

Monetary Policy Report: Using Rules for Benchmarking

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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

Since the December Monetary Policy Report, the economy has continued on a trajectory that is consistent with a soft landing. Inflation has continued to edge down, economic growth has slowed, and the labor market is cooling. Consumer confidence measures indicate that households remain optimistic about economic conditions going forward. The housing market

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.

remains soft even as house prices continue to rise. The March Summary of Economic Projections (SEP) indicates that Federal Open Market Committee (FOMC) participants expect the federal funds rate to fall to around 4.6 percent by the end of the year.

Real gross domestic product (GDP) growth for the fourth quarter of 2023 was revised down slightly but remained strong at 3.2 percent. Consumer spending was the main source of strength, adding 2 percentage points to growth. Government spending, business fixed investment, and net exports also made contributions to the topline growth number. Productivity was up at a strong 3.2 percent pace in the fourth quarter, the second fastest pace since 2020.

The labor market remains resilient and showed stronger-than-expected growth in February, while average hourly earnings growth decelerated. Nonfarm payroll employment increased by 275 thousand in February, above the average pace of 230 thousand jobs per month over the last year. Most job gains in February came from health care, food service and drinking places, and government. Note that both January and December payroll gains were revised down by a total of about 170 thousand jobs. The unemployment rate ticked up from 3.7 percent to 3.9 percent in February while the labor force participation rate remained unchanged at 62.5 percent.

Real consumer spending growth dipped slightly in January while real disposable income remained flat. Over the last year, real disposable income is up 2.1 percent as of January, reflecting the strong labor market and the decline in consumer price inflation. The personal savings rate remained about unchanged at 3.8 percent of disposable income. Although real consumption declined slightly in January, it posted strong gains in December and November, so some normalization is to be expected. Spending on both durable and nondurable goods fell in January, while spending on services rose, lifted by nonprofits spending, financial services, and a weather-related rebound in utilities. Retail sales bounced back in February after a weak January reading. Auto dealer sales surged, but core retail sales posted a healthy monthly gain of 3.5 percent, led by building supply stores and electronics and appliance stores.

The housing sector remains soft. New residential construction fell in January. However, housing starts rose 10 percent in February compared to the previous month. New-home sales were up modestly in January, and the inventory of new homes for sale declined slightly. Even in the face of weak demand, house prices were up about 5.5 percent in 2023, according to S&P CoreLogic Case-Shiller. The Federal Housing Finance Agency's purchase-only price index was up 6.6 percent in 2023.

Consumer price index (CPI) inflation came in higher than expected in January and February, driven mainly by higher rental rates. The core CPI rose 0.4 percent in February and was up 3.8 percent from a year ago. The three-month moving average of core CPI was up at a 4 percent annual rate for February. In January, the core personal consumption expenditures (PCE) inflation index was up 2.8 percent from a year ago.

To conclude, the pace of economic activity appears to be healthy overall but is slowing. Tight monetary policy will continue to weigh negatively on economic growth, especially in interest-sensitive sectors. The labor market remains healthy and is coming into better supply and demand balance. So far, the consumer has proven surprisingly resilient to higher interest rates. At present, risks remain to the upside for inflation and appear balanced for growth. The view that economic activity is likely to soften is reflected in FOMC members' March projections of economic activity, which continue to anticipate modest growth and above-target inflation. This year's median expected real GDP growth is at 2.1 percent, and at 2 percent in 2025. The unemployment rate is expected to rise modestly to 4 percent in the fourth quarter of 2024. Expectations for PCE inflation are at 2.4 percent for headline and 2.6 percent for core in 2024, falling to 2.2 percent in 2025. The median participant sees the federal funds rate reaching 4.6 percent at the end of 2024, down from 5.3 percent this quarter.

