DEFLATION

Current and Historical Perspectives

Edited by

RICHARD C. K. BURDEKIN
Claremont McKenna College

PIERRE L. SIKLOS
Wilfrid Laurier University

CAMBRIDGE
UNIVERSITY PRESS

PUBLISHED BY THE PRESS SYNDICATE OF THE UNIVERSITY OF CAMBRIDGE
The Pitt Building, Trumpington Street, Cambridge, United Kingdom

CAMBRIDGE UNIVERSITY PRESS
The Edinburgh Building, Cambridge CB2 2RU, UK
40 West 20th Street, New York, NY 10011-4211, USA
477 Williamstown Road, Port Melbourne, VIC 3207, Australia
Ruiz de Alarcón 13, 28014 Madrid, Spain
Dock House, The Waterfront, Cape Town 8001, South Africa

http://www.cambridge.org

First published 2004

Printed in the United States of America

Typeface Times Ten 10/13.5 pt. *System* LaTeX 2$_\varepsilon$ [TB]

A catalog record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data

Deflation : current and historical perspectives / edited by Richard C. K. Burdekin, Pierre L. Siklos.

p. cm. – (Studies in macroeconomic history)

Includes bibliographical references and index.

ISBN 0-521-83799-5

1. Deflation (Finance). 2. Monetary policy. 3. Prices. I. Burdekin, Richard C. K. (Richard Charles Keighley), 1958– II. Siklos, Pierre L., 1955– III. Series.

HG229.D384 2004
332.4′1 – dc22 2003069669

ISBN 0 521 83799 5 hardback

Contents

1 Fears of Deflation and the Role of Monetary Policy

Some Lessons and an Overview

Richard C. K. Burdekin and Pierre L. Siklos

INTRODUCTION

Episodes of sustained declines in consumer prices have been rare since the 1930s. Recently, however, in addition to Japan's well-known ongoing experience with deflation, persistently falling consumer prices have been seen in other countries, such as Argentina, China, Hong Kong, Singapore, and Taiwan. Indeed, international success in reducing inflation by the mid-1990s was quickly followed by fresh fears of deflation.[1] Deflation may be "worse" than inflation because of firms confronting rising real wages should nominal wage rigidity prevail.[2] In the United States, Federal Reserve Bank of Richmond President J. Alfred Broaddus, having cast more dissents than anyone else in favor of tighter monetary policy in Federal Open Market Committee (FOMC) meetings in the past decade, recently stated that it would be "ironic to have fought all this time to bring the inflation rate down . . . and then lose price stability on the down side" (see Ip 2002: p. A1). Meanwhile, the FOMC meeting of May 6, 2003, gave official notice of the Fed's concern that "the probability of an unwelcome substantial fall in inflation, though

[1] Norton (1997), *The Economist* (November 15, 1997, pp. 77–78; February 20, 1999a, pp. 19–22; September 25, 1999b, pp. 26–30; November 15, 1999c; September 14, 2002a; October 12, 2002b), Lushkin (2001), and Wanniski (2001) are just some who have raised fears over the specter of deflation. The latest expression of rising interest, if not concern, over the prospects of deflation is reflected in the D-word index produced by *The Economist* (2002c) meant to parallel the magazine's R-word recession indicator that has apparently signaled the onset of earlier recessions. Although the D-word index " . . . is spreading like a plague" it has yet to meet Goodhart's Law that, in the present context, might imply that publicity given to the potential for deflation might well ensure that it never occurs.

[2] There remains lively disagreement among academics, however, over the extent to which wages would in fact remain rigid downward if sustained deflation set in (see, for example, King 1999).

minor, exceeds that of a pickup in inflation from its already low level." As Ip (2003: p. A1) points out, this represented "a profound shift from half a century of preoccupation with fighting inflation."

In the euro area, deflation is a distinct possibility in some of the major economies, especially in Germany (International Monetary Fund 2003).[3] The very low inflation rates in Germany (1 percent or less, at the time of writing, based on the consumer price index [CPI]) have led to complaints that the policy of the European Central Bank has been too tight. Another culprit is the potential role played by the Stability and Growth Pact, which is currently seen as an excessively binding constraint on the fiscal policy of several member countries. Inflexible labor markets pose yet another threat. But while real interest rates have risen sharply in Germany and certain other parts of the euro area, elsewhere in Euroland we see negative real interest rates. And, even though several central bankers have become concerned about the possibility of deflation, many are also keen to point out that such fears are overblown (Bernanke 2002a; Stevens 2002). For example, low inflation in Germany could be a reflection of relative price changes within the euro area (Bean 2002).

