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Special Report
Research Department

Monetary Policy Report: Using Rules for Benchmarking

Keith Sill
Senior Vice President and Director, Real-Time Data Research Center

Jonas Arias
Economic Advisor and Economist

Thorsten Drautzburg
Economic Advisor and Economist

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Introduction

This special report highlights ongoing work to benchmark the stance of monetary policy using a range of policy rules that are widely employed in studies of monetary economics.[1] We perform this exercise with a structural forecasting model based on the New Keynesian dynamic stochastic general equilibrium methodology. We then employ this model to explore the expected behavior of economic variables, including the policy rate, under alternative policy rules. The policy rules help to benchmark the current stance of the federal funds rate, and they provide guidance on how the path of policy is likely to evolve in the context of the model. Such an exercise as part of a more comprehensive quarterly monetary policy report would enhance communication and promote a more systematic approach to monetary policy.

We begin with an overview of the economy and then discuss the benchmark model we use to generate our forecasts.

Economic Overview

Inflation continues to run at a pace above levels consistent with the Federal Open Market Committee's (FOMC's) 2 percent target, driven by prices for shelter and other core services. Data from the first quarter tended to surprise on the upside, but more recent data on inflation and employment suggest the pace of activity is moderating. Real gross domestic product

[1] The views expressed in this report are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of Philadelphia or the Federal Reserve System. We thank Anna Benoit and Riley E. Thompson for their assistance.

(GDP) growth for the first quarter was revised down slightly to a 1.3 percent annual pace, largely due to a downward revision to personal consumption expenditures (PCE). First quarter growth is now estimated at 1.3 percent and consumption growth at 2 percent.

Employment growth in May surprised on the upside with total nonfarm payroll growth coming in at 272 thousand jobs, a bit higher than the average monthly gain of 232 thousand over the prior 12 months. Job gains were led by health care, government, leisure and hospitality, and professional services. The household survey continued to deviate from the establishment survey. The number of employed persons fell by 408 thousand in the Household Survey, and the unemployment rate ticked up to 4 percent. Both the labor force participation rate and the employment-population ratio were little changed in May. In May, average hourly earnings for all employees on private nonfarm payrolls rose 0.4 percent. Over the past year, average hourly earnings have risen by 4.1 percent—a pace largely thought higher than is consistent with 2 percent inflation. The number of job openings as measured in the Job Openings and Labor Turnover Survey (JOLTS) changed little in April and stood at 8.1 million; it is down about 1.8 million over the past year. Both hires and total separations were little changed, as were quits and layoffs and discharges. On balance, the labor market remains tight, although it continues to evidence gradual moderation.

Inflation is showing signs of moderation compared to what we saw in the first quarter. For April, PCE core inflation rose 0.2 percent while headline was up 0.3 percent. On a year-over-year basis, headline PCE inflation rose 2.7 percent, the same pace as in March, while core inflation rose 2.8 percent—similar to the pace in February and March. The slow decline in year-over-year inflation largely reflects the sluggish decline of shelter inflation (although we note that inflation for services ex. shelter remains elevated). On a year-over-year basis, inflation for houses and utilities is at 5.4 percent. Services ex. housing and utilities inflation is up a more moderate 3.4 percent. Goods inflation is up only 0.1 percent. Between 2010 and 2019, housing and utilities inflation ran at a 2.4 percent average pace, services ex. housing and utilities was 2.2 percent, and goods inflation was 0.2 percent. May data on the Consumer Price Index (CPI) inflation rate showed year-over-year headline inflation ticking down to 3.3 percent, while core CPI inflation fell 0.2 percentage point to 3.4 percent on a year-over-year basis.

Recent monthly indicators continue to suggest that the pace of economic activity has slowed from last year. Growth in real PCE and real disposable income were weak in April. Both measures fell by 0.1 percent in April. Real consumption expenditures were revised down slightly in both February and March. As well, industrial production was flat on a month-over-month basis in April and was down 0.4 percent on a year-over-year basis. Capacity utilization has been trending down gradually over the last year. The housing market remains weak in the

face of tight supply and high mortgage rates. New single-family home sales were down 4.7 percent in April compared to March and were down 7.7 percent on a year-over-year basis. Existing home sales were down 1.9 percent in April compared to March and were down a similar amount on a year-over-year basis. Looking across the most commonly used house price indexes (FHFA, Case-Schiller, NAR, and CoreLogic), house prices are up 5 to 7 percent on a year-over-year basis.