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

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

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, 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 fourth quarter of 2023, together with an assumption of how output growth, inflation, the federal funds rate, and unemployment will fare in the first quarter of 2024.³ The forecast then begins in the second 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:

- Real output growth is forecast to be 1.9 percent in 2024, 2.1 percent in 2025, and 2.2 percent in 2026, on a fourth quarter over fourth quarter basis. This represents a

² The model calibration implies that the long-run equilibrium value of the federal funds rate is 2.4 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.

modest upward revision in the forecast for this year, and minor changes for the remainder of the forecast horizon, compared to the December forecast (Figure 5a).

- Core PCE inflation falls from a 3.2 percent pace in 2023 to 2.4 percent in 2024, 2.2 percent in 2025, and 2 percent in 2026, on a fourth quarter over fourth quarter basis. The forecast for this year represents a modest downward revision relative to the December forecast (Figure 5b).
- The unemployment rate is expected at 3.8 percent at the end of 2024, remaining at that level at the end of 2025 before edging up to 4 percent by the end of 2026. This represents a noticeable downward revision throughout the forecast horizon compared to December (Figure 5c).
- The federal funds rate averages 5.1 percent in the second quarter of 2024, falling to 4.2 percent in the fourth quarter of 2024, 3.1 percent in the fourth quarter of 2025, and 2.5 percent by end-2026. This path has changed little relative to December (Figure 5d).

The forecast for output growth in 2024 is a tad stronger compared to the December forecast, as output growth in the fourth quarter came in higher 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 March SEP. There remains a great deal of uncertainty about how the economy will evolve over the near term. War in Europe and the Middle East, the possibility of renewed supply-chain strains, and the uncertainty about policy tightening lags suggest that forecast uncertainty remains elevated.

After increasing at a pace of 3.1 percent in 2023, the model anticipates that output growth will slow down to about 1.9 percent in 2024, edging up to 2.1 percent in 2025 and to 2.2 percent by the end of the forecast horizon. The assumed growth of 1.7 percent in the current quarter is lower than the Survey of Professional Forecasters (SPF) median projection of 2.1 percent for the first quarter of 2024. On an annual average basis, the growth forecast is a little stronger than that of the SPF from 2024 to 2026: The baseline model shows output growing at an about long-run average pace of 2.5 percent in 2024, subsequently decreasing to reach 2 and 2.1 percent in 2025 and 2026, respectively.⁵

The labor market remains strong. We impose a nowcast for the unemployment rate of 3.8 percent for the current quarter. The model predicts that the unemployment rate will remain at that level until the end of 2025 and then gradually tick up to 4 percent at the end of 2026. This

⁵ The model estimates long-run real per capita output growth of about 1.6 percent. We then assume that population growth averages 0.8 percent per year over the forecast horizon.

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 that inflation is easing relative to a year ago. With tight monetary policy and below-trend output growth, inflation moves down over the forecast horizon to average 2.4 percent in 2024, decreasing further to 2.2 percent in 2025 and 2 percent in 2026. Thus, the model anticipates that inflation will 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 a little stronger on growth than the median projections from the first-quarter 2024 SPF. The median respondent expects real output growth of 1.7 percent in 2024, compared to 1.9 percent in our baseline forecast. Looking ahead, on an annual average over annual average basis, the SPF expects 1.8 percent in 2025 and 2.2 percent in 2026, close to the implied growth of annual averages in our forecasts. The SPF's core PCE inflation forecast is 2.1 percent (Q4/Q4) for 2024, edging down to 2 percent in 2025 and 2026. Thus, on inflation, the SPF forecast is slightly lower than the model baseline. The forecasters' path for the unemployment rate is about 0.2 percentage point higher 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. The annual average for 2025 is also 4.1 percent according to the SPF, and the unemployment rate is expected to remain at that level in 2026.