The present chapter explores some key themes regarding deflation. First, we review past and present macroeconomic concerns over the causes and consequences of deflation. Next, we examine various perspectives about what deflation means and why policy makers and academics have worried, and continue to worry, about the emergence of deflation. A separate section considers some international evidence that attempts to tease out certain stylized features that can be drawn from the historical evidence on deflation from the nineteenth and first half of the twentieth centuries. Next, we provide an overview of the two deflations in China and Japan. The chapter concludes by providing a summary of the remaining contributions to this volume.

[3] Although the European Central Bank has shied away from expressing concerns over deflation ("So our analysis does not show any tendency for deflation. I want to remove that fear" [Duisenberg 2002: p. 9]), members of the European Parliament have repeatedly expressed such fears partly in light of the lack of clarity over the inflation objective (the so-called second pillar of monetary policy). A case in point is the recent testimony of the ECB president: "The monetary strategy that we have pursued has been to aim for price developments of basically between 0.5 and 2 percent" (Duisenberg 2002: p. 9). Later on, the president adds: "I can confirm that, if the outlook for inflation were to go in the direction below 1 percent, . . . the prospects of deflation, alluded to earlier, would become more threatening" (op. cit., p. 17).

FEARS OF DEFLATION THEN AND NOW

With much of the developed world currently facing near-zero inflation, it is useful to reexamine the channels through which deflation may influence aggregate economic performance. Fisher's (1933) debt-deflation mechanism suggests that declines in goods prices would be closely linked to declines in asset prices, with higher real debt burdens leading to rising default rates and bankruptcy. High debt levels during the 1920s, followed by an unprecedented deflation, which was unanticipated when the debt was issued, may have allowed this mechanism to play an important role in the United States during the Great Depression (Parker and Fackler 2001). There is also the potential for "reverse causation" running from asset prices to goods prices, whereby a severe asset price decline, as in the October 1929 crash, may trigger deflationary pressures in the economy as a whole. Collateral constraints may well also play a role here. In Japan, as land prices and share prices plunged, not only was loan collateral wiped out but bank balance sheets also suffered from direct bank exposure to the stock market, thereby magnifying the developing bad debt problem and making banks still less willing to make new loans.

Until international stock markets began their sharp drop in early 2000, few outside Japan worried about the feedback from asset prices to consumer prices. Today, however, more are inclined to echo the sentiments of Roach (2002: p. 13): "The equity bubble helped create other bubbles – most notably in the housing market and in consumer spending. Their continued existence poses a serious threat to lasting expansion and yet puncturing them raises the grave risks of deflation."

The growing share of wealth in the form of financial assets, as well as large swings in asset prices at the end of the twentieth century, have highlighted the potential for wealth effects on goods prices, in particular, and the economy more generally. Although these effects have yet to be satisfactorily quantified, Shilling (2001) argues that the sudden negative effect on household net wealth in the face of stock market losses in 2000 could have important effects on savings-consumption patterns. Indeed, Shilling (2001: p. 43) asserts that even a relatively moderate switch from the recent two-thirds of a percentage point decline in the savings rate to a one percentage point increase "will virtually ensure deflation." Although we do not know at this point whether any such effect will actually emerge in the United States or elsewhere, the post-2000 period of stock market weakness in the United States and in other

countries has certainly been followed by rising default rates on corporate debt and a number of high-level bankruptcies. This has helped fuel concern that the United States may be at risk of emulating Japan's recent period of economic decline whereby, as in the case of the Great Depression, declines in both goods and asset prices are combined with a slumping real economy.

