Center *for* Inflation Research

FEDERAL RESERVE BANK *of* CLEVELAND

2023 Annual Report

The mission of the Center for Inflation Research is to improve the understanding of policymakers, researchers, and the public about inflation and the factors that influence its behavior. The Center is an initiative of the Federal Reserve Bank of Cleveland, www.clevelandfed.org.

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Center for Inflation Research Annual Report 2023. Edward S. Knotek II and Robert Rich. Federal Reserve Bank of Cleveland, May 2024.

Executive Summary

In 2023, the Center for Inflation Research realized another successful year of furthering its objectives and strengthening its reputation as a leading resource on inflation during a period of sustained public interest in inflation and monetary policy. The Center maintained its focus on generating insightful analysis on inflation issues, updating indicators and data related to inflation, producing quality research, promoting scholarly discourse, and contributing to a greater awareness and understanding of inflation. As one indication of the success of the Center's approach, the US Bureau of Labor Statistics (BLS) began producing a new index based on inflation-related research by Bank and BLS economists. As in previous years, the Center held its annual inflation conference, hosted events that invited the public into conversations about the fundamentals of inflation and the perspectives of inflation experts, and continued to engage its advisory council in meaningful dialog. The Center's inflation indicators were widely covered in the media and were followed extensively by the broader public, with the inflation nowcasting page's garnering significant attention. The Center was also active in discussing inflation developments and promoting its work through interviews with media outlets and presentations with external audiences. With inflation releases remaining an object of significant interest during the year, Center staff, in partnership with the communications and marketing staff of the Federal Reserve Bank of Cleveland, continued to build upon communications strategies to promote data releases via social media. The "Inflation 101" section of the Center's webpages was further enhanced to include three infographics and two additional stop-motion videos.

Key accomplishments in 2023 follow.

Research. Bank staff produced or revised 30 inflation-related articles and papers documenting research findings in the Bank's *Economic Commentary* and working paper series. Some of the topics covered included firms' price-setting practices and the extent of passthrough from costs to prices, the effect of social networks on inflation expectations, inflation dynamics in the post-pandemic era, the role of individual experience in the formation of inflation expectations, and the properties of and the properties of different rent inflation measures. The Center also assumed responsibility for the reporting of the Survey of Firms' Inflation Expectations (SoFIE) that provides quarterly updates of top business executives' outlooks for inflation.

Professional collaboration. Through several channels, the Center engages researchers in presenting and discussing their latest work. In collaboration with the European Central Bank, the Center organized and cosponsored the Bank's signature annual inflation conference titled Inflation: Drivers and Dynamics. Papers from the 2022 conference were published in a special issue of the prestigious *Journal of Monetary Economics* in November 2023. The BLS began producing the new-tenant rent index as a research series based on inflation-related research by Bank and BLS economists that shows that new-tenant rents tend to be a leading indicator for broader housing inflation as calculated by statistical agencies. The Center also organized sessions at three external academic conferences and hosted formal and informal visits by prominent researchers.

Programs. Center staff sponsored two events as part of the Bank's *Conversations on Central Banking* series that brings together individuals with varied backgrounds and views on current and prospective monetary policy issues.

Education. The Center's "Inflation 101" content was expanded to include new graphic elements and multimedia features. The most significant additions were three infographics and two stop-motion videos explaining the terms "hyperinflation" and "deflation" in accessible language.

Awareness. Media citations for the Center's inflation indicators, especially the inflation nowcasting model, picked up considerably in 2023, and outlets such as *USA Today*, *Wall Street Journal*, and Vox cited Center research and economists. Center staff worked with the Bank's communications, media relations, and marketing teams to increase the visibility of its work and make this work more accessible to a wider nonspecialist audience. The Center continues to distribute its quarterly newsletter to its growing subscriber base and has gained considerable traction through its use of social media to summarize developments in the Center's inflation indicators after their releases.

Center for Inflation Research 2023: Insights in a Year of Slowing Inflation

The work of the Center for Inflation Research in 2023 was shaped in part by the steady downward trend in inflation during the year. While inflation ended the year at a lower level than in the prior two years, it nevertheless remained above the Federal Open Market Committee's (FOMC's) 2 percent target. Also driving the work were questions about the nature of inflation that are at the center of active research.

Following the surge in inflation in spring 2021 and the persistent and elevated readings during 2022, the FOMC began to remove monetary policy accommodation in March 2022 and gradually raised the federal funds rate to a target range of 5.25 percent to 5.5 percent, where it has remained since July 2023. After peaking in June 2022, inflation—measured as the 12-month change in the personal consumption expenditures (PCE) price index—slowed from 7.1 percent to 2.6 percent at the end of 2023.

While inflation cooled in 2023, it was unclear if inflation would return to target in short order or would prove sticky at a level above target. Because of the critical importance of this question, the Center has focused considerable attention on the sustainability of the disinflation process. In one approach, Bank researchers analyzed inflation dynamics using a Phillips curve model featuring asymmetries and frequency components of the unemployment gap. Their analysis suggests that inflation will only very gradually return to 2 percent. Specifically, they find that neither a soft landing nor a moderate recession can move inflation down to its 2 percent target by the end of 2025. Instead, this outcome requires a "higher for longer" monetary policy that would produce a fairly deep recession.

There are, however, other models available to help inform the debate about the sustainability of the disinflation process. One approach that has gained recent popularity constructs forecasts of inflation using information on its underlying components such as goods inflation, services inflation excluding energy and housing, and housing services inflation. This modeling choice is motivated by the asynchronized movements of these components during the pandemic and its aftermath. Goods inflation led the inflation surge but has subsequently moderated, while the response of services inflation was initially muted but now remains elevated. Adopting this components-based framework, Cleveland Fed researchers find that their model's baseline projection puts core inflation at 2.6 percent in 2026. However, scenario analysis indicates that there is an

increased probability of core inflation's returning to 2 percent by 2026 if goods or nonhousing services inflation slows to prepandemic levels alongside slower wage growth.

