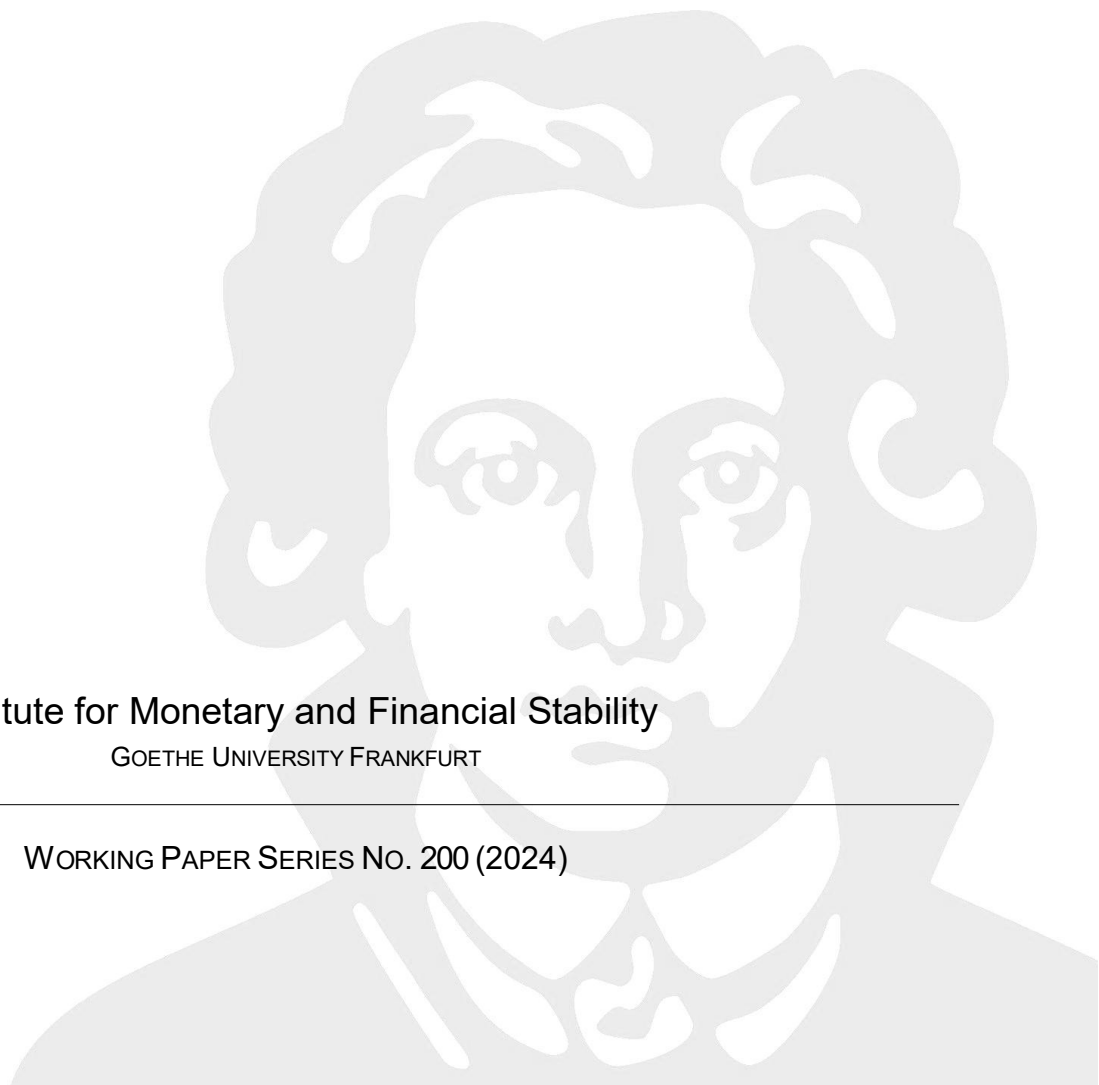ATHANASIOS ORPHANIDES

Enhancing resilience with natural growth targeting

Institute for Monetary and Financial Stability
GOETHE UNIVERSITY FRANKFURT

This Working Paper is issued under the auspices of the Institute for Monetary and Financial Stability (IMFS). Any opinions expressed here are those of the author(s) and not those of the IMFS. Research disseminated by the IMFS may include views on policy, but the IMFS itself takes no institutional policy positions.

The IMFS aims at raising public awareness of the importance of monetary and financial stability. Its main objective is the implementation of the "Project Monetary and Financial Stability" that is supported by the Foundation of Monetary and Financial Stability. The foundation was established on January 1, 2002 by federal law. Its endowment funds come from the sale of 1 DM gold coins in 2001 issued at the occasion of the euro cash introduction in memory of the D-Mark.

The IMFS Working Papers often represent preliminary or incomplete work, circulated to encourage discussion and comment. Citation and use of such a paper should take account of its provisional character.

Institute for Monetary and Financial Stability
Goethe University Frankfurt
House of Finance
Theodor-W.-Adorno-Platz 3
D-60629 Frankfurt am Main
www.imfs-frankfurt.de | info@imfs-frankfurt.de

Enhancing resilience with natural growth targeting

Athanasios Orphanides*
MIT

February 2024

Abstract

Despite a number of helpful changes, including the adoption of an inflation target, the Fed's monetary policy strategy proved insufficiently resilient in recent years. While the Fed eased policy appropriately during the pandemic, it fell behind the curve during the post-pandemic recovery. During 2021, the Fed kept easing policy while the inflation outlook was deteriorating and the economy was growing considerably faster than the economy's natural growth rate—the sum of the Fed's 2% inflation goal and the growth rate of potential output. The resilience of the Fed's monetary policy strategy could be enhanced, and such errors be avoided with guidance from a simple natural growth targeting rule that prescribes that the federal funds rate during each quarter be raised (cut) when projected nominal income growth exceeds (falls short) of the economy's natural growth rate. An illustration with real-time data and forecasts since the early 1990s shows that Fed policy has not persistently deviated from this simple rule with the notable exception of the period coinciding with the Fed's post-pandemic policy error.

Keywords: Federal Reserve, monetary policy strategy, discretion, simple rules, real-time data.

JEL Classification: E32, E52, E58, E61.

In monetary policy central bankers have a potent means for fostering stability of the general price level. By training if not also by temperament, they are inclined to lay great stress on price stability, and their abhorrence of inflation is continually reinforced by contacts with one another and with like-minded members of the private financial community. And yet, despite their antipathy to inflation and the powerful weapons they could wield against it, central bankers have failed so utterly in this mission in recent years. In this paradox lies the anguish of central banking. (Arthur Burns, 1979, p. 7.)

I. Introduction

The Federal Reserve has been more successful in fulfilling its mandate since Arthur Burns' tenure as Fed Chair in the 1970s and his Per Jacobson lecture on September 30, 1979. Starting with Paul Volcker's monetary reform, announced one week later, on October 6, 1979, the Fed acknowledged the essential role of defending price stability for fulfilling its mandate, for supporting economic stability, maximum sustainable growth and employment over time.[1] At considerable cost, the Fed rebuilt its shattered credibility and brought inflation under control during the 1980s (Goodfriend and King, 2005). Price stability was subsequently reestablished with the 1990 recession and inflation has been broadly contained around 2% since then. Over the past three decades, the Fed adapted its monetary policy strategy and communication in a manner that has made policy more effective. In January 2012, the Federal Open Market Committee (FOMC) formally adopted and communicated a numerical definition of price stability—an inflation rate of 2 percent (Federal Reserve, 2012). This has been reaffirmed every year in the FOMC *Statement on Longer-Run Goals and Monetary Policy Strategy* that has also presented a consensus outline of policy strategy.[2]

And yet, in recent years, the Fed failed to defend price stability effectively (Figure 1). After easing policy aggressively during the pandemic, as was appropriate, the Fed failed to remove this accommodation promptly. During 2021, with inflation and inflation expectations rising, and while nominal income growth was consistently projected to exceed the economy's natural growth rate by a wide margin, the Fed used its discretion to peg the federal funds rate at zero and continued to ease policy further by expanding its balance sheet. The rise of inflation during the course of 2021 and early 2022 evoked the malaise of the 1970s. Inflation subsequently peaked during 2022 at levels not seen in four decades. Despite continued "antipathy to inflation," and

---

[1] Chairman Volcker's reform was announced one week after Burns' speech, on October 6, 1979, but the preparation was already under way in September (Lindsey et al, 2005). Hetzel (2008) and Meltzer (2009) present detailed histories of the Fed's inflationary troubles before the reform, and subsequent changes.
[2] The *Statement on Longer-Run Goals and Monetary Policy Strategy* was first adopted and communicated on January 24, 2012, (Federal Reserve, 2012). It reflected the culmination of discussion among FOMC participants over several years (Orphanides, 2020). Vice Chair Yellen, who chaired the FOMC's subcommittee on communication that drafted the initial "consensus" statement described the cumulative changes over preceding decades as a "revolution" in central bank communication (Yellen, 2012).

despite "the powerful weapons they could yield against it" Federal Reserve policymakers once again lost control of the inflationary process.

What lessons can be drawn from this experience?

Part of the rise in inflation could be attributed to "temporary" adverse supply factors and the faster than anticipated recovery from the pandemic. However, Fed policy fueled inflation further during 2021 by driving real interest rates to excessively negative levels thereby boosting aggregate demand well above the economy's natural growth rate. Fortunately, unlike the 1970s, the Fed recognized its policy error and demonstrated willingness to take corrective action during 2022. Following a timid start in March, the Fed adjusted its policy rate at a faster pace than in earlier inflationary episodes. The sequence of four 75 basis points hikes in consecutive FOMC meetings starting in June 2022 was unprecedented but critical: With this action, the Fed ultimately succeeded in addressing an incipient disanchoring of inflation expectations—the Fed prevented an "inflation scare" from taking hold.[3] The Fed's aggressive action during 2022 tempered actual and expected growth in nominal income, bringing it closer to balance with the economy's natural growth rate—the sum of the Fed's 2% inflation goal and the growth rate of potential output.

