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The Risk of Deflation

The worsening global recession has heightened concerns that the United States and other economies could enter a sustained period of deflation, as did Japan in the 1990s and the United States during the Great Depression. Indeed, a popular version of the well-known Phillips curve model of inflation predicts that we are on the cusp of a deflationary spiral in which prices will fall at ever-increasing rates over the next several years. A sizable and persistent deflation would likely worsen already very difficult global economic and financial problems. Macroeconomic forecasters, however, generally view such a dire outcome as highly unlikely. The most recent Survey of Professional Forecasters (SPF) puts only a 1-in-20 chance of core price deflation this year or in 2010. Are we on the brink of years of deflation, or are the professional forecasters right? This *Economic Letter* examines the risk of deflation in the United States by reviewing the evidence from past episodes of deflation and inflation.

The Phillips curve and the risk of a deflationary spiral

A useful framework for examining the behavior of inflation and the risk of deflation is provided by the Phillips curve model. This theory posits that the inflation rate depends positively on the *expected* rate of inflation and negatively on the degree of slack in the economy, as measured, for example, by the difference of the unemployment rate from its equilibrium level. For this discussion, it is useful to distinguish between two variants of the Phillips curve model that differ in how expectations are formed. In the first, “unanchored” Phillips curve model, expected inflation rates are assumed to depend primarily on past inflation rates. That is, people expect inflation in the future to be about what it was in the recent past, say the past year or two. In this case, inflation expectations are said to be “unanchored,” in that they move around with actual inflation like a boat being pulled to and fro by the waves. As discussed below, this model does a good job of describing inflation in the United States for much of the postwar period and is therefore a popular model of inflation in the United States.

If inflation expectations are unanchored, then a severe recession can lead to a deflationary spiral. The logic is as follows: In the early stage of recession, the emergence of slack causes the inflation rate to dip. The resulting lower inflation rate prompts people to

reduce their future inflation expectations. Continued economic slack causes the inflation rate to fall still further. If the recession is severe and long enough, this process eventually will cause prices to fall and then spiral lower and lower, resulting in ever-faster deflation rates. The deflation rate stabilizes only when slack is eliminated. And inflation turns positive again only after a sustained period of *tight* labor markets.

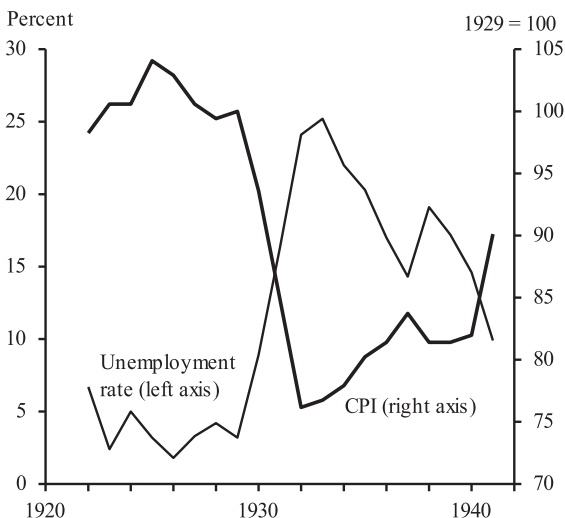
The second model is one where inflation expectations are “well anchored” in the sense that they are consistent with the goals and policies of the central bank. In this case, even in a severe recession, people expect the central bank to take policy actions that will restore a positive rate of inflation, and this expectation acts as a magnet pulling prices up. Although deflation will occur if the extent of slack is sufficiently large, a deflationary spiral only develops in the direst circumstances in which monetary policy is incapable of righting the economy (see Reifschneider and Williams 2000). These two versions of the Phillips curve model—one in which inflation expectations are well anchored and the other in which they are not—have very different implications for the likelihood, severity, and duration of deflation. In the end, which version better describes the behavior of inflation is an empirical question. To answer it, we turn to evidence from history.