Another area of particular interest is the measurement of rent inflation. Because rent is a key driver of CPI inflation, it has important implications for aggregate inflation dynamics. Using CPI microdata, Cleveland Fed researchers together with researchers from the US Bureau of Labor Statistics created the new-tenant repeat-rent index and the all-tenant repeat-rent index. They find that rent inflation for new tenants leads the official BLS rent inflation series by approximately one year. This result bears upon the previous discussion concerning the components-based approach to forecasting inflation. Specifically, the tenant rent indexes offer monetary policymakers an earlier read on changes in rental market conditions that they then can incorporate into their inflation outlook.

The Center continues to explore other issues related to the pandemic and its consequential effects on the economy. One issue is the reason for the marked increase in nominal wage growth during and after the pandemic and whether it reflected compensation for a higher cost of living because of the rise in inflation or instead was the outcome of an extremely tight labor market. The conclusion from Cleveland Fed staff is that the increase in wage growth largely reflected the passing through of higher inflation and not labor market imbalances. The high-inflation environment also raised questions about the extent to which firms were passing through changes in costs to their prices. Center staff along with researchers from the Federal Reserve Banks of Atlanta and New York developed and fielded a survey to Federal Reserve District business contacts to study their price-setting practices. Using multiple approaches, they estimated an average passthrough of 60 percent from costs into firms' prices.

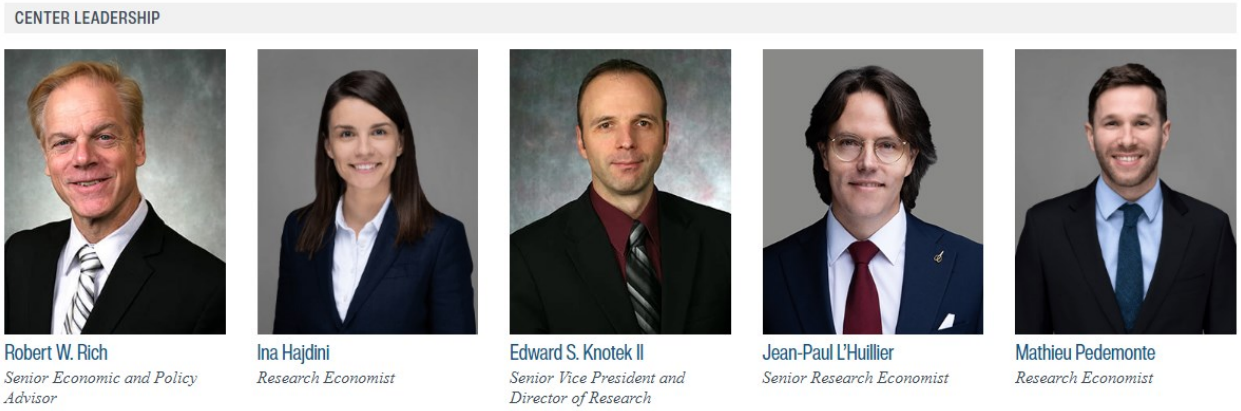
Inflation expectations remains an area of ongoing interest among researchers and policymakers. Expanding the scope of previous research, Center researchers examined the link between social networks and inflation expectations. Their findings indicate that inflation expectations in social networks are positively and statistically significantly associated with individual expectations, with a stronger relationship for groups that share common demographic characteristics. Researchers also worked to develop a new measure of inflation expectations anchoring that combines the deviation of a consensus forecast from an inflation target with forecaster disagreement. The measure indicates that longer-run inflation expectations in the United States remained well-anchored during the pandemic, while the anchoring of medium-run expectations weakened significantly during the pandemic before strengthening in early 2023.

In addition to the topics described previously, Bank staff published new research on a variety of other inflation topics, including the long-run costs of higher inflation, the impacts of supply chains and bank equity price declines on inflation, the predictive content of alternative measures of inflation expectations, the exploration of different techniques to improve the accuracy of inflation forecasts, and the effects of trend inflation and supply-versus-demand shocks on the Phillips curve. The inflation-related research presented at Center-sponsored academic forums in 2023 focused on the Phillips curve, the inflation effects of supply disruptions, the dynamics of inflation after COVID-19, price dispersion, and the formation of inflation expectations.

Looking ahead, the Center will continue to address both important questions that have emerged about inflation in the past year and others that remain unanswered. For example, it will be important to continue monitoring the disinflation process and the progress being made toward reaching the FOMC's

2 percent target. A critical part of this assessment will be an ongoing evaluation and improvement of models to predict inflation at short horizons (nowcasting) as well as longer horizons, and specifications that feature component disaggregation. Another question on which there is no consensus, despite its recognized importance, is how to improve monetary policy communications to affect consumers' inflation expectations. Guidance should rely on the effectiveness of different treatments from experimental designs that account for both the informedness and compliance of the survey respondents. While the Phillips curve remains a crucial building block used by central banks throughout the world to analyze and forecast inflation, debate continues about its slope and whether it has changed over time or displays nonlinearities. These topics and others remain areas for future research and will continue to be featured at Center-sponsored conferences.

Center Leadership



Robert Rich is the director of the Center, and the Center reports to Edward S. Knotek II, senior vice president and director of research. Other Center staff members are Ina Hajdini, Jean-Paul L'Huillier, and Mathieu Pedemonte.

In addition to these specialists in inflation, six experts from academia, central banking, and the private sector serve on the Center's advisory council and provide the Center with guidance and feedback.

