INTERNATIONAL MONETARY FUND

The Rise and Retreat of US Inflation: An Update

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WP/25/94

2025
MAY

WORKING PAPER

 WP/25/94

IMF Working Paper
The Western Hemisphere Department

The Rise and Retreat of US Inflation: An Update
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Authorized for distribution by Nigel Chalk
May 2025

ABSTRACT: Why did US inflation rise over 2021-22 and why has it retreated since then? Ball, Leigh, and Mishra (2022), writing near the inflation peak, explained the rise with a framework in which inflation depends on three factors: long-term expectations; the tightness of the labor market as measured by the vacancy-to-unemployment (V/U) ratio; and large changes in relative prices in particular industries such as energy and autos. This paper finds that the same framework explains the retreat in inflation since our earlier work.

JEL Classification Numbers:	E24, E31, E32
Keywords:	Inflation; Inflation shocks; Core inflation; Phillips curve
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* The authors thank Ziyan Han for excellent research assistance, Kristine Laluces for excellent editorial support, and Mai Chi Dao, Zhao Zhang, and Mouhamadou Sy for helpful comments.

I. Introduction

After a quarter century of quiescence, US inflation rose sharply during the COVID-19 pandemic. The twelve-month CPI inflation rate rose from an average of 2.1 percent over 2017-2019 to 9.0 in June 2022, alarming economists and the public. Then inflation started declining and in March 2025 it stood at 2.4, most of the way back to its pre-pandemic level. A large body of research has studied that experience.

One contribution to this literature is our earlier work: Ball, Leigh, and Mishra (2022). That paper analyzed data through September 2022, when inflation was near its peak, and sought to explain why inflation had risen sharply. We offered an explanation based on three factors: the tight labor market over 2021-2022, as captured by an extremely high ratio of job vacancies to unemployment (V/U); sharp rises in relative prices in certain industries, such as energy and autos; and a modest rise in long-term inflation expectations.

This paper asks whether the factors that explain the rise in inflation can also explain the fall since late 2022. We conclude that they can. All three drivers of the inflation increase have reversed: the tightness of the labor market has diminished; prices in sectors such as energy and autos have fallen; and long-term inflation expectations have returned to pre-pandemic levels. As a result, the inflation equations estimated in our earlier paper, which fit the data through September 2022, also fit the subsequent fall in inflation.

Section 2 of this paper reviews the behavior of CPI inflation since 2020. As in our earlier work, we decompose the headline inflation rate into two components: core inflation, as measured by the weighted median inflation rate from the Federal Reserve Bank of Cleveland; and “headline shocks” arising from large relative-price changes in particular industries. We see that the inflation surge over 2021-2022 reflected both rising core inflation and positive headline shocks, and both declining core and negative shocks have contributed to the subsequent disinflation.

Section 3 informally examines the drivers of inflation since 2020, and Section 4 estimates the equation for core (weighted median) inflation from our 2022 paper. We estimate the equation for the earlier paper's sample period of 1985 through September 2022, and with the sample extended through March 2025. We find that fitted values from our estimated equation follow actual core inflation fairly closely over the entire period from 2020 through 2025—even when the equation is estimated with the shorter sample, in which case the fitted values after September 2022 are out-of-sample conditional forecasts. As of March 2025, the actual level of twelve-month core inflation is 3.5 and the fitted values are 3.1 and 3.2 for the shorter and extended samples, respectively.

Section 5 examines the sources of headline-inflation shocks, which in our framework affect inflation both directly and by passing through into core inflation. We again estimate an equation from our 2022 paper, one that explains headline shocks with changes in the relative prices of energy and autos and a measure of supply chain disruptions. We find that movements in these variables explain most of the positive headline shocks when inflation was rising and most of the negative shocks when inflation was falling.

Finally, Section 6 summarizes our interpretation of the post-COVID inflation experience. The rise in twelve-month inflation from January 2020 to the peak in June 2022 is explained primarily by positive headline shocks, which raised inflation both directly and by passing through into core inflation. By early 2023, however, the effects of these shocks had faded away and inflation remained high because of extremely high levels of V/U. The decline in inflation since then has reflected falling V/U and negative headline shocks. As of March 2025, core inflation remains above target levels mainly because V/U remains above its historical norm. We end the paper with a discussion of how inflation could evolve in the future.

II. Headline and Core Inflation

We study the behavior of inflation over the period from 1985 to the present, and especially since 2020. We focus on the inflation rate in the consumer price index and consider the personal consumption expenditure (PCE) deflator (for which our results are broadly similar) in the Appendix.

As in our earlier work, we decompose headline inflation into core inflation and headline inflation shocks, defined as headline minus core inflation. We seek to explain core inflation with inflation expectations and labor market tightness—the variables in the Phillips curve—and pass-through from headline shocks. The headline shocks themselves reflect large relative price changes in particular industries.

We measure core inflation with the weighted median of industry inflation rates, which is published by the Federal Reserve Bank of Cleveland. This variable is less volatile and more closely related to macroeconomic conditions than the traditional core measure of inflation excluding food and energy prices, because it filters out unusually large price changes in all industries. The difference between median inflation and the traditional core measure was especially pronounced during the pandemic and subsequent recovery (Ball and others 2021).

For the period 2020-2025, Figure 1 show the paths of headline inflation and core (median) inflation, both at annualized monthly rates (in the left panel) and at the smoother twelve-month rates that are often the focus of policy discussions (in the right panel). The vertical line indicates September 2022, the last month in the sample period for our 2022 paper. We can see that both rising core inflation and positive headline shocks contributed to the run-up in inflation over 2021-2022. Similarly, the subsequent fall in headline inflation reflected both falling core inflation and negative headline shocks. In what follows we examine the economic forces underlying these patterns.

III. Three Drivers of the Inflation Cycle

This section examines the behavior since 2020 of inflation expectations, labor market tightness, and headline inflation shocks. Each of these variables moved in the right direction to help explain the rise in inflation over 2021-2022, and then each shifted course, helping to explain the subsequent retreat in inflation. We examine the data informally in this section and then estimate equations for core inflation and headline shocks in sections 4-5.

Inflation Expectations

In conventional macroeconomics, one determinant of the inflation rate is expected inflation. Like a number of other researchers (for example, Hazell and others 2022), we measure expected inflation with the median ten-year-ahead forecast of CPI inflation from the quarterly Survey of Professional Forecasters. Figure 2 shows this variable from 2016 through 2025.

Expected inflation appeared well-anchored before the pandemic, and it stood at 2.2 percent in 2019:Q4. But after a brief dip at the start of the pandemic, it rose over 2021 and 2022 and peaked at 2.95 percent in 2022:Q4. This rise was modest compared to the rise in actual inflation, but economists such as Reis (2021) warned that it might be the start of a de-anchoring of expectations from the Federal Reserve's target.

Starting in 2023:Q1, the rise in expected inflation was sharply reversed. In 2025:Q1 it stood at 2.3 percent, close to the pre-pandemic level. Evidently the Federal Reserve's tightening and communication over 2022-2023, as well as the progress in reducing actual inflation, reassured forecasters that inflation would remain near the Federal Reserve's target in the long run.

The Vacancy-to-Unemployment Ratio

Another tenet of macroeconomics is that inflation is influenced by tightness or slack in the labor market. The traditional Phillips curve includes the unemployment rate as a measure of labor market tightness (Phillips 1958), but in the last five years a consensus has grown that a better measure, both theoretically and empirically, is the ratio of job openings (vacancies, V) to unemployment (U). This measure was adopted by Furman and Powell (2021) and Barnichon, Oliveira, and Shapiro (2021), and used in our 2022 paper and subsequent work such as Bernanke and Blanchard (2024) and Benigno and Eggertsson (2023).

Figure 3 shows the path of V/U in monthly data since 2016. This ratio rose rapidly over 2021 and peaked at 2.0 in March 2022. That level of V/U is dramatically higher than the average level of 0.6 over 1985-2019, and is the highest at any point since 1951, the first year for which data are available.[1] After the peak, V/U fell steadily until mid-2024 and stood at 1.1 in February 2025—close to the December 2019 level (also 1.1), but still somewhat higher than the historical average. In the econometric work below, we find that the rise and fall in V/U is the most important factor behind the behavior of core inflation.

Underlying the behavior of the V/U ratio are the well-known shifts that have occurred in the Beveridge curve relating V and U. Figure 4 shows the evolution of the vacancy and unemployment rates (V and U as fractions of the labor force) since 2009. We see there was a stable Beveridge curve from 2009 through March 2020, and then a dramatic outward shift at the start of the pandemic. Starting in late 2022, falling vacancies moved the economy downward in the Beveridge space, and by the end of 2024 the economy was back on the pre-pandemic Beveridge curve. The reasons for the shifting Beveridge curve are not entirely clear, but possible factors include a temporary effect of the pandemic on sectoral reallocation (Blanchard, Domash, and Summers 2022) and a temporary decrease in job search due to the expansion of unemployment benefits (Briggs 2022).[2]

The economy's downward movement in the Beveridge space since late 2022 meant that the V/U ratio fell, reducing inflation, even though the unemployment rate never rose above 4.2 percent. Common predictions that disinflation would require high unemployment were based on the view that the outward shift in the curve during the pandemic would persist (for example, Blanchard, Domash, and Summers 2022). If that had proven true, a decline in V/U would have required a movement along the curve with U rising significantly as well as V falling.

[1] Data on vacancies are available since 2001 in the Bureau of Labor Statistics (BLS) Job Openings and Labor Turnover Survey (JOLTS). The vacancy rate back to 1951 is available thanks to Barnichon's (2010) extension of this series using the help wanted index from the Conference Board.

[2] See Barlevy and others (2024) for other factors behind the Beveridge curve shifts, including the surge in layoffs at the start of the pandemic and the rise in quit rates during the "Great Resignation" of 2021-2022.

Headline Shocks

The final factor influencing inflation in our framework is headline inflation shocks—deviations of headline from core, which arise from sharp changes in sectoral prices. These shocks influence headline inflation directly and can also pass through into future core inflation because they influence costs of production and wage demands throughout the economy, channels emphasized by economists such as Blanchard (2022) and di Giovanni and others (2022) (a relationship that we estimate in the next section).

Once again, we see a shift from inflationary forces over 2021-2022 to disinflationary forces since then. As shown above in Figure 1, the twelve-month average of headline shocks was positive from March 2021 to December 2022, peaking at 3.7 percentage points in March 2022, and has been negative since then, with a trough of -3.2 in June 2022. It stands at -1.1 percentage points in March 2025.

