

The Inflation Surge of the 2020s: The Role of Monetary Policy

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Abstract

We investigate the extent to which the Federal Reserve's new monetary policy framework, introduced in August 2020, along with its implementation via forward guidance and asset purchases, delayed the Fed's response to the 2021 inflation surge. We do not aim to quantify the new framework's direct effect on inflation. Instead, we focus on the possible ways it could have contributed to the inflation surge.

Our first key finding is that the new policy framework introduces an inflationary bias that was not present in the previous one. The bias arises due to two changes: a) an asymmetric employment loss function that penalizes only when employment falls below its maximum, unlike the prior framework which penalizes both under- and overshooting; and b) the introduction of an asymmetric average inflation target. These changes were driven by inflation running consistently below its target post 2008, which, coupled with a continuous fall in real interest rates in recent decades, had made the effective lower bound on interest rates a constraint on monetary policy easing. Another key motivation was a widespread belief that the Fed's preemptive tightening in 2015-2019 was a mistake because the Fed underestimated the maximum level of employment.

Our second key finding suggests that the forward guidance introduced in September 2020 amplified the inherent inflationary bias of the new policy framework. This guidance linked interest rate increases to two conditions: inflation surpassing its target and employment achieving its maximum. Taken literally, this suggested an unchecked rise in inflation if employment did not hit its estimated maximum. Furthermore, we argue that the Federal Open Market Committee's interpretation of "maximum employment" understated the tightness of the labor market in 2021. This also contributed to a delayed policy response.

In conclusion, we propose several lessons from this experience. We hope they will be of value when the Federal Reserve reconsiders its policy framework and, moreover, helps future formulation of forward guidance.

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1. Introduction

The inflation surge that started in March 2021 marks the largest and most persistent increase in inflation since the Great Inflation of the 1970s. The surge was unexpected not only by policymakers but by most outside economists and market participants as well. Critically, its persistence was consistently underestimated.

The objective of this paper is to evaluate the role the policy framework of the Federal Reserve and its implementation in forward guidance for interest rates and asset purchases played in generating the unexpected inflation surge. On August 27, 2020, the Federal Reserve adopted a “[Statement on Longer-run Goals and Monetary Policy](#).” This statement was largely developed based on the experience of the Federal Reserve prior to the pandemic. We will refer to this as the 2020 Policy Framework. We will refer to what it replaced as the [2012 Policy Framework](#). Shortly after the new framework was adopted, the Federal Open Market Committee (FOMC) issued forward guidance about the conditions that would need to prevail to begin backing away from the very accommodative stance of policy adopted as COVID hit the global economy. That guidance was characterized by Federal Reserve Chair Jerome Powell as “[forcefully](#)” implementing the new framework. The main contribution of this paper is to analyze the change in the policy framework and offer a tentative analysis about how large a role the framework and its forceful implementation via forward guidance played in generating the inflation surge.

We do a detailed textual analysis of the 2020 Policy Framework relative to its 2012 counterpart. The framework encompassed two major changes. One was adopting Flexible Average Inflation Targeting (FAIT). This says that if inflation persistently undershoots the 2 percent target it will be offset by deliberate “moderate” overshoots “for some time” to better assure that inflation averages 2 percent over time. The second was an asymmetric response to labor market deviations from “maximum employment.” Instead, policy would be informed only by shortfalls from maximum employment and not by estimated or projected overshoots. We propose a simple model that illustrates the implication of this asymmetry. The key conclusion is that an asymmetric objective function, coupled with the common assumption that policy affects activity with a lag, implies an inflationary bias. We recognize that this bias was a deliberate choice of the FOMC designed to offset the disinflationary bias of being constrained by the effective lower bound on interest rates (ELB). Another motivation was to avoid what was seen as the mistake of 2015-19. During this period the FOMC raised rates because it believed the labor market was tight and that further reductions in the unemployment rate would lead to inflation in excess of the 2 percent goal. Yet, unemployment continued to fall without generating any inflation pressure. This led many to conclude that the 2015-2019 tightening cycle was unwarranted and had held back welcome gains in labor market participation and jobs.

We then move to a qualitative narrative of the surge emphasizing a combination of various forces, putting special emphasis on explanations where the 2020 Policy Framework and guidance may have played a role. It is worth highlighting that such a narrative and emphasis will, by design, overweight the role of the policy framework in explaining the surge. Nevertheless, we think this is a productive way of proceeding. Any policy framework should be robust to a broad range of scenarios. In some respect, this paper can be read as using the 2020’s inflation surge as a stress test for the 2020 Policy Framework.

Demand rebounded strongly as the economy re-opened after the pandemic, boosted by very stimulative fiscal and monetary policies. But another important part of the story, in our telling, is the role of the unevenness of the recovery. One example is that spending on goods outpaced the recovery in

spending on services in the post-pandemic economy. This unevenness was also featured by the Fed in its explanations for “transitory” inflation pressures and is important for understanding the delayed realization of its implications for labor market measures of tightness. The unevenness implied, for example, that people who had been working in the service sector needed to seek jobs in the good producing sector. We suggest that this process of reallocation may have led policymakers at the start of the inflation surge to underestimate the tightness of the labor market. The 2020 Policy Framework then played an important role by delaying tightening of policy because it elevated measures of labor market shortfall as the central focus of the policy process—a delay that was amplified by the forward guidance.

Moreover, one important premise of the 2020 Policy Framework focus on labor shortfalls, in contrast to the “balanced approach” of the 2012 Policy Framework, was the belief that labor market tightness had very limited impact on inflation. In other words, the Fed believed that the Phillips curve was flat. In explaining the benefits of the 2020 Policy Framework, for example, Governor Lael Brainard emphasized in a [September 1, 2020, speech at Brookings](#) that “a flat Phillips curve has the important advantage of allowing employment to continue expanding for longer without generating inflationary pressures, thereby providing job opportunities to people that might not otherwise have them.” Governor Brainard argued that a key benefit of the 2020 Framework is that it eliminated the “longstanding presumption that accommodation should be reduced preemptively” as the labor market tightens “in anticipation of high inflation that is unlikely to materialize.” The 2020 Policy Framework, thus, had the promise of generating more job opportunities for Americans with what policymakers perceived as very limited downside.

There is increasing evidence, however, that once the labor market becomes sufficiently tight the slope of the Phillips curve becomes steeper. Indeed, this is one of the central ideas of Phillips’s (1958) first formulation of the curve that later became synonymous with his name.

Accordingly, one simple account of the inflation surge is a combination of three factors:¹

- i) The 2020 Policy Framework led the Fed to focus with increasing intensity on labor market shortfalls due to an asymmetric loss function
- ii) The highly unusual nature of the recovery from the pandemic led the Federal Reserve to underestimate labor market tightness
- iii) Unexpected non-linearities in the Phillips curve started biting due to the extraordinary labor market tightness not seen since WWII.

Central to our narrative is the role forward guidance in September 2020 played in delaying the policy tightening to March 2022, but also how it became intertwined with the credit easing policies of asset purchases, which implied additional constraints on policy tightening. As we will argue, the forward guidance in September 2020 committed the Federal Reserve to tolerate an inflation surge until employment reached the Federal Reserve’s estimated maximum—even though the FOMC did include an escape clause that was never utilized. Yet, it is fair to recognize that while we agree that Chairman Powell’s interpretation that the forward guidance in September 2020 was a “forceful” implementation of the policy framework, we also recognize that a reasonable case can be made that it went further than the framework

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1. This account, and others closely related such as Benigno and Eggertsson (2023), differ slightly from the one presented in Bernanke and Blanchard (2023), who attribute less importance to labor market tightness, especially for the initial phases of the inflation, though the contribution of labor market tightness increases as inflation has persisted. One explanation for this discrepancy is that Bernanke and Blanchard (2023) only allow the labor market to influence inflation through wages, as measured by Employment Cost Index (ECI), while other authors instead allow labor market tightness as measured by vacancies over unemployment to directly affect inflation, see e.g. Benigno and Eggertsson (2023). Benigno and Eggertsson find that labor tightness both had a direct impact on inflation, but also via interaction effect; that is, the tighter labor market made supply shocks more inflationary.

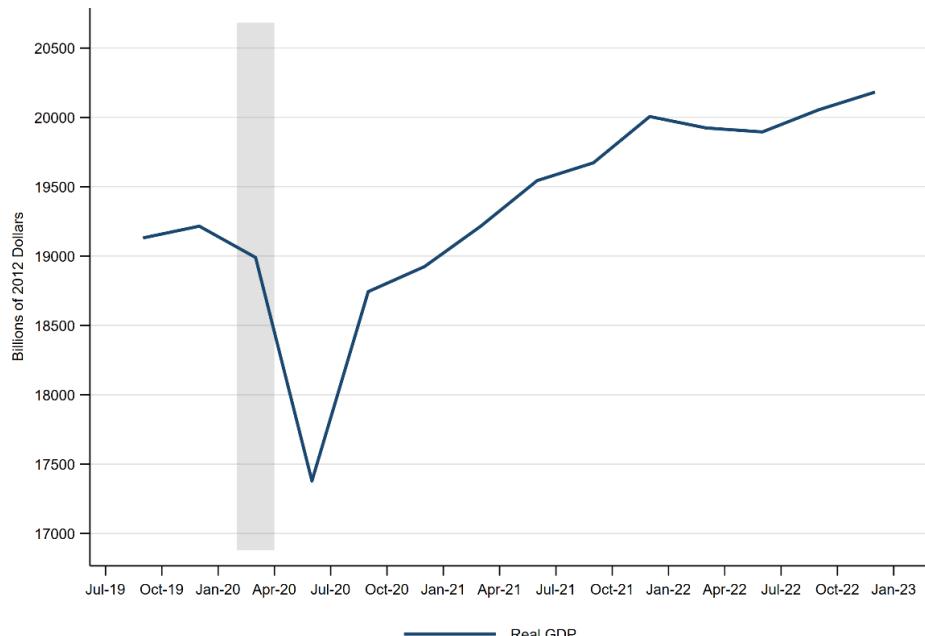
mandated. Still, given that [the policy statement in September 2020](#) was the very first monetary policy statement the FOMC released after introducing the new policy framework, it is difficult at this stage to separate one from the other. That will be an important challenge for policymakers as they view this episode in the rearview mirror.

We are not arguing that a more prompt policy response to inflation pressures would have entirely prevented the surge or its persistence. High inflation has been a global phenomenon, sparked to an extent by unanticipated supply-side disruptions from virus variants and the Russian invasion of Ukraine. And Federal Reserve policymakers have responded to their realization of the seriousness of the inflation problem with a nearly unprecedented increase in their policy rate to compensate for the delay. But earlier recognition and response, by damping demand sooner, likely would have shaved something off the level of inflation and would have enabled a more gradual tightening in policy with potential benefits for financial stability. Because we find that the framework and forward guidance put in place in late 2020 contributed to delayed action and the inflation overshoot, we believe there are lessons to be learned for future frameworks and the use of policy tools.

2. Narrative background: The economy during the pandemic and what led up to it

The period following the COVID-19 pandemic must count as one of the most challenging circumstances on record faced by public policymakers. Any ex-post assessment of performance must therefore be done with a good dose of humility. There was no script to follow. Circumstances were unprecedented with perhaps the Spanish flu a century ago being the closest comparison, yet one of limited practical value as it came during World War I. Not only was it difficult to forecast the immediate impact of the COVID-19 pandemic, but projecting its aftermath was no less challenging—especially considering the experience in the years leading up to it.

Figure 1. Real GDP



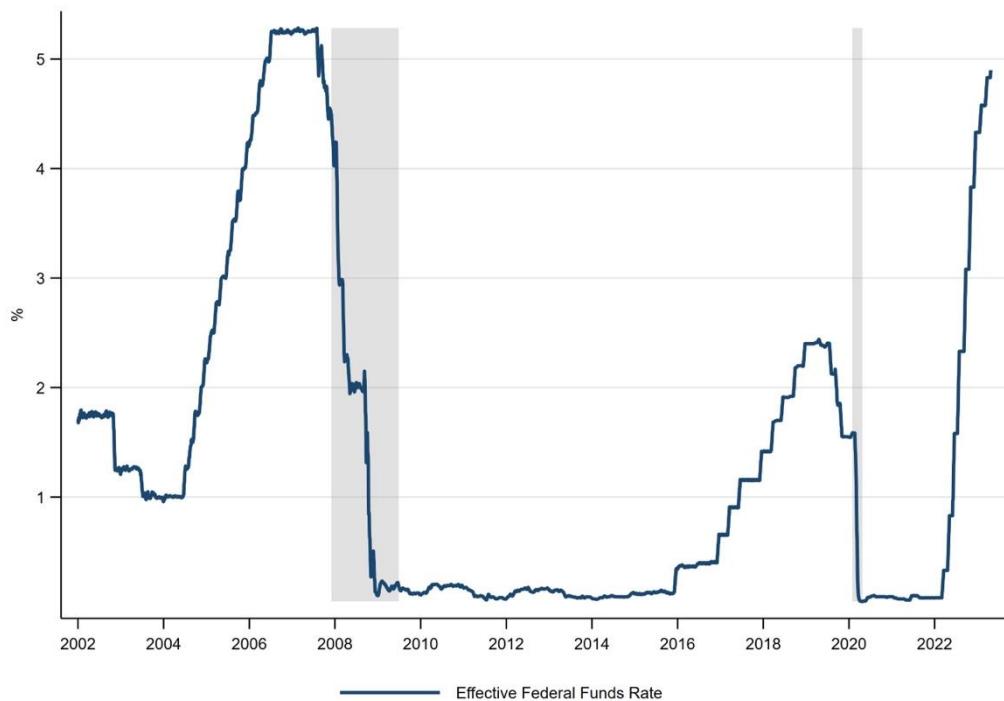
Note: Shaded areas indicate U.S. recessions. Source: BEA

2.1 The COVID-19 pandemic

The World Health Organization declared COVID-19 a pandemic in March 2020. Its effects on output in the U.S. were first registered in Q1 2020 GDP, as shown in Figure 1. Real GDP bottomed out in Q2 2020, close to 10 percent lower than Q4 2019. During the early months of the pandemic, there was discussion of what kind of recovery we should expect. Optimistic projections suggested a “V” shaped recovery. Former Federal Reserve Chairman Ben Bernanke [used the analogy of a “snowstorm.”](#) Output will fall during the storm, but once the weather clears up, things will go back to normal. More pessimistic voices raised the specter of a “U” or even “L” shaped recovery.

In retrospect, the recovery resembles a “V” shape—to a surprising degree. Yet, this also reflects a strong policy response.

Figure 2. Federal funds rate



Note: Shaded areas indicate U.S. recessions. Source: FRBNY

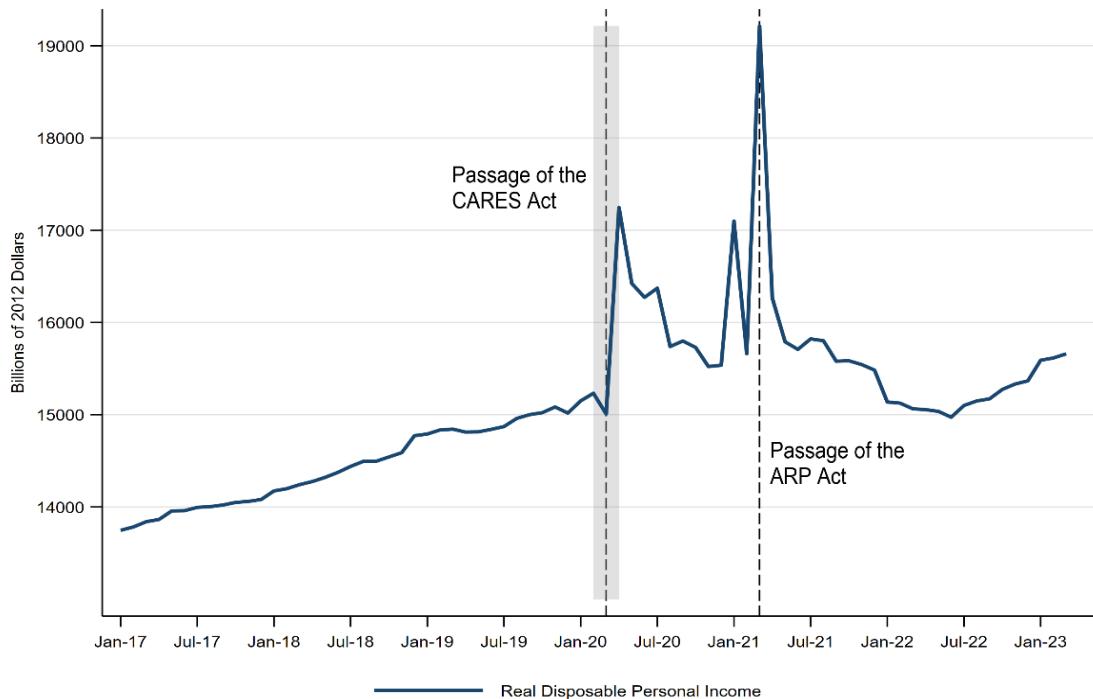
In March 2020, the Federal Reserve dropped the policy rate to the effective lower bound of 0 to $1/4$ percent. In addition, the Federal Reserve implemented a series of policies aimed at facilitating smooth market functioning, the flow of credit, and further easing financial conditions.²

It is beyond the scope of this paper to analyze fiscal policy. Edelberg, Furman, and Geithner (2022) give a good overview suggesting COVID-19 related support generated a federal deficit of 10.4 percent of GDP in fiscal 2020 and 11.0 percent in fiscal 2021. The two most significant pieces of legislation were the

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2. To do this, the Federal Reserve bought both government securities and mortgage-backed securities and continued to do so even after market functioning had been restored to further ease financial conditions and boost demand. In addition, it established a host of liquidity facilities to help businesses, households, and state and local governments access credit even as financial markets were disrupted.

\$1.72 trillion Coronavirus Aid, Relief, and Economic Security (CARES) Act which was signed into law in March 2020 and the \$1.92 trillion American Rescue Plan (ARP) signed into law a year later.

Figure 3. Real disposable income



Note: Shaded areas indicate U.S. recessions. Source: BEA

A significant part of the fiscal packages were direct monetary transfers to households. The quantitative significance of these transfers is highlighted by the time series for Real Disposable Income (Figure 3).³ The two largest spikes correspond to the CARES and ARP acts. Such large spikes are unprecedented in U.S. historical data.