Although it is unclear just how much monetary policy makers should fear deflation today, influential individuals at the U.S. Federal Reserve did not worry enough about deflation in the 1920s and early 1930s. Indeed, the competence of the interwar Fed has been the subject of considerable ongoing debate throughout the decades (see, for example, Friedman and Schwartz 1963; Meltzer 2003). Disagreements over the role of credit in deflation and concerns as to how to reinvigorate the economy were, of course, also expressed in public at the time. Strikingly, the relationship between deflation and central bank policy was often entirely missing from the discussion, however. For example:

> Governor Harding [of the Federal Reserve] said: "We have heard much complaint of constant deflation, which some allege has been the cause of the depression, but it is evident that the deflation which has taken place has not been a deflation of credit or currency." (*New York Times*, January 19, 1921, p. 10, col. 4)

A few days later, a former Chancellor of the Exchequer argued,

> This policy of gradual monetary deflation, but deflation so guarded as to not interfere with production, is a policy impossible of execution. . . . A fall in wholesale prices will follow, due to goods being thrown upon the market by traders who are unable to carry their stocks or have failed in business. There will be a diminution in production, profits will be greatly lessened and unemployment will grow. . . . (*New York Times*, January 29, 1921, p. 2, col. 2)

While not all deflationary episodes have been associated with overall declines in economic activity (Bank for International Settlements 1999: pp. 78–80), Sylla (1991) does suggest that nineteenth-century U.S. evidence offers further examples of widespread speculative excesses apparently triggering a cycle of boom and bust that produced not only financial disturbances (or "panics") but full-blown economic depression. In addition to the potential threat of Fisher's debt-deflation mechanism, another reason to fear deflation in consumer prices is that, if it is expected that such declining prices will continue in the future, there is an incentive to delay purchases. This then leads to a further decline in aggregate demand, putting further downward pressure on prices and suggesting that deflation could be at least partially

self-sustaining. This helps explain why Keynes (1923), for example, emphasized that deflation was more dangerous than inflation (see also Laidler 1999: p. 109; Meltzer 1988: p. 47).

Monetary policy makers must also confront the zero lower bound on nominal interest rates. Once rates have been cut to zero, as in Japan, real interest rates remain positive in the face of deflation; yet there is no scope for providing any further boost through interest-rate policy alone. Concerns over avoiding deflation are reflected in a statement made by David Dodge shortly before he assumed the office of Governor of the Bank of Canada in 2001 (as quoted in Thorsell 2001: A15): "I think the costs of going down to [zero inflation] are high, and there are real asymmetries when you get into price deflation. We haven't got much evidence that things work a lot better at zero than they do at one or two."

Meanwhile, in the United States, Treasury official John Taylor, reflecting on the current Japanese experience with deflation, stated: "I get worried about deflation and that is another reason to have an inflation target" (see Snowdon and Vane 1999: p. 201). This begs the question of how deflation arises in the first place and why it appears to have " . . . a frightening history" (Poole and Rasche 2002: p. 1). Policy makers in the 1930s, while facing an unprecedented decline in overall economic activity, did nevertheless have plenty of past experiences with deflation upon which to draw. As Mundell (2000: pp. 329–330) puts it, "Deflation was already in the air . . . the deflation of the 1930s has its precedents in the 1780s, the 1820s, and the 1870s." Snyder (1935: p. 202) draws the following conclusion from these earlier episodes: "Periods of serious price disturbances are periods of industrial and financial disturbance and social unrest. Practically never one without the other. And periods of price stability are periods of industrial and social equilibrium and sanity."

Contemporary observers recognized that financial distress occasioned by falling prices, and the belief that these conditions would continue, was exacerbating deflationary pressures:

> The continuous expectation of a further fall in prices has had a very restricting influence on the buying power of the public. The steady reduction in prices has made it impossible in a great many cases to pay back money borrowed at a time when prices were higher. . . . Further, restriction of credit has followed, with the result that prices have been forced down still more. . . . (*New York Times*, November 27, 1921, p. 8, col. 1)

