NBER Macroeconomics Annual Proposal

Understanding the Rise and Fall of US Inflation Since the Pandemic

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The post-pandemic inflation surge, as measured by the twelve-month CPI inflation rate, peaked at 9.0 percent in June 2022. This experience quickly produced a literature that sought to explain inflation with a range of factors, including labor market tightness, shifts in inflation expectations, and supply-side factors such as energy prices and disruptions of supply chains.

Inflation started to decline in the Fall of 2022, and in June 2024 twelve-month CPI inflation was 3.0 percent. We think it is a good time to take stock of that experience and see whether the leading explanations for the rise of inflation also explain the subsequent decline. Do the various Phillips curves and other equations designed to fit the data through 2022 or early 2023 continue to fit after that? Or will we once again find that, as Stock and Watson (2010) put it, the fate of inflation equations "is one of apparently stable relationships falling apart upon publication?" An *NBER Macroeconomics Annual* paper could address this question with data through early 2025.

We have already assessed the out-of-sample fit of the Phillips curve developed in Ball, Leigh, and Mishra (2022), as of June 2024. Here we describe this work and our plans for extending it. We will also examine the performance of other well-known papers on the inflation surge, such as Bernanke and Blanchard (2024) and Benigno and Eggertsson (2023).

The Ball-Leigh-Mishra Specification

The starting point of our earlier work is a decomposition of headline CPI inflation into core inflation, as measured by the Cleveland Fed's weighted median inflation rate, and headline inflation shocks (deviations from core). The latter arise from large price changes in particular industries. Figure 1 shows this decomposition for both annualized monthly inflation and twelve-month inflation since January 2020. We see that rising core inflation and positive headline shocks both contributed to the runup in inflation in 2021-2022. Similarly, the recent decline reflects both falling core inflation and negative headline shocks.

Our 2022 paper explains core inflation with a variation on a Phillips curve:

$$\pi = \pi^e + f(V/U) + g(H) + \varepsilon \quad (1)$$

where π^e is expected inflation as measured by ten-year forecasts from the Survey of Professional Forecasters; V/U is the average of the vacancy/unemployment ratio over the current and previous eleven months; H is the average of headline inflation shocks over the current and previous eleven months, capturing the pass-through of these shocks to core inflation; and f(.) and g(.) are cubic functions, which allow for non-linearities in a flexible way.

Our paper finds that this equation fits the behavior of core inflation from 1985 through September 2022. The post-pandemic rise in core inflation is explained by a combination of three factors: a rise in V/U, pass-through from headline shocks, and a modest rise in expected inflation. We also find that the headline shocks themselves are explained by supply chain problems (as captured by an index of backlogs of work) and by shocks in the energy and automobile industries.

Explaining the Decline in Inflation

Critics of our 2022 paper (for example, Sahin, 2022) pointed out, fairly enough, that our specification was designed to fit the surge in inflation over 2021-2022, making it an open question how well it would fit going forward. The experience of the last two years is informative on this question, especially since the path of inflation has shifted sharply. We have therefore carefully examined the out-of-sample fit of our framework from October 2022 through June 2024.

Consider the path of core inflation that we seek to explain with equation (1). Figure 2 compares the actual path of annualized monthly core inflation to fitted values from the equation, along with twelve-month averages of actual and fitted values. We show two versions of the fitted values: the first are based on the equation estimated over January 1985-September 2022, the sample period in our previous paper, and the second extends the sample through June 2024. For the first version, the fitted values after September 2022 are out-of-sample conditional forecasts.[1]

As one might expect, the equation fits somewhat better when the sample is extended to the present. This reflects the fact that the estimated cubic relationship between core inflation and V/U changes modestly when the sample is expanded (see Figure 3). For the full sample, the equation's fit is very good, with actual and predicted monthly and twelve-month inflation falling in tandem since late 2022. For the sample ending in September 2022, actual and predicted inflation are again highly correlated, but the level of predicted inflation is somewhat higher. In June 2024, with actual twelve-month core inflation at 4.2 percent, predicted inflation is 4.1 percent for the full sample and 4.3 percent for the shorter sample.

