Deflation and Depression: Is There an Empirical Link?

By ANDREW ATKESON AND PATRICK J. KEHOE*

According to standard economic theory, deflation is the necessary consequence of optimal monetary policy. In 1969, Milton Friedman argued that, under the optimal policy, the nominal interest rate should be zero, and the price level should fall steadily at the real rate of interest. Since then, Friedman's argument has been confirmed in a formal setting (see e.g., V. V. Chari et al., 1996; Harold Cole and Narayana Kocherlakota, 1998).

Most policymakers, however, are extremely reluctant to implement any policy that would lead to deflation. This reluctance seems to stem from the experience of the Great Depression, in which deflation and depression appear to have been tightly linked (see e.g., Ben Bernanke and Kevin Carey, 1996). That experience has led to theories in which deflation leads to depression. The quantitative ability of those theories to account for the Great Depression is now being debated (see e.g., Cole and Lee Ohanian, 2001).

Here we examine the empirical relationship between deflation and depression in a broad historical context, including but not limited to the Great Depression. We use a panel data set on inflation and real output growth for 17 countries and more than 100 years. To focus on medium-term fluctuations, we break the time series on inflation and real output growth for each country into five-year episodes, and for each episode, we compute the average annual inflation rate and the average annual real output growth rate. For any episode, we define a *deflation* as a negative average inflation rate and a *depression* as a negative average real output growth rate. Throughout, we restrict attention to *moderate inflations,* those with average annual inflation below 20 percent.

Our main finding is that the only episode in which there is evidence of a link between deflation and depression is the Great Depression (1929–1934). We find virtually no evidence of such a link in any other period. Here we have made no attempt to distinguish anticipated from unanticipated deflations, while theory, of course, makes a sharp distinction. Optimal monetary policy in a broad class of models with nominal rigidities dictates engineering small anticipated deflations and avoiding unanticipated deflations altogether. To the extent that the deflation in the Great Depression is thought of as unanticipated, as in most existing theories, this episode is not relevant for evaluating the costs of anticipated deflation. Our finding thus suggests that policymakers' fear of anticipated policy-induced deflation that would result from following, say, the Friedman rule is greatly overblown.

We note here that, since World War II, one country has come close to having both a depression and a deflation: Japan in the late 1990's. Is Japan's recent slowdown from an historically high average growth rate primarily due to its very low inflation rates? We doubt it. Since 1960, Japan's average growth rates have basically fallen monotonically, and since 1970, its average inflation rates have too. Attributing this 40-year slowdown to monetary forces is a stretch. More reasonable, we think, is that much of the slowdown is the natural pattern for a country that was far behind the world leaders and had begun to catch up.

I. The Data

All of our series end in 2000. Here are the countries (and the years their data start): Argentina (1885), Australia (1862), Brazil (1861), Canada (1870), Chile (1908), Denmark (1871), France (1820), Germany (1830), Italy (1867), Japan (1885), the Netherlands (1900), Norway (1865), Portugal (1833), Spain (1849), Sweden (1861), the United Kingdom (1870), and the

*Atkeson: Department of Economics, Bunche Hall 9381, University of California–Los Angeles, Los Angeles, CA 90095-1477, Federal Reserve Bank of Minneapolis; Kehoe: Research Department, Federal Reserve Bank of Minneapolis, 90 Hennepin Avenue, Minneapolis, MN 55401-2171, and University of Minnesota. We thank Kathy Rolfe for excellent editorial assistance and Yan Bai for excellent research assistance. The views expressed herein are those of the authors and not necessarily those of the Federal Reserve Bank of Minneapolis or the Federal Reserve System.

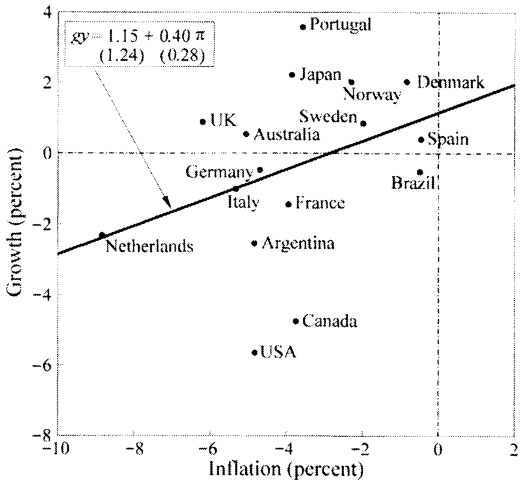

FIGURE 1. THE GREAT DEPRESSION EPISODE: ANNUAL INFLATION AND REAL OUTPUT GROWTH IN 16 COUNTRIES, 1929–1934

United States (1820). For all countries except Australia and Denmark, the data up to 1980 are taken from Arthur Rolnick and Warren Weber (1997). The data for Australia and Denmark up to 1980 are taken from David Backus and Kehoe (1992). The data for 1980 on are from the International Financial Statistics of the International Monetary Fund. (The pre-1980 data are missing some observations.)

