

BY TIM SABLİK

Forecasting Inflation

For policymakers and market participants, inflation can be challenging to predict

In recent months, inflation has climbed to levels not seen in a generation. The Fed's preferred measure of inflation, the Personal Consumption Expenditures (PCE) price index, increased to 4.4 percent in September 2021 compared to the same month the previous year. The last time the index reached such heights, George H.W. Bush was president, and Alan Greenspan was just finishing his first term as chair of the Fed's Board of Governors.

Maintaining price stability is one half of the Fed's dual mandate, so Fed officials have been watching this spike in inflation closely. According to the monetary policy framework adopted by the Fed last year, it judges inflation that averages 2 percent over time to be consistent with its price stability mandate. While inflation measures in recent months have come in above that 2 percent threshold, that hasn't been entirely unexpected nor unwelcome. Prices fell last year as the pandemic rippled through the global economy. Some of the current surge in prices is actually "reflation" as the economy ramps back up after months of lockdowns, and the Fed's new framework was designed to allow periods of higher inflation following periods when inflation is below target. (See "The Fed's New Framework," *Econ Focus*, First Quarter 2021.)

But Fed officials have also admitted that inflation has proven more lasting than they initially anticipated. As the economy has reopened, consumer demand has outpaced supply for some goods and services. Lingering supply chain disruptions have led to product shortages and price increases that are more than just a return to pre-pandemic trends. The challenge facing Fed policymakers now is trying to predict whether inflation will remain elevated in the

absence of monetary policy intervention or gradually return to levels consistent with the Fed's target once the shocks from the pandemic fade.

In April, when inflation pressures began emerging, Fed Chair Jerome Powell said that it seemed "unlikely" that inflation would move up in a persistent way. But at his press conference following the Federal Open Market Committee's (FOMC) meeting in September, he noted that the supply bottlenecks contributing to rising prices in many sectors "have been larger and longer lasting than anticipated."

Past experience during the 1970s and 1980s taught the Fed that it can be costly to tame inflation after it has run too high for too long. But the Fed's new framework was built with the lessons of the Great Recession in mind, which highlighted the benefits of waiting as long as possible to normalize monetary policy after an economic downturn. Choosing the right approach, then, requires some estimate of where inflation is headed — a forecast that can be quite challenging to make.

MAKING SENSE OF THE DATA

When Fed officials talk about inflation, they are taking a broader view than the typical household or business might. On its website, the Fed Board of Governors explains that "inflation cannot be measured by an increase in the cost of one product or service, or even several products or services. Rather, inflation is a general increase in the overall price level of the goods and services in the economy."

One way to look at how prices are moving across the economy is to use a price index like PCE or the Consumer Price Index (CPI). These measure the price change in a basket of goods and

services consumed by the average household. Prices for some commonly consumed items are more volatile than others and can swing indexes in either direction month to month. (See "Is Your Inflation Different?" *Econ Focus*, Second/Third Quarter 2021.)

To get a clearer sense of the general price trend in the economy, Fed officials often turn to indexes that attempt to strip out some of that volatility. Core PCE and core CPI exclude food and energy prices, for example, while the Dallas Fed's trimmed mean PCE excludes categories that experience the most extreme price changes each month. Another measure, the Atlanta Fed's sticky-price CPI, focuses on components of the CPI that change prices infrequently.

Each of these indexes shows an uptick in inflation in recent months, some more pronounced than others. (See chart.) But even these attempts to smooth out volatility can be overwhelmed by extreme events, such as a once-in-a-century global pandemic. Prices have behaved in unexpected ways over the past year. In the spring and early summer of 2021, the average cost of plywood surged before falling in September to roughly the same level as the beginning of the year. Used cars and trucks appreciated sharply starting in the spring of 2021 as the supply of new vehicles has been constrained by a shortage of computer chips and other essential components. While used car price growth seems to have leveled off, prices have not yet decreased to their previous level.

It can be hard for policymakers and economic forecasters to interpret what such incoming data points might signal about future inflation. Are they outliers that ought to be disregarded, or early signals of more lasting price pressures?

Richmond Fed economist Alexander Wolman dug into this question in a September *Economic Brief*. Rather than trying to smooth or strip out volatile components of PCE, he broke the index down into its components to see what was driving inflation in 2021. In March through June, the 5 percent of consumption categories with the largest price increases accounted for between 48 percent and 60 percent of overall inflation. But in July, that share fell to 42 percent, suggesting that inflation had become more broad-based. He also compared the behavior of prices in recent months to the last 25 years, when inflation has been low and stable, and this too provided some evidence of a persistent upward shift in inflation.

