

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 last Monetary Policy Report in September, the economy has shown signs of cooling: Inflation continues to decline steadily and the labor market is softening. Personal consumption moderated in October, especially for big-ticket items that are interest-rate

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.

sensitive. As well, the housing market continues to slow, though a dearth of homes for sale is keeping prices high.

The second estimate of third quarter GDP growth came in at 5.2 percent, driven by personal consumption expenditures, inventory investment, and government spending. However, incoming data are pointing toward softer fourth quarter growth, with many nowcasts pointing to growth at around 1 percent. Consistent with slowing growth, the labor market is showing signs of cooling—albeit at a gradual pace. Payroll employment growth came in at 199 thousand in November. Over the six months ended in November, payroll growth averaged 233 thousand. Average hourly earnings were up 0.4 percent in November and 4 percent year-over-year. Wage growth is gradually decelerating from near 6 percent in March 2022 but remains higher than what is consistent with a 2 percent inflation target. The Employment Cost Index rose 1.1 percent in the third quarter and was up 4.3 percent relative to one year ago. The unemployment rate ticked down to 3.7 percent in November from 3.9 percent in October. In the establishment survey, the number of employed workers rose by about 750 thousand, while the number of unemployed workers fell by about 215 thousand. The JOLTS survey for October showed the number of job openings down slightly compared to September. Openings decreased in health care and social assistance, finance and insurance, and real estate and rental and leasing. Job openings increased in information.

Inflation has continued to moderate since our last Monetary Policy Report in September. On a year-over-year basis, CPI headline inflation was 3.1 percent in November, compared to 3.2 percent in October and 3.7 percent in September. However, little progress has been seen in core CPI inflation over the last few months, as it continues to average about 4 percent on a year-over-year basis. Data on PCE inflation is somewhat less timely, with headline up 3 percent on a year-over-year basis in October while core was up 3.5 percent. Though progress is slow, inflation has been trending down steadily over the last two years.

Consumer spending remains healthy, with retail sales up 0.3 percent in November, beating expectations. November was a rebound from October's downwardly revised 0.2 percent decline. Excluding autos and gasoline, sales were up 0.6 percent from October. Overall sales rose 4.1 percent in November from one year ago. The Conference Board Consumer Confidence index bounced back in November from three straight monthly declines. The expectations component of the index rose, while the present situation component ticked down slightly. Despite the improvement in November, the expectations index remained below 80 for a third consecutive month, a level which historically has been indicative of an economic slowdown.

Construction spending continued to surprise on the upside, rising 0.6 percent in October. On a year-over-year basis, the value of construction put in place rose 10.7 percent. Private

residential construction rose a strong 1.2 percent in October. Total spending on nonresidential construction was up 20 percent relative to one year ago in October. Housing starts and permits stabilized in September and October after falling through the summer months. However, the NAHB composite housing index slid further in November to 34, well below 50, the threshold for good building conditions. New single-family home sales fell 5.6 percent in October, though the pace was up 18 percent compared to October of last year. The price of new single-family homes has fallen about 18 percent on a year-over-year basis as the composition of new homes built has shifted away from higher-end listings. Existing home sales fell in October as well, with declines posted in all four geographic regions of the U.S. After double-digit increases over the past two years, house price appreciation has cooled in the face of high mortgage rates. However, house prices remain elevated and have not yet shown signs of falling. Decreases in the supply of homes for sale have largely offset the decline in demand induced by higher mortgage rates.

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' December projections of economic activity, which continue to anticipate modest growth and above-target inflation. This year's median expected real GDP growth is at 2.6 percent, falling to 1.4 percent in 2024. The unemployment rate is expected to rise modestly to 4.1 percent in the fourth quarter of 2024. Expectations for PCE inflation are at 2.8 percent for headline and 3.2 percent for core in 2023, falling to 2.4 percent in 2024. The median participant sees the federal funds rate reaching 4.6 percent at the end of 2024, down from 5.4 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 is generated using observed data through the third quarter of 2023, together with an assumption of how output growth, inflation, the federal funds rate, and unemployment will fare in the fourth quarter of 2023.³ The forecast then begins in the first quarter of 2024 and extends through the fourth quarter of 2026. The forecast under the baseline is shown in Figures 1–4. The baseline forecast is represented by the dark solid lines. The colored bands

