

# Philadelphia Fed Forecasting Surveys: Their Value for Research\*

BY DEAN CROUSHORE

**T**he Federal Reserve Bank of Philadelphia has conducted both the Survey of Professional Forecasters and the Livingston Survey for 20 years. Both surveys of private-sector forecasters provide researchers, central bankers, news media, and the public with detailed forecasts of major macroeconomic variables. The surveys have proved helpful for people who are planning for the future, and they have also provided useful input into the decisions of policymakers at the Federal Reserve and elsewhere. In this article, Dean Croushore provides an overview of the surveys and discusses the ways in which researchers have used the surveys.

The Federal Reserve Bank of Philadelphia has conducted both the Survey of Professional Forecasters and the Livingston Survey for 20 years. Both surveys of private-sector forecasters provide researchers, central bankers, news media, and the public with detailed forecasts of major macroeconomic variables. The surveys have been made available to the public at no charge, reflecting the public education



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article is available free of charge at [www.philadelphiafed.org/research-and-data/publications/](http://www.philadelphiafed.org/research-and-data/publications/).

mission of the Federal Reserve. The surveys have proved helpful for people who are planning for the future. They have also provided useful input into the decisions of policymakers at the Federal Reserve and elsewhere. This article will provide an overview of the surveys and discuss the ways in which researchers have used the surveys.

The Livingston Survey is the older of the two Philadelphia Fed surveys. It started when Joseph Livingston, a Philadelphia newspaper reporter, wanted to get a sense of what forecasters thought would happen to the economy in the next year, and so he began sending a survey to prominent

\*The views expressed here are those of the author and do not necessarily represent the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System.

economists around the country.<sup>1</sup> He continued to publish his survey every six months, gathering and reporting on the forecasts and tracking their evolution over time. His survey, which was the only collection of private-sector forecasts of macroeconomic variables in the country at the time, gained a national following. Economic researchers began using the survey extensively in the early 1970s to test theories about people's expectations. By 1978, Livingston was having trouble keeping up with all of the requests for the data and turned the data over to the Philadelphia Fed's Research Department, which organized the data in a computer database and made them available to researchers on request. Livingston still ran the survey, but the Philadelphia Fed compiled the results and maintained the database. Livingston provided the first report of the survey's results in his column in the *Philadelphia Inquirer*. When Livingston died in 1989, the Fed took over the administration of the survey and carried on Livingston's legacy. Since the advent of the Internet, the Fed has made all of the historical Livingston data available on its website.<sup>2</sup>

<sup>1</sup>Herb Taylor's 1992 article describes the survey and Livingston's newspaper columns reporting on the survey. For an in-depth discussion of the setup of the survey and a description of early research using it, see my 1997 article.

<sup>2</sup>The Philadelphia Fed's website (at: [www.philadelphiafed.org/research-and-data/real-time-center/livingston-survey/](http://www.philadelphiafed.org/research-and-data/real-time-center/livingston-survey/)) contains background material about the Livingston Survey, news releases from the survey going back to 1991, data files containing both forecasts of individuals and means or medians across the forecasters for each variable in each survey, and an academic bibliography listing research papers that have used the survey.

The Survey of Professional Forecasters began as the idea of Victor Zarnowitz and others at the American Statistical Association and the National Bureau of Economic Research. They began the ASA/NBER Economic Outlook Survey in 1968 and successfully carried it out for 22 years. The survey was similar to the Livingston Survey in that it asked private-sector forecasters for their projections for the next year for major macroeconomic variables. But the ASA/NBER survey was conducted more frequently than the Livingston Survey (quarterly instead of semi-annually), asked for quarterly forecasts (instead of Livingston's half-year forecasts), and included some unique questions about the probabilities of different outcomes, instead of asking just for the point forecasts (that is, the most likely outcome) reported by the Livingston Survey. In 1990, the ASA/NBER turned the survey over to the Philadelphia Fed, which rechristened it the Survey of Professional Forecasters (SPF).<sup>3</sup>

Why do people need forecasts? When planning their personal budgets, people need to know what the forecast for inflation is; when planning production, firms need to forecast demand for their products; when buying and selling financial assets, investors need to forecast both inflation and future interest rates;

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<sup>3</sup> For more on the setup of the Survey of Professional Forecasters and its origins, see my 1993 article. The Philadelphia Fed's website (at [www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/](http://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/)) contains background material about the survey, news releases from the survey going back to 1990, data files containing both forecasts of individuals and means or medians across the forecasters for each variable in each survey, an academic bibliography listing research papers that have used the survey, and forecast error statistics that present data on the accuracy of the survey forecasts.

and when setting policy, government analysts need to know how the economy is likely to fare in the future. Forecasting surveys can help all of these groups figure out the most likely outcomes for the variables that most concern them.

