Breaking Down the Latest Fight Against Inflation

We apply a novel empirical approach to understand the role monetary policy played in post-COVID inflation.

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Like the central banks of other major advanced economies, the Federal Reserve has embraced systematic monetary policy, which means that its decisions are data dependent and this dependence follows a pattern understood by the public. For example, when economic output is above its natural level and inflation is above its intended target, the public understands that the Fed will likely increase the federal funds rate—which affects the rates banks charge for mortgages, car loans, credit cards, and other loan products—to rein in inflation.[1]

Economists and central bankers generally use monetary policy rules to summarize the conduct of systematic monetary policy.[2] Although these rules offer a useful benchmark, the Fed has never formally adopted one as a strict decision-making mechanism.[3] Instead, Fed policymakers set the federal funds rate by considering the bulk of economic data and assessing the balance of risks involved in achieving their objectives as mandated by Congress.[4] These deliberations take place at the Federal Open Market Committee (FOMC) meetings and culminate with the committee announcing its decision.

If the Fed doesn't strictly adhere to a specific monetary policy rule, how can we characterize the systematic behavior that underlies the decisions of the FOMC? And why is this characterization useful?

Characterizing systematic policy requires an analytical framework. In empirical macroeconomics, one popular approach uses structural vector autoregressions (SVARs), a class of flexible econometric models first proposed by Nobel laurate Christopher Sims.[5] Building on Sims's work, Giorgio Primiceri of Northwestern University proposed that economists estimate the Fed's systematic behavior by using an SVAR of the U.S. economy that would account for changes in how the Fed responds to data and changes in other economic relationships.[6]

*See **Structural Vector Autoregressions***

Although appealing, Primiceri's proposed SVAR requires economists to impose restrictions regarding the functioning of the entire economy. In some cases, such as when the number of variables included in the SVAR increases, these restrictions are hard to justify using economic theory or institutional knowledge.[7] To address this concern, the authors of this article, along with Juan Rubio-Ramírez of Emory University and Daniel Waggoner of the Federal Reserve Bank of Atlanta, recently developed a methodology that relaxes this requirement. The distinctive feature of our approach is its ability to estimate systematic monetary policy using assumptions based on institutional knowledge about the Fed without needing to impose controversial restrictions on other aspects of the economy.

By characterizing systematic monetary policy with an SVAR, we can better understand FOMC decisions and conduct counterfactual experiments. In the counterfactual experiment we discuss later in this article, we assess how the economy would have evolved if the Fed had been more dovish or hawkish on inflation. (In the world of central banking, a hawk puts more weight on the inflation leg of the Fed dual mandate relative to a dove.)[8] This is especially important during episodes such as the postpandemic inflation surge—the first episode of high inflation since the Great Inflation of the 1970s.[9] During this surge, there was a debate about how much interest rates would have to increase to bring inflation back to its 2 percent target, and how much this would cost in terms of output. As noted by Federal Reserve Chair Jerome Powell, doing too little or too much could cause unnecessary harm to the economy.[10]

More specifically, by analyzing systematic monetary policy, we can answer three important questions: How did the Fed respond to the state of the economy during the most recent policy-tightening cycle?[11] How does this response compare with a more dovish or hawkish monetary policy response? And should the Fed have fought inflation earlier? In this article, we summarize our findings and discuss our results.

How Systematic Policy Interacts with the Economy

Before tackling the three questions posed above, let us illustrate how systematic monetary policy interacts with the economy. Understanding this interaction reveals why estimating systematic monetary policy is essential for our analysis. We do so with a conceptual aggregate demand and aggregate supply framework, which makes clear that, to understand how monetary policy interacts with the economy, we need to understand both demand channels and supply channels.[12]

The demand channels are summarized by an aggregate demand curve that describes a negative relationship between output and inflation. For instance, as inflation increases above the Fed's 2 percent inflation target, the public expects the Fed to increase interest rates. Higher real interest rates induce consumers to postpone some of their consumption plans and thus lead to lower demand for output today.

The supply channels are summarized by an aggregate supply curve that describes a positive relationship between output and inflation. For instance, as output increases above its natural level, firms in the economy must hire additional workers at higher wages or pay additional compensation to its current employees for them to work longer hours. This increase in labor costs raises production expenses, which leads to higher prices and inflation.

Systematic monetary policy directly affects the aggregate demand curve's slope, which captures the trade-off between inflation and output in the demand side of the economy. If the Fed were to put substantially more weight on inflation than on output, the public would expect the Fed to increase interest rates sharply in response to a given increase in inflation, inducing a large decline in the demand for goods and services. Thus, the aggregate demand curve flattens when the Fed prioritizes controlling inflation. For example, the public's demand for goods and services would noticeably fall in the face of an inflationary shock caused by an unexpected increase in oil prices due to a curtailment of oil production in the Middle East. In part, this would happen because the public would anticipate that the Fed would raise rates sharply in response to this inflationary shock.[13]

But if the Fed were to put substantially more weight on output than on inflation, the public would expect interest rates to rise moderately in response to a given increase in inflation. Hence, the public's demand for goods and services would fall by less than in the previous case in the face of the same inflationary shock. The aggregate demand curve steepens when the Fed prioritizes maintaining output at its natural level.

