Economic Trends

December 2014 (November 25, 2014-December 29, 2014)

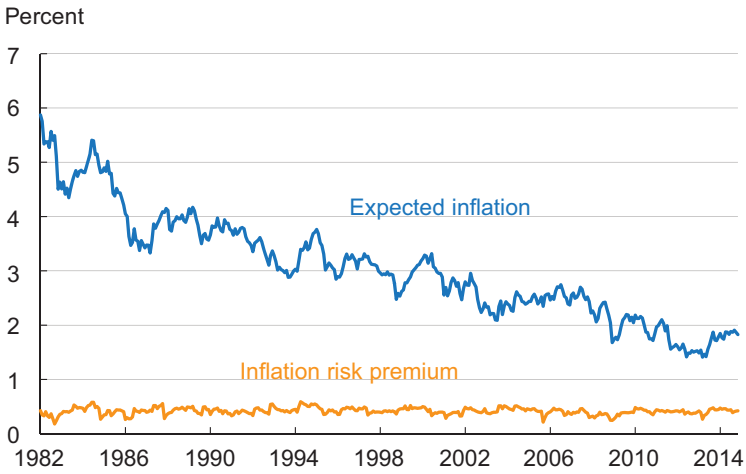
In This Issue:

FEDERAL RESERVE BANK
of CLEVELAND

Cleveland Fed Estimates of Inflation Expectations, December 2014

News Release: December 17, 2014

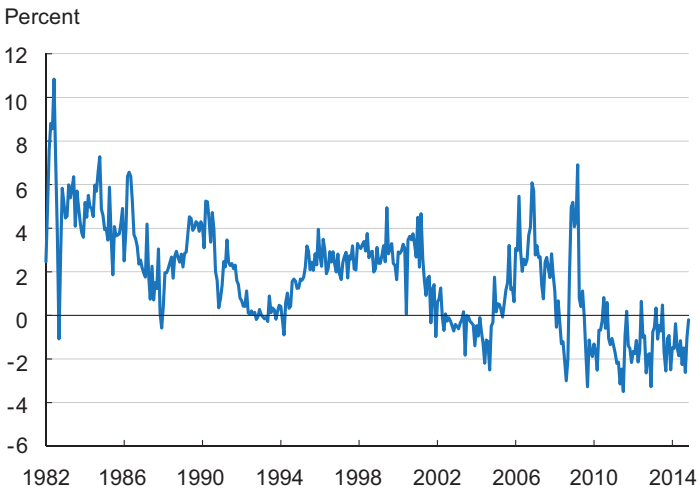
Ten-Year Expected Inflation and Real and Nominal Risk Premia



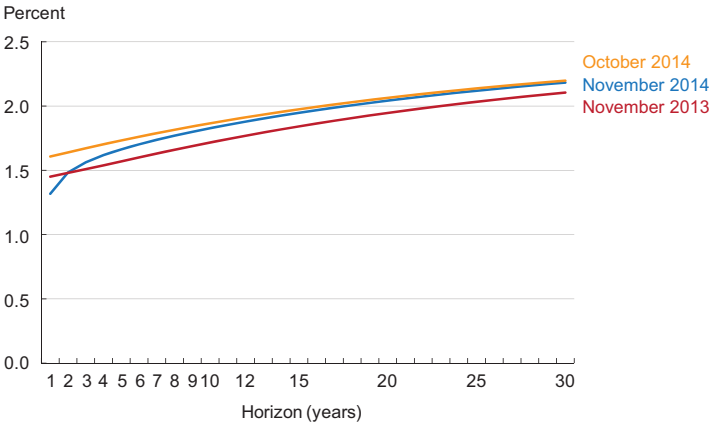
The latest estimate of 10-year expected inflation is 1.78 percent, according to the Federal Reserve Bank of Cleveland. In other words, the public currently expects the inflation rate to be less than 2 percent on average over the next decade.

The Cleveland Fed's estimate of inflation expectations is based on a model that combines information from a number of sources to address the shortcomings of other, commonly used measures, such as the "break-even" rate derived from Treasury inflation protected securities (TIPS) or survey-based estimates. The Cleveland Fed model can produce estimates for many time horizons, and it isolates not only inflation expectations, but several other interesting variables, such as the real interest rate and the inflation risk premium.

Real Interest Rate



Expected Inflation Yield Curve



Source: Haubrich, Pennacchi, Ritchken (2012).

Inflation Expectations for Short-Term Inflation Fall; for Long-Term, Measures Differ

12.29.14
by Mehmet Pasaogullari and Sara Millington

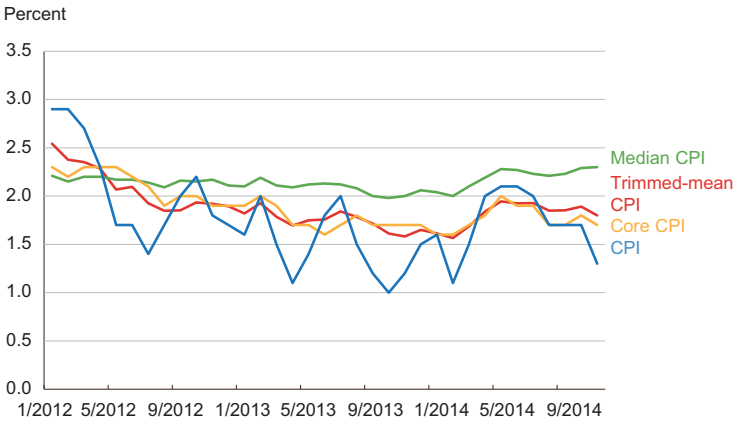
Following three months of flat year-over-year inflation readings as measured by the Consumer Price Index (CPI), November's reading moved down to 1.3 percent. The core CPI, which had been 1.8 percent in October, ticked down slightly in November, to 1.7 percent. Other measures of underlying inflation, the trimmed-mean CPI and the median CPI, have also been relatively stable since August of this year.

Declines in the energy component of the CPI help explain the difference between the year-over-year changes in headline and core CPI. The CPI's energy component has been declining for the last 5 months; November's month-over-month reading is down 3.8 percent. Losses in energy are offsetting gains seen in other components in the core CPI, and holding the headline CPI steady.