² The model calibration implies that the long-run equilibrium value of the federal funds rate is 2.3 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.

around the baseline forecast represent 10 percent confidence intervals of the predictive distribution around the median of the baseline forecast.⁴

The key features of the baseline forecast are as follows:

- Real output growth is forecast to be 2.5 percent in 2023, 1.6 percent in 2024, 2 percent in 2025, and 2.2 percent in 2026, on a fourth quarter over fourth quarter basis. This represents a significant upward revision in the forecast for this year, and minor changes for the remainder of the forecast horizon, compared to the September forecast.
- Core PCE inflation runs at a 3.5 percent pace in 2023, falling to 2.6 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 is virtually unchanged.
- The unemployment rate is projected at 3.9 percent at the end of 2023 and is expected to rise over the forecast horizon, reaching 4.4 percent at the end of 2024, 4.5 percent at the end of 2025, and 4.6 percent at the end of 2026. This represents a small upward revision for 2023 and 2024, and a small downward revision for the subsequent two years compared to September.
- The federal funds rate averages 5.3 percent in the fourth quarter of 2023, falling to 4 percent in the fourth quarter of 2024, 3.1 percent in the fourth quarter of 2025, and 2.6 percent by end-2026. This path has changed little relative to September.

The forecast for output growth in 2023 is significantly stronger compared to the September forecast, as output growth in the third 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 December Summary of Economic Projections (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.

The model anticipates that output growth will be 2.5 percent in 2023 and then slow down to about 1.6 percent in 2024 and 2.0 percent in 2025, edging up to 2.2 percent by the end of the forecast horizon. The assumed growth of 0.9 percent in the current quarter is slightly lower than the Survey of Professional Forecasters (SPF) median projection of 1.23 percent for the fourth quarter of 2023. On an annual average basis, the growth forecast is similar to that of

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

the SPF from 2024 to 2026. The baseline model shows output growth decelerating next year to a pace that, on average, is about 0.8 percentage point below its long-run average, and subsequently rebounds gradually to reach 2 percent in 2026.⁵

The labor market is cooling, but it remains tight. We impose a nowcast for the unemployment rate of 3.9 percent for the current quarter. The model predicts that the unemployment rate will then rise gradually over the forecast horizon to reach 4.4 percent at the end of 2024 and 4.6 percent at the end of 2026. This is above 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. Based on current data, we assume that core PCE inflation runs at 2.9 percent in the fourth quarter, implying core PCE inflation of 3.5 percent in 2023. With tight monetary policy and below-trend output growth, inflation then moves down over the forecast horizon to average 2.6 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 is stronger on growth than the median projections from the fourth-quarter 2023 SPF. The median respondent expects real output growth of 1.3 percent in 2024, compared to 1.6 percent in our baseline forecast. Looking ahead, on an annual average over annual average basis, the SPF expects 1.8 percent in 2025 and 2.1 percent in 2026, close to the implied growth of annual averages in our forecasts. The SPF's core PCE inflation forecast is 3.5 percent (Q4/Q4) for 2023, edging down to 2.4 percent in 2024 and 2.1 percent in 2025. Thus, on inflation, the SPF forecast is slightly lower than the model baseline. The forecasters' path for the unemployment rate is noticeably lower over the forecast horizon compared to the baseline: The median SPF forecast for the unemployment rate is 4.2 percent in the last quarter of 2024. The annual average for 2025 is also 4.2 percent according to the SPF, before it decreases slightly to 4.0 percent in 2026.

The December 2023 SEP by FOMC participants shows the median projection for output growth at 2.6 percent in 2023, 1.4 percent in 2024, 1.8 percent in 2025, and 1.9 percent in 2026. The median forecast of the unemployment rate is 3.8 percent at the end of 2023 and 4.1 percent from the end of 2024 to the end of 2026. Core PCE inflation is projected at 3.2 percent in 2023, 2.4 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 reach 5.4 percent at

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.

the end of 2023 and then move down to 4.6 percent at the end of 2024, 3.6 percent at the end of 2025, and 2.9 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 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. Although the Taylor 1993 and 1999 rules lead to outcomes similar to the baseline forecast, 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 suggest policy should slow the real economy more than in the baseline to bring down inflation more quickly.