Our previous paper identified three variables that explain most of the headline shocks that occurred as inflation rose: changes in the relative prices of energy and auto-related items (each measured as the monthly inflation rate in the sector minus median inflation), and a measure of backlogs of work reported by firms in a survey from IHS Markit Economics. We interpret this last variable as capturing the disruptions in supply chains that were frequently cited as a cause of shortages during the 2021-2022 inflation surge.

Figure 5 shows the paths of these three variables since 2020. The horizontal line in each panel shows the level where the contribution to inflation is neutral: zero for the two relative inflation rates, and 50 for backlogs—the level at which there is “no change in backlogs of work” (Williamson 2021). We see that all three variables fell by large amounts when the pandemic hit in April 2020, and then moved to inflationary levels from late 2020 until sometime in 2022. Then all three moved in a disinflationary direction as the previous energy and auto-price increases were partially reversed and supply chains normalized. In our econometric analysis below, we will see that this experience explains the pattern of positive and then negative headline inflation shocks in Figure 1.

IV. Estimating an Equation for Core Inflation

The centerpiece of our 2022 paper was an equation for core (weighted median) inflation estimated over 1985-2022. We found that it fit the data well, including during the period of rising inflation over 2021-2022. Here we examine the fit when the sample is extended to include the subsequent period of falling inflation.

The Equation

Our equation seeks to explain the path of monthly core inflation. (A similar equation fits the data at the quarterly frequency.) The equation includes the three inflation drivers that we discussed in the last section:

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

where f(•) and g(•) are functions that we specify below. The variable π is annualized monthly core inflation and πe is expected inflation from the SPF, which we assume has a one-for-one effect on actual inflation.[3] In month t, V/U is the average level of V/U over the twelve months from t-11 to t, which accounts in a parsimonious way for the lagged relationship between labor market tightness and inflation. Similarly, H is the average of the headline inflation shock (headline minus median) from t-11 to t. This variable captures the possible pass-through over time of headline shocks into core inflation, which can occur through production chains, movements in near-term inflation expectations, and wage adjustments.

Researchers have suggested a variety of reasons that the effects of both labor market tightness and past headline shocks could be asymmetric or otherwise non-linear. For example, Blanchard (2022) emphasizes the salience of large shocks; Ball and Mankiw (1994) theorize that shocks have asymmetric effects in the presence of menu costs and trend inflation; and a number of studies find asymmetric pass-through effects from crude oil to retail fuel prices (“rockets and feathers”). We want to allow for these possible non-linearities.

We do not, however, have strong a priori views on what kinds of non-linearities are important. We therefore agnostically make f(•) a cubic function of V/U and g(•) a cubic function of H, which can capture a variety of shapes that might be consistent with the data.

Estimated Relations with V/U and H

Table 1 presents estimates of our equation for core inflation. We present results for 1985-September 2022, the sample period in our previous paper, and for 1985-March 2025.

To help us interpret the estimated cubic functions, Figure 6 shows them graphically for the two sample periods, with 95 percent confidence intervals. Panel A shows the estimated relationship between V/U and the “core inflation gap”—the deviation of core inflation π from expected inflation π^e. This relationship is steepest at unusually high or low levels of V/U and flatter in between. The steep estimated slope for V/U above 1.5 reflects the high levels of core inflation when V/U was in that range in 2022-2023.

Qualitatively, the estimated relationships between V/U and inflation are similar in the full sample and in the sample ending in September 2022. However, extending the sample reduces the steepness of the relationship at high V/U by a modest amount.

Panel B of Figure 6 shows the pass-through from the headline shock H to the core inflation gap. This relationship is sharply asymmetric: positive headline shocks pass through into higher core inflation, but negative shocks do not have a significant effect. This estimated relationship does not change materially when the sample is extended to the present.

[3] A Phillips curve specification where changes in long-run inflation expectations affect current inflation one-for-one is derived by Hazell and others (2022) in a New Keynesian framework under the assumption that shocks to the natural rate of unemployment and cost-push shocks are transitory. The authors show that under such conditions, long-run inflation expectations enter the Phillips curve with a coefficient of one. Data for long-term (ten-year-ahead) CPI inflation expectations come from the Federal Reserve Bank of Philadelphia website. These data are quarterly and come from the SPF starting in 1991:Q4 and from Blue Chip survey data before then. For our monthly analysis, we allocate the quarterly forecasts to the middle month of each quarter and interpolate between these months.

Fitted Values for 2020-2025

Here we address the central question of this paper: Does the core inflation equation from our 2022 paper, which was designed to explain the rise in core inflation, also explain its subsequent decline? To answer that question, we compare the actual path of core inflation since 2020 to fitted values from our estimated equation. We compute two sets of fitted values, one based on estimates for our full sample through March 2025 and the other based on the sample ending in September 2022. In the latter case, the fitted values after September 2022 are conditional forecasts based on the sample period in our earlier work.

Figure 7 shows the results. The left panel compares the actual path of annualized monthly core inflation to the two sets of fitted values, and the right panel shows twelve-month actual and fitted inflation rates constructed by aggregating the monthly rates.

The Figure indicates that our equation fits well. For twelve-month core inflation the actual and fitted values are close to each other during both the rise in inflation to early 2023 and the subsequent fall. Not surprisingly, the fitted values based on data ending in September 2022 are farther from actual inflation than those based on data through the present, but not by much. In the monthly graph, core inflation is somewhat volatile, although much less so than headline inflation; it trends upward and downward along with the fitted values.

For most of the period since September 2022, the twelve-month fitted values based on the shorter sample are a bit higher than actual inflation, but at the end of the sample they dip slightly below actual inflation. That is, recent levels of core inflation have been slightly *higher* than our equation predicts. In March 2025, twelve-month core inflation stood at 3.5 percent and the fitted values were 3.1 for the shorter sample and 3.2 for the longer sample.

A detail: our results for the sample ending in September 2022 are not identical to the results reported in our earlier paper because of data revisions. Specifically, changes in seasonal adjustment factors have made a difference for the data, especially the monthly inflation data for 2022. Fitted values for inflation after September 2022 are somewhat higher with estimates based on the original data than with revised data. The Appendix compares the results with current-vintage data that we report here to our 2022 results.

Decomposing the Path of Core Inflation

Finally, we quantify the roles of the three determinants of core inflation—expected inflation, V/U, and pass-through from headline shocks—since 2020. We do so by decomposing the fitted values of core inflation into the contributions of each variable. Figure 8 shows this decomposition based on parameter estimates for the full sample of 1985-2025.

We see that the rise in twelve-month core inflation, which peaked in February 2023 at 7.0 percent, reflected both pass-through from headline shocks (the gold bars) and rising V/U (the red bars). The former was the more important factor as core inflation started to rise in 2021, but the latter became increasingly important as the rise continued. The contribution of rising expected inflation (the blue bars) was modest.

The pass-through of headline shocks into core inflation faded away in early 2023. At that point, core inflation was still high because the influence of high levels of V/U was at its peak. The subsequent decline in core inflation was driven primarily by the fall in V/U, with a modest contribution from falling expected inflation. Notice that pass-through from headline shocks did *not* contribute materially to the fall in core inflation because of the asymmetry in pass-through: there were negative headline shocks in 2023-2025, but our estimated equation implies that negative shocks do not influence core inflation.

V. An Equation for Headline Shocks

We have seen that both the rise in headline inflation over 2021-2022 and the subsequent fall reflected headline-inflation shocks—deviations of headline from core inflation—as well as movements in core inflation. We have also seen that three factors that influence headline shocks—energy inflation, auto-related inflation, and firms' backlogs of work—all moved in an inflationary direction as headline inflation rose and then became neutral or disinflationary. Our earlier paper showed that these three factors account quantitatively for the headline shocks through September 2022. Once again, we extend our analysis through March 2025.
Table 2 reports regressions of the headline inflation shocks on the three factors for the sample period in the earlier paper, which runs from January 2020 through September 2022, and for the extended sample. The coefficient estimates are similar for the two samples and the R-squared statistics are high (0.95 for both samples). As a result, the fitted values based on either sample are close to the actual headline shocks, as shown in Figure 9. Once again, an equation that we previously estimated through September 2022 yields accurate conditional predictions through the present.

Figure 10 decomposes the headline shocks since 2020 into the contributions of the three factors (based on fitted values for the full sample) and a residual. We see that energy prices were the most important factor, contributing positive shocks in most months from June 2020 to June 2022—with especially large spikes after Russia's invasion of Ukraine in February 2022 raised world energy prices—and then mostly negative shocks as energy prices subsided. Auto prices contributed materially to headline shocks during the period of rising inflation, especially over April-June of 2021, which included the pandemic-induced chip shortage. The contribution of backlogs of work (after controlling for auto and energy prices) was relatively modest as backlogs rose above the neutral level of 50 and then fell below it.

The residuals in Figure 10, shown in gray, capture other sources of headline shocks. These residuals were mostly negative and dampened the total headline shocks during the period of rising inflation. They reflect a variety of idiosyncratic industry shocks in different months. For example, during the period of rising inflation, the two largest negative residuals came in February and September 2021 and reflected—in both cases—falls in airline fares and apparel prices. During the period of falling inflation, the largest negative residual came in November 2023 and reflected a fall in the relative price of food at home.

VI. Conclusion

This paper seeks to explain the path of US inflation since 2020. Our central findings are summarized in Figure 11, which decomposes headline inflation into core inflation and headline shocks, with core inflation further decomposed into contributions from inflation expectations, the vacancy-to-unemployment ratio (V/U), and pass-through from headline shocks.

We see that the rise in twelve-month inflation from January 2020 to the peak in June 2022 is explained primarily by positive headline shocks, which raised inflation both directly and by passing through into core inflation. By early 2023, however, the effects of these shocks had faded away and inflation remained high because of extremely high levels of V/U. The decline in inflation since then has reflected falling V/U and negative headline shocks. We have also seen that movements in energy and auto-related prices have been the most important sources of headline shocks.

These findings come from a framework developed in our 2022 paper to explain the rise in inflation over 2021-2022. In our view, the good fit of the framework in explaining the disinflation since 2022 strengthens the credibility of our approach.

Our interpretation of the US inflation experience since the COVID-19 crisis has points in common with other recent studies. In particular, the central role of the V/U ratio in our account is similar to papers such as Benigno and Eggertsson (2023). That work and ours differ somewhat from Bernanke and Blanchard (2024), who attribute less of the inflation runup to V/U and more to supply shortages and sectoral price increases. Dao and others (2024) suggest that these differences arise because our framework allows V/U to have a nonlinear relationship with inflation and—as a broad measure of macroeconomic conditions—to affect prices directly, not only through wage inflation as in Bernanke and Blanchard.[4]

After analyzing recent inflation, it is natural to speculate about the future. In March 2025, twelve-month core (median) inflation stood at 3.5 percent, which exceeds the level consistent with the Federal Reserve's target. This gap reflects the fact that the vacancy-to-unemployment ratio, at 1.1, is still higher than the historical norm, implying upward pressure on underlying inflation. Reducing inflation to the Fed's target would—other things equal—require a further cooling of the labor market that pushes V/U closer to its average of 0.6 over 1985-2019.