To conclude, the pace of economic activity appears to be healthy overall but is slowing from the pace in 2023. Tight monetary policy is dampening growth, especially in interest-sensitive sectors such as housing. The labor market remains healthy and is coming into better supply and demand balance. The consumer has proven surprisingly resilient to higher interest rates, but recent evidence suggests that spending is moderating. FOMC members' June projections of economic activity continue to anticipate modest growth and above-target inflation. This year's median expected real GDP growth remains at 2.1 percent, and at 2 percent in 2025 and 2026. The unemployment rate is expected to end the year at 4 percent and then edge up to 4.2 percent at the end of 2025. Expectations for PCE inflation are at 2.6 percent for headline and 2.8 percent for core in 2024, falling to 2.3 percent for both measures in 2025. The median participant sees the federal funds rate reaching 5.1 percent at the end of 2024, up from 4.6 percent in the March Survey of Economic Projections (SEP).

The Benchmark Model

To create our forecast, we use a structural forecasting model based on the New Keynesian dynamic stochastic general equilibrium (NKDSGE) methodology, which is at the forefront of macroeconomic modeling and forecasting. Our model features households and firms that are forward-looking and that make decisions while facing resource constraints. The model includes a labor market in which firms and households engage in search-and-matching behavior—allowing us to model the unemployment rate in a meaningful way. The model features a rich menu of shocks as well as adjustment costs that make wages and prices less than fully flexible in responding to changes in economic conditions. We have added additional shocks to the model to account for the pandemic—but we have not changed the model's structural equations in response to the pandemic. Implicit in this view is that the structure of the economy has returned to a prepandemic state now that the virus has been mitigated. While through the lens of our model some economic effects of the pandemic linger, this forecast is largely based on the economy's prepandemic structure. Detailed documentation on the model structure is available from the authors upon request.

The underlying baseline policy rule in the model is a response function of the form

$$R_t = \rho R_{t-1} + (1-\rho)[\Psi_\pi(\pi_{t|t-4} - \pi^*) + \Psi_y ygap_t + T(\text{T-year-}\bar{\pi}_t - \pi^*)] + \varepsilon_t^R,$$

where R_t is the deviation of the effective federal funds rate from its long-run equilibrium value, $\pi_{t|t-4}$ is the four-quarter change in core PCE inflation (the one-year-average inflation rate), $ygap_t$ is a measure of the output gap, $\text{T-year-}\bar{\pi}_t$ is the T-year-average inflation rate at an annual rate, and ε_t^R is a monetary policy shock.[2] The parameters ρ, Ψ_π, Ψ_y, and T determine how monetary policy reacts to economic conditions. We run forecast simulations under five different versions of the basic rule shown here:

Table 1

Rule	ρ	Ψ_π	Ψ_y	T
Baseline	0.8	2.5	0.5	0.0
Taylor (1993)	0.0	1.5	0.5	0.0
Taylor (1999)	0.0	1.5	1.0	0.0
Inertial Taylor (1999)	0.85	1.5	1.0	0.0
Average Inflation Targeting	0.85	1.0	1.0	2.0

The baseline rule uses parameter values that are estimated from the data using the full NKDSGE model. That is, the baseline rule depicts the historical behavior of monetary policymakers.

Model Forecasts Under the Baseline

The forecast, shown in Figures 1–4, is generated using observed data through the first quarter of 2024, together with an assumption of how output growth, inflation, the federal funds rate, and unemployment will fare in the second quarter of 2024.[3] The forecast then begins in the third quarter of 2024 and extends through the fourth quarter of 2026. In each figure, the baseline forecast corresponds to the median of the predictive distribution and is represented by a dark solid line. The colored bands around the baseline forecast represent 10 percent confidence intervals of the predictive distribution.[4]

The key features of the baseline forecast are as follows:

[2] The model calibration implies that the long-run equilibrium value of the federal funds rate is 2.5 percent. The output gap is calculated using the flexible-price version of the model. The gap is then measured as the log difference of realized output from its flexible-price counterpart. For the baseline rule, the output gap is a growth gap—the deviation of realized output growth from its longer-run trend.

[3] Our forecast was made prior to the most recent FOMC meeting.

[4] The forecast simulations are generated using Bayesian methods. The fan charts show 10 percent quantiles around the median of the posterior predictive distribution.