One lesson from this experience is that despite improvement over the past three decades, the Fed's monetary policy strategy, as implemented in recent years, is insufficiently resilient. While the Fed eased policy appropriately during the pandemic, it severely fell behind the curve during the recovery phase of the crisis. Views vary on how early it had become evident that the Fed had fallen behind the curve, but there is broad agreement that the policy error was clear well before the end of 2021.[4] To be sure, the pandemic and post-pandemic recovery presented an unusual challenge, which unavoidably raised the odds for error in decision making. In such an environment, the risk of human error is particularly high when decisions reflect meeting-by-meeting policy discretion, without guidance from a policy rule. Behavioral biases can lead discretionary policy astray (Orphanides, 2015). During the pandemic, ascertaining the current state of the economy and the risks to the outlook was unusually difficult, contributing to outsized forecast errors. With the return of overnight rates to zero in March 2020, the Zero Lower Bound (ZLB) constrained interest rate policy, necessitating re-activation of balance sheet tools that complicated policy calibration further. In the event, policy ended up being far less systematic than would have been desirable and, for several quarters, badly miscalibrated, even accounting for the information limitations that complicate real-time policy decisions. The consensus outline of a strategy at hand proved unhelpful. The Fed's meeting-by-meeting discretionary decision making could have benefited from more concrete guidance than is currently reflected in the Fed's policy strategy.

---

[3] Goodfriend (1993) first explained the importance of preventing inflation scares in relation to the Federal Reserve's policy strategy (Orphanides and Williams, 2022).
[4] See Bordo et al (2023) and references therein.

This study examines how the resilience of the Fed's monetary policy strategy could be enhanced with guidance from a simple policy rule. The analysis draws on the recent experience to revisit the basic thesis that guidance from a simple and robust policy rule improves policy outcomes by guarding against major policy mistakes. This thesis has been analyzed extensively over the past few decades, especially following the seminal contributions by McCallum (1988) and Taylor (1993). Fischer (1990), Clarida, Gali and Gertler (1999), McCallum (1999), and Taylor and Williams (2011) present comprehensive reviews of the pertinent literature.

I focus on a simple natural growth targeting rule that captured the contours of Fed policy reasonably well before the pandemic (Orphanides, 2003, 2020). In its simplest form, the rule prescribes that the change of the federal funds rate from the previous quarter be guided by the difference between the projected growth of nominal income, n, and the natural growth rate, n^*. The rule takes the simple form:

$$\Delta i = \theta(n - n^*)$$

where Δi is the rule's prescription for the quarterly change of the policy rate from its level one quarter earlier, and θ is a parameter governing how responsive policy should be to the projected imbalance. Orphanides (2003) originally illustrated this rule with $\theta = 0.5$ using real-time data and Federal Reserve staff projections of GNP/GDP growth over one year ending three-quarters ahead. Since these forecasts are only made available to the public with a five-year lag, to allow discussion of the most recent period this study relies instead on real-time data and forecasts from the Survey of Professional Forecasters.

Natural growth targeting closely relates to policy frameworks that track nominal income growth as a means of maintaining price stability while simultaneously tempering business cycle fluctuations. By accommodating changes in the growth rate of potential output, instead of targeting a constant growth rate of nominal income, natural growth targeting guides policy towards achieving a constant inflation goal in the medium term, consistent with the inflation targeting policy approach and the Fed's adoption of a 2% inflation goal. Instead of employing a monetary aggregate as an instrument, as the McCallum (1988) rule, the simple rule illustrated in this study prescribes quarterly changes in the federal funds rate, thereby avoiding the need for real-time estimates of the equilibrium velocity of money that have become less reliable in recent decades. The rule can also be seen as a version of the classic Taylor (1993) rule but with the price level as a nominal anchor (instead of the inflation rate), and employed in first-difference form (Williams, 2017). This makes this rule simpler to implement than the classic Taylor rule: Implementation does not require real-time estimates of concepts such as the natural rate of interest or the natural rate unemployment. The focus on the growth rate of output instead of the output gap relates to the Lean-Against-the-Wind approach discussed by Hetzel (2022), and the speed-limit/timeless-perspective policies examined by Walsh (2003) and Woodford (2003).

Examination of the real-time quarterly prescriptions from the natural growth rule shows that it captures the contours of Fed policy over the past thirty years reasonably well with one major exception: the period corresponding to the recovery from the pandemic. Actual policy was systematically more accommodative than prescriptions from the simple rule during 2021, when the Fed fell behind the curve. Had the Fed paid closer attention to a simple rule of this nature, the post-pandemic policy error would have been checked. Tighter policy would have been implemented already in 2021, policy would have been more systematic throughout this episode. The analysis also suggests that the Fed's unprecedented series of rate hikes during 2022 succeeded in correcting the earlier policy miscalibration and that the additional tightening in 2023 resulted in somewhat more restrictive policy than suggested by the simple rule.

The paper is organized in four sections. Following this introduction, Section II offers a brief review of policy in recent years, focusing on elements of the Fed's strategy and policy decisions that contributed to the Fed's policy error in 2021. Section III describes the natural growth rule and compares its prescriptions to the federal funds target over the past three decades. Section IV concludes.

II. The pandemic, the ZLB and the forward guidance trap

To better understand how the Fed fell behind the curve during the post-pandemic recovery, it is helpful to compare its policy in the last few years with the Fed's earlier encounter with the ZLB, in the aftermath of the Global Financial Crisis (GFC). The ZLB complicates monetary policy by necessitating the activation of multiple policy tools to provide accommodation beyond what can be provided by pushing the federal funds rate to zero. The added complexity introduces additional risks for policy error and proved to be a factor in the post-pandemic policy error.

Figure 2 presents daily data for the federal funds rate, two-year OIS rate and inflation swap rate from 2014 to the end of 2023. Plotting the 2-year OIS rate, in addition to the federal funds rate, provides simple metric of the role of policy communication in shaping the monetary conditions by affecting interest rates beyond short-term maturities. When overnight rates are constrained at the ZLB, policy can continue to ease by compressing longer-term yields. This can be done in two ways: through balance sheet policies aiming to compress term premia; and through communication that the Fed intends to maintain the overnight rate low in the future—forward guidance (Bernanke, 2020, Orphanides, 2021).

The Fed eased policy both by expanding its balance sheet and by communicating that it intended to maintain low short-term interest rates during the GFC as well as during the pandemic. But the recovery phase from the two crises was quite different. In the aftermath of the GFC, the recovery was quite slow and inflation stayed low. In this environment, the Fed could afford to maintain zero rates longer than it expected and longer than markets anticipated for quite some time. The Fed implemented lift-off on December 16, 2015, while inflation and inflation

expectations (as reflected by the inflation swap rate) remained somewhat below its 2% target. The evolution of inflation in the aftermath of the GFC afforded the Fed a very gradual normalization process.

In contrast, the evolution of inflation was much less benign during the pandemic. The two-year inflation swap rate is illustrative of the rapidly changing inflationary environment. In late 2019, before the global reach of the pandemic was recognized, readings of the inflation swap rate were somewhat below 2%. By end-March 2020, the inflation swap rate plummeted and briefly fell to just below zero, reflecting concerns of a collapse of the economy associated with severe disinflationary pressures. However, this sentiment quickly abated, in large part as a result of the successful policy easing that was implemented by the Fed, but also an outsized fiscal policy response. As the recovery from the pandemic took hold, the inflation swap rate rose above its pre-pandemic level. By December 2020, the inflation swap rate had already reached 2%. It subsequently continued to rise, exceeding 3% by May 2021 and reaching 4% by November 2021. And yet, the Fed kept the overnight rate at zero and continued to expand its balance sheet. By the time the Fed implemented lift-off on March 16, 2022, the 2-year inflation swap rate had risen to just under 5%, a clear indication that policy had been severely miscalibrated.

Figure 3 illustrates the Fed's challenge by comparing the two-year inflation swap rate with the two-year *ex ante* real interest rate that can be constructed by comparing the inflation swap and OIS rates. Comparison of the real interest rate around lift-off during the post-GFC and post-pandemic recovery highlights how miscalibrated policy was during 2021. For over a year before the March 16, 2022 lift-off, as the inflation swap rate rose, the Fed kept guiding real interest rates to lower and more negative levels.

Multiple elements that contributed to this policy error are reviewed in Eggertsson and Kohn (2023) and Orphanides (2023). Most pertinent for our subsequent discussion was the Fed's decision to shift away from a forward-looking policy orientation that had characterized its policies in previous years to an explicitly myopic approach that de-emphasized the outlook of inflation, in particular. A forward-looking policy orientation is critical for successful monetary policy in light of the lags in the monetary policy transmission and had been an important feature of the Fed's policy approach before this change.

The change towards a myopic policy approach was most clearly evident in the Fed's implementation of forward guidance—the communication of explicit information about the likely path of future interest-rate policy. At its September 16, 2020 meeting, the FOMC introduced *outcome-based* forward guidance in place of the *forecast-based* guidance communicated at its previous meeting, on July 29, 2020.

In July, the statement provided forward guidance as follows:

> "The Committee expects to maintain this target range until it is confident that the economy has weathered recent events and *is on track to achieve* its maximum employment and price stability goals." (Federal Reserve, 2020a, emphasis added.)

In September this clause was replaced with:

> "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." (Federal Reserve, 2020b, emphasis added.)