Although systematic monetary policy directly affects the aggregate demand curve, it has little influence on the aggregate supply curve. Instead, this curve's slope is mainly determined by other factors, such as how the economy produces its goods and services.[14]

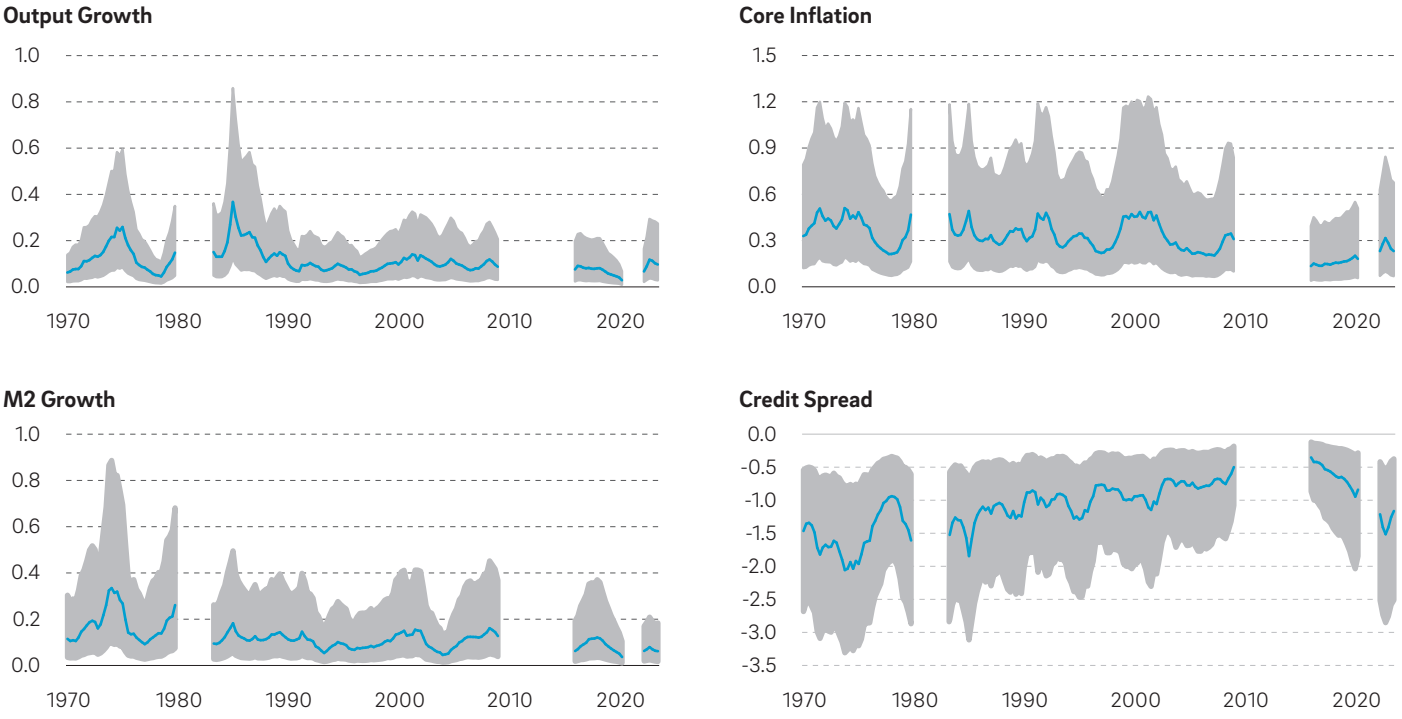
Inflation and output are determined by the intersection of the aggregate demand and aggregate supply curves. As the economy evolves, supply shocks (like our hypothetical spike in oil prices) and demand shocks (like an unexpected decline in consumer confidence) shift these curves, determining new values for inflation and output. If the central bank is primarily focused on maintaining low inflation (and thus the aggregate demand curve is flat, which means that inflation is unresponsive to output fluctuations), the shocks will lead to a larger fluctuation in output. If, however, the central bank is primarily focused on output (and thus the aggregate demand curve is steep, which means that output is unresponsive to inflation), the shocks will lead to a larger fluctuation in inflation.[15]

FIGURE 1

The Fed's Reaction Function Evolves Over Time

The Fed has changed how it sets the federal funds rate in response to movements in inflation, output, and financial market indicators.