Since 2023, the inward shift of the Beveridge curve has allowed vacancies to fall, reducing V/U and inflation, without a substantial rise in unemployment. It is possible this benign trend will continue, but that would require the Beveridge curve to shift inward relative to its pre-pandemic position; the reversal of the outward shift over 2020-2022, which has already occurred, is not enough. If the Beveridge curve stabilizes at its current position or shifts outward again as a result of new labor market disruptions, a normalization of V/U will require a movement along the curve, with a significant rise in unemployment as well as a fall in vacancies.

The future could also bring either positive or negative headline shocks. We might, for example, see disinflationary shocks resulting from the recent decline in international energy prices, or inflationary shocks from tariffs and their effects on global supply chains. Unfortunately, our findings suggest that such shocks would have asymmetric effects, because inflationary shocks pass through into core inflation and disinflationary shocks do not. Overall, how soon inflation returns to target will depend on which shocks occur, the evolution of V/U, and whether long-term inflation expectations remain at target-consistent levels.

[4] Many other papers seek to measure the contributions of different factors to post-pandemic inflation, with varying conclusions about the importance of labor-market tightness, other variables capturing aggregate demand, sectoral shocks, and supply constraints. Examples of this work include Gagliardi and Gertler (2024), Harding and others (2023), Comin and others (2024), Crump and others (2024), Dynan and Elmendorf (2024), Giannone and Primiceri (2024), Levy (2024), Shapiro (2024), Chen and others (2024), and Bolhuis and others (2025).

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Appendix A. The Effects of Date Revisions

In the main text of this paper, we compare results for the sample period in Ball, Leigh, and Mishra (2022), which ends in September 2022, to results when the sample is extended through March 2025. The extended sample is not, however, the only difference from the earlier paper; our results are also influenced by revisions in the data, especially the CPI data. Because of these revisions, our current results differ somewhat from the previous paper even for the same sample period.

Non-seasonally-adjusted CPI data are not revised after their initial release. However, seasonal adjustment factors are revised annually, causing changes in seasonally adjusted CPI inflation. The revisions in 2023 made an unusually large difference for inflation over 2022, reflecting the difficulty of seasonal adjustment in the volatile COVID period. In particular, as shown in Figure A1, the revisions reduced the average core (weighted median) inflation rate over June-September 2022 from 8.3 to 7.6.

These data revisions have a non-negligible effect on the estimated relationship between core inflation and the V/U ratio. Figure A2 compares the cubic relationships shown in Figure 6 of the main text, based on current-vintage data through September 2022 and through March 2025, to the relationship estimated with the data from our earlier paper. This third relationship is identical to the one shown in Figure 6 of the earlier paper.

As discussed in the text, the relationship between V/U and core inflation is somewhat steeper at high levels of V/U when estimated with current-vintage data through September 2022 than with data through the present. The relationship is steeper still when we use the data from our earlier paper; indeed, updating the data through September 2022 makes a larger difference than extending the sample period to the present. This result reflects the fact that data revisions reduced core inflation rates in the summer of 2022, suggesting a smaller effect of high levels of V/U.

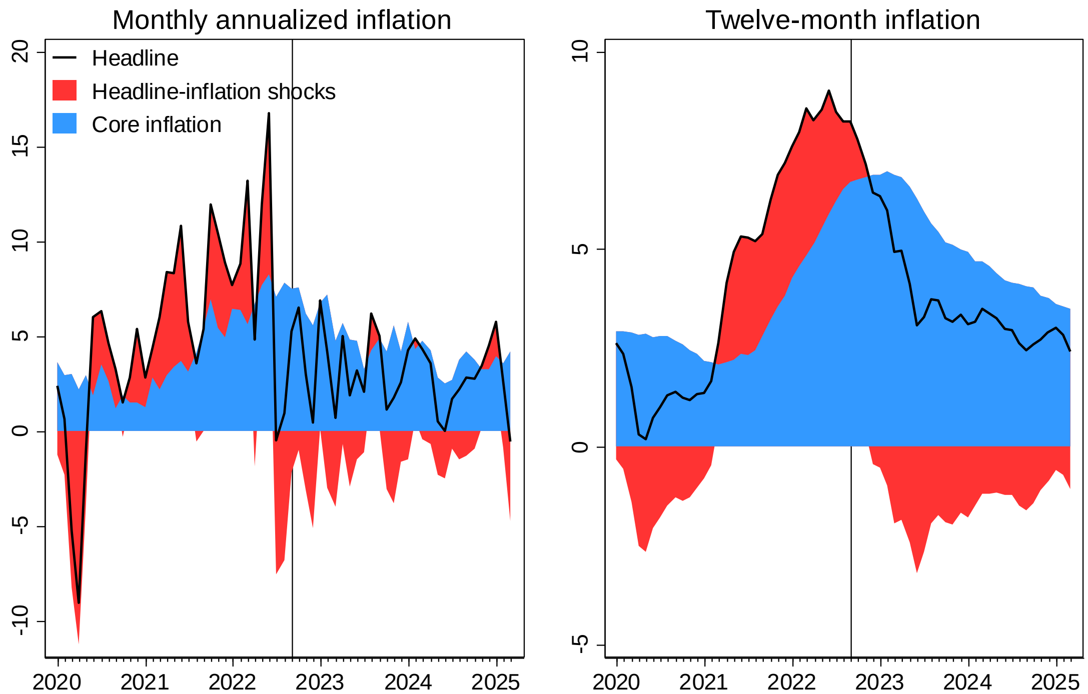
Figure A3 compares the fitted values for core inflation in Figure 7 of the text to fitted values based on the older data from our previous paper. Once again, we see that the vintage of the data makes a bigger difference than the sample period. Because the older data imply a steeper relationship at high levels of V/U, they yield higher fitted values for core inflation in late 2022 and 2023.

Appendix B. Results for the PCE Deflator

The main text of this paper focuses on inflation in the consumer price index (CPI). Here we examine the personal consumption expenditure (PCE) deflator, the Federal Reserve's preferred measure of inflation. We measure core PCE deflator inflation with the weighted median PCE inflation rate from the Federal Reserve Bank of Cleveland.

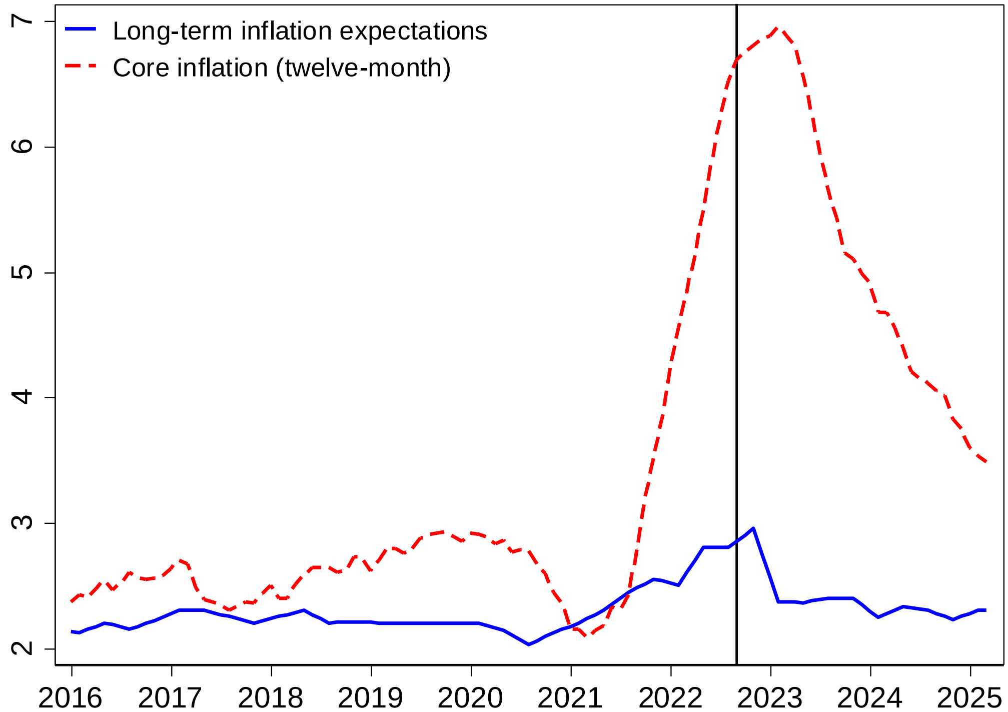
Table B1 and Figures B1-B5 repeat the main empirical exercises in the text with the PCE deflator. We decompose headline inflation into core inflation and headline shocks; estimate our equation for core inflation; compare fitted values to actual core inflation; decompose core inflation into contributions from expected inflation, V/U, and pass-through from headline shocks; and report the full decomposition of headline inflation. Generally, the results for PCE deflator inflation are similar to those for CPI inflation.

Figure 1. CPI Inflation: Headline, Core, and Headline Inflation Shocks, 2020–2025
(percent)



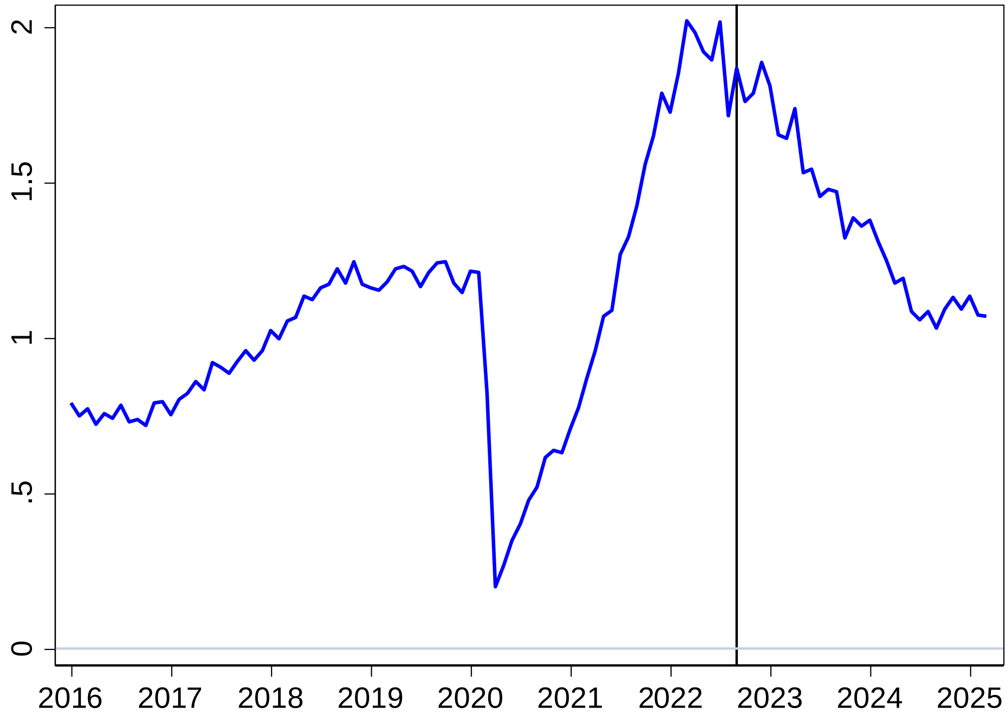
Sources: Federal Reserve Bank of Cleveland; authors' calculations.
Note: Core inflation is the weighted median CPI inflation rate from the Federal Reserve Bank of Cleveland. Vertical line indicates September 2022.

