

Inflation and Monetary Policy: Six Research Questions

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Introduction

I thank the Cleveland Fed for inviting me to speak today. And I thank you, Sandy, for that very warm introduction. I am honored to have been chosen as the Federal Reserve Bank of Cleveland's next president and CEO. I realize I have a very hard act to follow, but I am very grateful that Sandy has built such a fine institution. The conference we have enjoyed over the past two days underscores the strengths and interests of the researchers at the Cleveland Fed, and I plan to build on that foundation when I officially start my new job next week.

Understanding inflation dynamics is of vital importance to central banks. Today I will focus on some open research questions surrounding inflation from a policymaking viewpoint. I toyed with the idea of titling my talk "We Need Your Help," but thought better of it. Nonetheless, my hope is to inspire researchers to work on some of these questions and perhaps participate in a future conference here at the Cleveland Fed. I view conferences that bring together central bank, academic, and market economists, as well as members of the business community, as important avenues to improve our collective understanding of the economic issues facing monetary policymakers.

Before continuing, I note that my remarks represent my own views and not necessarily those of others in the Federal Reserve System.

The Benefits of Price Stability

Congress has directed the Federal Reserve to conduct monetary policy in pursuit of a dual mandate of maximum employment and stable prices. In my view, these goals are complements.

In keeping with the theme of our conference, I am going to concentrate on the price stability part of the mandate. The benefits of price stability for the economy seem clear and have been pointed out by a number of Fed officials over the years.¹ When prices are stable, businesses and consumers can focus on productive activities rather than on ways to protect the purchasing power of their money. They can make long-term plans and commitments without having to deal with the uncertainty about the value of their money. Also, when the price level is stable, any price changes reflect changes in the supplies of certain goods or services relative to others. These relative price changes provide important information for businesses and consumers when deciding where to allocate their scarce resources. Another significant

¹ See, e.g., Ben S. Bernanke, "[The Benefits of Price Stability](#)," Center for Economic Policy Studies, Princeton University, Princeton, New Jersey, February 24, 2006, and Charles I. Plosser, "[Strengthening Our Monetary Policy Framework](#)," 20th Annual Hyman P. Minsky Conference, New York, NY, April 14, 2011.

benefit of price stability is that it promotes the other important responsibilities of the central bank. It helps foster financial stability by minimizing unexpected transfers from lenders to borrowers that happen when inflation causes loan values to fall. And by fostering confidence in the economy, price stability supports growth and maximum employment, the other part of the Fed's dual mandate.

Recent Policy Developments

So I think you will agree that price stability is valuable and it is an important goal of monetary policy. This is fitting since over the longer run, monetary policy is the principal determinant of inflation. In fact, the Federal Open Market Committee, or FOMC, made this important point in its statement on longer-run goals and monetary policy strategy, which it issued in January 2012 and has affirmed each year since.

This statement lays out the guiding principles that the FOMC follows in setting monetary policy. As part of those principles, the statement established for the first time an explicit numerical goal for inflation over the longer run. The goal is 2 percent inflation, as measured by the year-over-year change in the price index for personal consumption expenditures, or PCE inflation. Being explicit about the inflation objective reflects the FOMC's desire to be transparent and communicate clearly to the public. But it also underscores the FOMC's commitment to price stability.

When businesses and consumers have confidence that the central bank is committed to 2 percent inflation over the longer run and will defend that target when inflation is either above or below it, they are more likely to look through temporary changes in inflation. This helps anchor inflation expectations at the target. As a result, underlying inflation will be less responsive to one-time supply shocks, such as changes in the price of oil. So having an explicit target helps promote price stability.

I view the FOMC's statement on its longer-run goals as entirely consistent with the Fed's dual mandate. The statement makes explicit that the FOMC will take a balanced approach to meeting its mandated goals and explains why the FOMC has established a numerical objective for inflation but not a comparable one for maximum employment. Monetary policy is the chief determinant of inflation over the longer run, but the maximum level of employment is largely determined by demographics, production technology, and other factors that change over time and are not influenced by monetary policy. While the FOMC can choose the value of inflation it seeks to achieve over the longer run, it does not have the ability to achieve just any long-run objective for employment. Long-run employment is determined by economic fundamentals. That said, sound monetary policy is a necessary ingredient in promoting strong economic fundamentals, allowing the economy to more effectively achieve its potential. By helping policymakers

set appropriate monetary policy, the explicit 2 percent inflation target promotes not only price stability but also full employment over the longer run.

Today, the FOMC reiterates that 2 percent inflation goal in the policy statement it releases after its meetings. And the target is an important part of its forward guidance on the policy interest rate. For example, the April policy statement said that in deciding how long to maintain the current 0 to ¼ percent target range for the federal funds rate, the FOMC will assess realized and expected progress toward its objectives of maximum employment and 2 percent inflation.