Keynes had also long recognized that expectations could only be affected if the policies put in place were credible: "For my part, I believe that confidence in the price level is the biggest practical help which the official would give to the business world." (as quoted in *The Times* August 7, 1923) Falling goods prices could be triggered by any number of factors, including not only a drop in asset prices but also positive supply shocks that shift the economy's aggregate supply curve to the right, thereby putting downward pressure on prices even as output increases. Although this allows for the possibility of "good" deflation rather than "bad" deflation, it is still true that sustained deflation is only possible when the rate of money growth falls behind the rate of growth of output and money demand. Just as the inflation of the 1970s could not be ascribed to supply shocks alone, but rather required central bank accommodation of these supply shocks through loose monetary policy, sustained deflation must surely imply a similar failure of central bank policy in the opposite direction. According to Federal Reserve Chairman Alan Greenspan (1998): "While asset price deflation can occur for a number of reasons, a persistent deflation in the prices of currently produced goods and services – just like a persistent increase in these prices – necessarily is, at its root, a monetary phenomenon." Contrasting with this position is the view expressed by former Bank of Japan Governor Hayami (2001) that, "at a time when prices decline on account of productivity gains based on rapid technological innovation, a forceful reduction in interest rates with a view to raising prices may amplify economic swings."[4]

Japan's recent experience actually reveals abundant evidence of a chronic shortfall of aggregate demand, and the long-lived period of decline dates back to the abrupt tightening in Japanese monetary policy at the end of the 1980s. Using a quantity-theory-based approach, Hetzel (1999) points to a sudden shift from excess money creation in the 1980s to an overly restrictive monetary policy that lagged behind growth in money demand in the early 1990s. Miyao's (2002) empirical analysis supports the importance of this "deflationary shock" and Miyao points to persistent effects of monetary shocks on real output during the rise and fall of the "bubble economy." It is certainly hard to see why monetary expansion would hurt Japan's supply-side performance today. After all, the problem is that of a downturn, not an upturn, in the real economy. Nor does there seem to be any clear reason

[4] This view might be more defensible if aggregate price movements were actually being explained by movements in the prices of goods influenced directly by technological change (e.g., computers). But, as Kuttner and Posen (2001) point out, until recently, Japan's CPI excluded products undergoing significant productivity improvements.

why expansionary policies would delay or impede any needed structural adjustments in the Japanese economy – a perspective that would have us embracing the "'liquidationist' views of then–Treasury Secretary Andrew Mellon and others who opposed macroeconomic stimulus during the Hoover administration in the United States" (Kuttner and Posen 2001: p. 103).[5] It is probably just as well that the Bank of Japan did an about-face in late 2001 and concluded, in agreement with the government, that deflation is enemy number one. By that time, at least one member of the Policy Board of the Bank of Japan was seriously contemplating the possibility of a deflationary spiral (Takebe 2001a, 2001b; Bank of Japan 2001).

WHAT IS DEFLATION ANYWAY? HISTORICAL AND INTERNATIONAL PERSPECTIVES

Deflation occurs only when there is a general fall in some aggregate price level. As several observers have pointed out, however, this does not preclude the possibility of *relative* price changes wherein some components of the price level fall while others keep rising. Although most discussions about the role of monetary policy focus on the behavior of headline price indices, deflation in certain key components of aggregate prices can be just as worrisome if the effects of deflation in some sectors of the economy eventually spill over onto the rest of the economy. Hence, in what follows, we shall treat deflation as a sustained fall in some aggregate price level that has demonstrable macroeconomic implications. In this fashion, our definition covers not only prices for goods and services but it can also include asset prices more generally.

The prewar view that any plans to stabilize goods prices must make allowance for productivity improvements is perhaps exemplified by Viner's (1933) reference to a productivity-induced deflation as "balanced deflation." Furthermore, many policy makers and academics in the 1920s and 1930s believed that the occasional deflation was actually a necessary spur

[5] In this regard, Fisher (1935: p. 265–266) also quotes Federal Reserve Board Governor Miller as rejecting Congressional proposals to stabilize prices because "the thing to be expected in this country if we operated under a stabilization philosophy would be inflation." On the otherhand, Hayek (1931) claimed that opponents of deflation focused too strongly on aggregate price movements, neglecting the role of relative price changes and the role of productivity changes in directing economic resources to their best uses. According to Hayek (1931: p. 7), contemporary views of deflation led to ". . . very erroneous opinions . . . that a rising price level tends always to cause an increase in production, and a falling price level always a decrease in production."

for economic growth and therefore a symptom of economic health, not economic malaise (see DeLong 1997).[6] Dickey (1977) offers some support for this perspective, arguing that the U.S. deflation of 1869–1896 was primarily of the "good" variety since relative price changes, profit expectations, and bond yields all implied that supply-side influences dominated price movements over demand-side effects.[7] Another way of addressing this issue is to assess how much of a deflation (or, for that matter, an inflation) is monetary in nature (i.e., demand-pull). More recently, Greenspan (1998) has recognized the advisability of falling prices in the face of productivity improvements while also warning that "... when the characteristics of products and services are changing rapidly, defining the unit of output, and thereby adjusting an item's price for improvements in quality, can be exceptionally difficult."