Figure 2. Long-Term CPI Inflation Expectations and Core Inflation, 2000–2025
(percent)



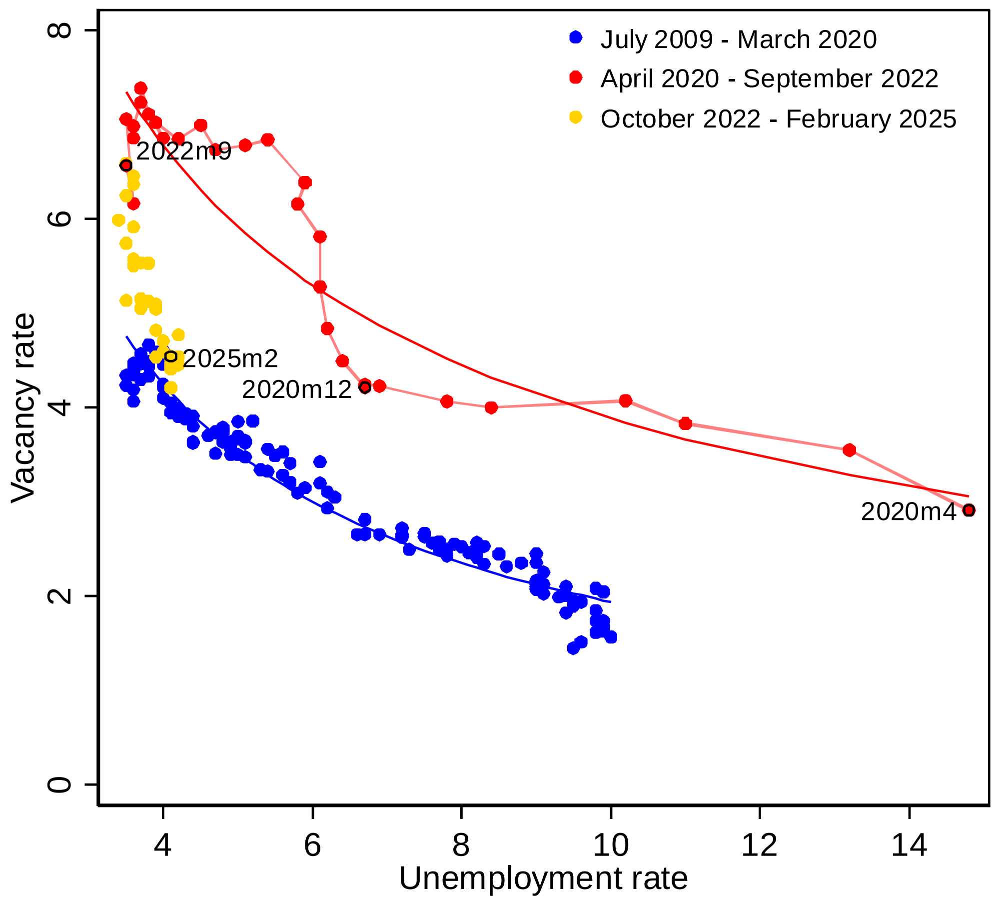
Sources: Federal Reserve Bank of Cleveland; Survey of Professional Forecasters; authors' calculations.
Note: Long-term inflation expectations denote ten-year-ahead CPI inflation forecasts. Vertical line indicates September 2022.

Figure 3. Ratio of Vacancies to Unemployed, 2016–2025



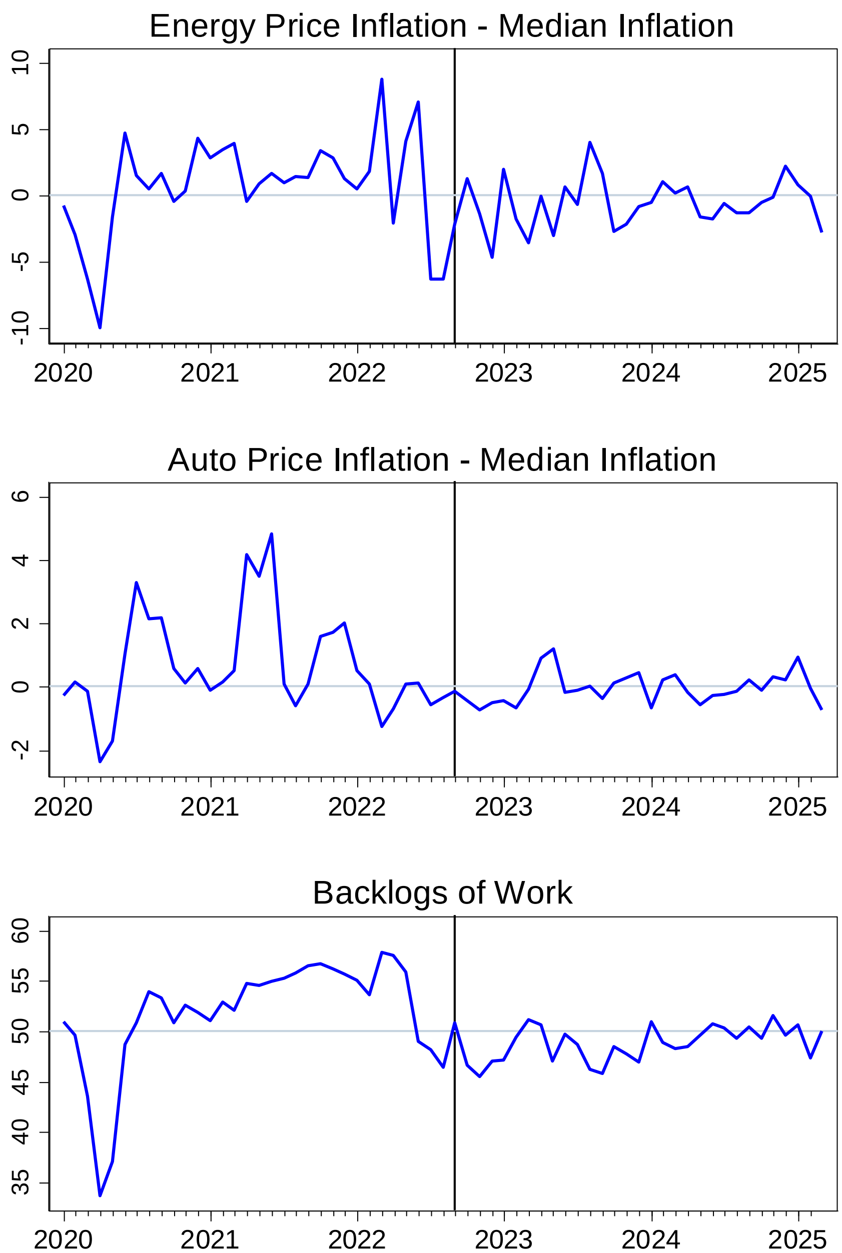
Sources: Haver analytics; authors' calculations.
Note: Vertical line indicates September 2022.

Figure 4. The Behavior of the Beveridge Curve, 2009–2025
(percent of the labor force)



Source: Bureau of Labor Statistics.
Note: July 2009 to March 2020 covers the pre-COVID-19 expansion, based on National Bureau of Economic Research (NBER) business cycle dates, and the first month of the COVID-19 era. The figure reports log-linear curves fitted to each period.

Figure 5. Factors Associated with Headline Inflation Shocks
(non-annualized inflation rates, percentage points; index)



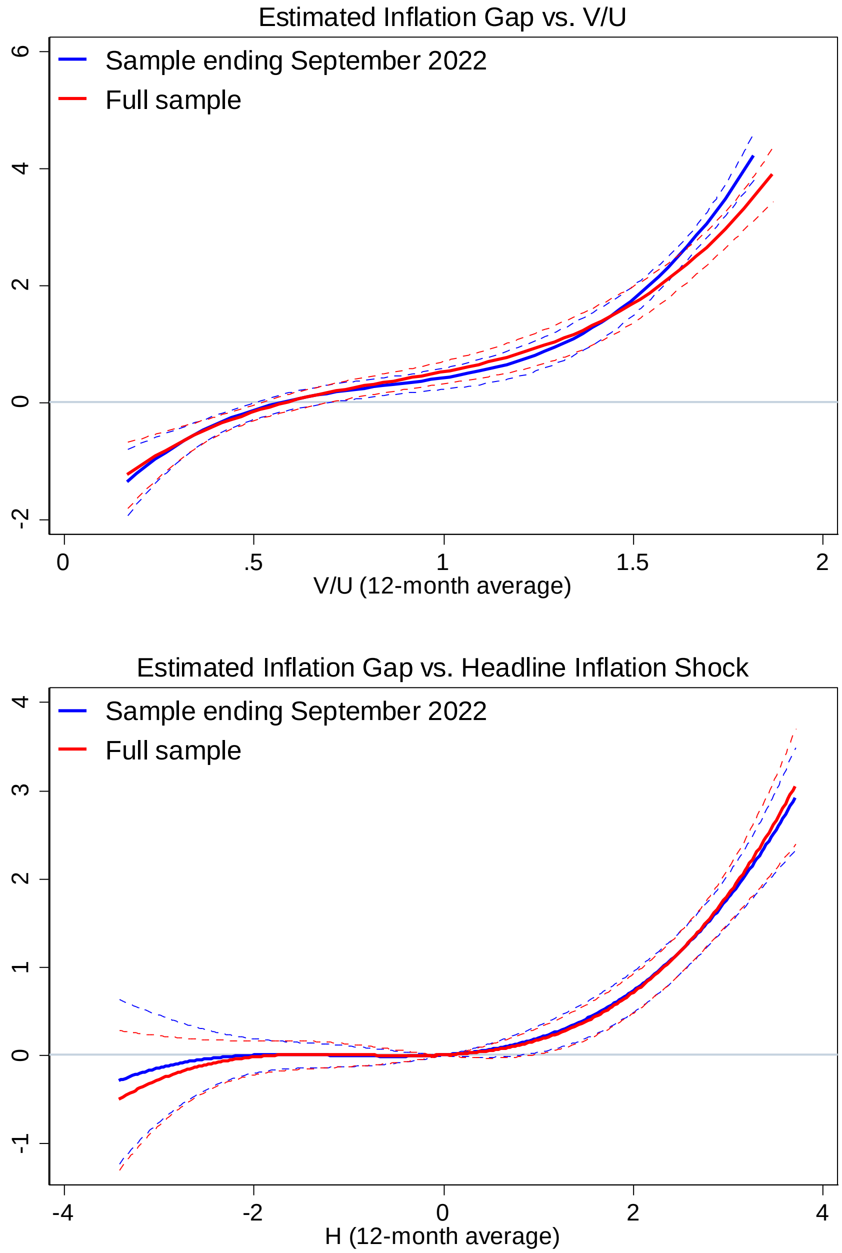
Sources: Haver analytics; IHS Markit Economics; authors' calculations.
Note: Vertical line indicates September 2022.