One basic problem with this formulation is that it precluded a reasonable policy re-calibration in the event inflation rose notably before the foreseen improvement in labor market conditions materialized. Indeed, as late as November 2021, despite a significant rise in inflation and despite a notable and more worrying deterioration of the inflation outlook, Chair Powell explained the Fed's inaction by referring to the pertinent clause of the September 2020 statement. In response to a question at the post-meeting press conference he stated:

> "We have not focused on whether we meet the liftoff test, because we don't meet the liftoff test now because we're not at maximum employment." (Federal Reserve, 2021.)

Under the circumstances, policy inaction was equivalent to a deliberate decision to push the real interest rate to a lower, more negative level. In effect, the Fed's policy strategy failed to protect the Fed from a rather basic policy error: lowering the real interest rate when inflation is already too high and rising. The Fed fell into the forward guidance trap.

Figure 3 also illustrates that with the rapid policy hikes put in place in 2022 the Fed managed to correct the policy miscalibration that was evident in 2021. By the end of 2022, the two-year real interest rate had risen to about 2% and was kept above 2% for much of 2023. The tightening of monetary policy during 2022 moderated growth sufficiently to contain inflationary pressures.

To place the Fed's recent policy error and recovery in historical context, it would have been desirable to extend Figure 3 backwards and compare the recent policy error to the 1970s. Unfortunately, comparable data that would allow the construction of the *ex ante* real interest rate are not available. Instead, Figure 4 presents two proxies of the real-interest rate that can be extended to the 1960s. In both cases the average level of the federal funds rate during each quarter is used to measure the nominal interest rate. In the first proxy, real-time data on actual inflation are used as a proxy of expected inflation, specifically inflation of the output deflator over four quarters ending in the previous quarter. Until 1991 the GNP deflator is employed, switching to the GDP deflator in 1992, reflecting the changeover in the reporting of the National Income and Product Accounts by the Bureau of Economic Analysis. The one-quarter lag in the measurement reflects the usual reporting lag of these statistics. Data on inflation for any given quarter first become available in the subsequent quarter. In the second proxy, inflation

expectations are measured as the one-year ahead inflation, starting from the previous quarter, using the median survey three-quarter ahead responses in the SPF. Once again, the inflation is measured by the GNP or GDP deflator, the concept of inflation for which survey responses date back to the late 1960s.

Figure 4 suggests that the miscalibration of policy during 2021, as reflected in deeply negative real interest rates, was indeed comparable to the unhappy episode in the 1970s. However, it also illustrates that, unlike the 1970s, the Fed quickly corrected policy thereafter. Comparison of the two proxies with the real rate shown in Figure 3 also points to the difficulties of relying on such proxies, especially based on inflation outcomes, to measure the real interest rate and accurately assess the stance of monetary policy. Using survey measures of inflation expectations provides a cleaner picture of *ex ante* real interest rates.

III. A Natural growth targeting rule

Could guidance from a simple policy rule have helped the Fed avoid the recent policy mistake? Following McCallum (1988) and Taylor (1993), this section illustrates that the Fed could indeed have avoided the post-pandemic policy error with guidance from a simple rule.

The illustration is based on the natural growth targeting rule originally proposed in Orphanides (2003) that incorporates key elements from the McCallum (1988) and classic Taylor (1993) rule but is simpler to implement and more robust to real-time uncertainty faced by policymakers in practice. According to this rule, the change of the federal funds rate from the previous quarter can be guided by the difference between the projected growth of nominal income, n, and the natural growth rate, n^*, defined as the sum of the Fed's inflation goal, π^*, and the growth rate of real potential GDP, g^*. The rule takes the first-difference form:

$$\Delta i = \theta(n - n^*)$$

where Δi is the rule's prescription for the quarterly change of the policy rate from the previous quarter, and θ is a parameter governing how responsive policy should be to the projected imbalance.

This policy rule closely relates to frameworks that track nominal income growth as a means to maintain price stability while simultaneously tempering business cycles. By accommodating changes in the growth rate of potential output instead of targeting a constant growth rate of nominal income, natural growth targeting guides policy towards achieving a constant inflation goal in the medium term, consistent with the inflation targeting policy approach.[5]

---

[5] See McCallum (2007) for a discussion relating the approach to inflation targeting and Beckworth and Hendrickson (2019) for a recent implementation of nominal GDP targeting.

Instead of employing a monetary aggregate as an instrument, as the McCallum (1988) rule, this rule prescribes quarterly changes in the federal funds rate thereby avoiding the need for tracking real-time estimates of equilibrium velocity which complicated the implementation of the McCallum rule. In his original implementation, McCallum proposed using the monetary base as an instrument and adjusted equilibrium velocity in an adaptive manner based on recent historical data. Practical implementation by the Fed could also adjust for temporary factors impacting the monetary base. However, with increased financial innovation, and the activation of balance sheet tools, assessing equilibrium velocity of the monetary base and adjusting for temporary factors has become more complex.

The rule can also be seen as a variation of the classic Taylor (1993) rule with the price level instead of the inflation rate as a target variable and used in first-difference form (Williams, 2017). Recall that the classic Taylor rule prescribes that the federal funds target rate should respond to the sum of inflation, π, and the output gap, y, and that inflation is the growth rate of the price level. Thus, the first difference of a Taylor rule that uses the price level as the anchor, instead of inflation, takes the form:

$$\Delta i = \theta(\pi - \pi^*) + \theta \Delta y$$

Two accounting identities can help rewrite this in the form of the natural growth rule. (These are exact when growth rates are expressed as log-differences and approximate when growth rates are expressed as percentages.) First, letting g denote the growth rate of real output, recall that the growth of nominal income can be restated as the sum of the growth of real income and inflation. This implies that:

$$(n - n^*) = (g - g^*) + (\pi - \pi^*)$$

Second, recall that the difference of real output growth from the growth rate of potential output over any interval can be expressed as the difference of the output gap over the same interval:

$$(g - g^*) = \Delta y$$

Replacing the rate of inflation with the price level in the classic Taylor rule and using the first-difference of the rule for providing prescriptions makes this rule simpler to implement than the classic Taylor rule. Implementation does not require real-time estimates of concepts such as the natural rate of interest or the natural rate unemployment or the level of the output gap that are notoriously problematic in real time.[6] The only time-varying element of the structure of the economy that is required for implementation is the rate of growth of potential output. Taking into account real-time estimates of potential output growth in determining the natural growth rate is essential to ensure that policy aims to deliver a constant inflation rate, in line the central bank's

---

[6] The robustness characteristics of simple rules of this type in environments of imperfect knowledge, and comparisons with alternatives, have been explored in studies such as McCallum and Nelson (2004), Orphanides and Wieland (2013), Orphanides and Williams (2002, 2007, 2013), and Tetlow (2015).

definition of price stability. While estimating the growth of potential output in real time is also subject to uncertainty, historical experience suggests that the resulting real-time misperceptions are an order of magnitude smaller than misperceptions in level concepts such as the output gap (Orphanides, 2003).

As a result of the equivalence discussed above, the natural growth targeting rule may also be implemented by using inflation and the difference of the output gap. This allows monitoring prescriptions based on alternative measures of inflation, such as based the PCE concept. Alternatively, using an approximation of Okun's law, $\Delta y = \kappa \Delta u$, where u is the unemployment rate and κ is the Okun's law coefficient, the rule could be implemented by tracking projected inflation deviations from the Fed's inflation target and the difference in unemployment:

$$\Delta i = \theta(\pi - \pi^*) + \theta\kappa\Delta u$$

In recent years, a version of this specification has been included in the Federal Reserve's Monetary Policy Report (MPR). The Fed first included this policy rule, referred to as the first-difference rule, together with other rules, including a version of the classic Taylor rule, in the July 2017 MPR (Federal Reserve, 2017). The MPR version applies the Okun's law coefficient $\kappa = -2$ and uses the core PCE measure of inflation. Compared to other simple rules shown in the MPR, the first-difference rule tracked actual policy more closely than the other simple rules presented, in the period from 2000 and until the pandemic. However, the rules presented in the MPR, including the first-difference rule, are not operational: They are not based on real-time data and forecasts available when policy is set, limiting their usefulness.

In real time, the natural growth rule employs short-term forecasts to check whether nominal income grows in line with the economy's natural growth rate. The rule compares a real-time estimate of the natural growth of income and a projection of nominal income growth one year ahead from the previous quarter (which is the quarter for which the most recent actual data are available). For the illustration in this study, I rely on real-time data and forecasts from the Survey of Professional Forecasters that are published by the Federal Reserve Bank of Philadelphia (Croushore and Stark, 2001 and 2019). Specifically, I rely on the median survey responses to construct the forecast of nominal income growth over four quarters ending three-quarters ahead. This is the "year-ahead" forecast starting from the quarter before the survey—the most recent quarter for which actual data are available in real time.

The quarterly series for the nominal GDP growth forecast shown in Figure 5 is based on the surveys conducted and published by the Federal Reserve Bank of Philadelphia in every quarter. Since 1992, the survey conducted in the first quarter has also included a question on the 10-year annual-average real GDP growth. I use the median responses from this question as a real-time estimate of potential output growth. The survey only includes this question in the first quarter so I retain the same estimates for subsequent quarters until a revised estimate is available in the first

quarter if the following year. The quarterly series for the natural growth rate shown in the figure reflects the sum of this series and the Fed's 2% inflation goal.

With the responsiveness parameter $\theta = 0.5$, the rule prescription for the change in the federal funds rate during each quarter is simply one half the difference between the forecast of nominal GDP growth and the natural growth rate. This is compared in the top panel of Figure 6 with change in the federal funds rate target (or midpoint of target range) from the end of the previous quarter to the end of the current quarter. The bottom panel shows the level of the federal funds target rate at the end of each quarter and the corresponding rule prescription.

