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Navigating Inflation Waves: A Phillips Curve Perspective

Remarks by

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Thank you, Tom, and thank you for the invitation to give the Whittington Lecture.[1] It is humbling to be here giving this lecture to honor the memory and legacy of Leslie Whittington. While I did not cross paths with Leslie here at Georgetown University, when I arrived, I heard so many stories about her contributions to the school, the university, and the students. She worked on research about the effects of economic policies on children and families, so I know that if I had had the good fortune to overlap with her as a colleague, I would have benefited greatly from her work and presence. It is also an honor to be giving this lecture, because so many dynamic leaders have previously stood before you, including some who have been inspirations to me in my career, such as Alice Rivlin and Cecilia Rouse.

Today I will be discussing a topic that has certainly captured the attention of central bankers, and the public at large, in recent years: inflation and the relationship between inflation and unemployment. But before I talk about a lens through which to think about the inflation experienced in the pandemic period, I want to update you with my views on the current outlook for the U.S. economy and the Federal Open Market Committee's (FOMC) efforts to sustainably return inflation to our 2 percent objective while maintaining a strong labor market.

Economic Outlook

The overall picture is that the U.S. economy remains on a firm footing, with output growing at a solid pace. Real gross domestic product grew 2.5 percent in 2024. Consumer spending continued to drive this solid pace last year. While retail sales posted a decline last month, January data are often difficult to interpret. Bad weather and

[1] The views expressed here are my own and are not necessarily those of my colleagues on the Federal Reserve Board or the Federal Open Market Committee.

seasonal adjustment difficulties may have affected the release, and it should be noted the slowdown came after a strong pace of sales in the second half of last year. That said, as usual, I pay attention to many indicators to gauge the state of the economy. Employment readings show that the labor market is healthy and stable. Payroll job gains have been solid recently, averaging 189,000 per month over the past four months, according to the Bureau of Labor Statistics (BLS). After touching 4.2 percent as recently as November, the unemployment rate has flattened to 4 percent since then, consistent with a labor market that is neither weakening nor showing signs of overheating.

Inflation has fallen significantly since its peak in the middle of 2022, though the path continues to be bumpy and inflation remains somewhat elevated. Readings last week from the BLS showed price pressures persisted in the economy in January. Our preferred inflation gauge at the Fed, the personal consumption expenditures (PCE) price index, will be released next week. Based on the consumer price index and producer price index data for January, it is estimated that the PCE index advanced about 2.4 percent on a 12-month basis in January. Excluding food and energy costs, core prices are estimated to have risen 2.6 percent. Those readings show there is still some way to go before achieving the FOMC's 2 percent objective.

Regarding monetary policy, the FOMC judged in September that it was time to begin reducing our policy interest rate from levels that were strongly restrictive on aggregate demand and putting downward pressure on inflation. We reduced that rate 100 basis points through December, leaving our policy rate at moderately restrictive levels. At our latest meeting in January, I supported the decision to hold the policy rate steady. I see this as appropriate, given that the downward risks to employment have

diminished but upside risks to inflation remain. The potential net effect of new economic policies also remains highly uncertain and will depend on the breadth, duration, reactions to, and, importantly, specifics of the measures adopted.

Going forward, in considering the appropriate federal funds rate, we will watch these developments closely and continue to carefully assess the incoming data and evolving outlook.

Now, turning back to the main topic of my speech, I will start with the core mission of the Federal Reserve: to pursue the dual mandate, given to us by Congress, of promoting maximum employment and stable prices. We saw firsthand during the pandemic period why the price-stability portion of the mandate is so important. High inflation imposes significant hardship and erodes Americans' purchasing power, especially for those least able to meet the higher costs of essentials like food, housing, and transportation. As a policymaker and economist, I think it is vitally important to have a good understanding of inflation dynamics and how those dynamics may have evolved over time. This knowledge allows me to pursue the best policies to deliver stable prices while maintaining a solid labor market.

Waves of Inflation

Five years after the pandemic took hold suddenly and with little warning, there is a tendency to remember the inflation buildup as a fast and uniform phenomenon. But that was not the case. Inflation stemming from the pandemic shock came in waves. Today I will first describe the different waves of inflation experienced in the pandemic period. Then I invite you aboard the sailboat that we will use to navigate those waves: You could call it the SS *Phillips Curve*. The Phillips curve is a model that has been used

for a long time to try to explain inflation dynamics and the tradeoffs between inflation and unemployment. Finally, I will discuss with you how this voyage may have changed the charts for policymakers.