Contemporaneous coefficients characterizing the Fed's systematic reaction function from 4Q1959 to 2Q2023



Data Source: Arias et al. (2025)

Note: Dark lines represent posterior medians; shaded regions represent the 68th percentile probability band. Blank spaces correspond to the periods in which the federal funds rate was not the Fed's main policy instrument (4q1979–4q1982) or was subject to the zero lower bound constraint (1q2009–3q2015 and 2q2020–4q2021).

Thus, systematic monetary policy is at the heart of the economy, and different monetary policy stances (that is, different views on how strongly to weight inflation and output in the dual mandate) will result in different economic outcomes. This is why we need to understand what the Fed did in terms of systematic policy, and what it could have done differently.

To be sure, conducting systematic monetary policy involves more than reacting to an increase in inflation as assumed in our illustrative conceptual aggregate demand and aggregate supply framework. In practice, the systematic behavior of central banks takes into account a large number of economic and financial indicators when deciding on the appropriate level of interest rates. Even then, systematic monetary policy does not always fully account for FOMC decision-making; sometimes policymakers' actions are better explained as deviations from their systematic behavior. These deviations are known as monetary policy shocks. Importantly, our analysis will also shed light on whether the actions of the Fed during the postpandemic inflation surge resulted from systematic policy or monetary policy shocks.

How to Measure Systematic Policy in Practice

Researchers have developed several methods for measuring the relationship between systematic policy and the economy. As highlighted above, our method's main advantage is that it estimates systematic monetary policy by leveraging assumptions rooted in institutional knowledge about Federal Reserve policy while maintaining an agnostic stance toward other, more complex aspects of the economy that are challenging to model—all in an environment that allows for structural change.

More specifically, we use time-varying monetary policy coefficients that capture the reaction of the Fed to output growth, inflation, and two financial market indicators: money growth and corporate credit spreads.[16] (The Fed reacts to more than output growth and inflation in part because timely measures of these variables are usually unavailable. So, the Fed also looks at financial market indicators such as money growth and corporate credit spreads to gauge the state of the economy in real time.)

In our SVAR, these policy coefficients characterize the Fed's systematic reaction function. This function quantifies precisely how much the Fed adjusts its main policy instrument (that is, the federal funds rate) in response to economic data, which provides a concrete representation of systematic monetary policy within our SVAR framework.[17] Even so, as mentioned above, the Fed does not always respond exactly as it has according to the

systematic reaction function. These deviations are captured in our SVAR by monetary policy shocks, as explained above.[18]

We can estimate the Fed's systematic reaction function by looking at its historical response to movements in inflation, output, and financial market indicators; we do so by fitting our SVAR to the data. When we estimate contemporaneous coefficients that characterize the Fed's systematic reaction function from the fourth quarter of 1959 through the second quarter of 2023, our key insight is that systematic monetary policy has changed (Figure 1). We illustrate this by highlighting four phenomena often discussed in academic and monetary policy circles.

*See **Monetary Policy Coefficients***

First, the Fed reacted more strongly to inflation in the early 1980s than during the subsequent Great Moderation, on average. Also, the federal funds rate reacted strongly to inflation during the first years of Chair Arthur Burns's tenure (1970–1978) and around the 2000s under Chair Alan Greenspan (1986–2006). Second, although many people think of Chair Paul Volcker's tenure (1979–1986) as exclusively focused on combating inflation, the Fed reacted strongly to output growth in 1983–1984. This suggests that the Fed viewed the high growth of real GDP in 1983–1984 as having the potential to overheat the economy, which would have hindered the progress made against inflation following Chair Volcker's appointment. Third, the political pressure President Richard Nixon exerted on the Fed during the early 1970s is reflected in the Fed gradually becoming more responsive to the credit spread determining borrowing costs of firms (rather than less responsive to inflation).[19] After the end of Nixon's presidency in 1974, the response to corporate credit spreads decreased in absolute terms before the Fed gradually became more responsive again after the Global Financial Crisis (2007–2008). Fourth, the stock of money's response to the growth rate has trended lower since the early 1980s, when policymakers expressed skepticism about using the quantity of money to guide policy.[20] These four changes in systematic monetary policy demonstrate why we need a flexible framework to capture the evolution of monetary policy.

Deconstructing the Latest Tightening Cycle

Time-varying coefficients summarize historical trends in the Fed's behavior. But to assess the role played by systematic policy in a particular episode, such as during the post-COVID inflation surge, economists typically rely on historical decompositions that divide the observed values of economically meaningful variables (such as the federal funds rate, inflation, and output growth) into predictable and unpredictable parts (Figure 2).