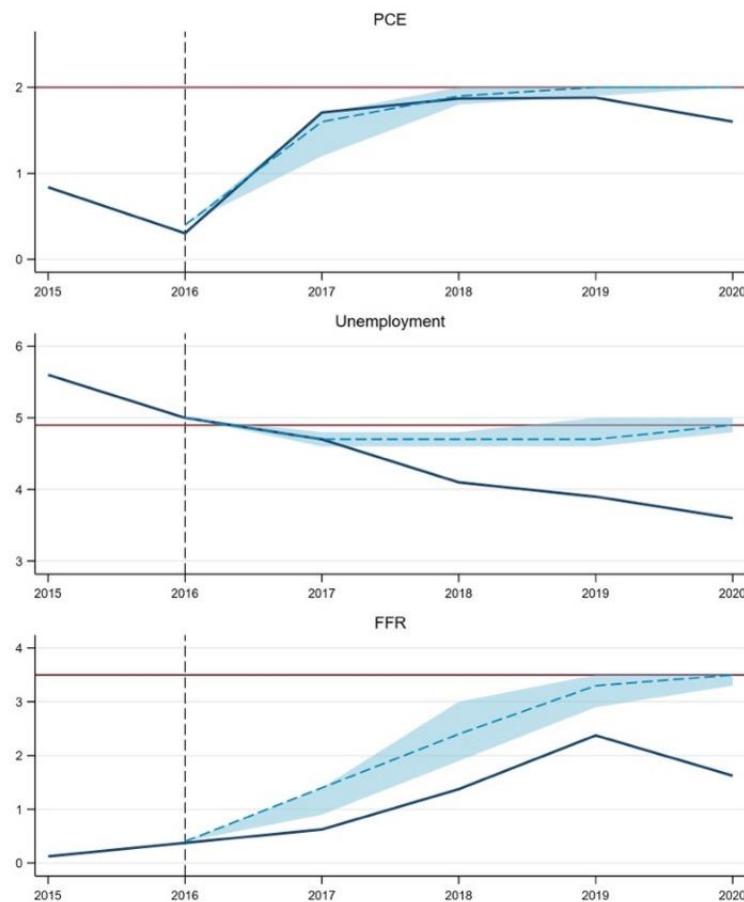
In short, coming out of the pandemic, Federal Reserve policymakers were faced with a sharp but uneven rebound in demand due to pent up spending, large fiscal spending bills, and very accommodative monetary policy. At the same time, the supply side was severely constrained due to the pandemic. This environment was fundamentally different from the one following the Global Financial Crisis (GFC) of 2007-09. Yet, the experience following the GFC shaped the outlook of the fiscal authorities and the Federal Reserve. Indeed, as we will see, the response of the Federal Reserve to the COVID-19 crisis can largely be explained by its experience in the years following the GFC.

3. This data is collected by the Bureau of Economic Analysis. Real Disposable Income documents income people get from wages, salaries, Social Security and other benefits, dividends and interest, and other sources after taxes.

2.2 The mistake of 2015-2019 and the policy consensus leading up to the pandemic

In December 2008, the Federal Reserve responded to the GFC by cutting the federal funds rate to 0 to $\frac{1}{4}$ percent. The aftermath of the GFC was marked by a sluggish recovery and a gradual decrease in unemployment. For a span of seven years, rates remained at the effective lower bound (ELB). It was not until December 2015 that the Federal Reserve decided to raise rates to $\frac{1}{4}$ to $\frac{1}{2}$ percent. Leading up to the pandemic, a growing consensus emerged among policymakers that the rate increases starting in 2015 were a mistake.

Figure 4. Summary of economic projections from the December 2015 FOMC meeting



Note: The dashed light blue line shows the median SEP forecast, the blue shaded area shows the forecast central tendency, and the solid dark blue line shows the actual evolution of the economy. Horizontal red lines show the long-run values expected by the FOMC. Source: Federal Reserve Board of Governors, Federal Reserve Bank of New York, BEA, BLS

To see how this consensus was formed, consider Figure 4. The blue shaded region illustrates the central tendency of the Federal Open Market Committee (FOMC) members' projections, with the median indicated by dashed lines. These projections are derived from the Survey of Economic Projections (SEP) issued following the December 2015 meeting, marked by the vertical dashed line in the figure.

The Federal Reserve raised rates because the unemployment rate was at 5 percent and expected to drop further. The FOMC estimated that an unemployment rate consistent with maximum employment was 4.9 percent. Accordingly, it projected that labor market tightness would trigger inflationary pressures, so that inflation, which at the time was below the 2 percent target, would gradually converge to the inflation target in the next few years. Meanwhile, employment was projected to gently overshoot its maximum level and then converge back to a level consistent with 4.9 percent unemployment.

The projections were wrong. The solid lines show the actual data that soon emerged. Unemployment continued falling, dropping to 3.7 percent in July 2019, and, though inflation rose, it remained below 2 percent. In July 2019 the Federal Reserve reversed course and began cutting rates, pausing at the December 2019 meeting just before the outbreak of the pandemic. Why did the Federal Reserve cut rates in mid-2019 when unemployment was at 3.7 percent? The concern was that inflation remained below the inflation target. Indeed, inflation had been running persistently below target ever since the GFC.

This created concerns among policymakers. It risked de-anchoring inflation expectation below the 2 percent target. This creates significant complications due to the ELB. That the federal funds rates cannot fall below the ELB gives the Federal Reserve limited room to cut rates in response to negative shocks if rates are already low. Falling inflation expectations take nominal rates with them, making the problem more challenging. At the same time, a consensus was emerging that r^* —the real interest rate projected to prevail at full employment and price stability—also had declined permanently and might even drift down some more due to demographic trends, further reducing nominal interest rates.⁴ In sum, the concern was that a combination of persistently low r^* together with declining inflation expectations and ELB would create a systematic deflation bias by limiting the Federal Reserve's ability to counter negative demand shocks. This became the major concern of policymakers and played a central role in the formulation of the 2020 Policy Framework.

Meanwhile, the experience since 2015 was shaping a new policy consensus. First, the decline in unemployment from 5 percent to 3.7 percent while inflation was still *undershooting* its 2 percent target suggested that the natural rate of unemployment is a moving target and, relatedly, that the unemployment rate is an imperfect proxy for maximum employment. Second, a reduction in unemployment has very limited effect on inflation, a conclusion supported by growing academic literature. According to the widely cited estimate by Hazzell, Herreño, Nakamura, and Steinsson (2022), for example, a 1 percentage point reduction in unemployment generates only a 0.34 point increase in inflation. In other words, the Phillips curve is flat.

The bottom line of the emerging consensus was that overshooting maximum employment has trivial effect on inflation. A logical conclusion is that, given the uncertainty about maximum employment, much is to be gained by letting the labor market run hot and generate new jobs at very low risk to inflation.⁵ This consensus led to the 2020 Policy Framework.

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4. This concern over deflationary bias was closely tied to that of several prominent economists who argued that the U.S. was in a secular stagnation – the idea that the balance of global supply and demand for savings had shifted in such a way to produce a permanent reduction in neutral interest rate, or r^* , into possibly negative territory over the course of the last half a century. A large body of literature emerged in the mid 2010s making this case, with many prominent authors affiliated with the Federal Reserve.
 5. See e.g., Powell (2020) Jackson Hole Speech that announces the new framework and Brainard (2020) that summarizes this consensus and how it was formed.

3. The Policy Framework of the Federal Reserve and how it changed in 2020

The 2012 Policy Framework was adopted on January 24, 2012. The language in the Policy Framework was modestly changed during the next seven years, with the latest iteration released in January 2019. None of those changes were substantive, and we use the 2019 version, still labeled the 2012 Framework, in our comparisons to the 2020 Framework. The 2012 Policy Framework is a succinct document that describes the general strategy of the Federal Reserve in seven paragraphs. The 2020 Framework was released on August 27, 2020, and has the same structure.

3.1 The 2012 Policy Framework

The 2012 Policy Framework formalized the Federal Reserve's approach to its dual legislative objectives. First, it states that the Federal Reserve's criteria for price stability is that inflation, as measured by the Personal Consumption Expenditures chain price index, is 2 percent. Second, it doesn't define maximum employment, which is a matter for judgment, but it does point to the Committee's estimate.

The lags in the effects of monetary policy are emphasized in paragraph two:

Moreover, monetary policy actions tend to influence economic activity and prices with a lag. Therefore, the Committee's policy decisions reflect its longer-run goals, its medium-term outlook, and its assessments of the balance of risks, including risks to the financial system that could impede the attainment of the Committee's goals.

Importantly, the 2012 Policy Framework put weight on overshooting and undershooting **both** elements of the dual objective; that is, on inflation and employment. Thus the 2012 Federal Reserve was equally concerned with employment being above its estimate of maximum employment as when it falls short of it because overshooting on employment is assumed eventually to result in inflation overshooting. The definition of the inflation part of the objective is clear, while the employment part is more challenging to estimate in real time. On the employment part, the most relevant passage in paragraph three (boldface is ours) is:

The maximum level of employment is largely determined by nonmonetary factors that affect the structure and dynamics of the labor market. These factors may change over time and may not be directly measurable. Consequently, it would not be appropriate to specify a fixed goal for employment; rather, the Committee's policy decision must be informed by **assessments of the maximum level of employment**, recognizing that such assessments are necessarily uncertain and subject to revision.

The paragraph concludes with:

The committee considers a wide range of indicators in making these assessments. Information about Committee participants' estimates of the longer-run normal rates of output growth and unemployment is published four times per year in the FOMC's Summary of Economic

Projections. For example, in the most recent projections, the median of FOMC participants' estimates of the longer-run normal rate of unemployment was 4.4 percent.⁶

Paragraph six of the 2012 Policy Framework then makes clear that the Committee considers deviation of employment above maximum level in the same way as deviation below. The same applies for inflation (boldface is ours):

In setting monetary policy, the Committee seeks to mitigate deviations of inflation from its longer-run goal and **deviations of employment from the Committee's assessments of its maximum level.**

The statement says that these objectives are generally complementary, but if not, the committee will follow a "balanced approach" in paragraph six:

These objectives are generally complementary. However, under circumstances in which the Committee judges that the objectives are not complementary, it follows a **balanced approach in promoting them**, taking into account the magnitude of the deviations and the potentially different time horizons over which employment and inflation are projected to return to levels consistent with its mandate.

A natural reading of the Committee's framework is that its objective—a simple example of which is illustrated in the next section in Figure 5—is to minimize the deviations of both inflation from target and of employment from the Fed's assessment of its sustainable maximum. In that equation the policymaker puts equal weight on deviations from target in either direction. The 2012 Framework doesn't say that explicitly, but it may be inferred from its embrace of the balanced approach to conflicts and from the policy rules published in the Monetary Policy Reports of the era.⁷ In other words, the responses to misses are symmetrical.

3.2 The 2020 Policy Framework

As we stressed, concerns over low r^* were essential to the formulation of the 2020 Policy Framework. This is reflected in a new addition to the second paragraph of the statement:

The Committee judges that the level of the federal funds rate consistent with maximum employment and price stability over the longer run has declined relative to its historical average. Therefore, the federal funds rate is likely to be constrained by its effective lower bound more frequently than in the past. Owing in part to the proximity of interest rates to the effective lower bound, the Committee judges that downward risks to employment and inflation have increased.

...
6. This is from the 2019 version of the 2012 Framework, the last issued before the 2020 rewrite.

7. See for example the Taylor and Balanced Approach rules in the July 2017 Report:
<https://www.federalreserve.gov/monetarypolicy/2017-07-mpr-part2.htm>

3.2.1 Introducing asymmetry

One major new element of the 2020 Policy Framework is that the Federal Reserve is no longer giving equal weight to upside and downside deviations of employment from its estimated maximum. Instead, in its policy choices, the FOMC will give considerable weight to shortfalls in employment and little if any to situations in which the labor market is above its estimate of maximum employment. More generally, the new framework seems to put higher weight on the employment side of the objective. Below boldface represents the new framework and elements eliminated from the 2012 Policy Framework are illustrated with a strike through.

The increased focus on employment is the very first change to the document:

Employment, inflation, employment, and long-term interest rates fluctuate over time in response to economic and financial disturbances.

Here the FOMC explicitly reverses the order of the elements of its objectives, putting employment ahead of inflation in describing the key variables of interest. To be sure, the new ordering follows that of the legislation, but it seems natural to interpret the impulse to shift the order as the FOMC wanting to communicate its increased attention to this part of the dual mandate. As we discuss below, this hierarchy shows through clearly in the forward guidance on interest rates, through which the FOMC implemented the new framework in the first meeting after the framework was released.

A more expansive definition of maximum employment and an asymmetrical way of evaluating deviations from it is introduced in paragraph three:

The maximum level of employment is **a broad-based and inclusive goal that is not directly measurable and changes over time owing** largely determined by ~~to~~ nonmonetary factors that affect the structure and dynamics of the labor market. ~~These factors may change over time and may not be directly measurable.~~ Consequently, it would not be appropriate to specify a fixed goal for employment; rather, the Committee's policy decisions must be informed by assessments of the **shortfalls of employment from its** maximum level of ~~employment~~, recognizing that such assessments are necessarily uncertain and subject to revision. The Committee considers a wide range of indicators in making these assessments. ~~Information about Committee participants' estimates of the longer run normal rates of output growth and unemployment is published four times per year in the FOMC's Summary of Economic Projections. For example, in the most recent projections, the median of FOMC participants' estimates of the longer run normal rate of unemployment was 4.4 percent.~~

Here we see two critical changes. First, the new statement emphasizes a "broad-based and inclusive goal," a phrase not clarified in the framework. By deleting the language later in the paragraph on the unemployment rate, it shifts focus to other possible measures and doesn't give any examples of quantifiable estimates of maximum employment. It appears to open the door for considering the status of subsections of the nation, based on income or another defining characteristic. In fact, some participants highlighted the potential gains for such groups due to the new framework.

Second, the new statement has replaced the broad reference to estimates of maximum employment to informing policy decisions only on the Committee's assessment of the "shortfalls of employment from its

maximum level." The implied asymmetry—no attention to overshoots of employment—is spelled out clearly in paragraph five:

In setting monetary policy, the Committee seeks **over time** to mitigate **shortfalls of employment from the Committee's assessment of its maximum level and** deviations of inflation from its longer-run goal ~~and deviations of employment from the Committee's assessments of its maximum level.~~

To highlight further the new asymmetric criteria, the sixth paragraph reads:

~~These The Committee's employment and inflation objectives are generally complementary. However, under circumstances in which the Committee judges that the objectives are not complementary, it follows a balanced approach in promoting them, taking takes into account the magnitude of the employment shortfalls and inflation deviations and the potentially different time horizons over which employment and inflation are projected to return to levels judged consistent with its mandate.~~

The 2020 Policy Framework removes the sentence saying it takes a balanced approach when evaluating the deviation of inflation from target and employment from its maximum level in cases of conflict. Instead, it states it cares about "inflation deviations" from target in either direction while on the employment side it is only concerned with "employment shortfalls."

To sum up, we think the new policy framework is clearly designed to put higher emphasis on employment, and, moreover, that it cares more if employment is below its maximum level (shortfall) than if it is above it. It is not obvious from the statement that the Committee would consider employment above its assessment of maximum employment, an outcome it would like to avoid. In the simple analytic framework in Appendix 1, we give one way one can give a mathematical interpretation of the asymmetric nature of the 2020 framework.

3.2.2 The average inflation target

As we have already stressed, the key motivation for the revision of the 2020 Policy Framework was to build on the concern that that the 2012 Policy Framework interacting with low nominal interest rates would bring the ELB into play more frequently, causing the Fed to miss on the low side of both of its dual objectives and de-anchoring expectations below the 2 percent target. If inflation expectations would fall, this would give the Federal Reserve even less room to reduce real interest rate in response to negative shocks. To address this issue, the Federal Reserve introduced Flexible Average Inflation Targeting (FAIT):

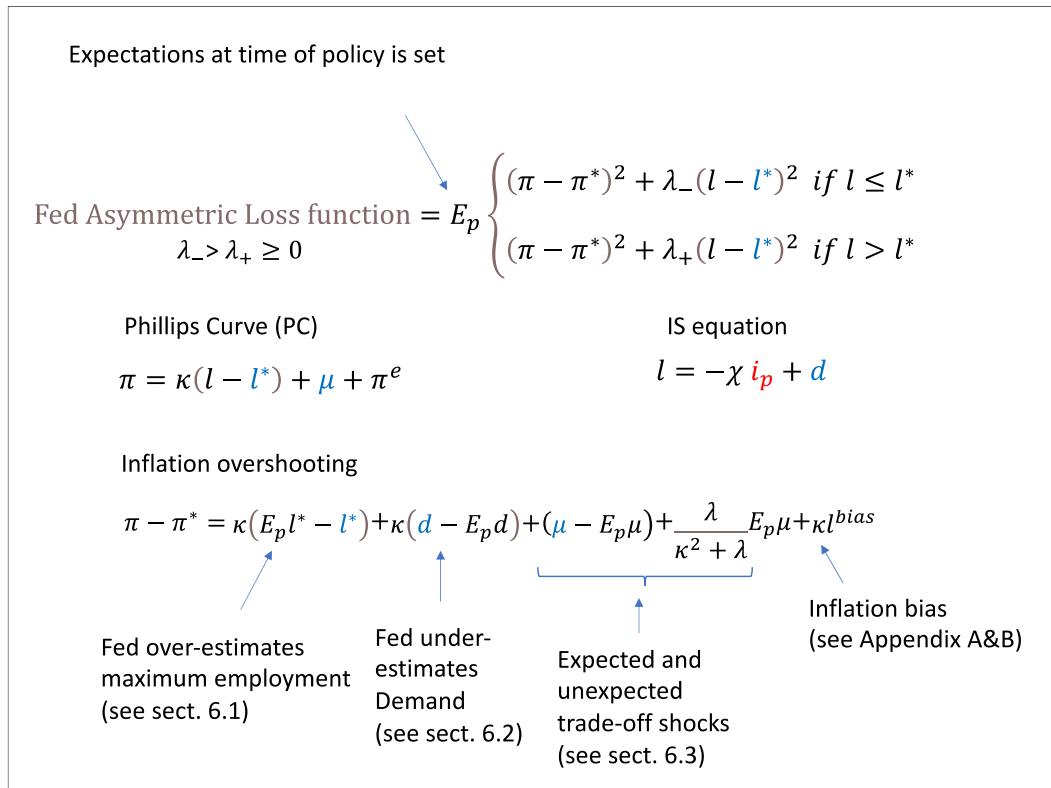
~~The Committee would be concerned if inflation were running persistently above or below this objective. Communicating this symmetric inflation goal clearly to the public helps keep judges that longer-term inflation expectations firmly that are well anchored thereby at 2 percent fostering price stability and moderate long-term interest rates and enhancing enhance the Committee's ability to promote maximum employment in the face of significant economic disturbances. In order to anchor longer-term inflation expectations at this level, the Committee seeks to achieve inflation that averages 2 percent over time, and therefore judges that, following periods when inflation has been running~~

persistently below 2 percent, appropriate monetary policy will likely aim to achieve inflation moderately above 2 percent for some time.

