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The Unstable Phillips Curve

Remarks by

Christopher J. Waller

Member

Board of Governors of the Federal Reserve System

at

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Thank you, Sylvain, and thank you to the Federal Reserve Bank of San Francisco for inviting me to speak tonight. After listening to many dinner speakers through the years, I am well aware that after the entrees are served, no one wants to hear someone blabber for 45 minutes. So, I will try to keep this short to leave enough time for a robust discussion afterward, which I hope my remarks will generate.

My topic tonight is “The Unstable Phillips Curve.”¹ This is not intended to be a deep academic analysis but rather to present some thoughts for discussion. I know that I am walking into the Phillips curve lion’s den, given the number of researchers in the Bay Area who work on Phillips curve estimation. But in my current job, I am used to people disagreeing with me.

The Phillips curve, a relationship between price or wage inflation and some measure of economic slack, has been the foundation of monetary policy for decades. A common way to estimate it is to look at output price inflation and the unemployment rate. One theory, or story, is that as aggregate demand increases, labor demand will increase as well. As a result, prices of goods and services will rise and firms will hire more workers, as long as there is some stickiness in nominal wages. Consequently, this story implies that the unemployment rate will fall. So, there is a negative relationship between price inflation and unemployment.

Another story, based on the New Keynesian model, is that monopolistically competitive firms set prices for some period of time. Firms may have “sticky prices” because of menu costs. That is, firms face costs to adjust their prices and so choose to reset their prices only when the benefits outweigh the costs. Because firms are not

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

identical, only a share of firms adjust their prices each period. So, when aggregate demand increases, firms with set prices agree to supply the goods demanded at their current prices. Firms that find it worthwhile to adjust their prices will increase their prices. As a result, inflation will arise from the firms that adjusted their prices.

Meanwhile, higher employment will come from the sticky price firms, and, implicitly, higher employment goes along with lower unemployment. Once again, we obtain a negative relationship between output price inflation and unemployment. The slope of this relationship hinges on the fraction of firms adjusting their prices in response to the aggregate demand shock. Put another way, the frequency of price changes determines the slope of the Phillips curve.

In both these stories, expectations of future inflation play a critical role. In the sticky nominal wage story, workers will seek to maintain their real wages by setting their wage demands based on what they think future inflation will be. In the New Keynesian model, firms set their output prices based on what they think aggregate price inflation will be in the future, and how often and at what pace they expect to change prices. Regardless of whether you think nominal wages are sticky or output prices are sticky, inflation expectations play a critical role in how unemployment responds to changes in the inflation rate.

This explanation is all about the short run. In either model, in the long run, nominal rigidities, or stickiness, disappear and expectations of inflation converge to trend

inflation. As a result, in most models of nominal rigidities the long-run Phillips curve is vertical.²

What do economic data tell us about this relationship? We all know that if you simply plot inflation against the unemployment rate over the past 50 years, you get a blob. There does not appear to be any statistically significant correlation between the two series. In the 1980s and 1990s, so-called freshwater macroeconomists, who tended to work at universities in the middle of the country, argued the data showed that stories about nominal wage or price stickiness were simply wrong and we should quit talking about Phillips curves of any type. Diehard believers in the Phillips curve, the saltwater economists working on the East and West coasts, argued that the data blob was the result of unstable inflation expectations. If inflation expectations were not stable, then the Phillips curve would shift around in such a way that you could not observe the true relationship in the data.

What would cause inflation expectations to be unstable? Kydland and Prescott (1977) provided an explanation, later popularized by Barro and Gordon (1983), that blamed the central bank. If the central bank's promises to keep inflation low were not credible, then private agents' inflation expectations would be different than what the central bank promised, which in turn would cause the Phillips curve to shift around. As a result, the idea that the central bank had to make credible promises to keep inflation low became a bedrock principle of central banking that holds to this day.

² But there is a debate that the long-run Phillips curve is positively sloped. Friedman (1977) provides an intuitive explanation for a positive slope while Berentsen, Menzio and Wright (2011) derive it formally in a New Monetarist model.

Inflation targeting provided a framework for making promises of low inflation credible, and since the late 1990s it has proved to be very successful in practice. With a central bank strongly committed to inflation targeting, promises to keep inflation at 2 percent are credible in large part because the central bank is observed taking action to keep it near 2 percent, regardless of what is happening to the unemployment rate. When these promises are credible, the Phillips curve should be relatively flat.