Table 1. Phillips Curve Estimates: Median CPI Inflation

	(1) 1985-2022	(2) 1985-2025
V/U	8.393***	6.564***
	(2.216)	(2.110)
V/U-squared	-8.957***	-6.271***
	(2.492)	(2.308)
V/U-cubed	3.513***	2.410***
	(0.828)	(0.744)
H	0.071	0.048
	(0.077)	(0.080)
H-squared	0.090***	0.085***
	(0.020)	(0.017)
H-cubed	0.028**	0.033***
	(0.013)	(0.012)
Constant	-2.542***	-2.190***
	(0.586)	(0.574)
Observations	453	483
R^2	0.553	0.622
Adjusted R^2	0.547	0.617

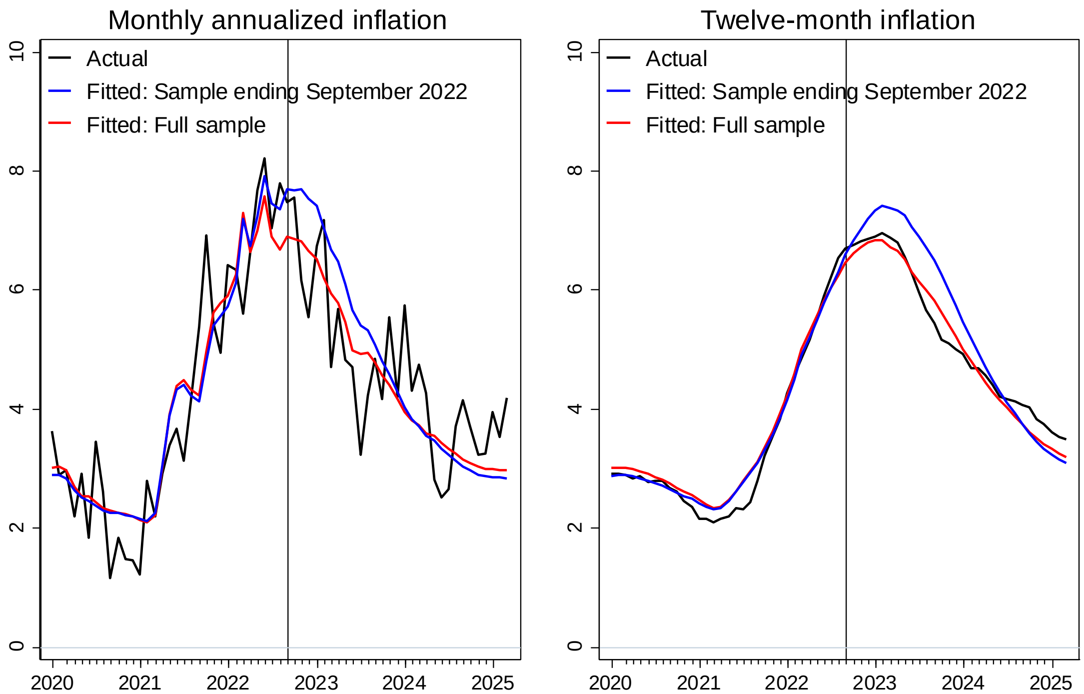
Notes: V/U denotes ratio of vacancies to unemployed (12-month average). H denotes headline-inflation shock (12-month average). Columns 1 and 2 are based on the samples from January 1985-September 2022, and January 1985-March 2025 respectively. Newey-West standard errors with 12 lags in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively.

Figure 6: Estimated Inflation Gap as a Function of Slack and Headline Inflation Shocks
(percentage points)



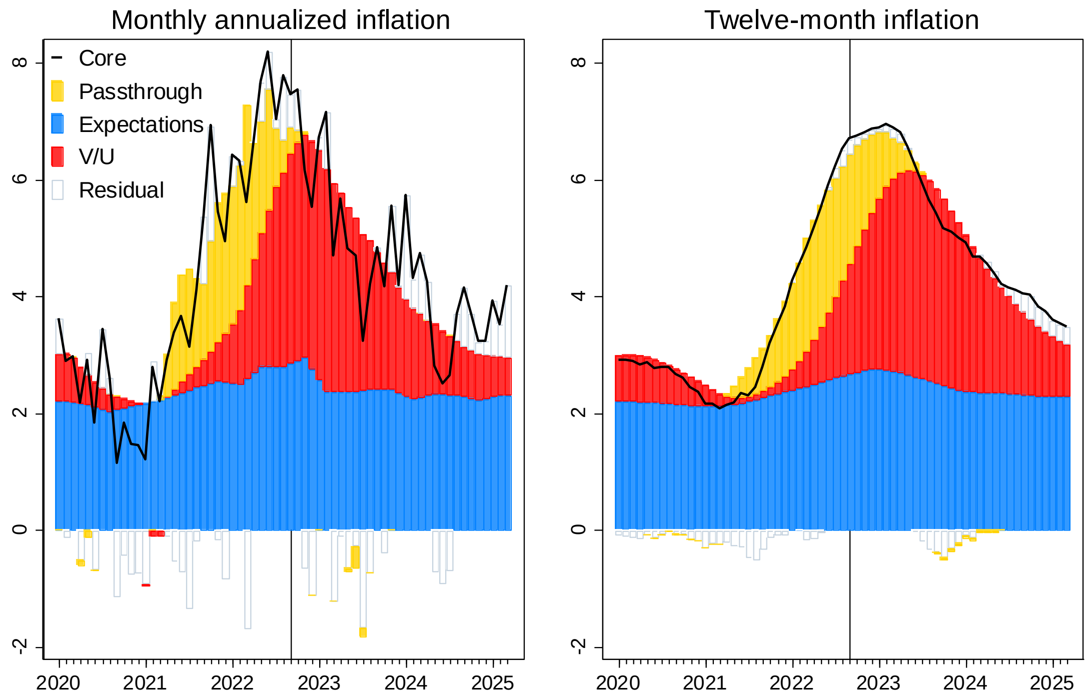
Sources: Haver analytics; Survey of Professional Forecasters; authors' calculations.
Note: Panel A reports fitted values for constant term and V/U terms from equation estimates reported in Table 1. Panel B reports fitted values for headline inflation shock (H) terms. Dotted lines indicate 95 percent confidence intervals. Inflation gap denotes monthly annualized median CPI inflation minus long-term inflation expectations.

Figure 7. Predictions for Median CPI Inflation Since the Pandemic: Comparison Across Sample Periods
(percent)



Source: Authors' calculations.
Note: Figure reports predicted values based on monthly equation estimated for January 1985 - September 2022 (Table 1, Column 1) and for January 1985 – March 2025 (Table 1, Column 2).

Figure 8. Accounting for the Rise and Retreat of Core Inflation
(percentage points)



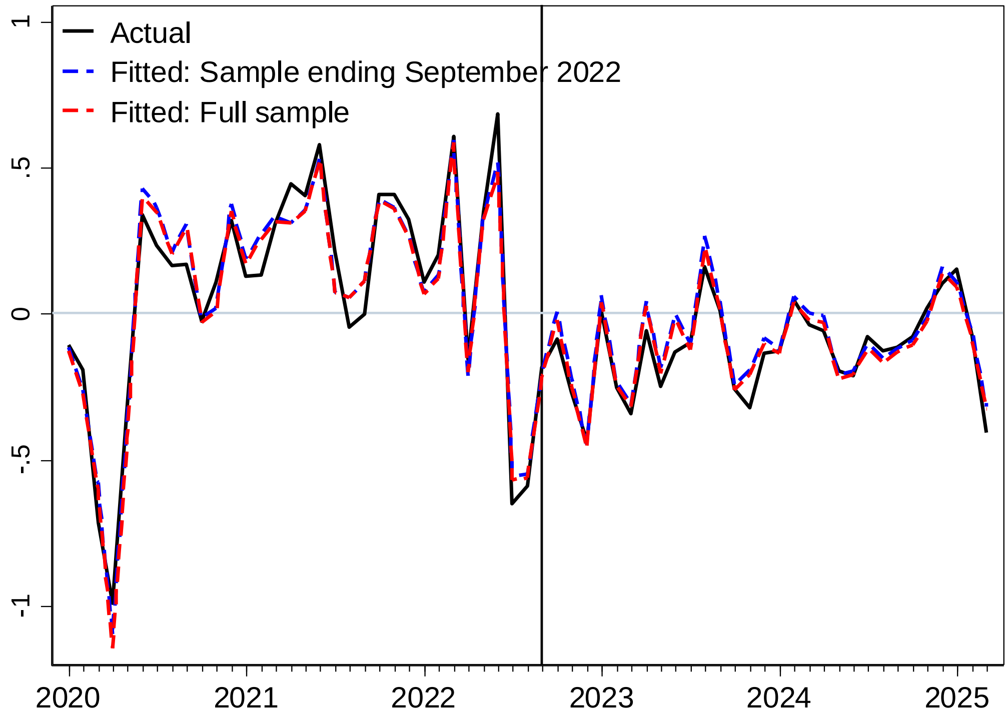
Source: Authors' calculations.
Note: "Pass-through" denotes pass-through of headline shocks to core inflation. "Expectations" denotes contribution of long-term (SPF) inflation expectations to core inflation. "V/U" denotes contribution of ratio of vacancies to unemployed. Vertical line indicates September 2022.