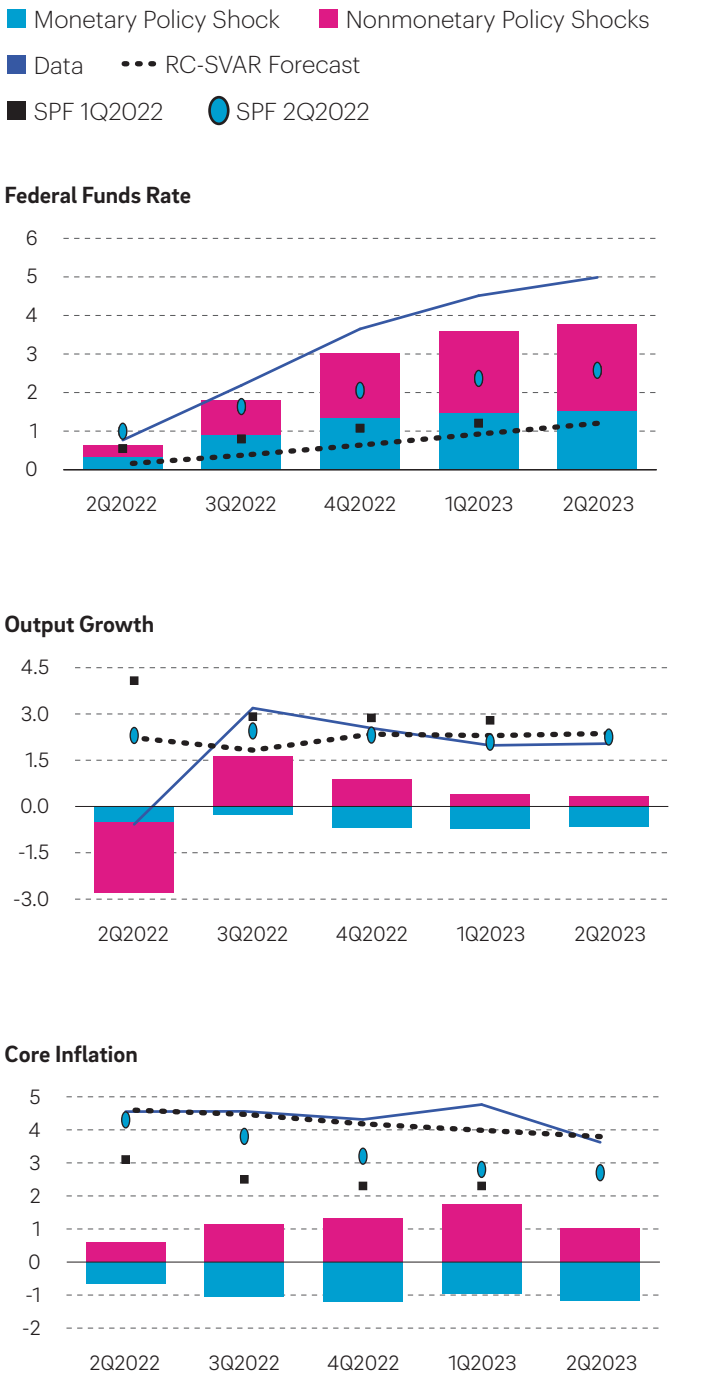
The predictable part is our SVAR's best forecast of how the economy will evolve. For our period of interest, this prediction broadly aligns with the predictions of professional forecasters as measured by the Survey of Professional Forecasters.[21] The unpredictable part is the difference between the realized data and the SVAR's predictions. Our SVAR attributes any difference between the data and the predicted values to either monetary policy shocks or nonmonetary policy shocks. The former are Fed actions that deviate from the reaction function; the latter

FIGURE 2

How Did the Fed Respond to the State of the Economy During the Most Recent Policy-Tightening Cycle?

The bulk of the unexpected increase in the federal funds rate was driven by a combination of demand and supply shocks that were more inflationary than anticipated.

The difference between the realized data (federal funds rate, inflation, and output growth) and the SVAR's predictions; monetary and nonmonetary policy shocks (i.e., the combination of demand and supply shocks) that explain that difference, according to the SVAR; percent for federal funds rate, percent log-difference annualized for output growth and core inflation; 2Q2022–2Q2023