The chart below breaks down the 12-month percent change in the price indexes of various components that make up the CPI. A majority of categories experienced price increases from October to November. The only exceptions were gasoline, fuel oil, and used cars. Two of these categories are included in the CPI but are excluded from the core CPI.

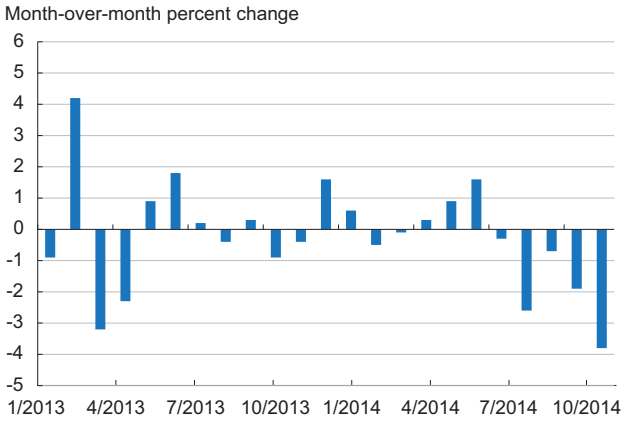
Expectations for inflation in the short term declined in November relative to the previous month; the trend is seen in the Survey of Professional Forecasters (SPF) and the Cleveland Fed's model of inflation for expectations of inflation in the next 12 months. SPF forecasters' prediction in the fourth quarter of 2014 is for 1.9 percent inflation in the next 12 months, slightly below the SPF average of 2.0 percent that we have seen over the last year. The Cleveland Fed's model of inflation expectations, which uses survey information from Blue Chip forecasters and the SPF and inflation swap data to calculate inflation expectations, estimates that expected inflation will be below 1.2 percent in

Measures of CPI Inflation



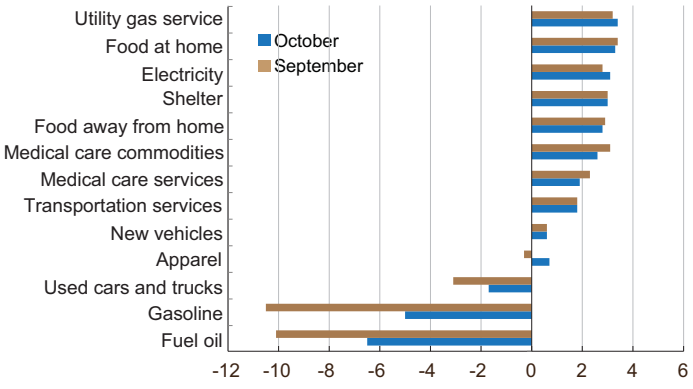
Source: Bureau of Labor Statistics.

CPI Energy Component



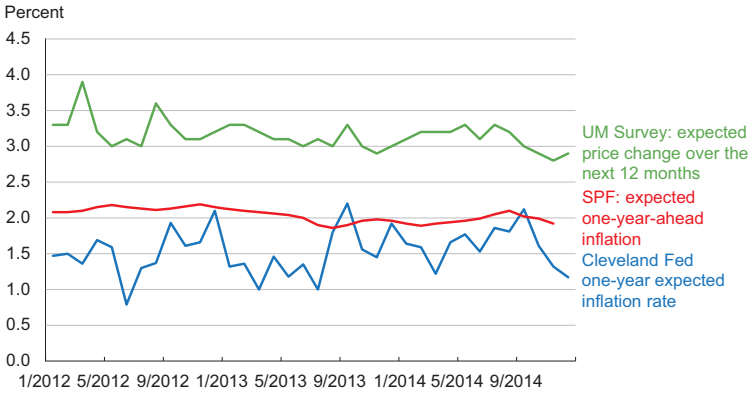
Source: Bureau of Labor Statistics.

12-Month Percent Change in Price Index of CPI Component



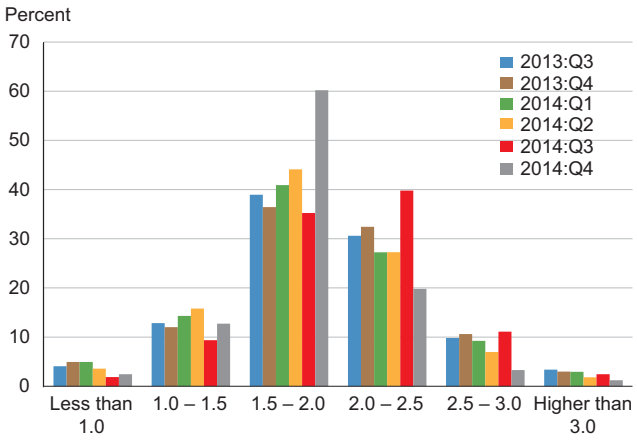
Source: Bureau of Labor Statistics.

One-Year-Ahead Inflation Expectations



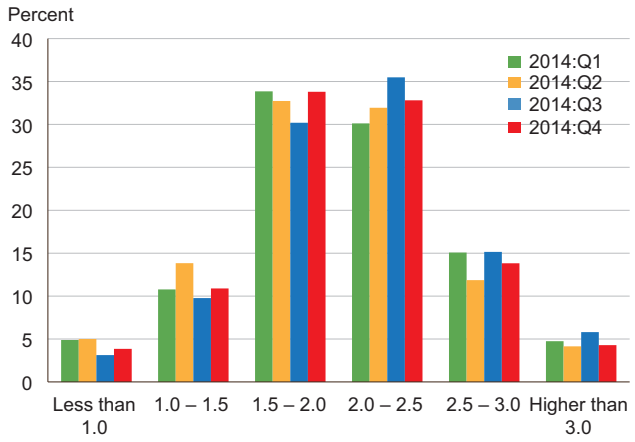
Sources: Federal Reserce Bank of Cleveland; Survey of Professional Forecasters; University of Michigan.

Core CPI Probabilities, 2014:Q4



Source: Survey of Professional Forecasters, Federal Reserve Bank of Philadelphia.

Core CPI Probabilities, 2015:Q4



Source: Survey of Professional Forecasters, Federal Reserve Bank of Philadelphia.