The Center hosted its 2023 advisory council meetings on May 16 and November 13. Meeting conversations focused on current inflation-related issues and topics, the relevance of social networks for inflation expectations, the impact of increases in the funds rate on consumers' inflation expectations, and the inflation outlook. Conversations also featured a review of the Center's accomplishments and a presentation of selected research by Center staff.

Advisory Council Members, 2023

Oscar Arce
Director General Economics, European Central Bank

Olivier Coibion
Professor, University of Texas at Austin

Julia Coronado
President and Founder, MacroPolicy Perspectives
Clinical Associate Professor of Finance, University of Texas at Austin

Jon Faust
Senior Special Advisor to the Chair of the Federal Reserve

Ricardo Reis
A.W. Phillips Professor of Economics, London School of Economics and Political Science

Sharon Kozicki
Deputy Governor, Bank of Canada

Research

Outlined below is a selection of the inflation-related *Economic Commentaries*, working papers, and *Research [in] Brief* series that were produced in 2023 and long-term research projects maintained during the year.

Economic Commentaries

[A Real-Time Assessment of Inflation Nowcasting at the Cleveland Fed]
Edward S. Knotek II and Saeed Zaman

Using a model based on staff research, the Cleveland Fed's website provides daily nowcasts—or near-term predictions—of multiple US inflation measures for public use. In this Commentary, we compare the historical predictive accuracy of the model behind those inflation nowcasts with the accuracy of inflation nowcasts coming from competing sources: surveys of professional forecasters and alternative statistical models. We find that our inflation nowcasts have performed relatively well in these comparisons, both over a long sample and a short sample that focuses on the period since the start of the COVID-19 pandemic.

[Trend Inflation and Implications for the Phillips Curve]
Ina Hajdini

This *Economic Commentary* estimates trend PCE inflation and a Phillips curve with time-varying parameters while allowing for trend inflation to affect the frequency at which firms change prices. Since the beginning of 2021, trend PCE inflation has risen well above the FOMC's 2 percent long-term inflation target, and the most recent estimate of trend inflation in 2022:Q4 is 3.4 percent. With the increase in trend inflation, the Phillips curve slope has risen above its prepandemic level. At the same time, the relationship between current inflation and inflation expectations has strengthened. Together, these results imply that even though a slowing economy would help to bring down inflation through the steeper slope of the Phillips curve, high short-term inflation expectations could put upward pressure on inflation to a larger extent than they had prior to the pandemic.

[The Impacts of Supply Chain Disruptions on Inflation]
Matthew V. Gordon and Todd E. Clark

Since early 2021, inflation has consistently exceeded the Federal Reserve's target of 2 percent. Using a combination of data, economic theory, and narrative information around historical events, we empirically assess what has caused persistently elevated inflation. Our estimates suggest that both aggregate demand and supply factors, including supply chain disruptions, have contributed significantly to high inflation.

The Survey of Firms' Inflation Expectations

Christian Garciga, Edward S. Knotek II, Mathieu Pedemonte, and Taylor Shiroff

The inflation expectations of individuals who lead firms can influence the prices that their firms charge customers and hence can influence overall inflation. This Economic Commentary summarizes results from the Survey of Firms' Inflation Expectations (SoFIE), which asks top business executives for their inflation expectations once per quarter alongside a second question from a rotating set. We document that this group's inflation expectations increased with the run-up in inflation over 2021 and 2022 but then began to decline in early 2023. The Cleveland Fed will post estimates from the Survey of Firms' Inflation Expectations each quarter, available via clefed.org/SoFIE

The Anchoring of US Inflation Expectations Since 2012

Kristoph Naggert, Robert W. Rich, and Joseph Tracy

The stabilization, or anchoring, of inflation expectations at a target can help a central bank meet its goals. This paper develops a measure of expectations' anchoring that combines the deviation of a consensus forecast from an inflation target with forecaster disagreement. We apply the measure to survey-based forecasts of PCE price inflation at medium- and longer-run horizons. Following the FOMC's 2012 announcement of a 2 percent inflation target, the anchoring of both forecast series steadily improved through 2020:Q4. Recently, while longer-run expectations have remained well-anchored, the anchoring of medium-run expectations weakened significantly during the pandemic before strengthening in 2023:Q1.

Monetary Policy since the Onset of the COVID-19 Pandemic: A Path-Dependent Interpretation

Christopher Healy and Chengcheng Jia

Some argue that the Fed underreacted to rising inflation in 2021 after the US economy started to recover from the COVID-19 crisis. By using data from the Summary of Economic Projections (SEP), we surmise that the FOMC expected to keep the federal funds rate near zero by the end of 2021, but at the same time, the committee also expected to make the policy rate catch up to inflation over the next two years. We then argue that the Fed chose this gradual approach in response to the negative demand shock that pushed the policy rate to its effective zero lower bound. Economic literature on optimal monetary policy suggests that this policy approach is optimal in an event such as the COVID-19 crisis.

Postpandemic Nominal Wage Growth: Inflation Pass-through or Labor Market Imbalance?

Martin DeLuca and Willem Van Zandweghe

Measures of wage growth have increased substantially during and after the pandemic compared to their average levels in the decade before. Does higher wage growth reflect compensation for a higher cost of living, brought about by an increase in inflation in the past two years? Or has an imbalance between strong labor demand and restrained labor supply lifted wage growth? Using a new empirical wage Phillips curve model, we find that the increase in wage growth largely reflects the pass-through of higher inflation and does not reflect labor market imbalances. The model forecasts a decline in wage growth to about 3 percent annually by 2025.

The Long-Run Costs of Higher Inflation
Jean-Paul L'Huillier and Martin DeLuca

This *Economic Commentary* provides an overview of several frictions and the channels through which they affect economic welfare under elevated trend inflation above 2 percent. These frictions, associated with financial transactions, price and wage stickiness, and cognitive limitations, suggest that inflation imposes significant costs on society. Higher inflation may lead to a steeper Phillips curve, a situation which increases the volatility of inflation and interest rates.