The Great Depression

The natural starting point for a discussion of deflation is the U.S. Great Depression of the 1930s. The duration and magnitude of the declines in economic activity and prices during the Depression were astounding. Between 1929 and 1933, real gross domestic product per capita plummeted by nearly 30% and the unemployment rate soared from about 3% to over 25%. The consumer price index (CPI) plunged by nearly 25%, with the rate of deflation exceeding 10% in 1932.

A striking pattern during the Depression and the decade leading up to it was a strong and stable negative relationship between the price level and the unemployment rate. As shown in Figure 1, the CPI and the unemployment rate were relatively stable during the 1920s. But, during the first four years of the Depression, the CPI plunged as the unemployment rate soared. That prices fell during the early part of the Depression is consistent with either ver-

Figure 1
The Great Depression



sion of the Phillips curve model of inflation. What is surprising is that the CPI then rose steadily from 1934 through 1937, despite the unemployment rate averaging over 18% during that period.

Analysis of the relationship between prices and unemployment during the 1920s and the Depression indicates that the inflation rate was closely linked to the *change* in the unemployment rate, rather than the *level* of the unemployment rate. That is, when unemployment was rising, prices fell, and when unemployment was falling, prices rose. This finding indicates that inflation did not fall into a deflationary spiral as would be expected if inflation expectations were not well anchored. Instead, deflation lasted only while the economy was getting worse and turned to positive inflation once the unemployment rate stabilized.

What explains this relationship between prices and unemployment? As discussed by Ball (2000), the behavior of inflation depends critically on monetary policy and the ways that policy affects inflation expectations. The United States was following the gold standard at the onset of the Depression, a policy that produces a relatively stable price level over long periods. After falling 25% in the early part of the Depression, prices were well below their “normal” level of the past. One interpretation of the outbreak of positive inflation between 1934 and 1937 was that people expected that prices would eventually rise again from abnormally low levels, and this expectation helped push the inflation rate into positive territory, despite the very high unemployment rate.

Japan’s lost decade

Inflation dynamics today are likely to be very different than they were during the 1920s and 1930s.

Among other reasons, the United States and other countries no longer adhere to the gold standard. Instead, they generally follow policies aimed at maintaining low, positive inflation rates rather than stable price levels.

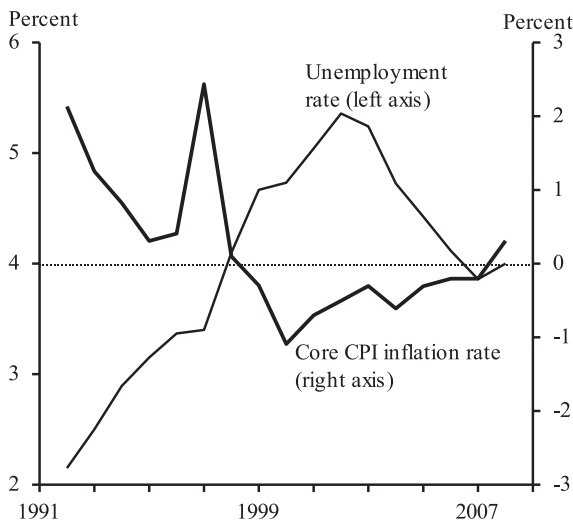
Japan provides recent evidence of what can cause sustained deflation. Core consumer price inflation in Japan averaged a little over 2% during the 1980s and the first half of the 1990s. Following the bursting of the Japanese housing and stock market bubbles, the economy tumbled into a lengthy recession, with the unemployment rate rising to nearly 5½%, about three percentage points above its prior long-run average. Nine straight years of core CPI deflation followed, as shown in Figure 2. The anomalous spike in the inflation rate in 1997 resulted from an increase in the value-added tax that boosted consumer prices that year. Interestingly, despite the relatively high rates of unemployment in Japan during the past 10 years, a downward deflationary spiral did not ensue. Statistical analysis confirms that inflation in Japan is not described well by the unanchored Phillips curve model. Instead, inflation expectations appear to have been reasonably well anchored despite the prolonged period of deflation and high unemployment.