Monitoring this rule can guard against policy mistakes by flagging large deviations for consecutive quarters. Small deviations, and deviations that do not persist over multiple quarters are not necessarily reflections of policy miscalibration once some of the practical considerations that must be accounted for are taken into account. Some discrepancies of actual policy from the prescriptions shown in the figure should be expected as a result of differences in the assessment of the outlook of the economy and the natural growth rate by the SPF panel and the Fed. On some occasions, timing issues account for an apparent one-quarter delay in the prescription shown in the figure from the prescription that would be available to Fed officials if this rule were to be implemented in real time using Fed projections. One reason for this discrepancy is that the survey is conducted in the middle of each quarter and cannot reflect all the information available to the Fed by the end of the quarter. The first quarter of 2020 is illustrative of a large discrepancy of this nature. The survey was conducted in mid-February 2020, at which time the severe impact of the pandemic on the economy was not yet known. This became clear later during the first quarter, prompting the massive policy response by the Fed during March.

Another practical consideration is that as a rule for the policy interest rate, the natural growth rule does not provide prescriptions for the specific balance sheet policy tools that need to be activated at the ZLB. A prescription for a negative interest rate setting should be read as calling for balance sheet expansion, which the Fed could calibrate to provide equivalent accommodation. Two such episodes stand out in the sample: The first quarter of 2009, when the rule called for the target to be set below minus 2 percent; and the second quarter of 2020, when the rule prescription called for a target rate below minus 3 percent. On both occasions, the Fed activated balance sheet measures to provide additional accommodation, as was appropriate, but these policies were not reflected in the fed funds target rate.

Overall, taking into account these practical considerations, Figure 6 suggests that the simple rule captures the contours of Fed policy over the past three decades. Fed policy has not persistently deviated from this simple rule with one notable exception: The period coinciding with the Fed's post-pandemic policy error. During 2021, the actual fed funds target rate was over 100 basis points below the rule prescription in every quarter. The average deviation during the year was minus 162 basis points. No other period in this sample registers a comparable inflationary deviation.

Figure 7 compares the natural growth rule that tracks nominal income growth with alternative implementations based on unemployment and core PCE inflation. This allows comparison with the first-difference rule presented in the MPR (denoted with MPR/FD). The MPR version of the first difference rule is constructed using revised data for core PCE inflation and unemployment, following the practice presented in the MPR. In each quarter, the inflation and unemployment change employed as inputs reflect the 4-quarter change ending in the quarter shown. As can be seen, the MPR version of the difference rule does not track actual policy as well as the natural growth targeting rule before the pandemic, and provides quite different prescriptions since then. However, a more useful version of the natural growth targeting rule employing core PCE inflation and unemployment can be tracked based on short-term forecasts of unemployment and core PCE inflation. In the figure, this is illustrated using SPF projections for core PCE and unemployment, comparable to the nominal income projections used in the illustration of the rule in Figure 6. Prescriptions from this rule are shown starting only in 2007Q1, when questions regarding core PCE were first included in the survey.

As can be seen, the prescriptions of the natural growth targeting rule using forecasts of inflation and unemployment are quite similar to the prescriptions of the rule using forecasts of nominal income growth. Their prescriptions vary most during 2020, when the measurement of the unemployment rate was particularly challenging, resulting in an abnormal swing in recorded statistics.

This can be seen more clearly in Figure 8, which presents a detail of the bottom panel of Figure 7 for the past few years. As can be seen, while prescriptions from the unemployment/inflation and nominal income growth implementations of the rule differed somewhat during 2020, they have been quite similar before and since the pandemic. In 2021, both implementations flagged that the Fed had fallen severely behind the curve and needed to tighten policy. More recently, after the Fed's policy correction in 2022, both implementations suggest that the Fed tightened policy somewhat more aggressively than suggested by the simple rule.

Figure 8 also reinforces the limited usefulness of the version of the rule presented in the MPR, compared to the operational implementations using forecasts. Because of its backward-looking nature, the version of the rule presented in the MPR does not properly account for the evolution of the outlook in real time. In periods of abnormally large swings in the data, as observed during and shortly after the pandemic, this can result in erratic prescriptions. Short-term forecasts of economic indicators such as nominal income, real economic activity, and inflation, provide a more useful summary description of the current state of the economy and are more useful inputs for a simple and robust policy rule.

IV. Conclusion

The Fed's monetary policy strategy proved insufficiently resilient in recent years. The pandemic and post-pandemic recovery presented an unusual challenge that highlighted the risks of the Fed's discretionary policy approach. The challenge was initially handled well: The Fed's prompt and decisive easing in 2020 helped contain the economic cost. However, the Fed subsequently miscalibrated policy. Throughout 2021, the Fed kept easing policy even though the economy was growing considerably faster than the economy's natural growth rate and the inflation outlook was deteriorating. This was a persistent deviation from systematic policy that could have been checked with guidance from a simple policy rule.

Rules-based policy need not be impractically rigid. Adopting a benchmark rule can limit unhelpful discretion while retaining the optionality of occasional discretionary action (Taylor, 2015) and while retaining the flexibility to adapt the policy rule to accommodate changes in the structure of the economy (Woodford, 2003; McCallum, 2004).

Policy research and practical experience over the past few decades has provided guidance on the desirable characteristics of a benchmark rule: The rule must be simple and operational; focused on preserving price stability and well-anchored inflation expectations in line with the Fed's inflation goal; It can be somewhat countercyclical, tempering business cycle booms and busts; It must be robust to imperfect knowledge, including properly accounting for the pitfalls of relying on unknowable natural rate concepts; It must be forward-looking, embracing benefits from current analysis, now-casting, short-term projections, thereby respecting the lags in the monetary policy transmission and protecting policy from falling behind the curve.

Natural growth targeting presents one such option. This is illustrated with a simple example that prescribes that the federal funds rate during each quarter be raised (cut) when projected nominal income growth over the next few quarters exceeds (falls short) of the economy's natural growth rate. Alternatives could also be considered: instead of nominal income growth projections, the benchmark rule could be based on short-term projections of inflation and unemployment.

The illustrative simple rule captures the contours of Fed policy since the early 1990s. Fed policy has not persistently deviated from the natural growth rule with the notable exception of the period coinciding with the Fed's post-pandemic policy error. Had the Fed paid closer attention to a simple rule of this nature, the post-pandemic policy error would have been checked. Tighter policy would have been implemented already in 2021, policy would have been more systematic throughout this episode.

The resilience of the Fed's monetary policy strategy could be enhanced with guidance from a natural growth targeting rule.

References

Beckworth, David and Joshua R. Hendrickson (2019). Nominal GDP Targeting and the Taylor Rule on an Even Playing Field. Journal of Money, Credit and Banking, 52(1) p. 269-286.

Bernanke, Ben (2020). The new tools of monetary policy. American Economic Review 110(4), pp. 943-983.

Bordo, Michael, John Cochrane and John Taylor, eds. (2023). How Monetary Policy Got Behind the Curve—and how to get back. Stanford: Hoover Institution Press. https://www.hoover.org/research/how-monetary-policy-got-behind-curve-and-how-get-back

Burns, Arthur (1979). The Anguish of Central Banking. The 1979 Per Jacobsson Lecture, Belgrade, September 30. http://www.perjacobsson.org/lectures/1979.pdf

Clarida, Richard, Jordi Gali, and Mark Gertler (1999). The Science of Monetary Policy: A New Keynesian Perspective. Journal of Economic Literature, 37 (4): 1661–1707. https://www.aeaweb.org/articles?id=10.1257/jel.37.4.1661

Croushore, Dean, and Tom Stark (2001). A Real-Time Data Set for Macroeconomists. Journal of Econometrics 105, November, pp. 111–30.

Croushore, Dean, and Tom Stark (2019). Fifty Years of the Survey of Professional Forecasters. Economic Insights, 4(4), pp. 1–11. https://www.philadelphiafed.org/-/media/frbp/assets/economy/articles/economic-insights/2019/q4/eiq419-spf-50.pdf

Eggertsson, Gauti and Donald Kohn. (2023). The Inflation Surge of the 2020s: The Role of Monetary Policy. Hutchins Center Working Paper No. 87, August. https://www.brookings.edu/articles/the-inflation-surge-of-the-2020s-the-role-of-monetary-policy/

Federal Reserve Board (2012). Statement on Longer-Run Goals and Monetary Policy Strategy. January 25. http://www.federalreserve.gov/newsevents/press/monetary/20120125c.htm

Federal Reserve Board (2017). Monetary Policy Report. July. https://www.federalreserve.gov/monetarypolicy/files/20170707_mprfullreport.pdf

Federal Reserve Board (2020a). FOMC Statement. July 29. https://www.federalreserve.gov/newsevents/pressreleases/monetary20200729a.htm

Federal Reserve Board (2020b). FOMC Statement. September 16. https://www.federalreserve.gov/newsevents/pressreleases/monetary20200916a.htm

Federal Reserve Board (2021). Transcript of Chair Powell's Press Conference, November 3, 2021. https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20211103.pdf

Fischer, Stanley (1990). Rules versus Discretion in Monetary Policy. Chapter 21 In B. M. Friedman and F. H. Hahn (eds.) Handbook of Monetary Economics, Volume 2. Elsevier.

Goodfriend, Marvin (1993). Interest Rate Policy and the Inflation Scare Problem: 1979–1992. Economic Quarterly, Federal Reserve Bank of Richmond, 79 (1), Winter, pp. 1–23. https://www.richmondfed.org/publications/research/economic_quarterly/1993/winter/goodfriend

Goodfriend, Marvin and Robert G. King (2005). The incredible Volcker disinflation. Journal of Monetary Economics 52, pp. 981–1015.

Hetzel, Robert (2008). The Monetary Policy of the Federal Reserve: A History. Cambridge: Cambridge University.

Hetzel, Robert (2022). The Federal Reserve: A New History, Chicago: University of Chicago.