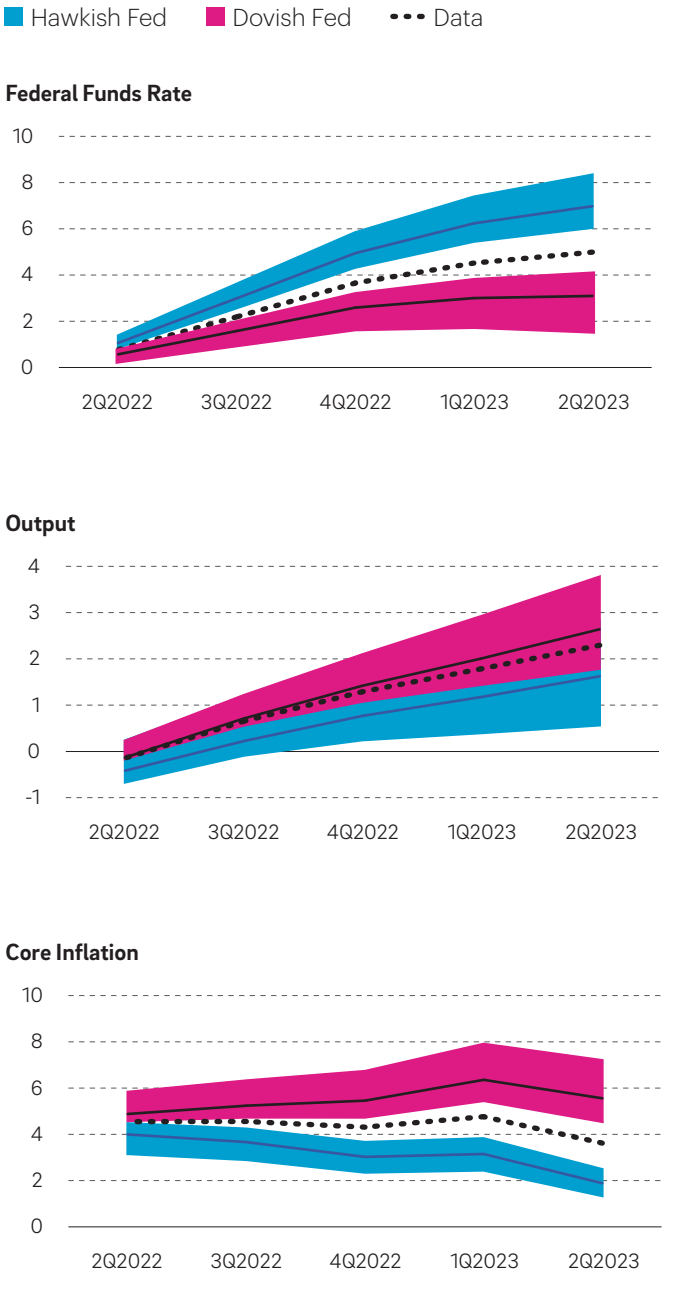
Data Source: Arias et al. (2025)

FIGURE 3

How Does the Fed's Response to the State of the Economy in 2022–2023 Compare with a More Dovish or Hawkish Monetary Policy Response?

A hawkish Fed would have returned inflation to target with negligible lost output.

The difference between the realized data (federal funds rate, inflation, and output) and the SVAR's predictions; actual and hawkish and dovish counterfactuals, according to the SVAR; percent for federal funds rate, percent log-change for output, percent log-difference annualized for core inflation; 2Q2022-2Q2023



Data Source: Arias et al. (2025)

Note: Lines represent posterior medians; shaded regions represent 68th percentile probability bands.

are a combination of demand and supply shocks that shift the economy's aggregate demand and supply relations.

Systematic policy is the critical factor underlying the deconstruction into predictable and unpredictable parts. When coefficients are large, an unpredictable change in the federal funds rate is mainly the result of nonmonetary policy shocks–that is, the Fed is responding to unanticipated changes to supply or demand in pursuit of its dual mandate of full employment and price stability. But if coefficients are small, an unpredictable change in the federal funds rate must be mainly the result of a monetary policy shock–that is, the Fed has changed rates for some reason beyond its systematic reaction function. In addition, systematic policy influences how quickly the economy achieves a status consistent with the Fed's mandate. For instance, a large inflation coefficient means that the Fed is squarely focused on inflation and will quickly aim to neutralize the inflationary effects of any shock by raising rates, whereas a large output growth coefficient means that the Fed will quickly seek to neutralize an adverse demand shock (such as a decline in consumer confidence) by lowering rates.

By deconstructing the path followed by economic variables into predictable and unpredictable parts, we make sense of the evolution of interest rates, output growth, and inflation we observe in the data. We begin the deconstruction in the first quarter of 2022 because the Fed began the latest tightening cycle near the end of that quarter, on March 16. In the first quarter of 2022, a forecaster using our SVAR would have predicted a gradual increase in the federal funds rate, (roughly) on-trend output growth, and persistently high inflation. But by the second quarter of 2023, the federal funds rate averaged 5 percent–nearly 4 percentage points higher than what the SVAR had predicted.

There are two explanations for why the Fed increased interest rates beyond what the SVAR would have predicted. The Fed could have reacted to new information that affected the reaction function, such as unexpected demand and supply shocks that caused the economy to run hotter than could have been anticipated by our SVAR in the first quarter of 2022. In this case, we would attribute the unpredictable part of the historical decomposition to nonmonetary policy shocks. However, the Fed could have reacted to new information outside its typical reaction function. For example, the Fed could have increased rates beyond the prescription of the reaction function to make up for previous deviations from the rule, or it could have taken account of a development or risk not explicitly included in our rule. In this case, we would attribute the unpredictable part of the historical decomposition to monetary policy shocks.