Implications of Bank Equity Price Declines for Inflation
Ina Hajdini

This *Economic Commentary* examines the relationship between bank equity price index returns and inflation in advanced economies. While large declines in bank equity price indices are generally followed by declines in the ratio of bank credit to GDP, a measure of credit supply, and economic activity as measured by GDP, they have essentially no effect on inflation. These findings suggest that the collapse of several regional banks in early 2023 would not, on its own, put downward pressure on inflation.

Research [in] Brief

What Are Business Leaders' Inflation Expectations? Ask SoFIE

SoFIE provides quarterly readings on inflation expectations among top business executives in a nationally representative sample.

Supply Chain Disruptions and Inflation

Economists have pointed to multiple potential drivers of the recent high-inflation environment, and supply chain issues stand out among them.

Working Papers

The Transmission of International Monetary Policy Shocks on Firms' Expectations
Serafin Frache, Rodrigo Lluberas, Mathieu Pedemonte, and Javier Turen

Motivated by the dominant role of the US dollar, we explore how monetary policy (MP) shocks in the US can affect a small open economy through the expectation channel. We combine data from a panel survey of firms' expectations in Uruguay with granular information about firms' debt position and total imports on a monthly basis. We show that a contractionary MP shock in the US reduces firms' inflation and cost expectations in Uruguay. This result contrasts with the inflationary effect of this shock on the Uruguayan economy, suggesting uncertainty about the policy regime. We discuss the issues and challenges of this expectation channel.

House Prices and Rents in the 21st Century
Lara Loewenstein and Paul Willen

We study the joint evolution of prices and rents of residential property. We construct indices for both rents and prices of renter-occupied properties and for prices of owner-occupied properties. We then decompose the change in the price of occupant-owned property into three components: (1) changes in rent, (2) changes in the relative prices of investor- and occupant-owned properties, and (3)

changes in the price-rent ratio. We use a simple model to link our decomposition to different sources of variation in house prices. We argue that while the 2000s boom was plausibly driven by exuberant expectations, the boom of the 2020s more likely resulted from a preference shock.

The Hard Road to a Soft Landing: Evidence from a (Modestly) Nonlinear Structural Model
Randal J. Verbrugge and Saeed Zaman

What drove inflation so high in 2022? Can it drop rapidly without a recession? The Phillips curve is central to the answers; its proper (nonlinear) specification reveals that the relationship is strong and frequency dependent, and inflation is very persistent. We embed this empirically successful Phillips curve—incorporating a supply-shocks variable—into a structural model. Identification is achieved using an underutilized data-dependent method. Despite imposing anchored inflation expectations and a rapid relaxation of supply-chain problems, we find that absent a recession, inflation will be more than 3 percent by the end of 2025. A simple welfare analysis supports a mild recession as preferred to an extended period of elevated inflation, under a typical loss function.

Aggregate Implications of Heterogeneous Inflation Expectations: The Role of Individual Experience
Mathieu Pedemonte, Hiroshi Toma, and Esteban Verdugo

We show that inflation expectations are heterogeneous and depend on past individual experiences. We propose a diagnostic expectations-augmented Kalman filter to represent consumers' heterogeneous inflation expectations-formation process, where heterogeneity comes from an anchoring-to-the-past mechanism. We estimate the diagnosticity parameter that governs the inflation expectations-formation process and show that the model can replicate systematic differences in inflation expectations across cohorts in the US. We introduce this mechanism into a New Keynesian model and find that heterogeneous expectations anchor aggregate responses to the agents' memory, making shocks more persistent. Central banks should be more active to prevent agents from remembering current shocks far into the future.

The Intermittent Phillips Curve: Finding a Stable (But Persistence-Dependent) Phillips Curve Model Specification
Richard Ashley and Randal J. Verbrugge

We establish that the Phillips curve is persistence-dependent: inflation responds differently to persistent versus moderately persistent (or versus transient) fluctuations in the unemployment rate gap. This persistence-dependent relationship appears to align with business-cycle stages and is thus consistent with existing theory. Previous work fails to model this dependence, thereby finding numerous "inflation puzzles" – e.g., missing inflation/disinflation – noted in the literature. Our specification eliminates these puzzles; for example, the Phillips curve has not weakened, nor was inflation "stubbornly low" in 2019. The model's coefficients are stable, and it provides accurate conditional recursive forecasts through the Great Recession. There are important monetary policy implications.

Mis-specified Forecasts and Myopia in an Estimated New Keynesian Model
Ina Hajdini

The paper considers a New Keynesian framework in which agents form expectations based on a combination of autoregressive mis-specified forecasts and myopia. The proposed expectations formation process is shown to be consistent with all three empirical facts on consensus inflation forecasts. However, while mis-specified forecasts can be both sufficient and necessary to match all three facts, myopia alone is neither. The paper then derives the general equilibrium solution consistent with the proposed expectations formation process and estimates the model with likelihood-based Bayesian methods, yielding three novel results: (i) macroeconomic data strongly prefer a combination of autoregressive mis-specified forecasting rules - of the VAR(1) or AR(1) type - and myopia over other alternatives; (ii) no strong evidence is found in favor of VAR(1) forecasts over simple AR(1) rules; and (iii) frictions such as habit in consumption, which are typically necessary for models with full-information rational expectations, are significantly less important, because the proposed expectations generate substantial internal persistence and amplification to exogenous shocks. Simulated inflation expectations data from the estimated general equilibrium model reflect the three empirical facts on forecasting data.