- Real output growth is forecast to be 1.8 percent in 2024 and 2.0 percent in both 2025 and 2026, on a fourth quarter over fourth quarter basis. This represents a slight downward revision in the forecast, compared to the March forecast (Figure 5a).
- Core PCE inflation falls from a 3.2 percent pace in 2023 to 2.9 percent in 2024, 2.3 percent in 2025, and 2 percent in 2026, on a fourth quarter over fourth quarter basis. The forecast represents a noticeable upward revision for this year, with minor changes for the remainder of the forecast horizon, relative to the March forecast (Figure 5b).
- The unemployment rate is expected at 4.1 percent at the end of 2024, remaining at that level until the end of 2026. This represents a modest upward revision throughout the forecast horizon compared to March (Figure 5c).
- The federal funds rate averages 5.0 percent in the third quarter of 2024, falling to 4.6 percent in the fourth quarter of 2024, 3.3 percent in the fourth quarter of 2025, and 2.6 percent by end-2026. This path is somewhat higher than it was in March (Figure 5d).

The forecast for output growth in 2024 is slightly weaker compared to the March forecast, as output growth in the first quarter came in lower than expected. The forecast for the federal funds rate is completely data determined according to the model's policy reaction function. The model path for the federal funds rate is below both the financial market expectation and the median forecast from the June SEP. Uncertainty about how the economy will evolve over the near term remains high due to several factors, including the wars in Europe and the Middle East, above-target inflation, the possibility of renewed supply-chain strains, and uncertainty about policy tightening lags.

After increasing at a pace of 3.1 percent in 2023, the model anticipates that output growth will slow down to 1.8 percent in 2024, edging up to 2.0 percent in 2025 and 2026. The assumed growth of 2.1 percent in the current quarter is in line with the Survey of Professional Forecasters (SPF) median projection for the second quarter of 2024. On an annual average basis, the forecast for output growth is broadly similar to that of the median SPF projection throughout the forecast horizon: The baseline model shows output growing at an average pace of 2.5 percent in 2024 and subsequently slowing down to a 2.0 percent pace in both 2025 and 2026.[5]

The labor market remains strong. We impose a nowcast for the unemployment rate of 3.9 percent for the current quarter. The model predicts that the unemployment rate will gradually tick up to 4.1 percent at the end of this year and remain at that level until the end of 2026.

[5] The model features long-run real per capita output growth of 1.6 percent. We revised up the path of population growth over the forecast horizon. Specifically, we assume that population growth equals 1.4 percent in 2024, 0.9 percent in 2025, and 0.7 percent in 2026 on a fourth quarter over fourth quarter basis. This projection is roughly in line with the Congressional Budget Office's "Demographic Outlook: 2024–2054."

This is below the model's natural rate of unemployment—i.e., the level of unemployment that the model returns to in the long run, which is 4.4 percent.

Recent data have shown an uptick in inflation in the first quarter of this year. In spite of this, with tight monetary policy and below-trend output growth, the model anticipates that inflation will continue its overall downward trajectory, averaging 2.9 percent in 2024, decreasing further to 2.3 percent in 2025 and to 2 percent in 2026. Thus, inflation is expected to run somewhat above the FOMC target of 2 percent average inflation over the next two years.

The baseline forecast for 2024 on a fourth quarter over fourth quarter basis is equal to the median projections from the second-quarter 2024 SPF. Looking ahead, on an annual average over annual average basis, the SPF expects 1.9 percent in both 2025 and 2026, 0.1 percentage point below the implied growth of annual averages in our forecasts. The SPF's core PCE inflation forecast is 2.9 percent (Q4/Q4) for 2024, edging down to 2.2 percent in 2025 and 2.1 percent in 2026. Thus, on inflation, the SPF forecast is slightly lower than the model baseline. The SPF's path for the unemployment rate is nearly identical over the forecast horizon compared to the baseline: The median SPF forecast for the unemployment rate is 4 percent in the last quarter of 2024, and the annual average for both 2025 and 2026 is 4.1 percent according to the SPF.

The June 2024 SEP by FOMC participants shows the median projection for output growth at 2.1 percent in 2024, 2 percent in 2025, and 2 percent in 2026. The median forecast of the unemployment rate is 4 percent at the end of 2024; it edges up to 4.2 percent at the end of 2025 and decreases to 4.1 percent at the end of 2026. Core PCE inflation is projected at 2.8 percent in 2024, 2.3 percent in 2025, and 2 percent in 2026. The median FOMC member forecast anticipates that the federal funds rate will go down to 5.1 percent at the end of 2024, 4.1 percent at the end of 2025, and 3.1 percent at the end of 2026.

Alternative Policy Rules

With this edition of the Monetary Policy Report, we continue to analyze traditional alternative policy rules from the literature as prescriptions for the course of monetary policy over the next few years, as well as the average inflation targeting rule (described in Arias, Bodenstein, Chung, Drautzburg, and Raffo [2020]) under a two-year symmetric window, which we have included since the June 2023 Report.