The conflict between "demand-pull" and "cost-push" views of deflation harks back to controversies in the late nineteenth and early twentieth centuries over the causes of inflation and deflation. Laughlin (1933: p. 225) defended the costs of production view while simultaneously denigrating the theories associated with Fisher and others. However, it is the views of Fisher (e.g., Fisher 1911) and others, including Keynes, that triumphed because it was eventually recognized that nominal interest rates do not fully adjust to falling prices, except in the long run. Therefore, the distinction between anticipated and unanticipated deflation is critical to an understanding of the potential consequences of a deflation. Nevertheless, it ought to be emphasized once more that even fully anticipated deflation can have negative economic consequences if, for example, the sector of the economy that experiences lower prices suffers from wages that are downward inflexible.

In an exhaustive review of the causes and consequences of the ongoing deflation in Japan, Ahearne et al. (2002) conclude that unanticipated shocks and insufficiently aggressive policies have been the main problem in that country.[8] The idea of an expectations trap has also resurfaced amid calls for

[6] See also Selgin (1995).

[7] Dickey (1977: p. 5), in fact, characterizes this 1869–1896 period as one of "dramatic changes in production functions."

[8] Much of the evidence presented by the authors is based on forecasts from Consensus Economics. However, they never compare the forecasting performance in Japan with the experience in other industrial countries such as the United States. Siklos (2002: ch. 6) argues, based on the monthly forecasts of inflation and real GDP growth in *The Economist*, while the inflation rate was poorly forecasted in Japan in 1997–1998 the resulting forecast errors were not larger than, say, the errors in forecasting U.S. inflation in the early 1990s when the economy was in a recession. On the other hand, it is true that forecast errors were far more volatile in Japan than in the United States and this may be taken as causal evidence that the economic environment more generally was considerably more uncertain in Japan.

the Bank of Japan to deliberately engineer expectations of inflation while expanding the money supply through the monetization of government debt (Krugman 1998). Exactly how such a policy would convince the public that future deflation will evaporate, especially when the lever of interest rates has vanished, is left unexplained. Nevertheless, this is exactly what the Bank of Japan *did* do after leaving the gold standard in 1931 – at which time Japan's response to the onset of the Great Depression appears to have been much more aggressive than the widely studied Federal Reserve (non)response. Large-scale government debt purchases helped facilitate robust economic growth in Japan through most of the 1930s and "allowing the exchange rate to depreciate effectively stopped domestic deflation" (Cargill, Hutchison, and Ito 2000: p. 140).[9]

As was clearly true in the 1930s, the choice of exchange rate regimes remains a key question that continues to be debated today. Whereas there was no fixed exchange rate constraint in the case of post-bubble Japan, other recent deflations in Argentina and Hong Kong involved policy makers applying deflationary policies to maintain their fixed exchange rate with the strong U.S. dollar. The desire to escape the external constraint limiting policy makers' ability to counter deflationary pressures during the Great Depression led the United Kingdom and Japan in 1931, and later the United States in 1933, to abandon the prewar international gold standard. Hong Kong's deflationary trend after November 1998 could not be readily countered by expansionary monetary policy because of the continued exchange rate commitment, however, and when "U.S. monetary policy tightened in the summer of 1999 . . . Hong Kong had to follow suit" (Jao 2001: p. 164). Hong Kong's consumer price index has continued to fall every year since 1999 and, by the fall of 2002, property values were down 65 percent from 1997 levels. Hong Kong's adherence to the currency board arrangement vis-á-vis the U.S. dollar contrasts, of course, with Argentina's December 2001 move to float its exchange rate after being mired in a four-year recession.