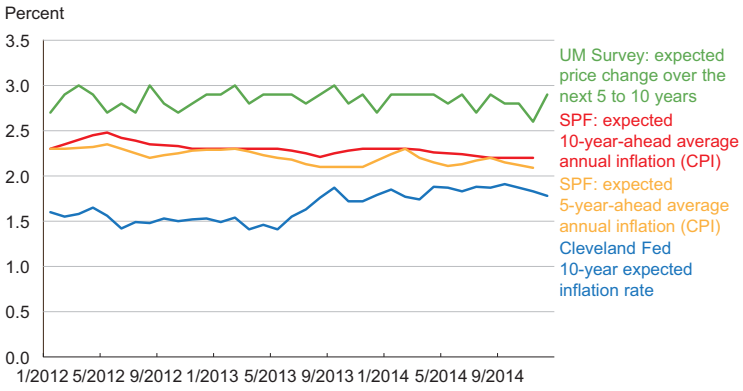
the coming 12 months. The one short-term measure that increased was the University of Michigan's Survey of Consumer sentiment (UM Survey), which prior to this month's increase had declined for four consecutive months. UM Survey respondents said in December that they expect inflation in 12 months to be 2.9 percent, which is up from November's expectation of 2.8 percent, the lowest year-ahead inflation rate expected from the UM survey respondents since October 2010. While the UM Survey is up from last month's reading, it is down from December of last year's, which was 3.0 percent.

Additional detail from the SPF provides information on how participants in this survey broadly see the risk to inflation in the near term. The SPF asks respondents to assign probabilities to particular ranges of expected year-over-year core CPI inflation for the fourth quarter of the current year and one year ahead. A high probability in one or two particular ranges suggests a bit more certainty for the inflation outlook, while a more balanced set of probabilities on the various ranges suggests less certainty.

The majority of surveyed respondents predict that the core CPI will fall to within the range of 1.5 to 2.5 percent in the fourth quarter of 2014. Respondents' certainty that core CPI will remain in the 1.5 to 2.0 percent range has increased, which could largely be due to the fact that more data for the predicted quarter has been released, allowing forecasters to predict with more certainty. The shift in expectations for the core CPI in the fourth-quarter forecast to the range of 1.5 percent to 2.0 percent suggests that forecasters see the rest of the quarter's core CPI numbers to be similar to October's reading of 1.8 percent.

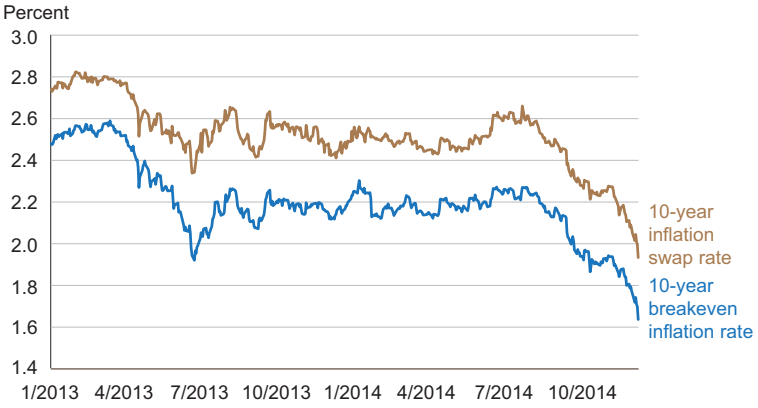
Predicted values for the fourth quarter of 2015 are much less certain, with probabilities relatively spread out. Between the third- and fourth-quarter 2015 readings, predictions shifted slightly down, much like they did for the fourth quarter of 2014. SPF forecasters expect core CPI to remain in the same 1.5 to 2.0 percent range, with a possible increase in the 2.0 to 2.5 percent range.

Longer-Term Inflation Expectations



Sources: Federal Reserce Bank of Cleveland; Survey of Professional Forecasters; University of Michigan.

Market-Based Measures of Inflation Expectations



Source: Bloomberg.

Expected inflation over the longer term (5 to 10 years) looks much more stable than the 1-year-ahead forecast. In November, the UM Survey dropped below the 12-month moving average for expected inflation in the next 5 to 10 years, but it returned to the range in December. Long-term inflation expectations for UM Survey respondents is 2.9 percent in December, up from November's expectation of 2.7 percent. SPF ten-year expectations are stable, while expected inflation in five years decreased in the fourth quarter from 2.2 percent to 2.1 percent. The FRBC model's estimate of 10-year expected inflation decreased slightly from November, with a decrease of 0.04 percent to finish at 1.78 percent.

Market-based measures of inflation expectations give a general sense of how investors view prospects for future inflation. Two such measures are break-even inflation rates and inflation swap rates. Market-based measures of inflation expectations are experiencing a much sharper decline than survey-based measures. The downward trend began at the end of July and has continued through December. In the first half of 2014, the 10-year breakeven rate was in the range of 2.1 percent to 2.3 percent. In the last two months it has remained below 2.0 percent. The 10-year swap rate for the first half of the year was in the range of 2.4 percent to 2.7 percent. In the last three months, it has been well below this range and continues to fall. As of December 17, 2014, the 10-year breakeven rate was at 1.7 percent and the 10-year inflation swap rate was at 2.0 percent.

Survey-based measures of inflation expectations seem to remain anchored in the long term, though they show some volatility in the short term. Measures based on financial data, on the other hand, point to long-term expectations for inflation falling below the average range we have seen over the last year. Expectations for long-term inflation based on financial data are, in fact, well below those based on surveyed projections. Assessing whether long-term inflation expectations are anchored depends on which type of measure you consider more reliable: financial measures or survey-based measures..