Table 2. Explaining Headline Inflation Shocks, 2020-2025
(Dependent variable: Headline – Median CPI monthly non-annualized inflation)

	(1) 2020-2022	(2) 2020-2025
Energy price inflation	0.081***	0.079***
	(0.006)	(0.005)
Backlogs of work	0.005	0.008**
	(0.004)	(0.004)
Auto-related inflation	0.087***	0.087***
	(0.012)	(0.010)
Constant	-0.034*	-0.050***
	(0.018)	(0.009)
Observations	33	63
R^2	0.952	0.950
Adjusted R^2	0.947	0.947

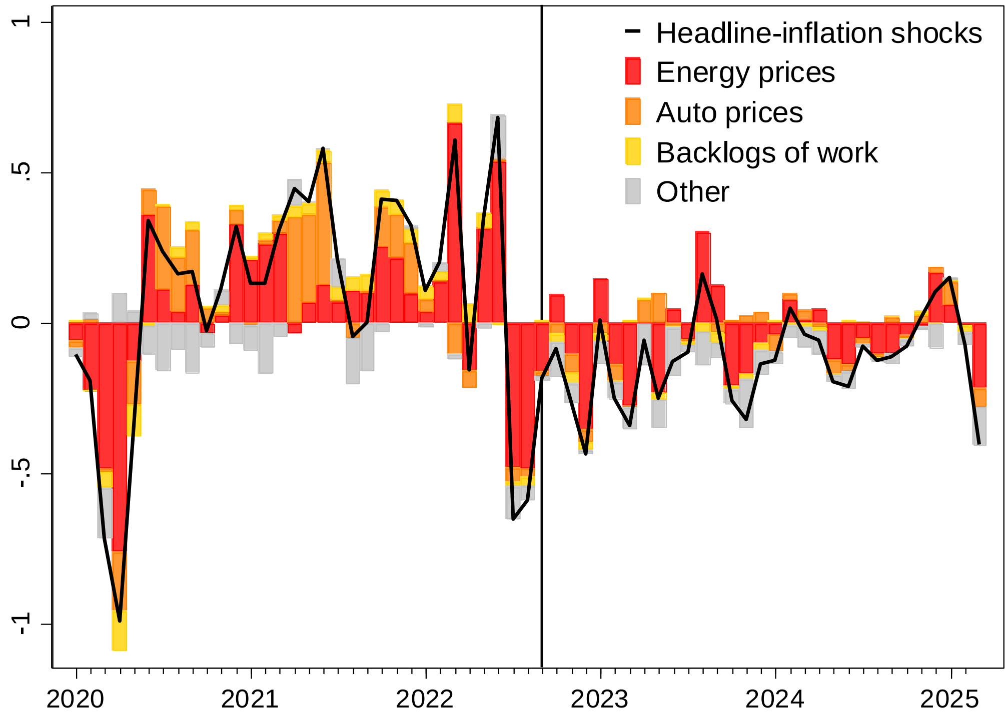
Sources: Haver analytics; IHS Markit Economics; authors' calculations.
Note: Relative energy and auto-related inflation variables are created by subtracting median inflation from energy and auto-related inflation respectively. Backlogs of work variable is taken from IHS Markit Economics, with the neutral value of 50 subtracted. Columns 1 and 2 are based on the samples from January 2020-September 2022, and January 2020-March 2025, respectively. Huber-White standard errors in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively. We do not report Newey-West standard errors because they can be unreliable in a sample as short as ours.

Figure 9: Headline Inflation Shocks: Actual vs. Fitted Values
(Non-annualized monthly rate, percent)



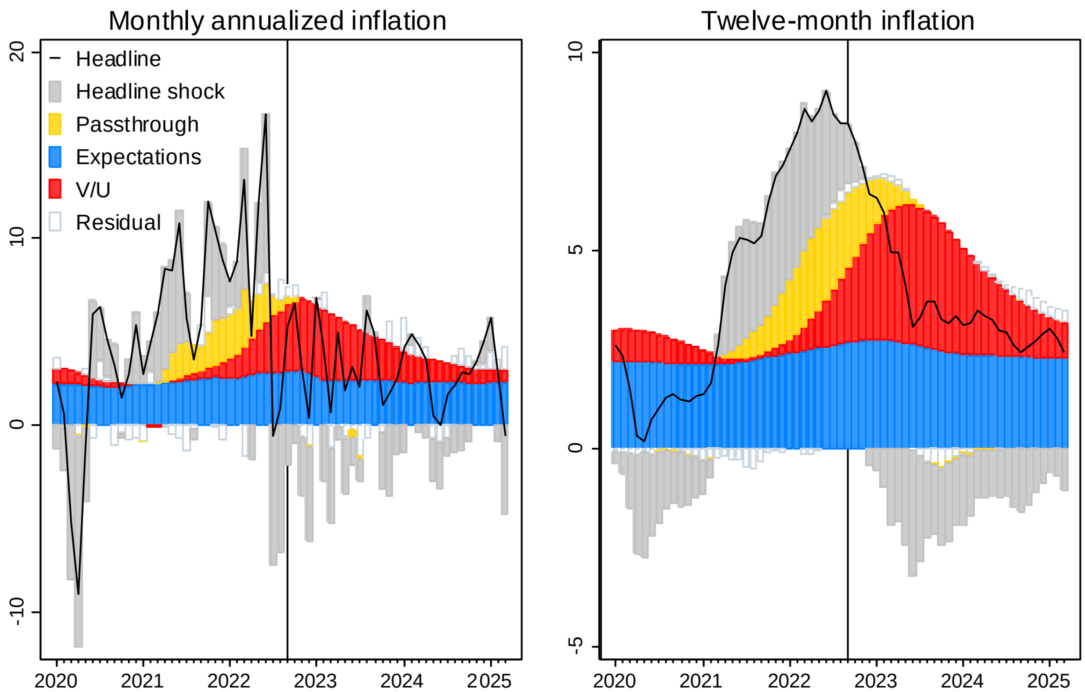
Sources: Haver analytics; IHS Markit Economics; authors' calculations.
Note: Headline inflation shocks denote the difference between headline and core inflation (non-annualized). Fitted values are based on estimation results in Table 2. Vertical line indicates September 2022.

Figure 10. Decomposition of Headline Inflation Shocks
(monthly non-annualized rate, percentage points)



Sources: Haver analytics; IHS Markit Economics; authors’ calculations. Vertical line indicates September 2022.

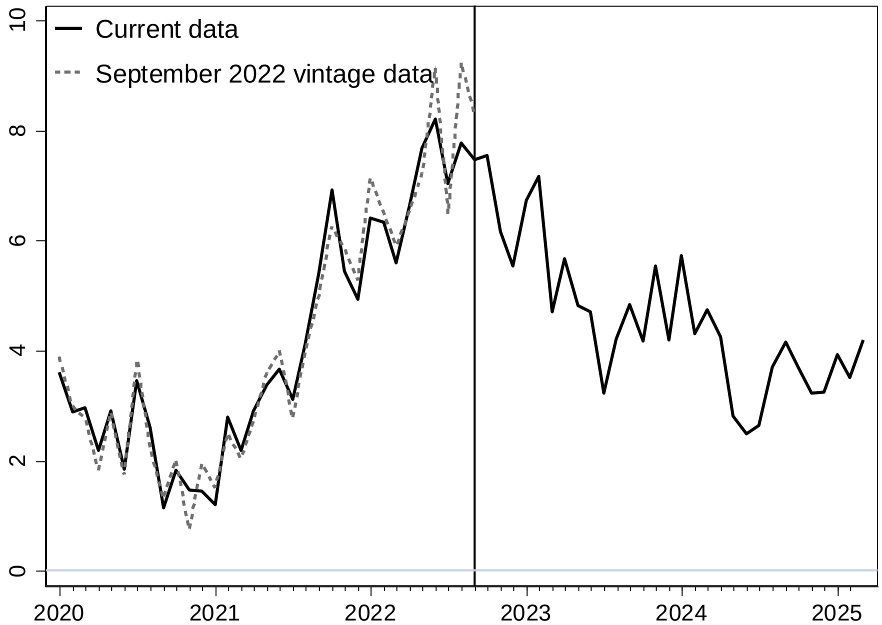
Figure 11. Accounting for the Rise and Retreat of Headline Inflation
(percentage points)



Source: Authors' calculations.
Note: "Pass-through" denotes pass-through of headline shocks to core inflation. "Expectations" denotes contribution of long-term (SPF) inflation expectations to core inflation. "V/U" denotes contribution of ratio of vacancies to unemployed. Vertical line indicates September 2022.

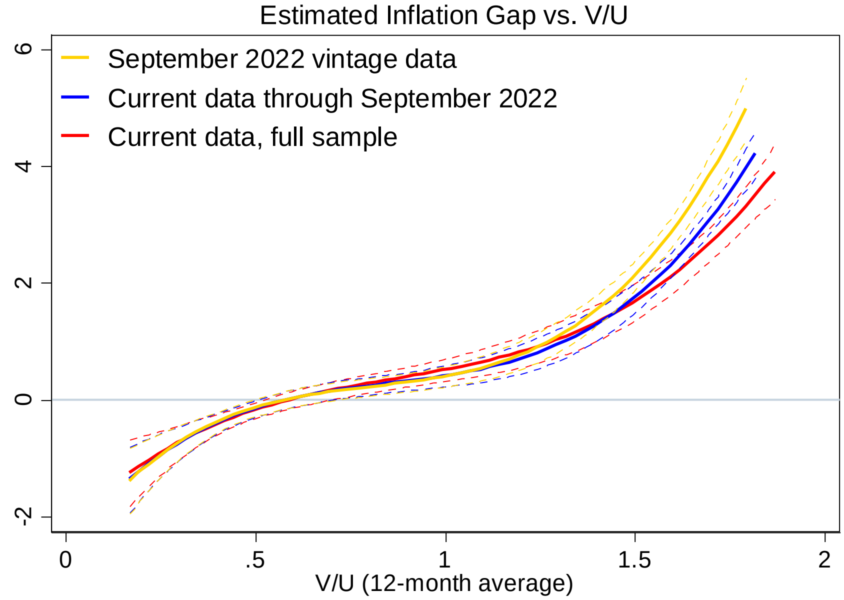
Appendix A: Data Vintages

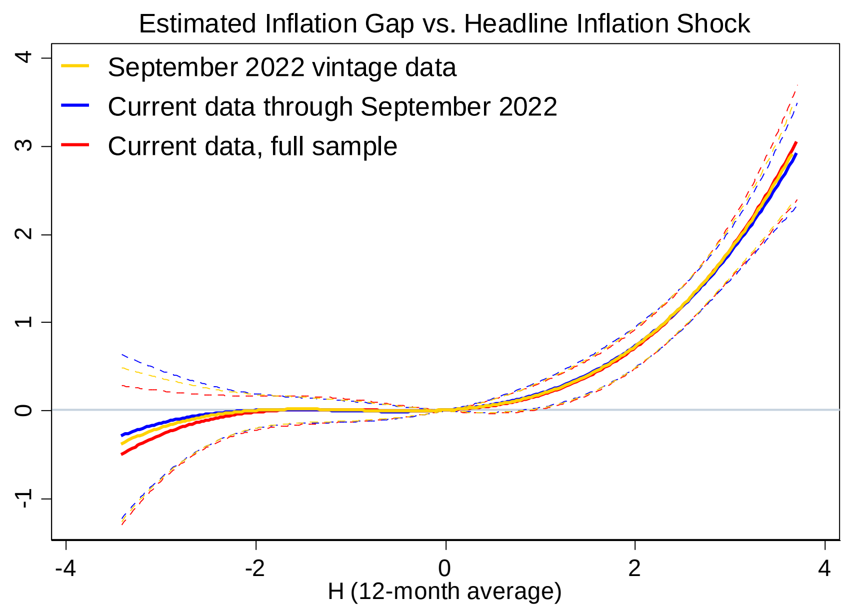
Figure A1. Median CPI Inflation: Current Data and September 2022 Vintage Data
(Monthly annualized rate, percent)



