Economic Trends

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Inflation: Waiting for the Upturn

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Over the course of the past year there have been concerns about falling long-term inflation expectations. One closely watched measure of inflation expectations comes from the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters (SPF). The 2015:Q4 SPF reading showed that, after having been essentially unchanged at 2 percent since the first quarter of 2013, the median SPF projection for annual average inflation in the Personal Consumption Expenditures (PCE) price index over the next 10 years decreased to 1.9 percent. One-tenth of one percentage point is small in the grand scheme of things. But because this measure had been so stable—and because this decline coincided with decreases in several other measures of inflation expectations—it is notable.

A closer examination reveals that the decline was driven by a drop in the median SPF projection for average PCE inflation over the next five years, which fell from 1.8 percent to 1.65 percent. This decline continued the gradual downward trend in this measure since it reached a local maximum of 2.2 percent in 2011:Q2. Meanwhile, the median SPF projection for the 5-year/5-year-forward PCE inflation rate (the average expected rate of inflation over the five-year period that begins five years from today) has been relatively

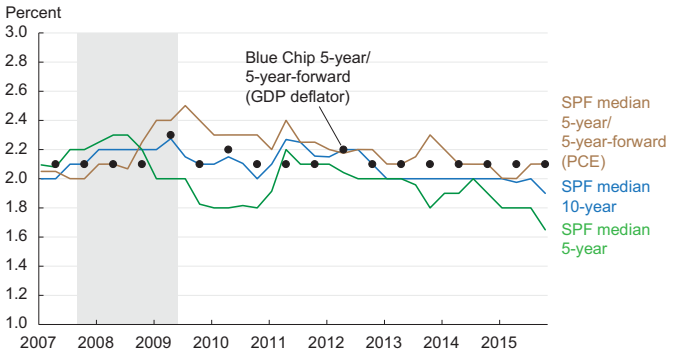
stable since 2014:Q2 and, at 2.1 percent, currently matches the Blue Chip Economic Indicators consensus for the 5-year/5-year-forward rate of growth in the GDP Chained Price Index.[1] These readings indicate that while longer-run inflation expectations remain steady according to the SPF and Blue Chip surveys, short- and medium-term inflation expectations appear to be drifting lower.

Economists pay attention to inflation expectations because economic theory and empirical evidence suggest they help to determine where inflation is likely to go. On the theory side, because firms tend to change prices infrequently, there is an incentive for them to take into account future conditions when they set their prices today. The expected path for inflation is one such future condition they consider. If businesses expect higher inflation in the future, they may start preemptively raising their prices today, which in turn could cause inflation to increase as well. Conversely, if businesses expect lower inflation in the future, they may pull back on some price increases, which would weigh on inflation.

On the empirical front, recent research—including some here at the Cleveland Fed—has found that it is possible to make more accurate forecasts of inflation by incorporating inflation expectations into forecasting models. In these models, the inflation gap—which is the difference between inflation today and the longer-run expected inflation rate—is the variable of interest; inflation itself is backed out after the fact. Using the inflation gap concept, Faust and Wright (2013) provide evidence that a very simple model produces forecasts that are very difficult to beat on average. Their fixed-coefficient gap model says that the inflation gap in a given quarter is equal to 0.46 times the inflation gap in the previous quarter. Moreover, the Faust and Wright (2013) gap is based on using 5-year/5-year-forward expected inflation readings from surveys of professional forecasters—which, as we showed above, have remained stable.

So if we were to make a forecast for PCE inflation based on the fixed-coefficient gap model, taking on board the most recent quarterly inflation reading from 2015:Q3, that forecast would have predicted that

Survey Measures of Long-Term Inflation Expectations



Last observation: 2015:Q4.
Sources: Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters, Blue Chip.

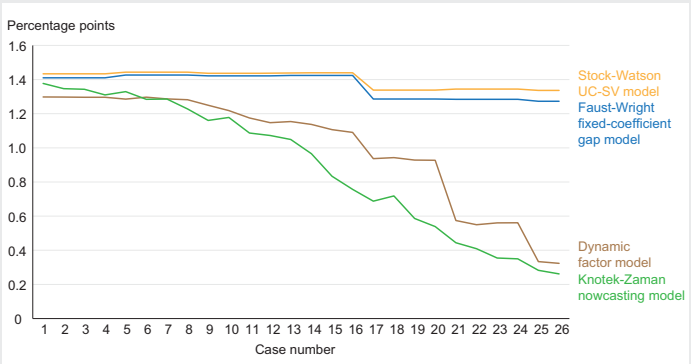
inflation in 2015:Q4 should be picking up. Except that fourth-quarter PCE inflation doesn't appear to be picking up… at least, not yet.

Because there is some persistence in inflation, a corollary to the Faust and Wright (2013) work is that it is possible to generate more accurate medium-term inflation forecasts by getting the near-term inflation picture right. To this end, Knotek and Zaman (2015) develop an inflation nowcasting model that has historically outperformed a number of competing statistical models and surveys of professional forecasters in nowcasting inflation in the current quarter. This model forms the basis for the daily inflation nowcasts published on the Federal Reserve Bank of Cleveland's website.[2] For the purposes of this article, we take the Cleveland Fed nowcast made on November 25, 2015, the day of the most recent PCE release by the Bureau of Economic Analysis, to be a high-quality nowcast of PCE inflation in 2015:Q4.