Low Passthrough from Inflation Expectations to Income Growth Expectations: Why People Dislike Inflation
Ina Hajdini, Edward S. Knotek II, John Leer, Mathieu Pedemonte, Robert W. Rich, and Raphael S. Schoenle

We implement a novel methodology to disentangle two-way causality in inflation and income expectations in a large, nationally representative survey of US consumers. We find a 20 percent passthrough from expected inflation to expected income growth, but no statistically significant effect in the other direction. Passthrough is higher for higher-income individuals and men. Higher inflation expectations increase consumers' likelihood to search for higher-paying new jobs. In a calibrated search-and-matching model, dampened responses of wages to demand and supply shocks translate into greater output fluctuations. The survey results and model analysis provide a labor market channel for why people dislike inflation.

Post-COVID Inflation Dynamics: Higher for Longer
Randal J. Verbrugge and Saeed Zaman

We implement a novel nonlinear structural model featuring an empirically-successful frequency-dependent and asymmetric Phillips curve; unemployment frequency components interact with three components of core PCE—core goods, housing, and core services ex-housing—and a variable capturing supply shocks. Forecast tests verify the model's accuracy in its unemployment-inflation tradeoffs, crucial for monetary policy. Using this model, we assess the plausibility of the December 2022 Summary of Economic Projections (SEP). By 2025:Q4, the SEP projects 2.1 percent inflation; however, conditional on the SEP unemployment path, we project inflation of 2.9 percent. A fairly deep recession delivers the SEP inflation path, but a simple welfare analysis rejects this outcome.

Estimates of Cost-Price Passthrough from Business Survey Data
Keshav Dogra, Sebastian Heise, Edward S. Knotek II, Brent Meyer, Robert W. Rich, Raphael S. Schoenle, Giorgio Topa, Wilbert van der Klaauw, and Wändi Bruine de Bruin

We examine businesses' price-setting practices via open-ended interviews and in a quantitative survey module with business contacts from the Federal Reserve Banks of Atlanta, Cleveland, and New York in December 2022 and January 2023. Businesses indicated that their prices were strongly influenced by demand, a desire to maintain steady profit margins, and wages and labor costs. Survey respondents expected reduced growth in costs and prices of about 5 percent on average over the next year. Backward-looking, forward-looking, and hypothetical scenarios reveal average cost-price passthrough of around 60 percent, with meaningful heterogeneity across firms.

Sticky Wages on the Layoff Margin
Steven J. Davis and Pawel M. Krolikowski

We design and field an innovative survey of unemployment insurance (UI) recipients that yields new insights about wage stickiness on the layoff margin. Most UI recipients express a willingness to accept wage cuts of 5 percent to 10 percent to save their jobs, and one-third would accept a 25 percent cut. Yet worker–employer discussions about cuts in pay, benefits, or hours in lieu of layoffs are exceedingly rare. When asked why employers don't raise the possibility of job-preserving pay cuts, four-in-10 UI recipients don't know. Sixteen percent say cuts would undermine morale or lead the best workers to quit, and 39 percent don't think wage cuts would save their jobs. For those who lost union jobs, 45 percent say contractual restrictions prevent wage cuts. Among those on permanent layoff who reject our hypothetical pay cuts, half say they have better outside options, and 38 percent regard the proposed pay cut as insulting. Our results suggest that wage cuts acceptable to both worker and employer could potentially prevent a quarter of the layoffs in our sample. We draw on our findings and other evidence to assess theories of wage stickiness and its role in layoffs.

Improving Inflation Forecasts Using Robust Measures
Randal J. Verbrugge and Saeed Zaman

Theory and extant empirical evidence suggest that the cross-sectional asymmetry across disaggregated price indexes might be useful in forecasting aggregate inflation. Trimmed-mean inflation estimators have been shown to be useful devices for forecasting headline PCE inflation. But is this because they signal the underlying trend or because they implicitly signal asymmetry in the underlying distribution? We address this question by augmenting a "hard" to beat benchmark headline PCE inflation forecasting model with robust trimmed-mean inflation measures and robust measures of the cross-sectional skewness, both computed using the 180+ components of the PCE price index. Our results indicate significant gains in the point and density accuracy of PCE inflation forecasts over medium- and longer-term horizons, up through and including the COVID-19 pandemic. Improvements in accuracy stem mainly from the trend information implicit in trimmed-mean estimators, but skewness information is also useful. An examination of goods and services PCE inflation provides similar inference.

The FOMC versus the Staff: Do Policymakers Add Value in Their Tales?
Ilias Filippou, James Mitchell, and My T. Nguyen

Using close to 40 years of textual data from FOMC transcripts and the Federal Reserve staff's Greenbook/Tealbook, we extend Romer and Romer (2008) to test if the FOMC adds information relative to its staff forecasts not via its own quantitative forecasts but via its words. We use methods from natural language processing to extract from both types of document text-based forecasts that capture attentiveness to and sentiment about the macroeconomy. We test whether these text-based forecasts provide value-added in explaining the distribution of outcomes for GDP growth, the unemployment rate, and inflation. We find that FOMC tales about macroeconomic risks do add value in the tails, especially for GDP growth and the unemployment rate. For inflation, we find value-added in both FOMC point forecasts and narrative, once we extract from the text a broader set of measures of macroeconomic sentiment and risk attentiveness.

The Expectations of Others
Ezequiel Garcia-Lembergman, Ina Hajdini, John Leer, Mathieu Pedemonte, and Raphael S. Schoenle

Based on a framework of memory and recall that accounts for social networks, we provide conditions under which social networks can amplify expectations. We provide evidence for several predictions of the model using a novel dataset on inflation expectations and social network connections: Inflation expectations in the social network are statistically significantly, positively associated with individual inflation expectations; the relationship is stronger for groups that share common demographic characteristics, such as gender, income, or political affiliation. An instrumental variable approach further establishes causality of these results while also showing that salient information transmits strongly through the network. Our estimates imply that the influence of the social network overall amplifies but does not destabilize inflation expectations.