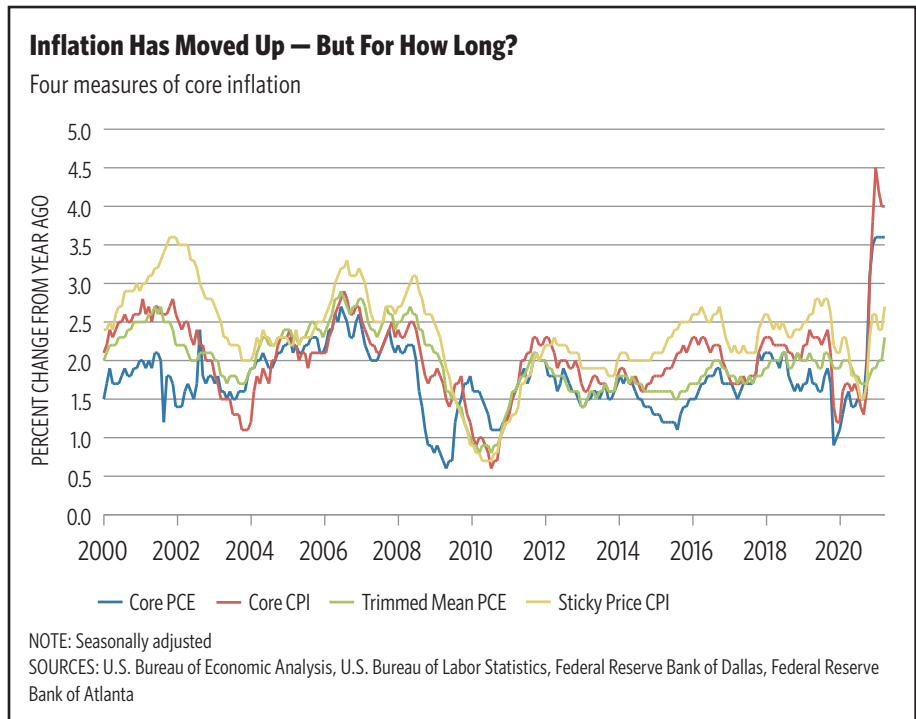
“If a similar pattern appears in the coming months, it would represent tentative evidence that the increase in inflation is a more persistent phenomenon that reflects monetary factors and will not dissipate without an adjustment of monetary policy,” Wolman wrote.

SEPARATING SIGNAL FROM NOISE

Even when comparing incoming inflation data to the past, it can be difficult to determine whether those data signal a change in the long-run trend of inflation or temporary volatility. That’s why many forecasters rely on models to help them.

There’s no shortage of ways to model the inflation process. Economic theory points to many different potential drivers of inflation, from the amount of slack in the labor market, to the level of interest rates relative to the economy’s natural rate of interest, to the size of the money supply relative to the economy’s productive capacity. But some of these variables are not directly observable, and it can be hard to know which might be driving inflation in the moment.

“Inflation is a relatively volatile process affected by many different factors, making it hard to figure out why inflation is evolving the way it is and predict its future path,” says Richmond Fed economist Paul Ho.



One solution to this dilemma is to use a purely statistical approach that is more agnostic about the shocks hitting the economy. Signal extraction models take incoming inflation data and separate it into two components: a “signal” about where underlying inflation is trending and “noise” — temporary volatility that will average out to zero over the long run.

“If successive inflation measures are moving in a particular direction, the model will assign more weight to that being a signal about underlying inflation rather than noise,” says Richmond Fed economist Pierre-Daniel Sarte.

In a recent *Economic Brief* with fellow Richmond Fed economist John O’Trakoun, Sarte used a signal extraction model to analyze decades of core CPI and core PCE inflation data. For the 1960s through the 1980s, the model predicted underlying inflation that was high and volatile, consistent with the rising inflation of that period. For the period since the 1990s, the model treated the fluctuations of incoming PCE and CPI data as mostly noise, predicting that trend inflation

will remain stable. When looking at data from April 2021 and extrapolating it out through the second quarter, Sarte and O’Trakoun estimated a slight increase in trend inflation, although it still remained close to the Fed’s long-term 2 percent target.