What have we seen in the recent data? Let's consider a Phillips curve based on the price index for personal consumption expenditures, which is the Federal Open Market Committee's (FOMC) preferred measure. As shown in figure 1, the Phillips curve was very flat for the 20-plus years before the pandemic, consistent with the story that the Federal Reserve was credible at keeping inflation low.³

Then in the spring of 2021, after more than a decade of hibernation, inflation came roaring back to life. As the economy recovered from the pandemic shutdowns, inflation increased each month of the year and was running at more than double the Fed's 2 percent target throughout the latter half of 2021. Meanwhile, unemployment fell quite rapidly in 2021, from 6.3 percent at the start of the year to 3.9 percent in December, which was surprising given the long, slow recoveries after recent recessions. Based on the flatness of the Phillips curve in recent decades, some commentators argued that unemployment would have to rise dramatically to bring inflation back down to 2 percent. Others argued that, based on analysis of the Beveridge curve, inflation could be brought

³ The FOMC began using an explicit 2 percent inflation target in 2012, but before then it was presumed to be targeting 2 percent.

down without a significant rise in unemployment, although this conjecture was not without controversy.⁴

But considering the data for 2021, as shown in figure 2, the Phillips curve suddenly looked relatively steep. That is, the labor market became extremely tight as the U.S. economy emerged from pandemic lockdowns. Figure 3 shows that since January 2022, the Phillips curve is essentially vertical: The unemployment rate has hovered around 3.6 percent, and inflation has varied from 7 percent (in June) to 5.3 percent (in December).

The recent experience raises the question: What happened to the Phillips curve that it is acting so differently now than in the pre-pandemic period? Freshwater macroeconomists would once again argue that this difference shows the Phillips curve is a statistical anomaly and should not be used as a foundational element guiding monetary policy. Having grown up in the profession surrounded by freshwater macroeconomists, I am very sympathetic to this argument.

But setting that view aside for now, let's consider the two other possible stories I've mentioned to explain the data. The first story relies on inflation expectations becoming unanchored and causing the short-run Phillips curve to shift around. This theory is illustrated in figure 4. There is a vertical long-run Phillips curve anchored at U^* , which is the rate of unemployment that occurs in the absence of price stickiness, and realized inflation is equal to inflation expectations. And there is a downward sloping short-run Phillips curve that shows a tradeoff between inflation and unemployment due to

⁴ See Figura and Waller (2022) for a discussion of how much unemployment necessarily needed to rise to bring inflation down toward the FOMC's 2 percent target. This view was not universal, see Blanchard, Dornbusch and Summers (2022).

some nominal price or wage stickiness in the economy. The short-run Phillips curve assumes a given level of inflation expectations. If inflation expectations increase, the short-run Phillips curve shifts up. So, if inflation expectations have increased in recent history, we would move from a lower to a higher Phillips curve, as shown by the vertical shift up in the dots. These shifting dots generate what, on the surface, looks like an essentially vertical Phillips curve, thereby matching the 2022 data.

The second possible explanation follows from the New Keynesian Phillips curve where there is a sudden increase in the frequency of price changes.⁵ In that model, the slope of the Phillips curve is determined by the frequency of price changes—the more often prices change, the steeper is the Phillips curve. This dynamic is illustrated in figure 5. An increase in the frequency of price changes steepens the short-run Phillips curve even if inflation expectations are well anchored at 2 percent. If in recent years the frequency of price changes has increased, we would move from a flatter to a steeper short-run Phillips curve. On the surface, moving from the blue to red dot, it again looks like an essentially vertical Phillips curve, but just as in the first story, the data are showing us points on different Phillips curves.

What does this suggest about the relationship between inflation and labor market slack and the implications for monetary policy? The answer depends on data about inflation expectations and the frequency of output price changes. Let's look at each of these factors.

⁵ Hall (2023) suggests that in times of high volatility of price determinants—costs and productivity—, like around the time of the pandemic, firms will adjust their prices more frequently than in other times.

Figure 6 reproduces two charts on inflation expectations from the Federal Reserve's March 2023 *Monetary Policy Report*.⁶ The charts show that the behavior of inflation expectations depends on the data one uses to measure those expectations.⁷ The left panel reports survey-based measures, while the right panel captures market-based inflation expectations over a variety of time horizons.

On the left, we see that shorter-run inflation expectations followed observed inflation up and down in recent years, with a notable increase in 2021 before reversing course in 2022 and into early 2023. But inflation expectations over a longer horizon remained within the range of values seen in the years before the pandemic and appear broadly consistent with the FOMC's longer-run 2 percent inflation objective. Similarly, in the right panel, market-based measures of longer-term inflation compensation are also broadly in line with readings seen in the years before the pandemic. So, overall, measures of longer-term inflation expectations have remained contained, while shorter-term expectations had moved up in 2021 and have partially reversed their earlier increases. These data suggest that changes in inflation can be associated with an unanchoring of inflation expectations if we believe price-setting behavior is influenced by changes in shorter-term inflation expectations.