Before the COVID-19 pandemic, the U.S., and much of the world's developed economies, experienced a prolonged period of low inflation. Then, when the economy broadly shut down in March and April 2020, the U.S. experienced a brief period of deflation. But by the middle of that year, we saw that the first of several waves of inflation began hitting the economy's shores.

The first notable wave of inflation came from food prices. With many restaurants closed and people fearful of gathering, consumers pivoted their spending to grocery stores and online grocery delivery to meet their families' needs, with some stockpiling essential items because they feared future shortages. This jump in demand was met with snarled supply chains for food processing and groceries. Annual food inflation reached a first peak of 5 percent in June 2020. There was a second food inflation wave with the onset of the Russian invasion of Ukraine in the middle of 2022. Beyond the cost alone, grocery prices are an important determinant of inflation expectations for consumers since food is purchased so frequently.[2] Another wave of inflation came from goods other than food and energy—what economists call "core goods." In the years immediately before the pandemic, goods prices were not a significant source of inflation. During the expansion from 2009 until 2020, core goods inflation declined 0.5 percent annually on average. However, once the pandemic took hold, consumer demand rotated from

[2] D'Acunto, Malmendier, Ospina, and Weber (2021) show that consumers disproportionately rely on the price changes of goods in their grocery bundles when forming expectations about aggregate inflation; see Francesco D'Acunto, Ulrike Malmendier, Juan Ospina, and Michael Weber (2021), "Exposure to Grocery Prices and Inflation Expectations," *Journal of Political Economy*, vol. 129 (May), pp. 1615–39.

services to goods. At the same time, additional supply chain issues arose, including closed factories and disrupted ports. As consumption rapidly shifted toward goods, their prices rose sharply.[3] Core goods inflation picked up markedly in the spring of 2021 and reached a peak of 7.6 percent on a 12-month basis in February 2022. This was a notable development because, during most of this century, goods price deflation offset price increases in other categories and thus kept a lid on overall inflation.

A third wave of inflation came from services costs, excluding housing. Near the start of the pandemic, millions of Americans lost their jobs, and many left the labor market, with some retiring and others fearful of being exposed to the virus. When the economy began to reopen from shutdowns, demand for workers rose faster than the supply. As a result, the labor market quickly became very tight. To attract workers, employers raised wages. And to offset that expense, many raised prices. Given that labor is the most important input into the production of services, core services inflation ensued, reaching a peak of 5.2 percent on a 12-month basis in December 2021. Core services inflation stayed persistently high until it began to turn down in February 2023.

The final wave of inflation I will discuss came from PCE housing services inflation. During the pandemic, many Americans reassessed housing choices, including those who preferred to move to detached homes in the suburbs from multifamily dwellings in cities. The supply of housing has long been constrained, so when a further increase in demand met limited supply, prices rose. Housing inflation rose to a peak of 8.27 percent on a 12-month basis in April 2023 and has moved lower since then. The

[3] Ferrante, Graves, and Iacoviello (2020) show that a sharp reallocation of demand from one sector to another can exacerbate supply chain disruption and cause aggregate inflation; see Francesco Ferrante, Sebastian Graves, and Matteo Iacoviello (2023), "The Inflationary Effects of Sectoral Reallocation," *Journal of Monetary Economics*, supp., vol. 140 (November), pp. S64–81.

run-up in housing inflation came more slowly, but it is also the component most slowly to abate. This is an area that experienced catch-up inflation, as housing inflation rises and falls slowly because rents are reset infrequently, usually only once a year for most renters.

For the remainder of this discussion, I will focus on core inflation, and specifically core goods and core services inflation. My objective is to discuss several additions to an augmented Phillips curve model that allow us to capture the dynamics of those waves we encountered on our journey.

The Traditional Phillips Curve

Since price stability and maximum employment are the two components of the Fed's dual-mandate goal, it is important for policymakers to be able to interpret the inflation process and relate it to macroeconomic conditions, including unemployment. One traditional way of understanding the usual tradeoff between inflation and unemployment is the use of the Phillips curve. It was first employed by New Zealand economist A.W. Phillips in 1958 to describe a simple relationship between wage growth and unemployment. Basically, it demonstrates that wage inflation is lower when unemployment is high, and higher when unemployment is low. Since then, several variants and updates have been offered to the Phillips curve model, and I will offer updates, too.