The focus is undershooting; FAIT does not address whether or how to average if inflation exceeds its target for a time. The statement does not confine FAIT to periods at the ELB, but presumably if inflation were running too low, the FOMC would cut rates to zero if necessary to achieve the desired averaging and anchoring. In that regard it is closely related to suggestions for temporary price level targeting at the ELB. A relatively rich literature has developed, with several prominent contributions from Federal Reserve staff members, which shows that a policy of this kind can not only stabilize long term inflation expectations but also mean that a recession that triggers the ELB is likely to be much milder than if the Fed followed, for example, a Taylor rule. Richard Clarida, the Fed vice chair in charge of the Framework review, articulated FAIT as a natural implementation of a well-known idea suggested by Ben Bernanke in 2017 (Bernanke (2017), Clarida (2020)). In Bernanke's formulation, in the event the Fed missed its target on the downside and had reduced its target funds rate to zero, the Federal Reserve would then commit to keep the nominal interest rate at zero until the price level reached a 2 percent trendline. This suggestion, of course, is just another way of saying that interest rate will be kept at zero, until inflation averages at the inflation target, where the relevant horizon for computing this average begins at the time at which interest rate drop to zero.

4. A simple analytic framework of a central bank with an asymmetric objective

Figure 5. A simple analytical model



Here we propose a simple analytic framework to think about the implications of an asymmetric policy objective. While this analysis may help some readers to interpret what follows, little is lost in the narrative by proceeding directly to the next section. The most important bottom line is that an asymmetric objective gives rise to an inflationary bias through multiple mechanisms.

Figure 5 shows the main elements of the framework, relegating details to Appendix 1.⁸ There are two major assumptions of the model shown in Figure 5:

1. Policy (i_p) works with a lag. Hence while the policy is chosen at some time p , its effects on inflation (π) and employment (l) are only observed later. This means that the Federal Reserve needs to form expectations—or projections—of all the key variables that affect its policy objectives; these projected variables are blue in Figure 5, i.e., the maximum rate of employment (l^*), demand (d), and a cost-push shocks (μ).
2. Policy institutions regularly simulate macroeconomic models assuming, for simplicity, a quadratic penalty on deviations of inflation from target and employment from its maximum with some weight λ determining the relative importance of the two. A simple interpretation of the 2020 Policy Framework is that the Federal Reserve puts a higher weight on employment being below maximum employment via the coefficient λ_- than if employment is above it λ_+ . A literal reading of the framework is $\lambda_+ = 0$. But all that is required is that $\lambda_- > \lambda_+$. We assume that—as observed in the data—expectations are well anchored, i.e., $\pi^e = \pi^*$.

A key result is that an asymmetric policy objective naturally gives rise to an expansionary bias. The main reason is that a policy that is systematically more expansionary decreases the probability of "shortfalls of employment." This also generates—on average—an inflation bias. The extent to which inflation is higher depends on the slope of the Phillips curve (κ). If the Phillips curve is very flat, the implication of this bias may be quantitatively trivial while at the same time the employment gains substantive. A key assumption underlying this result is that the central bank takes expectations as given, i.e., it maximizes policy under discretion. An inflationary bias does not arise if instead we assume a policy framework which arguably corresponds to the 2012 one where $\lambda_+ = \lambda_-$. Hence what we document here is a new source of inflation bias that is less well understood than the traditional one emphasized in the literature, which occurs if the central bank aims for employment above its maximum level.

It is not obvious what effect this bias has on how well inflation expectations are anchored in practice. If the ELB gives rise to a deflationary bias, as was a topic of concern leading up the 2020 Policy Framework, the inflationary bias of an asymmetric objective could simply cancel it out.⁹

- ...
8. Here l is employment, l^* max employment, π inflation, π^* inflation target, π^e expected inflation, κ slope of PC, χ interest rate elasticity, i_p is the monetary stance determined at time p , μ cost push shock, d demand shock, μ trade-off shock and E_p is expectation at the time policy is determined.
 9. Indeed, that result was shown to policymakers in optimal control simulations in 2016. One example included a policy objective that assigned no weight to losses to unemployment outcomes below the estimated natural rate.

The Simple Analytic Framework implies a simple formula for possible sources of inflation overshooting its target that are independent of the traditional inflation bias.¹⁰ These different forces are illustrated in Figure 5, which also show the relevant subsection where these forces are discussed in the paper.

It is possible that an asymmetric objective may also create a bias by changing the prism through which policymakers weigh incoming data, i.e., generate a perception bias. A highly stylized illustrative example of how this could happen is given in Appendix 2. We include this in the Appendix as food for thought, as we suspect it might be worth further study.

5. The impact of the 2020 Policy Framework on FOMC forward guidance

Following the introduction of its 2020 Policy Framework, the Federal Reserve issued forward guidance both about its interest rate policy and its asset purchases. These interacted because the criteria for stopping purchases needed to be met before the criteria for rate lift off and because the FOMC viewed completing asset purchases as necessary before raising rates. Moreover, the Federal Reserve committed itself to announce well in advance when it would slow down asset purchases.

As we discuss, the guidance was presented as the implementation of the framework. However, while it was consistent with the framework, it went beyond what the framework required in setting criteria for tapering asset purchases and lifting off interest rates—that is, kept policy more accommodative for longer.

5.1 Forward guidance for interest rates

The 2020 Framework was announced on August 27, 2020. It had an immediate effect on the next policy statement of the FOMC issued on September 16, 2020:

The first major policy change relative to last FOMC statement prior to the announcement of the 2020 Policy Framework (i.e., the July 29, 2020 statement) was a new paragraph which we split into two. The first part of the paragraph reads:

The Committee seeks to achieve maximum employment and inflation at the rate of 2 percent over the longer run. With inflation running persistently below this longer-run goal, the Committee will aim to achieve inflation moderately above 2 percent for some time so that inflation averages 2 percent over time and longer-term inflation expectations remain well anchored at 2 percent. The Committee expects to maintain an accommodative stance of monetary policy until these outcomes are achieved.

In this part of the paragraph the FOMC is communicating that it will implement the FAIT aspect of the 2020 Policy Framework. The second half of the paragraph will have an even greater effect on policy in the period ahead:

The Committee decided to keep the target range for the federal funds rate at 0 to 1/4 percent and expects it will be appropriate to maintain this target range until labor market conditions have reached levels consistent with the Committee's assessments

...
10. The inflationary bias of discretionary policy can be mitigated, for example, if the central bank commits itself to a policy rule or maximizes under full commitment.

of maximum employment and inflation has risen to 2 percent and is on track to moderately exceed 2 percent for some time. [emphasis added]

Critically, rates would be kept at zero until both conditions were met—inflation at or above 2 percent and full employment reached. Neither inflation at 2 percent and headed higher by itself nor a labor market reaching maximum employment alone was sufficient to warrant an increase in the policy rate. FOMC seem to believe that this forward guidance was a natural implementation of the 2020 Policy Framework.

To put this language in context, it is useful to consider Chair Powell's explanation of it in [testimony to Congress in February 2021](#), where he states: "We have implemented our new framework by forcefully deploying our policy tools." That both conditions needed to be met is also emphasized [by Vice Chair Richard Clarida in the fall of 2020](#). What seems clear from the context of Clarida's speech is that this "forceful" implementation appears tailored to avoid the 2015-2019 mistake.¹¹

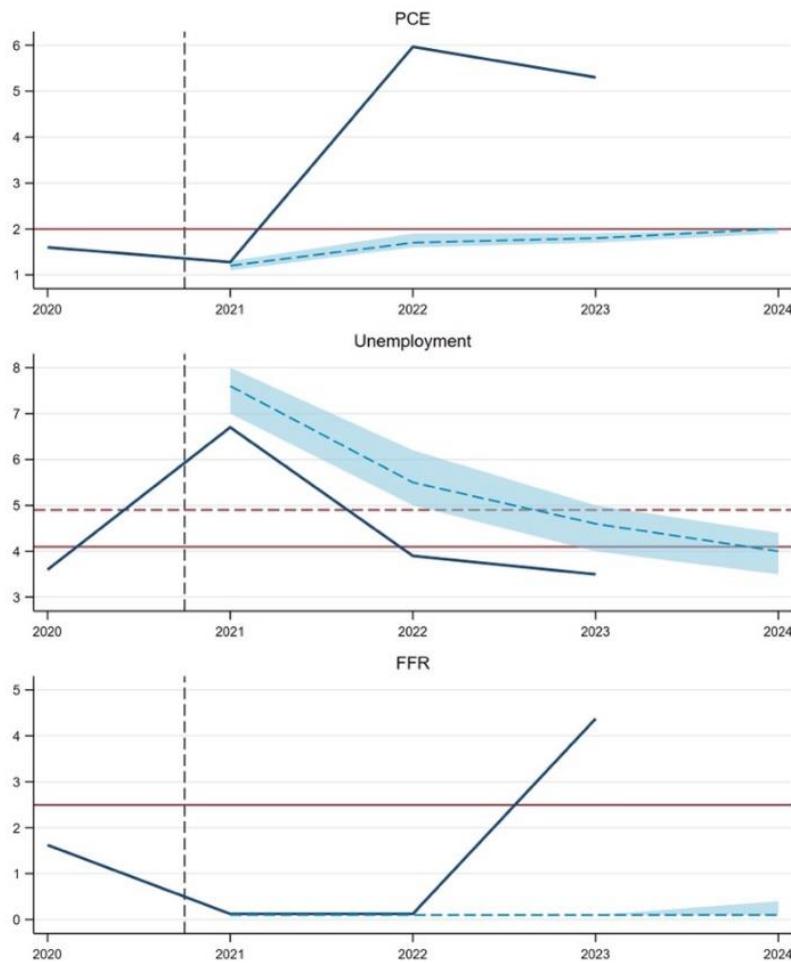
In addition, in this first FOMC statement after the new framework was adapted, the following sentence from the July statement was eliminated:

~~In determining the timing and size of future adjustments to the stance of monetary policy, the Committee will assess realized and expected economic conditions relative to its maximum employment objective and its symmetric 2 percent inflation objective.~~

Eliminating this sentence was consistent with moving to a one-sided response to employment misses relative to estimated potential. And it also removed the reference to "expected" conditions; the FOMC would not adjust policy to a forecast of, say, inflation over 2 percent that might be expected from an excessively tight labor market. Instead, it would hold rates at zero until full employment was achieved and inflation was already at 2 and about to go over. This, too, appears to be tailored to avoid the mistake in 2015-19 when policy was tightened based upon forecasts that inflation would start picking up as unemployment moved below FOMC participants' estimate of the natural rate—4.9 percent.

...
11. Clarida states "when in a business cycle expansion labor market indicators return to a range that, in the Committee's judgment, is broadly consistent with its maximum-employment mandate, it will be data on inflation itself that policy will react to, but going forward, policy will not tighten solely because the unemployment rate has fallen below any particular econometric estimate of its long-run natural level." Thus, the FOMC forward guidance seems to have been tailored to avoid the preemptive tightening in 2015-19 when the labor market appeared to be tight while inflation was still running low.

Figure 6. Summary of Economic Projections from the September 2020 FOMC Meeting



Note: The dashed light blue line shows the median SEP forecast, the blue shaded area shows the forecast central tendency, and the solid dark blue line shows the actual evolution of the economy. Horizontal red lines show the long-run values expected by the FOMC. The dashed horizontal red line in the unemployment panel shows the estimated NAIRU from 2015. Source: Federal Reserve Board of Governors, Federal Reserve Bank of New York, BEA, BLS

The projections of FOMC participants at the September 2020 meeting, shown in Figure 6, reflected the experience of 2015-19. They show the unemployment rate gradually falling, reaching their estimate of the natural unemployment rate at the end of 2024. Inflation would pick up in 2022 but then rise very gradually until hitting the target in 2024. The gradual rise in inflation was thought to be consistent with holding the target federal funds rate at zero over the whole period. It was consistent with the forward guidance and expectation that holding rates at zero until full employment would likely be consistent with maybe a small, desirable overshooting of inflation in 2025, assuming the Phillips curve to be as flat as it seemed in the earlier period. Unlike the 2015-19 period, the FOMC would not tighten to preempt a rise in inflation beyond the target as the unemployment rate fell through the estimated natural rate.

Unfortunately, the guidance was not appropriate for the situation the FOMC ended up facing, with inflation surging beyond the 2 percent target while many measures of labor markets suggested

employment had not reached its maximum. This paragraph of the statement implied that the FOMC would tolerate any level of inflation without acting if employment had not reached maximum. Moreover, the effects of COVID disruptions on labor markets greatly complicated reading the labor market and assessing maximum employment.

FOMC statements are typically unanimous. But this one was an exception. On the one hand, [Neel Kashkari](#) of the Minneapolis Fed dissented on the dovish side, arguing that the Fed should say that it expected to keep rates at zero “until core inflation has reached 2 percent on a sustained basis.” [Robert S. Kaplan](#) of the Dallas Fed, on the hawkish side, turned out to be prescient.

While Kaplan said he expected the current target rate was appropriate until the economy had weathered recent events and was *on track* to achieve maximum employment and price stability, according to the FOMC statement, he preferred “that the Committee retain greater policy flexibility beyond that point.”

5.2 The escape clause

The September forward guidance emphasizes that inflation needed to be at least on its way to exceeding its target and employment reached its maximum. In isolation, this may seem to suggest that the FOMC was committing itself to tolerate any degree of inflation until maximum employment was reached. The statement, however, in the last substantive paragraph, includes an “escape clause” which modifies the comparable paragraph from the July statement.

In assessing the appropriate stance of monetary policy, the Committee will continue to monitor the implications of incoming information for the economic outlook including information related to public health, as well as global developments and muted inflation pressures, and will use its tools and act as appropriate to support the economy. In determining the timing and size of future adjustments to the stance of monetary policy, the Committee will assess realized and expected economic conditions relative to its maximum employment objective and its symmetric 2 percent inflation objective. This **The Committee would be prepared to adjust the stance of monetary policy as appropriate if risks emerge that could impede the attainment of the Committee's goals. The Committee's assessments will take into account a wide range of information, including readings on public health, measures of labor market conditions, indicators of inflation pressures and inflation expectations, and readings on financial and international developments.**

The language here does seem to provide the FOMC some flexibility to adjust policy relative to the forceful forward guidance during the inflation surge. As we will see, however, the FOMC did not try to use this escape clause but instead appears to have viewed its commitment to attain maximum employment as binding. The forward guidance committing to reaching both maximum employment and inflation above target would remain in place until December 2021. At that point, however, the FOMC did not activate its escape clause, even if inflation was running far above its target. Instead, it reiterated its commitment to keep interest rates at zero until maximum employment was reached.

5.3 Forward guidance and asset purchases

The Federal Reserve decided to tie its hands further at the [December meeting](#). At that time forward guidance was extended to the pace of asset purchases.

In addition, the Federal Reserve will continue to increase its holdings of Treasury securities by at least \$80 billion per month and of agency mortgage-backed securities by at least \$40 billion per month until substantial further progress has been made toward the Committee's maximum employment and price stability goals. These asset purchases help foster smooth market functioning and accommodative financial conditions, thereby supporting the flow of credit to households and businesses.

Winding down asset purchases (tapering) would require “substantial further progress” toward its goals. The FOMC and its chair emphasized that the Committee would give plenty of warning before tapering. Tapering would precede lift off, and, indeed, lift off would not occur until tapering was complete—that is, the Federal Reserve was no longer buying securities.

On the warning before lift off, Chairman Powell answered a question about that at [the June 2021 press conference](#): “Our intention for this process is that it will be orderly, methodical, and transparent. And I can just tell you we ... see real value in communicating well in advance what our thinking is. And we'll try to be clear. And, as I mentioned, we'll ... give advance notice before announcing a decision to taper. And so all I can say is that we ... think it's important—we think where the balance sheet's concerned, a lot of notice, as much transparency as we can give, and as far ... in advance as we can to give people a chance to adjust their expectations.”

As tapering was approaching in fall 2021 and then started in December, Chairman Powell in his press conferences took pains to emphasize that the criteria for lift off were more stringent than for tapering. He noted that the projections of FOMC participants had very little in the way of rate increases in 2022, even though by November 2021 the Committee had warned that tapering would occur soon.

And he was clear that lift off would not occur until the FOMC stopped buying bonds. [At the December press conference](#) Chairman Powell was asked if he would not raise rates until the Fed had stopped asset purchases. Powell responded: “Yes. The sense of that, of course, being that buying assets is adding accommodation and raising rates is removing accommodation. Since we're two meetings away from completing the taper, assuming things go as expected, I think if we wanted to lift off before then ... you would stop the taper potentially sooner. But it's not something I expect to happen. But I do ... not think it would be appropriate, and we ... don't find ourselves in a situation where we ... might have to raise rates while we're still purchasing assets.”

The bottom line is that the forward guidance growing out of the 2020 Policy Framework involving asset purchases introduced additional inertia to the policy process. It did so by pre-committing to give plenty of warning before tapering of asset purchases and delaying lift off until tapering was completed. The FOMC thus tied its hands in two ways when it came to raising rates. This made the guidance more effective at keeping rate expectations very low, promoting financial conditions that helped to spur the rapid rebound in the economy. But it also made it difficult to adapt to changing circumstances to deal with unexpectedly strong demand and high inflation in a timely way.

In retrospect, it is unclear why the FOMC saw the need to tie interest rate policy so closely to asset purchases. There is nothing in the 2020 Policy Framework which requires these two policies to be so closely tied together, and in principle there was nothing preventing the Federal Reserve from increasing rates while continuing gradual tapering.