Let's now look at the data on the frequency of output price changes in 2021 and 2022. Preliminary work by Montag and Villar Vallenias (2023) uses U.S. Consumer Price Index micro-data to examine about 90,000 individual prices each month and determines

⁶ See Board of Governors of the Federal Reserve System (2023), *Monetary Policy Report* (Washington: Board of Governors, March), https://www.federalreserve.gov/monetarypolicy/files/20230303_mprfullreport.pdf.

⁷ Gorodnichenko (2023) recently argued at the U.S. Monetary Policy Forum that inflation expectations of households and firms have become unanchored.

if there was a change and, if so, was the change an increase or decrease. Figure 7 summarizes their findings. The monthly price change frequency (the black line) increased from about 10 percent of the sample in 2019 to around 20 percent by the end of 2021 and held around that level in 2022. The increase in price change frequency is primarily driven by firms upwardly adjusting their prices (the red dashed line) during this period. Furthermore, anecdotal evidence I have received from market contacts is consistent with the view that firms were quicker to change prices over 2021-22 than they were in the previous decade. So, hard and soft data suggest that the frequency of price changes is contributing to what looks like a steep Phillips curve in recent years.

Other than providing for a fun academic discussion, what does this analysis mean for monetary policy makers? If unanchored inflation expectations were driving what looks like a shifting Phillips curve, this would be extremely problematic for central bankers because it could require dramatic actions by the FOMC to lower inflation expectations to shift the Phillips curve back down. In current circumstances, one would need to believe it is shorter-term expectations that matter for price setters. If this belief is true, I take some comfort in the fact that short-term inflation expectations have moved down reasonably fast over the past year. However, I am not sure how much weight to put on this story.

The higher-frequency-of-price-changes story is a more encouraging guide for central bankers. A steep Phillips curve means inflation can be brought down quickly with relatively little pain in terms of higher unemployment. Recent data are consistent with this story.

To conclude, it may not surprise you all that I like story number two a lot better. But we will need more data to conclude which story is right—which is what a data-dependent central bank does to implement appropriate monetary policy. With that, I will stop talking, and I look forward to a robust discussion with lots of good arguments telling me I am wrong.

References

Robert J. Barro, David B. Gordon. A Positive Theory of Monetary Policy in a Natural Rate Model, *Journal of Political Economy*, Vol. 91, No. 4 (Aug. 1983), pp. 589-610.

Aleksander, Berentsen, Guido Menzio and Randall Wright (2011). Inflation and Unemployment in the Long Run, *American Economic Review*, Vol. 101, No. 1, (Feb. 2011), pp. 371-98.

Olivier Blanchard, Alex Domash and Lawrence H. Summers. Bad News for the Fed from the Beveridge Space, Peterson Institute for International Economics, Policy Briefs, 22-7, July 2022.

Andrew Figura and Christopher Waller. What Does the Beveridge Curve Tell Us About the Likelihood of a Soft Landing? *FEDS Notes*, July 29, 2022.

Milton Friedman. Nobel Lecture: Inflation and Unemployment, *Journal of Political Economy*, Vol. 85, No. 3 (June 1977), pp. 451–472.

Yuriy Gorodnichenko. Why Did We Miscast Inflation? Panel discussion, US Monetary Policy Forum, (Feb. 2023)

Robert Hall. A Major Shock Makes Prices More Flexible and May Result in a Burst of Inflation or Deflation, NBER Working Paper No. 31025, March 2023.

Finn Kydland and Edward Prescott. Rules Rather than Discretion: The Inconsistency of Optimal Plans, *Journal of Political Economy*, Vol. 85, No. 3 (June 1977), pp. 473-492

Hugh Montag and Daniel Villar Vallenas. Price-Setting in the Covid Era.
<https://www.aeaweb.org/conference/2023/program/powerpoint/ZkzNkh7Q>



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Christopher J. Waller
Member