We choose the five-year episodes to start and end with years ending in "9" or "4." This way, we include the Great Depression of 1929–1933 in a single episode covered by the five-year average of 1929–1934 and the depression of 1921–1922 in the five-year average of 1919–1924.

II. The Findings

A. *The Great Depression Episode*

We start with the Great Depression episode, 1929–1934. The data for this episode do seem to show a link between deflation and depression—but not an overwhelmingly tight link.

In Figure 1, we plot average inflation and output growth for the 16 countries for which we have data for this period. (Chile's output data are missing.) In 1929–1934, all 16 countries had deflation, eight had deflation and depression, and the other eight had deflation but no depression. For all 16 countries, a regression of output growth on a constant and the inflation rate has a slope coefficient of 0.40 (0.28). (Here, and throughout, we record the standard error of a regression coefficient in parentheses.) The slope coefficient implies that, on average, a 1-percentage-point lower inflation rate is associated with a drop in growth of 0.4 of a percentage point, say, from 3.40 to 3.00 percent. (We summarize all our regressions in Table 1.)

TABLE 1—REGRESSION OF OUTPUT GROWTH ON INFLATION

	Regression equation	
Episode	Constant	Slope
Great Depression (1929–1934)	1.15 (1.24)	0.40 (0.28)
Other episodes		
Including world war	3.02 (0.19)	0.04 (0.03)
Excluding world war	2.96 (0.15)	0.10 (0.03)
Before Great Depression (pre-1939)	2.35 (0.18)	0.11 (0.04)
After World War II (post-1949)	4.00 (0.28)	−0.03 (0.04)
All episodes (1820–2000)	2.74 (0.17)	0.08 (0.03)

In the Great Depression episode, then, all countries had deflation, and half of them had depression. In a regression sense, there seems to be a link here. Researchers disagree on how strong that link is. Some, like Barry Eichengreen and Jeffrey Sachs (1985) and Bernanke and Carey (1996), argue that deflation and depression during the Great Depression were closely linked; Cole et al. (2003) argue to the contrary.

B. *Outside the Great Depression*

While the debate about the Great Depression episode is ongoing, our interest lies mainly in looking for a robust relationship in a broader historical context. If we find none, the Great Depression may have been a special experience with little to offer policymakers considering a deflationary policy today. And that is what we find.

In Figure 2, we plot average inflation and output growth rates for the 17 countries for all five-year periods except 1929–1934. Here we see only eight episodes with both deflation and depression. There are 65 episodes of deflation

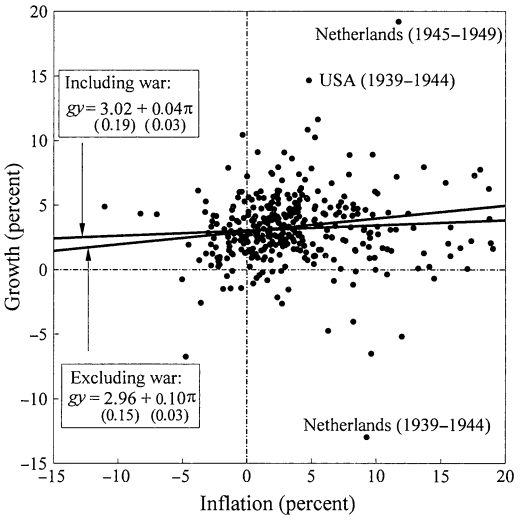

FIGURE 2. EPISODES OUTSIDE OF THE GREAT DEPRESSION: AVERAGE INFLATION AND REAL OUTPUT GROWTH IN 17 COUNTRIES IN ALL FIVE-YEAR PERIODS EXCEPT 1929–1934

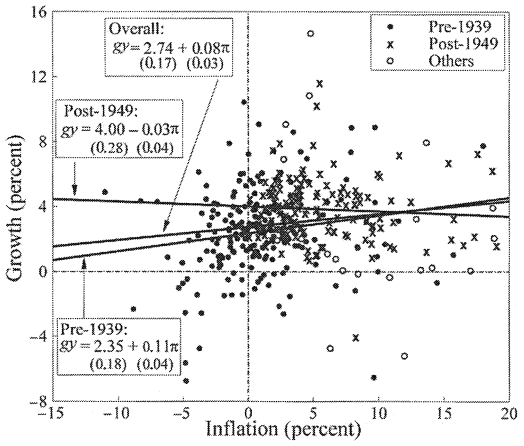

FIGURE 3. ALL EPISODES: AVERAGE INFLATION AND REAL OUTPUT GROWTH IN 17 COUNTRIES IN ALL FIVE-YEAR PERIODS, 1820–2000

without depression and 21 of depression without deflation. Thus, 65 of 73 deflation episodes had no depression, and eight of 29 depression episodes had no deflation. What is striking is that nearly 90 percent of the episodes with deflation did not have depression. In a broad historical context, beyond the Great Depression, the notion that deflation and depression are linked virtually disappears.