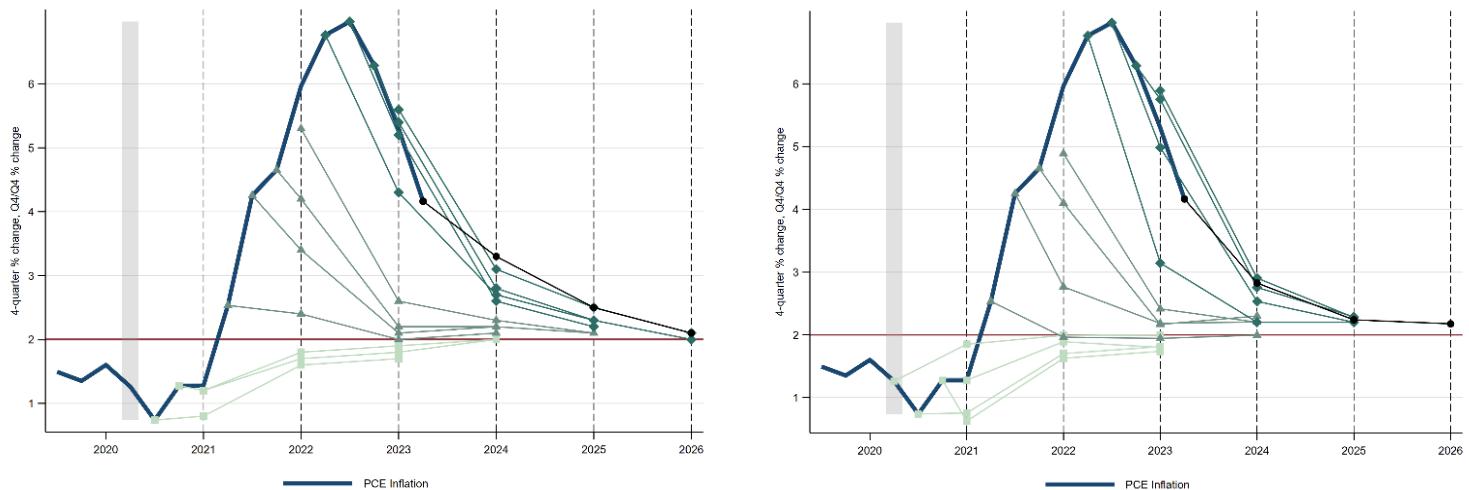
However, the power of asset purchases as a monetary policy tool to reduce longer-term interest rates—rather than to bolster market functioning—should come primarily from the expectations of market participants about the total size of the purchases. That's fixed once the taper has been announced.

Tapering, rather than an abrupt end to purchases, is to protect market functioning and, in theory, need not conclude before rates are raised.

6. The unexpected increase in inflation in 2021 and the policy response

As we noted at the beginning of this paper, the past few years have been marked by unique circumstances that greatly complicated forecasting and policymaking. This made inflation exceptionally difficult to forecast, it complicated the assessment of labor market conditions, and it may have affected the interaction of labor and product markets with inflation. A key conclusion we arrive at in the narrative in this section is that the labor market was significantly tighter by mid-2021 than was generally recognized by the Federal Reserve (and many other forecasters) due to the uneven recovery from the pandemic and its effects on labor force participation and job matching. And the constraints on labor supply were met on the demand side by a very strong rebound as the economy reopened and monetary and fiscal policies provided nearly unprecedented stimulus.

Figures 7 & 8. PCE inflation versus projections from the Summary of Economic Projections (left) and the Survey of Professional Forecasters (right)



Note: The solid blue line shows quarterly YoY PCE Inflation. The colored, connected dots show Q4/Q4 forecasts of PCE inflation from the SEP and SPF. Forecasts issued before Q4 are connected to the originating quarter PCE value. Color and dot style are the same for all forecasts made within a given year. Source: Federal Reserve Board of Governors, Federal Reserve Bank of Philadelphia

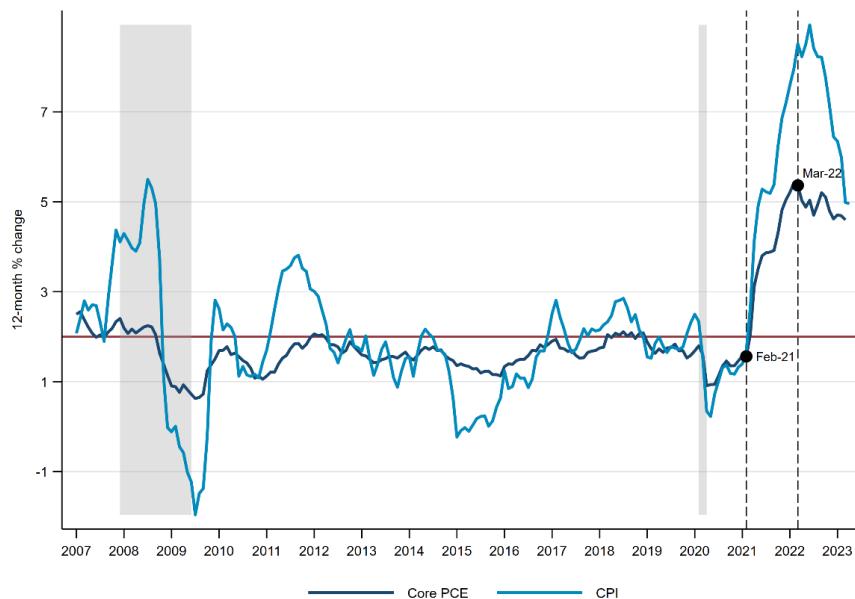
The recovery from the pandemic was fundamentally different from the recovery from the financial crisis of 2008. While employment reached its estimated maximum level before inflation reached its target after the financial crisis, it was exactly the other way around during the recovery from the pandemic. Now inflation surged past its target while policymakers assessed that employment was still weak. As we have stressed, the problem that emerged was that, while forward guidance in September 2020 was well designed to avoid a repeat of a preemptive tightening after 2015 when there was high employment but low inflation, it was less well-suited for a situation in which it was the other way around.

Policymakers faced several related and interacting factors in gauging the likely level and persistence of inflation:

- i) Whether the causes were a temporary response to COVID-related distortions to supply and demand that would go away as economic activity returned to normal
- ii) How tight the labor market was
- iii) How much inflation would a tight labor market produce

The inflation surge that emerged in 2021 was unexpected, and higher and more persistent once it started than the Federal Reserve and most private forecasters anticipated. We can see this in Figures 7 and 8. The PCE price index, the one that the Fed states as its target, is shown with a blue line. The thin colored connected dots show the median inflation forecast of FOMC participants (Figure 7) and the median inflation forecast of the respondents in the Survey of Professional Forecasters published by the Federal Reserve Bank of Philadelphia (Figure 8). The projections leading up to the surge, which starts approximately in Q1 of 2021, show that the surge in inflation was completely unanticipated. Once the surge got going, however, we see another pattern: Policymakers and the professional forecasters persistently predicted inflation to fall back toward the 2 percent target reasonably promptly.¹² The surge was therefore both unexpected and underestimated once it took off.

Figure 9. Core PCE and overall CPI



Note: Shaded areas indicate U.S. recessions. The horizontal red line shows the 2 percent target. Source: BEA, BLS

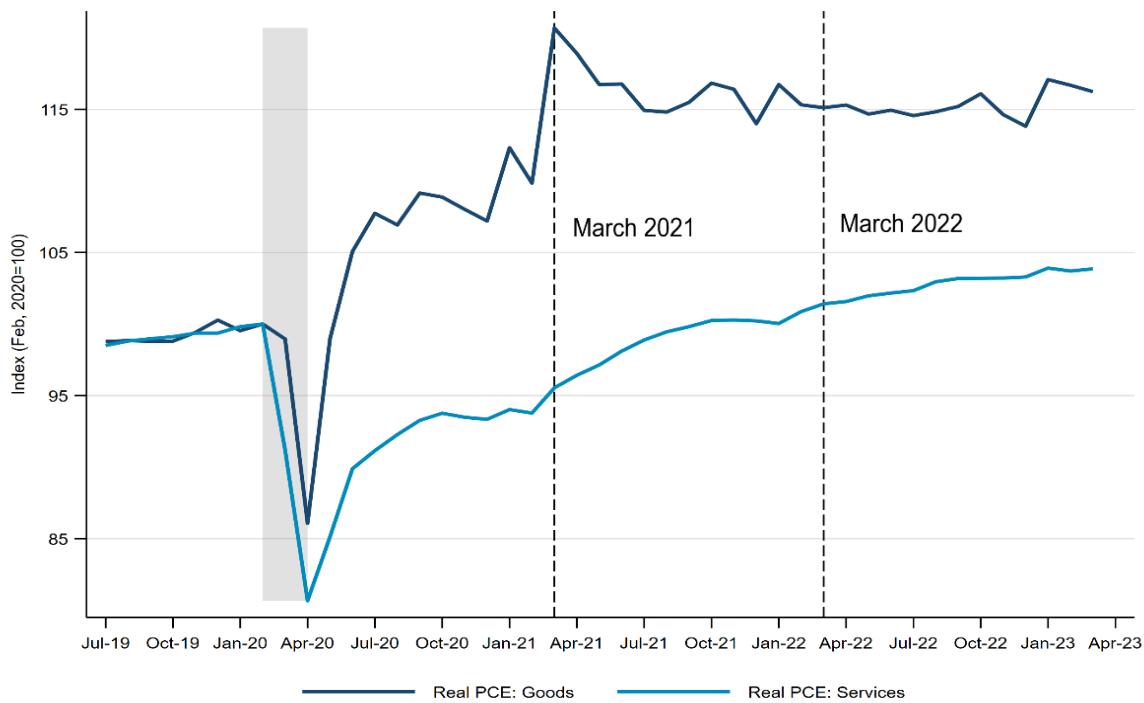
Figure 9 takes a broader perspective. It shows inflation as measured by monthly year-on-year percentage changes in the Consumer Price Index (CPI) and contrasts it with core PCE. Core PCE strips out the two most volatile components of inflation, namely food and energy prices. Measured relative to its

...
12. As late as the fourth quarter of 2021, the median forecasters—both FOMC and private sector—were expecting headline PCE inflation to drop back from around 5 percent in 2021 to the neighborhood of 2-1/2 percent in 2022, and core to fall from 4 to 4-1/2 to a range around 2-1/2 percent. It wasn't until March of 2022 that the Fed forecasters saw inflation moving up to over 4 percent in 2022, while earlier in the quarter private forecasters still had inflation dropping to 3 percent in 2022.

level a year ago, core PCE increases from 1.6 percent in February 2021 to over three percent a few months later, to 5.4 percent in March 2022. The overall CPI increases from 1.7 percent in February 2021 and peaks at 8.9 percent in June 2022.¹³

Arguably, sometime in the spring of 2021 the FAIT piece of the new framework had been satisfied. Inflation had averaged at the 2 percent target since the ELB had been hit in March 2020 (the Bernanke criterion) and each passing month made up for more of the previous undershoots of the target. Measures of long-term inflation expectations rose, reversing their decline of the year or so before the pandemic.

Figure 10. Evolution of goods expenditures relative to service expenditures



Note: Shaded areas indicate U.S. recessions. Source: BEA

Yet there were good reasons to doubt that the inflation pressures would persist.¹⁴ Much of the uptick was centered on a few categories of goods. Demand for goods had surged in the pandemic as people drew back from many services that required personal contact and found their incomes bolstered by several fiscal policy packages, as was illustrated in Figure 3. At the same time the ability of businesses to expand production was constrained by COVID-related disruptions to supply chains and by constraints on labor market participation as schools and childcare opened slowly and as older workers retired early. As these supply-side constraints eased and demand shifted back toward services, inflation might revert to the low level seen pre-pandemic.

13. Part of the reason for the discrepancy between the peak in CPI and core-PCE is that oil prices continued to increase after the March decision with one possible explanation being the Russian invasion into Ukraine starting at the end of February, which influenced the volatility of both oil and food prices.

14. The case for inflation being “transitory” was most clearly laid out by Chair Powell in [his speech at Jackson Hole in late August 2021](#).

Figure 11. “Super-Core” CPI which excludes shelter, food, energy and used cars.



Source: BLS (CUSR0000SA0L12E4)

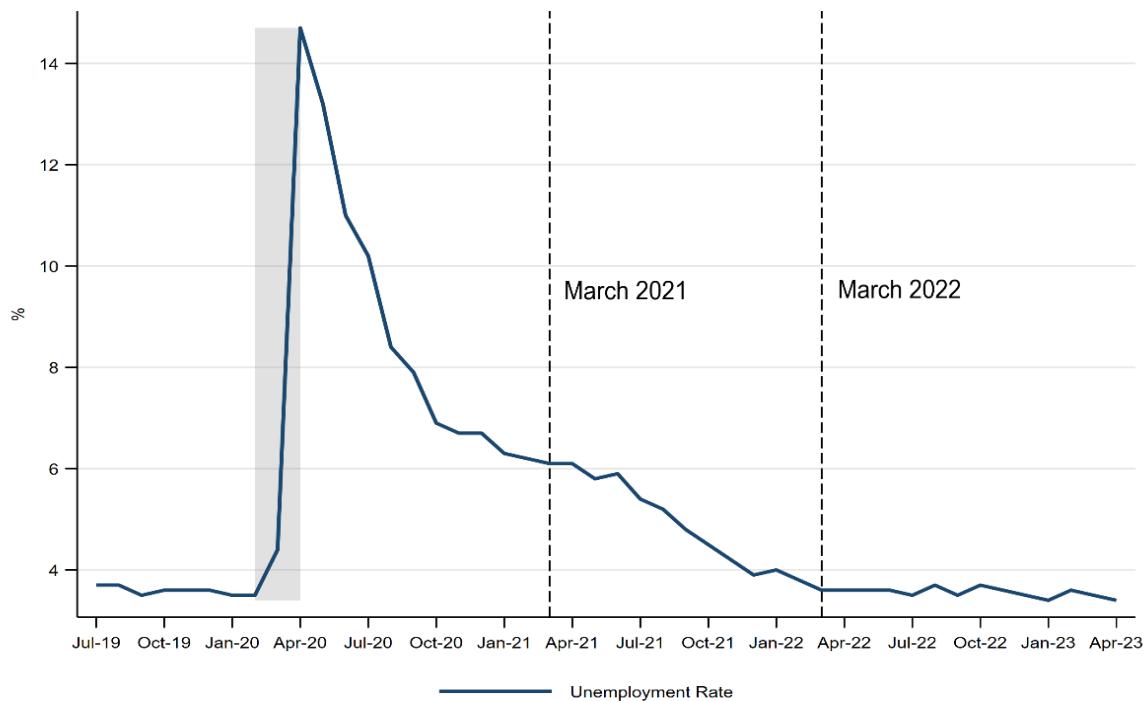
Indeed, several measures of inflation did drop down over the summer. During the inflation surge, both Federal Reserve officials and economists started paying closer attention to various trimmed versions of core inflation. Figure 11 shows one, a “Super-Core measure.” It shows CPI excluding shelter, food, energy, and used cars. Instead of reporting year-on-year inflation, Figure 11 reports inflation during the three previous months annualized. As the figure highlights, there is a surge in Super-Core inflation in the spring, perhaps reflecting in part demand growing from the March 2021 fiscal package. By mid-summer, however, it appears to have peaked. This led many, heading into the fall, to conclude the surge had been temporary. But as “Super-Core” and other measures started trending upward from September 2021 onwards, it was becoming increasingly clear, at least in retrospect, that the inflation surge was broad based and persistent.

FOMC participants did revise their inflation projections higher between September and December, initiated a tapering of their purchases of securities, and began to contemplate raising interest rates in 2022. But, under framework-derived forward guidance, higher inflation was necessary, but not sufficient, to motivate an actual lift off. That required already achieving their maximum employment objective, regardless of the rate of inflation. That raised the challenge of judging the capacity of the labor market and when it had reached maximum employment.

Early recognition of when labor markets reach capacity was especially important because, under the new framework, policy would not attempt to preempt inflation by tightening in expectation of future pressures on labor markets. Reflecting this, the forward guidance on policy had been revised in

September 2020 to delete an earlier reference to expected conditions.¹⁵ Given the lags in the effects of monetary policy, earlier recognition should lead to reduced overshooting. Below we examine the signals from number of labor market indicators over 2021.

Figure 12. Unemployment



Note: Shaded areas indicate U.S. recessions. Source: BLS

6.1 Did the Federal Reserve overestimate the maximum level of employment?

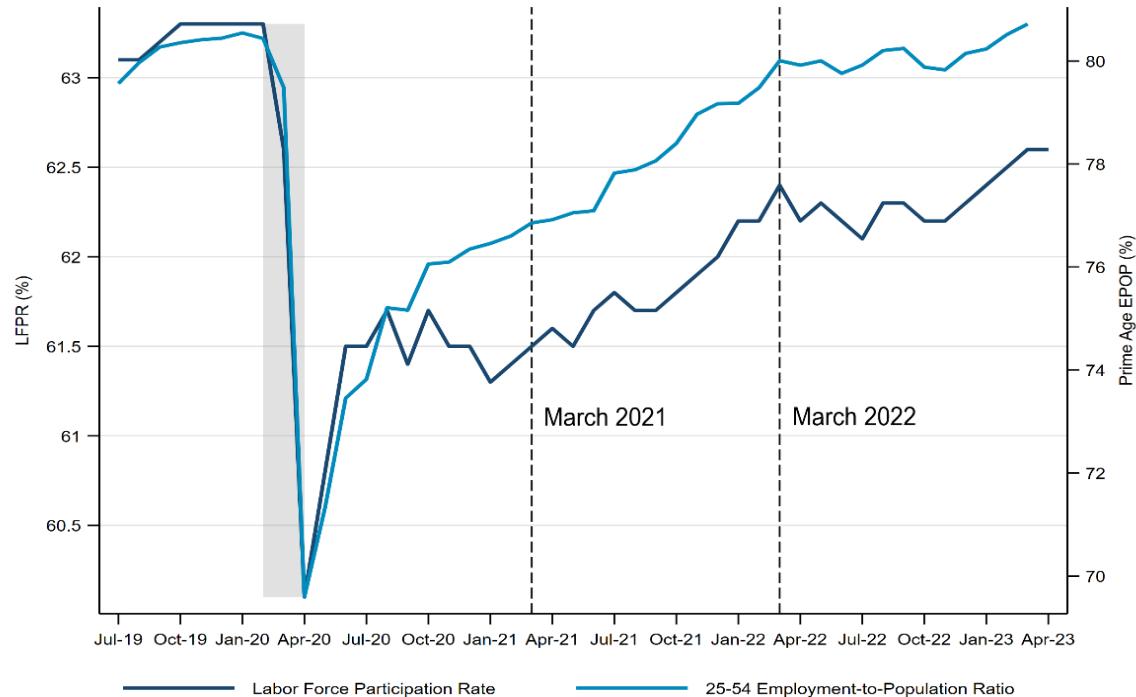
A possible source of the inflation surge is if the Federal Reserve overestimated the maximum level of employment, and hence underestimated the pressures on labor markets and costs from a given level of employment (see Figure 5 in Section 4 above where the analytic framework is discussed). How the Federal Reserve was thinking about maximum sustainable employment during the time frame March 2021 to March 2022 is the focus of this subsection. This time window is not coincidental. By some metrics the inflation objectives of FAIT had been reached in the spring of 2021. That interest rates were not raised until March of 2022 was partly based on the belief that inflation would fall back to 2 percent without requiring a sharp increase in the federal funds rate. The most important basis of this belief was the FOMC judgement about the state of the labor market. And misjudgments about the latter would lead to misjudgments about the former.