In our analysis, we find that 60 percent of the unexpected increase in interest rates between the first quarter of 2022 and the second quarter of 2023 was due to nonmonetary policy shocks that caused the economy to run hotter than previously anticipated, and the Fed had to increase rates to address this new development. The remaining 40 percent of the unpredictable increase was due to monetary policy shocks and can be interpreted as either the Fed making up for previous deviations from the rule or the Fed accounting for a development or risk not explicitly included in our rule, such as the risk of an inflationary spiral. The latter was a chief concern during the latest tightening

cycle. As Chair Powell said in December 2022, "The worst pain would come from a failure to raise rates high enough and from us allowing inflation to become entrenched in the economy." If that were to happen, he added, "the ultimate cost of getting [inflation] out of the economy would be very high in terms of employment, meaning very high unemployment for extended periods of time, the kind of thing that had to happen when inflation really got out of control and the Fed didn't respond aggressively enough or soon enough ... 50 years ago."[22]

Counterfactual Experiment

Historical decompositions help us understand how the economy and monetary policy have evolved, but our SVAR also helps us determine how output and inflation would have evolved if the Fed had departed from our estimated reaction function.[23] To this end, we replay history since the second quarter of 2022 using a counterfactual reaction function in which the Fed's response to inflation is twice as large as in our estimates. Because this counterfactual captures a more aggressively anti-inflationary stance, we call it the hawkish counterfactual. We then replay history using a counterfactual reaction function in which the response to inflation is half as large as in our estimates. This counterfactual is designed to capture a less aggressive fight against inflation, so we call it the dovish counterfactual.

According to our estimates, the dovish counterfactual would have caused a modest gain in output at the cost of inflation running persistently above 5 percent (Figure 3). In contrast, under the hawkish counterfactual, inflation would have returned to the 2 percent target at a negligible cost in terms of output. Ultimately, the cost in terms of output is determined by the slope of the aggregate supply curve, which measures the supply side trade-off between output and inflation. Our results are consistent with a steepening of this curve, which suggests that during the post-COVID inflation surge, policymakers faced a less adverse trade-off than they had faced in the 1970s.[24]

Was the Fed Behind the Curve?

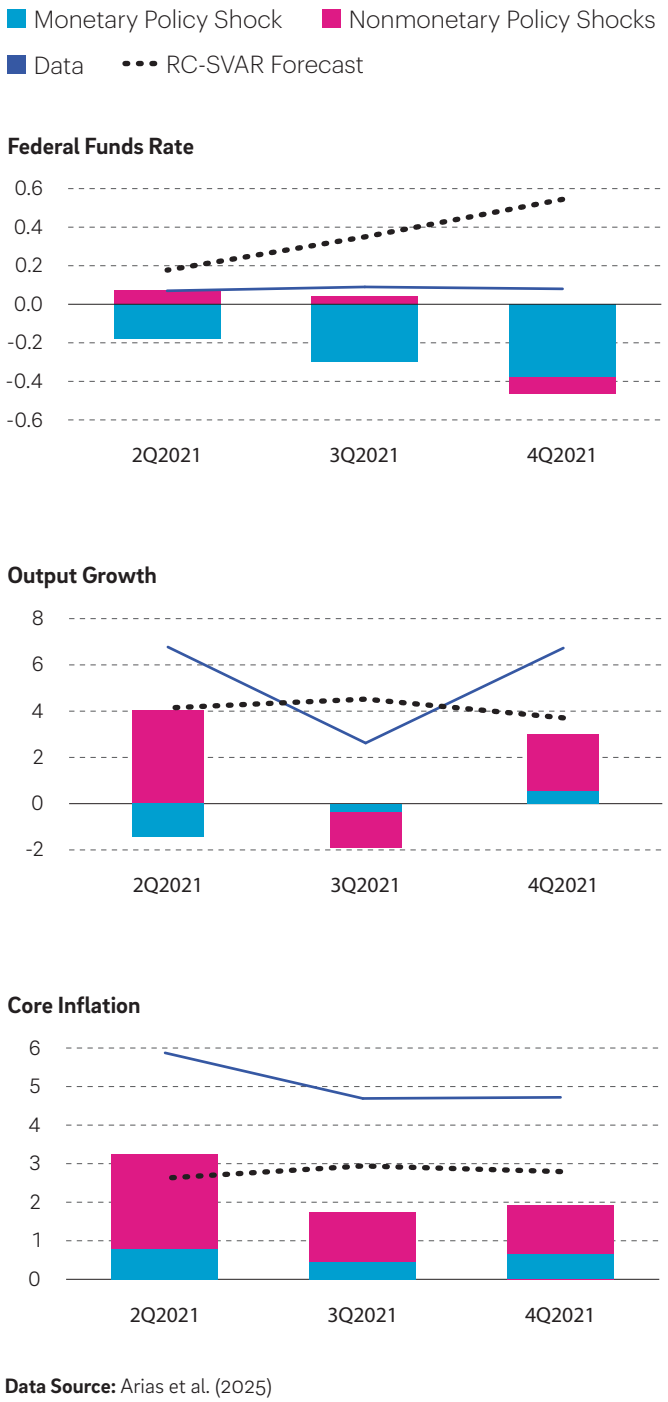
The tightening cycle we deconstructed began on March 16, 2022, when the Fed decided to increase interest rates from the 0-to-1/4 target range to the 1/4-to-1/2 range. But several economic commentators were already calling for interest rate hikes by then, which suggests that the Fed delayed the onset of the tightening cycle beyond what would have been prescribed based on its past behavior.[25]