The Philadelphia Fed's surveys are not the only surveys of forecasters. A well-known U.S. survey is the Blue Chip Economic Indicators, which

a European version of the Survey of Professional Forecasters in 1999 after consulting with the Philadelphia Fed on its methods.

The table on page 3 lists the major macroeconomic variables covered by the surveys, for which the respondents provide short-term forecasts (for the next one to two years). In addition to those variables, the surveys ask for long-term forecasts — the SPF asks

**The SPF asks about forecasts for inflation in both the CPI and PCE price index for the next five years and the next 10 years, while the Livingston Survey asks about real GDP growth and CPI inflation for the next 10 years.**

was started by Robert Eggert in 1976. The Blue Chip concept was to publish forecasts monthly (compared with the quarterly SPF and the semi-annual Livingston Survey) and to publish the names of each forecaster along with his or her forecast (forecasters for both the SPF and the Livingston were anonymous). In addition, the National Association for Business Economics (NABE) has produced a quarterly survey of forecasters since the early 1960s, and the *Wall Street Journal* also conducts a similar survey that is reported in great detail on its website. Direct measurement of consumers' inflation expectations is gathered by the monthly Reuters/University of Michigan survey of consumers, which asks a random sample of consumers for their forecasts of inflation. For other countries there have been a number of surveys, most notably *Consensus Forecasts*, which gathers detailed forecasts for all major developed countries in the world and less detailed forecasts for numerous other countries. Also, the European Central Bank started

about forecasts for inflation in both the CPI and PCE price index for the next five years and the next 10 years, while the Livingston Survey asks about real GDP growth and CPI inflation for the next 10 years. In addition, in every survey, the SPF asks about the probability of a decline in real GDP in each of the next five quarters and about the probability that real GDP, the inflation rate in the GDP price index, the CPI excluding food and energy, and the personal consumption expenditures (PCE) price index excluding food and energy will fall into certain ranges. The latter questions are designed to get an idea of the degree of uncertainty that forecasters attach to their forecasts. Each survey also asks special questions from time to time on a variety of topics of current interest.

Both the SPF and the Livingston Survey provide anonymity for the forecasters. The survey news release lists the names of the forecasters, but a reader cannot tell which forecaster provided which forecast. The benefit of anonymity is that the forecasters

**TABLE**

**Variables Included in the Surveys**

Both Surveys	
nominal gross domestic product (GDP)	real (inflation-adjusted) GDP
unemployment rate	inflation (consumer price index, CPI)
industrial production	corporate profits after tax
business fixed investment	housing starts
interest rate on three-month Treasury bills	interest rate on 10-year Treasury notes
Livingston Survey	
producer price index	S&P 500 stock prices
average weekly earnings	prime interest rate
retail trade sales	auto sales
Survey of Professional Forecasters	
interest rate on AAA bonds	payroll employment
GDP price index	consumer price index excluding food and energy prices
personal consumption expenditures price index	personal consumption expenditures price index excluding food and energy prices
consumption	residential fixed investment
federal government spending	state and local government spending
net exports	changes in private inventories

may be more likely to reveal their true forecasts if they know that their name will not be associated with a particular forecast. If they think that their forecast is very different from that of other forecasters, they would have no incentive to hide it. However, if they were providing their forecasts in a nonanonymous survey (such as the *Wall Street Journal* or the Blue Chip survey), they might prefer to shade their forecasts closer to the consensus, out of fear that they will be seen as being out of the

mainstream. Other forecasters might be looking for attention and might intentionally make their forecasts stand out from the crowd. The anonymity of the SPF and Livingston avoids these problems.<sup>4</sup>

<sup>4</sup> In his study, Owen Lamont looked at a nonanonymous survey, finding that forecasters tended to distort their forecasts to manipulate their reputations, while Tom Stark's study found no such evidence for the SPF, which is anonymous.

The timing of the SPF and Livingston surveys differs, in part because the SPF is conducted four times each year, while the Livingston survey is conducted just twice a year. More important, since the SPF focuses on the national income accounts, the survey forms are sent to participants immediately following the initial release of the GDP data for the preceding quarter, which occurs in late January, April, July, and October each year. The forecasters are given about 10 days to

respond to the survey questions, and they then e-mail their responses to the Philadelphia Fed before the middle of the following month (when key data on consumer prices are released). The Livingston Survey's timing is based on the release of the consumer price index data in May and November, with the forecasts due before the next month's release of the consumer price index.

## EVALUATING THE SURVEY FORECASTS

Given the uses to which people, firms, and policymakers put the surveys, it is important that the forecasts be accurate. Of course, no forecast is going to be on the mark all the time. Economists have tested the surveys extensively. Simple tests examine the forecast errors over time to see if they are zero, on average, which would be the hallmark of an unbiased forecast. Another test is how precise the forecast is, that is, how large the average error is. More sophisticated tests look at the correlation between forecast errors and information available to forecasters when they made their forecasts; if such a correlation exists, the forecasters in the survey are not using that information efficiently.