As indicated in Table 1, the alternative rules are forms of the monetary policy rule described above, with differing weights on the inflation gap, the output gap, and the lagged interest rate. Relative to the baseline, the Taylor 1993 and 1999 rules call for an abrupt fall in the federal funds rate leading to faster real GDP growth, lower unemployment, and inflation above 3

percent throughout 2024. The inertial Taylor 1999 and average inflation targeting rules lead to remarkably lower core inflation, lower real output growth, and a higher unemployment rate over the forecast horizon. Thus, these alternative rules would slow the real economy more than in the baseline, causing inflation to run below target for a protracted period.

As shown in Figure 4, the average inflation targeting rule implies a commitment to maintain a higher federal funds rate for longer in response to an extended period of above-target inflation. This rule calls for one 25 basis point cut in the federal funds rate in 2024. Although it then calls for additional rate cuts in 2025, the projected path is higher than the path implied by the noninertial rules. This causes inflation to jump down to 1.6 percent in the third quarter of 2024 before rising gradually to 1.9 percent by the end of the forecast horizon. This rapid fall in inflation, however, comes at the cost of a sharp transient increase in the unemployment rate to 4.6 percent within one quarter, a level that is sustained through the end of 2024. Thereafter, unemployment gradually declines to 4.3 percent at the end of 2025 and to 4.0 percent by the end of 2026. Output growth on a fourth quarter over fourth quarter basis slows a tad to 1.6 percent in 2024 and rebounds to about 2.1 percent over the remainder of the forecast horizon.

All other rules call for more than one 25 basis point interest rate cut this year, with noticeably pronounced interest rate cuts implied by the noninertial rules. For example, these rules call for an about 140 basis point cut in the third quarter of 2024, followed by gradual interest rate increases to converge to the baseline path by mid-2025. The interest rate is at about 2.4 percent by the end of 2026, the long-run level implied by all rules considered here. The sharp interest rate cuts temporarily stimulate the economy a tad at the cost of noticeably higher inflation. The unemployment rate is on average 0.2 percentage point lower than in the baseline in 2024, and output growth is 0.3 percentage point higher than in the baseline over the second half of this year. This comes at the cost of an increase in inflation to about 3.5 percent in the third quarter, followed by a slow convergence to the baseline path by the end of 2026.

The inertial Taylor 1999 rule calls for an interest rate path that closely tracks the one of the baseline model in the near term and runs about 25 basis points lower than the baseline in the medium term. As in the case of the average inflation targeting rule, however, it yields lower inflation at the cost of temporarily higher unemployment and lower growth. The inertial Taylor rule slows the economy while maintaining a lower interest rate path than in the baseline because of the expectations channel: Households act on the expectation that monetary policymakers will respond more aggressively to the output gap compared to the baseline. All else equal, the inertial Taylor rule implies that interest rates would remain high even after inflation and the output gap have been brought down. Instead, forward-looking households

and firms adjust their demand and prices immediately, lowering the output gap and inflation, and increasing the unemployment rate, allowing the monetary authority to not have to follow through on the threat of persistently higher rates.

Summary

The baseline NKDSGE model uses historical correlations in the data to generate its forecasts and does not incorporate significant judgmental adjustment. The NKDSGE model also does not explicitly account for any structural changes to the economy that may have been induced by the pandemic. The model projects below-trend output growth over the forecast horizon. Inflation eases gradually and finally reaches the FOMC target of 2 percent in 2026. Forecast uncertainty remains high as the economy deals with wars in Europe and the Middle East, tighter financial conditions, and the possibility of renewed supply-chain strains. These factors are not directly incorporated into the model forecast. On balance, as in the March projection, the forecast continues to call for below-trend output growth and above-target inflation in the near term.