This is especially pronounced for the average inflation targeting rule, shown in Figure 4, which 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 peaks at 5.5 percent in the first quarter of 2024. Although it then starts declining, it still averages more than 5 percent in 2024, about 1 percentage point higher than the noninertial rules. This causes inflation to jump down to 1.2 percent in the first 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 1 percentage point rise in the unemployment rate within one quarter, followed by a further 0.2 percentage point increase that is sustained through the end of 2024. In 2025 and 2026, unemployment gradually declines to its natural rate. Output growth also slows, but less dramatically: In 2024, growth averages 1.1 percent.

All other rules call for interest rate cuts, with particularly pronounced interest rate cuts implied by the noninertial rules. For example, the Taylor 1993 rule calls for a full percentage point cut in the first quarter of 2024, followed by a gradual 2 percentage point cut over the remainder of the forecast horizon. This leaves the interest rate at 2.4 percent, about at the long-run level implied by all rules considered here. The faster interest rate cut stimulates the economy temporarily, leaving the unemployment rate on average 0.25 percentage point lower than in the baseline, and slightly raising output growth.

The inertial Taylor 1999 rule calls for an interest rate path between that of the noninertial and the average inflation targeting rules, tracking the interest rate path of the baseline model closely. Similar to 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 similar interest rate path as 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 in 2024, followed by near-trend growth over the next two years. Inflation eases gradually and finally reaches the FOMC target of 2 percent in early 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 September projection, the forecast continues to call for below-trend output growth and inflation above target in the near term.