A visual inspection of the data sometimes suffices to see whether a particular forecast has forecast errors that are zero, on average. Figure 1 shows a scatter plot in which the value of the inflation rate (based on the GDP deflator over a one-year period) is plotted on the vertical axis and the forecasts from the Livingston Survey for that year are plotted on the horizontal axis. The 45-degree line in the figure helps you gauge the accuracy of the forecasts because if the forecasts were perfect, every point in the diagram would be on that line. The fact that most of the points in the graph are close to the 45-degree

line suggests that the forecasts are fairly accurate. Formal statistical tests confirm that the mean forecast error in this series is not statistically significantly different from zero.<sup>5</sup> Despite the unbiasedness of the survey forecasts over the entire period from the early 1970s to the mid-2000s, there are numerous periods in which the survey forecasts appear to have performed poorly. Figure 2 shows the actual values of inflation (measured using the GDP price index) over a one-year period compared with the SPF forecasts for the corresponding period.

The SPF forecasts for inflation were clearly far from the mark in the early and late 1970s, with very large forecast errors. Perhaps these forecast errors were understandable, given the unprecedented increase in the growth of the money supply that occurred during that decade, which caught forecasters by surprise. In the early 1980s, the forecasts were wrong in the opposite direction, as inflation fell much more than the forecasters thought it would. Similarly, in most of the 1990s, the forecasters made a string of forecast errors, with inflation continually coming in lower than the forecasters had projected. In that period, productivity growth surged, and it took some time before the forecasters realized that the economy was not overheating, but rather that potential output was increasing more rapidly than before, so inflation would not be rising significantly.<sup>6</sup> Thus, the forecasters clearly go through periods in which they make persistent forecast errors.

In addition to periods in which the forecasters make persistent forecast

errors, the forecasters in the surveys may be inefficient in their use of other information. Economists test this idea by examining the relationship between the survey's forecast errors and data that were known when the forecasters made their forecasts. For example, Laurence Ball and I found that output forecast errors were associated with changes in the real (inflation-adjusted) federal funds rate (the interest rate on short-term loans between banks, which is the Federal Reserve's main policy instrument), which means that the forecasters did not accurately modify their forecasts in response to a change in monetary policy. This can be seen in Figure 3, which plots the output forecast error from the SPF (the actual rate of output growth minus the forecasted rate of output growth) against the lagged change in the real federal funds rate. The negative relationship between these two variables implies that the output forecasts from the SPF are not efficient with respect to changes in monetary policy.

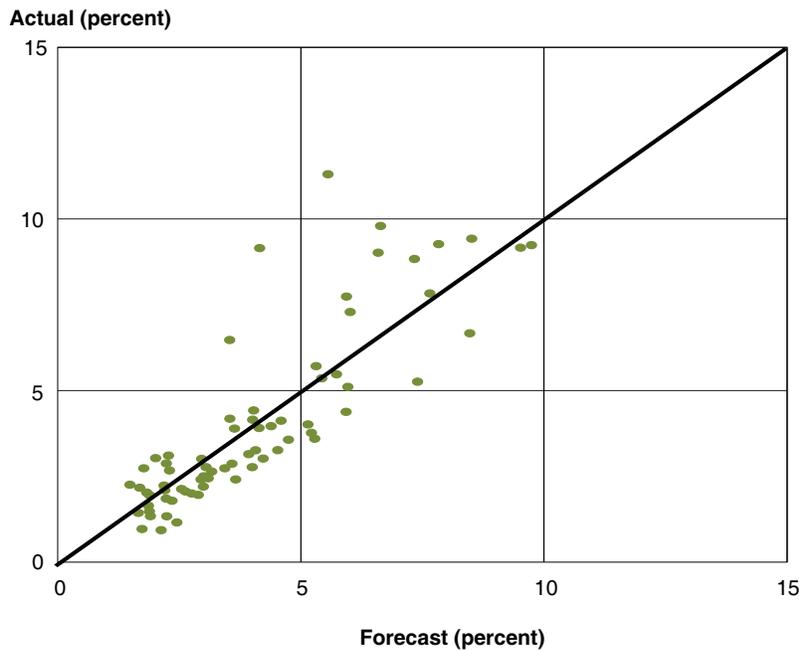
A little-explored aspect of the SPF is the probability distribution forecasts it provides. Each forecaster is asked to list the probability that real GDP growth and inflation in the GDP price index will fall into certain ranges. In the most recent surveys, the forecasters are asked to state the probability that real GDP growth in the next year will be 6 percent or more, 5.0 to 5.9 percent, 4.0 to 4.9 percent, 3.0 to 3.9 percent, 2.0 to 2.9 percent, 1.0 to 1.9 percent, 0.0 to 0.9 percent, -1.0 to -0.1 percent, -2.0 to -1.1 percent, and -2.0 percent or less. The same question is also asked for real GDP growth in the following year. For the percent change in the GDP price index, the ranges are two percentage points higher, so the top range is 8 percent or more, and so on.