One of the most notable updates came from Milton Friedman in 1967 in his presidential address to the American Economic Association.[4] In that speech, he argued

[4] See Milton Friedman (1968), "The Role of Monetary Policy," *American Economic Review,* vol. 58 (March), pp. 1–17; and Edmund S. Phelps (1967), "Phillips Curves, Expectations of Inflation and Optimal Unemployment over Time," *Economica,* vol. 34 (135), pp. 254–81.

that there is only a temporary tradeoff between inflation and unemployment, because inflation depends on both the unemployment rate relative to a natural rate (the unemployment gap) and expectations of future inflation.

The unemployment gap measures how much unemployment is above or below some reference level such as the natural rate of unemployment, or NAIRU (non-accelerating inflation rate of unemployment), which is thought to be the normal level of unemployment absent cyclical forces. An unemployment rate that is above the reference level indicates that there is slack in the economy. Conversely, if the unemployment rate is below the reference level, the economy is tight. The unemployment gap has an inverse relation to wage and price inflation, because slack in the economy means that there are excess resources to meet demand while tightness in the labor market means there is little room to expand demand without putting upward pressure on prices. Let's turn now to the other ingredient in Friedman's Phillips curve: inflation expectations. Inflation expectations represent the rate at which people expect prices to rise in the future. A Phillips curve model that includes inflation expectations is called an "expectations-augmented Phillips curve."

The idea behind adding inflation expectations to a Phillips curve is that workers care about their inflation-adjusted wage, rather than nominal wages, over the course of a period of employment when bargaining their pay. Meanwhile, price-setting firms care about their relative price in pricing their products. Both sets of agents must forecast as best as possible the future path of inflation to efficiently bargain their wages or set their prices. In other words, both parties form expectations about the general price level, and

these expectations will feed back into the inflation process.[5] Friedman assumed that inflation expectations respond to lagged observed inflation—or what are called "adaptive expectations"—and when that is so, it provides a mechanism for inflation to be persistent.

This view captured inflation dynamics in the 1970s and early 1980s fairly well; however, it was not broadly applicable to the period from the late 1980s through 2019, often called the "Great Moderation." Rather, regarding inflation dynamics over an extended period, inflation appears to be more strongly related to long-run inflation expectations than to lagged inflation or short-run inflation expectations measures. Monetary policy can play an important role in setting long-run inflation expectations. Both wage seekers and price setters form their inflation expectations, in part, from their beliefs about the central bank's inflation goal. When long-run inflation expectations stay close to the central bank's goal, we say that inflation expectations are anchored at that goal. That goal is currently set at 2 percent, and long-run inflation expectations have indeed been in a tight range around that target.[6]

The empirical literature on the Phillips curve has considered additional variables that may affect inflation and used those variables to create new versions of a Phillips curve. For example, Phillips curves have long included measures of "cost-push" pressures such as core import prices. These cost pressures more fully capture shocks to

[5] Friedman did not consider forward-looking price-setting firms, but more recent advances in macroeconomics do, such as New Keynesian models; see Jordi Galí (2015), *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework and Its Applications* (Princeton, N.J.: Princeton University Press).

[6] In an earlier speech, I have sketched a model in which agents infer the central bank target by observing inflation, interest rates, and unemployment data; see Adriana D. Kugler (2024), "Central Bank Independence and the Conduct of Monetary Policy," speech delivered at the Albert Hirschman Lecture, 2024 Annual Meeting of the Latin American and Caribbean Economic Association and the Latin American and Caribbean Chapter of the Econometric Society, Montevideo, Uruguay, November 14, https://www.federalreserve.gov/newsevents/speech/kugler20241114a.htm.

firms' costs coming from global price pressures and not captured by other measures of slack. Other Phillips curves also include lags of inflation to capture persistence in the inflation process.[7]

To summarize, the empirical literature has come to the conclusion that inflation dynamics can best be captured by a Phillips curve that includes lags of inflation, long-run inflation expectations, and a measure of slack, as well as import and energy prices as cost-push shocks. An instance of that formulation of a Phillips curve is included in former Chair Janet Yellen's speech from 2015.[8] Next, I would like to assess the accuracy of this baseline model during the recent run-up of inflation and consider how to augment the Phillips curve model with some new variables that may be able to capture some of the shocks experienced during the pandemic and post-pandemic period. A large literature has emerged on how to interpret the recent run-up in inflation, and more research is needed to fully understand this complicated episode. The Phillips curve model that I will use is another approach to consider. This is a simple approach, but it is possible to consider more complex models, such as models that consider the joint dynamics of inflation and other variables or models that explicitly consider nonlinearities.[9] However, I still see value in starting from this simple framework, seeing what it can and cannot

[7] For a review of Phillips curve formulations, see Robert J. Gordon (2018), "Friedman and Phelps on the Phillips Curve Viewed from a Half Century's Perspective," *Review of Keynesian Economics*, vol. 6 (4), pp. 425–36.