Consider now the unemployment picture during the start of the inflation surge and the period leading up to the Federal Reserve raising rates. At the height of the pandemic, unemployment peaked at 14.7 percent in April 2020 on account of various shut-down and travel bans. By March 2021, however, unemployment was down to 6.1 percent, still well above the 4 percent FOMC participants saw as the

15. The “escape clause” paragraph did reference the “economic outlook,” but the paragraph was separate from the forward guidance, and, as we discussed, it did not seem to have had any effect on policy.

longer-run level consistent with price stability. Indeed, it was only when unemployment fell to 3.6 percent in March 2022 that the Federal Reserve finally raised rates.

Figure 13. Total labor force participation and prime age employment to population ratio



Note: Shaded areas indicate U.S. recessions. Source: BLS

Policy had tightened in 2015 based on an unemployment rate that turned out to underestimate the capacity of the labor market to operate without inflation pressures. The 2020 Framework eliminated the direct reference to the unemployment rate in the 2012 Framework and defined maximum employment as “a broad-based and inclusive goal.”

The standard U3 measure of the unemployment rate only includes the people that have decided to join the workforce but have not found a job. It does not include those that may stay home for one reason or another. This is one reason why the Federal Reserve started increasingly looking at several measures such as the labor force participation rate, which is shown by dark blue line in Figure 13. Judging from total labor force participation, the labor market also showed few signs of being tight. On the eve of the pandemic, labor force participation was 63.3 percent and had only recovered to 61.5 percent in March 2021. At the time the Fed started tightening, labor force participation was still more than a percentage point lower than prior to the pandemic.

That lower participation rate partly reflected early retirements. One metric that does not suffer issues related to age composition is the prime-age employment-to-population ratio. Moreover, unlike the unemployment rate, it would not count as “good news” if somebody simply exits the labor force (which reduces measured unemployment). Chair Powell has suggested this metric as a good alternative to

unemployment to estimate maximum employment.¹⁶ The prime-age employment-to-population ratio, shown in the by the light blue in Figure 13, also indicates slack in the labor market in March 2021 at 76.9 percent relative to 80.5 percent prior to the pandemic. By the time of the increase in interest rates in March 2022, the prime-age employment-to-population ratio had almost fully recovered to 80 percent.

So it is not hard to see how labor force participation and the unemployment rate painted a picture of a labor market shortfall in the spring and summer of 2021 with little reason for believing that the labor market was a source of inflation pressure.

Other indicators were flashing yellow beginning in the spring, however. In particular, businesses were complaining about the difficulty of finding workers, “now hiring” signs were everywhere, and this firm perspective was increasingly evident in the number of vacancies they were posting.

There is a long tradition in labor economics, dating back to Beveridge (1944), that emphasizes a measure of labor market tightness that takes account of the labor market not only by focusing on it from the perspective of workers (number of unemployed) but also from the perspective of firms attempting to hire people. This can be done, for example, by computing the *ratio* of the number of jobs firms are trying to fill, i.e., firms’ *vacancies*, relative to the number of workers trying to find jobs. We denote this ratio by v/u . The higher this number, the tighter is the labor market and more likely to generate inflationary pressure.

The literature that built on Beveridge’s work defined full, or maximum, employment as when $v/u=1$.¹⁷ More recent literature, see, e.g., Benigno and Eggertsson (2003), labels regimes of *labor shortage*—which trigger non-linearities in a Phillips curve in their model, an issue we come back to—as periods when the number of vacancies exceed those of the number of unemployed workers, i.e., $v/u>1$. Episodes during which v/u is above 1 are rare in U.S. data. Outside of the COVID-19 episode, they have largely been confined to wartimes, when potential workers have been absorbed into the armed services and there is run-up in military spending.¹⁸ These episodes of $v/u>1$ were also associated with inflation surges. If we consider the period from 1993–2008, a period often associated with the “Great Moderation,” when inflation stayed relatively close to the 2 percent target, we find that average v/u is 0.63. This seems like a reasonable, if crude, benchmark for when conditions in the labor market are neither inflationary nor deflationary on average. Recently, several authors have found that v/u is more helpful to describe inflation and wage dynamics; recent example includes Bernanke and Blanchard (2023).

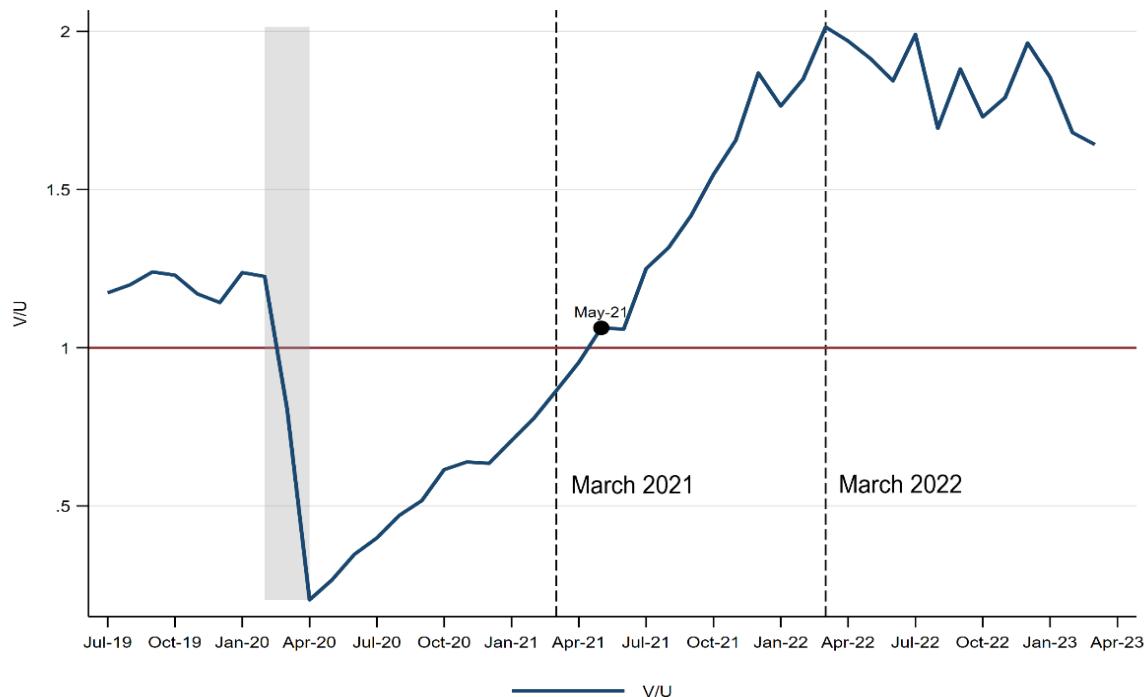
Figure 14 shows v/u since the onset of the pandemic. As the figure shows, shortly before the pandemic, v/u was already very high, climbing up on the heels of the Fed’s interest rate cuts in mid-2019 aimed at increasing inflation to their target. This tightness is also consistent with readings from the unemployment rate at that time, which was at historic lows at 3.5 percent.

16. Board of Governors of the Federal Reserve System. “Speech by Chair Powell on Getting Back to a Strong Labor Market.” February 10, 2021. https://www.federalreserve.gov/news_events/speech/powell20210210a.htm.

17. See Rees (1957).

18. v/u measures above 1 in WW1, WW2, the Korean War, and the late 1960s in the runup of the Vietnam War. See Benigno and Eggertsson (2023) for full time series.

Figure 14. Measure of labor tightness as the ratio of the number of jobs firm seek to fill (vacancies) relative to the number of unemployed workers seeking jobs



Note: Shaded areas indicate U.S. recessions. Source: BLS

The key observation, however, is that v/u paints a very different picture of the state of the labor market during the critical period of March 2021 to March 2022 than the unemployment rate or the prime age employment to population ratio. Instead, we see in Figure 14 that in March 2021 $v/u = 0.88$ —well above the Great Moderation average, crossing into territory of *labor shortage*, i.e., $v/u > 1$ in May 2021. By the time the Federal Reserve started raising rates, v/u had surpassed 2. This is the highest level of v/u since WWII, when the government resorted to price controls to contain inflation. As of April 2023, v/u is still quite elevated at 1.66—more than two times higher than the average during the Great Moderation Period.¹⁹

Why does the v/u metric paint such a different picture than the other two measures of labor market tightness? At a broad level, the reason is that the pandemic changed the labor market in fundamental ways, such as triggering early retirement and raising people's reservation wages. In addition, changes in spending patterns also implied that the nature of available jobs also changed. One possible explanation for the deviation of v/u relative to the other indicators, for example, is that the type of workers which firms needed during this period did not correspond to the set of skills of the existing workforce. This may happen, for example, if the mix of what people purchase changes in a short period of time, requiring large relocation of workers across sectors or regions. One indication of a development of this kind following the pandemic is that the increase in spending of goods relative to services changed substantially during the pandemic as we noted earlier and illustrated in Figure 10. The change in composition of people's spending

19. During the Great Moderation there were only a period of 3 months in which v/u crosses 1 which are the months that immediately precede the dot-com crash in March 2000. Latest reading for April retrieved on June 5 at: <https://www.bls.gov/charts/job-openings-and-labor-turnover/unemp-per-job-opening.htm>

patterns has persisted to a substantial extent to this day.²⁰ Under the assumption that people that used to work in one sector have different sets of skills and experiences relative to those that firms want to hire in another sector, this will naturally lead to tightness in the labor market in a way that is imperfectly reflected by the unemployment rate.

Although the Federal Reserve was looking at “broad-based and inclusive” indicators of labor market tightness, they were perhaps not broad-based enough. Moreover, the asymmetries of the 2020 Framework may also have influenced how they were weighting the indicators they did have. It is worth noting, however, that there were voices within the Federal Reserve that were stressing as early as May 2021, 10 months before the tightening cycle began, that the labor market was much tighter than indicated by traditional metrics. Robert Kaplan of the Dallas Fed, who dissented when the September 2020 forward guidance was formulated, [warned in an article written with researchers at the Dallas Fed](#) that the labor market was tight, based among other things on v/u as well as several other indicators that pointed in the same direction. This warning, however, seemed to have little effect on the official narrative of the FOMC at the time.

In section 4 we suggested that one way in which the bias we show in our analytical framework may express itself is that with an asymmetric loss function, the FOMC will inevitably pay more attention to preventing employment shortfalls since the framework suggests that overshooting employment is of less concern. We show in Appendix 1B that this naturally gives rise to a systematic expansionary bias in policy.

Considering the asymmetric weights, a prudent decisionmaker might put less weight on less traditional metrics that suggested tightness, such as v/u . If such untraditional measures were sending a wrong signal, then the loss would be larger relative to traditionally prominent indicators, such as the unemployment rate, that suggest a weak labor market. Such a decisionmaker would be engaged in a form of risk management. We give a simple example for the logic of this in the footnote, and a mathematical formulation in Appendix 1.²¹ This kind of bias seems worthy of further research and consideration. This type of bias, of course, is particularly problematic when interacted with the decisionmaker not anticipating the possibility of a non-linear Phillips curve, since in this case the decisionmaker will not correctly perceive the cost of overshooting the employment objective.

6.2 The role of a non-linear Phillips curve

Waiting for full employment—even accurately gauged—then overshooting because of lags might be especially costly in terms of inflation if the Phillips curve is not flat and linear beyond full employment. In Appendix 3 we summarize some recent evidence in favor a non-linear Phillips curve based upon both recent and historical data.

If the Phillips curve is non-linear, and if the U.S. labor market was tight enough for those non-linearities to become quantitatively significant, it means the tightness of the labor market, as measured by v/u , not only gave the Federal Reserve a reason to declare it had satisfied the forward guidance of

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20. We normalize each index at 100 at the beginning of the pandemic. In the period 2009-2019, services account for 66 percent of personal consumption, and goods 34 percent. The spending in both categories collapses in March and April 2020. Spending on goods exceeded its pre-pandemic levels in real terms 3 months later in June 2020. In contrast it took services more than one and a half years to reach its pre-pandemic levels, i.e., only recovering in October 2021. If we consider the period March 2021-March 2022 the fraction spend on services is only 61 percent of personal expenditures compared to 66 percent in the decade 2009-2019. Even as this is written, the fraction of personal consumption spend on services is still only 62 percent.
 21. The intuition for this implication of asymmetric objective when there are incomplete indicators: Imagine preparing for a one-day walk. You have two weather forecasts: One predicts rain while the other predicts sun. In case of rain, the cost of not bringing a raincoat is large. In contrast, if sun, the cost of bringing a raincoat is small. In this case, as a decisionmaker, you would put a higher weight on the rain forecast and bring a raincoat, even if you thought the other forecast was more accurate.

September 2020—it also suggests that failing to recognize this tightness could have been an important source of the inflation surge.

6.3 The implication of the maximum employment assessment on the policy response to inflation

The Federal Reserve judgment about the maximum level of employment is critical for two reasons. First, with inflation running consistently above the 2 percent target, a judgment about maximum employment was required to begin winding down asset purchases and then raising interest rates. Second, overestimating maximum employment may have been an important contributor to the inflation surge if one assumes that the Phillips curve is non-linear and becomes steeper above maximum employment. Under those circumstances, the policy delay caused by the overestimation would add to the inflationary consequences of tying lift off to reaching full employment.

Before the lift off, [the FOMC said](#) it had to find “substantial further progress toward” its goal to begin to wind down its asset purchases. It did this in November, after seeing a 4.8 percent unemployment rate for September, getting much closer to its estimated 4 percent long-run value. v/u and similar metrics were quite elevated and still rising and reached a peak of 2 in March 2022. Strength in demand and in inflation in the fourth quarter added urgency to completing the taper to make way for raising rates, as had been promised. And the FOMC accelerated the taper in December.

The forward guidance FOMC issued in September 2020, as a forceful implementation of the 2020 Policy Framework, said that the necessary condition for a lift off was that both inflation should be rising above its target *and* employment should be at its maximum. This clause remained unchanged until December 15, 2021. At that time the FOMC was looking at numbers from November that year that indicated year-on-year core-PCE inflation of 4.8 percent. Meanwhile, as shown in Figure 11, the fall in “Super-Core” observed in the summer of 2021 had proved temporary. Elevated readings of the “Super-Core” suggested broad-based inflation pressures. The FOMC changed its September 2020 forward guidance on December 15, 2021, as follows:

~~The Committee... expects it will be appropriate to maintain this target range until labor market conditions have reached levels consistent with the Committee's assessments of maximum employment and inflation has risen to 2 percent and is on track to moderately exceed 2 percent for some time. In support of these goals, the Committee decided to keep the target range for the federal funds rate at 0 to 1/4 percent. With inflation having exceeded 2 percent for some time, the Committee expects it will be appropriate to maintain this target range until labor market conditions have reached levels consistent with the Committee's assessments of maximum employment.~~

Crucially for lift off, as late as December 2021 when the FOMC was looking at numbers for employment at 4.2 percent, prime-age employment ratio at 79.1—just shy of the pre-pandemic 80.5—and v/u at a then-post war record of 1.6, the FOMC still believed that its job on the employment front was not yet done. The maximum employment criteria had not been satisfied and the statement reiterates the FOMC’s intention to keep rates at zero until it judges that the economy is already producing at its potential.

6.4 The role of fiscal policy and other demand factors

While an overestimation of maximum employment is one possible inflation source, another one is that the Federal Reserve underestimated the strength of aggregate demand (see Figure 5). There have been several narratives that have pursued this line of reasoning. Famously, for example, [Lawrence Summers warned](#) in February 2021, the month before President Biden's American Rescue Plan was passed, that it would increase spending more than three times the size of the monthly output shortfall at the time the act was passed. Another related common line of reasoning in public discussion at the time was that during the pandemic households had accumulated large amounts of "excess" savings from the combined effects of the cutoff of spending as COVID set in and the very large fiscal supplements to income. This savings would be drawn down over time to support higher spending as the economy opened post-COVID. Prior to the passage to the ARP Act economists estimated excess savings to be on the order of \$1.6 trillion, and by fall estimates were on the order of \$2.3 trillion.²² Other economist stressed that when viewed in comparison to the estimated net worth of households, which is \$130 trillion, this increase in savings (representing an increase in net worth of about 1.2-1.8 percent) might not necessarily trigger much additional spending.²³

Monetary policy can in principle offset excess demand due to fiscal policy simply by raising rates. Since monetary policy operates with a lag, however, it would need to anticipate the surge in spending. The [minutes](#) from the FOMC meeting on March 16-17, 2021, do suggest that the size of the ARP came as a surprise to the Federal Reserve. The minutes state that "the size of the ARP enacted in March was considerably larger than what the staff had assumed in the January projection."²⁴ As we documented, the rise in measured real disposable income in Figure 3 is remarkable and unparalleled in historical context. While the Federal Reserve was caught by surprise by the size of the ARP, it did not seem to affect their outlook in a meaningful way or their underlying narrative of what was driving the inflation surge. The FOMC saw their conditional forward guidance as providing some automatic offset to excess demand as the conditions would be triggered earlier. However, as we've argued, holding rates at zero until full employment guarantees overshooting and doesn't protect against the inflationary effects of a demand shock.