China's deflation, unlike that of Hong Kong, predated the Asian Financial Crisis of 1997–1998 and began in the midst of extremely tight monetary policy aimed at combating an inflationary spike in 1993–1994. Although some observers like Bernanke (2002b) and Stevens (2002) contend that the ensuing

[9] This accords with Viner's (1933: p. 26) more general observation that the "countries which went off the Gold Standard have . . . weathered the economic storm much better than we." And at this time, Sweden in the 1930s even pioneered the use of price level targeting as an explicit policy objective (Berg and Jonung 1999; Fregert and Jonung: in this volume).

deflation may be one of the few to fall into the good category (that is, driven by productivity improvements), this perspective is controversial. It has also been alleged that cheap Chinese exports have been putting downward pressure on prices elsewhere in Asia. For example, Lehman Brothers economist Graham Parry argues that this effect will be especially strong "for countries that compete on price rather than technology.... Because of it, Asia will remain a source of deflation for the rest of the world" (see Booth and Pottinger 2001: p. A2). As concerns with deflation continue to mount today, we should not forget that scope for international transmission of deflationary pressures remains an important policy issue.

To sum up, good or productivity-generated deflations are the exception. In general, most deflations reflect an expectational trap assisted by poor policy choices. Few today would see deflation as the normal, if not inevitable, cyclical counterpart of inflationary tendencies in the economy. Deflation could initially reflect supply-side technological improvements. But, as the Japanese example amply demonstrates, persistent deflation eventually exposes poor policy choices and, in this respect, raises fears of deflation on a global scale.

HISTORICAL EVIDENCE ON DEFLATIONARY EPISODES

This section explores the properties of annual price level data extending back into the nineteenth century (see also the extended version of this chapter available at www.wlu.ca/~wwwsbe/faculty/psiklos/deflation.htm). Whereas sustained inflation is the hallmark of the post-1945 period, the earlier era offers a mix of inflation and deflation. Table 1.1 presents some international evidence concerning the frequency of deflationary episodes in 20 countries (including the United States). The data suggest that, while most of the foreign deflations occurred at the same time as in the United States, the fraction of deflationary years that overlap with the U.S. experience drops sharply if we exclude the Great Depression. This episode was clearly an international phenomenon. Nevertheless, deflations were frequent prior to 1945 in many countries, even though, with the exception of the United Kingdom and France, they did not occur as frequently as in the United States, especially if the years of the Great Depression are excluded.

If we examine simple pair-wise cross-correlations between deflations in the United States and elsewhere in our 20-country sample, we usually find

Table 1.1. *The historical experience with deflation: pre-1945*

			Excluding great depression (1928–1933)		
Country	*No. of years of deflation pre-1945*	*Percent of time common with U.S.*	*Number of episodes of deflation*	*No. years of deflation*	*Percent of time common with U.S.*
Australia	33	76	5	13	30
Austria	11	45	1	2	5
Belgium	32	78	10	21	49
Canada	10	80	2	4	9
Denmark	31	87	7	22	51
Finland	12	50	2	1	2
France	34	82	4	24	56
Germany	27	59	7	18	42
Ireland	8	75	4	2	5
Italy	34	85	7	24	56
Japan	9	56	1	1	2
Netherlands	39	72	5	22	51
Norway	18	67	2	6	14
New Zealand	12	83	1	5	12
Portugal	7	86	2	2	5
Spain	11	36	3	2	5
Sweden	33	82	9	21	49
Switzerland	26	69	5	13	30
U.K.	40	80	5	26	60
U.S.	43	—	4	24	—

Periods of deflation include years when the year-over-year change in consumer prices is zero or negative. All data are annual. Episodes of deflation refer to the number of years of consecutive deflation interrupted by inflation. Samples are not the same for all countries.

Sources: See Appendix available at www.wlu.ca/~wwwsbe/faculty/psiklos/deflation.htm.

that U.S. deflations either *lead* deflations elsewhere or are coincident.[10] Only the Australian and Italian experiences reveal no apparent statistically significant cross-correlations. Also, it is worth noting that, while the peaks in the cross-correlation functions are usually positive, an indication that price declines in the United States are correlated with similar reductions in prices in other countries, the opposite is found for Austria, Denmark, and Germany. Austria and Germany experienced hyperinflation during the sample considered, which may explain this result, while the deflation in Denmark during the 1920s was both sharper and more persistent than in the United States. Table 1.1 also notes the number of episodes of deflation evaluated as the

[10] It was suggested to us that, over part of the sample considered, the U.K. might be a better candidate as a basis of comparison. However, the essentials of our arguments are unchanged if we use U.K. data.

instances of consecutive years of deflation separated by at least one year of inflation. Generally, deflations occur fairly infrequently – though, in several European countries, multiple episodes of deflation were experienced.