Lindsey, David E., Athanasios Orphanides and Robert Rasche (2005). The Reform of October 1979: How It Happened and Why. Federal Reserve Bank of St Louis Review 87 (2, Part 2), pp. 187–235. https://research.stlouisfed.org/publications/review/05/03/part2/MarchApril2005Part2.pdf

McCallum, Bennett (1988). Robustness properties of a rule for monetary policy. Carnegie-Rochester Conference Series on Public Policy, 29, pp. 173–204.

McCallum, Bennett (1999). Issues in the Design of Monetary Policy Rules. In Handbook of Macroeconomics, John B. Taylor and Michael Woodford (eds). Chapter 23, pp. 1483–1530.

McCallum, Bennett (2004). Misconceptions Regarding Rules vs Discretion for Monetary Policy. Cato Journal, 23, Winter. http://object.cato.org/sites/cato.org/files/serials/files/cato-journal/2004/1/cj23n3-5.pdf

McCallum, Bennett (2007). Inflation Targeting for the United States? Cato Journal, 27, Spring/Summer. https://www.cato.org/sites/cato.org/files/serials/files/cato-journal/2007/5/cj27n2-14.pdf

McCallum, Bennett and Edward Nelson (2004). Timeless Perspective vs. Discretionary Monetary Policy in Forward-Looking Models. Federal Reserve Bank of St Louis Review, 86(2), pp. 43–56. https://files.stlouisfed.org/files/htdocs/publications/review/04/03/McCallum.pdf

Meltzer, Alan (2009). A History of the Federal Reserve, Volume 2, University of Chicago.

Orphanides, Athanasios (2003). Historical monetary policy analysis and the Taylor rule. Journal of Monetary Economics 50, p. 983–1022.

Orphanides, Athanasios (2015). Fear of Lift-off: Uncertainty, Rules, and Discretion in Monetary Policy Normalization. Federal Reserve of St Louis Review 97(3), pp. 173-96.

https://research.stlouisfed.org/publications/review/2015/09/08/fear-of-liftoff-uncertainty-rules-and-discretion-in-monetary-policy-normalization/

Orphanides, Athanasios, (2020). Monetary Policy Strategy and its Communication. In *Challenges for Monetary Policy*, Proceedings of the 2019 Jackson Hole Economic Policy Symposium, Jackson Hole, WY.
https://www.kansascityfed.org/documents/6954/Orphanides_Jh2019.pdf

Orphanides, Athanasios (2021). The Power of Central Bank Balance sheets. Monetary and Economic Studies, November, pp. 35–54.
https://www.imes.boj.or.jp/research/papers/english/me39-4.pdf

Orphanides, Athanasios (2023). The Forward Guidance Trap. Bank of Japan IMES Discussion Paper No. 2023-E-6, October. https://www.imes.boj.or.jp/research/papers/english/23-E-06.pdf

Orphanides, Athanasios, and Volker Wieland (2013). Complexity and Monetary Policy. International Journal of Central Banking, 9(S1), January, pp. 167–203.
https://www.ijcb.org/journal/ijcb13q0a8.pdf

Orphanides, Athanasios, and John C. Williams (2002). Robust Monetary Policy Rules with Unknown Natural Rates. Brookings Papers on Economic Activity 2002(2), pp. 63–145.
https://www.brookings.edu/bpea-articles/robustmonetary-policy-rules-with-unknown-natural-rates/

Orphanides, Athanasios, and John C. Williams (2007). Robust Monetary Policy with Imperfect Knowledge. Journal of Monetary Economics 54 (August), pp. 1406–1435.

Orphanides, Athanasios, and John C. Williams (2013). Monetary Policy Mistakes and the Evolution of Inflation Expectations. In The Great Inflation: The Rebirth of Modern Central Banking, Michael D. Bordo and Athanasios Orphanides (eds). Chicago: University of Chicago Press. http://www.nber.org/chapters/c9176

Orphanides, Athanasios, and John C. Williams (2022). Taming Inflation Scares. In Essays in Honor of Marvin Goodfriend: Economist and Central Banker, Robert King and Alexander Wolman editors FRB Richmond, 2022, pp. 217–227.
https://www.richmondfed.org/publications/research/goodfriend/orphanides_and_williams

Taylor, John B. (1993). Discretion versus Policy Rules in Practice. Carnegie-Rochester Series on Public Policy, 39, December, pp. 195–214.

Taylor, John B. (2015). Getting Back to a Rules-Based Monetary Strategy. Presented at the Shadow Open Market Committee, Princeton Club, New York, March 20.
http://web.stanford.edu/~johntayl/2015_pdfs/SOMC-talk%20_Taylor-3-20-15.pdf.

Taylor, John B., and John C. Williams (2011). Simple and Robust Rules for Monetary Policy. In Handbook of Monetary Economics, 3. Benjamin Friedman and Michael Woodford (eds). Elsevier. p. 829–859.

Tetlow, Robert (2015). Real-Time Model Uncertainty in the United States: Robust Policies Put to the Test. International Journal of Central Banking, 11(1), March, pp. 113–155. http://www.ijcb.org/journal/ijcb15q2a4.pdf
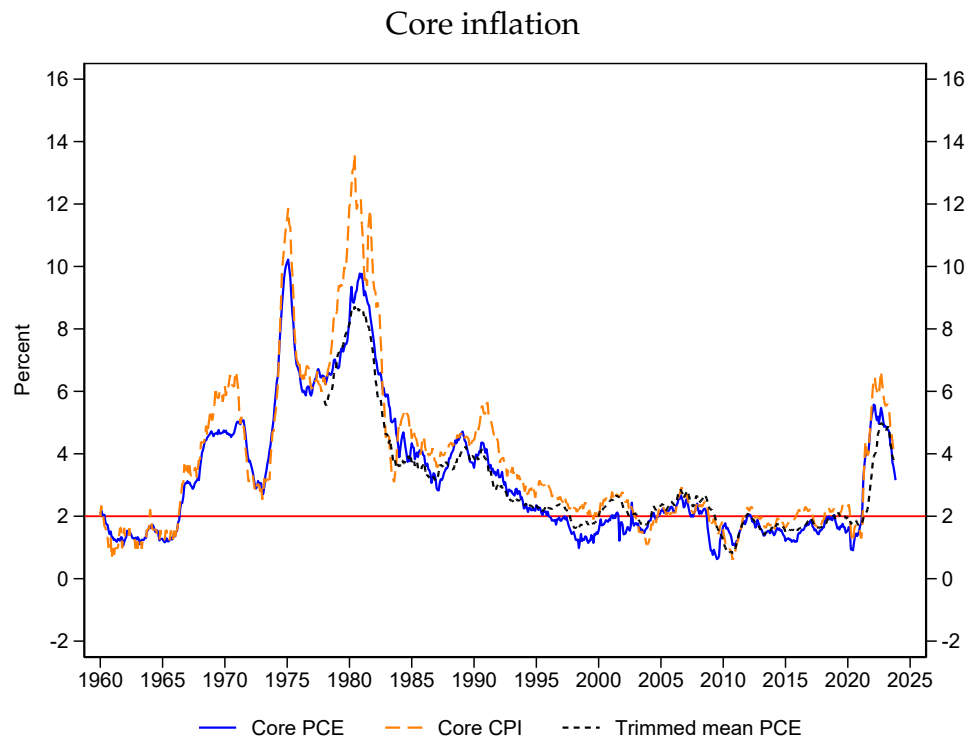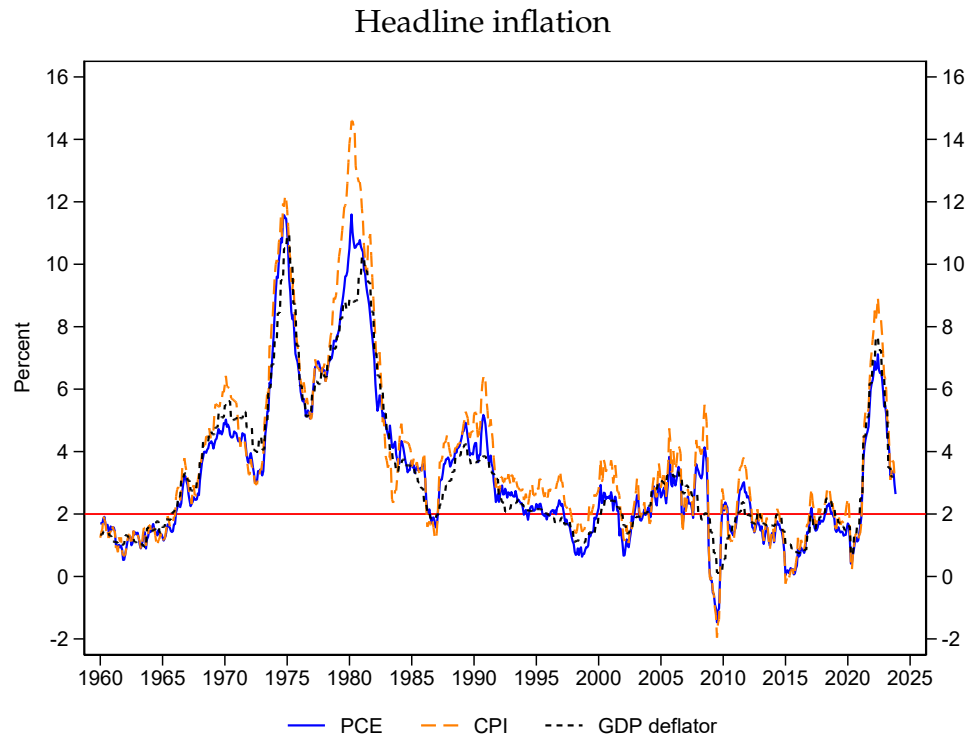
Walsh, Carl (2003). Speed limit policies: the output gap and optimal monetary policy. American Economic Review, 93(1), pp. 265–278.