The March 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 4.1 percent at the end of 2025 and decreases to 4 percent at the end of 2026. Core PCE inflation is projected at 2.6 percent in 2024, 2.2 percent in 2025, and 2 percent in 2026. The median Committee member forecast anticipates that the federal funds rate will go down to 4.6 percent at the end of 2024, 3.9 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 a resurgence of inflation to 3 percent. The inertial Taylor 1999 and the 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. Under this rule, the federal funds rate remains in the current target range through the first half of 2024 before declining to 4.6 percent by the end of 2024. Although it then starts declining, it still averages more than 5 percent in 2024, more than 1 percentage point higher than according to the noninertial rules. This causes inflation to jump down to 1.3 percent in the second 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 rise in the unemployment rate to 4.3 percent within one quarter, a level that is sustained through the end of 2024. Thereafter, unemployment gradually declines to 3.9 percent in 2025 and 2026. Output growth also slows a tad: In 2024, growth averages 1.6 percent, rebounding to about 2.2 percent over the remainder of the forecast horizon.

All other rules call for interest rate cuts, with noticeably pronounced interest rate cuts implied by the noninertial rules. For example, these rules call for an about 200 basis point cut in the second quarter of 2024, followed by transient interest rate increases to converge to the baseline path over the remainder of the forecast horizon. 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 faster interest rate cuts stimulate the economy temporarily, leaving the unemployment rate on average 0.3 percentage point lower than in the baseline in 2024, and slightly raising output growth relative to the baseline over the same period.

The inertial Taylor 1999 rule calls for an interest rate path broadly similar to that of the noninertial and the average inflation targeting rules, tracking the interest rate path of the baseline model closely in the near 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 or the war in Europe. 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 very 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 incorporated into the model forecast. On balance, as in the December projection, the forecast continues to call for below-trend output growth and inflation slightly above target in the near term.