<sup>5</sup> See my 2010 paper.

<sup>6</sup> These concepts are explored in more detail in my 2010 paper.

**FIGURE 1**

**Forecasts Versus Actuals: Livingston Survey**

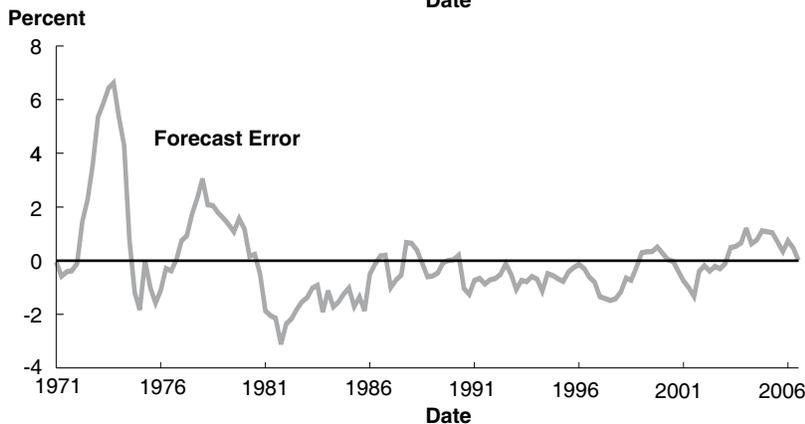
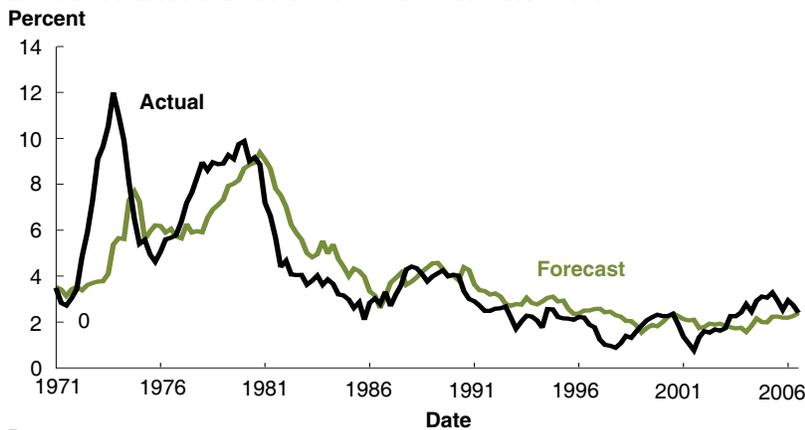


Frank Diebold, Anthony Tay, and Kenneth Wallis analyzed these probability distribution forecasts from the SPF using new methods. Their goal was to test the accuracy of the distribution forecasts, and for the most part, they found that the forecasts were reasonably accurate. However, the forecasts failed to pass some tests: (1) they placed too large a probability on a large decline in inflation; and (2) they made persistent inflation forecast errors, though the forecasters eventually adapted and the errors disappeared. They also found that when inflation was low, uncertainty about inflation was also low.

Overall, recent research on the accuracy of the SPF and Livingston forecasts has found that they are reasonable, even if there are a few areas in which they are imperfect. However, as the literature using the surveys for research evolved over time, the accuracy of the forecasts was often called into question.