Figure 1: Real GDP Growth

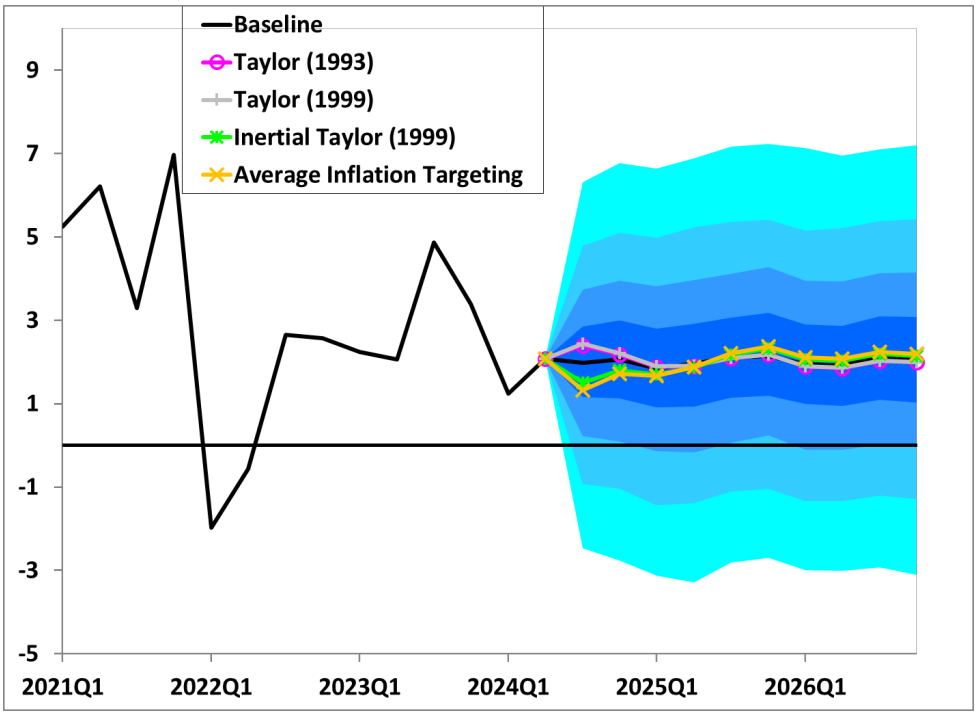


Figure 2: Core PCE Inflation

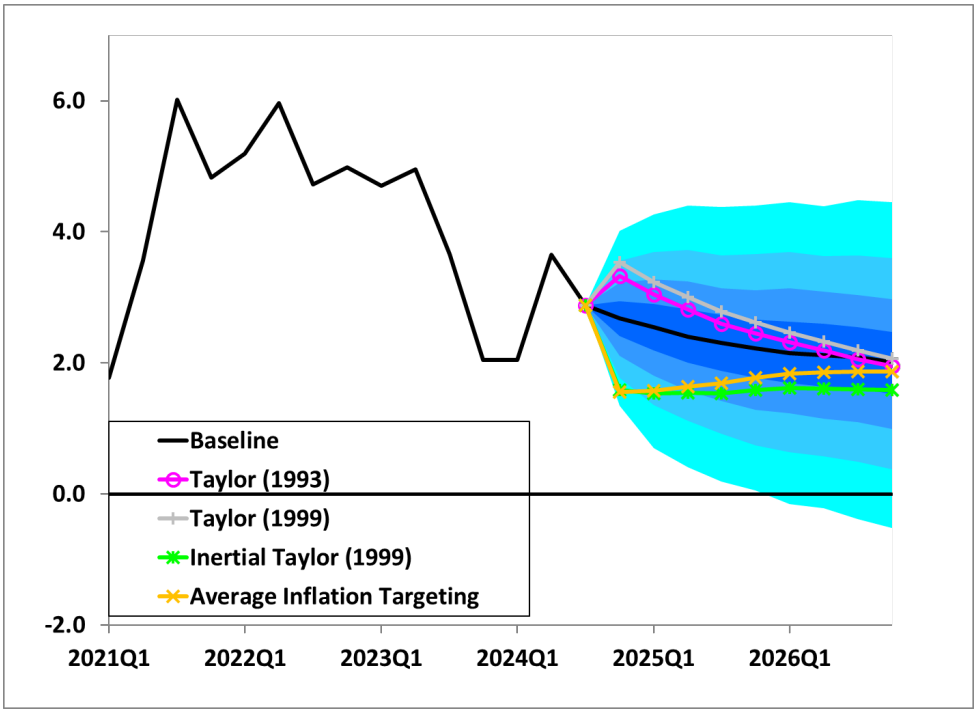


Figure 3: Unemployment Rate

