Do the Effects of Interest Rate Changes Depend on Inflation?

By Dimitris Christopoulos, Peter McAdam, and Elias Tzavalis

Inflation, as measured by the 12-month change in the consumer price index, fell from a peak of 9 percent in June 2022 to 3.7 percent in August 2023. Despite this decline, inflation remains well above the Federal Open Market Committee's (FOMC) longer-run objective of 2 percent—an objective not met since February 2021. This performance stands in marked contrast to recent decades (starting in the mid-1990s), when inflation generally averaged below 2 percent. However, that benign era was preceded by the high inflation of the 1970s and 1980s.

Accordingly, many economists have interpreted inflation rates over time as belonging to different regimes or states—for example, being persistently "high" or "low." These regimes may influence how monetary policy affects the economy: for example, high inflation reduces real (that is, inflation-adjusted) interest rates, which influence the demand for interest-sensitive goods and add to uncertainty. In this article, we assess whether U.S. monetary policy (represented by the path of the federal funds rate) has different effects on the economy depending on which inflation state the economy is in. We find that the economy reacts more slowly and with more volatility to a change in monetary policy in a high-inflation state—that is, when our measure of inflation expectations exceeds a value of around 4 percent—than in a

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low-inflation state. We also find that in a high-inflation state, interest rates must be held higher for longer to bring inflation back down relative to a low-inflation state.

Section I discusses the evolution of inflation and the federal funds rate since the 1970s and broadly tries to identify high- and low-inflation regimes. Section II shows how different economic variables react to a positive monetary policy shock in the different inflation regimes using a statistical model. Section III examines why the effects of monetary policy may depend on the economy's inflation regime.

I. Inflation and the Federal Funds Rate since the 1970s

To assess how different inflation regimes might influence the effect of monetary policy, we first look at how inflation and the federal funds rate have evolved over time. Chart 1 shows monthly annualized inflation (blue line) alongside the monthly value of the federal funds rate (green line) from 1970 through 2020. The data appear volatile over the full sample, with periods of high and low inflation and high and low interest rates. Given this long and diverse period of inflation, the reaction of monetary policymakers has likely varied over time as well—in terms of the importance they attach to different economic objectives over time, how they conduct monetary policy, and how their changes to monetary policy transmit to the economy.

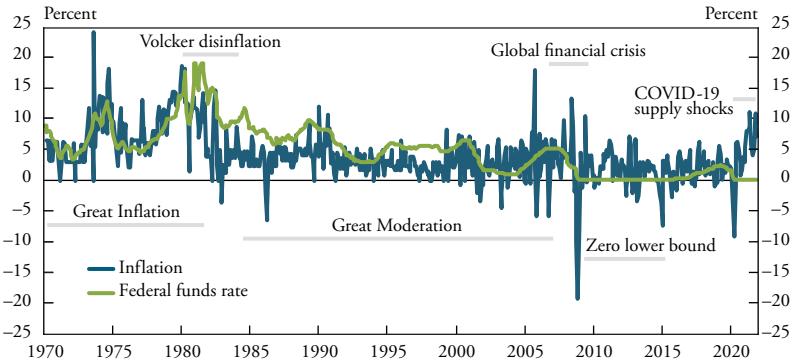
Monetary policy regimes

At a broad level and across a variety of methodologies, many researchers have tended to categorize the evolution of monetary policy into different regimes or states (see, for example, Sims and Zha 2006; Davig and Leeper 2007, 2008; Liu, Waggoner, and Zha 2009; Bianchi 2013; Davig and Doh 2014; Ascari and Haber 2022). These narratively defined regimes offer a useful way to think about the evolution of the economy and of policy. However, they can also provide a useful benchmark for the model-partitioned regimes that our statistical model identifies, which we will discuss in Section II. The regimes that follow have been generally accepted in extant research.