Disentangling Rent Index Differences: Data, Methods, and Scope
Brian Adams, Lara Lowenstein, Hugh Montag, and Randal J. Verbrugge

Rent measurement determines 32 percent of the CPI. Accurate rent measurement is therefore essential for accurate inflation measurement, but the CPI rent index often differs from alternative measures of rent inflation. Using repeat-rent inflation measures created from CPI microdata, we show that this discrepancy is largely explained by differences in rent growth for new tenants relative to all tenants. New-tenant rent inflation provides information about future all-tenant rent inflation, but the use of new-tenant rents is contraindicated in a cost-of-living index such as the CPI. Nevertheless, policymakers should integrate new-tenant inflation into inflation forecasts and monetary policy decisions.

Late Payment Fees and Nonpayment in Rental Markets, and Implications for Inflation Measurement: Theoretical Considerations and Evidence
Wesley Janson and Randal J. Verbrugge

Accurate rent measurement is essential for constructing a consumer price index (CPI) and for measuring household welfare. Late payment fees and nonpayment of rent are common components of rental expenditures and thus belong in CPIs. Late payment fees are often excluded; we offer a novel critique. In the US CPI, nonpayment is ostensibly included, but,

we show, severely undermeasured. Moreover, the manner of its inclusion renders the CPI extremely sensitive to nonpayment variations; we show how to fix this. Nonpayment undermeasurement suggests at least a 1 percentage point overestimate in 2020 CPI shelter inflation. Timely nonpayment and late fee measurement is challenging; we offer a practical solution.

Federal Reserve Structure and the Production of Monetary Policy Ideas
Michael D. Bordo and Edward S. Prescott

We evaluate the decentralized structure of the Federal Reserve System as a mechanism for generating and processing new ideas on monetary policy over the 1960–2000 period. We document the introduction of monetarism, rational expectations, credibility, transparency, and other monetary policy ideas by Reserve Banks into the Federal Reserve System. We argue that the Reserve Banks were willing to support and develop new ideas due to internal reforms to the FOMC that Chairman William McChesney Martin implemented in the 1950s and the increased ties with academia that developed in this period. Furthermore, the Reserve Banks were able to succeed at this because of their private-public governance structure. We illustrate this with a time-consistency model in which a decentralized organization is better at producing new ideas than a centralized one. We argue that this role of the Reserve Banks is an important benefit of the Federal Reserve's decentralized structure by allowing for more competition in formulating ideas and by reducing groupthink.

The Distributional Predictive Content of Measures of Inflation Expectations
James Mitchell and Saeed Zaman

This paper examines the predictive relationship between the distribution of realized inflation in the US and measures of inflation expectations from households, firms, financial markets, and professional forecasters. To allow for nonlinearities in the predictive relationship we use quantile regression methods. We find that the ability of households to predict future inflation, relative to that of professionals, firms, and the market, increases with inflation. While professional forecasters are more accurate in the middle of the inflation density, households' expectations are more useful in the upper tail. The predictive ability of measures of inflation expectations is greatest when combined. We show that it is helpful to let the combination weights on different agents' expectations of inflation vary by quantile when assessing inflationary pressures probabilistically.

Forecasting Core Inflation and Its Goods, Housing, and Supercore Components
Todd E. Clark, Matthew V. Gordon, and Saeed Zaman

This paper examines the forecasting efficacy and implications of the recently popular breakdown of core inflation into three components: goods excluding food and energy, services excluding energy and housing, and housing. A comprehensive historical evaluation of the accuracy of point and density forecasts from a range of models and approaches shows that a BVAR with stochastic volatility in aggregate core inflation, its three components, and wage growth is an effective tool for forecasting inflation's components as well as aggregate core inflation. Looking ahead, the model's baseline projection puts core inflation at 2.6 percent in 2026, well below its 2023

level but still elevated relative to the Federal Reserve's 2 percent objective. The probability that core inflation will return to 2 percent or less is much higher when conditioning on goods or non-housing services inflation slowing to pre-pandemic levels than when conditioning on these components remaining above the same thresholds. Scenario analysis indicates that slower wage growth will likely be associated with reduced inflation in all three components, especially goods and non-housing services, helping to return core inflation to near the 2 percent target by 2026.

Can Supply Shocks Be Inflationary with a Flat Philipps Curve?
Jean-Paul L'Huillier and Gregory Phelan

Not in standard models. With conventional pricing frictions, imposing a flat Phillips curve also imposes a price level that is rigid with respect to supply shocks. In the New Keynesian model, price markup shocks need to be several orders of magnitude bigger than other shocks in order to fit the data, leading to unreasonable assessments of the magnitude of the increase in costs during inflationary episodes. To account for the facts, we propose a strategic microfoundation of shock-dependent price stickiness: prices are sticky with respect to demand shocks but flexible with respect to supply shocks. This friction is demand-intrinsic, in line with narrative accounts for the imperfect adjustment of prices. Firms can credibly justify a price increase due to a rise in costs, whereas it is harder to do so when demand increases. Inflation from supply shocks is efficient and does not justify a monetary policy response.

Long-term Research Projects

Consumers and COVID-19. The Center stopped updating the Consumers and COVID-19 data on its website, but survey efforts to capture consumers' attitudes and expectations for many inflation-specific questions continue.

Inflation Expectations. The Center continued its work with the survey company Morning Consult to record consumers' inflation expectations in the US weekly and in 14 international countries monthly. Updates are made publicly available on the Central Bank Research Association (CEBRA) website.