Figure 1: Real GDP Growth

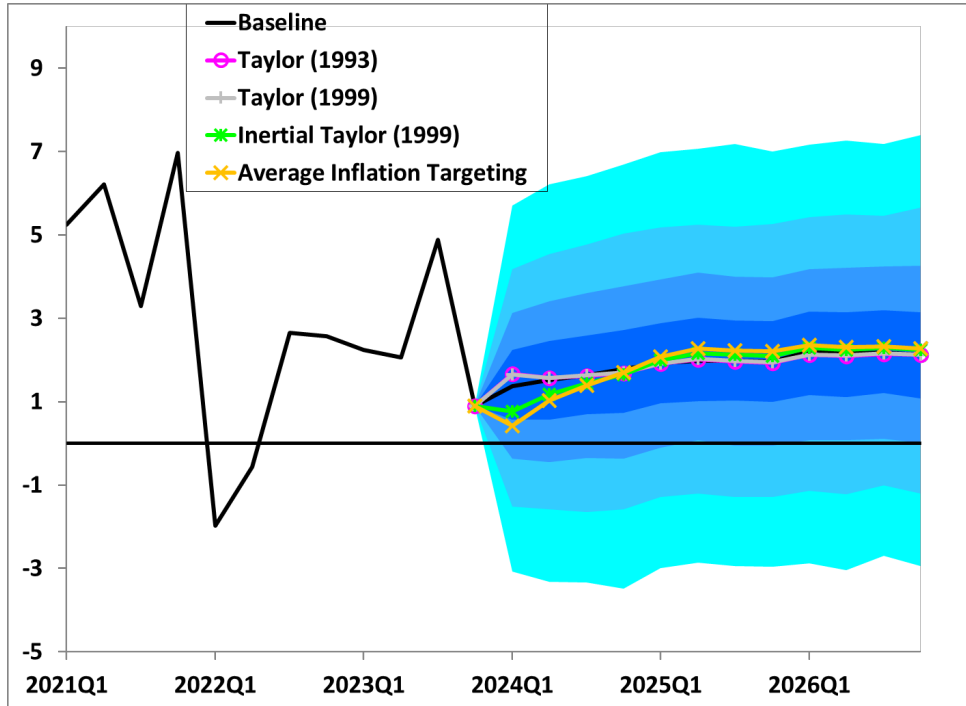


Figure 2: Core PCE Inflation

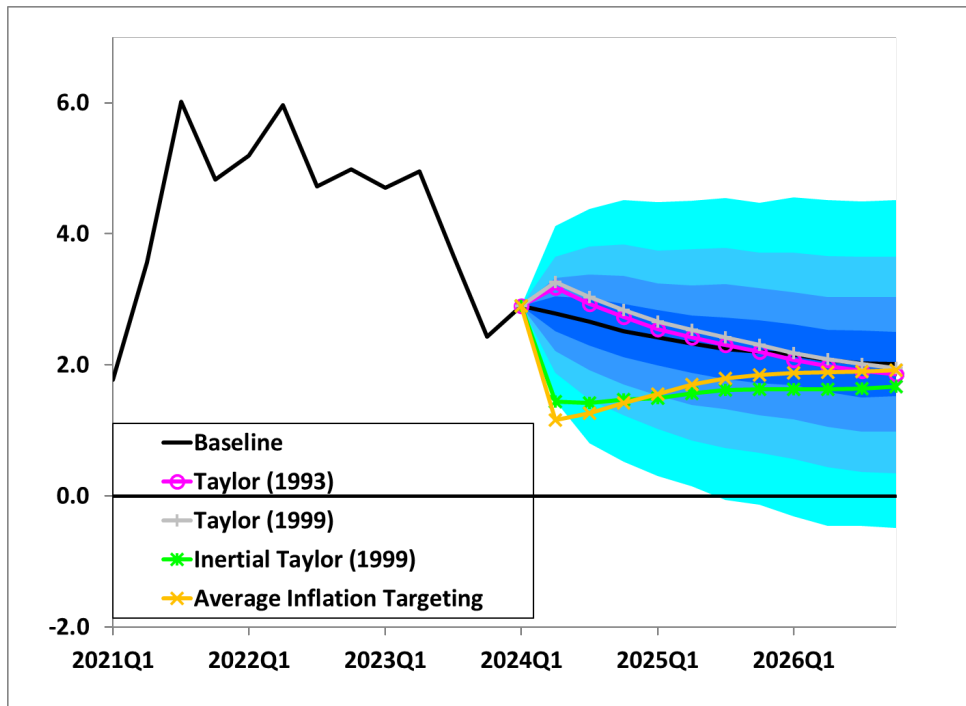


Figure 3: Unemployment Rate