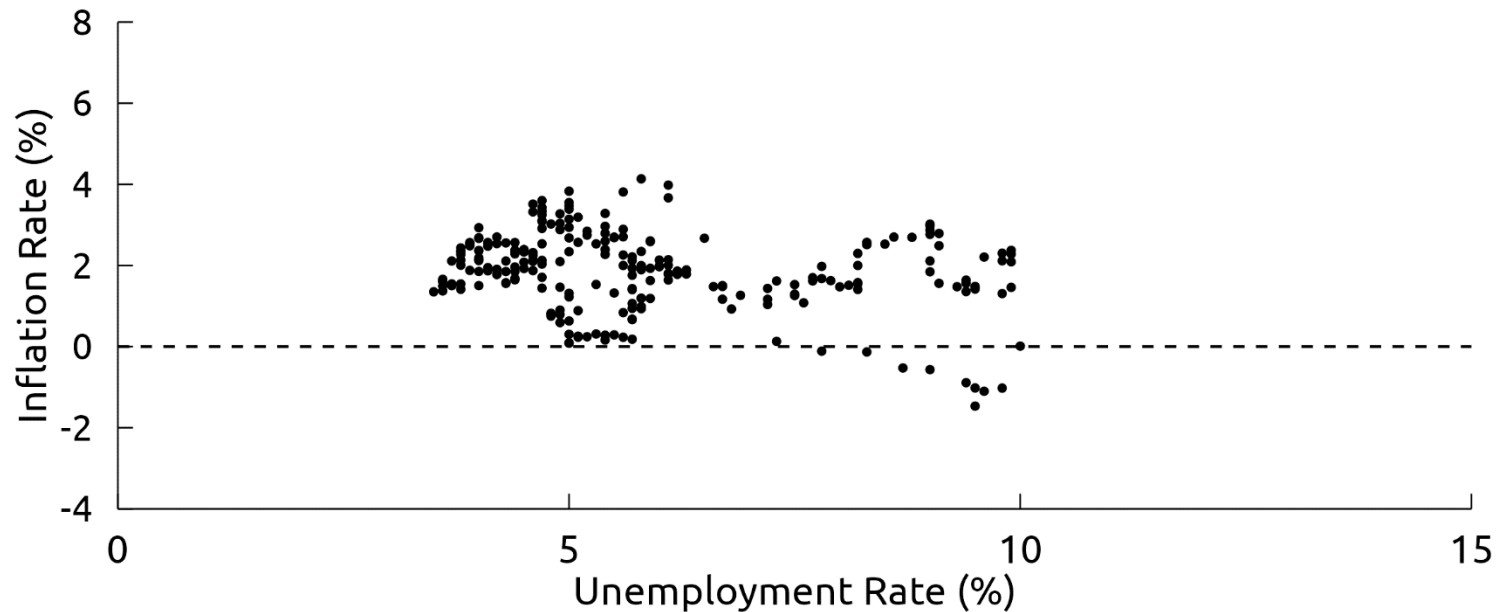
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Figure 1