Firms' Price-Setting Behaviors. Researchers from the Center, together with researchers at the Federal Reserve Banks of Atlanta and New York, created a survey questionnaire that was used to interview company representatives about their price-setting behavior. This project is being undertaken as part of a long-term effort to better understand and document firms' pricing practices. The project resulted in publication of the working paper "Estimates of Cost-Price Passthrough from Business Survey Data" by Keshav Dogra, Sebatian Heise, Edward S. Knotek II, Brent Meyer, Robert W. Rich, Raphael S. Schoenle, Giorgio Topa, Wilbert van der Klaauw, and Wändi Bruine de Bruin.

Firms' Inflation Expectations. The Center has assumed responsibility for fielding the Survey of Firms' Inflation Expectations (SoFIE) from Professor Olivier Coibion and Professor Yuriy Gorodnichenko and began posting the survey on a dedicated webpage in May 2023. The launch of the webpage was accompanied by publications of the *Research in Brief* "What Are Business Leaders' Inflation Expectations? Ask SoFie" and the *Economic Commentary* "The Survey of Firms' Inflation Expectations" by Christian Garciga, Edward S. Knotek II, Mathieu Pedemonte, and Taylor Shiroff.

Professional Collaboration

The Center sponsored the following events and invited the following scholars to visit and present their latest work and meet with Cleveland Fed research staff.

Events

Inflation: Drivers and Dynamics Conference 2023.
The Center hosted its eighth installment of the Bank's signature inflation conference, the fifth since the Center made it an annual event. It brought together top researchers from academia, central banks, and other policy institutions to present research findings related to inflation. The 2023 conference was cosponsored by the Center and the European Central Bank, and it was held in person in Frankfurt, Germany, with virtual attendance available for nonspeakers on August 31–September 1. The program and videos of the sessions were posted to the Center's conference website.

Central Bank Research Association 2023.
The Center organized a presentation session on inflation during the 2023 meeting of the Central Bank Research Association (CEBRA), held in New York City on July 5–7. Videos for papers presented were posted to the conference website.

43rd International Symposium on Forecasting.
The Center organized a presentation session at the 43rd International Symposium on Forecasting held in Charlottesville, Virginia, on July 25–28.

Computational and Financial Econometrics 2023.
The Center organized two sessions at the 17th International Conference on Computational and Financial Econometrics (CFE), which was hosted by Hochschule für Technik und Wirtschaft Berlin (HTW Berlin), Wilhelminenhof, Berlin, Germany, on December 16–18. One session was focused on inflation and the other session on applied econometrics**.**

Presentations

Center staff and Bank research economists made presentations at conferences and invited seminars.

Paola Boel

- "Liquidity, Capital Pledgeability and Inflation Redistribution," presented at seminar at Purdue University.

Ina Hajdini

- "Low Passthrough from Inflation Expectations to Income Growth Expectations: Why People Dislike Inflation," presented at the CFM-Warwick-Vienna Global Macro Conference, CEBRA webinar, CEBRA Annual Meeting, Kansas City Reserve Bank WISER conference, T2M, and the Bank of England.

Edward S. Knotek II

- "Estimates of Cost-Price Passthrough from Business Survey Data," presented at ECB/Cleveland Reserve Bank Inflation: Drivers and Dynamics 2023.

James Mitchell

- "Practice Makes Perfect: Learning Effects with Survey-Based Point and Density Forecasts of Inflation," presented at ISF 2023.

Mathieu Pedemonte

- "The Expectations of Others," presented at LMU Munich, Jornadas Anuales de Economia BCU, Workshop Challenges for Monetary Policy in Times of High Inflation, Fourth Joint BoC–ECB–FRBNY Conference on Expectations Surveys, NBB Workshop on Macroeconomics and Survey Data.
- "Transmission of International Monetary Policy Shocks on Firms' Expectations," presented at Inflation Expectations: Determinants and Consequences Conference.

Willem Van Zandweghe

- "Labor Supply Shocks, Labor Force Entry, and Monetary Policy," presented at AEA meeting.

Randal J. Verbrugge

- "Disentangling Rent Index Differences: Data, Methods and Scope," presented at National Association of Business Economists webinar.
- "The Intermittent Phillips Curve" and "Post-COVID Inflation Dynamics: Higher for Longer," presented at Midwest Econometrics Group

Saeed Zaman

- "Post-COVID Inflation Dynamics: Higher for Longer," presented at Swiss National Bank Annual Research Conference 2023.
- "The Distributional Predictive Content of Measures of Inflation Expectations," presented at Midwest Econometrics Group conference hosted by the Cleveland Reserve Bank.

Visitors

Laurence Ball
Professor, Johns Hopkins University

Mark Bils
Hazel Fyfe Professor of Economics, University of Rochester

Jenny Chan
Bank of England

Yoosoon Chang
Professor, Indiana University

Sarah Lein
Associate Professor, University of Basel

Yueran Ma
Associate Professor and Kathryn and Grant Swick Faculty Scholar, University of Chicago Booth School of Business

Carolin Pflueger
Associate Professor, University of Chicago Harris School of Public Policy

Michael Weber
Associate Professor, University of Chicago Booth School of Business

Education

The Center implemented further enhancements to its "Inflation 101" section to ensure the content is broadly accessible to the widest possible audience.

Inflation videos. Center staff worked with a cross-functional team to develop two brief stop-motion videos explaining the terms "hyperinflation" and "deflation."

Infographics. The Center worked with a cross-functional team to develop infographics on three important inflation related topics.
Why is what people expect inflation to do so important?
How does raising interest rates help to lower inflation?
Infographic on inflation: food and energy prices

Programs

Cleveland Fed Conversations on Central Banking. The Center continued to sponsor the Bank's *Conversations on Central Banking* series, which provides a forum to convene experts on topics important to central bankers. The first event was moderated by Nancy Marshall-Genzer and the second event was moderated by Rachel Siegel, followed by three distinguished panelists who provided short presentations.