[8] The model that I will use is similar to the one described by Janet Yellen in her famous speech at the University of Massachusetts in 2015; see Janet L. Yellen (2015), "Inflation Dynamics and Monetary Policy," speech delivered at the Philip Gamble Memorial Lecture, University of Massachusetts, Amherst, September 24, https://www.federalreserve.gov/newsevents/speech/yellen20150924a.htm.

[9] See Pierpaolo Benigno and Gauti B. Eggertsson (2023), "It's Baaack: The Surge in Inflation in the 2020s and the Return of the Non-Linear Phillips Curve," NBER Working Paper Series 31197 (Cambridge, Mass.: National Bureau of Economic Research, April), https://www.nber.org/papers/w31197.

explain about pandemic inflation, and then seeing whether the addition of certain variables can help the model more fully account for inflation during the pandemic.

Estimation of the Phillips Curve Today

As I just explained, the Phillips curve model allows flexibility in the choice of variables, but economists employing the model must decide how to weight these variables. And those weights must be chosen in some way. Economists choose weights by examining available data and deciding which capture the inflation process in the best possible way. This decision is called "estimation." The modern way to undertake such an estimation is called "training." Economists train a model on a specific set of data and consider different cuts of the data set to determine different ways to compute those weights.

I will consider quarterly data that have been consistently produced since 1964, allowing us to include the periods of the Great Inflation, the Great Moderation, and the most recent inflation run-up. We could use this entire data set to train the model. However, subsample analysis also serves to prove some valuable points.

First Result: Examining the Great Moderation

Let's start by updating former Fed Chair Yellen's results. She estimated the model using the data during the so-called Great Moderation; I will update her results by training the model through 2019, the last year before the COVID-19 pandemic took hold in the U.S. As the term "moderation" implies, this was a period in which both inflation and output became much less volatile. We do not know exactly what brought about the Great Moderation. Hypotheses include the effects of better inventory management or better monetary policy. We do know, however, that inflation settled into a trend near to

or slightly below 2 percent during that period. We estimate the model with data from this period, and we decompose how much of inflation is explained by the variables and how much is left unexplained, which economists call the "residual." As it turns out, this model does a good job of capturing the inflation process over that period before the pandemic, and my results are similar to Yellen's. The model explains 70 percent of the variation in inflation, meaning that only 30 percent of the variation in inflation is attributed to unexplained residuals. An alternative way to understand the unexplained part is as the standard deviation of the residual or the unexplained portion of the model, which was 0.50 percentage point for the period from 2010 to 2019, compared with the standard deviation of inflation of about 0.8 percentage point.

This model, however, struggles to explain the run-up in inflation in the years immediately after the pandemic took hold. The unexplained portion of inflation, the residual, rises dramatically in 2021 and 2022. In 2021, the unexplained portion is almost 2 percentage points, and the following year, it is about 1.5 percentage points. Perhaps we should not be surprised by the outcome. These years saw inflation reach a four-decade peak, but the model has been trained on a Great Moderation sample that saw relatively quiet inflation.[10]

Second Result: Using a Longer Sample

The results are more encouraging if, instead, we also include data from the previous period of significant inflation and train the model on data starting in 1964. Intuitively, it makes sense that including a period with persistent inflation, like the 1970s, might help us better understand another inflationary episode. I stop at 2019 because I

[10] The results that I obtain for the 1990–2019 period are similar to those that Yellen reports for the 1990–2014 period.

want to see if training on data from the previous 55-year period can explain the post-2020 inflation.

The model captures more of the most recent run-up in inflation when using the longer period of analysis. The unexplained residual drops to about 1.5 percentage points in 2021 and to a bit above 0.5 percentage point in 2022. Allowing for greater persistence in inflation allows an inflation equation to fit the pandemic period better, though it does not settle the question of whether the pandemic inflation was caused by large and persistent shocks or by large shocks and a persistent inflation process—for example, because of greater feedback between wages and prices.