Figure 1: Real GDP Growth

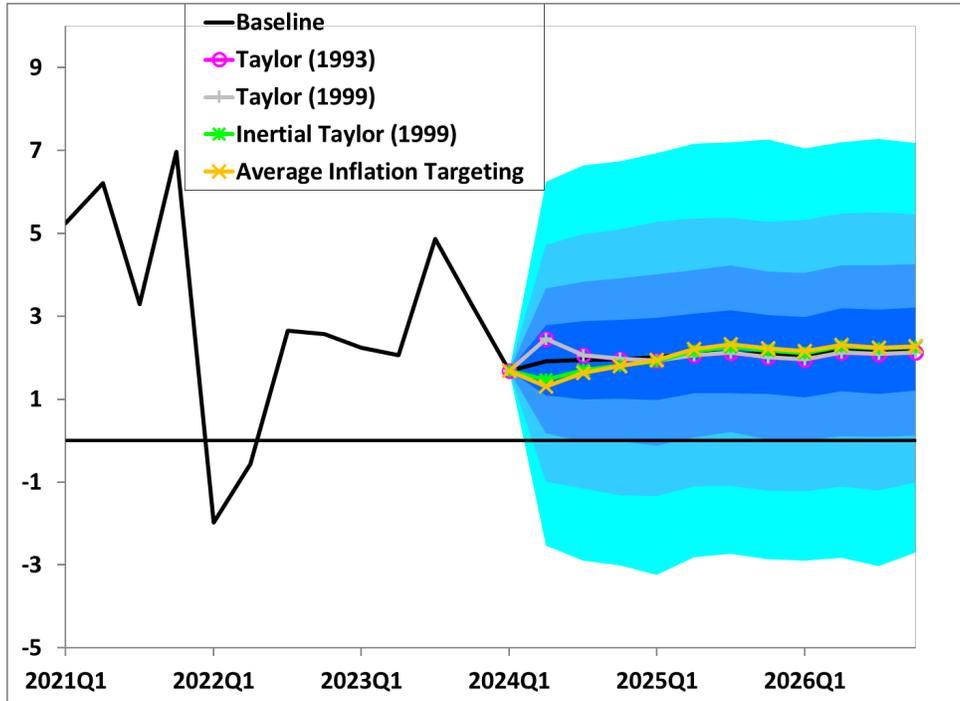


Figure 2: Core PCE Inflation

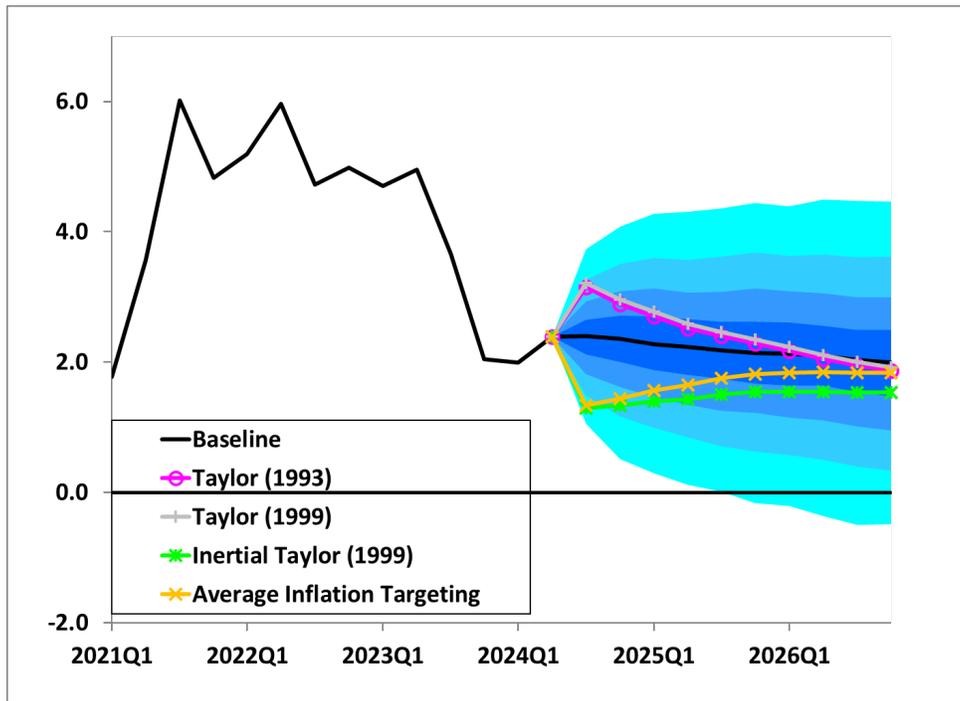


Figure 3: Unemployment Rate