Phillips Curve, 2000–19

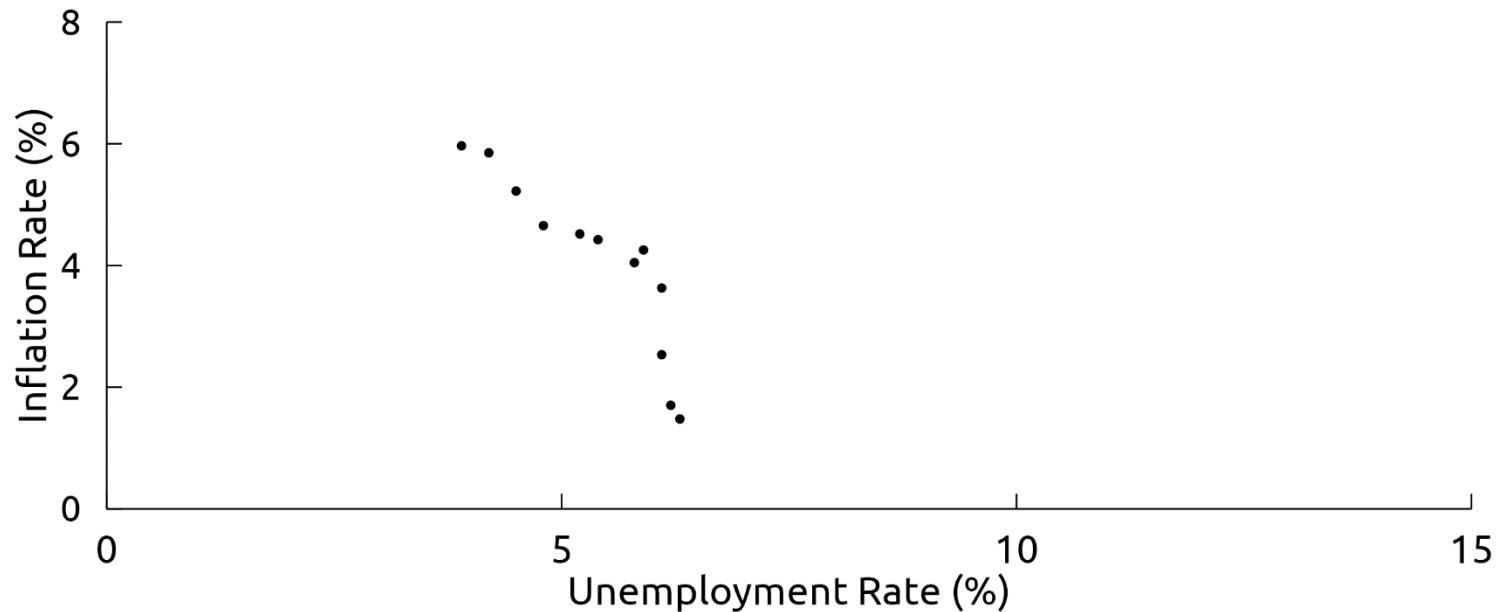


Note: Inflation is the 12-month percent change in the personal consumption expenditures index.

Source: Bureau of Economic Analysis; Bureau of Labor Statistics; both via Haver Analytics.

Figure 2

Phillips Curve, 2021

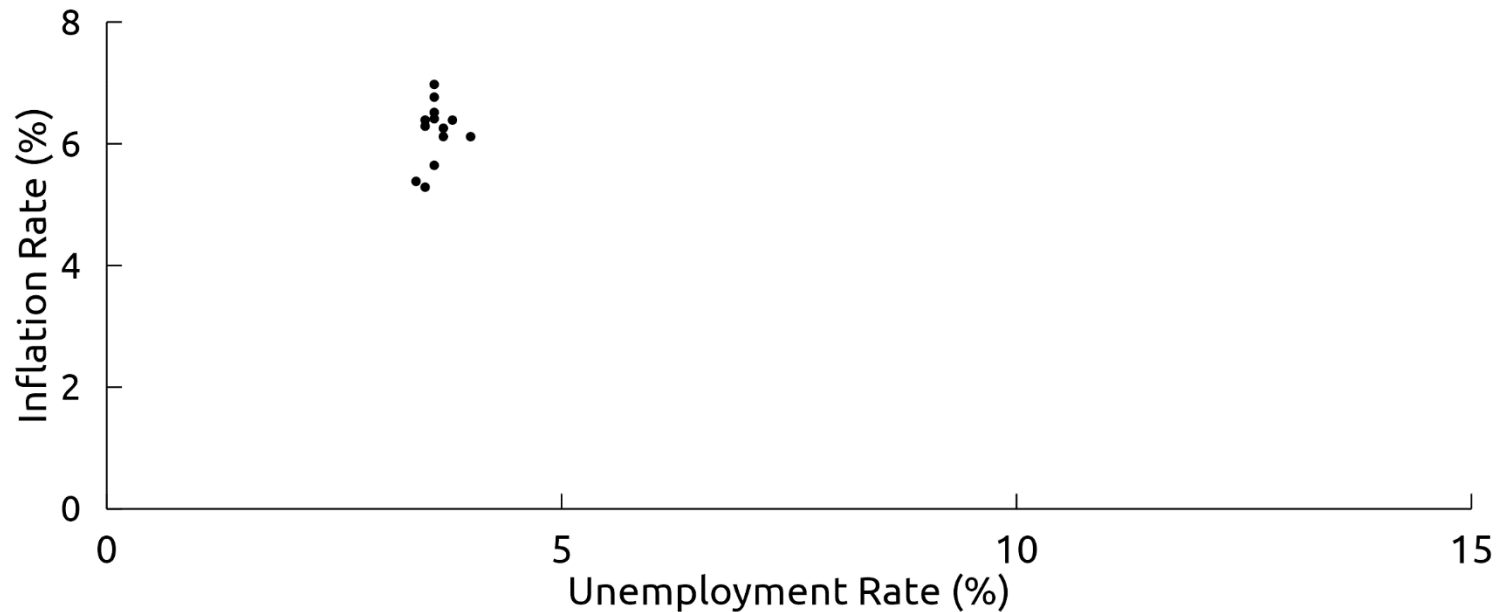


Note: Inflation is the 12-month percent change in the personal consumption expenditures index.

Source: Bureau of Economic Analysis; Bureau of Labor Statistics; both via Haver Analytics.

Figure 3

Phillips Curve, 2022–Present



Note: Inflation is the 12-month percent change in the personal consumption expenditures index.

Source: Bureau of Economic Analysis; Bureau of Labor Statistics; both via Haver Analytics.