Great Inflation. Accommodative monetary policy in the 1970s set the stage for high inflation, exacerbated by relatively loose fiscal policies, oil shocks, and the breakdown of the Bretton Woods system of

Chart 1

Inflation and the Federal Funds Rate, 1970–2021



Sources: Board of Governors of the Federal Reserve System and U.S. Bureau of Labor Statistics, both accessed through the Federal Reserve Bank of St. Louis (FRED).

fixed exchange rates. During this period, inflation climbed to historic double-digit values, and the economy entered four separate recessions. This Great Inflation period may be considered to begin as early as the mid-1960s and last until 1982 (the latter years also spanning the "Volcker disinflation").

Volcker disinflation. To try to control the Great Inflation, then-Federal Reserve Chair Paul Volcker worked to bring down inflation at the cost of a high and volatile federal funds rate and two deep recessions. From the 1970s until the early 1980s, inflation trended up to atypically high levels before starting to decline in the mid-1980s. Accordingly, the federal funds rate rose drastically too, reaching a peak of around 20 percent in 1980–81. Interest rates during this period were both higher and sustained at higher levels for longer than during the Great Inflation period.

Great Moderation. The monetary policies of the Volcker regime may have set the stage for a long period of macroeconomic stability that started in the mid-1980s and lasted until just before the global financial crisis in 2007. Although inflation was still quite volatile during this period, average inflation values were generally below or around 2 percent.

Global financial crisis and zero lower bound episode. The global financial crisis of 2007–09 was characterized by very low inflation rates, which thereafter fluctuated around 2 percent. In policy terms, the period was exemplified by highly accommodative monetary and fiscal policies. From 2009 until around 2015, in a bid to stimulate

the economy, the federal funds rate was reduced to around zero, and central banks around the world set interest rates at very low (sometimes even negative) values (this period is marked as the zero lower bound in Chart 1). At the same time, central banks began engaging in a range of unconventional policies such as quantitative easing and forward guidance (Bundick and Smith 2022). These actions reflected not only the severity of the economic crisis and depressed inflation but also that central banks deemed traditional policy responses insufficiently potent.

COVID-19 and global disruptions. Toward the end of the sample, from 2020 onward, the COVID-19 pandemic and a variety of associated shocks produced global supply-chain disruptions. Accordingly, starting in early 2021, both inflation and the federal funds rate began to rise as demand pressures took hold.

Relationships between inflation and monetary policy over time

Both Chart 1 and the associated regimes help illustrate that the relationship between inflation and the federal funds rate is by no means monotonic. In the early 1970s, high inflation was succeeded by a strong monetary policy response, with several hikes to the federal funds rate. In late 2008, however, inflation was above 2 percent (the Fed's inflation target since 2012), but the federal funds rate was barely above zero.

Therefore, inflation and interest rates need not move in lockstep over time. Different shocks and economic conditions may warrant different monetary policy responses. Moreover, the Federal Reserve's monetary policy framework has changed over this 1970–2020 sample from responding to the exchange rate and money supply to targeting inflation. Given that the effect of changes in monetary policy is likely to be sensitive to these distinct policy and economic states, our analysis in the next section uses a framework that tries to assess the state-dependency of monetary policy.

II. Monetary Policy in High- and Low-Inflation Regimes

To assess whether persistently high or low inflation influences the conduct of monetary policy, we estimate a statistical model that allows for monetary policy responses to differ depending on the state of the economy. Specifically, we use a threshold vector autoregression model (TVAR), which allows for different parameter values and model

responses when a "threshold variable" exceeds a certain estimated value. In our case, the threshold variable is a 20-month moving average of inflation rates.[1] We think of this as a measure of inflation expectations. We use this measure to capture the idea that different monetary policy states are likely to emerge only after protracted changes in inflation, not discrete, temporary spikes.

First, we examine how the TVAR model, when estimated, partitions the data into high-and low-inflation regimes and evaluate whether this partitioning aligns with the narrative regimes identified in the previous section. Second, we examine how the economy responds to an unanticipated increase in interest rates in each inflation state.