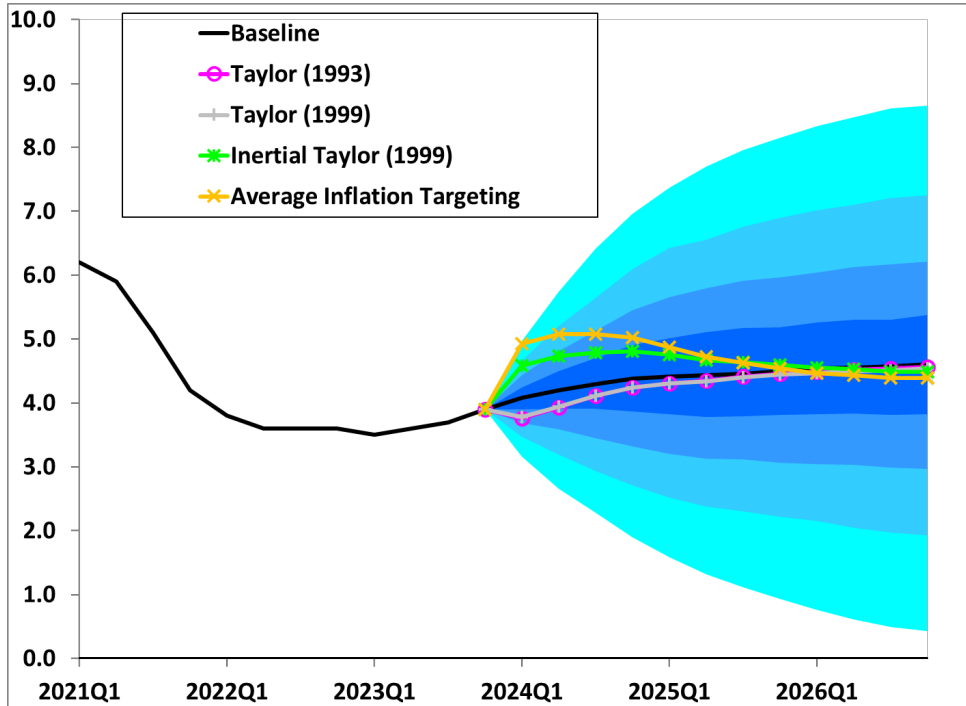


Figure 4: Federal Funds Rate

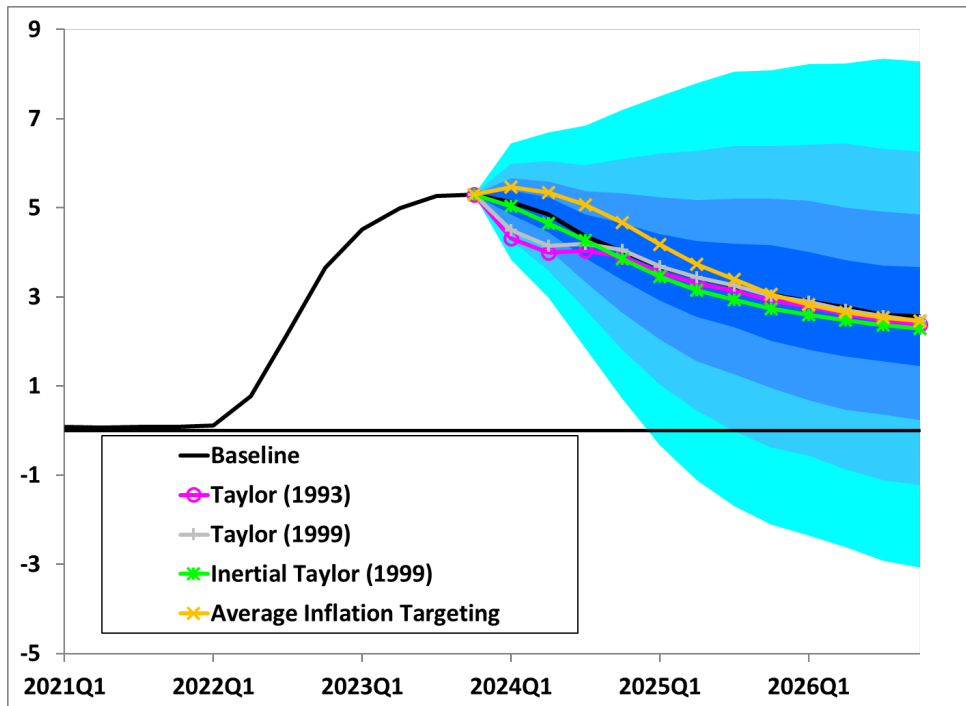


Figure 5: Baseline Forecast Comparisons

Figure 5a: Real GDP Growth