The Great Inflation

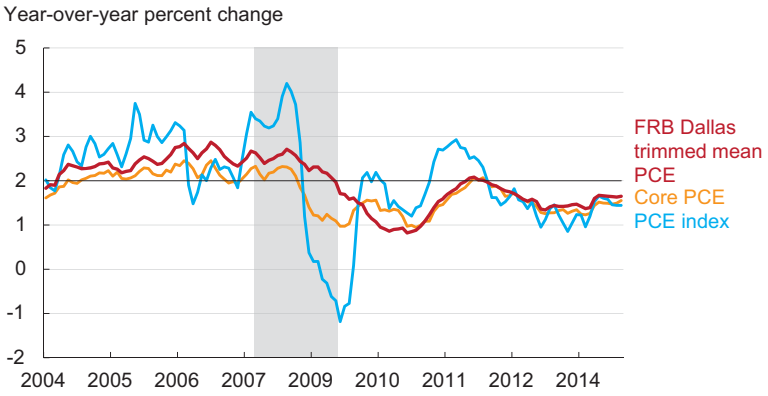
12.29.14
by Owen F. Humpage and Jessica Ice

Price pressures seem quiet—almost too quiet. In October, the PCE chain price index increased 1.4 percent on a year-over-year basis. This was the 30th consecutive month that changes in the PCE index have remained below the FOMC's 2 percent inflation target. Even without its volatile food and energy components, the index told a similar tale. The core PCE index increased 1.6 percent (year-over-year) in October, its 31st month below the FOMC's inflation threshold. Likewise, the Federal Reserve Bank of Dallas' trimmed-mean PCE index increased 1.7 percent in October, its 31st month below the inflation target. Inflation expectations also seem subdued. As it has over the past 41 months, the Federal Reserve Bank of Cleveland's measure of inflation expectations continues to anticipate inflation below 2 percent over the next ten years. All is calm; all is bright.

Yet, some people still worry about inflation. They hear faint echoes from the 1960s and 1970s and fear a return. The Great Inflation began in late 1965 and lasted until Federal Reserve Chairman Paul Volcker's disinflation policies took hold in the early 1980s. Inflation first topped 2 percent in early 1966. In contrast, between 1960 and 1965, inflation had averaged only 1.3 percent with little variation. Over the next fourteen years, inflation ratcheted up in three big movements: It reached 5 percent in early 1970, before subsiding. Inflation then rocketed to double-digit heights in early 1974, before again subsiding. This time, however, the ebb was much less. Inflation then climbed again to double-digit territory in late 1979.

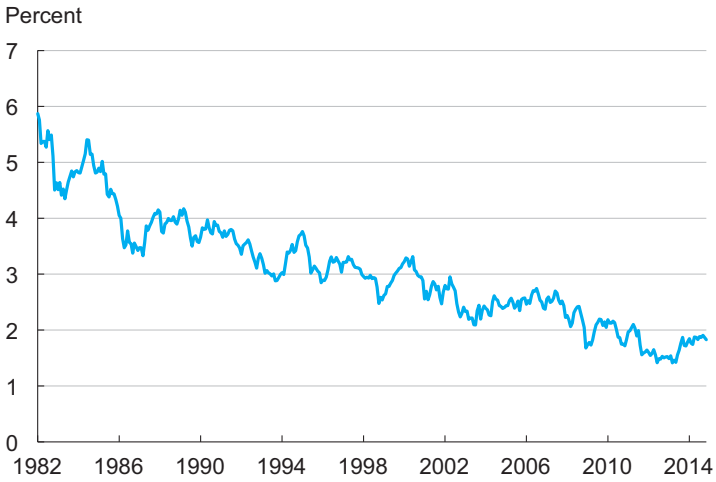
Economic historians primarily attribute this episode to an economic framework that downplayed money's causal role in the inflation process, but a policy preference for low unemployment over low inflation, measurement errors, and political pressures also contributed. By late 1977, worldwide confidence in US monetary policy had evaporated, and the dollar was tumbling against the other ma-

PCE Price Indexes



Note: Shaded bar indicates a recession.
Sources: Bureau of Economic Analysis; Federal Reserve Bank of Dallas.

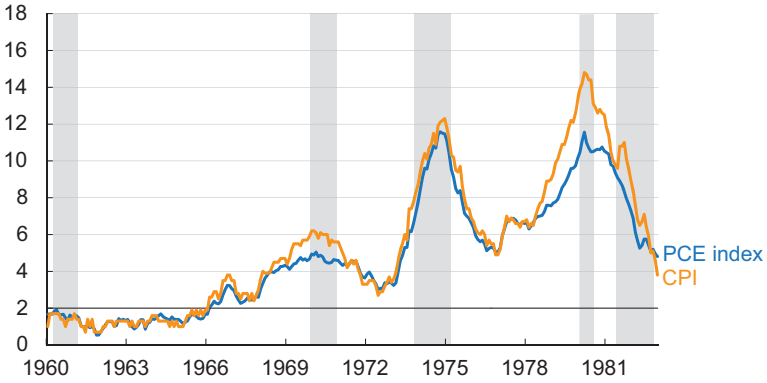
Ten-Year Expected Inflation



Source: Haubrich, Pennacchi, Ritchken (2012).

PCE and CPI Price Indexes

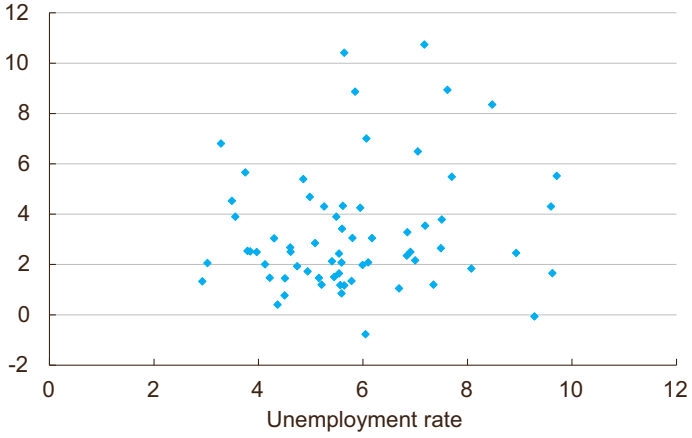
Year-over-year percent change



Source: Bureau of Economic Analysis.

Inflation-Unemployment Tradeoff: 1948–2013

PCE index year-over-year percent change



Sources: Bureau of Economic Analysis and Bureau of Labor Statistics.

jor currencies. Still, it took two additional years for the FOMC to forcefully respond.

The line of thinking that led to this framework originated around 1960, when policymakers began to distinguish between demand-pull and cost-push inflation, a paradigm that gave monetary policy a subservient role to fiscal and incomes policies. Demand-pull inflation resulted when aggregate demand, as measured by actual GDP, exceeded aggregate supply, as measured by potential GDP. If the economy operated below its potential, demand-pull inflation could not possibly be the problem. Fiscal policy was to return GDP quickly to its potential growth path and restore full employment by running a budget deficit. Monetary policy was to accommodate fiscal policy by keeping interest rates low. Any inflation that existed when economic activity fell below potential must by definition be of the cost-push variety. Chief among the espoused causes of cost-push inflation were union wage demands, but monopoly pricing, commodity-price shocks, and myriad other ad hoc relative price pressures also contributed. Fiscal and monetary policies could do nothing about cost-push inflation short of pushing the economy into a protracted recession. Eliminating cost-push inflation required the administration to adopt some type of incomes policy. Outside of supporting a fiscal tightening when economic growth exceeded potential, monetary policy had virtually no role in any inflation fight.