Williams, John C. (2017). Preparing for the Next Storm: Reassessing Frameworks and Strategies in a Low R-star World. FRBSF Economic Letter, 2017. https://www.frbsf.org/economic-research/publications/economic-letter/2017/may/preparing-for-next-storm-price-level-targeting-in-low-r-star-world-speech/

Woodford, Michael (2003). Interest and Prices: Foundations of a Theory of Monetary Policy. Princeton, N.J.: Princeton University Press.

Yellen, Janet (2012). Revolution and Evolution in Central Bank Communications. Berkeley, November 13. https://www.federalreserve.gov/newsevents/speech/yellen20121113a.htm

Figure 1
The post-pandemic inflation in historical context

Headline inflation

Legend: PCE (blue solid) — CPI (orange dashed) — GDP deflator (black dotted)

Core inflation

Legend: Core PCE (blue solid) — Core CPI (orange dashed) — Trimmed mean PCE (black dotted)

Alternative measures of inflation. Year-on-year, monthly for PCE/CPI, quarterly for deflator.

Figure 2
Federal funds rate and two-year OIS and inflation swap rates
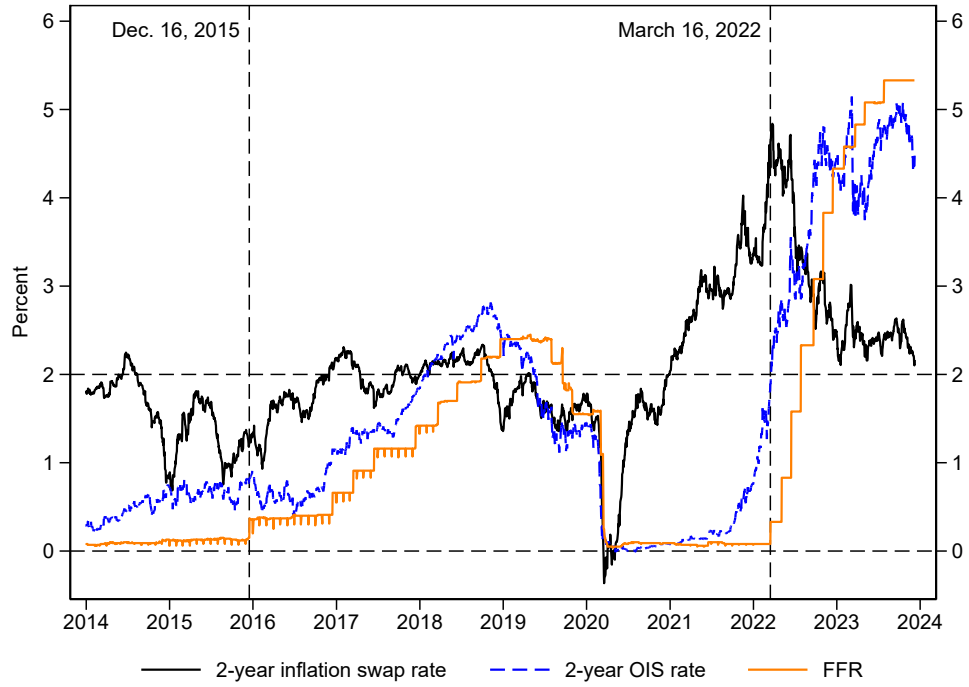
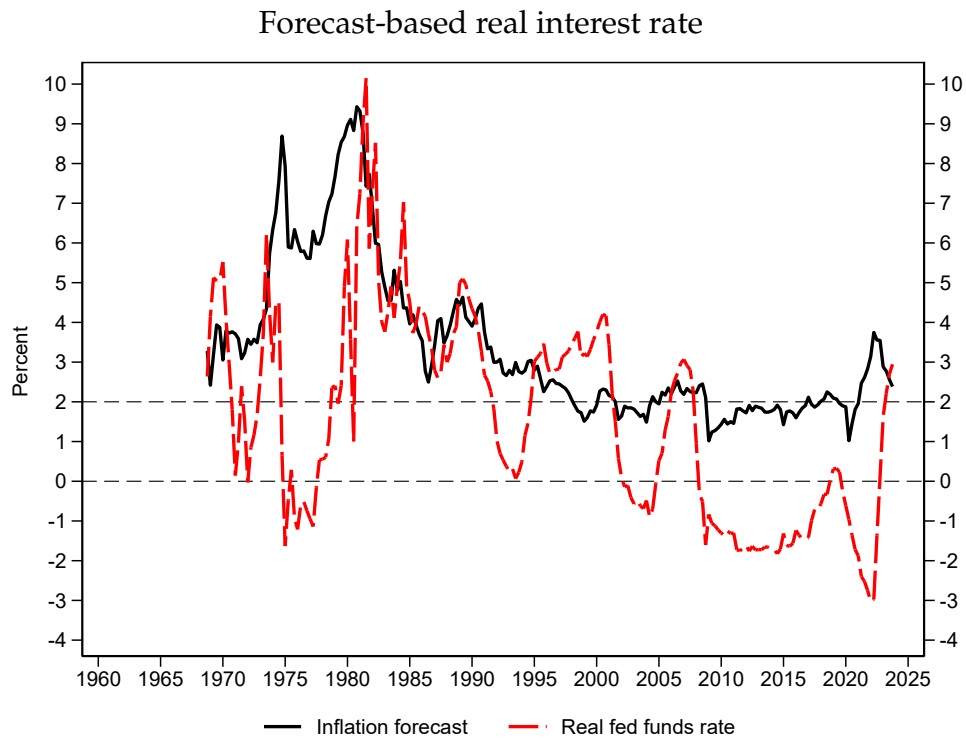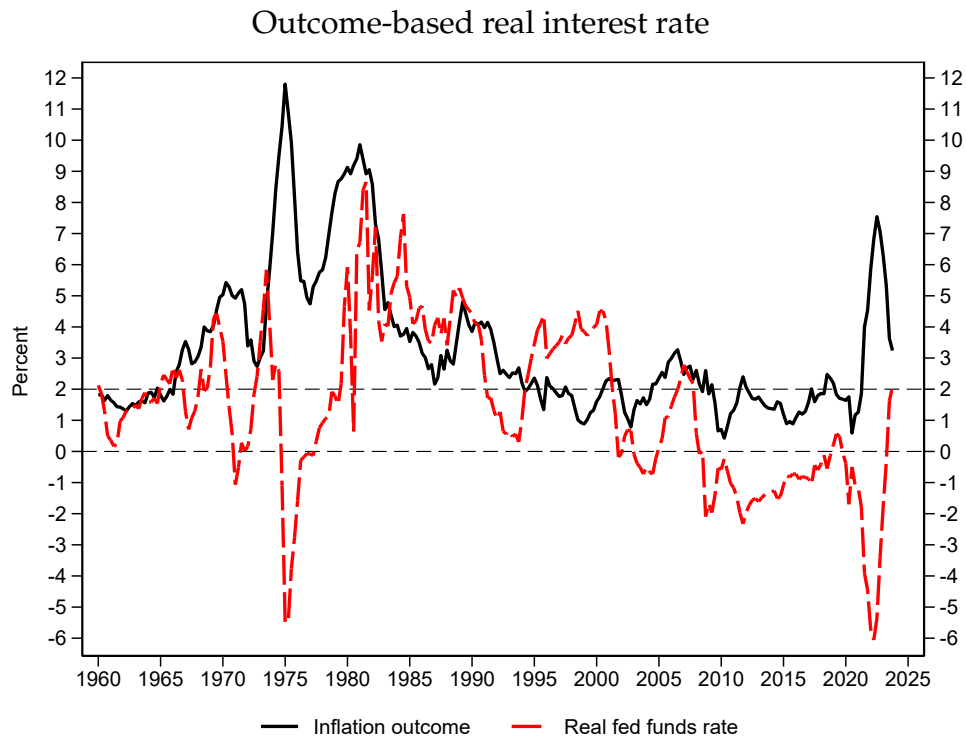Vertical lines denote policy liftoff after GFC and pandemic recessions.