Figure 4 – Unanchored Inflation Expectations

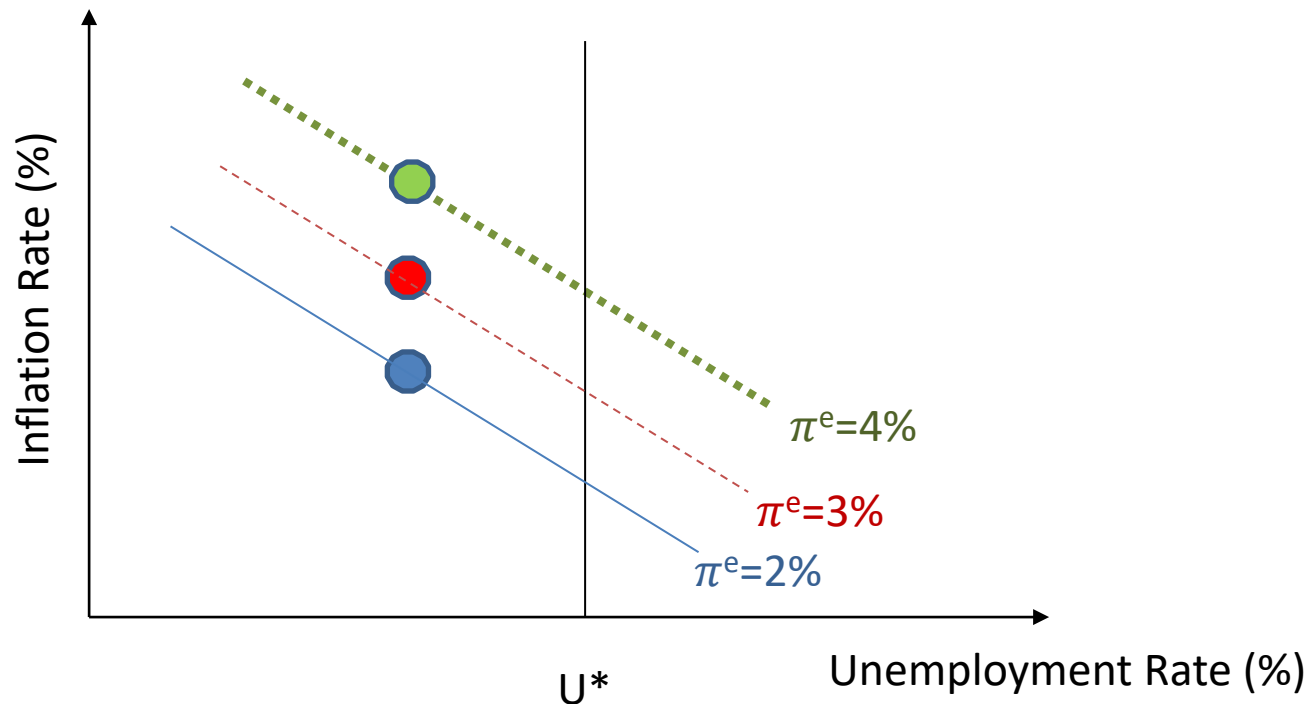


Figure 5 – Frequency of Price Changes

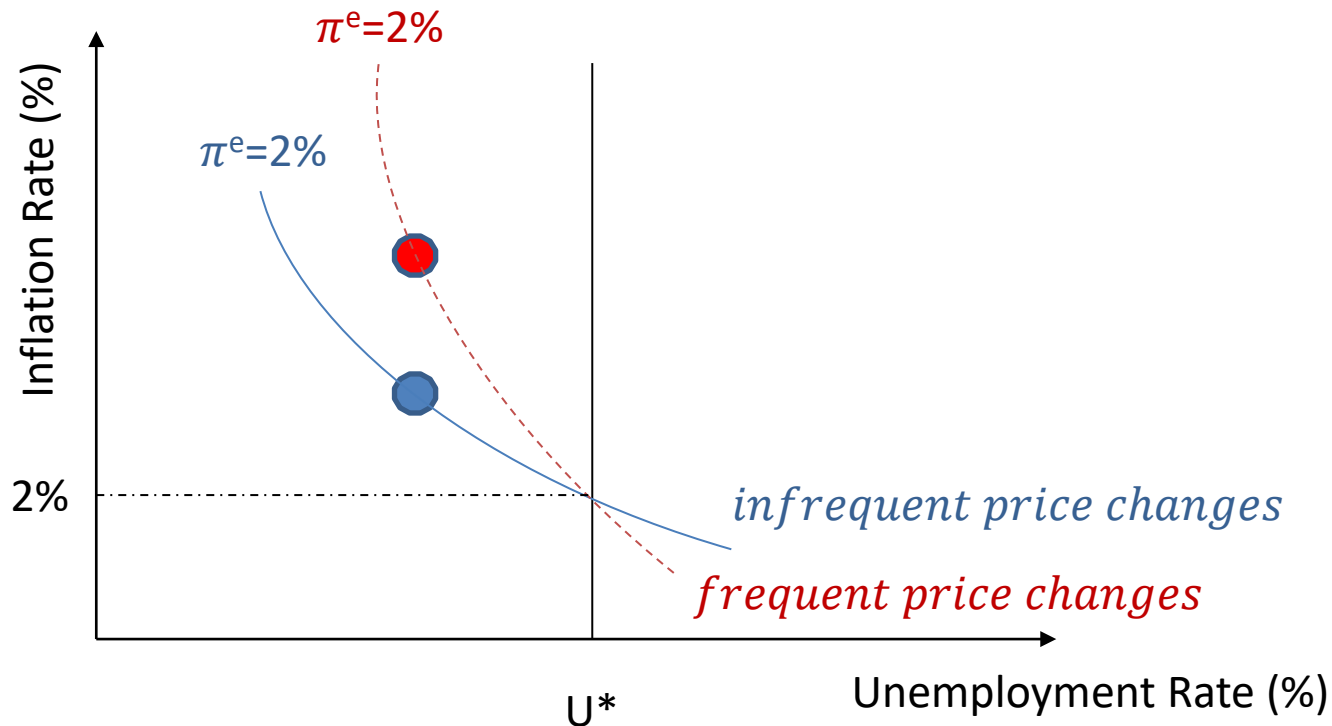
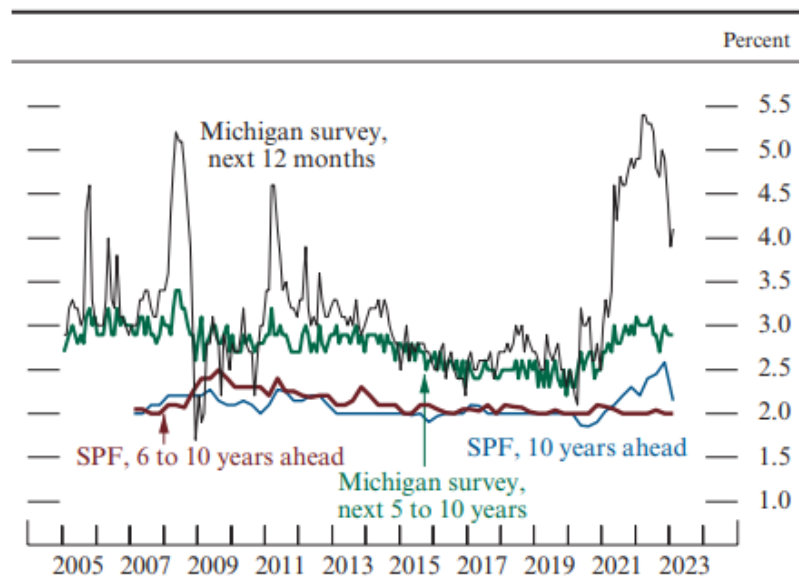


Figure 6 – Inflation Expectations