Unfortunate as this view of the inflation process was, measurement error made matters worse. Policymakers at the time consistently overestimated the level and growth rate of potential output. Such errors led policymakers to underpredict inflation, to incorrectly attribute any observed inflation to cost-push factors and to maintain an excessively accommodative monetary policy. Given the substantial relative price shocks and structural changes taking place in the early 1970s, it is not surprising that policymakers overestimated the nation's potential growth path.

Further complicating matters was a policy preference for low unemployment over low inflation. Economists—at least prior to 1970—believed that they could manufacture a lower unemployment rate

by accepting a higher inflation rate. Many economists and policymakers, with vivid memories of the Great Depression, believed that unemployment was far more socially disruptive than inflation. Indeed, the Employment Act of 1946 echoed these sentiments and required the federal government to pursue full employment as its primary macroeconomic policy objective. So policymakers were willing to attempt the trade. They could, however, only succeed if the public failed to anticipate future inflation. This may have been the case in the early 1960s, but not by end of the decade. In any event, the tradeoff proved ephemeral.

Moreover, as the public grew savvier about the inflation process, the output and employment costs of any disinflation policy increased, making the administration, Congress, and the Federal Reserve all the more reluctant to incur the costs. With the perception that the economy was often below potential and unemployment was often too high, administrations sometimes exerted pressure on the Federal Reserve to accommodate fiscal expansions by keeping interest rates low. At the time, the Federal Reserve interpreted its independence more narrowly than today, believing it should avoid actions, if at all possible, that might thwart the administration's policy objectives. Consequently, the FOMC was often overly slow and cautious about tightening monetary policy and quick to reverse course when the unemployment rate rose.

Not until the Volcker chairmanship in 1979 would the Federal Reserve fully recognize inflation as a monetary phenomenon and fully assert its independence to pursue price stability. Ever since, monetary policymakers have attempted to strengthen their credibility by championing central-bank independence, adopting specific inflation objectives, and improving their communications.

Yield Curve and Predicted GDP Growth, November 2014

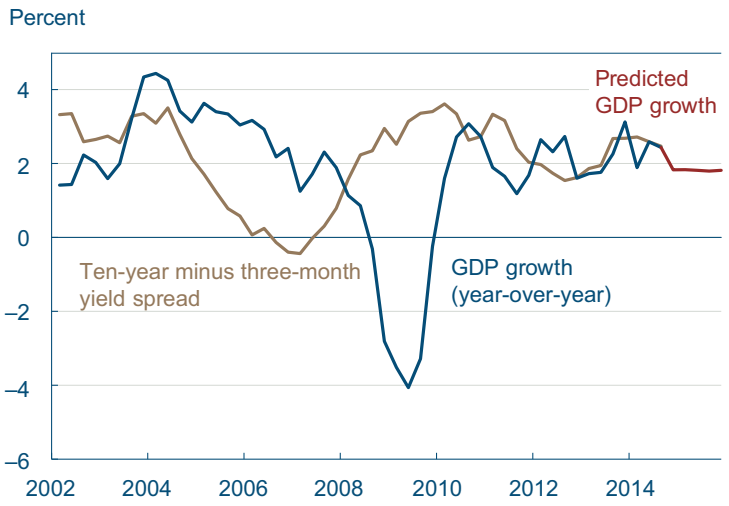
Covering October 25, 2014–November 21, 2014
by Joseph G. Haubrich and Sara Millington

Highlights

	November	October	September
Three-month Treasury bill rate (percent)	0.02	0.02	0.02
Ten-year Treasury bond rate (percent)	2.33	2.25	2.61
Yield curve slope (basis points)	231	223	259
Prediction for GDP growth (percent)	1.8	1.8	1.5
Probability of recession in one year (percent)	3.02	3.42	1.99

Sources: Board of Governors of the Federal Reserve System; authors' calculations.

Yield Curve-Predicted GDP Growth



Sources: Bureau of Economic Analysis, Board of Governors of the Federal Reserve System, authors' calculations.

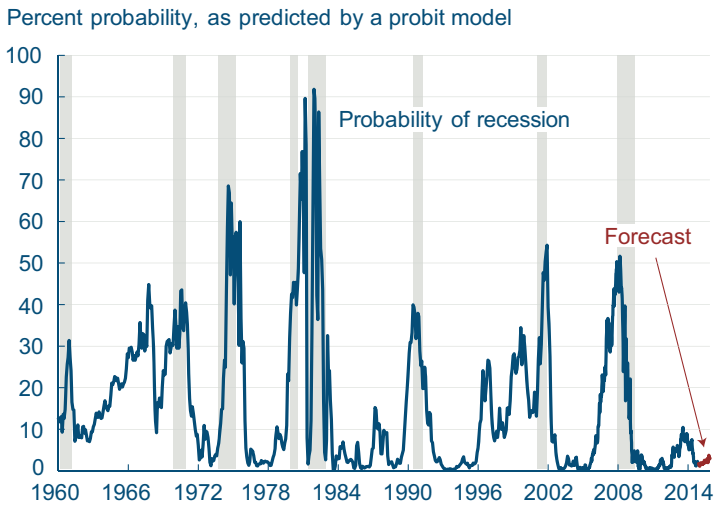
Overview of the Latest Yield Curve Figures

Since last month, the yield curve has bounced back, steepening after October's sharp flattening move. Long rates rose while the short end stayed constant, with the three-month (constant maturity) Treasury bill rate staying at the very low 0.02 percent (for the week ending November 21), sitting even with September's and October's rates. The ten-year rate (also constant maturity) rose 8 basis points to 2.33 percent, up from October's 2.25 percent, but still far below September's 2.61 percent. The slope increased to 231 basis points, up from October's 223 basis points, but still below September's 259 basis points.