Figure 3
Two-year inflation swap and ex ante real rates
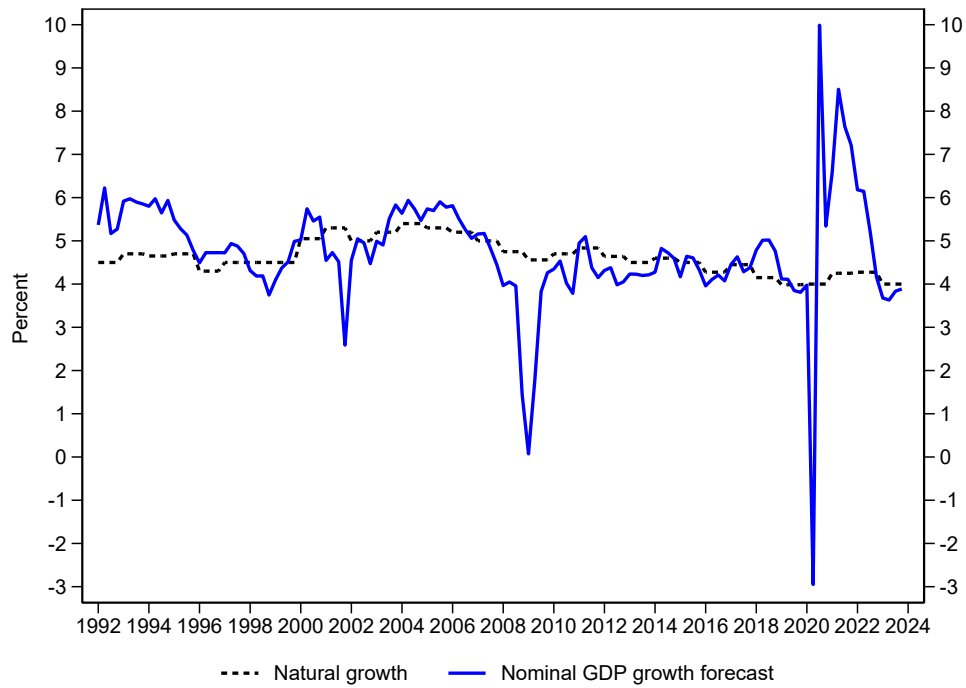
Inflation
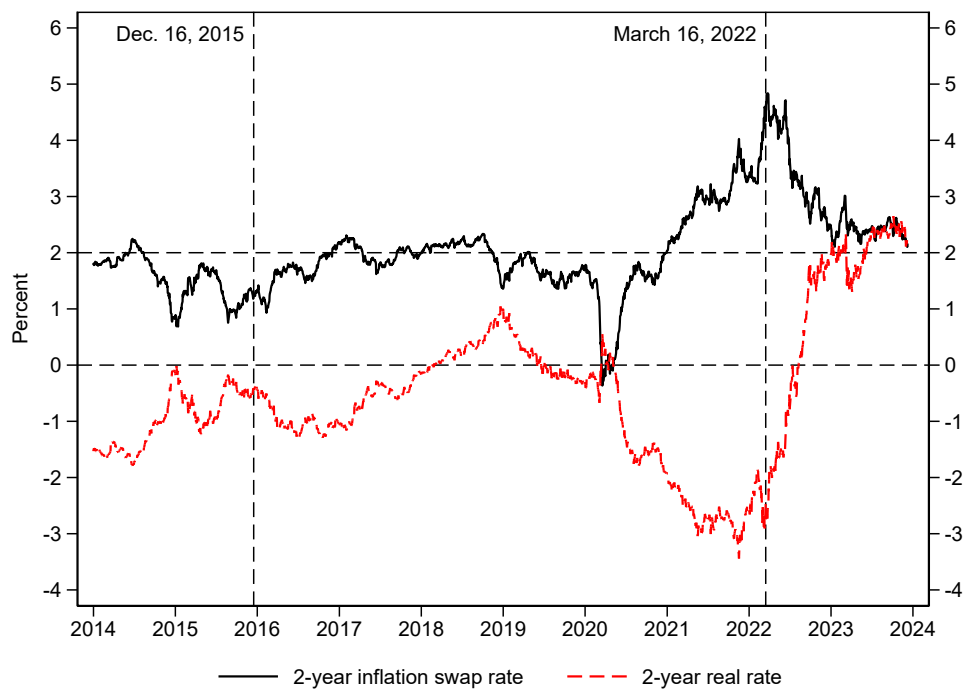
Real rates based on OIS and inflation swap rates.

Figure 4
The trap in historical perspective: Inflation and real rates

Outcome-based real interest rate

Inflation outcome ——— Real fed funds rate - - -

Forecast-based real interest rate

Inflation forecast ——— Real fed funds rate - - -

Inflation outcome is GNP/GDP deflator growth over 4 quarters as available in real time. Forecast based on median SPF forecast of the deflator over four quarters, ending 3 quarters ahead. Real fed funds rate is quarter-average rate minus inflation outcome/forecast.
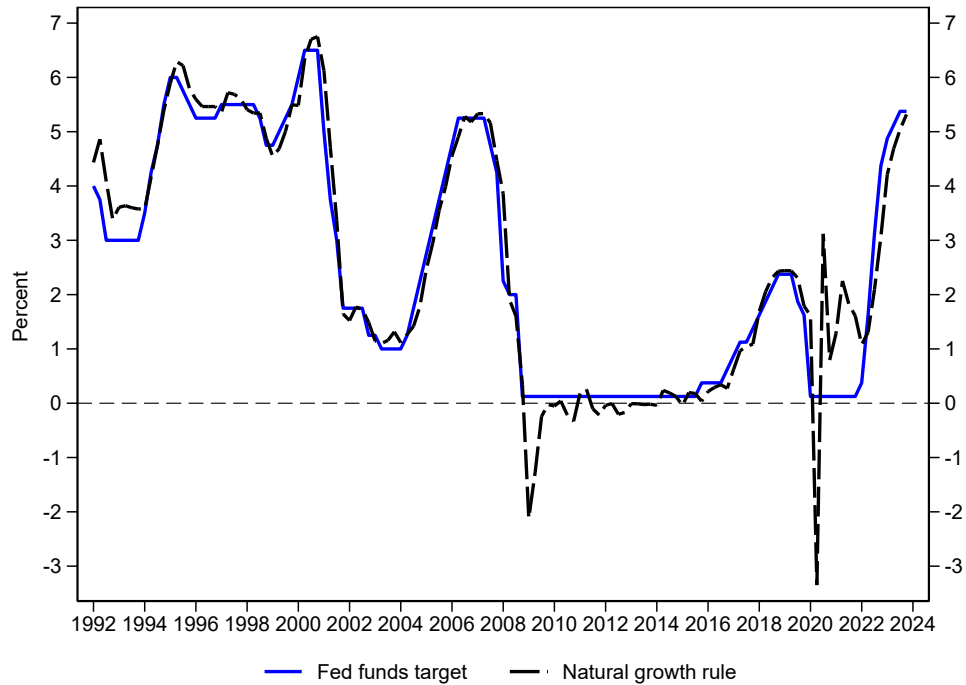
Figure 5
Inputs to Natural Growth Rule

Natural growth is the sum of the Fed's 2% inflation goal and the median SPF forecast of GDP over th enext 10 years. Nominal GDP growth forecast is the median SPF forecast of growth over four quarters, ending 3 quarters ahead.

Figure 6
Natural Growth Rule

Quarterly change

Fed funds target — — Natural growth rule
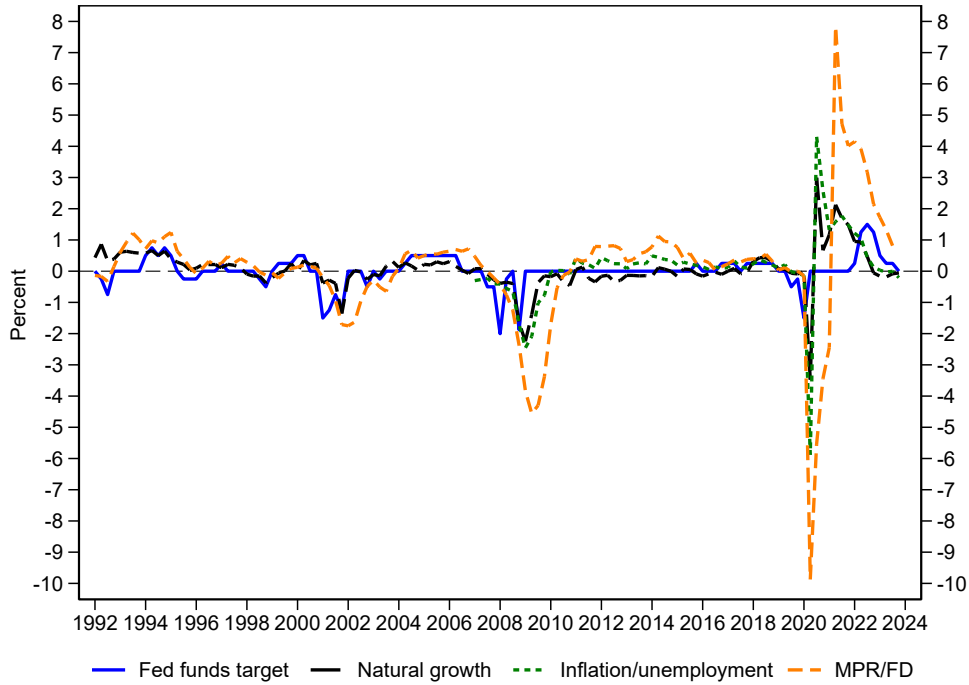
End-quarter Level