Sources: Federal Reserve Bank of Cleveland; authors' calculations.
Note: Vertical line indicates September 2022.

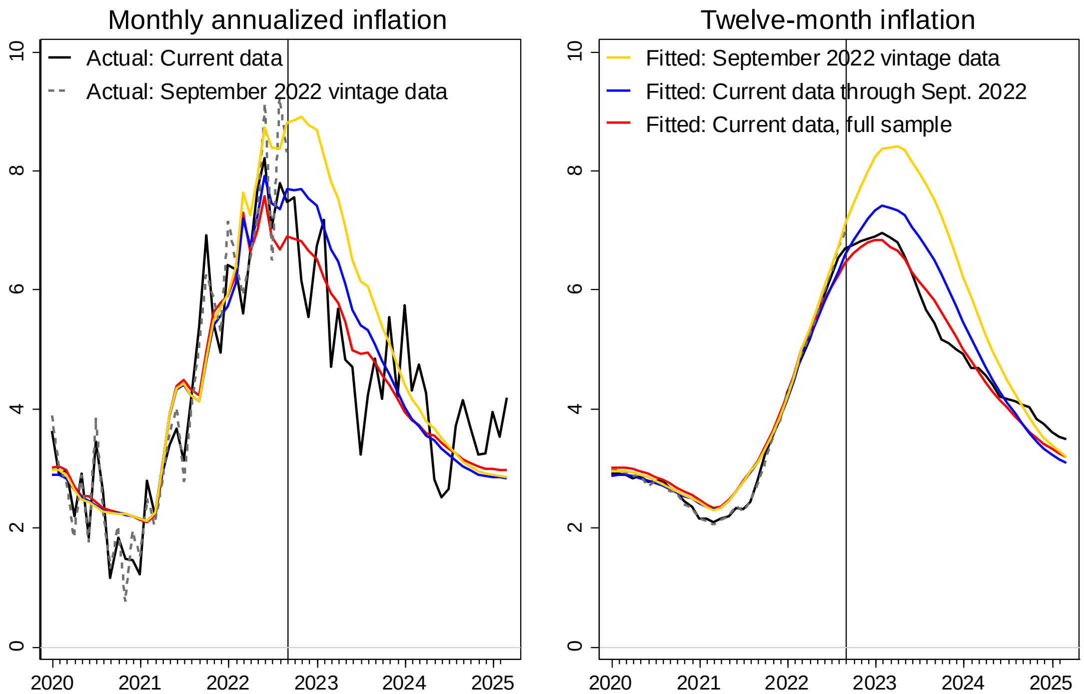
Figure A2. Estimated Functions: Comparison Across Data Vintages





Sources: Haver analytics; Survey of Professional Forecasters; authors' calculations.
Note: Panel A reports fitted values for constant term and V/U terms based on monthly equation estimated with current data for January 1985 – September 2022 (Table 1, Column 1) and for January 1985 – March 2025 (Table 1, Column 2), and based on monthly equation estimated for January 1985 – September 2022 using the vintage dataset of Ball, Leigh, and Mishra (2022). Panel B reports fitted values for headline inflation shock (H) terms. Dotted lines indicate 95 percent confidence intervals. Inflation gap denotes monthly annualized median CPI inflation minus long-term inflation expectations.

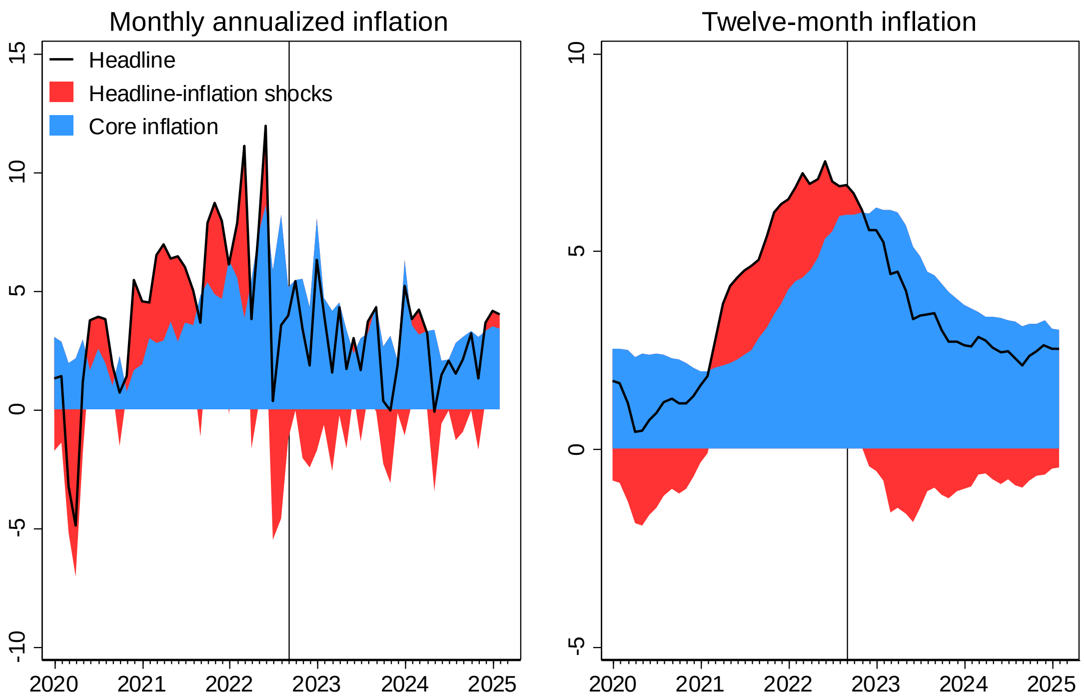
Figure A3. Predictions for Median CPI Inflation: Comparison Across Data Vintages



Source: Authors' calculations.
Note: Figure reports predicted values based on monthly equation estimated with current data for January 1985 – September 2022 (Table 1, Column 1) and for January 1985 – March 2025 (Table 1, Column 2), and based on monthly equation estimated for January 1985 – September 2022 using the vintage dataset of Ball, Leigh, and Mishra (2022). Vertical line indicates September 2022.

Appendix B: PCE Inflation

Figure B1. PCE Inflation: Headline, Core, and Headline Inflation Shocks, 2020–2025
(percent)



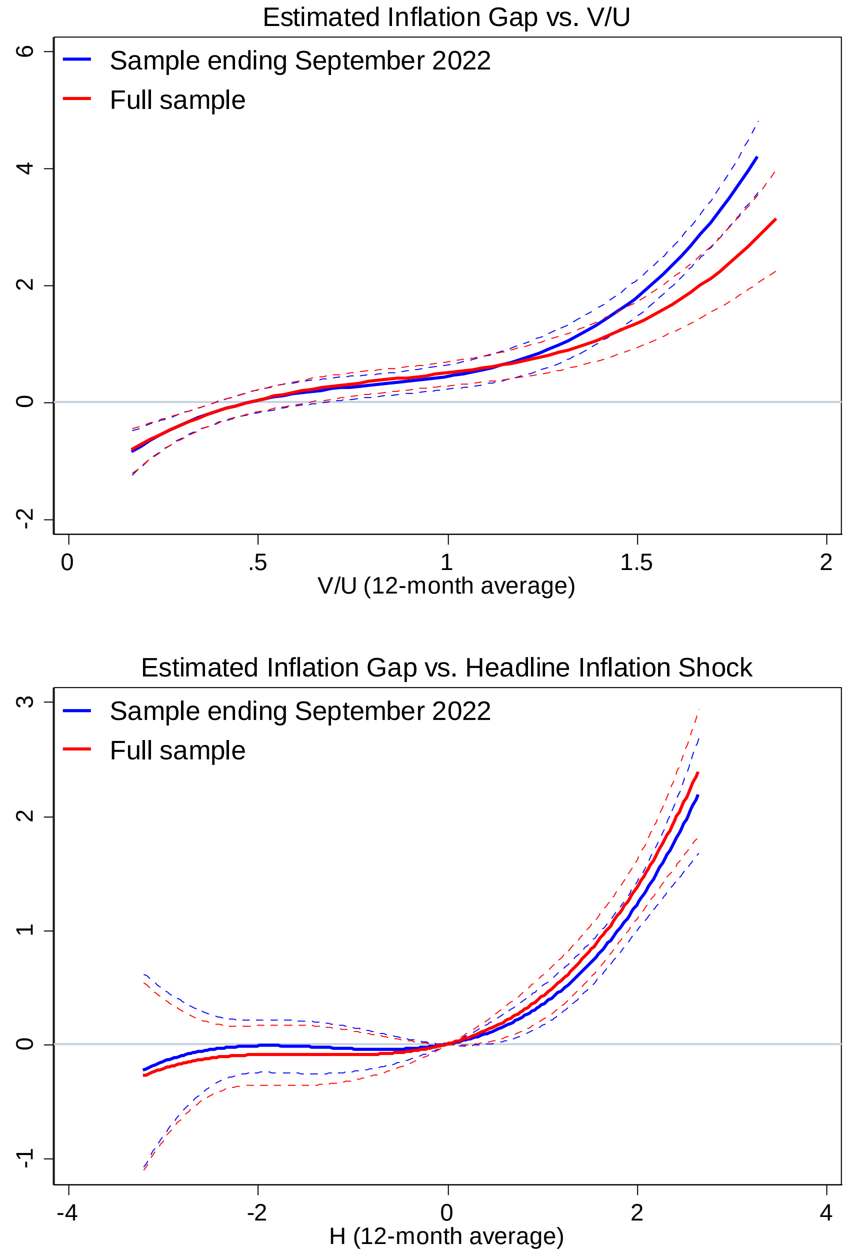
Sources: Federal Reserve Bank of Cleveland; authors' calculations.
Note: Core inflation is the weighted median PCE inflation rate from the Federal Reserve Bank of Cleveland. Vertical line indicates September 2022.