Each event concluded with general discussion and a Q&A session. The Center hosted sessions on May 24 (Why is the Fed's Inflation Target 2%?) and November 17 (The Unequal Burden of Inflation).

FedTalk. The Bank's *FedTalk* series creates opportunities for Bank experts to interact with industry experts, local businesses, community organizations, policymakers, and engaged citizens to discuss various issues. On January 10, Bruce Fallick delivered a presentation on the economic outlook for 2023 focused on the current monetary policy landscape, the latest inflation data, the labor market and the prospects for labor force growth in 2023.

On February 13, Edward S. Knotek II, Robert W. Rich, and two economists from the St. Louis and Atlanta Reserve Banks were panelists on the FedTalk program titled Lowering Inflation: The Who, What, and How, which focused on inflation measures, the Federal Reserve's tools for controlling inflation, and how expectations about inflation impact its actual trajectory, among other topics.

Media Citations

Inflation-focused research, indicators and data were widely cited in 2023, as were Bank economists. A list of the most significant citations follows.

Apricitas

- The Most Important New Inflation Indicator – Economics blog by Joseph Politano and viral tweet described the new-tenant rent index as "the Most Important New Inflation Indicator." Led to Politano interview about the index on National Public Radio's *Marketplace*.

Bloomberg

- Cleveland Fed Finds Its Inflation Forecast Outperforms Others – Summarizes *Economic Commentary* describing accuracy of the inflation nowcasting model.

Cleveland.com

- Why has inflation dropped to a 2-year low? Cleveland Fed researcher explains – Robert Rich talks about why inflation went up and came back down.

MNI

- MNI INTERVIEW: US Inflation Could Take Many Years to Reach 2% – Randal Verbrugge and Saeed Zaman were interviewed for an article and podcast based on their working paper on post-COVID-19 inflation dynamics.
- Expectations "Source Of Concern" — Fed's Knotek – Ed Knotek discusses inflation expectations and other inflation trends and mentions the Bank's surveys and research.
- MNI INTERVIEW: Fed's Rich Says Inflation Set to Keep Falling – Robert Rich talks about inflation trends and discusses how a new Cleveland Fed measure showed declining inflation expectations.

New York Times

- Opinion | Wonking Out: Inflation and the Imputation Game – Paul Krugman column cites new-tenant rent index, with link.

Reuters

- June Inflation Data May Have Pushed Fed over the Mountaintop – "A study released this week from the Cleveland Fed's Center for Inflation Research found the long-term inflation outlook was 'anchored near the Federal Reserve's 2% target,' a finding generally shared by Fed policymakers who consider any move higher in public inflation expectations a warning that inflation itself may accelerate."

Scripps Websites

- Housing Market Guidance – National Scripps story about the housing market said CfIR "has a good breakdown" of the many causes for inflation, with link. Ran on more than 18 regional websites.

USA Today

- The Hidden Price Of Inflation: High Costs Disrupt Life In More Ways than We Can See – Summarizes main points of the "Long Run Costs of Higher Inflation" *Economic Commentary*.

Vox

- The Problem Isn't Inflation. It's Prices. – **Robert Rich** is cited three times in this article about the difference between inflation and high-yet-stable prices. Story links to working paper "Low Passthrough from Inflation Expectations to Income Growth Expectations: Why People Dislike Inflation." CfIR is named.

Wall Street Journal

- Inflation Expectations Return to Fed's 2% Target, Cleveland Fed Research Finds – **Robert Rich** was interviewed for this article summarizing an *Economic Commentary* on inflation anchoring.
- Higher Wages Weren't the Driving Force for Inflation, Cleveland Fed Researchers Say – **Willem Van Zandweghe** was interviewed for this article that cites and links to an *Economic Commentary* on post-pandemic wage growth.

Citation Information

- The Center garnered 324 media citations in 2023, including from prominent outlets not listed above, including CNBC, CNN, Fox Business, CBS News, *Forbes*, and *The Economist*. Roughly half of the Center's 2023 citations were references to the inflation nowcasting indicator, by far the most popular web page on the Cleveland Reserve Bank's external website, clevelandfed.org.

Other Activities and Coverage

Annual Report. The Center produced an annual report for 2022 that summarized its activities for the year.

CfIR Newsletter. The Center published four installments of its quarterly newsletter, which provides summaries of and links to recent research papers, details of upcoming events, and news of Center developments such as the development of inflation infographics, participation in *FedTalk* sessions and Conversations on Central Banking, and interviews with national media.

Communications. Center staff produced communications for the public through data releases, social media posts and promotion campaigns, an annual report, and the Center's quarterly newsletter.

Data Releases. Center staff released data updates for five inflation indicators throughout the year: the median consumer price index (CPI), median personal consumption expenditures (PCE) inflation, inflation expectations, inflation nowcasting, and Survey of Firms' Inflation Expectations (SoFIE).

Marketing Plan. Center staff worked with the Bank's communications and marketing teams to develop a plan for achieving greater visibility for the Center and a wider audience for its research and data products. As part of this initiative, the Center published two new stop-motion videos explaining hyperinflation and deflation.

Social Media Promotion Campaigns. Center staff engaged with the communications and marketing teams and continued sending out tweets and other social media posts coinciding with monthly updates of inflation-related content on the Bank's website that included CPI and PCE inflation data releases.

Website Metrics. Website traffic for inflation-related products continued to be high in 2023 as inflationary pressures remained persistently elevated. The inflation nowcasting page was extremely popular, views of which comprised more than one-third of all views of clevelandfed.org pages. Other pages that received considerable attention included working papers, *Economic Commentary* articles, and the median CPI and inflation expectations pages.

Future Plans

Looking ahead to 2024, the Center plans to continue to build on its recent successes by contributing to policy conversations about inflation, conducting research on inflation and its determinants, organizing conferences, developing new data products, and providing new resources on the website to inform the public about inflation.