A way of thinking about the consequences of deflation versus inflation is to examine their persistence properties. Burdekin and Siklos (1999) find, using a data set similar to the one being used here, that an AR(1) model of inflation, augmented with other variables, adequately explains the evolution of inflation over long periods. However, this earlier work makes no distinction between inflation and deflation episodes for the four countries examined (United Kingdom, United States, Canada, and Sweden). In an AR(1) model, inflation persistence is estimated by the coefficient on the lagged inflation rate from the following expression:[11]

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \varepsilon_t \tag{1.1}$$

where π is the annual rate of inflation and α_1 is the measure of inflation persistence. Based on equation (1.1), we find that inflation is easier to predict, based on its past history, than deflation and this may be one reason for the unease with policies or events that lead to falling prices. Why does this matter? An important argument in modern macroeconomics is that economic "shocks," that is, unexpected movements in economic variables, create fluctuations in economic activity. If deflation is more difficult to predict, then unexpected movements are likely to have a larger economic impact.[12] This is, of course, simply an argument for stability in the movement of prices.

Persistence, as defined here, while a function of the particular monetary regime in place, also serves another function. Assuming the Fisher relationship between nominal interest rates and inflation holds approximately, highly persistent inflation will translate into highly persistent interest rates, another well-known feature of post–World War II data. The likelihood of reaching the zero bound of interest rates may very well be a function of the level of

[11] Needless to say, more complicated models can be developed to address the question (e.g., Benati 2002; Cogley and Sargent 2002). Nevertheless, these approaches do not arrive at fundamentally different conclusions, concurring that inflation persistence is not an intrinsic property of all monetary regimes.

[12] Whether policy makers or agents learn from these errors depends, however, on the size of such shocks. If the shock is large, learning about such an event will likely be faster than where there is a succession of small shocks. It should be added, however, that recognizing a large shock does not guarantee that the right policies will be put in place to deal with its consequences.

inflation persistence, since, for example, higher interest rates can be used to maintain positive inflation expectations. Unfortunately, sticky inflationary expectations may also pose considerable difficulties for the conduct of monetary policy if deflation is persistent.[13] A separate question then, and one that is outside the scope of this chapter, is what level of inflation is consistent with some notion of price stability and thereby can prevent a deflationary trap.[14]

Figure 1.1 provides forecasts of CPI inflation over two centuries of data for three cases. The top figure shows the case in which the data are "uncensored," which means that we implicitly assume agents make no separate allowance in their forecasts for inflation or deflation.[15] The remaining two figures are for the cases in which there is a memory of only inflation or only deflation, respectively, but not both. Root-mean-square-error estimates reveal that the case in which memory of deflation is excluded (middle figure) produces the best forecasts followed by the case in which both inflation and deflation data are incorporated into the model (top figure). Not surprisingly, the least successful forecasting model is the one that relies on effectively deflation data alone.

There are some interesting additional observations that can be made about the results shown in Figure 1.1. First, censoring inflation implies that the Great Depression could not have been anticipated despite the deflation of the 1920s. Second, even if agents use all available information (as in the top entry in Figure 1.1), they will consistently underestimate the *severity* of sharp inflations or deflations. Finally, a model that is based solely on what we might call "fears" of deflation (bottom Figure 1.1) may imply that the deflation will end up becoming uncontrollable. Overall, the evidence suggests that the prior emphasis on whether price level changes before World War II can be forecasted (Barsky and DeLong 2000; Summers 1983) may be

[13] Besides inflation persistence, the speed with which shocks are transmitted also has important implications for interest rate adjustment (Yates 2002). If an interest rate change proceeds quickly through the transmission process, smaller changes will be required to achieve a desired inflation and output outcome and, consequently, there is a reduced probability of hitting the zero bound for nominal interest rates.