Open Research Questions on Inflation and Inflation Expectations and the Implications for Monetary Policy

That the FOMC is now more explicitly formulating its monetary policy in terms of projected progress toward its goals underscores how important it is for policymakers to be able to accurately measure inflation and inflation expectations and to forecast inflation over the medium and longer run. As we have discussed over the past two days of the conference, there has been considerable progress in advancing our knowledge of inflation dynamics, measurement, and forecasting. But there is more work to do. Let me discuss six open questions – not quite as many as a David Letterman Top-Ten List – but questions where I believe further research will help inform our understanding of inflation and in turn, aid monetary policymaking. I will start with a couple of measurement issues.

First, how should we estimate the underlying trend in inflation?

There are various measures of inflation. The FOMC’s preferred measure of consumer inflation is the PCE inflation rate. A perhaps more familiar measure is the Consumer Price Index, or CPI, inflation rate.² Even though these and other measures of inflation tend to move together over the long run, they can diverge in the short run. Policymakers need to look through noisy month-to-month changes in the indexes to discern the underlying trend in inflation. They need a way to separate temporary changes from changes that are more persistent.

² The PCE index and CPI index differ in their coverage and method of computation. For discussion, see Joseph Haubrich and Sara Millington, “[PCE and CPI Inflation: What’s the Difference?](#)” *Economics Trends*, Federal Reserve Bank of Cleveland, April 17, 2014 and “[Differences between the Consumer Price Index and the Personal Consumption Expenditures Price Index](#),” U.S. Bureau of Labor Statistics, *Focus on Prices and Spending* 2, May 2011.

To get a signal about the underlying trend, many economists look at the traditional core measures of PCE and CPI inflation, which exclude the prices of food and energy because they tend to be very volatile. But research has shown that the prices of other components of the CPI basket, like apparel, tend to be even more volatile than the prices of food.³ For that reason, the Cleveland Fed's measures of median CPI inflation and 16 percent trimmed-mean CPI inflation are potentially more informative than the core CPI measure. In constructing their measures, Cleveland Fed economists exclude a percentage of the most volatile components each month regardless of which items they happen to be. These measures have been shown to help identify the underlying trend in CPI inflation.⁴ On the other hand, some of my own research has shown that headline PCE inflation can beat the core measure in predicting future PCE inflation.

And a further forecasting complication is that the PCE inflation rate gets revised over time. This leads me to my second research question: How should monetary policymakers incorporate revisions to PCE inflation into their policymaking framework?

Policymakers need to set monetary policy in real time knowing that their policy affects the economy with a lag and knowing that their targeted inflation measure is subject to revision. The revisions are beneficial because they reflect new data that yield a more accurate measure of inflation. But the revisions also pose a challenge to setting monetary policy. For example, in early 2002, policymakers were concerned about a drop in inflation. However, this drop was ultimately revised away.

Of course, policymakers know that the data are going to be revised. In fact, some interesting research has shown that the revisions can be predicted to a certain extent.⁵ Better understanding the magnitude and pattern of these revisions could help inform policymakers about how best to respond to changes in measured inflation rates. More broadly, further research on how monetary policymakers should set policy in the face of uncertainty about the state of the economy would be useful.

My next questions concern the nexus between our economic models and our measures of inflation.

³ Theodore M. Crone, N. Neil K. Khettry, Loretta J. Mester, and Jason A. Novak, "[Core Measures of Inflation as Predictors of Total Inflation](#)," *Journal of Money, Credit and Banking*, Volume 45, Issue 2-3, pages 505–519, March-April 2013.

⁴ See Todd E. Clark, "[Comparing Measures of Core Inflation](#)," Federal Reserve Bank of Kansas City Economic Review, Second Quarter, 2001, pp. 5-31.

⁵ See Dean Croushore, "[Revisions to PCE Inflation Measures: Implications for Monetary Policy](#)," Federal Reserve Bank of Philadelphia Working Paper No. 08-8, May 2008.

Question three asks: Would households and businesses be better off if the central bank chose to target an inflation measure other than headline inflation?

Some theoretical models suggest this is the case – although there is still a lot of debate in the literature. According to some models, central banks should target those prices of goods and services that tend to adjust slowly to changing economic conditions – what economists call “sticky prices.”⁶

To see some of the practical implications of this question, suppose the model is right and it is best to stabilize sticky prices. One admittedly crude way to identify sticky versus flexible prices is to break up the overall Consumer Price Index into its services and goods components. Today, if you look at core prices in the service sector, inflation has been relatively stable at 2.25 to 2.5 percent since 2012. It is the less sticky core goods prices that have decelerated and have brought the broader measures of inflation down below the FOMC’s goal.

Even a less crude measure of flexible versus sticky price inflation, which was developed at the Cleveland Fed and is now provided by the Federal Reserve Bank of Atlanta, shows that sticky price inflation has been relatively stable around 2 percent.⁷ To the extent that the model is valid, this paints a more benign view of recent inflation, one that could have implications for the appropriate path of monetary policy.

Of course, these models are simplifications, based on several assumptions, and not ready to be used for setting monetary policy. However, I think this example provides ample motivation for further research on alternative measures of inflation and modeling.

That our models could benefit from further research underscores my fourth research question: How should we reconcile the actual pricing behavior of firms with predictions from the workhorse inflation model used by many mainstream macroeconomists, the so-called New Keynesian model?