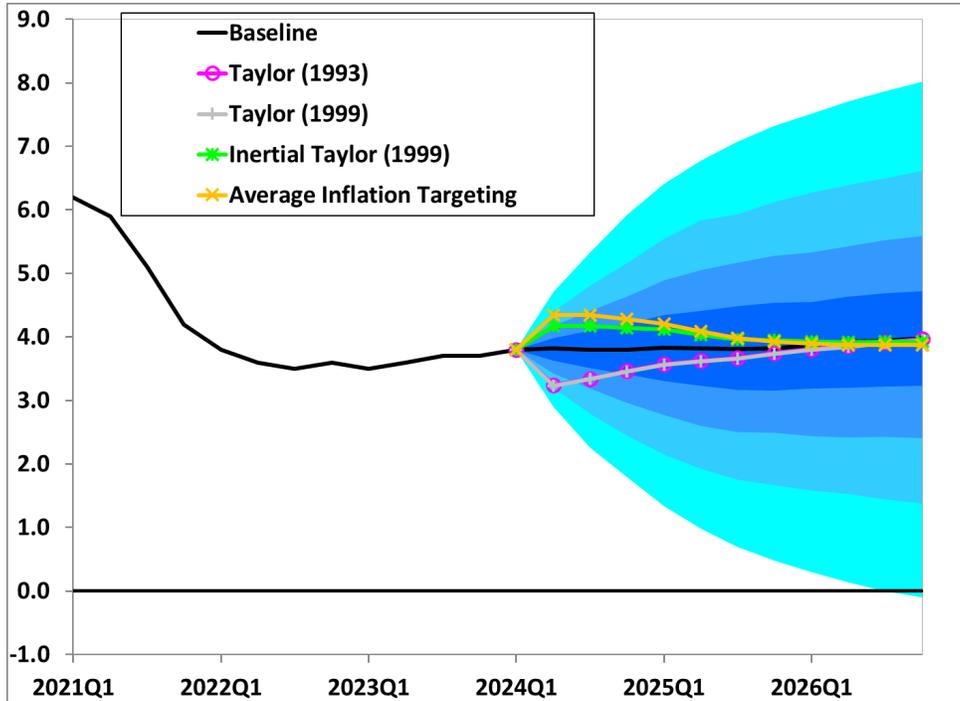


Figure 4: Federal Funds Rate

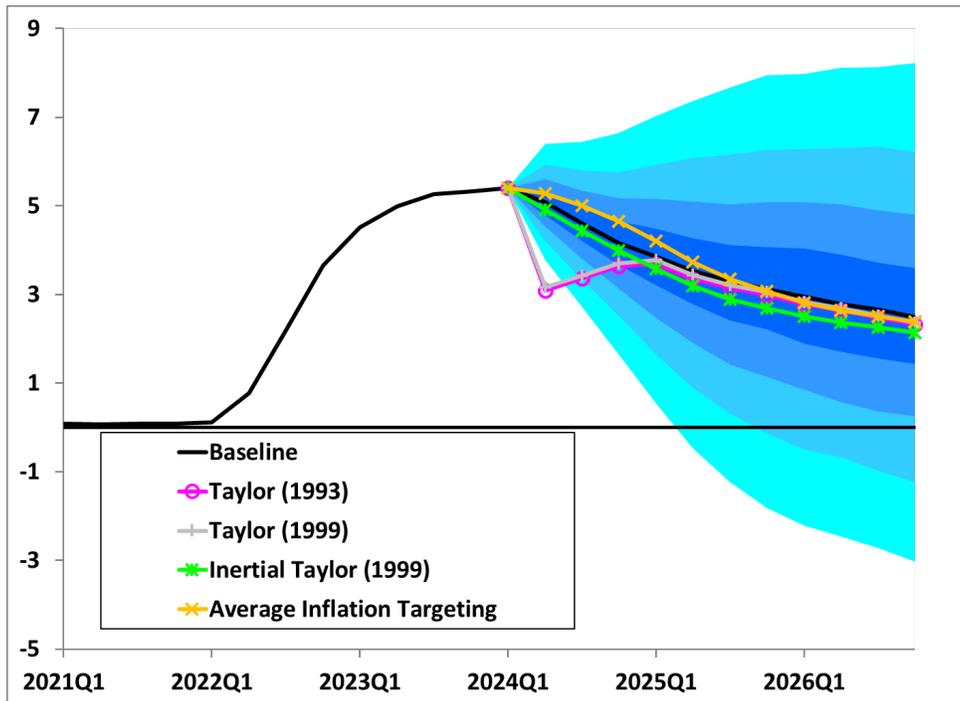


Figure 5: Baseline Forecast Comparisons

Figure 5a: Real GDP Growth