But what model generates the most accurate results for the next quarter—in forecasting jargon, for the one-step-ahead forecast? We investigate this issue by extending the Knotek and Zaman (2015) results to evaluate the performance of several competing models at generating one-step-ahead forecasts of PCE inflation over various points in time. That is, we examine the ability of the models to make a near-term forecast of inflation in quarter t while we are in quarter $t-1$ and, as time passes, to also make a nowcast of the rate of inflation in quarter t during the course of quarter t. In our exercise we consider the models' ability to forecast inflation in quarter t as of the last day of quarter $t-2$ (case 1), roughly once every week during quarter $t-1$ (cases 2-13), roughly once every week during quarter t (cases 14-25), and immediately after the CPI is released for the last month of quarter t, which occurs roughly midway through the first month of quarter $t+1$ (case 26).[3] With the data available on November 25, 2015, that would put us in case 9 for forecasting inflation in 2016:Q1 and in case 21 for nowcasting inflation in 2015:Q4.

We find that at the very end of quarter $t-2$ (case 1) and through the first month of quarter $t-1$ (cases 2 through 5), a dynamic factor model has tended to produce the most accurate one-step-ahead PCE infla-

Quarterly Root Mean Squared Forecast Errors



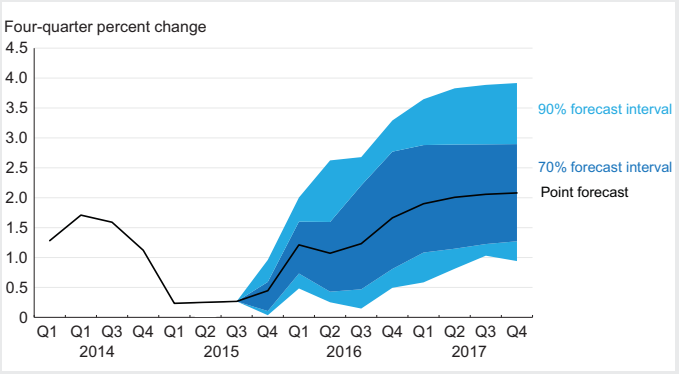
Source: Authors' calculations.

tion forecasts over the last 15 years; it has the lowest root mean squared errors (RMSEs), which essentially measure the typical forecasting error in absolute terms.[4] But in the second and third months of quarter *t*−1 (cases 6 through 9 and cases 10 through 13, respectively), and throughout quarter *t*, the inflation nowcasting model in Knotek and Zaman (2015) has outperformed the dynamic factor model for predicting the quarter *t* PCE inflation rate. Both models make far more accurate short-term forecasts and nowcasts than statistical models of quarterly inflation, including the Faust and Wright (2013) fixed-coefficient gap model and the Stock and Watson (2007) model with unobserved components and stochastic volatility (UC-SV). Hence, the Cleveland Fed inflation nowcasting model appears to be useful for making one-step-ahead forecasts as well, a feature we'll look to add to the Bank's website.

For forecasting further into the future, however, the evidence from our exercise and in Faust and Wright (2013) suggests that the fixed-coefficient gap model is a tough competitor to beat. So if we combine the Cleveland Fed approach for nowcasting and one-step-ahead forecasting with the fixed-coefficient gap model for two steps ahead and beyond, we can generate a composite picture for how inflation is likely to evolve. This forecast would expect year-over-year PCE inflation to remain very low through the end of 2015, before picking up to the 1¼ percent range through the first three quarters of 2016. Thereafter, PCE readings are expected to pick up even further, and by mid- to late 2017 they are expected to be near the Federal Open Market Committee's 2 percent longer run inflation objective.

That said, no inflation forecast would be complete without highlighting the many uncertainties surrounding it, a point explored earlier by Cleveland Fed staff. In addition to our "point" forecast, we also use the historical forecast errors from this composite modeling approach to construct 70 percent and 90 percent prediction intervals around the point forecast. If history is a good guide to the future, then we would expect actual inflation to stay within these bands 70 percent and 90 percent of the time, respectively.

Forecast of Headline PCE Inflation



Source: Authors' calculations.

These bands are quite wide and skewed somewhat to the upside, showing how difficult it is to predict inflation accurately. For example, another collapse in oil prices in 2016, which would pull inflation down toward zero percent, would be a big, negative surprise based on recent history; a recovery in oil prices, which would push inflation somewhat above our baseline forecast, would be less of a surprise. Furthermore, it's worth highlighting that the forecast and the associated prediction intervals assume that professional forecasters' 5-year/5-year-forward inflation expectations remain anchored at their current levels and do not drift lower. The potential for downward moves in these longer-run inflation expectations bears very close watching, because such moves would pull the inflation outlook lower as well.

Footnotes

1. The Blue Chip Long-Range Consensus U.S. Economic Projections, released twice annually in March and October, do not cover the PCE price index.

2. There is a small technical difference between the model in Knotek and Zaman (2015) and the PCE inflation nowcasts from the Cleveland Fed's website, which is documented here. This difference limits the ability to do historical real-time out-of-sample nowcasting exercises with the exact Cleveland Fed model. But the results in Knotek and Zaman (2015) regarding the role of food inflation in making good nowcasts of headline inflation suggest that the nowcasting performance of the models should be highly comparable

3. See Knotek and Zaman (2015) for their quarterly cases. For cases 2-13, we assume their cases occur during quarter $t-1$ instead of quarter t.

4. Following Knotek and Zaman (2015), the dynamic factor model we consider is a modification of Modguno (2013).

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