Our equation explains the decrease in core inflation since 2022 because all three factors behind the preceding increase have reversed: V/U has fallen (from a peak of 2.0 in March 2022 to 1.2 in May 2024), due to a declining path of V with a relatively stable U; expected inflation has returned to roughly its pre-pandemic level (from a peak of 3.0 in November 2022 to 2.3 in June 2024); and headline inflation shocks have mostly been negative. These headline shocks largely reflect falling energy prices, as well as large price decreases in some months in industries such as used cars and medical services.

[1] These results are based on current vintage data. The results differ somewhat if we use the data available in September 2022, because those data were revised significantly when seasonal factors were adjusted in 2023. With the original data, our equation predicts somewhat less of the inflation decline that has occurred.

We have also examined the behavior of headline inflation from January 2020 through June 2024. For each month in this period, Figure 4 presents the decomposition of headline into core inflation and headline shocks, and a further decomposition of each of these components based on the methods in our previous paper. We again see the effects on core inflation of the V/U ratio and pass-through from headline shocks. We also see that headline inflation fluctuated by more than core because of positive and then negative headline shocks. During the run-up in inflation in 2021, headline shocks were mostly the result of supply chain backlogs and spikes in auto prices, but energy prices have been the main source of headline shocks since early 2022, following Russia's invasion of Ukraine.

Other Studies

We plan to examine other well-known studies of pandemic-era inflation in the same way we examine our own previous work: by seeing whether equations that explain the rise in inflation fit the subsequent decline as well. One important study is Bernanke and Blanchard (2024), whose conclusions have points in common with our work but who attribute much less of the inflation run-up to labor market tightness. Like us, Bernanke and Blanchard emphasize a comparison of actual and fitted values for inflation, and it should be straightforward to examine the fit of their specification after 2023Q1, their last observation.

Other studies that we plan to examine include Benigno and Eggertsson (2023) and Cecchetti and others (2023). We will also consider the *NBER Macroeconomics Annual* papers on inflation by Amiti and others (2023) and Beaudry and others (2024), although direct comparison with our work or Bernanke-Blanchard is non-trivial because of differences in methodology.

The Factors Behind Inflation Movements

The literature we have discussed mostly takes as given the behavior of key macroeconomic variables such as the V/U ratio and inflation expectations and seeks to explain inflation outcomes conditional on these variables. We hope to go further and learn about the underlying determinants of inflation. Our ideas for studying that issue are less developed, but here are some initial thoughts.

The behavior of V/U since 2020 has reflected shifts in the Beveridge curve relating V and U: an outward shift and then a shift back toward its pre-pandemic position. The unemployment rate has been fairly stable since 2021, but the shifting curve has meant large movements in vacancies and hence in V/U. We plan to explore the labor-market developments behind this experience. A starting point is the recent work of Barlevy and others (2024), which considers such factors as a surge in temporary layoffs at the start of the pandemic and a spike in quit rates in 2021-2022 (the "Great Resignation").

The behavior of expectations has also been important for inflation outcomes. During the high inflation of 2021-2022, measures of long-term inflation expectations started to creep up,

suggesting a risk of de-anchoring that would make it difficult to reduce inflation. However, once the Fed started raising interest rates and inflation fell somewhat, expected inflation quickly returned to its pre-pandemic level. What is the explanation for this pattern, and what does it tell us about optimal monetary policy? Here, we can draw on the recent explosion of research on inflation expectations, much of it based on new surveys of consumers and firms (for example, Candia and others (2023); Binder and others (2024)).