The availability of data on the individual prices used to construct aggregate price indexes like the CPI has allowed some intrepid researchers to establish several interesting facts about real-world pricing behavior.

⁶ Kosuke Aoki, “[Optimal Monetary Policy Responses to Relative-Price Changes](#),” *Journal of Monetary Economics*, vol. 48(1), pages 55-80, August 2001.

⁷ See Michael F. Bryan and Brent Meyer, “[Are Some Prices in the CPI More Forward Looking Than Others? We Think So](#),” *Economic Commentary*, Federal Reserve Bank of Cleveland, May 19, 2010 and Federal Reserve Bank of Atlanta’s Inflation Project, [Sticky Price CPI](#).

One finding is that firms appear to change prices more frequently than predicted by standard macroeconomic models that have been calibrated to match various features of the macroeconomic business cycle.⁸ This is a troubling finding in that it suggests a disconnect between the micro data and macro models that are often used to inform monetary policy analysis. Better reconciliation of the models with the empirical facts of the micro data would be a welcome avenue of additional research, and I would expect our models to improve the more we learn.

In fact, models of inflation have evolved over time as economists have become more knowledgeable about inflation dynamics. Modern theories have emphasized the important role of inflation expectations in determining current and future inflation. This brings me to my fifth research question: Which measure provides the best gauge of inflation expectations?

Surveys provide one way to measure inflation expectations. The Michigan Survey asks households about their inflation expectations. The Blue Chip Consensus Forecast polls economists. And the Philadelphia Fed's Survey of Professional Forecasters does exactly what its name suggests. But surveys do not solve the measurement problem because the measures differ across surveys. So economists have derived other measures of inflation expectations from financial market data, including the spread between nominal Treasury bond yields and yields on TIPs, or Treasury Inflation-Protected Securities, and rates on inflation swaps. But isolating inflation expectations from these measures is not a trivial challenge.

To help address the measurement issue, the Cleveland Fed produces estimates of inflation expectations that combine information from a number of different sources. The methodology is based on a model of long-term interest rates, which reflect expectations about what short-term interest rates will be in the future, as well as the premia investors demand to compensate for expected inflation and for the volatility in inflation and short-term interest rates over time. Cleveland Fed researchers use data on nominal yields, inflation swaps, and surveys of inflation expectations to separately identify these factors, which allows for a better measure of inflation expectations.

In addition to improved measures, clearer understanding of how inflation expectations are formulated and the interplay between expectations and actual inflation would be quite useful to monetary policymakers. While theory suggests that changes in inflation expectations should lead changes in inflation, in some

⁸ See Mark Bills and Peter J. Klenow, "[Some Evidence on the Importance of Sticky Prices](#)," *Journal of Political Economy* 112, 2004, pp. 947-985, and Emi Nakamura and Jón Steinsson, "[Five Facts about Prices: A Reevaluation of Menu Cost Models](#)," *Quarterly Journal of Economics*, November 2008, pp. 1415-1464.

studies, the empirics go the other way. Moreover, there have been times when inflation expectations seem to have become disconnected from actual inflation. For example, in Japan, after a long period of being stuck near zero, actual inflation ran below zero from 2009 through mid-2013. Even so, measures of inflation expectations were near 2 percent, well above actual inflation for a number of years.⁹ This presents a conundrum. Either the measures of expectations are off, or our theories of inflation and inflation expectations are off, or both. Whichever it is, there are implications for inflation forecasts that put significant weight on inflation expectations.

This brings me to my sixth and final research question: Is there a way for central banks to communicate about inflation and inflation expectations that will help ensure inflation expectations remain well-anchored and increase the central bank's credibility for achieving its inflation target?

Answering this question hinges on better knowledge of the relationship between inflation and inflation expectations, more accurate models of inflation dynamics that match the data, and measures that lead to more accurate forecasts of the underlying inflation rate – all the research questions I have just discussed. I believe effective central bank communication is a crucial area of further research, especially in today's environment when monetary policymakers are relying on forward guidance on interest rates as a primary policy tool.

Conclusion

In my remarks today I have focused on the price stability part of the dual mandate, in keeping with the theme of this conference. We cannot have full employment over the longer run without price stability over the longer run. That is why understanding inflation is so important for Federal Reserve policymakers who aim to set policy to achieve both parts of their dual mandate.

I have laid out quite an ambitious research agenda. But good policymaking depends on the research that informs it. I urge researchers at central banks, in academia, and in the private sector to tackle the questions I have discussed, and to do so sooner rather than later. I hope we can reconvene this group at a future Cleveland Fed conference to discuss your advances. The more we understand inflation dynamics, the more we will understand how inflation will respond to changes in monetary policy. These findings are going to be particularly relevant as the Fed, in response to improvements in economic conditions, returns to a more normal policy setting framework over time.

⁹ Bharat Trehan and Maura Lynch, “[Consumer Inflation Views in Three Countries](#),” *Economic Letter*, Federal Reserve Bank of San Francisco, November 2013.