We address this concern by resetting the clock to the first quarter of 2021, when President Joe Biden signed into law the American Rescue Plan (ARP)—one factor that motivated calls for an earlier increase in the federal funds rate. When we reset the clock, our SVAR agrees with the critics: The Fed would have increased interest rates in 2021 had it followed its historical behavior. However, our SVAR also indicates that the Fed's delay in raising interest rates was not a major contributor to inflation during the early stages of the post-COVID inflation surge (Figure 4).

FIGURE 4

The Fed Would Have Increased Rates in 2021 Had It Followed Its Historical Behavior

The difference between the realized data (federal funds rate, inflation, and output growth) and the SVAR's predictions; monetary and nonmonetary policy shocks that explain that difference, according to the SVAR; percent for federal funds rate, percent log-difference annualized for output growth and core inflation; 1Q2021–2Q2023



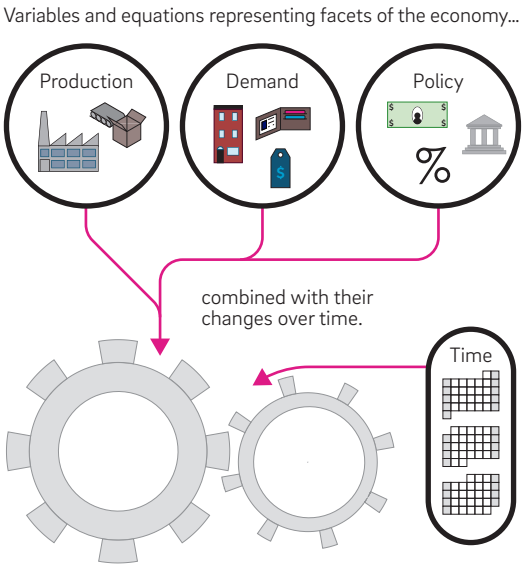
Data Source: Arias et al. (2025)

FIGURE 5

An Econometric Model Characterizing the Joint Behavior of Economic Variables

An SVAR comprises equations representing different parts of the economy. The economic relations described by these equations can evolve, as made clear by the pandemic.

SVARs Explained



Conclusion

In this article we discuss the importance and challenges of measuring systematic monetary policy, and we demonstrate how it can be used to break down the latest inflation fight. Our approach has the advantage of fitting the data at times when the economy is subject to structural changes, such as what we witnessed during the latest pandemic. As with any economic model, our SVAR provides only an approximation of the complex, real-world economy. Nonetheless, it empowers us to better understand the Fed's actions.

Structural Vector Autoregressions

A structural vector autoregression (SVAR) is an econometric model that characterizes the joint behavior of economic variables (Figure 5). An SVAR comprises equations that represent different parts of the economy. Some of these equations describe the production side of the economy, others the demand side, and others the behavior of policymakers. The economic relations described by these equations evolve over time, as made clear by the COVID pandemic. Other changes are subtle but also important. For example, systematic monetary policy has evolved since the Fed was created in 1913. In this context, SVARs that incorporate these structural changes offer a compelling framework for economic analysis.

Monetary Policy Coefficients

A monetary policy coefficient is a number that specifies how much a policy instrument, such as the federal funds rate (r), changes in response to a change in another variable, such as inflation (π), other things being constant. For example, in the policy rule $r = 1.5\pi$, the coefficient is "1.5," so, all else being equal, a percentage point increase in inflation leads to a 1.5 percentage point increase in the federal funds rate.

A *time-varying* monetary policy coefficient changes over time. For example, if the coefficient in the previous example is time-varying, it could be 1.5 during a particular period and 3 in another. How might this happen? In one hypothetical case, a newly appointed Federal Reserve Chair is more hawkish on inflation than their predecessor. If the new Chair immediately persuades the FOMC to change the policy rule, the coefficient will quickly change from 1.5 to 3; if it takes longer for the Chair to persuade the FOMC, this change will take longer and perhaps happen in stages.[26]

Notes

1 The natural level of output is the maximum amount of output an economy can achieve without generating inflationary pressure. The inflation target of the Federal Reserve is 2 percent over the longer run as measured by the annual change in the price index for personal consumption expenditures. See Board of Governors (2024).