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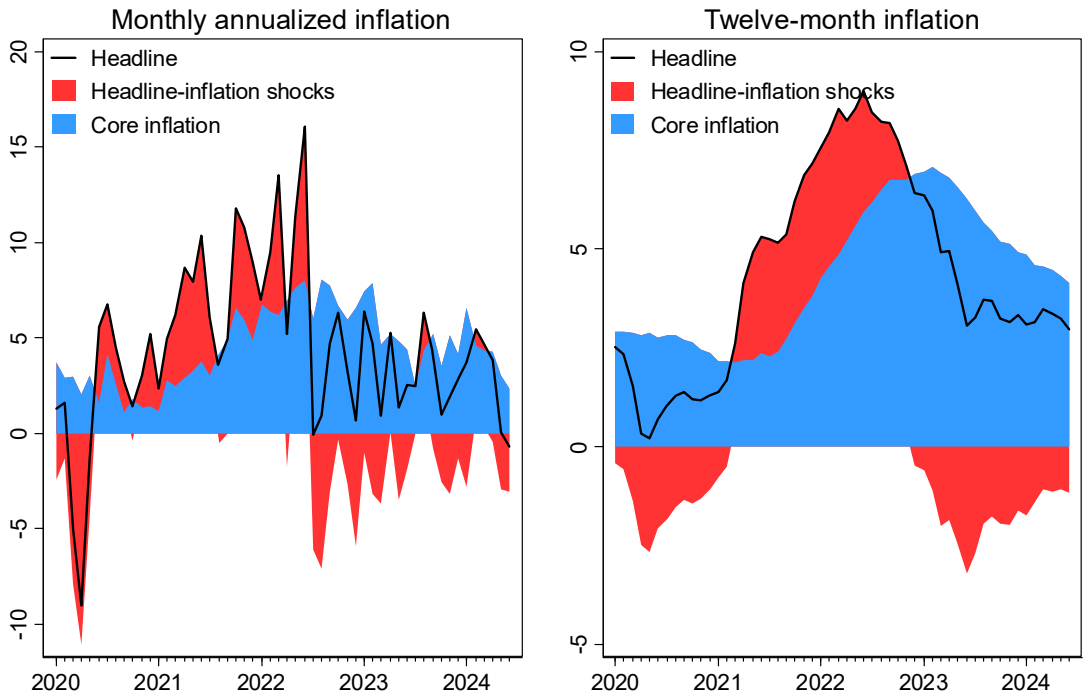
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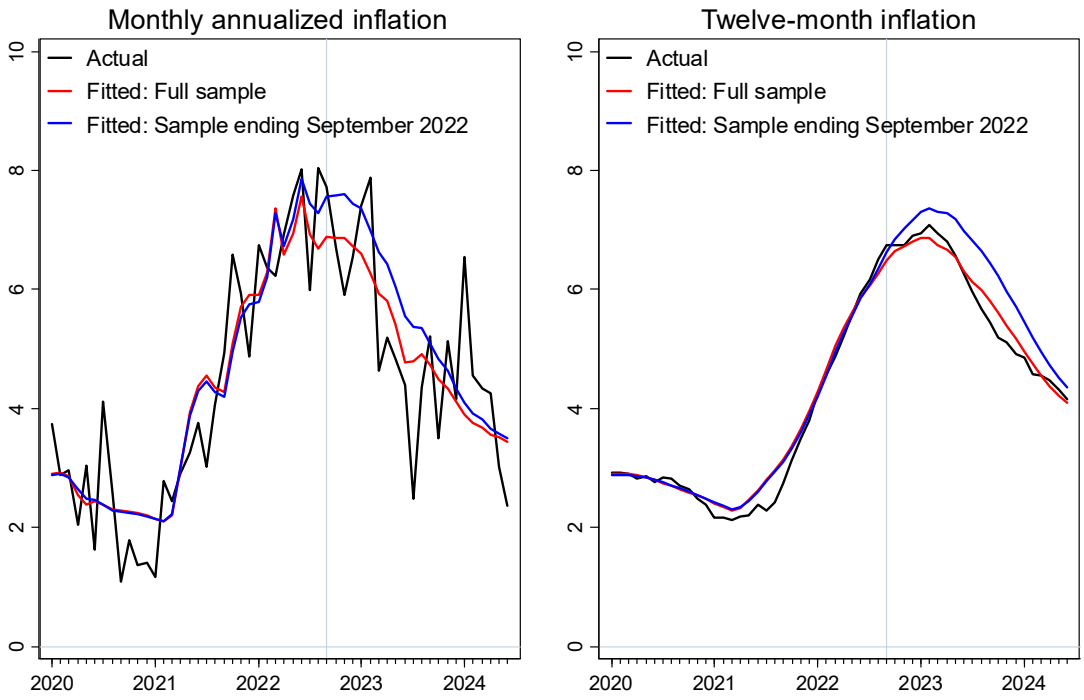
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Figure 1. CPI Inflation: Headline, Core, and Headline Inflation Shocks, 2020–2024 (Percent)