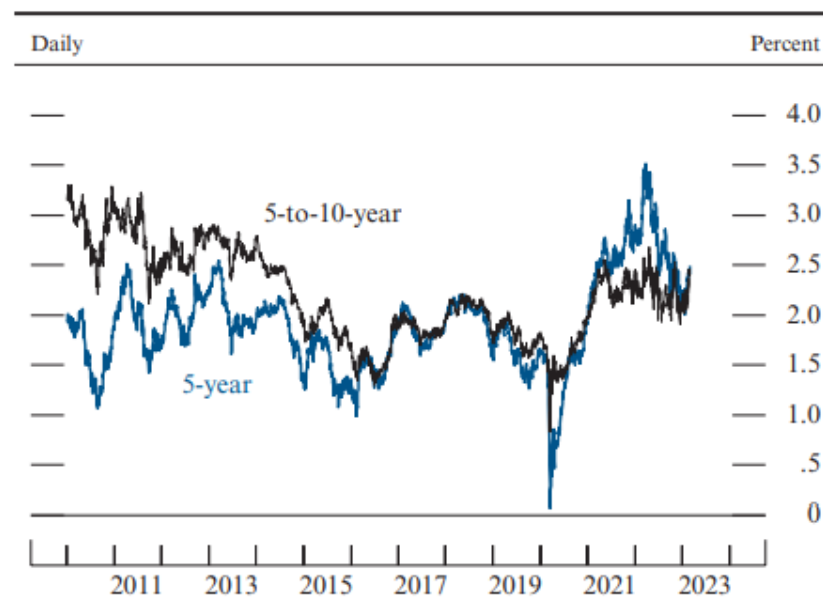
8. Measures of inflation expectations



NOTE: The Survey of Professional Forecasters (SPF) data are quarterly, begin in 2007:Q1, and extend through 2023:Q1. The data for the Michigan survey are monthly and extend through February 2023.