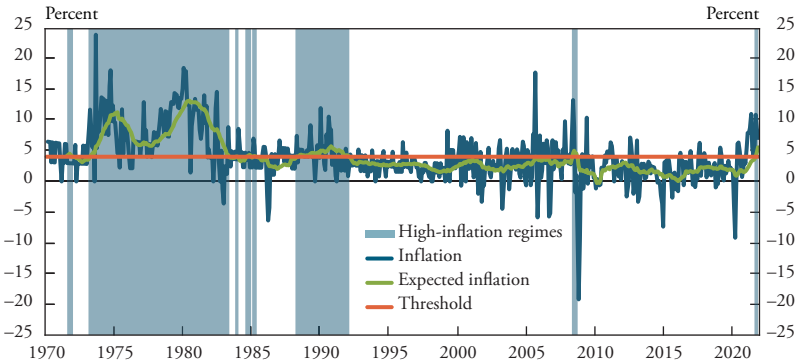
A graphical perspective on inflation and inflation regimes

Estimating the TVAR yields a threshold value of 4.05 percent for expected inflation, suggesting the economy is in a high-inflation state when expected inflation is above 4.05 percent and a low-inflation state otherwise. The model implies that the effect of monetary policy would be different in each of these two regimes. Chart 2 plots monthly annualized inflation rates in blue and trend or expected inflation (as measured by a moving average) in green. The horizontal orange line denotes the empirically determined threshold value. If expected inflation exceeds that threshold value, the economy is categorized as being in a high-inflation regime. Otherwise, the economy is in a low- (or "normal") inflation regime. The blue shading denotes periods in which the economy is in a high-inflation regime. For example, from the mid-1970s to the mid-1980s, expected inflation exceeded the threshold value of 4.05; thus, the economy is considered to have been in a high-inflation regime.

Comparing Chart 2 with Chart 1 reveals that the TVAR-identified high- and low-inflation regimes largely match up with the descriptive regimes identified in the previous section. As Chart 2 shows, the economy entered high-inflation states near the start of the sample, during a protracted window around 1988–92 and, more briefly, around late 2008 and the end of 2021. These periods are roughly consistent with the Great Inflation, Volcker disinflation, global financial crisis, and pandemic shock periods described in the previous section. Overall, the high-inflation states in Chart 2 represent around 40 percent of the sample.

Chart 2

Inflation and Identified High-Inflation States, 1970–2021



Notes: Our measure of expected inflation is a 20-month moving average of the inflation series. The orange horizontal line, which denotes the threshold value of inflation (around 4 percent), is estimated by our TVAR model. The shaded areas represent periods when expected inflation exceeds the threshold value.
Sources: Board of Governors of the Federal Reserve System (FRED), U.S. Bureau of Labor Statistics (FRED), and authors' calculations.

Note that the estimated threshold value of 4.05 percent exceeds the FOMC's 2 percent target, suggesting that when inflation is below this value, monetary policy and monetary policy responses are within some normal range. Accordingly, when inflation is within the zero to 4 percent range, the path of the federal funds rate may be reasonably approximated by some standard feedback rule such as a Taylor rule. However, when inflation is outside of that zero to 4 percent range, monetary policy may have to depart from such a rule—for example, by applying higher weights to policy targets (see Davig and Leeper 2008).