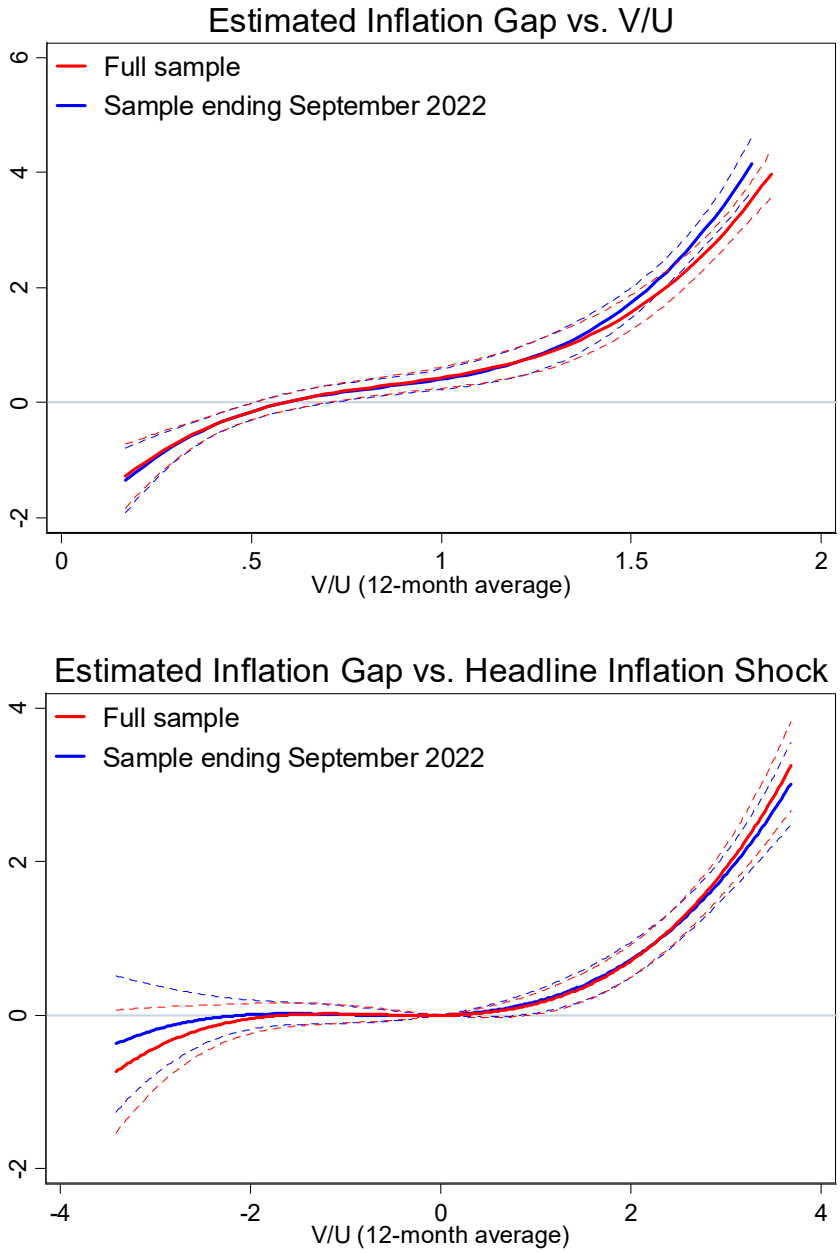
Sources: Federal Reserve Bank of Cleveland; authors' calculations.
Note: Core inflation is the weighted median CPI inflation rate from the Federal Reserve Bank of Cleveland. Vertical line indicates September 2022.