The here and now

The deflationary episodes in the United States during the Depression and more recently in Japan do not follow the pattern of a deflationary spiral predicted by the unanchored Phillips curve model (see Akerlof and Yellen (2006) for related evidence from other countries). We now turn to evidence from the United States during the postwar period. Unlike the two deflationary episodes described above, this model does a good job of describing the relationship between U.S. inflation and unemployment over the past 50 years.

In the current recession, this model predicts that, with unemployment remaining very high, core inflation will fall steadily over this year and next, with deflation occurring in 2010. This forecast uses the most recent SPF unemployment projection and a Phillips curve model based on the historical relationship between inflation and unemployment from 1961 to 2008. The SPF forecast is for the unemployment rate to rise to 9% early next year and then edge down during the remainder of 2010. According to this model, the high degree of slack in labor markets pushes the core personal consumption expenditures price index (PCEPI) inflation rate down from 1.9% in 2008 to 0.3% in 2009, and down further to a deflation rate of 0.8% in 2010. Based on this forecast and the historical average of core PCE inflation forecast errors reported in Reifschneider and Tulip

Figure 2
Japan's lost decade



(2007), the estimated probability of deflation is about 30% for 2009 and 85% for 2010.

This forecast is based on the “average” behavior of inflation over the past five decades, which includes both periods when inflation expectations were reasonably well anchored, such as the past two decades, as well as periods when they clearly were not, such as the late 1960s and the 1970s (see Orphanides and Williams 2005). As discussed by Williams (2006), the behavior of inflation over the past 15 years differs markedly from that in the preceding quarter century. A Phillips curve model estimate using data since 1993 is consistent with well-anchored inflation expectations and precludes the emergence of a deflationary spiral. Indeed, over the past 16 years, the U.S. inflation rate is negatively related to the change in the unemployment rate, rather than its level, similar to the pattern seen in the data from the 1920s and 1930s (see Gorodnichenko and Shapiro (2007) for related evidence).

The forecast from this model, again using the SPF forecast for unemployment, shows core PCE price inflation slowing to 1.1% this year, but then rising to 1.6% in 2010. The estimated probability of deflation based on this forecast is about 3% in each year. This inflation forecast is nearly identical to the SPF forecast of 1.1 and 1.5% inflation in 2009 and 2010, respectively, and the estimated probability of deflation from the model forecast is roughly in line with those reported by SPF forecasters. Evidently, professional forecasters view the experience of the recent past as more relevant for forecasting than that from the more distant past. Forecasters appear to be convinced that the Federal Reserve would not be content with sustained deflation and would take

policy actions to restore a positive rate of inflation. This contrasts with the 1970s, when forecasters were concerned that the Fed would tolerate high rates of inflation.

This analysis highlights the central roles of economic slack and inflation expectations in the risk of deflation over the next several years. The evidence indicates that a substantial increase in slack can lead to deflation, but the depth and duration of the deflation depends on how well anchored inflation expectations are. Two policy implications can be drawn from this and other research on deflation. First, a central bank should take appropriate actions to stem the emergence of substantial slack in the economy and thereby reduce the risk of deflation. Second, it should clearly communicate its commitment to low positive rates of inflation. An example of such communication is the Federal Open Market Committee's recently released long-run inflation forecasts. Such words, backed by appropriate actions, reinforce the anchoring of inflation expectations and reduce the chances of a deflationary spiral.