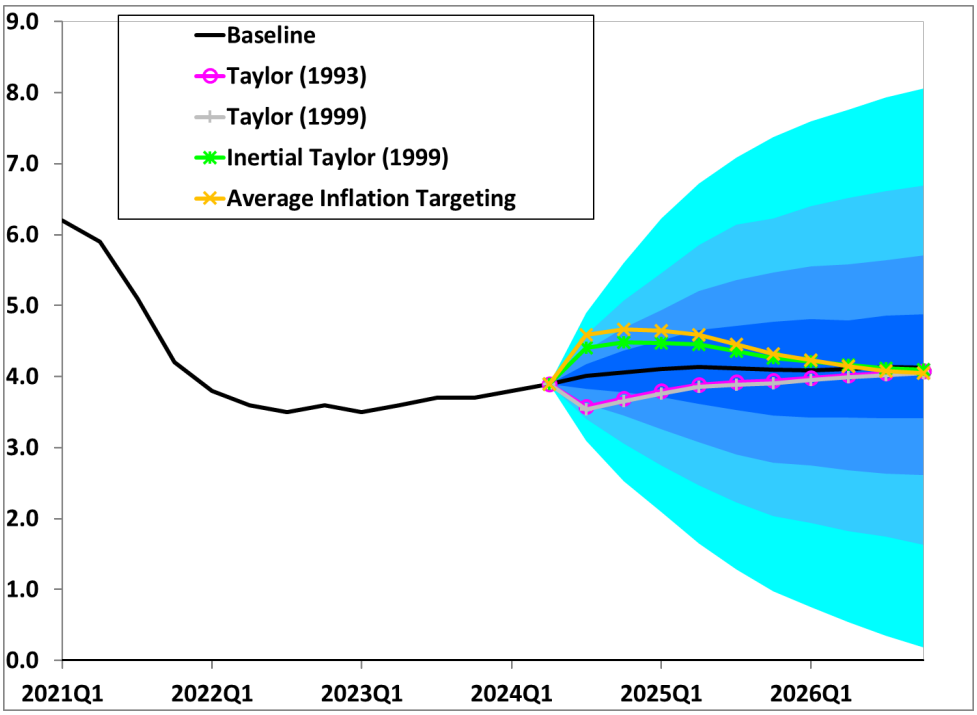


Figure 4: Federal Funds Rate

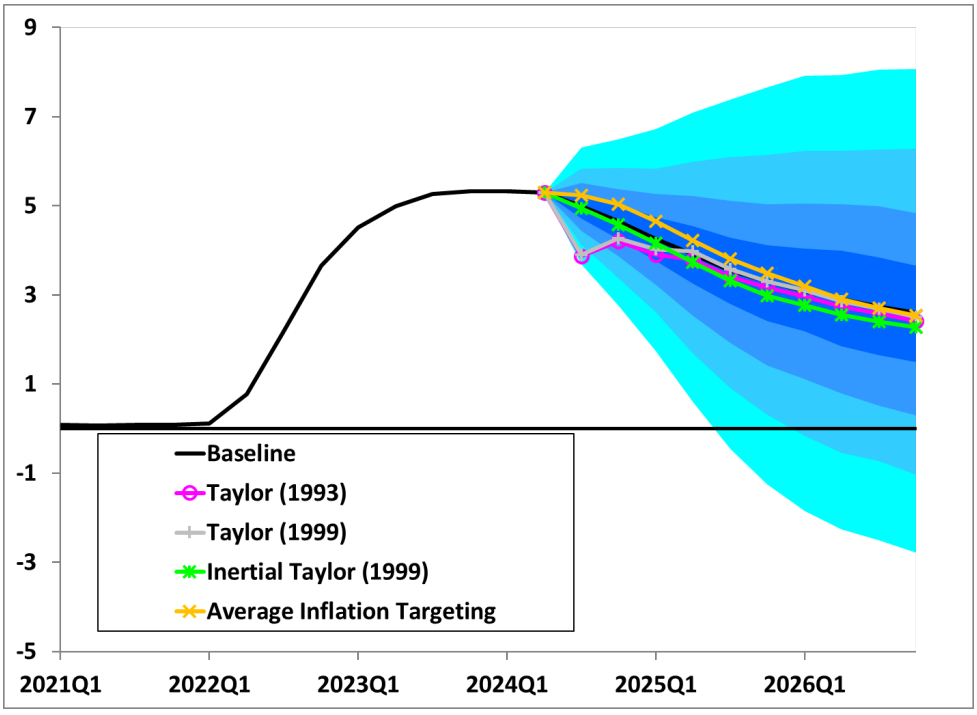


Figure 5: Baseline Forecast Comparisons

Figure 5a: Real GDP Growth