2 The most famous rule, known as the Taylor rule, prescribes setting the federal funds rate according to a specific function of inflation and the output gap (that is, the difference between realized output and its natural level or trend). See Taylor (1993) and Taylor (1999).

3 See for example Box 6 in the February 2025 Monetary Policy Report to Congress, https://www.federalreserve.gov/publications/files/20250207_mprfullreport.pdf.

4 See Board of Governors (2024).

5 See Sims and Zha (2006).

6 An example of the former is a change in the composition of the FOMC that leads to a change in the Fed's systematic policy, such as putting more weight on inflation than

on output, or vice versa. An example of the latter is what we experienced during the pandemic.

7 Intuitively, as the number of variables in the SVAR grows, the structural relationships among them become more complex than in SVARs with fewer variables. See the comments and discussion section of Leeper et al. (1996) for a debate about this issue.

8 See Board of Governors (2021) for a discussion of the Fed's dual mandate.

9 The Great Inflation was a period of high inflation in the United States that started in the mid-1960s and began to dissipate in the early 1980s.

10 See Powell (2023).

11 The Fed began the latest tightening cycle on March 16, 2022, when it raised the target range for the federal funds rate to 1/4 to 1/2 percent. The last interest rate hike of the cycle occurred on July 26, 2023, when the Fed raised the target range to 5-1/4 to 5-1/2 percent.

12 The aggregate demand and aggregate supply framework we use here is a simplified version of the one featured in Chapter 15 of Mankiw (2018).

13 An unexpected increase in oil prices can also cause a decrease in the public's demand for goods and services due to an income effect driven by a decline in the real value of income.

14 In more advanced dynamic stochastic general equilibrium models, there are channels through which systematic monetary policy can affect the supply-side conditions of the economy. See, for example, Coibion and Gorodnichenko (2011).

15 In less stylized models than the one we use, this trade-off also emerges in response to demand shocks, such as an unexpected decline in consumer confidence. See Erceg et al. (1998).

16 Our measure of money growth is based on the growth rate of the M2 monetary aggregate, which consists of M1 (that is, currency, demand deposits at commercial banks, and other liquid deposits) plus saving deposits, time deposits in amounts of less than $100,000, and balances in retail money market funds. See https://fred.stlouisfed.org/series/M2SL for details.

17 We choose the policy instrument (that is, the federal funds rate) and the data that enter the Fed's systematic reaction function (that is, output growth, inflation, money growth, and corporate credit spreads) based on theoretical and practical considerations.

18 The FOMC might be responding systematically to variables outside the SVAR, in which case our SVAR would be misspecified. To ease this concern, we show in our forthcoming *Review of Economic Studies* paper that our characterization of systematic policy implies monetary policy shocks that align well with the narrative approach of University of California, Berkeley, economists Christina and David Romer, who argue that there was a contractionary monetary policy shock in the summer or early fall of 2022.

19 See Drechsel (2024) for evidence of President Nixon's political pressure on Chair Burns.

20 The skepticism originated in the unstable relationships between various monetary aggregates and other economic variables such as output growth. For example, at the January 1980 FOMC meeting Chair Volcker said, "I would remind you that nothing that has happened—or that I've observed recently—makes the money/[gross national product] relationship any clearer or more stable than before. Having gone through all these redefinition problems, one recognizes how arbitrary some of this is. It depends on how you define [money]." See also Bernanke (2006).

21 The Survey of Professional Forecasters (SPF) is the oldest quarterly survey of macroeconomic forecasts provided by academics, forecasting firms, and banks and other financial institutions in the United States. We adopt the SPF projections for the three-month Treasury bill rate as our projections for the federal funds rate. See Research Department, Federal Reserve Bank of Philadelphia, Survey of Professional Forecasters, https://www.philadelphiafed.org/surveys-and-data/real-time-data-research/survey-of-professional-forecasters.

22 See Powell (2022).

23 In our main counterfactuals the public is not necessarily aware of a change in policy. Even though this is a plausible assumption in the context of our framework, some may wonder whether the public would have acted differently had it known about the policy change. The latter is known as Lucas's critique after Lucas (1976). To address this issue, our forthcoming *Review of Economic Studies* paper presents an alternative set of counterfactuals, inspired by McKay and Wolf (2023), that do not run afoul of this critique; our conclusions remain unchanged.

24 We document the steepening of the Phillips curve in Online Appendix V of Arias et al. (2025).

25 Among the economists calling for early monetary policy action were former International Monetary Fund chief economist Olivier Blanchard and former U.S. Secretary of the Treasury Lawrence Summers. See Blanchard (2021) and Summers (2021a, 2021b).

26 See Bordo and Istrefi (2023) for an analysis of how the composition of the FOMC committee in terms of hawks or doves can affect monetary policy decisions.

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