Figure 2. Predictions for Median Inflation, 2020–2024
(Percent)



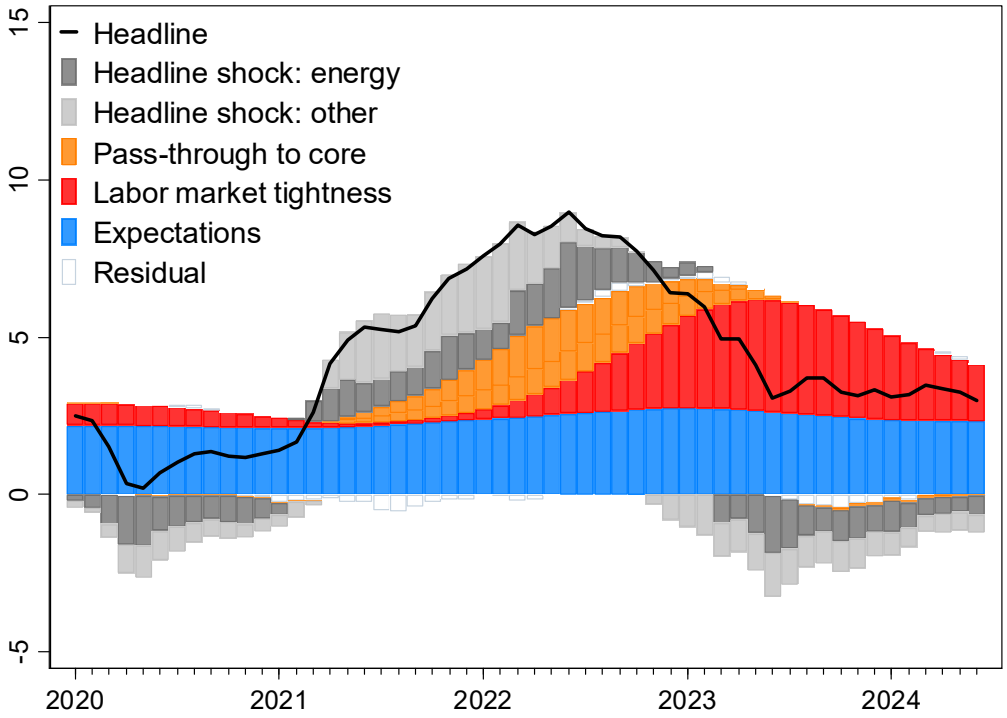
Sources: Survey of Professional Forecasters; authors' calculations.
Note: Figure reports fitted values from Phillips curve model estimated for the sample in Ball, Leigh, Mishra (2022), January 1985-September 2022, as well as for the full sample, January 1985-June 2024. Vertical line indicates September 2022.

Figure 3. Estimated Inflation Gap as a Function of Slack and Headline Inflation Shocks
(Percentage points; monthly data)



Sources: Survey of Professional Forecasters; authors' calculations.
Note: Top panel reports fitted values for constant term and V/U terms from equation estimates from Phillips curve model estimated for the sample in Ball, Leigh, Mishra (2022), January 1985-September 2022, as well as for the full sample, January 1985-June 2024. Bottom panel reports fitted values for headline inflation shock (H) terms. Dashes indicate 95 percent confidence interval. Inflation gap denotes monthly annualized median CPI inflation minus long-term inflation expectations.

Figure 4. Contributions to Headline Inflation, 2020-2024
(Decomposition of twelve-month headline inflation; percentage points)



Sources: Haver analytics; Federal Reserve Bank of Cleveland; and authors' calculations.
Note: "Shock" denotes contribution of headline inflation shocks (energy or other). "Energy" denotes relative energy price inflation. "Pass-through" denotes pass-through from headline inflation shocks into core inflation. "Expected inflation" denotes long-term inflation expectations. "Labor market tightness" denotes contribution of ratio of vacancies to unemployment.