**FIGURE 2**

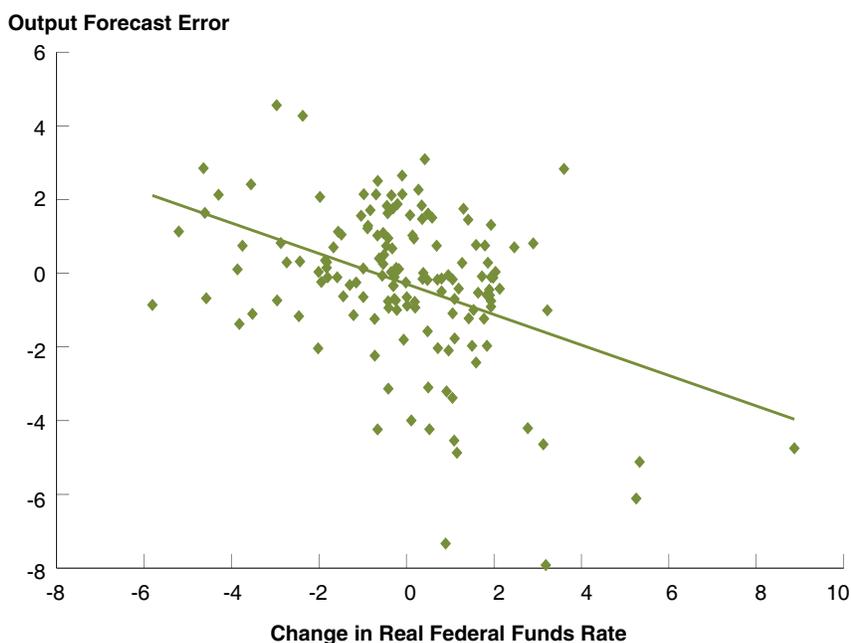
**Median Inflation Forecast from SPF**



**USING THE SURVEYS TO ANSWER RESEARCH QUESTIONS**

We now turn to a discussion about the areas of research in which researchers have used the SPF and Livingston Survey. These include investigating whether people have rational expectations, studying how people form their expectations, conducting empirical studies of macroeconomic theories, and

<sup>7</sup> This section discusses many of the major research studies that have used the surveys. For a more complete list of such studies, see the bibliographies posted on the Philadelphia Fed's website at [www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/academic-bibliography.cfm](http://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/academic-bibliography.cfm) and [www.philadelphiafed.org/research-and-data/real-time-center/livingston-survey/academic-bibliography.cfm](http://www.philadelphiafed.org/research-and-data/real-time-center/livingston-survey/academic-bibliography.cfm).

**FIGURE 3****Output Forecast Errors and Change in Real Fed Funds Rate**

answering questions about monetary policy.<sup>7</sup>

Economists have written major research papers using both the SPF and Livingston surveys, beginning with Stephen Turnovsky. Turnovsky tried to show how forecasters formed their expectations, and he developed an early test of rationality of the forecasts using the Livingston Survey. The first paper to use the SPF (actually its predecessor, the ASA/NBER survey) was one by Vincent Su and Josephine Su, which evaluated the accuracy of the survey forecasts using only a few years of data.

None of the earliest papers to use the Livingston Survey are reliable, however, because John Carlson discovered a major flaw in the data (which has subsequently been fixed). Because the survey's original purpose was for journalism, Livingston did not report the actual forecasts of the

forecasters in his newspaper column. Instead, he modified the forecast data if a data release occurred after the forecasters had submitted their forecasts but before his newspaper column appeared and if the data release would have changed the overall nature of the forecasts.

Carlson gives the following example. Suppose the CPI was released in September and October with a value of 121.1 and the forecasters have an average forecast for the following June of 121.2. Then, if the November data release (which came out after the forecasters had answered the survey but before the survey results were reported) for the CPI is 121.1, the June forecast is reasonable and Livingston would not adjust the forecast. But suppose the November CPI data were released as 121.6. Then if Livingston reported the November number and the June forecast, it would appear that

the forecasters thought there would be deflation, even though they were really forecasting a small amount of inflation. So, Livingston would instead report a forecast of 121.7, which maintains the 0.1 increase in the CPI that the forecasters thought would happen. But this means that the reported forecasts were fictional and depended on Livingston's personal judgment. Carlson remedied this situation by obtaining the true forecast values from Livingston and thus restoring the integrity of the data set. Carlson showed that Livingston's adjustments made the forecasts look better. Studies based on the incorrect data obtained somewhat different results compared with results based on the corrected data.

**Rational Expectations.** The Philadelphia Fed's surveys of forecasters were initially used by researchers in the early 1970s to investigate the concept of rational expectations, which asserts that people do not make systematic errors in forecasting. A number of early papers had used the Livingston Survey forecasts of inflation and rejected the rational expectations hypothesis because researchers found that the survey forecasts were biased (with a nonzero mean forecast error) and inefficient (because the forecast errors were correlated with data known when the survey was taken).

But in a 1978 study, Donald Mullineaux found a major flaw in the statistical procedure previous studies had used to test for and reject the rationality of expected inflation in the Livingston Survey.<sup>8</sup> Mullineaux then proposed a new test that is not

<sup>8</sup> The flaw is that the test used in much previous work (known as the Chow test) assumed identically and independently distributed (i.i.d.) errors in a framework where that is unlikely to hold. Mullineaux showed that the assumption can be rejected.

subject to the same statistical problem and found that the properly specified data are consistent with people having rational expectations.

The early literature on rational expectations often ran tests for unbiasedness and inefficiency of the survey forecasts. But those tests were flawed in an important way because they failed to account for the fact that a forecast error in one survey forecast carried over to other surveys because the length of the forecast horizon (eight or 14 months) was longer than the interval between surveys (six months). Thus, a sudden rise in inflation in one period could lead to forecast errors in two or three consecutive surveys, a situation that has come to be known as the overlapping observations problem.