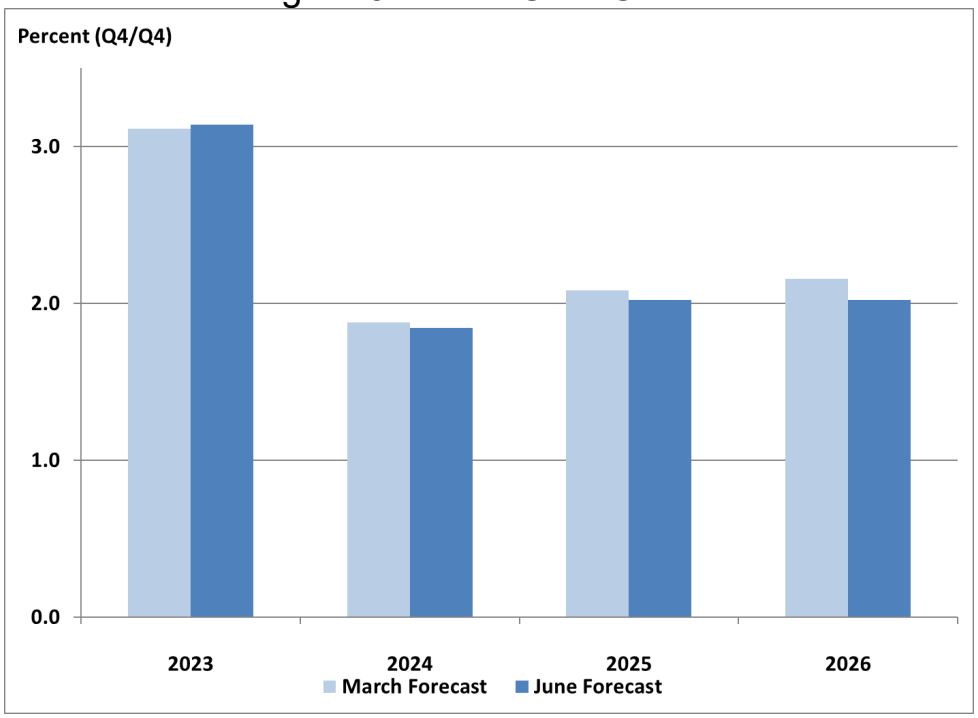


Figure 5b: Core PCE Inflation Growth

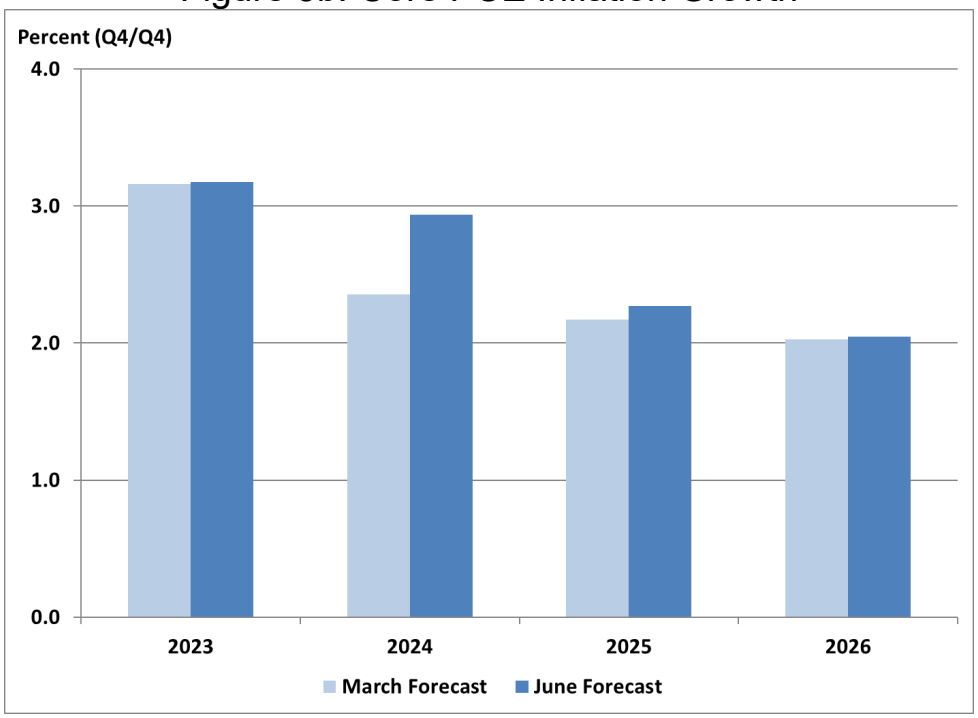


Figure 5c: Unemployment Rate