6.5 The role temporary shocks and the Federal Reserve narrative for the inflation surge

At the beginning of the surge in inflation, the overarching narrative of the Federal Reserve was that it was due to temporary factors (see Figure 5). This was the key message of Chairman Powell in his annual Jackson Hole speech in the summer of 2021. He was no doubt influenced by the data underlying the Super-Core measure in Figure 11, which does seem to peak during the middle of the summer. Inflation rises above the 2 percent target in March 2021, and as these data become available the April statement describes them as transitory. The language is largely unchanged throughout the year. It is finally in

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22. For discussion of estimates prior to ARP, see for example <https://www.piie.com/blogs/realtim-economics/defense-concerns-over-19-trillion-relief-plan> By fall, estimates of excess savings by Wall Street economists and Board Staff members had increased to about 2.3-2.4 billion, see for example <https://www.chase.com/personal/investments/learning-and-insights/article/tmt-october-seven-twenty-one-daily> and <https://www.federalreserve.gov/econres/notes/feds-notes/excess-savings-during-the-covid-19-pandemic-20221021.html>
 23. See <https://libertystreeteconomics.newyorkfed.org/2021/04/excess-savings-are-not-excessive/> for discussion.
 24. See Minutes of the Federal Open Market committee, March 16-17, 2021. Retrieved on May 21, 2023 at: <https://www.federalreserve.gov/monetarypolicy/files/fomcminutes20210317.pdf>

December that the FOMC drops a reference to “transitory,” instead attributing the price pressures to COVID reopening issues as it had in November.

November 3, 2021

Inflation is elevated, largely reflecting transitory factors that are expected to be transitory.

Supply and demand imbalances related to the pandemic and the reopening of the economy have contributed to sizable price increases in some sectors.

December 15, 2021

~~Inflation is elevated, largely reflecting factors that are expected to be transitory.~~

~~Supply and demand imbalances related to the pandemic and the reopening of the economy contributed to sizable price increases in some sectors~~ **have continued to contribute to elevated levels of inflation.**

Not until March and lift off did the FOMC acknowledge broader inflation pressures.

March 16, 2022

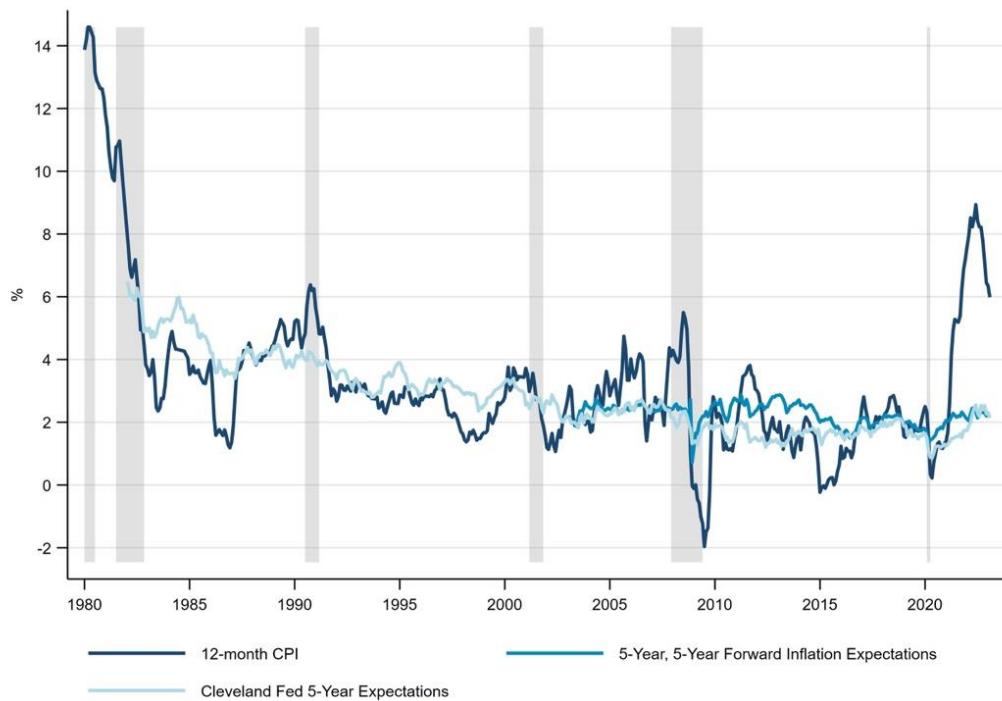
~~Supply and demand imbalances related to the pandemic and the reopening of the economy have continued to contribute to elevated levels of inflation.~~ **Inflation remains elevated, reflecting supply and demand imbalances related to the pandemic, higher energy prices, and broader price pressures.**

The invasion of Ukraine by Russia is causing tremendous human and economic hardship. The implications for the U.S. economy are highly uncertain, but in the near term the invasion and related events are likely to create additional upward pressure on inflation and weigh on economic activity.

In section 4 we raised the possibility that an asymmetric objective implies that a rational decisionmaker attributes higher weight to narratives that are less likely to trigger a recession than narratives that trigger sharp tightening, even if proven wrong. The long recognition lag, and the long time it took the Federal Reserve to acknowledge that inflation was in fact broad-based, seem consistent with this idea.

7. The stability of inflation expectations

Figure 15. Inflation and long-term inflation expectations



Note: Shaded areas indicate U.S. recessions. Source: BLS, Treasury, Federal Reserve Bank of St. Louis, Federal Reserve Bank of Cleveland

A remarkable feature of the inflation surge of the 2020s is how stable longer-term inflation expectations have remained. This is illustrated in Figure 15, which shows two measures of inflation expectations. The five-year, five-year forward is market-based. It reflects what markets expect the CPI inflation rate will be in a five year period starting five years from now, while the second is constructed by the [Federal Reserve Bank of Cleveland](#) and measures expectations of inflation over the next five years. Neither moved substantially during the surge. Any criticism of the policy framework must be tempered by the simple fact that, according to these measures, markets seemed to believe that the Federal Reserve would have both the will and the means to contain inflation.

There is a sense in which this success, however, may have reinforced the narrative that the surge was temporary. A conventional account of the Great Inflation of the 1970s is that it was triggered by the combination of negative supply shocks, coupled with expectations becoming unanchored. Most indicators suggest that long-term inflation expectations were moving along with actual inflation during this period. Clearly, this was not the case in the current inflation surge. The fact that inflation expectations did not move, coupled with the belief that Phillips curve was flat, may have strengthened the expectation that the surge was temporary and would resolve itself without substantial action by the Federal Reserve.

Clearly, inflation credibility cannot be taken for granted—and the Federal Reserve raised interest rates sharply once it recognized that labor markets were too tight to be consistent with stable inflation and that a good portion of excess inflation would persist absent aggressive policy action. Its actions, along with its announced determination to return inflation to target, have kept longer-term expectations anchored

through the inflation surge. Going forward, the Fed needs to assess whether the various inflation biases built into the 2020 Framework are simply offsetting the disinflationary bias of occasionally hitting the ELB or whether these biases imply more persistent inflation in excess of 2 percent that risks an upward drift in longer-term expectations.

8. Lessons learned

Our examination of the interaction of monetary policy choices with the inflation surge of 2021-2022 has centered on the role of the 2020 Framework and the forward guidance growing out of it in shaping the FOMC's policy choices as high inflation was settling in. We believe that these factors delayed the FOMC's response to the emerging threat to its price stability mandate. We acknowledge that the delay was not long, given the information available to the policymakers, and that the FOMC made up for this delay by accelerating the subsequent tightening of policy once it realized it had misjudged the situation.

Importantly, and this also reflects the hard-earned credibility of the Fed as well as the communication skills of its leadership, long-term inflation expectations remained anchored around the Fed's target of 2 percent. This is in sharp contrast to the Great Inflation of the 1970s when inflation expectations became unanchored. Yet, the delay incurred costs. By delaying the rebalancing of supply and demand it may have contributed to the inflation surge, forced a more abrupt tightening that might have been a factor in recent threats to financial instability, and has eroded confidence in the forecasting of the central bank.

With the benefit of hindsight, we see several broad problems with the framework and forward guidance that led to lessons learned for the future frameworks and policy execution. We first state them in terms of two overarching lessons, and then go into greater detail.

1. The framework was too focused on the experience of the 2010-19 period when inflation was less than the 2 percent target, nominal interest rates were very low, and the NAIRU turned out to be lower than expected. That led to two sources of inflationary bias in the framework: average inflation targeting that made up for undershoots of the target but not overshoots; and only weighting employment below its maximum level while putting no weight in policy on employment above its estimated maximum. The latter implies that both the inflation and employment goals will be exceeded on average over time if the FAIT aspect is sufficient to compensate for ELB episodes. Putting no weight on the labor market overshooting its maximum level rules out policy action to preempt emerging inflation pressure generated by a labor market if inflation is at or below target. The strategy of preemption has been an essential part of how the Federal Reserve has operated over the past decades and is arguably one of the reasons for its success in maintaining inflation within a relatively narrow band.²⁵ The 2020 Framework elevated the maximum employment goal and implied an inflation bias. This was indeed its purpose, and it was crafted for dealing with the last challenge the Federal Reserve faced as the economy emerged from the GFC. Yet every new challenge policymakers face is rarely the same as the last one. The current inflation surge is a vivid example of this.

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25. See Wolman (2021) that articulates this point: https://www.richmondfed.org/publications/research/economic_brief/2021/eb_21-22

2. The forward guidance issued under the new framework amplified the inflationary bias already implicit in the 2020 Policy Framework.²⁶ It underlined the elevation of the maximum employment goal over that of price stability by making progress toward and then meeting the employment goal a condition for tapering asset purchases and then lifting off rates, whatever the existing inflation rate. It was designed to avoid the perceived mistake of 2015 when policy was tightened because the estimated maximum employment had been reached before inflation had reached its 2 percent target. Yet, the FOMC was faced with the opposite dynamics to 2015 once the economy recovered. This time inflation overshot its target before the Fed's estimate of maximum employment had been reached. These different circumstances highlighted a key weakness of the strategy. While it is easy to judge when inflation reaches its target once maximum employment has surged through most reasonable estimates, it is a major challenge to estimate maximum employment once that becomes the criteria for policy tightening. This was especially true following the COVID-19 epidemic due to the uniqueness of the shock. Making matters worse, since meeting the maximum employment threshold was a prerequisite for raising rates, this effectively put no ceiling on how high inflation could go without the Federal Reserve activating some of the escape clauses in its statement. A second source of additional inflation bias was that the forward guidance on its asset purchases delayed its ability to raise rates. First, it committed to give warning far in advance before any changes would be made to its asset purchase program. Second, it declared that it would stop asset purchases before it could start raising the federal fund rate. In our view this brought additional inertia and delay into the policy process that did not rely on solid economic principles.

In sum, these commitments, given the nature of the uneven recovery:

- i) Guaranteed an overshoot of inflation without a clear bound to how high it could rise since reaching maximum employment became a prerequisite for raising rates
- ii) Required an accurate reading of maximum employment to limit the inflation overshoot at a time when assessing maximum employment was exceedingly hard due to the uneven and unprecedented nature of the recovery, making traditional metrics such as unemployment a poor proxy for maximum employment
- iii) Created an unnecessary delay in raising rates by making the completion of asset purchases a prerequisite for raising rates and furthermore by committing to give notice far in advance on how and when asset purchases would be completed

8.1 Lessons learned about the 2020 Policy Framework

1. Our primary lesson learned for the framework is that it was too focused on the 2010-19 experience and left the Committee inadequately prepared to deal with unexpected and new circumstances such as the inflation situation in 2021. A statement on monetary policy strategy ought to encompass a wide range of possibilities, including some that haven't confronted policy for some time. The next framework should be tested against considerably more and different kinds of scenarios. Among other things, thinking through the alternative possibilities should help the Committee formulate policy when the unexpected happens.
26. Powell has recognized the problems caused by the forward guidance. At a Hutchins Center event at Brookings in November 2022, he said: "One piece of guidance that we gave that I probably wouldn't do again is we said we wouldn't lift off [raise interest rates from zero] until we saw both maximum employment and price stability. I don't think I would do that again." A return of inflation, he said, simply seemed unlikely after so many years of very low inflation, "and yet here we are."

2. Many elements of the 2020 Framework were well-designed to address the primary problem facing the Federal Reserve leading up to the pandemic, a declining r^* and downward pressure on inflation. Clearly the framework created an inflationary bias aimed at offsetting this trend. But the introduction of asymmetric objective for employment brings up a whole host of complications and biases that have yet to be properly understood. Our tentative conclusion is that on balance, the complication created by an asymmetric objective may have created more problems than it solved. The recent experience suggests that when faced with the unusual challenge created by COVID-19, the framework increased the volatility of inflation, real output, and employment. The inflation penalty may be small in practice if the Phillips curve is flat. Yet, in that case, reversing the overshoot will be costly in terms output and employment. Conversely, if the Phillips curve instead is steeper than previously thought once the labor market becomes sufficiently tight, then any delay created by the framework plays a greater role in explaining the surge in inflation. In the next framework review, a central question should be whether the benefits hoped for by evaluating deviations of employment from its maximum level asymmetrically exceed its potential costs and can instead be addressed by alternative policy techniques, including flexibility in the timing of expected returns to price stability and maximum employment.

3. The Flexible Average Inflation Targeting piece of the Framework—aiming to “achieve inflation moderately above the target for some time”—is a good way to anchor expectations at the target in circumstances in which rates are at zero and inflation is falling below the target. Leaving “moderately” and “for some time” undefined was essential for flexibility. But, judging from press conference questions and commentary, the one-sided nature of the averaging (not when inflation had run strong) was not well understood and the lack of definition of “moderately” and “for some time” left observers uncertain about FOMC intentions as inflation rose. Moreover, committing to seek inflation above target may have made the FOMC more tolerant of high inflation than it should have been. Having a better understanding among the policymakers and the public of the terms in use might have disciplined policy and the forward guidance derived from the Framework.

4. The asymmetry in the framework puts extra pressure on judging maximum employment. A useful addition to the framework would be an explicit definition of maximum employment as the highest level of employment consistent over time with stable prices. That highlights the harmony of the two objectives and gives a whole-economy focus to the judgment. While most policymakers seem to have this definition in mind, given its importance in the policy process the framework should aim to make this definition explicit and part of the consensus.

8.2 Lessons learned about forward guidance

1. Forward guidance is a valuable tool to shape expectations when policy rates are pinned at the ELB. Conditions-based forward guidance is far preferable to calendar-based guidance. The forward guidance issued by the FOMC was very specific about the conditions, but poorly designed to a scenario in which inflation would overshoot before the FOMC was certain that employment had reached its maximum. The lack of clear and transparent definitions of how FOMC defined maximum employment compounded the problem. Conditions will never conform to those envisioned when the forward guidance is set, and forward guidance needs to have flexibility built

in, even at the cost of some effectiveness at pinning rate expectations. The forward guidance issued by the FOMC impinged too far on the “nimbleness” required for good policymaking.

2. Sometimes even some flexibility in guidance won’t be enough to allow the Committee to adjust policy to a very different situation than was expected. Arguably the complex interaction of unusual supply and demand influences and resulting high and persistent inflation accompanying diverse readings on the labor markets that characterized the second half of 2021 and early 2022 meet this criterion. In unusual situations policymakers need to adjust their forward guidance as a matter of course and explain clearly why this was necessary. Instead, the same interest rate forward guidance was kept in place from September 2020 into late 2021. Escape clauses are essential, and they need to be considered when circumstances greatly deviate from those projected.
3. The power of securities purchases comes primarily from the expected quantity of purchases, which becomes embedded in market prices. Once the taper is announced, stimulus from purchases is largely capped. The purpose of a well anticipated and gradual wind down is mainly to protect market functioning. There is no contradiction in raising rates while residual purchases are being executed. The FOMC anticipated that the extended timeline of warning/taper/liftoff was important to enable markets to adjust and hold back premature tightening of financial conditions. But it added an element of inertia to the tightening process even after the seriousness of the inflation situation became evident. Like the criteria for adjusting policy, forward guidance needs to build in flexibility in timing and sequencing to adapt to changing circumstances.
4. Holding rates at zero until full employment is reached is an extreme version of the labor market asymmetry in the framework, which calls for policy to remain accommodative so long as the FOMC perceives there to be labor market slack and inflation in line with the 2 percent target or the moderate overshooting of the FAIT. The forward guidance of 2019 went much beyond what the framework suggested by stipulating both that inflation had to be about to exceed its target and employment reach its maximum before rates would be lifted from zero. That guaranteed material overshooting and set the stage for an unusually sharp tightening of policy. Forward guidance and the policy it implies should be constructed not only to achieve FOMC’s goals at a point in time but with an eye to sustaining prices and employment around those goals after they are reached.
5. The years 2021 and early 2022 were extraordinarily difficult times for policymaking in which the path forward to accomplish the Federal Reserve’s dual mandate was not clear and subject to different judgments. Yet no FOMC voters dissented between September 2020 and June 2022, raising questions about whether Committee discussions and decisions were being sufficiently challenged by diverse viewpoints. The specific forward guidance, including its rejection of forecast-based policy, may have contributed to this outcome. Once the forward guidance was settled as Committee policy, it may have been perceived to lock policy into place until the very explicit criteria had been met. The FOMC has had a very consensus-driven decision process. The Committee should ask itself whether different aspects of its decisions and decisionmaking are allowing sufficient scope for effective challenges to the majority view.

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APPENDIX 1: SIMPLE ANALYTIC FRAMEWORK

Here we sketch out a simple model to think about the change in the policy framework in 2020. It delivers three key results. First, we show how the policy framework prevents a repeat of what the Fed considered a policy major mistake—that is, the 2015 tightening cycle. Second, we show that it naturally gives rise to an inflation bias that is proportional to the slope of the Phillips curve. Third, the model provides simple decomposition of sources of the inflation surge that can be helpful to interpret the data and the narratives presented in the paper.