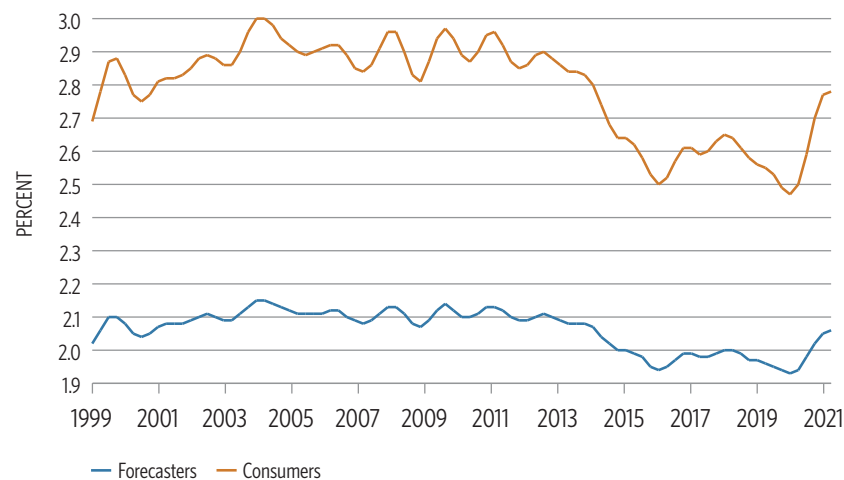
But how reliable are statistical methods at predicting sudden changes in trend inflation? Not very, according to Ricardo Reis, an economist at the London School of Economics and Political Science who studies inflation.

“If you are trying to predict inflation over the next two or three months, the statistical forecasting methods tend to do pretty well — with one exception, which is when there are big regime changes,” says Reis.

In a June *Economic Brief*, Ho wrote about the challenges that have plagued economic forecasters since the pandemic began. In such periods of high uncertainty, researchers need to decide whether the assumptions in their models are still correct, or whether volatility has simply increased temporarily. Ho argued that forecasters should clearly communicate the assumptions

Tracking Inflation Expectations

The Fed's Index of Common Inflation Expectations



NOTE: The Index of Common Inflation Expectations (CIE) summarizes the movement of 21 inflation expectations measures based on a dynamic factor model. The "forecasters" measure shows the index projected onto the Survey of Professional Forecasters 10-year-ahead PCE inflation expectations. The "consumers" measure, also known as the alternative CIE, shows the index projected onto the University of Michigan Surveys of Consumers inflation expectations for the next five to 10 years.
SOURCE: Federal Reserve Board of Governors

underlying their models. That way, even if someone disagrees with those assumptions, he or she could still learn something from the model by seeing how those assumptions influence the forecast.

LEARNING FROM OTHERS

Another option for Fed policymakers looking to understand where inflation may be headed is to seek the wisdom of the crowds. This can be particularly useful in the case of inflation because there is a self-fulfilling aspect to the public's expectations for future inflation. For example, if business owners believe that their competitors and suppliers are going to raise prices, they will raise their prices as well. If enough firms do this, then their expectations of higher prices become reality.

Because of this dynamic, policymakers pay close attention to surveys that ask households, businesses, and professional forecasters about their inflation expectations. Many such surveys exist, including the University

of Michigan's Surveys of Consumers and the Philadelphia Fed's Survey of Professional Forecasters. The Fed Board of Governors collects data from 21 different inflation expectation measures and synthesizes them into a single Index of Common Inflation Expectations. That index shows that inflation expectations have increased in recent months. (See chart.)

Despite the theoretical ties between expected inflation and actual inflation, there is also plenty of evidence that households, businesses, and even professional forecasters often guess wrong. In a 2019 working paper with Anmol Bhandari of the University of Minnesota and Jaroslav Borovička of New York University, Ho found that household expectations of future inflation were biased upward on average, and that bias increased during recessions.

In a recent article, Cleveland Fed economists Randal Verbrugge and Saeed Zaman concluded that the expectations of professional economists and business owners were more accurate predictors of future inflation than

household expectations, but a simple inflation forecasting model also proved to be just as accurate. Indeed, Sarte and O'Trakoun also compared the forecasts from their signal extraction model to surveys of inflation expectations and found that the most significant difference was that the model-based forecasts of PCE inflation were about half a percentage point lower than the surveys on average.

Policymakers can also look to the stock market for information about inflation expectations. One market-based measure is the breakeven rate between regular Treasury Securities and Treasury Inflation-Protected Securities (TIPS). Created in 1997, TIPS offer investors protection against inflation and deflation by adjusting their interest payments and principal based on changes in the CPI. The TIPS breakeven rate is the difference between nominal Treasuries and TIPS of the same maturity, providing a real-time measure of the market's inflation expectations. Another source of the market's inflation expectations can be found by looking at inflation swap contracts, which allow one party to transfer inflation risk to another for a fee.