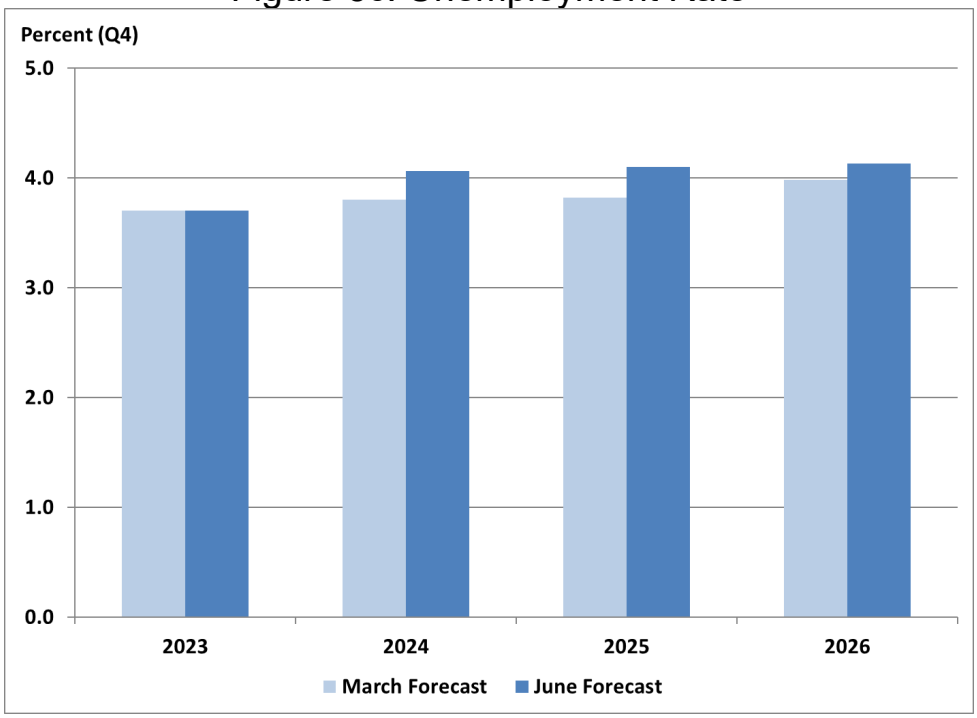
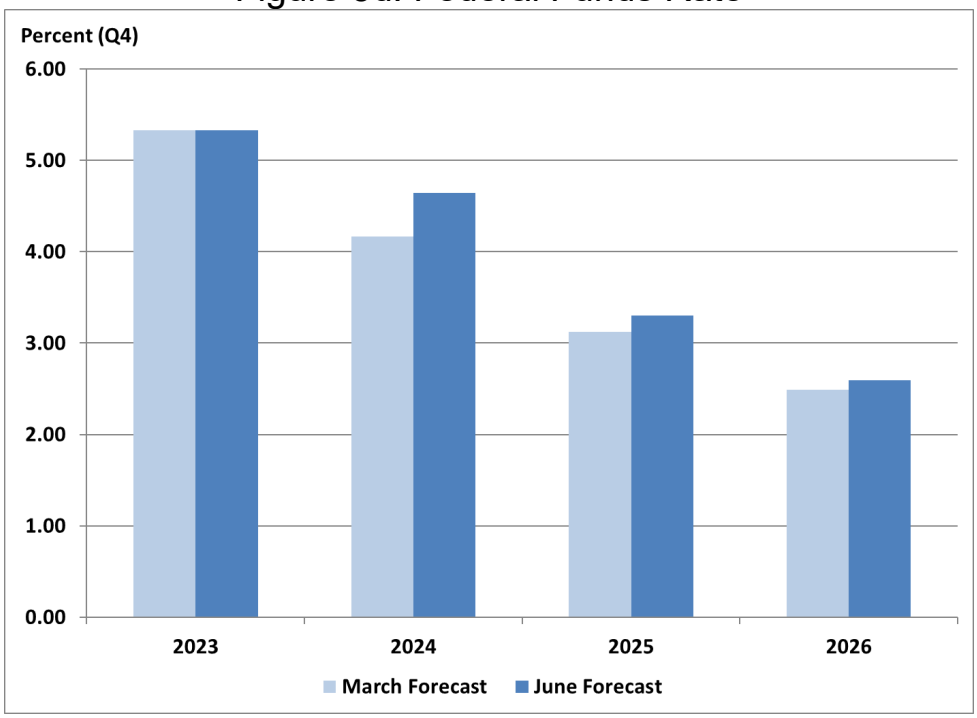


Figure 5d: Federal Funds Rate



Note: Historical data have been retrieved from Haver Analytics.