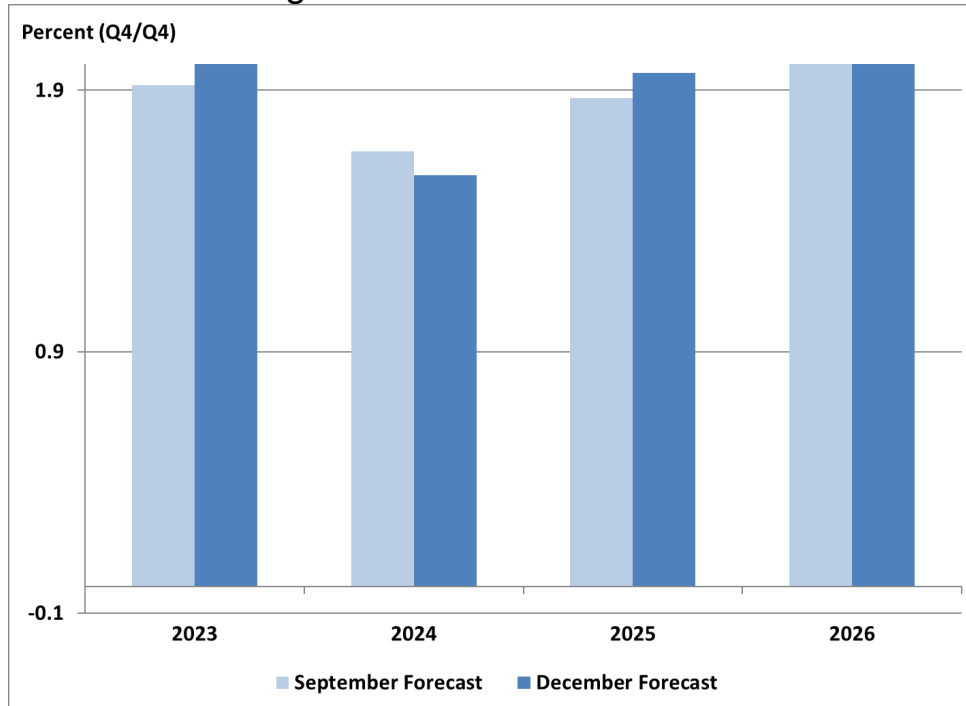


Figure 5b: Core PCE Inflation Growth

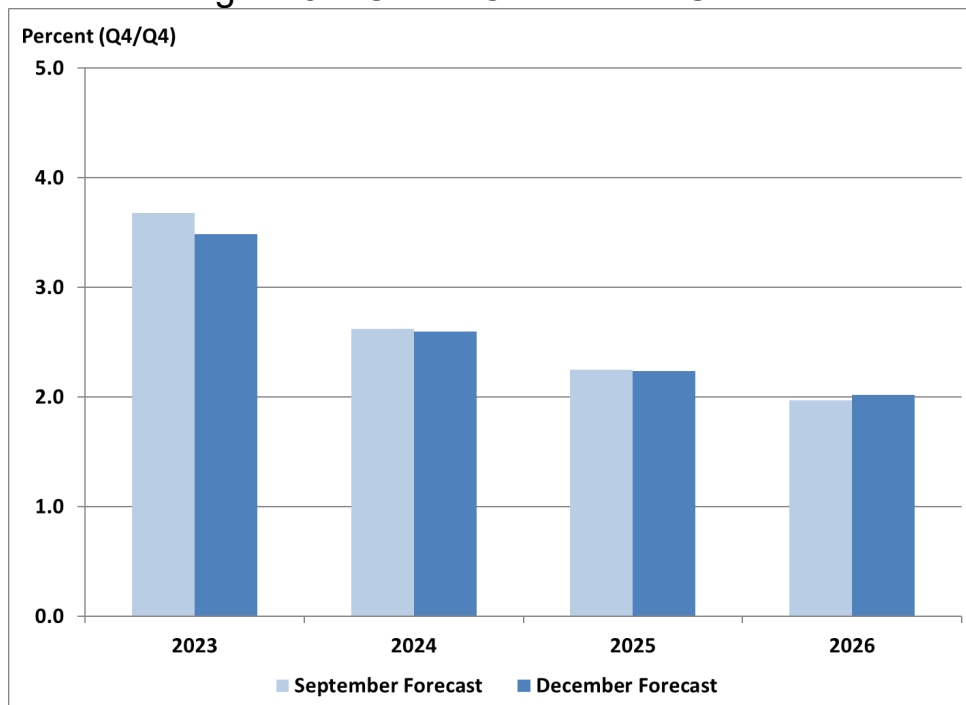


Figure 5c: Unemployment Rate