By failing to account for this correlation in the forecast errors, the researchers' tests for unbiasedness and inefficiency were overstating the case against the surveys. Bryan Brown and Shlomo Maital finally remedied this situation, making a key methodological contribution: recognizing the overlapping-observations problem and showing how to adjust the statistical tests so that they gave the correct inference. Brown and Maital then tested the Livingston Survey data for unbiasedness and efficiency. They generally found no bias, unlike many earlier researchers. But they did find some evidence that the Livingston Survey forecast errors were correlated with changes in money growth.<sup>9</sup>

Another challenge to rational expectations using the surveys came from Eugene Fama and Michael Gibbons. They created alternative inflation forecasts based on nominal and real interest rates, as well as

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<sup>9</sup> A related correlation is found in my paper with Laurence Ball.

changes in those rates. They showed that the inflation forecasts based on interest rates outperformed the Livingston Survey forecasts of inflation from 1977 to 1982.

Many other researchers became convinced that forecasters did not have rational expectations. One of them, Douglas Pearce, did a simple experiment to show how irrational the survey forecasts were. Pearce then constructed a forecast of inflation in which the change in the inflation rate from one period to the next depended only on the unexpected change in the inflation rate in the previous period and ignored data on other variables that a forecaster might use to forecast, including the money supply and the strength of the economy. Pearce correctly used only the data that the participants in the Livingston Survey had available to them at the time when they made their forecasts (known as real-time data; see the study that I did with Tom Stark for more on this concept of real-time data analysis). Pearce compared his simple model's forecasts with the forecasts from the Livingston Survey and found that his model had much better forecasts for inflation than the survey. He also showed that the rise in interest rates in the 1970s was better explained by his simple model than by the Livingston Survey.

If a very simple model can provide better forecasts than the forecasters in the survey, it would seem that the survey forecasts aren't that valuable, and professional forecasters are irrational because they could have used Pearce's model and made better forecasts.<sup>10</sup>

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<sup>10</sup> Later research showed that Pearce's results, though powerful, weakened over time. If you use the same method that Pearce used and the additional data that we have today, you would find that the survey now does better than the simple model that Pearce used. See my 2010 paper for an extensive analysis of the use of Pearce's method.

After many studies that found fault with the forecasting surveys, many economists began to believe that either people did not have rational expectations or that the surveys did not represent people's true forecasts, or both. Michael Keane and David Runkle sought to disprove both hypotheses, arguing that much of the literature on testing survey forecasts for rationality suffered from three flaws: (1) the use of the average forecast across forecasters was wrong because forecasters may have different information; (2) other research studies failed to adjust properly for data revisions; and (3) other research studies failed to account for the correlation of forecast errors across forecasters. Keane and Runkle avoided these problems by using individual forecasts on the GNP deflator, basing their analysis on real-time data (the first revision of the national income data, which come out one month after the initial release), and developing a statistical method that accounts for the correlation of forecast errors across forecasters. They evaluated current-quarter inflation forecasts from the SPF, finding that they were unbiased and efficient.

Overall, the literature on rational expectations has benefited tremendously from the existence of the SPF and the Livingston Survey. Though the results of tests for rationality have been mixed over time, more recent evaluations generally suggest that the survey forecasts are fairly accurate and pass most, though not all, tests for rationality.

**Expectations Formation.** Research on how people form expectations has a slightly different goal than the literature on testing rational expectations; it uses the surveys to investigate what information forecasters use to form their forecasts and the properties of their forecasts.

Alex Cukierman and Paul Wachtel introduced the idea that inflation expectations differ across individuals because people have different information at their disposal. In this situation, an increase in people's uncertainty about inflation leads to more variability in their inflation expectations over time than when inflation is more stable. Cukierman and Wachtel used the Livingston Survey forecasts on CPI inflation to examine the differences in inflation expectations across forecasters. They found that the variability of expected inflation across forecasters is positively related to the variability of the inflation rate and the growth rate of the economy's output. Thus, volatility in the economy translates into uncertainty in people's forecasts.

One branch of this literature is devoted to finding variables that are correlated with the survey forecasts, thus revealing the data that forecasters find important in forming their forecasts. In a 1980 study, Donald Mullineaux used the Livingston Survey forecasts to examine how forecasters form inflation expectations, using real-time data on the money supply (that is, the data known to forecasters when they made their forecasts, rather than revised data). He found that the forecasters used money-growth data in forming their forecasts, not just lagged inflation data, so that inflation forecasting models that are just based on past inflation rates are not efficient. Mullineaux found evidence that the expectations-formation process changed over time, perhaps in response to changes in the way monetary policy was conducted.