One way of summarizing the “dual objective” in the 2012 Policy Framework is to suppose that the Fed is setting its policy at time p to minimize a “dual objective” loss function:

$$(1) \quad L_p = E_p\{(\pi - \pi^*)^2 + \lambda(l - l^*)^2\}$$

where E_p is the expectation of the Fed at the time policy is set, time p . We introduce this notation to consider that policy affects outcome with a lag. Variables without subscripts capture a generic period after the policy is chosen. π is inflation and π^* is the inflation target. Employment is denoted by l while l^* is maximum employment defined as the level of employment consistent with inflation at its target in the absence of shocks that trigger trade-offs between inflation and employment. The co-efficient $\lambda \geq 0$ is the weight on the employment part of the dual objective. That the objective is quadratic is an oversimplification, but an analytic device commonly used in policy simulation at the Federal Reserve as well as in the academic literature. We also see that the objective is symmetric. This is consistent with the “balanced” approach emphasized in the 2012 framework.

The 2020 Policy Framework is formalized as follows:

$$(2) \quad L_p = E_p \begin{cases} (\pi - \pi^*)^2 + \lambda_-(l - l^*)^2 & \text{if } l \leq l^* \\ (\pi - \pi^*)^2 + \lambda_+(l - l^*)^2 & \text{if } l > l^* \end{cases}$$

Relative to objective (1) there are two major changes. First, the objective is asymmetric, i.e., $\lambda_- > \lambda_+$. The Federal Reserve puts higher weight on employment shortfalls (λ_-), than if employment is above the estimated maximum (λ_+). As we saw in section 3, this was what the framework was designed to do. Second, the 2020 framework puts a relatively higher weight on employment shortfalls than the previous one so that $\lambda_- > \lambda$. Observe that (1) is a special case of (2) if we set $\lambda_- = \lambda_+$.

Consider a Phillips curve in generic period denoted by omitting subscripts

$$(3) \quad \pi = \kappa(l - l^*) + \mu + \pi^e$$

where π^e is expected inflation. We assume inflation expectations are anchored at the inflation target π^* . Both l and l^* are expressed in log deviation from a deterministic trend. The term μ is an exogenous cost-push shock with zero mean. A cost push shock forces the central bank to trade-off deviation of inflation from its target and employment from its maximum level. The coefficient $\kappa > 0$ measures what the impact on inflation is if employment is above its maximum level. This coefficient is the slope of the Phillips curve. If κ is small, then if employment exceeds maximum employment, the impact of inflation is small.

The model is closed by assuming that employment is determined by an IS equation:

$$(4) \quad l = -\chi i_p + d$$

where the variable χ measures how much impact policy has on employment. The variable i_p indicates the overall policy stance of the Federal Reserve.²⁷ An accommodative policy stance represents a reduction in i_p . We assume that inflation expectations are anchored so they do not enter this equation. Equations (3) and (4) can be derived from micro foundations and are available upon request.

The key assumption in (4) is that we assume that the Federal Reserve's policy, i_p , is set *before* the realization of all the other variables in the model, i.e., (d, l, l^*, π, μ) . Accordingly, the model incorporates the assumption on prominent display in both policy frameworks that policy only affects outcomes with a lag. A natural implication is that the Federal Reserve needs to project all the relevant variables and the shock. The problem of the policymaker is to maximize (2) subject to (3) and (4).

Problems of this kind, and typically much more complicated ones, are well known in the academic literature. They are simulated as a matter of routine at policy institutions. There is one complication, however, that is highly relevant. The asymmetry of objective (3) complicates the policy problem relative to standard optimal policy problems. It implies that the policy itself affects the *shape* of the objective function. In other words, there is a different policy function that applies when $l > l^*$ than the case in which $l \leq l^*$. Moreover, by choosing either high or low interest rates monetary policy can affect the probability of which side of the loss function the economy finds itself in the future. An accommodative monetary policy, for example, increases the probability of avoiding an employment shortfall. It increases the probability that that policy function is evaluated in the outcome region $l > l^*$ which the 2020 Policy Framework says is less costly than if $l < l^*$.

...
27. At this level of abstraction we think of i_p as a broad measure of the policy stance that is decided at each meeting of the FOMC, which includes several dimensions, so we think of this policy level as being a broader construct than simply the current Federal Fund Rate.

This simple structure can be used to clarify how the 2020 Policy Framework, had it been in place, might have affected policy choices in 2015. Recall from our discussion in the body of the paper that the Federal Reserve started tightening policy in 2015 based upon the belief that highly accommodative policy when the labor market seemed already very strong would make inflation rise above its target. Thus, the Federal Reserve started increasing interest rates, even before inflation had reached its target. This action was an example of preemptive policy tightening. As we discussed in the body of the paper, this tightening became to be viewed as a mistake because inflation remained below target even as the labor market tightened further. Let us now consider why the new policy framework made such preemptive strike less likely.

1A. How the 2020 Policy Framework could reduce the chance of a repeat of the preemptive tightening in 2015

Rearranging the Phillips curve and assuming inflation expectations are anchored at $\pi^e = \pi^*e$ obtain:

$$\pi - \pi^* = \kappa(l - l^*) + \mu$$

Now take expectations of both sides at the time the policy decision is made, i.e., at time p . For simplicity, set $E_p\mu = 0$. In this case we obtain the expression

$$(5) \quad E_p(\pi - \pi^*) = \kappa E_p(l - l^*)$$

As discussed in the text, at the FOMC meeting in December 2015, inflation was below its target while the unemployment rate was at 5 percent. The FOMC assessment of maximum employment corresponded to 4.9 percent unemployment. The committee thus correctly projected that its employment objective would be satisfied according to this criterion, i.e., $E_p(l - l^*) > 0$, in the near future. Indeed, this turned out to be the case in January 2015 when unemployment fell to 4.9 percent. Moreover, employment was projected to exceed its estimated maximum in coming years, which, in turn, was projected to create inflation pressures. This implied that the FOMC would be overshooting both parts of its dual mandate—for employment and inflation. This, then, justified a tightening. Yet, the unemployment rate went down to 3.5 at the eve of the pandemic, without any inflationary pressures. Thus, it would appear the FOMC tightened preemptively based on a misjudgment of maximum employment and inflation pressures, according to the retrospective analysis of many FOMC members. At heart of this was presumably underestimation of l^* and possibly an over-estimate of κ . Accordingly, the narrative went, many jobs were sacrificed for no good reason.

The 2020 Policy Framework was designed to prevent this. As Governor Brainard suggested, “The longstanding presumption that accommodation should be reduced preemptively when the unemployment

rate nears the neutral rate in anticipation of high inflation that is unlikely to materialize risks an unwarranted loss of opportunity for many Americans.”

Consider now again equation (5). Under the 2020 Policy Framework, then even if it would be projecting, like in 2015, that $E_p(l - l^*) > 0$, this by itself—in the absence of any inflation—would not be a cause for concern or any tightening if the policy framework says it only cares about “employment shortfall,” that is $E_p(l - l^*) < 0$. By itself $E_p(l - l^*) > 0$ implies no loss for the Federal Reserve if we assume $\lambda_+ = 0$, which seems like the most literal interpretation of the statement of the framework. Moreover, the emphasis on the employment goal being “a broad-based and inclusive goal that is not directly measurable” could be used to justify that almost any realization of l , however high, might still be consistent with employment shortfall, by focusing on subsets of the U.S. population which for one reason or another were suffering adverse shocks.

This type of approach, not penalizing $E_p(l - l^*) > 0$, is especially attractive if one assumes that the Phillips curve is very flat, that is, if κ is close to zero. In this case, even if $E_p(l - l^*) > 0$ this overshooting is multiplied by a small number κ which is close to zero. Moreover, the FOMC, in any event, was concerned about inflation running persistently below its target for more than 10 years so a little bit of upward inflation bias was perhaps a feature, not a bug, of the 2020 Policy Framework in many people’s eyes. Thus, a key design feature of the framework was that even with a forecast suggesting $E_p(l - l^*) > 0$, the prudent strategy was to hold off until there was evidence of inflation overshooting. This was made operational by explicitly stating that the Fed was only concerned with employment shortfalls.

1B. The inflation bias of the 2020 Policy Framework

The policy chosen by the central bank optimizing (2) subject to (3) and (4) results in the following expression for the interest rate (for a detailed derivation see Appendix 4).

$$(6) \quad i_p = \chi^{-1} \left\{ E_p d - E_p l^* + \frac{\kappa}{\kappa^2 + \lambda} E_p \mu \right\} + i_p^{bias}$$

where $\lambda \equiv \frac{1}{2}(\lambda_- + \lambda_+)$ is the average weight on the employment part of the dual objective.

This expression highlights the role of three projections when the central bank determines its policy stance. If the Fed is expecting a high demand economy $E_p d > 0$, it raises rates. Despite projecting a high demand economy, however, the Fed may still choose to keep rates unchanged if the rise in demand is projected to be associated with closing an existing employment gap or a corresponding rise in maximum employment, i.e., $E_p l^* > 0$. Arguably this was the situation faced by the Federal Reserve in 2021. With the economy reopening, and a fiscal stimulus, demand was projected to be higher. Yet at the same time, unemployment was still high, and more people were projected to re-enter the labor force.

The third projection is due to a shock that implies a trade-off between inflation and employment, i.e., μ . The Fed raises rates in the face of inflation pressures—importantly, however, by how much depends on κ . To understand why, observe that the Fed reduces inflation by raising rates which in turn reduces employment. It is via an easier labor market that the Fed brings down inflation. If κ is very low, however, then the employment cost of reducing inflation is high so the Feds policy stance will be less affected by a high projected value of $E_p\mu$, regardless of if it is temporary or permanent.

In the case of a symmetric objective this is the end of the story. The last term in (6), however, captures an additional term that arises because the 2020 Policy Framework is asymmetric:

$$(7) \quad i^{bias} = -\chi^{-1}(\lambda_- - \lambda_+) \frac{1}{2H} \left\{ \frac{3\sigma_x^2}{\kappa^2 + \lambda} + \frac{\kappa^2}{(\kappa^2 + \lambda)^3} (E_p\mu)^2 \right\} > 0$$

where σ_x^2 is the variance of random variable x corresponding to the forecast/projection error of $d - l^*$ while H is a parameter of the probability distribution of x that defines its range.²⁸ This term implies that the policy stance will be *systemically more expansionary on average* relative to the 2012 Policy Framework.

To understand why it helps to write the expression for the deviation of employment from its maximum level:

$$(8) \quad l - l^* = (E_p l^* - l^*) + (d - E_p d) - \frac{\kappa}{\kappa^2 + \lambda} E_p \mu + i^{bias}$$

where $i^{bias} = -\chi i^{bias} > 0$. As we see from this expression (for simplicity setting $E_p\mu = 0$) employment is projected to exceed its maximum value, i.e. $E_p(l - l^*) = i^{bias} > 0$. In other words, the asymmetric framework implies that—on average—the Federal Reserve will target an employment level above the maximum where maximum employment is *defined* as the employment level consistent with inflation on target in the absence of tradeoff shocks.

The economics behind this result are straightforward. It is most easily explained by the first terms in expression (7). According to the asymmetric loss function, the Federal Reserve penalizes employment shortfalls ($l \leq l^*$) more than if employment exceeds its maximum level ($l > l^*$). This has the natural implication that the Federal Reserve is more willing to risk employment more than the maximum level than paying the price of employment shortfalls. Importantly, however, the Federal Reserve influences whether employment is above or below the maximum. The lower the interest rate, the less likely it is that there is an employment shortfall. This implies that employment, on average, is more often than not in

...
28. More precisely $x \equiv d - E_p d - (l - E_p l^*)$. We assume that x is uniformly distributed on the support $[-x^*, x^*]$. This implies it has variance $\frac{(x^*)^2}{3}$. More detailed derivation in Appendix 4.

excess of its maximum, absent other considerations such as the ELB. This is a basic implication of an asymmetric policy function which we expect applies in a broad range of models.

The higher the asymmetry, i.e., the greater the difference between $\lambda_- - \lambda_+$, the greater the bias. The first part of the bias is increasing in the variance of x . The variance of x captures how well the central bank forecasts maximum employment and aggregate demand when setting its policy. If the Federal Reserve can perfectly predict the risk of employment shortfalls relative to employment being above maximum employment, the asymmetry in the objective produces no bias via this channel. This is the case, for example, if one assumes there are no policy lags, and if the Fed can perfectly observe the shocks, which are assumptions common in the theoretical literature, such as the standard New Keynesian model (see e.g., Woodford (2003) and Gali (2015)).

The second term in equation (7) captures a bias that arises due to shock that creates a tradeoff between inflation and employment. That the central bank does not penalize employment above maximum level generates a natural bias coming from this source, which arises with or without policy lag.

1C. A useful decomposition

We can use expression (8), along with the Phillips curve, to obtain an expression for inflation. It is:

$$\pi - \pi^* = \kappa(E_p l^* - l^*) + \kappa(d - E_p d) + (\mu - E_p \mu) + \frac{\lambda}{\kappa^2 + \lambda} E_p \mu + \kappa l^{bias}$$

(9) *i.* *ii.* *iii* *iv.* *v.*

Equation (9) is helpful to systematically consider different reasons for the inflation surge.

Let us treat each in turn.

- i) The Federal Reserve misjudges what constitutes maximum employment at the time the policy is set so that $E_p l^* > l^*$: We discuss reasons for why this may have been the case in section 6. The Fed might, for example, have believed that it was reasonable for prime-aged employment ratio to reach pre-pandemic level, while the uneven recovery implied sectoral misallocation that was better measured by v/u .
- ii) There is an unexpected increase in demand relative to when policy was set. For example, the Federal Reserve may have failed to fully appreciate the expansionary impact of the fiscal stimulus, or the amount of "pent up spending" due to COVID.
- iii) There were unexpected cost-push shocks that were not anticipated when the policy was set. Examples could include supply chain bottlenecks.
- iv) At the time policy was set there were significant supply disturbances. The fact that inflation is above target reflects the Fed optimally trading off some projected inflation relative to the labor

shortfall that was expected because of the supply shocks observed during the time the policy was set. The work of Guerrieri et al (2021) suggests that sectoral misallocation may show up in reduced form as a trade-off shock that the Federal Reserve will optimally choose to accommodate.

- v) The asymmetric nature of the loss function generates constant term—or an inflation bias which is fixed—that is independent of the shock’s realization. Instead, the asymmetric component depends on the variance of $x \equiv d - E_p d - (l - E_p l^*)$ and on the square of the projected cost-push shock, i.e., $(E_p \mu)^2$.

We see that if κ turns out to be bigger than the Fed considered it will lead to a bigger effect of i) and ii) as well as v) to an extent that is suboptimal. The fact that demand shocks have a lower impact with lower κ) is somewhat special to the model. We have not worked out an extension in which the Federal Reserve take the non-linearity of the Phillips curve into account.

APPENDIX 2: ASYMMETRIC OBJECTIVE FUNCTION AND A PERCEPTION BIAS

An asymmetric objective function can also lead to a bias by which the central bank weights information, in the sense that it may put higher weight on one type of indicator, even if it provides inferior information than the alternative.

To be clear, this is optimal given the objective function. The question then becomes if the social welfare is well approximated by an objective function that is asymmetric. A problem that emerges, however, is like in the case considered in Appendix 1, the result of optimal policy in this setting generates an inflation bias.

We will consider a simplified version of the model in Appendix 1. We assume that the inflation target is zero, and maintain the assumption that inflation expectations are anchored by the inflation target, i.e., $\pi^e = 0$. Here we ignore the demand shock and the tradeoff shock so that the only source of uncertainty is

$$l^* = \begin{cases} l^{high} \\ l^{low} \end{cases}$$

The problem of the policymaker is to set policy, in the same model as before which is slightly simplified:

$$\pi - \pi^* = \kappa(l - l^*)$$

$$l = -\chi i_p$$

To simplify matters further, we assume that the policymaker is faced with the following choice:

$$i_p = \begin{cases} i_p^{loose} = -\chi^{-1} l^{high} \\ i_p^{tight} = -\chi^{-1} l^{low} \end{cases}$$

This assumption is not innocuous, for by making it, we are essentially tying the interest decision of the Fed to one narrative or another about the labor market. We suspect, however, that a similar conclusion can be generated relaxing this assumption.

Observe that if the policymaker knows the true state is l^{high} he would want to choose the loose policy, i.e., keep interest rate low, since he thinks the maximum level of employment is high.

Conversely if he knows the true state is l^{low} he wants to choose i_p^{tight} . It is now easy to confirm that:

For $(i_p = i_p^{loose}, l^* = l^{high})$

$$\pi = \pi^* \text{ and } l = l^{high} \text{ so that } l - l^* = 0$$

which is the optimal policy. Consider now the possibility of the central bank choosing i_p^{loose} but when l^{low} .

Then we have:

For $(i_p = i_p^{loose}, l^* = l^{low})$

$$\pi - \pi^* = \kappa(l^{high} - l^{low}) > 0 \text{ and } l = l^{high} \text{ so } l - l^* = l^{high} - l^{low} > 0$$

We can now do the same for i_p^{tight} to obtain:

For $(i_p = i_p^{tight}, l^* = l^{low})$

$$\pi = \pi^* \text{ and } l = l^{low}$$

And similarly, if the central bank chooses i_p^{tight} if l^{high} we obtain:

For $(i_p = i_p^{tight}, l^* = l^{high})$

$$\pi - \pi^* = \kappa(l^{low} - l^{high}) < 0 \text{ and } l = l^{low} \text{ so } l - l^* = l^{low} - l^{high} < 0$$

The only source of uncertainty is maximum employment, i.e., l^* . Let us now imagine that the central bank gets two signals, or narratives, about the state of the labor market. We assume that there are two series that give conflicting signals: v/u is the number of vacancies relative to number of unemployed, while the signal l_E^{prime} is the ratio of prime aged adults that are employed, with v/u suggesting maximum employment is low while l_E^{prime} says it is high. In terms of accuracy, we assume that the signal v/u is correct with probability $1-p$ while l_E^{prime} is correct with probability p . To summarize:

$v/u \rightarrow l^* = l^{low}$	$l_E^{prime} \rightarrow l^* = l^{high}$
Correct with probability $1-p$	Correct with probability p

We can now compute the expected loss from (2) by using the expressions above. The expression for expected losses condition on choosing i_p^{tight} is

$$L(i_p^{tight}) = p \kappa^2 (l^{low} - l^{high})^2 + p\lambda_- (l^{low} - l^{high})^2$$

$$L(i_p^{loose}) = (1-p) \kappa^2 (l^{high} - l^{low})^2 + (1-p) \lambda_+ (l^{high} - l^{low})^2$$

We can now evaluate the question of whether the central bank will choose a loose policy or a tight one. It will choose a loose policy if $L(i_p^{loose}) < L(i_p^{tight})$ giving rise to the condition that policy will be loose if

$$p > \frac{1}{2} \frac{\kappa^2 + \lambda_+}{\kappa^2 + \frac{\lambda_- + \lambda_+}{2}} = \frac{1}{2} \phi$$

where if $\lambda_- > \lambda_+$ i.e. there is higher loss for employment below the maximum, then $\phi < 1$ so that a decision maker will always choose to set policy according to the signal that says maximum employment is high as long as $p \geq \frac{1}{2}$. The reason is that even if he is wrong in that case, he will not in that case suffer losses that depend on λ_- . One can even chose λ_- such to make ϕ arbitrarily low so that the decision maker will always choose to be loose, even if the chances of him being right are very slim, provided the loss generated by a recession is large enough.