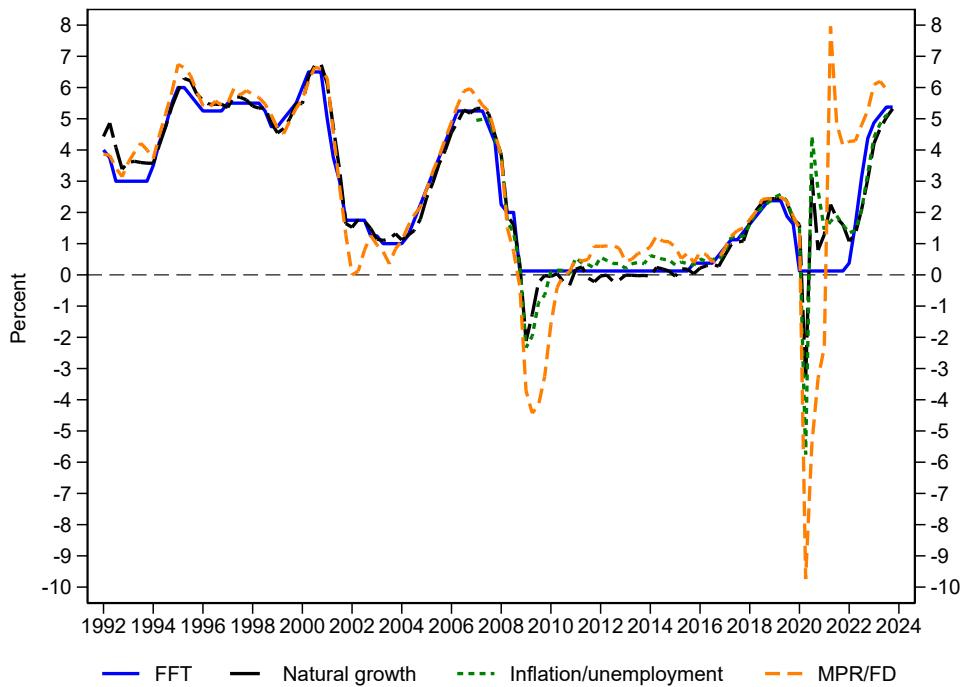Fed funds target — — Natural growth rule
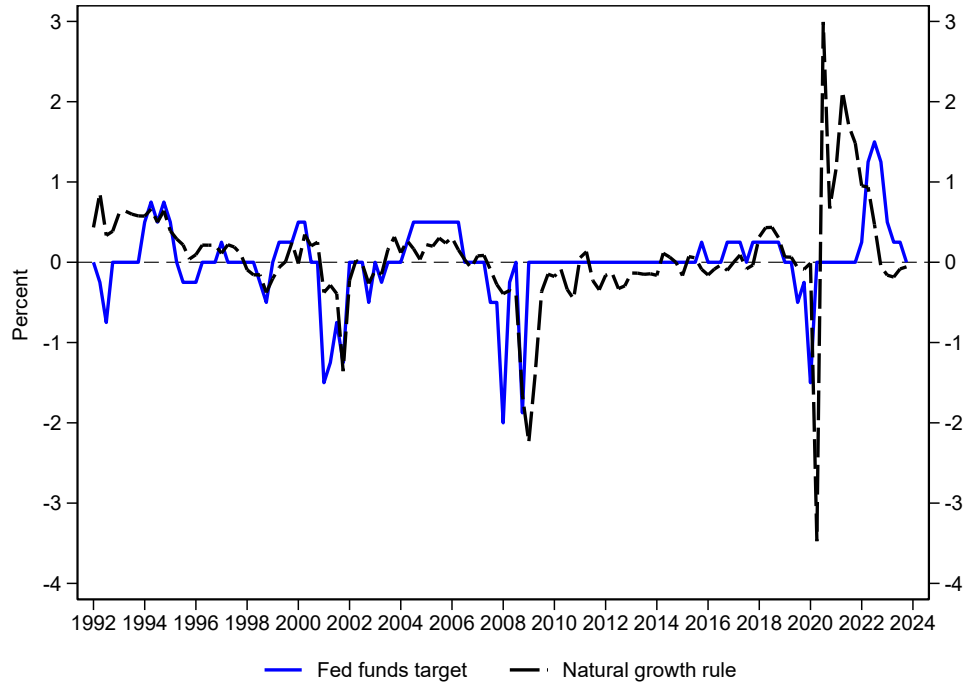
Natural growth rule, $\Delta i = \theta(n - n^*)$, with $\theta = 0.5$, based on SPF forecasts of nominal income growth

Figure 7
Natural Growth Rule Alternatives

Quarterly change

Legend: Fed funds target — Natural growth — Inflation/unemployment · · · MPR/FD - -

End-quarter Level

Legend: FFT — Natural growth — Inflation/unemployment · · · MPR/FD - -

Natural growth rule as in Figure 6. Alternatives show $\Delta i = \theta(\pi - \pi^*) + \theta\kappa\Delta u$, with $\theta = 0.5$ and $\kappa = -2$. MPR/FD uses current data on core PCE inflation and change in unemployment over four quarters ending in the current quarter. Inflation/unemployment implementation based on SPF forecasts of core PCE and unemployment over four quarters, ending 3 quarters ahead.

Figure 8
Natural Growth Rule Alternatives: Detail
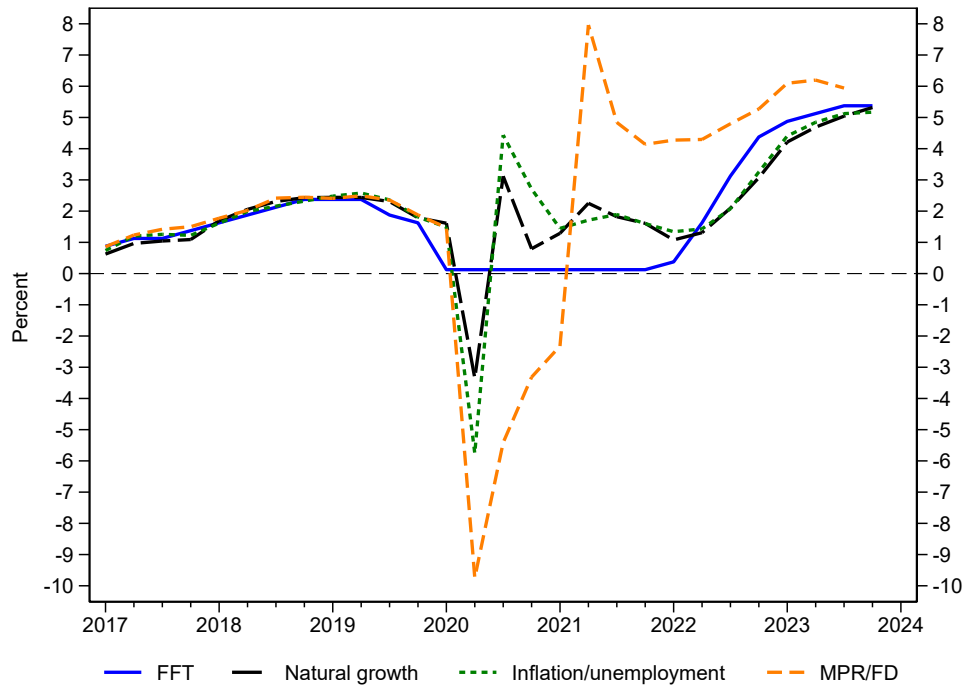
Detail reproduced from Figure 7.

IMFS WORKING PAPER SERIES

Recent Issues

200 / 2024	Thomas Jost Reimund Mink	Central Bank Losses and Commercial Bank Profits – Unexpected and Unfair?
198 / 2024	Lion Fischer Marc Steffen Rapp Johannes Zahner	Central banks sowing the seeds for a green financial sector? NGFS membership and market reactions
197 / 2023	Tiziana Assenza Alberto Cardaci Michael Haliassos	Consumption and Account Balances in Crises: Have We Neglected Cognitive Load?
196 / 2023	Tobias Berg Rainer Haselmann Thomas Kick Sebastian Schreiber	Unintended Consequences of QE: Real Estate Prices and Financial Stability
195 / 2023	Johannes Huber Alexander Meyer-Gohde Johanna Saecker	Solving Linear DSGE Models With Structure Preserving Doubling Methods
194 / 2023	Martin Baumgärtner Johannes Zahner	Whatever it takes to understand a central banker – Embedding their words using neural networks
193 / 2023	Alexander Meyer-Gohde	Numerical Stability Analysis of Linear DSGE Models – Backward Errors, Forward Errors and Condition Numbers
192 / 2023	Otmar Issing	On the importance of Central Bank Watchers
191 / 2023	Anh H. Le	Climate Change and Carbon Policy: A Story of Optimal Green Macroprudential and Capital Flow Management
190 / 2023	Athanasios Orphanides	The Forward Guidance Trap
189 / 2023	Alexander Meyer-Gohde Mary Tzaawa-Krenzler	Sticky information and the Taylor principle
188 / 2023	Daniel Stempel Johannes Zahner	Whose Inflation Rates Matter Most? A DSGE Model and Machine Learning Approach to Monetary Policy in the Euro Area
187 / 2023	Alexander Dück Anh H. Le	Transition Risk Uncertainty and Robust Optimal Monetary Policy
186 / 2023	Gerhard Rösl Franz Seitz	Uncertainty, Politics, and Crises: The Case for Cash

185 / 2023	Andrea Gubitz Karl-Heinz Tödter Gerhard Ziebarth	Zum Problem inflationsbedingter Liquiditätsrestriktionen bei der Immobilienfinanzierung
184 / 2023	Moritz Grebe Sinem Kandemir Peter Tillmann	Uncertainty about the War in Ukraine: Measurement and Effects on the German Business Cycle
183 / 2023	Balint Tatar	Has the Reaction Function of the European Central Bank Changed Over Time?
182 / 2023	Alexander Meyer-Gohde	Solving Linear DSGE Models with Bernoulli Iterations
181 / 2023	Brian Fabo Martina Jančoková Elisabeth Kempf Luboš Pástor	Fifty Shades of QE: Robust Evidence
180 / 2023	Alexander Dück Fabio Verona	Monetary policy rules: model uncertainty meets design limits
179 / 2023	Josefine Quast Maik Wolters	The Federal Reserve's Output Gap: The Unreliability of Real-Time Reliability Tests
178 / 2023	David Finck Peter Tillmann	The Macroeconomic Effects of Global Supply Chain Disruptions
177 / 2022	Gregor Boehl	Ensemble MCMC Sampling for Robust Bayesian Inference
176 / 2022	Michael D. Bauer Carolin Pflueger Adi Sunderam	Perceptions about Monetary Policy
175 / 2022	Alexander Meyer-Gohde Ekaterina Shabalina	Estimation and Forecasting Using Mixed-Frequency DSGE Models
174 / 2022	Alexander Meyer-Gohde Johanna Saecker	Solving linear DSGE models with Newton methods
173 /2022	Helmut Siekmann	Zur Verfassungsmäßigkeit der Veranschlagung Globaler Minderausgaben
172 / 2022	Helmut Siekmann	Inflation, price stability, and monetary policy – on the legality of inflation targeting by the Eurosystem
171 / 2022	Veronika Grimm Lukas Nöh Volker Wieland	Government bond rates and interest expenditures of large euro area member states: A scenario analysis
170 / 2022	Jens Weidmann	A new age of uncertainty? Implications for monetary policy