Table B1. Phillips Curve Estimates: Median PCE Inflation

	(1) 1985-2022	(2) 1985-2025
V/U	6.470***	5.450***
	(1.777)	(1.591)
V/U-squared	-7.360***	-5.413***
	(2.124)	(1.789)
V/U-cubed	3.083***	2.061***
	(0.734)	(0.599)
H	0.153	0.219*
	(0.113)	(0.125)
H-squared	0.151***	0.159***
	(0.021)	(0.023)
H-cubed	0.039*	0.037
	(0.024)	(0.024)
Constant	-1.757***	-1.600***
	(0.417)	(0.400)
Observations	453	482
R^2	0.460	0.476
Adjusted R^2	0.452	0.469

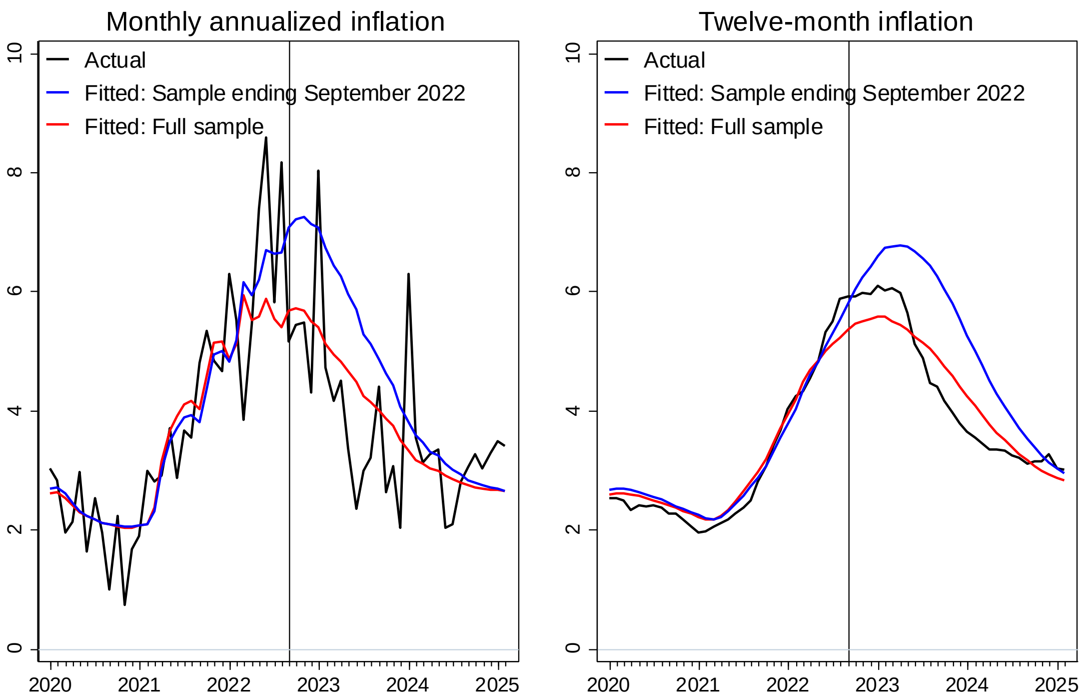
Notes: V/U denotes ratio of vacancies to unemployed (twelve-month average). H denotes headline-inflation shock (twelve-month average). Columns (1) and (2) are based on the samples from January 1985-September 2022, and January 1985-February 2025 respectively. Newey-West standard errors with 12 lags in parentheses. ***, **, and * denote statistical significance at the 1,5, and 10 percent level, respectively.

Figure B2: Estimated PCE Inflation Gap as a Function of Slack and Headline Inflation Shocks
(percentage points)



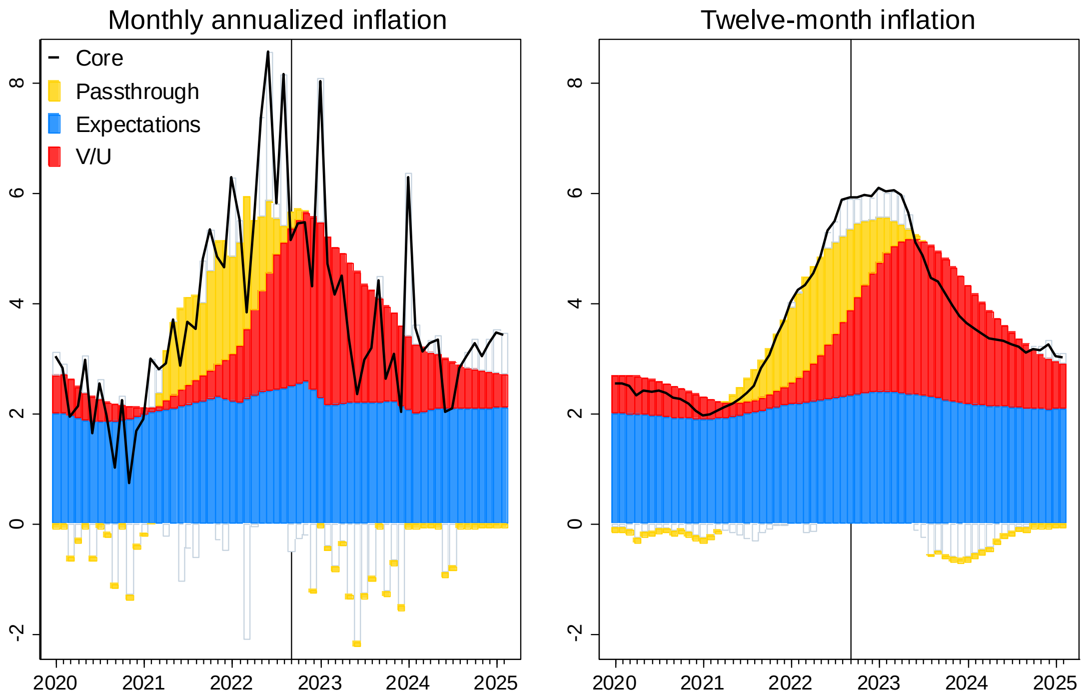
Sources: Haver analytics; Survey of Professional Forecasters; authors' calculations.
Note: Panel A reports fitted values for constant term and V/U terms from equation estimates reported in Table B1. Panel B reports fitted values for headline inflation shock (H) terms. Dotted lines indicate 95 percent confidence intervals. Inflation gap denotes monthly annualized median PCE inflation minus long-term inflation expectations.

Figure B3. Predictions for Median PCE Inflation Since the Pandemic: Comparison Across Sample Periods
(percent)



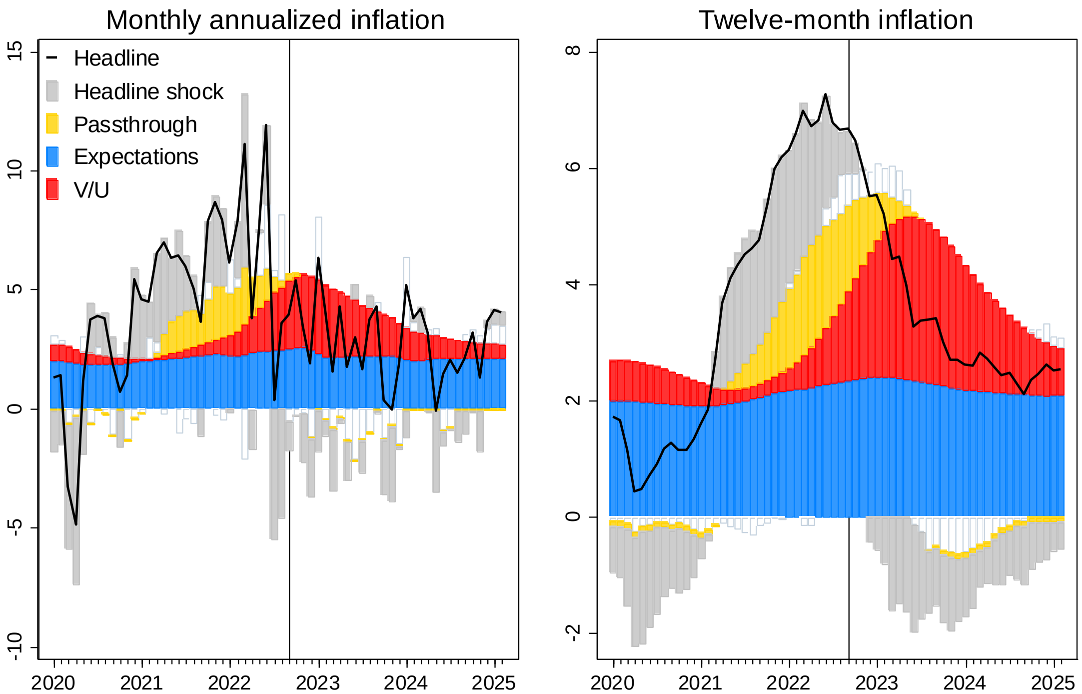
Source: Authors' calculations.
Note: Figure reports predicted values based on monthly equation estimated for January 1985 - September 2022 (Table B1, Column 1) and January 1985 – February 2025 (Table B1, Column 2).

Figure B4. Accounting for the Rise and Retreat of Core PCE Inflation
(percent)



Source: Authors' calculations.
Note: "Pass-through" denotes pass-through of headline shocks to core inflation. "Expectations" denotes contribution of long-term (SPF) inflation expectations to core inflation. "V/U" denotes contribution of ratio of vacancies to unemployed.

Figure B5. Accounting for the Rise and Retreat of Headline PCE Inflation
(percent)



Source: Authors' calculations.
Note: "Pass-through" denotes pass-through of headline shocks to core inflation. "Expectations" denotes contribution of long-term (SPF) inflation expectations to core (weighted median) inflation. "V/U" denotes contribution of ratio of vacancies to unemployed.

PUBLICATIONS

The Rise and Retreat of US Inflation: An Update

Working Paper No. WP/2025/094