The increase in slope did not have a large impact on predicted real GDP growth. Using past values of the spread and GDP growth suggest that real GDP will grow at about a 1.8 percentage rate over the next year, about the same as October's rate and up a bit from September's 1.5 percentage rate. The influence of the past recession continues to push towards relatively low growth rates, but recent stronger growth is counteracting that push. Although the time horizons do not match exactly, the forecast is slightly more pessimistic than some other predictions, but like them, it does show moderate growth for the year.

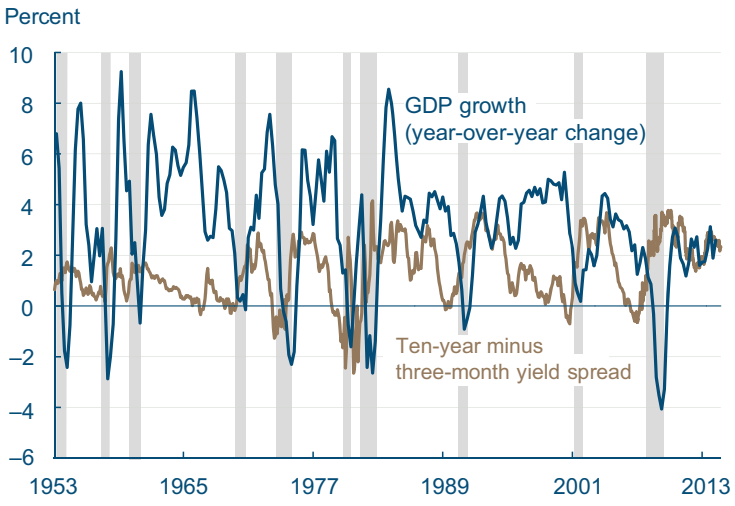
The steeper slope had the usual effect on the probability of a recession, which in fact dropped slightly. The relatively strong recent real GDP number (3.9 percent in the third quarter and 2.2 percent in the fourth) likely contributed somewhat as well. Using the yield curve to predict whether or not the economy will be in a recession in the future, we estimate that the expected chance of the economy being in a recession next November is 3.02 percent, down from October's reading of 3.42 percent, but still above September's 1.99 percent. So although our approach is somewhat pessimistic with regard to the level of growth over the next year, it is quite optimistic about the recovery continuing.

Recession Probability from Yield Curve



Note: Shaded bars indicate recessions.
Sources: Bureau of Economic Analysis, Board of Governors of the Federal Reserve System, authors' calculations.

Yield Curve Spread and Real GDP Growth



Note: Shaded bars indicate recessions.
Sources: Bureau of Economic Analysis, Board of Governors of the Federal Reserve System.

The Yield Curve as a Predictor of Economic Growth

The slope of the yield curve—the difference between the yields on short- and long-term maturity bonds—has achieved some notoriety as a simple forecaster of economic growth. The rule of thumb is that an inverted yield curve (short rates above long rates) indicates a recession in about a year. Yield curve inversions have preceded each of the last seven recessions (as defined by the NBER). One of the recessions predicted by the yield curve was the most recent one. The yield curve inverted in August 2006, a bit more than a year before the current recession started in December 2007. There have been two notable false positives: an inversion in late 1966 and a very flat curve in late 1998.

More generally, a flat curve indicates weak growth, and conversely, a steep curve indicates strong growth. One measure of slope, the spread between ten-year Treasury bonds and three-month Treasury bills, bears out this relation, particularly when real GDP growth is lagged a year to line up growth with the spread that predicts it.

Predicting GDP Growth

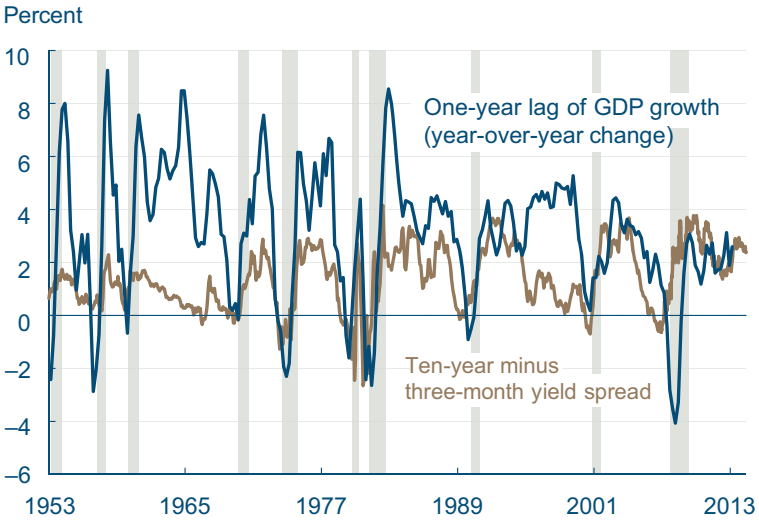
We use past values of the yield spread and GDP growth to project what real GDP will be in the future. We typically calculate and post the prediction for real GDP growth one year forward.

Predicting the Probability of Recession

While we can use the yield curve to predict whether future GDP growth will be above or below average, it does not do so well in predicting an actual number, especially in the case of recessions. Alternatively, we can employ features of the yield curve to predict whether or not the economy will be in a recession at a given point in the future. Typically, we calculate and post the probability of recession one year forward.

Of course, it might not be advisable to take these numbers quite so literally, for two reasons. First, this probability is itself subject to error, as is the case with all statistical estimates. Second, other researchers have postulated that the underlying determinants of the yield spread today are materi-

Yield Spread and Lagged Real GDP Growth



Note: Shaded bars indicate recessions.

ally different from the determinants that generated yield spreads during prior decades. Differences could arise from changes in international capital flows and inflation expectations for example. The bottom line is that yield curves contain important information for business cycle analysis, but like other indicators, should be interpreted with caution. For more detail on these and other issues related to using the yield curve to predict recessions, see the Commentary "Does the Yield Curve Signal Recession?" Our friends at the Federal Reserve Bank of New York also maintain a website with much useful information on the topic, including their own estimate of recession probabilities.