[14] The theoretical literature (e.g., see Orphanides and Wieland 1998; Amirault and O'Reilly 2001), however, finds that the likelihood of a deflationary spiral is much greater at inflation rates below 1 percent. Hence, one is likely to want to exclude 0 percent from an inflation target. By 2002, no industrial country with an explicit inflation target included 0 percent as a lower bound.

[15] The AR(1) case is equation (1.1). The AR(1) + WPI is equation (1.1) augmented with lagged inflation in the wholesale price index (WPI). Kahneman and Tversky (1979) argue that "editing" of information is actually more the rule than the exception – as is consistent with the literature on "bounded rationality."

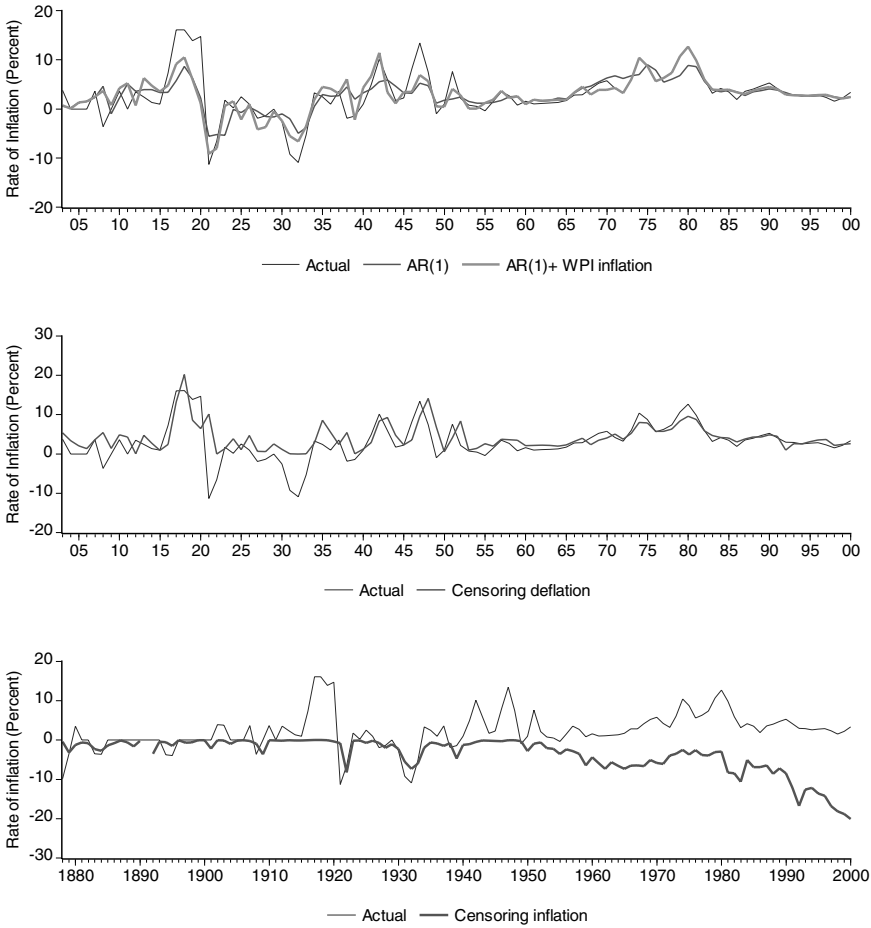

Figure 1.1. Alternative Forecasting Models of Inflation: Annual U.S., 1800–2000

Note: In the case of censored inflation, Tobit estimation is used. In the top figure, the entire history of inflation is used. In the middle figure, only the history of positive inflation is used, while in the bottom figure, only the history of zero or negative inflation is used.

misplaced. The key point is not to separate episodes of inflation. It seems more important that episodes of inflation be separated from instances of deflation.[16]

Clearly, aggregate demand and supply disturbances jointly determine inflation and output performance. Following Bayoumi and Eichengreen

[16] Whereas the foregoing analysis is that inflation forecasts are based on a purely backward-looking model, Fuhrer (1997) argues that the behavior of actual U.S. inflation is best described using a mix of backward- and forward-looking features. Re-estimation allowing for both forward-looking and backward-looking behavior does not significantly improve our ability to forecast deflation, however, especially during the 1895–1920 period.