To improve the model further, it would be useful to include additional explanatory variables that could better capture the overheating of the economy. In what follows, I include variables that might account for factors experienced in the most recent bout of inflation, such as a very tight labor market and supply chain snarls.

Third Result: Alternative Measure of Slack

As I mentioned before, the very tight labor market was an important contributor to inflation in recent years, especially to services inflation, yet the weight on the unemployment gap in the Phillips curve for the more recent period is very small. This measure of slack has become less and less important over time in explaining inflation, except during selected episodes such as in the aftermath of the Global Financial Crisis, which was characterized by a very sluggish recovery. Outside of that episode, and very few others, the Phillips curve places little weight on that measure of slack in explaining inflation over the Great Moderation, including during the recent run-up. This is also a reflection of training the model over the Great Moderation, in which inflation moved

fairly tightly around a very flat trend. Notice that this would suggest a "flat Phillips curve" or a big penalty in terms of unemployment needed to reduce inflation. Instead, I focus on another very promising alternative measure that I have paid a lot of attention to since I was chief economist at the Department of Labor—and again since I joined the Board of Governors—and that I am very familiar with as a scholar of labor markets. The measure is the ratio of vacancies to the level of unemployment.[11] In effect, this ratio measures how much competition there is for a given job, or the "tightness" of the labor market. Labor is an important input into most production processes, and, thus, tightness in the labor market is closely related to price pressures. I use the standard version of this ratio that measures job openings from the Job Openings and Labor Turnover Survey as the numerator and the unemployment level from the Current Population Survey as the denominator. This allows me to use data back to the 1960s.[12] The vacancy-to-unemployment ratio as a measure of slack is more effective at explaining inflation than the unemployment gap. This represents an interesting result because it offers a larger role to heated labor markets in explaining the run-up in inflation. My results echo research that finds the vacancy-to-unemployment ratio is a helpful measure of slack to consider in out-of-sample forecasting exercises.[13]

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[11] The ratio of job openings to unemployment has attracted the attention of many researchers. See, for instance, Olivier J. Blanchard and Ben S. Bernanke (2023), "What Caused the US Pandemic-Era Inflation?" NBER Working Paper Series 31417 (Cambridge, Mass.: National Bureau of Economic Research, June), https://www.nber.org/papers/w31417.

[12] Although job openings from the Job Openings and Labor Turnover Survey (JOLTS) go back only as far as the early 2000s, I use here the extended series from Barnichon that pieces together JOLTS data for the more recent period with a corrected version of the help-wanted index originally from the Conference Board for the period before 2001. See Regis Barnichon (2010), "Building a Composite Help-Wanted Index," *Economics Letters*, vol. 109 (December), pp. 175–78.

[13] See Regis Barnichon and Adam Shapiro (2022), "What's the Best Measure of Economic Slack?" FRBSF Economic Letter 2022-04 (San Francisco: Federal Reserve Bank of San Francisco, February), https://www.frbsf.org/research-and-insights/publications/economic-letter/2022/02/what-is-best-measure-of-economic-slack; and Régis Barnichon and Adam Hale Shapiro (2024), "Phillips Meets Beveridge," *Journal of Monetary Economics*, supp., vol. 148 (November), 103660.

Fourth Result: Supply Chain Snarls

Although the vacancy-to-unemployment ratio offers a promising measure of slack and supply chain pressures due to labor shortages, that measure does not necessarily capture supply chain snarls whose roots lie outside of the labor market. As I mentioned earlier, there were substantial supply chain disruptions during the past few years that came at the same time as strong demand. That resulted in material and labor shortages. Attempts at quantifying supply-side disruptions have been around for some decades now.[14] I rely on a new monthly shortages index created by a team of Fed Board economists, which relies on textual analysis to scan news articles for sentences that include the word pairs "labor shortages," "material shortages," or "food shortages."[15] The Shortage Index allows us to better measure cost-push pressures from different sources and is constructed all the way back to the beginning of the previous century. Thus, it makes a difference to have access to advances in natural language processing.[16] When I add the Shortage Index to the baseline Phillips curve or to the vacancy-to-unemployment–based Phillips curve, I obtain that the Shortage Index explains an even larger portion of the inflation run-up during and after the pandemic. The residual for

[14] The Institute for Supply Management's Supplier Deliveries Index has been around since the 1950s, the Federal Reserve Bank of New York's Global Supply Chain Pressure Index since 1998, and the Census Bureau's Quarterly Survey of Plant Capacity Utilization since 2008.

