the 1970s. Martin Baily added that the distinction between demand and supply shocks should be made in assessing the importance of downward sticky wages; such stickiness need not be a problem in a deflation driven by a supply shock.

Benjamin Friedman observed that recent experience showed time inconsistency was probably not the origin of pervasive inflation and that, even if it were, institutional changes were not required to stop inflation. By now, virtually all the developed countries have achieved low inflation and have done so without significant institutional changes. In the few countries that did make such changes, such as moving to explicit inflation targeting, inflation had in fact already come down. Friedman was also skeptical of the theoretical argument that principal-agent problems create a preference for debt contracts. For a typical American corporation, the value of equity outstanding is significantly greater than the value of debt securities. Moreover, the predominance of equity financing seems greater for the startups and small firms that are the hardest to monitor. Friedman was also unconcerned that, in the event of a deflation, people in the United States would get stuck servicing long-term nominal contracts with nominal rates set in inflationary times. With the exception of the government, few in the United States borrow long term at fixed interest rates. Long-term fixed-rate corporate debt and fixed-rate mortgages are callable,

enabling the firm or homeowner to get out of the deal if interest rates fall. Recent years have in fact seen widespread refinancing of home mortgages as rates have fallen.

In Friedman's view, the more serious risk is of an unexpected fall in the prices of assets used as collateral. Margin requirements mitigate the potential impact of stock price declines, but not of declines in real estate prices. In fact, Friedman asserted, in the United States it is easy to borrow 100 percent of the value of the property in most real estate transactions. He offered the experience of Texas in the 1980s as a good illustration of what can happen when the value of collateral falls. That experience was a solvency problem, not a liquidity problem. The Texas economy was subject to a relative price shock (oil prices fell), and local real estate prices declined. When debtors began to default on loans collateralized with real estate, the value of the real estate taken over by banks was less than the value of the loans on their books. This threatened the banks' own solvency. What happened on a regional scale in Texas could also happen on a national scale, as seen in Japan. Friedman also observed that a rapid runup in the prices of assets used as collateral to borrow from banks poses a difficult policy question. Monetary policy is virtually the only instrument available to control such a runup, but asset price inflation can occur at a time when goods and services prices are well behaved and there is no reason for a policy concerned with price stability and full employment to tighten.

Robert Hall was puzzled that the Federal Reserve does not adopt a regime in which bank reserves earn interest, since controlling the margin between the market interest rate and the interest rate on reserves would provide the Fed with a useful policy instrument. According to Hall, the central bank could raise the equilibrium price level simply by lowering the interest rate on reserves. He stressed that control of this rate was not equivalent to controlling market rates: the reserve rate would not be bounded below by zero—the central bank could pay a negative interest rate on reserves if that was needed during a time of deflation. He believed this would eliminate the unstable deflationary equilibrium discussed by Christopher Sims.

Sims disagreed, however, arguing that for such a policy to be effective, a way would have to be found to index currency or to prevent individuals from converting reserves into currency. Without indexed currency, currency would dominate bank deposits if banks paid negative rates, leading to shrinkage of the banking system.

William Nordhaus reasoned that the dynamics of disinflation are of more concern than disinflation per se. He feared the system's response to inadequate demand would be unstable in the presence of a liquidity trap. With the nominal interest rate already at zero, a shortfall of demand would lead to progressively greater deflation, consequent increases in real interest rates, further falls in demand, and downward pressure on prices. Such a cumulative deflationary process would be difficult to stop with conventional monetary policy. Nordhaus suggested, however, that if monetary policy operated at the longer end of the maturity structure or in equities, or was prepared to discount commercial loans, it might still be effective. Kenneth Arrow noted that interest rates in the Great Depression had reached zero, and on one occasion Treasury bill rates were actually negative, as a result of a tax gimmick. But he pointed out that the fact that the government faced a zero interest rate did not mean that corporate borrowers did also. Hence the kinds of policies suggested by Nordhaus might have been helpful. Martin Baily commented that, in a dramatically deflationary environment like that of the 1930s, or perhaps Japan today, it is unclear that bringing down the nominal interest rate by a percentage point or two would make much difference. The Great Depression witnessed a collapse of the banking system and of confidence. Japan today has a lot of excess capacity, and the effective marginal value of capital may be zero in many industries that have traditionally been the big investors. In both cases, the liquidity trap may be more a symptom of the problem than the root cause.

Baily said he had little concern about deflation in the United States at present. Despite Milton Friedman's warnings, the Federal Reserve has for many years successfully fine-tuned the economy by manipulating shortterm nominal interest rates. It would be reason for concern about deflation if interest rates were already close to zero. However, the federal funds rate is far from zero, and Baily doubted the Fed would need to drive rates that low any time soon. William Dickens agreed with Baily and was skeptical that the Fed would ever allow deflation to occur in the United States. On the other hand, he could imagine the ECB not reacting to deflationary pressures in Europe. The ECB is a new institution with an incentive to establish its credibility, unemployment is already high and the ECB is used to it, and the ECB is committed to price stability without any of Greenspan's equivocation about its definition.