Note that most of the episodes in the data set that have deflation and no depression occurred under a gold standard; does that somehow make them irrelevant for shedding light on deflations under a fiat system? No. If we interpret such standards as a rule with some commitment, as many (like Michael D. Bordo and Finn Kydland [1995]) do, then these episodes seem at least as relevant for thinking about the effects of following a Friedman rule as are the episodes in the post-World War II data, when policy was more discretionary. And if we think that the world economy has changed so much since World War II that all the data before it sheds no light on what might happen in an economy today, then there is not much to discuss, since in the post-World War II period, there are no episodes of deflation. Moreover, as has been commonly noted, inflation is actually negatively related to output growth in the post-World War II data.

A more compelling objection is that the data from periods of world wars are just not relevant for other periods. We thus investigate the data excluding all war-related episodes. We find that war does seem to play a role in generating depression. Of the 21 depression episodes without deflation, 10 were related to a world war: four during World War I, three during World War II, and three right after World War II. (We view Japan's dismal growth in 1949–1954 as war-related.) But that does not change our result about deflation and depression. Based on all of the data outside of the Great Depression, a regression of output growth on inflation has a slope coefficient of 0.04 (0.03). Excluding all the data from the war-related episodes (1914–1919, 1939–1944, 1944–1949) and the 1949–1954 episode for Japan gives a slope coefficient of 0.10 (0.03). These data thus show little or no relationship between deflation and depression. This finding is consistent with that of Bordo et al. (2002).

C. *The Overall Relation*

In Figure 3, we display all of the data. Here the regression line has a slope coefficient of 0.08 (0.03). Thus, a 1-percentage-point drop in inflation is associated with a drop in the average

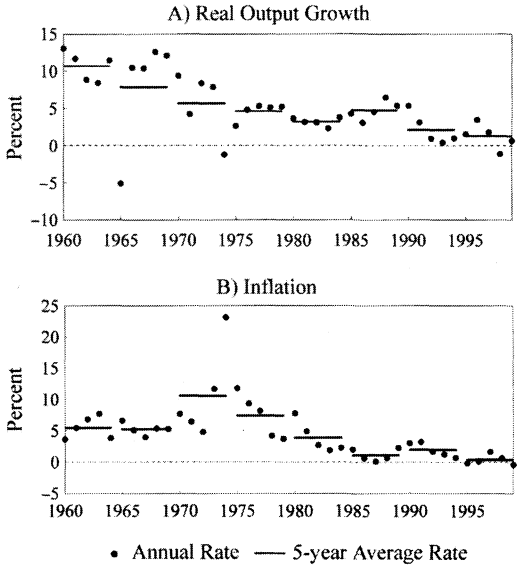

FIGURE 4. JAPAN SINCE 1960: REAL OUTPUT GROWTH AND INFLATION, 1960–1999

real growth rate of just 0.08 of a percentage point, say, from 3.08 to 3.00 percent.

The relation between deflation and depression does differ pre- and post-World War II. The slope coefficients are 0.11 (0.04) in the pre-World War II data and −0.03 (0.04) in the post-World War II data. The postwar result is consistent with the results of many studies, which typically associate higher inflation and lower growth.

D. *Japan*

In the postwar data, Japan's experience in the 1990's is the closest that any major economy has come to having both a deflation and a depression. Economists debate whether this experience is evidence of a link between these conditions. To put Japan's recent experience in context, consider Figure 4, where we plot its annual rates of output growth and inflation as well as the five-year averages since 1960.

Figure 4 essentially shows a 40-year decline in the output growth rate (Fig. 4A) and a 30-year decline in the inflation rate (Fig. 4B). We think standard theories, either neoclassical or new Keynesian, would have a hard time blaming Japan's secular growth slowdown on its secular decline in inflation. But that slowdown would naturally arise in many growth models in which a country grew rapidly in the early postwar period because it had been below its steady-state growth path; as it caught up to this path, its growth would naturally slow.

Has Japan's growth slowed too much? Not relative to countries like Italy and France. At 1.41, Japan's growth in the 1990's was dismal compared to the U.S. growth of 3.20, but not compared to the growth of Italy (1.61) or France (1.84) (see e.g., Atkeson and Kehoe, 1998).

III. Concluding Remarks

The data suggest that deflation is not closely related to depression. A broad historical look finds many more periods of deflation with reasonable growth than with depression, and many more periods of depression with inflation than with deflation. Overall, the data show virtually no link between deflation and depression.

This study simply characterizes the relation in the raw data between deflation and output growth, with no attempt to control for anything, like the type of monetary regime or the extent to which the deflation was anticipated. Perhaps a link between deflation and depression could be teased out of the data with a well-motivated set of controls. Our contribution here is to note that, without such controls, the data show no obvious relationship. The bar has thus been raised for those who claim that deflation and depression are closely linked.

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