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References

- Akerlof, George A., and Janet L. Yellen. 2006. “Stabilization Policy: A Reconsideration.” *Economic Inquiry* 44(1) (January) pp. 1–22.
- Ball, Laurence. 2000. “Near-Rationality and Inflation in Two Monetary Regimes.” NBER Working Paper 7988 (October).
- Gorodnichenko, Yuriy, and Matthew D. Shapiro. 2007. “Monetary Policy when Potential Output Is Uncertain: Understanding the Growth Gamble of the 1990s.” *Journal of Monetary Economics* 54(4) (May) pp. 1,132–1,162.
- Orphanides, Athanasios, and John C. Williams. 2005. “The Decline of Activist Stabilization Policy: Natural Rate Misperceptions, Learning, and Expectations.” *Journal of Economic Dynamics and Control* 29(11) (November) pp. 1,927–1,950.
- Reifschneider, David, and Peter Tulip. 2007. “Gauging the Uncertainty of the Economic Outlook from Historical Forecasting Errors.” Board of Governors of the Federal Reserve, Finance and Economics Discussion Series 2007–60 (November). <http://www.federalreserve.gov/pubs/feds/2007/200760/200760pap.pdf>
- Reifschneider, David, and John C. Williams. 2000. “Three Lessons for Monetary Policy in a Low Inflation Era.” *Journal of Money, Credit, and Banking* (November) pp. 936–966.
- Williams, John C. 2006. “Inflation Persistence in an Era of Well-Anchored Inflation Expectations.” *FRBSF Economic Letter* 2006–27 (October 13). <http://www.frbsf.org/publications/economics/letter/2006/el2006-27.html>

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Update of “The Risk of Deflation”

By John C. Williams

April 6, 2010

This note reports updated U.S. inflation forecasts from the models described in “The Risk of Deflation,” *FRBSF Economic Letter* 2009-12, March 27, 2009; <http://www.frbsf.org/publications/economics/letter/2009/el2009-12.html>. The estimates reported in the original *Letter* were based on data available in March 2009. The updated estimates use data available through early April 2010. The two inflation forecasting models have been reestimated using data through the fourth quarter of 2009.¹ The forecasts for unemployment are taken from the February 2010 Survey of Professional Forecasters (SPF). The upper panel of Table 1 reports the current forecasts for the four-quarter percent change in the core personal consumptions expenditures (PCE) price index, excluding food and energy prices. The February 2010 SPF core PCE price inflation forecasts are shown for comparison. The lower panel of the table reports the forecasts from the original *Letter*.

Core PCE price inflation was 1.5 percent in 2009, 0.4 percentage point *above* the forecasts from the “anchored Philips curve” model and the Survey of Professional Forecasters from a year ago. In contrast, core inflation was 1.2 percentage points above the forecast from the “unanchored Philips curve” model, which had predicted a much sharper fall in inflation.

Both models now predict higher core inflation in 2010 than they did a year ago. The unanchored Philips curve model forecast rose two full percentage points, while the anchored Philips curve model forecast rose only 0.2 percentage points. In contrast, the SPF forecast declined by 0.2 percentage point. The anchored Philips curve model now predicts that core inflation will reach 2 percent in 2011, one-half percentage point above the corresponding SPF forecast.

¹ In the original *Letter*, the estimated coefficients on the two lags of the unemployment rate in the “anchored Philips curve model” were nearly equal and opposite in sign. In this update, this model is estimated imposing this restriction on the coefficients. This restriction is not rejected by the data.

The risk of deflation has fallen significantly according to both model forecasts. Table 2 reports the probabilities of deflation in each year. The forecasts from the anchored Philips curve model and the SPF imply very small probabilities of deflation this year and next. The forecast from the unanchored Philips curve model also implies very little risk of core price deflation this year, but the probability of deflation rises to 18 percent next year.

Table 1: Core PCE Price Inflation Forecasts (Q4/Q4)

	2009	2010	2011
Current forecasts			
Unanchored Philips curve model		1.2	0.7
Anchored Philips curve model		1.8	2.0
Survey of Professional Forecasters		1.3	1.5
March 2009 forecasts			
Unanchored Philips curve model	0.3	-0.8	N/A
Anchored Philips curve model	1.1	1.6	N/A
Survey of Professional Forecasters	1.1	1.5	N/A

Table 2: Probability of Core PCE Price Deflation (percent; Q4/Q4)

	2009	2010	2011
Current forecasts			
Unanchored Philips curve model		2	18
Anchored Philips curve model		<1	<1
Survey of Professional Forecasters		2	3
March 2009 forecasts			
Unanchored Philips curve model	28	85	N/A
Anchored Philips curve model	3	3	N/A
Survey of Professional Forecasters	3	3	N/A