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Comments on Fuhrer, Olivei, and Tootell,
"Inflation Dynamics when Inflation is Near Zero"

This is an excellent paper; indeed, it is three papers for the price of one, no doubt related to the fact that there are three authors.

The paper does have a catchy unifying title, "Inflation dynamics in a low inflation environment," but the real central focus is on the question, "Will inflation decline further or rise over the year ahead?"

And on that issue, the paper clearly has a unified conclusion--all three papers or parts of the paper come to the same finding that inflation can be expected to fall significantly further, or at least will not be inhibited from doing so, over the year ahead.

In Part I of the paper the authors review conventional models of inflation. So called hybrid models, or those that put significant weight on backward-looking expectations are found to do a better job of fitting/explaining inflation during US post-war recovery cycles than those that put primary weight on forward-looking expectations. These models also tend to predict declining inflation well into cyclical recoveries as has been the historical norm. Not surprisingly, these models point to a continued gradual decline in US inflation over the next several years.

The authors note that these inflation models have exhibited both instability over time and nonlinearities that may call into question their applicability to the current period of unusually low inflation. That is, when unemployment is high, a given amount of or change in unemployment may have less effect on prices than when it is at more normal levels. With unemployment unusually high currently, the hybrid model may be overstating the amount of disinflation to come. As an aside, I would note that there may be some contradiction here with Stock and Watson's finding at this conference two years ago that output or unemployment gaps do not affect inflation significantly until they become large.

In any event, to address this problem, the authors focus on a model estimated over periods of low inflation, including 1954 to 1963 and 2003 to present. They find that the model's parameters estimated over each of these two periods are reasonably similar. They also find that the model predicts that core inflation will decline by another 1% over the year ahead, assuming unemployment remains near current levels and assuming the underlying long-term trend in inflation or long-term inflation expectations remain unchanged. As the authors note, the projected decline

in inflation is slightly greater than the decline predicted by Stock and Watson in their Jackson Hole paper this year based on a model with a fairly different specification.

I should emphasize here that the model Fuhrer, Olivei, and Tootell use for this forecast includes long-term inflation expectations with a coefficient constrained to unity. The addition of long-term inflation expectations is found to be crucial in helping to identify a stable relationship between inflation and unemployment during periods of low inflation or high unemployment. And in the forecast presented, the assumption that long-term inflation expectations will remain unchanged limits the projected decline in inflation in the face of a large output gap. As the authors note, if long-term inflation expectations begin to slip, the projected decline in inflation would be even greater, presumably by the amount of the decline in expectations.

To set up my discussion of the next two parts of the paper, a recent IMF survey paper by Andre Meier has documented an empirical regularity of sorts across countries in recent decades that high levels of unemployment beget significant disinflation, but that disinflation tends to taper off, and significantly so, as inflation nears zero. Rarely does one see significant deflation emerge. The two reasons most often cited for this behavior are (1) well anchored longer-term inflation expectations, and (2) downward nominal wage rigidities.

The second and third parts of the Fuhrer, Olivei, and Tootell paper challenge the view that disinflation will necessarily taper off at very low inflation rates. It does so by presenting evidence that the role of long-term inflation expectations may not be all that it is chalked up to be and evidence that nominal wage or compensation inflation in the US at least, is not constrained from moving below zero. The first finding is an important challenge to the received wisdom that stable and relatively elevated longer-term inflation expectations will at least limit further declines in inflation and could over time exert significant upward pressure on inflation.

Part II of the paper looks at Japan's experience with deflation and notes that reasonably well anchored positive long-term inflation expectations have not prevented a prolonged bout of deflation (12 years and counting), albeit a rate of deflation that has been relatively mild and stable.

The authors estimate a standard expectations-augmented Phillips curve model of Japanese inflation, in which they test survey measures of both long-term and short term inflation expectations. They find that long-term expectations do consistently poorly and short-term expectations consistently well in explaining movements in Japanese inflation. They then estimate parallel equations for the US and find much the same thing: that the SPF survey of one-year ahead inflation expectations does much better than the 10-year survey in explaining movements in US inflation. In fact, the long-term expectations survey is found generally to be statistically insignificant. The one-year expectations have considerably more variance than the

long-term expectations and can be successfully modeled as a function of lagged inflation and the output gap. Forecasting simulations with this model under plausible assumptions show that US inflation would follow a pattern very similar to that traced by Japanese inflation over the past decade, i.e., a prolonged period of moderate deflation.