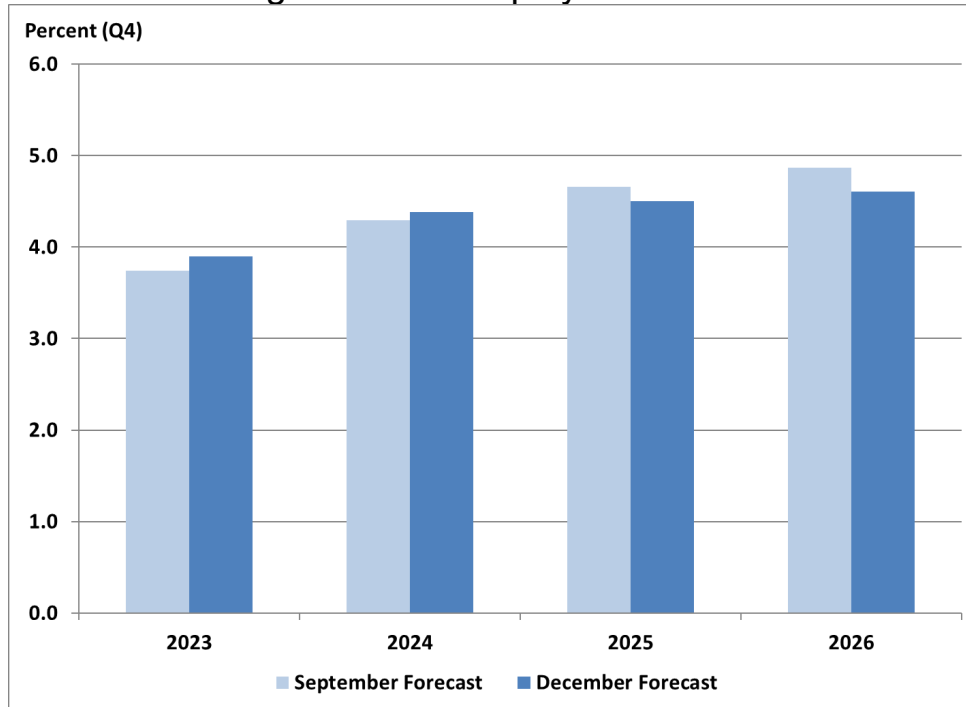
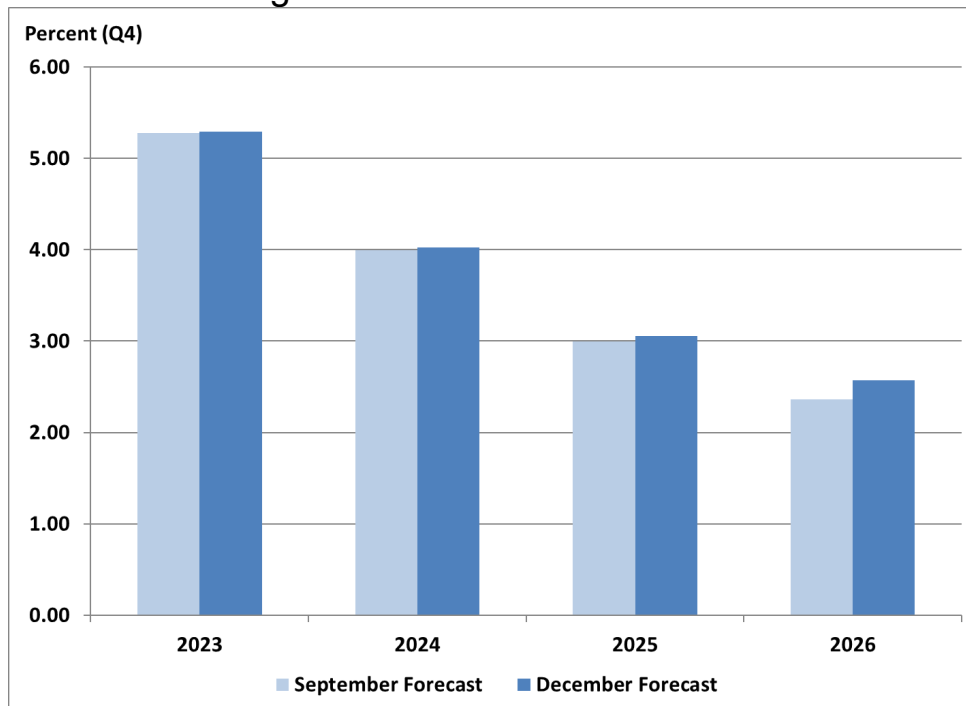


Figure 5d: Federal Funds Rate



Note: Historical data have been retrieved from Haver Analytics.