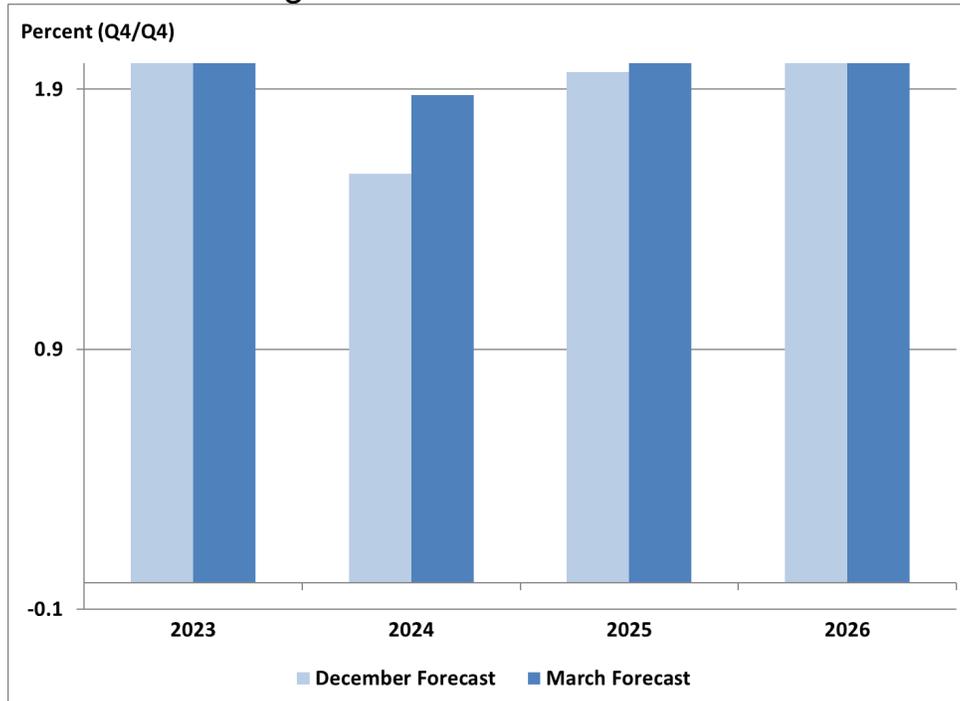


Figure 5b: Core PCE Inflation Growth

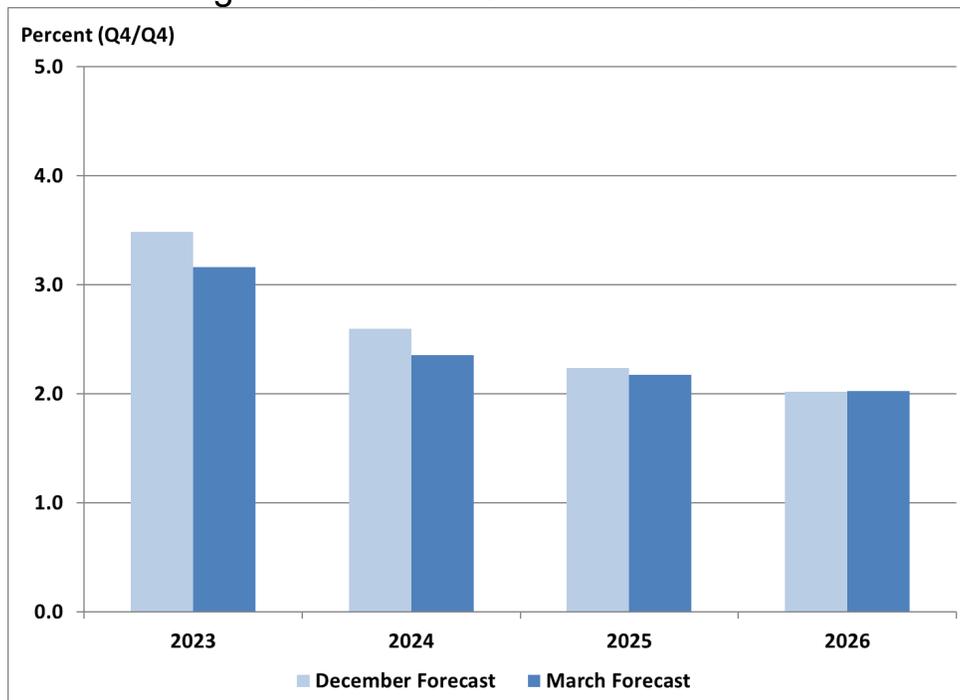


Figure 5c: Unemployment Rate