This is an important finding, since it provides evidence that is consistent with theoretical research by Nobel Prize winner Robert Lucas, who argued that when the Federal Reserve

changes the process by which it sets monetary policy (a process that clearly changed in the 1970s), equations such as those describing the formation of inflation expectations will undergo significant changes. Mullineaux also found evidence that the same model determining inflation expectations also determines actual inflation, so that survey forecasts are rational.

One of the most important papers in this literature is that of Victor Zarnowitz and Louis Lambros, who were the first to combine and compare the SPF point forecasts with the probability distribution forecasts.<sup>11</sup> They considered two concepts: (1) consensus, which is the degree to which the point forecasts are similar across forecasters; and (2) uncertainty, which is the degree to which an individual forecaster thinks a certain outcome is likely and is a measure of how much risk there is to her or his point forecast. Zarnowitz and Lambros found that consensus across forecasters may be very different from the uncertainty that each individual forecaster has about his or her forecast. Previously, most researchers had equated consensus and uncertainty, which had the effect of understating the true degree of uncertainty. Zarnowitz and Lambros also found that higher inflation rates were associated with greater uncertainty about inflation and showed that increased inflation uncertainty was associated with lower real output growth.

Recently, numerous researchers have begun focusing on how households form their own inflation

expectations. Gregory Mankiw, Ricardo Reis, and Justin Wolfers noted that professional forecasters disagree with each other in their forecasts of inflation, as do consumers. They showed that the extent to which forecasters disagree changes over time. To explain these disagreements, they developed a "sticky-information" model. The basic idea of sticky information is that collecting and analyzing information involves costs, so that people update their expectations infrequently. They then used the Michigan survey of consumers, the SPF, and the Livingston Survey to verify their model. They found that their model helps to explain the irrationality of inflation expectations, including why forecast errors are persistent and why it takes some time before news is incorporated into the forecasts.

A related paper is that of Christopher Carroll, who developed an interesting hypothesis: Households may not have rational expectations, but rather form their expectations by reading professional forecasts, which are rational. (See *How Would You Forecast?*) Households' expectations may not be rational because they only occasionally read the forecasts of professional forecasters and don't always pay attention to them. To test this view, Carroll examined whether the forecasts in the Michigan survey of consumers incorporate information from the SPF, or vice versa. By examining the relationship between the actual inflation rate, the Michigan consumer survey forecasts, and the SPF forecasts of inflation, he was able to show that the Michigan forecast contains no additional information that is not already in the SPF, but the SPF does contain additional information that is not in the Michigan survey. He also found evidence that SPF forecasts affected

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<sup>11</sup> The difference between a point forecast and a probability distribution forecast can be illustrated by an example. The survey's point forecast for inflation in the next year could be 2.5 percent. The probability distribution forecast might be a 25 percent chance that inflation will be 1.0 to 1.9 percent, a 50 percent chance that inflation will be 2.0 to 2.9 percent, and a 25 percent chance that inflation will be 3.0 to 3.9 percent.

## How Would You Forecast?

# I

f you were asked to forecast the economy, how would you do it? You might say, "I am not in the business of forecasting, so I don't know how I would construct forecasts of the economy!" But it turns out that most of us have some intuition

about how the economy is going to fare in the future. For example, the Michigan survey of consumers asks people who are not economists what they think the inflation rate will be over the coming year, and the consumers answer the question very well, in some periods forecasting inflation better than the professional economists in the Livingston Survey and the SPF.

One thing you could do is to look at recent values and assume that the future will be just like today. Or you might take a class at your local university and learn techniques of time-series forecasting, which would be far more sophisticated than assuming the future is like today and would give you much better forecasts. But most of us do not want to spend that much time to forecast for three good reasons: (1) the costs of forecasting are high because

most of us do not know much about forecasting; (2) the benefits of forecasting are low because our lives are not strongly affected by being able to forecast better; and (3) we can read the newspaper or surf the web and easily learn about the forecasts of experts, so why should we bother to make our own?

As our discussion in the text of Christopher Carroll's research suggests, most people do not spend much time forecasting, but they do read about forecasts in the media and on the Internet. As a result, the forecasts of experts are distributed around the country gradually over time. Thus, even though only a few economic experts take the time to work out their own forecasts, their views influence the forecasts of many citizens and thus affect economic activity. A further reason to turn to a survey like the Survey of Professional Forecasters or the Livingston is that the surveys combine the efforts of a number of forecasters who often look at the economy from different perspectives. As a result, a forecast that averages all of the projections (using the mean or the median) is often superior to any individual forecast.\*

\*There is a substantial amount of research in the area of forecast combination, which shows that simple averages of many forecasts often perform better than nearly all individual forecasts. See Alan Timmermann's article for an overview.

later Michigan surveys but that the Michigan survey did not affect later SPF forecasts. This result suggests that, over time, households come to incorporate the SPF forecasts. Carroll's results are also supported by the fact that when news coverage of inflation is high, Michigan forecasts get closer to SPF forecasts. Similar results occur when Carroll uses the unemployment rate in his empirical work, rather than the inflation rate.