References

- Akerlof, George, William Dickens, and George Perry. 1996. "The Macroeconomics of Low Inflation." *BPEA 1:1996*, 1–59.
- Bernanke, Ben. 1983. "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression." *American Economic Review* 73(3): 257–76.
- Blinder, Alan. 1998. *Central Banking in Theory and Practice*. MIT Press.
- Boianovsky, Mauro. 1998. "Wicksell on Deflation in the Early 1920s." *History of Political Economy* 30(2): 219–75.
- Boskin, Michael, and others. 1998. "Consumer Prices, the Consumer Price Index, and the Cost of Living." *Journal of Economic Perspectives* 12(1): 3–26.
- Burns, Arthur. 1960. "Progress Towards Economic Stability." *American Economic Review* 50(1): 1–19.
- Christiano, Lawrence, Martin Eichenbaum, and Charles Evans. 1998. "Monetary Policy Shocks: What Have We Learned and to What End?" Working Paper 6400. Cambridge, Mass.: National Bureau of Economic Research (February).
- DeLong, J. Bradford. 1997a. "Fiscal Policy in the Shadow of the Great Depression." In *The Defining Moment: The Great Depression and the American Economy in the Twentieth Century*, edited by Michael Bordo, Claudia Goldin, and Eugene White. University of Chicago Press.
- . 1997b. "America's Peacetime Inflation: The 1970s." In *Reducing Inflation: Motivation and Strategy*, edited by Christina Romer and David Romer. University of Chicago Press.
- DeLong, J. Bradford, and Lawrence H. Summers. 1992. "Macroeconomic Policy and Long-Run Growth." In *Policies for Long-Run Economic Growth*. Kansas City: Federal Reserve Bank of Kansas City.
- Eichengreen, Barry. 1992. *Golden Fetters: The Gold Standard and the Great Depression*. New York: Oxford University Press.
- Eichengreen, Barry, and Jeffrey Sachs. 1985. "Exchange Rates and Economic Recovery in the 1930s." *Journal of Economic History* 45(4): 925–46.
- Feldstein, Martin. 1983. *Inflation, Tax Rules, and Capital Formation*. University of Chicago Press.
- Fisher, Irving. 1926. "A Statistical Relation Between Unemployment and Price Changes." *International Labour Review*. Reprinted in the *Journal of Political Economy* 81(2): 496–502.
- Fisher, Irving. 1933. "The Debt-Deflation Theory of Great Depressions." *Econometrica* 1(4): 337–57.
- Friedman, Milton, and Anna J. Schwartz. 1963. *A Monetary History of the United States, 1867–1960*. Princeton University Press.
- Galbraith, John Kenneth. 1954. *The Great Crash*. Cambridge, Mass.: Riverside Press.

- Gordon, Robert J., editor. 1974. *Milton Friedman's Monetary Framework: A Debate with His Critics*. University of Chicago Press.
- Keynes, John Maynard. 1923. *A Tract on Monetary Reform*. London: Macmillan.
- . 1936. *The General Theory of Employment, Interest and Money*. London: Macmillan.
- Kindleberger, Charles. 1973. *The World in Depression, 1929–39*. University of California Press.
- Kydland, Finn, and Edward Prescott. 1977. “Rules Rather than Discretion: The Inconsistency of Optimal Plans.” *Journal of Political Economy* 87(3): 473–91.
- Perry, George. 1998. “Is Deflation the Worry?” Policy Brief 41. Brookings.
- Robbins, Lionel. 1934. *The Great Depression*. Macmillan.
- Rogoff, Kenneth. 1989. “Reputation, Coordination, and Monetary Policy.” In *Modern Business Cycle Theory*, edited by Robert Barro. Oxford, England: Basil Blackwell.
- Romer, Christina. 1990. “The Great Crash and the Onset of the Great Depression.” *Quarterly Journal of Economics* 105(3): 597–624.
- Sargent, Thomas. 1999. *The Conquest of American Inflation*. Princeton University Press.
- Shiller, Robert. 1989. *Market Volatility*. MIT Press.
- . 1997. “Why Do People Dislike Inflation?” In *Reducing Inflation: Motivation and Strategy*, edited by Christina Romer and David Romer. University of Chicago Press.
- Temin, Peter. 1974. *Did Monetary Forces Cause the Great Depression?* W.W. Norton.
- Viner, Jacob. 1936. “Mr. Keynes on the Causes of Unemployment.” *Quarterly Journal of Economics* 51(1): 147–67.