This is a troubling result for a number of reasons. Not only does it appear to disagree with a finding in the first part of the paper, but more importantly, it poses a threat to one's faith in a key argument for further action by the Fed at this juncture—the importance of doing everything possible to more firmly anchor long-term inflation expectations. Indeed, I was troubled enough to feel the urge to replicate the results reported in the paper and to do some additional testing.

Replicating the results reported in the paper was no problem. Finding a way out of them was more challenging. First, to test for robustness, I substituted the Michigan survey of short term and long term inflation expectations for the SPF measures and found essentially the same results, although the Michigan data did not do as well as the SPF data in explaining inflation movements. I also tried using the core PCE deflator in place of the core CPI, and estimating over different (earlier) sample periods, but neither of these changes significantly affected the results. Second, I wondered about direction of causation between core inflation and one-year expectations. Granger causality tests showed that the one-year expectations do Granger cause current inflation. Third, I wondered if long-term expectations might still have a role in affecting inflation via an influence on short-term expectations, and here I finally came up with something solid to grasp hold of.

When long-term expectations are inserted as an explanatory variable into the equation for short-term inflation expectations reported in the paper, they prove to be a highly significant contributing factor. In fact, they become the dominant contributor, significantly reducing the coefficients on current and lagged actual inflation as well as the constant term; they also result in a somewhat higher coefficient on the output gap. Thus it would appear that long-term inflation expectations do still have an important role to play in affecting inflation, but in this model it is via their influence on short-term inflation expectations.

To see how much difference this change makes to the inflation forecast, I ran a simple partial equilibrium projection with the inflation and short-term expectations equations, assuming the output gap, marginal cost inflation and long-term inflation expectations remain unchanged. Under these conditions, inflation is predicted to remain little changed over the year ahead, but the equations with long-term expectations have it about 0.3% higher than those without. Long-term expectations appear to have the expected effect.

I did not have the wherewithal to run a full or general-equilibrium model simulation as the authors did. One would need to think about how to make long-term inflation expectations endogenous, presumably by tying it to the monetary policy rule. In

that vein, I found myself wondering whether the policy rule in the paper—and the connection of expectations to it, might be enriched by the inclusion of a shift term for quantitative easing or LSAPs. Certainly widespread expectations of LSAP2 has helped to bolster market measures of inflation expectations of late.

A final thought on expectations. It may well be that the direct pull of longer-term expectations on inflation is weaker than we thought. But that does not mean it is absent. Long-term expectations of around 1% in Japan may have helped keep actual inflation from dipping below -1%. Likewise, Long-term expectations in the vicinity of 2 to 2.5% in the US may help keep inflation from dropping below zero.

Part III of the paper considers evidence on the existence of downward nominal wage rigidity at low inflation. There is a substantial empirical literature on this topic that finds significant existence of downward rigidity. Such rigidity is found to be stronger when unemployment is low, when unions are powerful, or when employment protection laws are strong. Not surprisingly, much of the evidence is derived from European experience, though there is some for the US as well. As the authors note, evidence in the US case is for the most part centered on data that focuses on surveys of individual workers that do exhibit resistance to wage declines.

The paper notes fairly convincingly, that downward rigidity for individuals does not prevent firms from reducing labor costs via job turnover. Indeed, evidence from one of the two available employer based surveys does show significant downward mobility of wage bills at the firm level. But the strength of this conclusion must be tempered by the findings of another paper (by Lebow, Saks, and Wilson) that is cited by the authors, which finds significant evidence of downward wage rigidity using the other available firm level survey, albeit one that is based on a relatively small sample of firms.

To conclude, this paper is an important companion to the recent Stock-Watson prediction that inflation is likely to decline noticeably over the year ahead. But it goes a step further than I would have in suggesting that stable positive long-term inflation expectations are unimportant in retarding that disinflation. Indeed, the paper appears to have two views on this point itself. There may well be something to the notion that short-term expectations have a stronger direct effect on inflation than long-term expectations, but well anchored long-term expectations would still appear to have a strong influence, at least through their effect on short-term expectations.