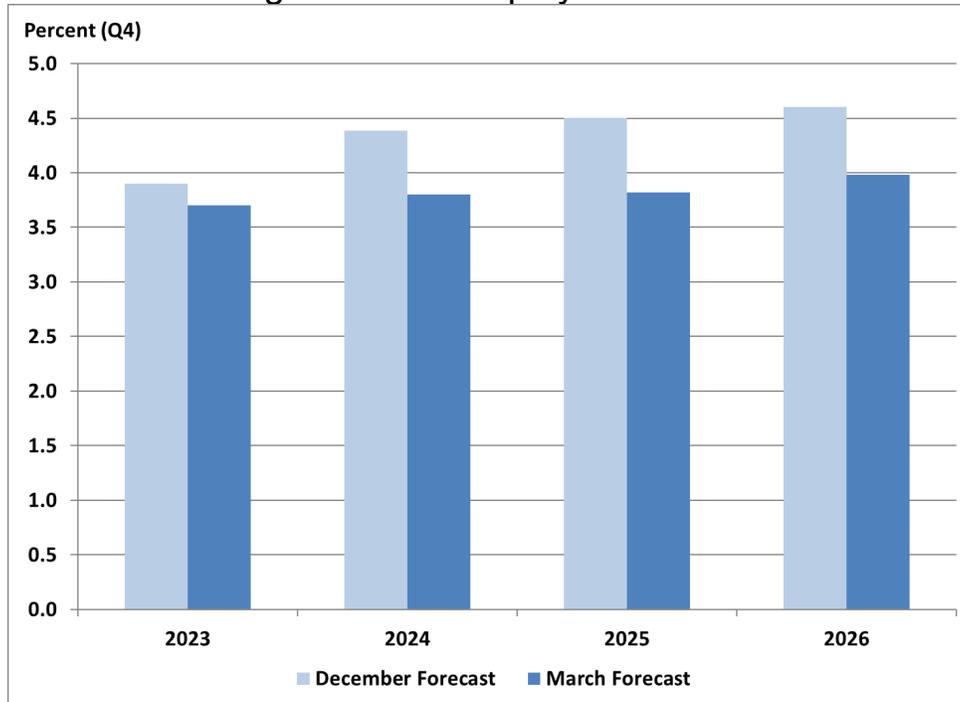
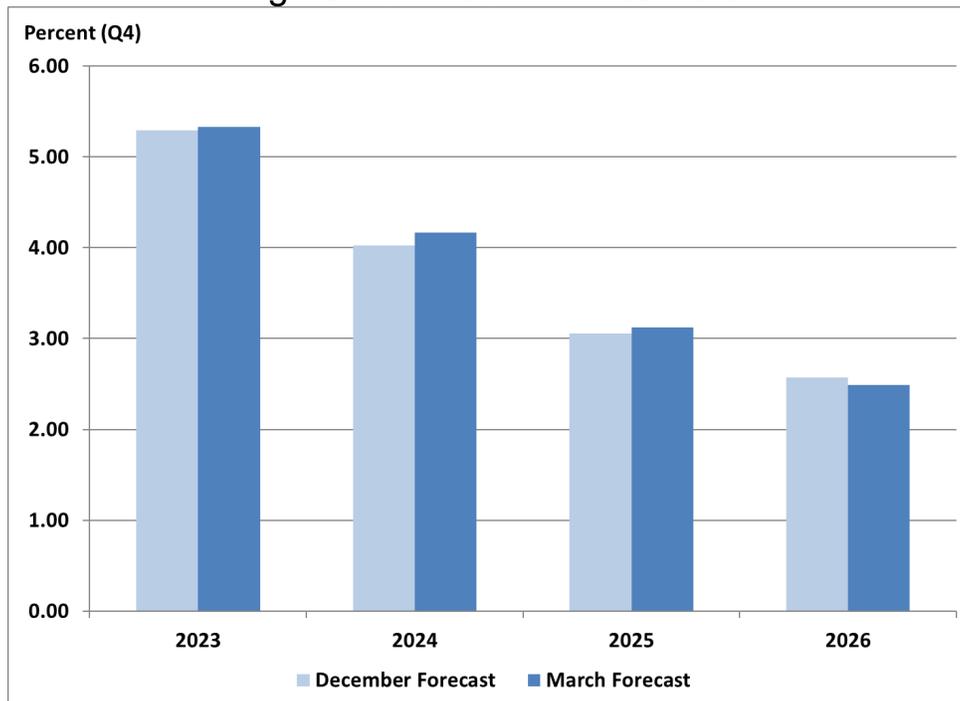


Figure 5d: Federal Funds Rate



Note: Historical data have been retrieved from Haver Analytics.