In theory, one might expect market participants to pay closer attention to inflation dynamics since they are putting their money at stake. But a 2015 study by Michael Bauer of the University of Hamburg and Erin McCarthy, formerly of the San Francisco Fed, suggests that such market-based indicators of future inflation may not be any more accurate than surveys or simple forecasting rules. They found that market measures largely reflected current and past inflation movements and did not provide a lot of useful information about future inflation.

WATCHING THE ANCHOR

Although surveys and market measures of expectations may not be reliable for forecasting future inflation, they still provide a useful signal of where the

public expects inflation to head.

Under its new monetary policy framework, the Fed has made it clear that it is less concerned about inflation fluctuating in the short run as long as it averages 2 percent in the long run. Another way of putting that is that the Fed wants long-run inflation anchored at 2 percent. Throughout the year, Chair Powell and other Fed officials have indicated that if long-run inflation expectations were to drift from that 2 percent anchor, the Fed would intervene.

“We are committed to our longer-run goal of 2 percent inflation and to having longer-term inflation expectations well-anchored at this goal,” Powell said at a press conference following the FOMC’s November policy meeting. “If we were to see signs that the path of inflation, or longer-term inflation expectations, was moving materially and persistently beyond levels consistent with our goal, we would use our tools to preserve price stability.”

This commitment stems in large part from the lessons the Fed learned during the Great Inflation of the 1970s. In that decade, inflation expectations became unmoored, drifting higher and fluctuating wildly with changes in the market. To reestablish the anchor, the Fed needed to convince the public that it would do whatever it took to stabilize long-run inflation. That meant allowing the federal funds rate, the Fed’s key policy interest rate, to rise above 20 percent in the early 1980s until long-run inflation expectations fell, prompting a long and severe economic recession.

Could Fed officials in the 1960s and 1970s have detected that inflation expectations were drifting earlier — and responded sooner? Reis of the London School of Economics and Political

Science thinks so. Although many of the various surveys of inflation expectations available today did not exist at the time, Reis collected data from market prices, professional surveys, and household surveys. In his paper discussed at the *Brookings Papers on Economic Activity* conference in September, he found that while no individual data series contained a perfect forecast of inflation, the disagreement between these series did provide a signal about how well-anchored inflation expectations were.

“When you just look at the average expectation of inflation from surveys, it tends to move super sluggishly,” says Reis. “Once you combine sluggish movement with a lot of noise, it becomes very hard to see much. But when you measure the standard deviation and skewness across surveys, which I call disagreement, you get a much better idea of where expectations are heading.”

Since individual survey respondents differ in how closely they pay attention to inflation and how quickly they adjust to new information about price changes, looking at the average of several different surveys provides a muddled picture. But tracking how expectations differ across surveys can provide a clearer picture of where the inflation anchor is headed. Applying this approach to the data, Reis found that the inflation anchor began to drift as early as 1967.

What about the anchor today? Applying the same approach to current expectations data, Reis found that the anchor has drifted, but it was still early in that process. Several other recent papers have looked at this question as well. In a May National Bureau of Economic Research working paper, Bernardo Candia and Yuriy Gorodnichenko of the University

of California, Berkeley, and Olivier Coibion of the University of Texas at Austin examined a survey of U.S. firms’ inflation expectations. They found evidence that the expectations of business managers appeared “far from anchored.” Similarly, a July article by Chicago Fed researchers Gadi Barlevy, Jonas Fisher, and May Tysinger measured how well-anchored long-term expectations were by looking at how sensitive short-term expectations were to news about inflation. If long-run expectations are well-anchored, they should not respond to news that affects short-run inflation. But they found that the sensitivity of long-run expectations to news about short-term inflation changes has increased, particularly in recent months.

Economic theory and history suggest that fiscal and monetary policy play an important role in ensuring that inflation expectations remain anchored. Atlanta Fed economist Federico Mandelman has examined inflation in the aftermath of World War II. After the war, pent-up demand from years of rationing was released, and inflation shot up from 2 percent to 20 percent from 1946 to 1947. But that spike was short-lived — by 1949, inflation had fallen back to 2 percent. Mandelman credited well-anchored inflation expectations inherited from the Great Depression as well as contractionary fiscal and monetary policy for quickly returning inflation to normal levels.

“In the end, it is policy that pins down inflation, not expectations,” says Reis. “A credible central bank uses monetary policy to make expectations that differ from its target unsustainable, ensuring that expectations and actual inflation are ultimately the same.” **EF**

READINGS

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