### Empirical Macroeconomics.

One puzzle that survey forecasts helped solve was the issue of why real (inflation-adjusted) interest rates declined so much in the 1970s. James Wilcox used the Livingston Survey forecasts of inflation in an attempt to

determine the main factors affecting nominal and real interest rates. He discovered that much of the decline in real interest rates in the 1970s (though not all) was due to increases in expected inflation rates. He argued that previous models failed to include a supply-shock variable representing the prices on inputs, such as oil prices. Once he included such a variable and used the Livingston Survey forecasts to represent expected inflation in calculating the real interest rate, his model fit the data well. In a related paper, Kajal Lahiri, Christie Tieglund, and Mark Zaporowski found that uncertainty about inflation (measured using the probability variables in the SPF) also affected real interest rates.

Their main result was that increased uncertainty about inflation causes the real interest rate to decline, with investment spending declining more than saving.

One of the most famous papers that empirically tests macroeconomic theory was that of Robert Hall, who found evidence supporting economists' major theory of consumption, which is that income in a given year has less impact on consumption spending than households' long-run average income, a theory known as the life-cycle/permanent-income hypothesis. Hall used the Livingston Survey to calculate the expected inflation rate and the expected return to the stock market. He also found that changes in

the real interest rate have little effect on consumption spending, much less than some economists had thought before Hall's research.

This discussion only touches on some of the main studies in the empirical macroeconomics literature that have benefited from the Philadelphia Fed's surveys.

**Monetary Policy.** One of the main mechanisms by which monetary policy affects the economy is by affecting people's inflation expectations. Researchers have suggested that the Federal Reserve bases monetary policy on inflation and the degree to which output in the economy is above or below trend (known as the output gap). The equation relating the federal funds interest rate (which measures monetary policy) to inflation and the output gap is known as the Taylor rule, named after John Taylor of Stanford University, who developed the idea. Most of the research done in this area suggests that the Fed looks at past inflation and the past output gap. But Athanasios Orphanides used the SPF to obtain forecasts of inflation and output to use in the Taylor rule and found that this produced better estimates of what the Fed did than using past data. Thus, the Fed appears to follow a forward-looking Taylor rule rather than a backward-looking rule.

How does the Fed respond to changes in expected inflation? Sylvain Leduc, Keith Sill, and Tom Stark investigated this issue, using the Livingston Survey as a source for the economy's expected inflation rate. They found that before 1979, the Fed responded to increases in expected

inflation by increasing the federal funds interest rate. But because the Fed did not increase the interest rate by as much as expected inflation increased, the real interest rate declined. This more accommodative monetary policy was followed by higher inflation, and the authors concluded that monetary policy contributed to the rise in inflation in the 1970s. However, after 1979, the Fed did the opposite, tightening monetary policy

percentage-point rise in the long-term expected inflation rate implies a 20 percent reduction in stock prices. Sean Campbell and Frank Diebold showed that the Livingston Survey could be used to predict stock returns, with stronger economic growth related to lower stock returns, and vice versa.

The surveys have also been used to investigate optimal methods of forecasting. Andrew Ang, Geert Bekaert, and Min Wei compared

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when expected inflation increased, thus raising the real interest rate and reducing future inflation.

**Other Important Research Results.** One key question about the data that are issued by government statistical agencies is whether data revisions are forecastable or not. Knut Mork sought to answer that question using the SPF survey as a measure of information known at the time the government releases its initial GDP data. He found that GDP revisions were correlated with the SPF forecast of GDP, and thus the revisions were forecastable, which means that the government's initial data releases are not efficient and could be improved.

Some economists have also used the Philadelphia Fed surveys to investigate a hypothesis in financial economics. Steven Sharpe related the SPF forecasts of one-year inflation rates and 10-year inflation rates to stock returns, finding that a one-

inflation forecasts from the Livingston Survey, SPF, and the Michigan survey of consumers. They found that the surveys forecast inflation better than do a number of other forecasting models that economists use. They also found that the Michigan forecasts are only slightly worse than the SPF and Livingston forecasts but still do better than the other forecasting methods.

### SUMMARY

There can be little doubt that the Philadelphia Fed's surveys of forecasters have played an instrumental role in economic research in the past 40 years. The surveys have been used to test rational-expectations theory, to analyze the formation of inflation expectations, to conduct empirical research in macroeconomics, and to investigate the formation and impact of monetary policy, and they have been used in a variety of other studies as well. 

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