Implied Taylor Rules among Forecasters

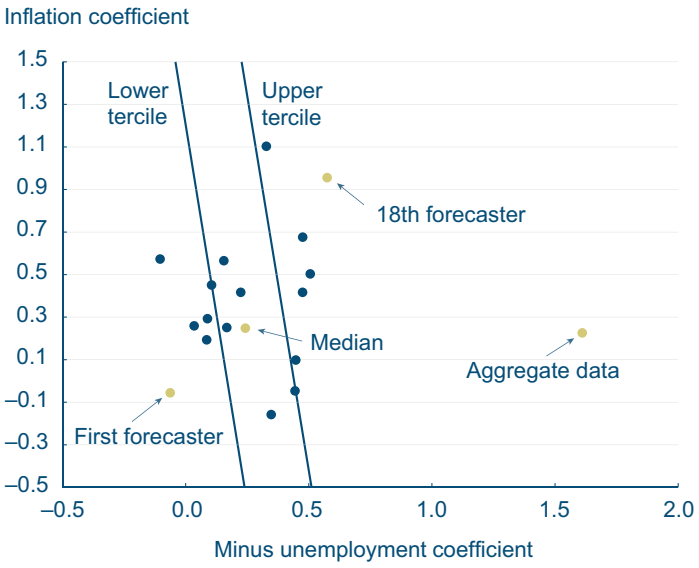
12.02.14
by Charles T. Carlstrom and Timothy Stehulak

It has become commonplace to think of the Fed in normal times (when the federal funds rate is above zero) as operating in terms of a Taylor-type rule. The Taylor rule postulates that the Fed chooses deviations of the funds rate from its long-run target level based on the "inflation gap" (deviation of inflation from its long-term target of 2 percent), the unemployment (or output) gap, and the past funds rate. While such a rule necessarily abstracts from the many complexities that factor into the Fed's actual setting of the federal funds rate target, it can effectively capture the historical evolution of monetary policy.

We explore whether professional forecasters appear to use a Taylor rule when they forecast the future funds rate, and if so, how similar their regression coefficients are to each other and to those in a Taylor rule that fits the historical data. We start by assuming that all forecasters follow a Taylor rule with an unemployment gap, and then we back out the implied Taylor rule coefficients from their forecasts of inflation, unemployment, and the funds rate. If the coefficients for each forecaster differ a great deal, it suggests that they use different versions of the Taylor rule or they don't use such a rule at all.

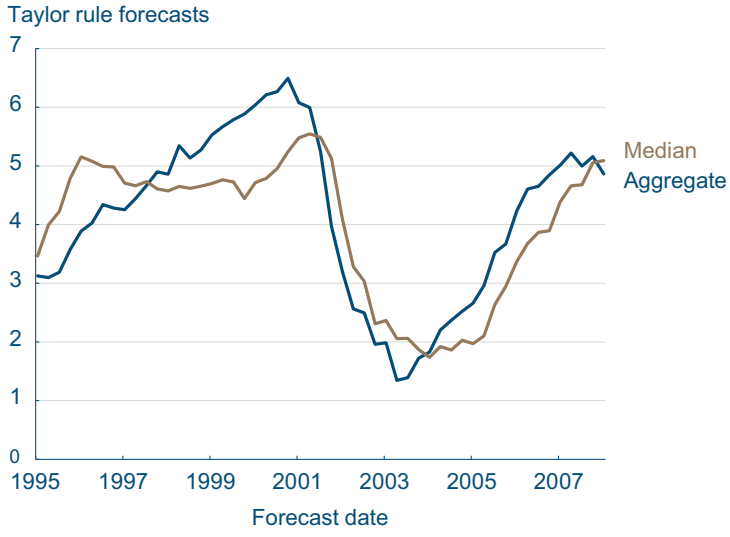
To estimate forecasters' Taylor rule coefficients, we use the projections that come from the Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. Among the questions asked in the survey are "What do you anticipate the inflation rate to be over the next four quarters?" and "What will the unemployment rate be four quarters from now?" While forecasters are not asked about what they expect the funds rate to be, they are asked what they think the 90-day T-bill rate will be three quarters from now, and since the T-bill rate is roughly the average of the funds rate over the next 90 days, we use this as a proxy for their funds rate forecast four quarters hence. We use these forecasts as inputs to estimate the implied coefficients of their Taylor rules.

Regression Coefficients of Individual Forecasters, Aggregate



Source: Authors' calculations using Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters' data.

Taylor Rules for the Median Forecaster, Aggregate



Source: Authors' calculations with Bureau of Labor Statistics and Board of Governors of the Federal Reserve System data from Haver Analytics.

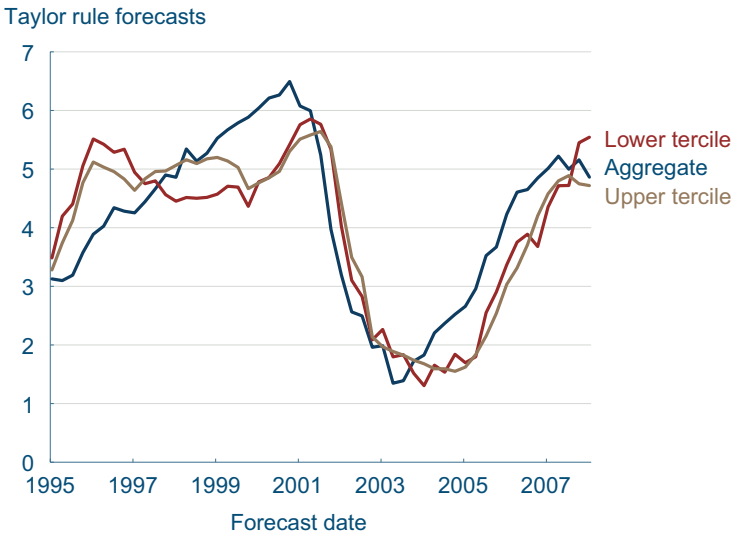
We have continuous data for 18 forecasters since 1995. The chart below plots the Taylor rule coefficients that are implied by each of their inputs for inflation and unemployment.

If a data point appears in the upper right area of the graph, it implies that a given forecaster's Taylor rule responds more aggressively to both inflation and unemployment than does the typical forecaster. If a point is in the lower left area, it implies that a forecaster's Taylor rule does not respond strongly to current data. Instead, forecasts of future funds rates are driven mostly by where the funds rate will move in the long run and today's funds rate. (Because an aggressive stance for unemployment is a large negative number, we plot the negative of the unemployment rate coefficient.)