[15] See Dario Caldara, Matteo Iacoviello, and David Yu (2024), "Measuring Shortages since 1900," working paper. Their index is available at https://www.matteoiacoviello.com/shortages.html.

[16] Other authors have used natural language processing in an attempt to produce a measure of shortages. For instance, see Paul E. Soto (2023), "Measurement and Effects of Supply Chain Bottlenecks Using Natural Language Processing," FEDS Notes (Washington: Board of Governors of the Federal Reserve System, February 6), https://www.federalreserve.gov/econres/notes/feds-notes/measurement-and-effects-of-supply-chain-bottlenecks-using-natural-language-processing-20230206.html. Blanchard and Bernanke use Google searches for the word "shortage" as an indicator of sectoral supply constraints in a Phillips curve equation; see Blanchard and Bernanke, "What Caused the US Pandemic-Era Inflation?" in note 11. For an early-attempt, hand-coded shortage index, see Owen Lamont (1997), "Do 'Shortages' Cause Inflation?" in Christina D. Romer and David H. Romer, eds., *Reducing Inflation: Motivation and Strategy* (Chicago: University of Chicago Press), pp. 281–306.

2020 is cut in half, the residual for 2021 is about 1 percentage point, and the residual is effectively eliminated in 2022. I judge this a noteworthy result and a proof of concept that with additional augmentation, the Phillips curve model can better capture inflation dynamics during the recent period. Through the lens of this model, supply shortages played an important role in 2022 in constraining output to grow at an anemic rate and in pushing up inflation. Moreover, the model is also able to capture the decline in inflation in 2023 and 2024 despite the strong expansion in real activity. I view the Shortage Index as a powerful indicator of the nonlinear effects stemming from a compounding of the contemporaneous interaction of demand and supply bottlenecks.

I have offered additional variables to account for a measure of slack as it relates to labor supply and material supply. This exercise could be extended further to better account for some of the subcategories of inflation that caused the waves I discussed earlier. For example, food inflation, which is characterized by two distinct waves, can mostly be explained by the Food Shortage Index, which captures a large portion of the residual in the baseline model.

Lessons for the Policymaker

Today I have discussed the waves of inflation the country faced starting five years ago. I also talked about how the vessel we use to navigate those choppy waters can be improved upon. As I conclude, I want to discuss with you how central bankers might recalibrate their compasses, based on what we learned from considering these augmentations to Phillips curve models. I think a clear lesson is that no single model alone can give a policymaker an understanding of every possible state of the economy. Policymakers must be open to various options, models, and frameworks—and not be

afraid to experiment in search of more accurate answers. Policymakers must be very attentive to the most recent contributions from academia and empirical practitioners. Broadly, that is the approach I take, and why I apply the same rigor I did as an academic researcher to the monetary policy decisions that I confront.

The recent run-up in inflation in many ways was a rather unique period, spurred, at least initially, by the first onset of a global pandemic in more than a century. Fully understanding the dynamics at play has provided a tough test for economists. The models I described today have had some success in capturing salient features of the inflation process during the pandemic period. I hope this illustrative analysis helps you see the difficulties of forecasting inflation in real time.

Another lesson to be learned from this experience is that the feared harsh tradeoff between unemployment and inflation, one that requires large costs in terms of job loss and reduction in incomes in order to reduce inflation, did not materialize in the years immediately after the 2022 inflation peak. Inflation has been significantly reduced while the labor market has remained solid. This is a historically unusual, but most welcome, outcome. While this outcome is in part due to the actions of Fed policymakers, it is also possible to explain that remarkable result through the lens of the models that I have presented today. A large fraction of the rise in inflation, most specifically core goods inflation, can be explained by supply chain snarls. The untangling of supply chains contributed to a decline in inflation with little cost in terms of unemployment. Likewise, labor markets were very tight in this period. As workers returned to the labor force, labor markets became less tight, and the vacancy-to-unemployment ratio declined. That

corresponded with a subsequent decline in inflation. That is a consistent result because services inflation is closely connected to the cost of labor.

Thank you for your time today. Once again, it is humbling to be asked to give the Whittington Lecture to honor the memory of fellow educator Leslie Whittington. I look forward to your questions.