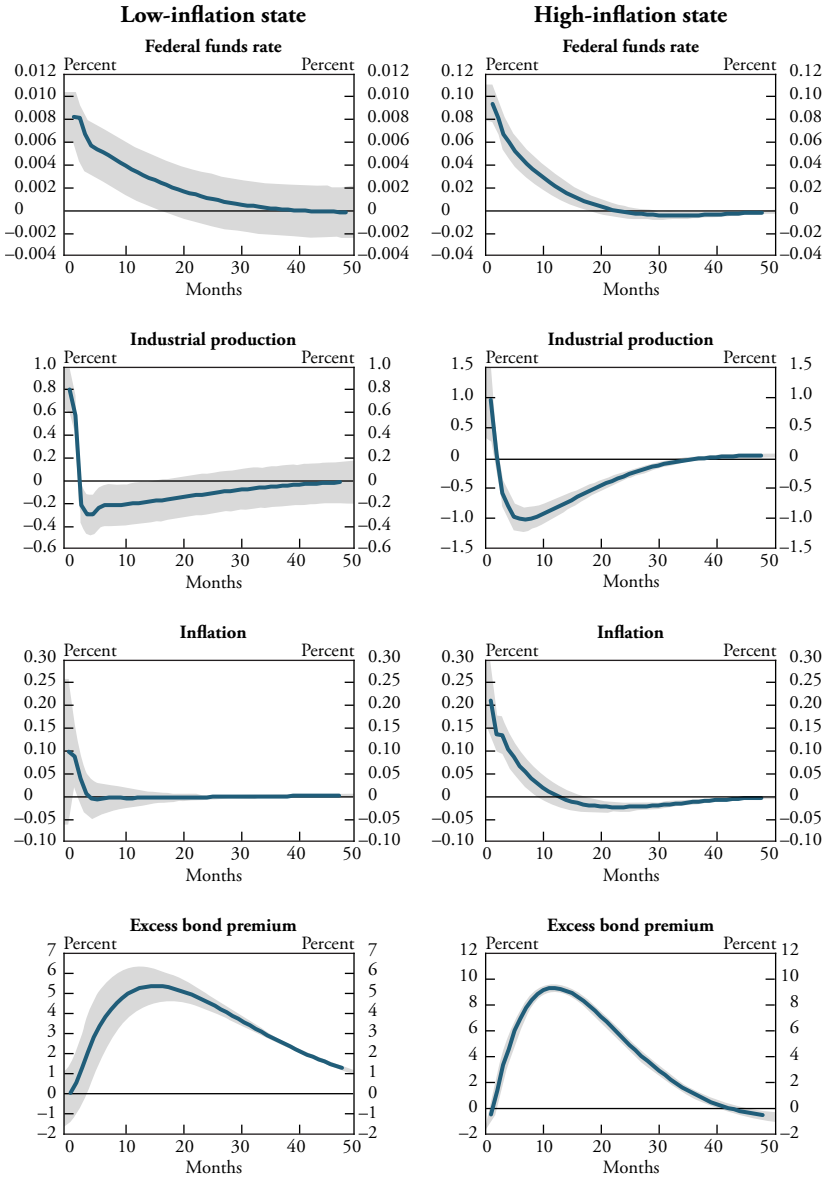
Graphical analysis of an unanticipated increase in interest rates

Chart 3 shows the effect of a one-standard-deviation increase in the federal funds rate when the economy is in the low-inflation regime (left column) or high-inflation regime (right column) over a 48-month reporting horizon. In particular, the panels show the responses of four variables commonly used to examine the transmission of monetary policy: the federal funds rate, industrial production (a measure of output), inflation, and the excess bond premium (a measure of firms' borrowing conditions).

Overall, the responses to a one-deviation increase to the federal funds rate follow a pattern consistent with many previous studies on the so-called monetary transmission mechanism: both inflation and output

Chart 3

Impulse Responses to a One-Standard-Deviation Increase in the Federal Funds Rate



Note: Gray bands indicate 90 percent confidence intervals.
Source: Authors' calculations based on the estimated TVAR model.

(as measured by industrial production) fall after an initial lag, while the bond premium rises, reflecting the tighter monetary policy conditions. Because the increase in interest rates is temporary, all series eventually return to the baseline. Higher interest rates reduce demand for goods and services in the economy, and this reduction in demand in turn dampens inflation. Because both prices and output change slowly, it takes time for the series to return to their baselines, and some series may be temporarily below (or above) base until the full adjustment is complete.