SOURCE: University of Michigan Surveys of Consumers; Federal Reserve Bank of Philadelphia, SPF.

9. Inflation compensation implied by Treasury Inflation-Protected Securities



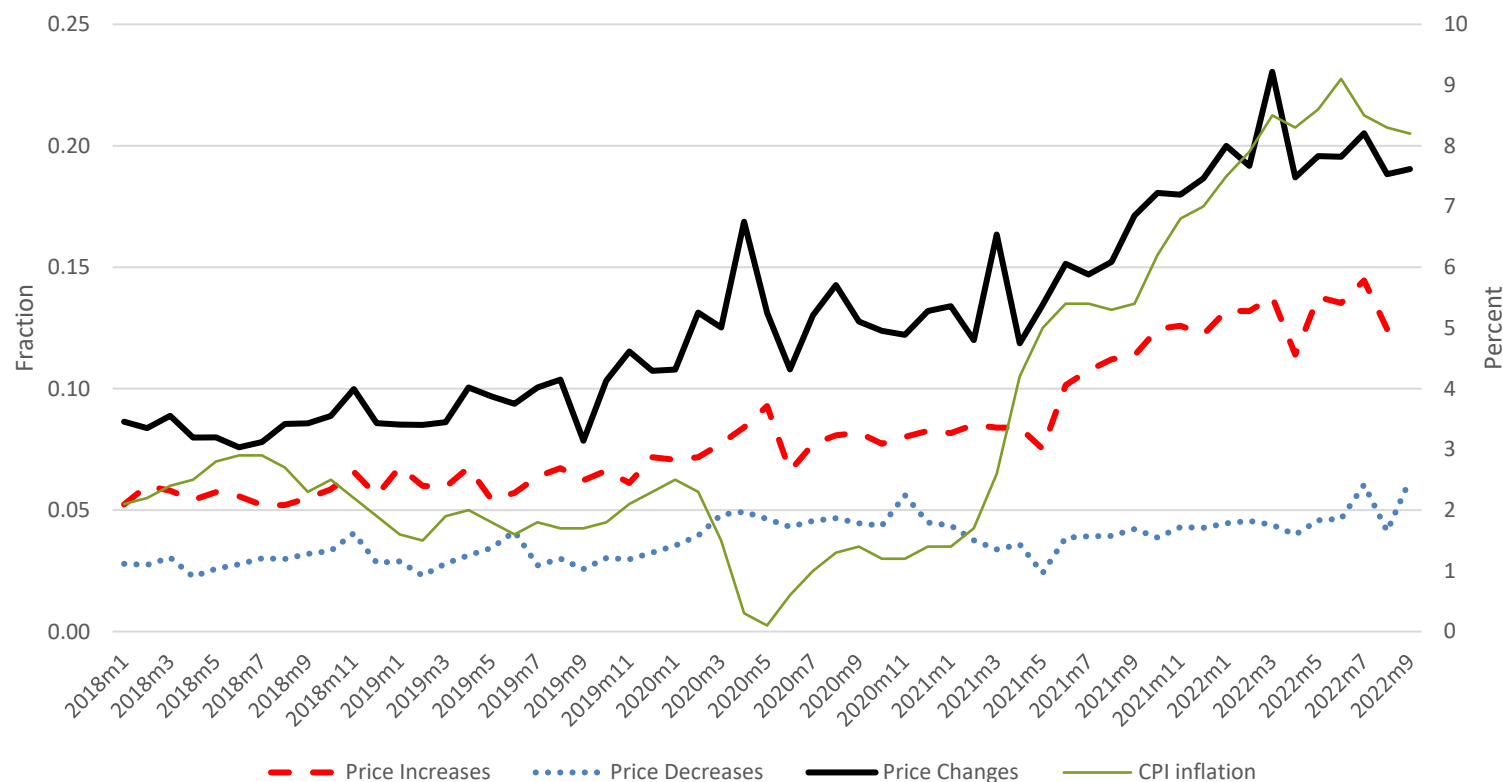
NOTE: The data are at a business-day frequency and are estimated from smoothed nominal and inflation-indexed Treasury yield curves.

SOURCE: Federal Reserve Bank of New York; Federal Reserve Board staff calculations.

Source: Board of Governors of the Federal Reserve System, *Monetary Policy Report*, March 3, 2023.

https://www.federalreserve.gov/monetarypolicy/files/20230303_mprfullreport.pdf

Figure 7 – Frequency of Price Changes



Note. CPI is consumer price index.

Source: Montag and Villar Vallenas (2023)