There is a tremendous amount of variability in the coefficients. They range from a forecaster who sees basically no relationship between his funds rate forecast and his inflation and unemployment forecasts, to the 18th forecaster, who responds strongly to both inflation and unemployment (coefficients of 1.0 and 0.6, respectively). Perhaps even more interesting is that none of the forecasters has Taylor rule coefficients that resemble the fit of a Taylor rule to actual data on inflation and unemployment, rather than forecasts. The point labeled "aggregate data" corresponds to the coefficients of the Taylor rule implied by using actual realized data for unemployment, inflation, and the funds rate. That is, these are the coefficients in a Taylor Rule implied by the historical behavior of monetary policy as it relates to actual inflation and unemployment. Interestingly, the unemployment responses, in particular, are much larger than those of any of the individual forecasters.

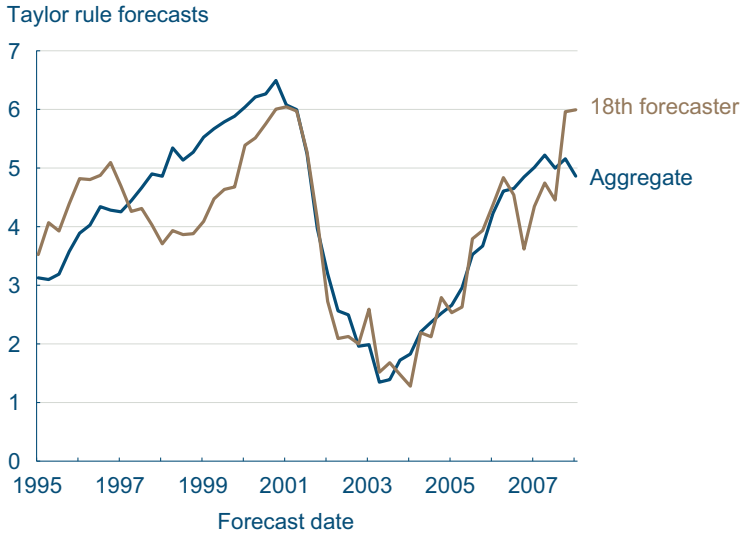
The median forecast is frequently taken to be the "consensus" forecast. If we compare the median forecast to the aggregate, we find that the median's inflation coefficient is roughly the same as the aggregate's, but the unemployment coefficient is substantially higher. In fact, the implied Taylor rule of the median forecaster bears little resemblance to the one describing the Fed's behavior. The chart below shows what the median and aggregate Taylor rules would suggest for the funds rate over time given

Taylor Rules for the Lower and Upper Terciles, Aggregate



Source: Authors' calculations with Bureau of Labor Statistics and Board of Governors of the Federal Reserve System data from Haver Analytics.

Taylor Rules for the 18th Forecaster, Aggregate



Source: Authors' calculations with Bureau of Labor Statistics and Board of Governors of the Federal Reserve System data from Haver Analytics.

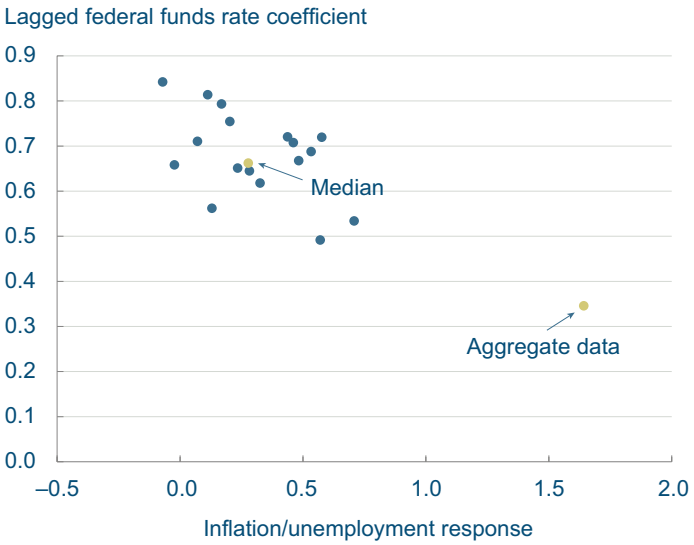
the realized values of inflation, unemployment, and past interest rates. While the two estimated funds rate series necessarily track each other, there are huge discrepancies. It is not uncommon for them to differ by over 100 basis points. In the policy space, such a gap is extremely large.

To help illustrate the variability of the Taylor rules, we graphed the federal funds rates that would be produced by the implied Taylor rules of the forecasters with the strongest and weakest responses to inflation and unemployment—those in the top tercile of the first chart above and those in the bottom tercile. (To group the forecasters, we separated them into three groups of six in terms of their combined inflation and unemployment response. This requires aggregating inflation and unemployment into a single number. While there is necessarily some arbitrariness to combine them we weight the two by the tradeoff between the two exhibited in the version of the Taylor Rule estimated with actual aggregate data.) The group with the strongest response to inflation and output tracks the behavior of past monetary policy marginally best. In fact, the forecaster that tracks the aggregate Taylor rule the best is the most extreme forecaster in terms of his or her inflation and unemployment responses. But even then the differences between the two can be large.

We concentrated on forecasters' inflation and unemployment responses because these would be the current data determining the funds rate in a Taylor rule. The past funds rate is included to capture the fact that the actual funds rate moves very slowly. (Because we obtained the SPF estimated Taylor rules from forecasts, it is the current funds rate for them.) To see whether there is a relationship between how much a forecaster depends on the past fed funds rate and on the inflation-unemployment response, we plot the coefficients of both.

There is an inverse relationship between how strongly forecasters rely on today's funds rate in determining where the funds rate will be in the future and how strongly they rely on their forecasts of inflation and unemployment. Those that do not rely on inflation and unemployment tend to rely more on the current funds rate. This suggests that some

Regression Coefficients of Individual Forecasters



Source: Authors' calculations using Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters' data.

forecasters assume the funds rate will be essentially what it is today without following any Taylor rule, while others appear to believe that a Taylor rule is important in determining the funds rate. Our estimates of forecasters' Taylor rules show that, if we assume they follow an unemployment Taylor rule, their coefficients are very different. Similarly, none of the forecasters' implicit Taylor rules is similar to estimates of the historical reaction of the funds rate to inflation, unemployment, and last year's funds rate, and this is especially true of the median or "consensus" forecaster.

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