Although the qualitative pattern is essentially the same in both low- and high-inflation regimes, the quantitative effects are not. In the low-inflation state, for instance, output and inflation revert to their baselines much more quickly and with much less volatility (fewer swings) than in the high-inflation state. Industrial output growth falls below zero three months after the shock (at a value of around –1.5 percent) and reverts quite rapidly back to its baseline. Inflation falls below zero over the same horizon but reverts to its baseline even more quickly. However, in the high-inflation state, the responses of inflation and output are both more volatile and more persistent (meaning, both take longer to return to their baselines).

Finally, comparing the responses of the federal funds rate in Chart 3 suggest that monetary policy must work harder in high-inflation regimes to maintain roughly the same outcomes. The initial increase in the federal funds rate is smaller in the low-inflation state than the high-inflation one, suggesting policymakers need to raise the federal funds rate by a greater amount to influence output, inflation, and the excess bond premium when inflation is high. In other words, in the high-inflation regime, monetary policy must be more aggressive to force inflation back to its target. This finding is consistent with current developments: since March 2022, the FOMC has engaged in a rapid upward movement of the federal funds rate, as it has become clear that increases in inflation were higher and more persistent than initially thought.

III. Why Should the Effect of Monetary Policy Depend on Movements in Inflation?

Having presented results showing that the effect of monetary policy changes on the economy differs depending on the prevailing inflation regime, we now touch upon why we might expect and rationalize such an outcome.

In many economic models, monetary policy is assumed to influence the economy precisely because of "price stickiness"—the idea that prices are slow to adjust over time to various economic shocks and events. Price stickiness slows the response of the economy to any shock and thus essentially transfers some of the effects of a shock to output and employment—variables that the Fed also cares about.

We might also expect the degree of price stickiness itself to change depending on the state of the economy. When inflation is low and stable, firms set and reset prices in a manner reflecting that environment. However, if inflation is high and volatile (or is expected to be as such), profit-maximizing firms will likely change prices much more rapidly. This change in firms' price-setting behavior would have implications for how monetary policy influences the economy. Indeed, several researchers (for example, Davig and Leeper 2007, 2008) have posited a threshold monetary policy rule in which the reaction of interest rates to inflation depends on how far inflation is away from its target.

Likewise, when inflation is high, long-run inflation expectations are more likely to become unanchored (in other words, people may stop believing inflation will eventually return to its target). Unanchored inflation expectations are a key concern for monetary policymakers, and so when inflation does drift up (or down) to extreme levels, monetary policymakers may react more forcefully.

Finally, high inflation reduces real (that is, inflation-adjusted) interest rates, which influence the demand for investment, durable goods, and housing—as well as adding to uncertainty. Inflation also redistributes resources across agents (such as savers and lenders), who may have very different spending and consumption patterns.

Conclusions

In this article, we examine whether monetary policy has different effects on key economic variables based on the economy's inflation regime. We find that when a measure of expected inflation exceeds a value of around 4 percent—our threshold for a high- versus low-inflation regime—the effect of monetary policy changes. Specifically, we find that in a high-inflation state, interest rates must be held higher for longer to bring inflation back down relative to a low-inflation state.

Endnote

[1]In a more extensive research article (Christopoulos, McAdam, and Tzavalis 2023), we also look at TVARs and monetary policy shocks but do so in a way that includes some additional statistical devices (namely, copulas) to better capture omitted "endogenous" interactions in the VAR. The model comprises four monthly variables: the growth of industrial production (a measure of output), the rate of inflation, the federal funds rate, and the excess bond premium. Inflation and output growth are expressed in annualized terms. The excess bond premium is taken from Gilchrist and Zakrajšek (2012) and begins in 1973. This variable is added to capture financial and corporate interactions in the transmission of monetary policy. These four variables have served as a benchmark in many VAR monetary studies (see Bauer and Swanson 2022; Gertler and Karadi 2015). The ordering of the variables in the TVAR allows us to implement the unexpected monetary change (or shock) in a manner consistent with theory (namely, a Cholesky ordering).

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