If $p = \frac{1}{2}$ then the signals are equally informative. In this case the decision marker will choose the loose policy. This, then, lead to an inflation bias given by

$$E_p(\pi - \pi^*) = \frac{1}{2} \kappa (l^{high} - l^{low})$$

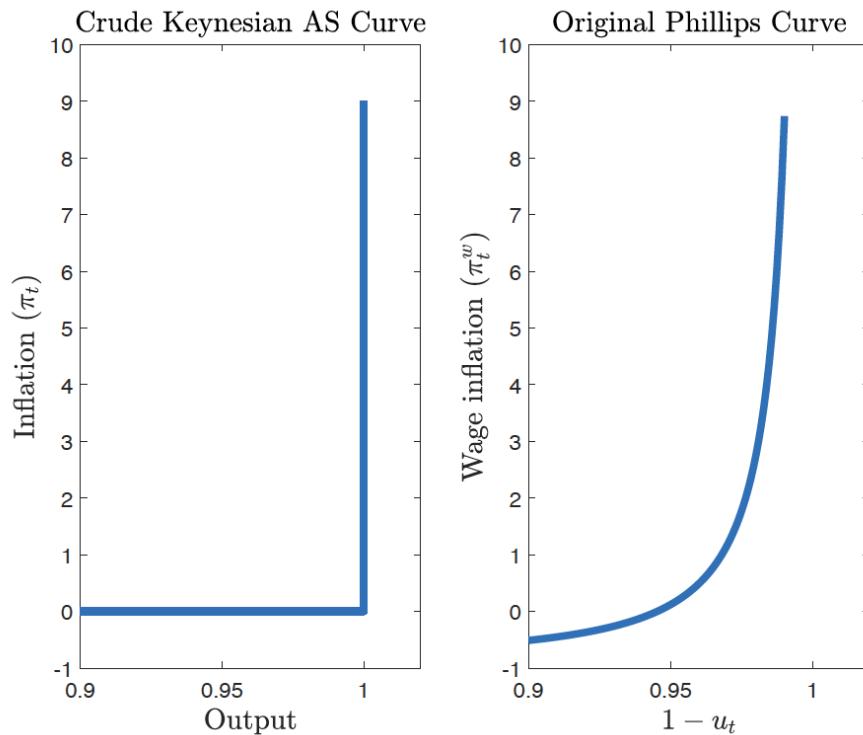
To sum up: In this illustrative example, the Federal Reserve obtains signals from different indicators about the state of the economy. In practice, the policymaker doesn't know which is the most reliable indicator—and has just a rough guess about the distribution of errors around each estimate. Since the 2020 Policy Framework puts at the very forefront the importance of avoiding employment shortfalls, this influences the weight the policymakers put on indicators suggesting employment shortfalls, such as prime-aged employment to population rate, relative to those indicators suggesting that the labor market was tight, such as the vacancy and unemployment ratio. In the simple example, an asymmetric policymaker may choose to rely on a signal which is suggestive that the maximum employment level is high, even if she suspects the indicator suggesting that the maximum employment level is low might have a slightly higher probability of being correct. With an asymmetric objective, then the cost of relying on the more accurate indicator, which if wrong, results in an employment shortfall, while the less accurate indicator, if wrong, instead leads to overshooting employment which has smaller (or no) penalty. One implication is that this perception bias contributes to the inflation bias. It is worth stressing that the decision maker is making a fully optimal choice by relying on less accurate information. The optimality of this choice follows directly from the assumed asymmetric objective. The more substantive question, then, is whether the asymmetric objective is a better representation of social welfare than objectives that imply

symmetry. The perception of labor market slack was a prerequisite for thinking inflation pressures were transitory, so how that perception was formed is critical for understanding policy choices through this period.

Nevertheless, it seems worth highlighting that the example here is admittedly quite special. In particular, we are imposing the restriction that the Federal Reserve is “buying” into one signal or another, and that decision translates directly into two distinct interest rate decisions. In practice, the Fed weighs many different indicators, as acknowledged in the 2020 Framework. “The Committee considers a wide range of indicators in making these assessments [about labor markets.]” And our judgment that it gave insufficient weight to v/u is much clearer ex post than it was over the summer of 2021 when key inflation measures were declining, as expected. It remains to be seen if this way of thinking about perception bias arising from asymmetry in the objective function can yield interesting insights into the policy process, but we offer it here as food for thought.

APPENDIX 3: SUMMARY OF RECENT EVIDENCE ABOUT NON-LINEARITIES IN THE PHILLIPS CURVE

Figure 16. Early examples of aggregate supply



Source: Benigno and Eggertsson (2023)

The idea of a non-linear aggregate supply, however, is far from new, and even predates the work of Phillips himself. Early Keynesian theorists, for example, imagined an aggregate supply being represented by a backward L. Below full employment prices would be roughly fixed. An increase in demand with partially empty factories and idle workers would simply increase output with little or no effect on prices. Once all the workers are employed, however, the economy hits a wall. Any increase in demand shows up directly in prices.

The early Keynesian view is shown on the left-hand side of figure 16. The original Phillips curve, estimated by Phillips (1958) on UK data from 1861-1907, is shown on the right side. Phillips' estimated curve captures to an important extent the backward-L envisioned by the early Keynesians. Once there are sufficiently many people employed, then his curve becomes close to vertical like a backward L.²⁹ Phillips's idea was that once the economy approaches maximum employment there would be essentially no more

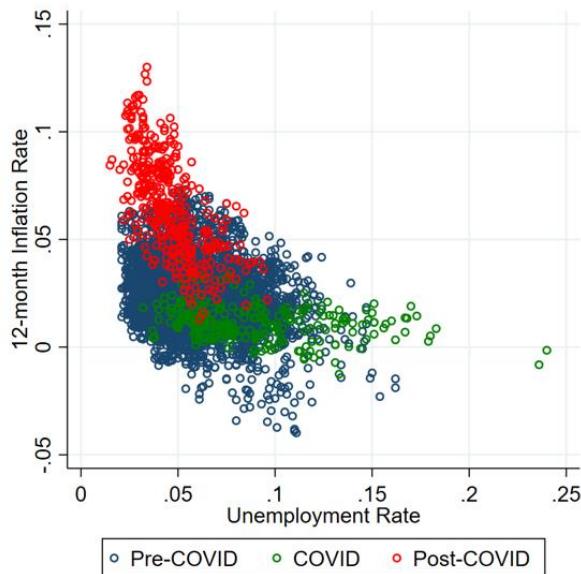
...
29. To facilitate a comparison between the two, Phillips original curve is plotted using $1-u$ which is a measure of employment.

people to be hired. In this case, the only way higher demand can manifest itself is via higher wages and prices.³⁰

There is a growing literature suggesting that the nonlinearities identified by Phillips and the early Keynesians continue to be relevant; once the labor market becomes sufficiently tight, inflation starts responding more strongly to further increases in labor utilization.

Let us briefly summarize the growing evidence in favor of that the Phillips curve is non-linear. Previously we cited a widely cited paper by Hazell et al. (2022) which suggested that a 1-percentage-point reduction in unemployment generates only a 0.34-point increase in inflation using cross-sectional data from U.S. metropolitan areas. Moreover, they found that this estimate was stable during their sample period that stretches back from the early 1980s up to the pandemic. Recently, however, their analysis has been updated using recent data in a paper by Cerrato and Gitti (2022). According to their analysis, the slope of the Phillips curve tripled once the economy moved out of the pandemic period. Figure 17 gives a hint for why this is the case by plotting up the raw data underlying their analysis where the x-axis represents unemployment and the y axis 12-month inflation rate in U.S. metropolitan areas. The green dots represent the COVID period—a period in which, if anything, the Phillips curve looks flatter—while the red dots represent the post-COVID period that starts in March 2021. The blue dots represent prior data. Even without going through the multistep identification strategy employed by the authors, a simple visual inspection of the data gives readers a strong hint of a highly non-linear Phillips curve. As the figure shows, in metropolitan areas with low levels of unemployment, a, for example, 1 percent reduction in unemployment (a movement to the left on the x-axis in the figure) increases inflation by much more than a 1 percent reduction in a metropolitan area that has high unemployment.

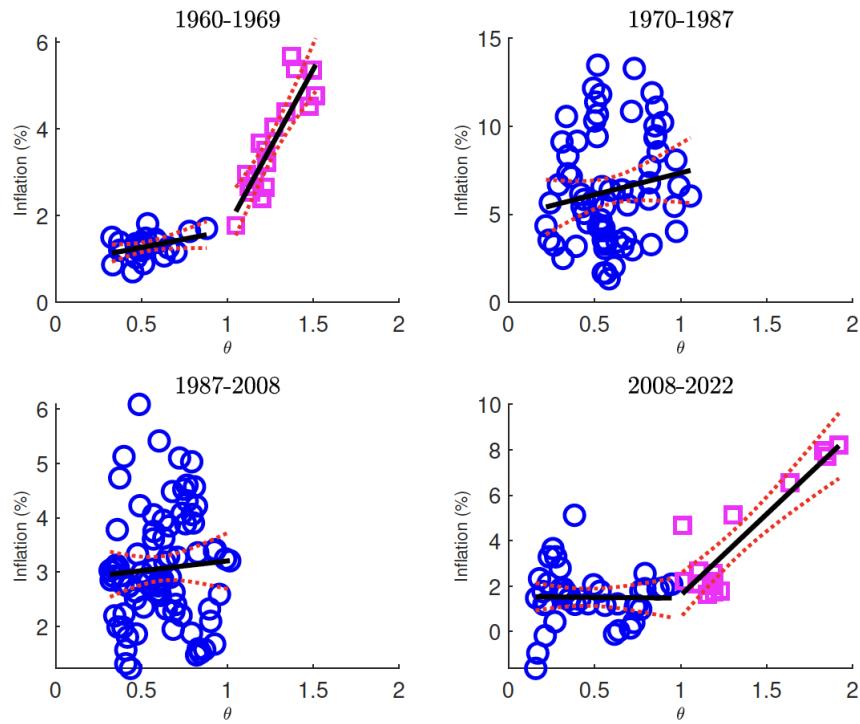
Figure 17. Evidence for a Non-Linear Phillips Curve in U.S. Metropolitan Areas since 1990



Note: Blue dots show the pre-COVID observations (Jan 1990 to Feb 2020), green dots show the COVID period (Mar 2020 to Feb 2021), and red dots show the post-COVID period (Mar 2021 to Aug 2022). Source: Cerrato and Gitti (2022)

30. The reason Phillips suggested his curve was flatter at high unemployment was due to downward wage rigidity.

Figure 18. Evidence for a non-linear Phillips Curve: V/U versus Inflation



Note: Theta represents openings over unemployment (V/U). Blue circles show points below $V/U=1$, magenta squares show points above $V/U=1$. Source: Benigno and Eggertsson (2023)

Benigno and Eggertsson (2023) use time series evidence from the U.S. to similarly uncover non-linearities in the Phillips curve. They argue that the Phillips curve is piecewise linear, like a backward-L, with a kink-point around at which point the Phillips curve becomes steeper. While they show the statistical significance of this proposition more formally, again simple graphical presentation of the data gives away the punchline. Figure 18 shows by blue dots inflation plotted against labor market tightness v/u . Blue points denote periods when $v/u < 1$ while pink dots represent periods in which $v/u > 1$. Typical empirical estimates use the data in the lower left and upper right subpanels which suggest a flat Phillips curve. The period 1960-1969 and the period 2008-2022, however, correspond to periods in which there was a sustained and significant increase in labor tightness which in both cases resulted in a much more rapid rate of inflation for a given increase in tightness. Ball, Leigh, and Mishra (2022) is another paper which uses U.S. time series data and finds evidence in favor of non-linearities.

Because the labor market was tight in U.S. time series data only in the late 1960s and in recent years, the empirical study of Smith, Timmermann and Wright (2023) is of particular interest. Several regions within the U.S. have at different times had very tight labor markets. The same is true of regions within the EU. These authors find statistically significant and economically large kinks in the Phillips curve when the labor market is tight at a local level. In the U.S., for example, their estimated slope is roughly three times steeper in a tight labor market, defined as unemployment below 4.2 percent. That increase in the slope is of the same orders of magnitudes as Cerrato and Gitti (2022) find.

APPENDIX 4: DERIVATION OF THE ASYMMETRIC SOLUTION

Here we sketch out how to derive equation (6). The employment gap is a stochastic variable that can be written as $X = l - l^* = x_p + x$, where x_p is non-stochastic and defined as $x_p \equiv -\chi i_p + E_p d - E_p l^*$, while x is stochastic and defined as $x \equiv d - E_p d - (l - E_p l^*)$. We assume x is uniformly distributed with support $[-x^*, x^*]$ where $x^* > 0$.³¹ It follows then from the assumption that x is $U_{[-x^*, x^*]}$ that

$$\begin{aligned} Pr[X < 0] &= \frac{-x_p + x^*}{2x^*} \\ E_p[X|X < 0] &= \frac{1}{2}(x_p - x^*), E_p[X|X > 0] = \frac{1}{2}(x_p + x^*) \\ E_p[X^2|X < 0] &= \frac{1}{3}(x_p - x^*)^2, E_p[X^2|X > 0] = \frac{1}{3}(x_p + x^*)^2 \end{aligned}$$

From here we write the loss function as a single equation by distributing the expectation using the cumulative probabilities, substituting in the Phillips curve and second moments, and combining like terms to yield (10).

(10)

$$L_p = \frac{1}{2}(\kappa x_p + E_p[\mu])^2 - \lambda_- \frac{(x_p - x^*)^3}{12x^*} + \lambda_+ \frac{(x_p + x^*)^3}{12x^*}$$

Differentiating with respect to x_p gives us the first-order condition, (11).

(11)

$$\frac{d}{dx_p} L_p = \kappa(\kappa x_p + E_p[\mu]) - \lambda_- \frac{(x_p - x^*)^2}{4x^*} + \lambda_+ \frac{(x_p + x^*)^2}{4x^*} = 0$$

Rearranging the FOC (12), we quickly see the symmetric solution (13) emerge.

(12)

$$\left(\kappa^2 + \frac{1}{2}(\lambda_- + \lambda_+) \right) x_p = -\kappa E_p[\mu] + (\lambda_- - \lambda_+) \frac{x_p^2}{4x^*} + (\lambda_- - \lambda_+) \frac{x^*}{4}$$

31. For the probabilities to be well-defined, we restrict $-x^* < x_p < x^*$.

(13)

$$x_p = \bar{x}_p = \frac{-\kappa E_p[\mu]}{(\kappa^2 + \lambda)} \text{ when } \lambda = \lambda_- = \lambda_+$$

To find the solution when $\lambda_- \neq \lambda_+$, we consider small deviations in λ_- , λ_+ , and x_p . More precisely, we calculate the differentials of each side of (12) with respect to λ_- , λ_+ , and x_p , evaluate those differentials in the symmetric case ($\lambda = \lambda_- = \lambda_+$), then add them back to the appropriate side of (12) evaluated in the symmetric case. We don't want to change the overall weight between inflation and unemployment in the loss function, so we further impose $d\lambda_+ = -d\lambda_-$. This yields the following, which simplifies into (14). Note that it is possible to solve (12) directly in the asymmetric case, but we have forgone that method to keep the solution comparatively simple and interpretable.

$$(\kappa^2 + \lambda)(\bar{x}_p + dx_p) + \frac{1}{2}\bar{x}_p d\lambda_+ + \frac{1}{2}\bar{x}_p d\lambda_- = -\kappa E_p[\mu] - \frac{d\lambda_+}{4x^*}(\bar{x}_p^2 - x^{*2}) + \frac{d\lambda_-}{4x^*}(\bar{x}_p^2 - x^{*2})$$

(14)

$$(\kappa^2 + \lambda)(\bar{x}_p + dx_p) = -\kappa E_p[\mu] - \frac{d\lambda_+}{2x^*}(\bar{x}_p^2 - x^{*2})$$

We reintroduce λ_- , λ_+ , and x_p by observing their new values outside the symmetric solution, $x_p = \bar{x}_p + dx_p$ and $\lambda_+ - \lambda_- = d\lambda_+$, yielding (15), an equation for the optimal employment gap target.

(15)

$$x_p = -\frac{\kappa E_p[\mu]}{\kappa^2 + \lambda} - (\lambda_+ - \lambda_-) \left(\frac{\kappa^2 E_p[\mu]^2}{2x^*(\kappa^2 + \lambda)^3} + \frac{x^*}{2(\kappa^2 + \lambda)} \right)$$

Through the IS curve, $l = -\chi i_p + d$, we find the optimal interest rate target (16) by subtracting the natural level of employment from both sides and substituting in (15) on the left-hand side and solving for i_p . The optimal rate can be decomposed into a symmetric and biased component, as follows.

(16)

$$\begin{aligned} i_p &= \chi^{-1} \left(E_p[d] - E_p[l^*] + \frac{\kappa E_p[\mu]}{\kappa^2 + \lambda} \right) + \frac{(\lambda_+ - \lambda_-)}{\chi} \left(\frac{\kappa^2 E_p[\mu]^2}{2x^*(\kappa^2 + \lambda)^3} + \frac{x^*}{2(\kappa^2 + \lambda)} \right) \\ i_p^{symmetric} &= \chi^{-1} \left(E_p[d] - E_p[l^*] + \frac{\kappa E_p[\mu]}{\kappa^2 + \lambda} \right) \\ i_p^{biased} &= \frac{(\lambda_+ - \lambda_-)}{\chi} \left(\frac{\kappa^2 E_p[\mu]^2}{2x^*(\kappa^2 + \lambda)^3} + \frac{x^*}{2(\kappa^2 + \lambda)} \right) \end{aligned}$$



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