

## **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.<sup>1</sup> We perform this exercise with a structural forecasting model based on the New Keynesian dynamic stochastic general equilibrium (NKDSGE) 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**

The U.S. economy appears to have ended 2024 on a solid footing. Real-time estimates of gross domestic product (GDP) growth for the fourth quarter have been revised up significantly over the course of the last few months. The upward revisions are largely attributed to strong

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<sup>1</sup> 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, Sam Jagolinzer, and Riley E. Thompson for their assistance.

consumer spending growth, fueled by a robust labor market with strong wage growth, healthy growth in disposable income, and rising consumer confidence. Holiday sales, including Black Friday and Cyber Monday, posted record highs, and November retail sales were up 3.8 percent year-over-year, indicating that consumer spending remains strong as we enter 2025.

The labor market remains healthy, with job gains averaging 174 thousand per month over the September through November period. The unemployment rate edged up from 4.1 percent in September and October to 4.2 percent in November but nonetheless remains below most estimates of the natural rate of unemployment. Wage growth ticked up slightly in October and November to about 4 percent on a year-over-year basis. This pace of growth remains somewhat above what is generally considered consistent with a rate of inflation that meets the Federal Open Market Committee (FOMC) target of 2 percent. The job opening rate edged up in October but has on balance remained nearly flat since July. The hiring rate moved down some in October but remains near the level of July and August.

Inflation has edged up over the last few months, rising from 2.1 percent (YOY) in September to 2.4 percent in November (for the headline personal consumption expenditures [PCE] price index). Core inflation edged up as well, from 2.6 percent in September (YOY) to 2.8 percent in November. While the general trend in inflation has been downward since the peak in September 2022, recent progress on disinflation has largely stalled. Shelter inflation has continued to decline and ran at a 4.7 percent pace (YOY) in November. Goods inflation continues to run at a slightly negative pace and near its prepandemic norm, and services inflation remains elevated, though it generally shows gradual disinflation.

The housing market continues to be affected by tight supply and low demand. House price growth is running at a slower pace than at the start of 2024. Existing home sales have begun to rebound, showing positive growth on a year-over-year basis in both October and November. Sales growth has largely been negative (on a year-over-year basis) since early 2022. New housing starts remain on the weak side, and new permits, while showing some acceleration in November, remain below the pace of activity we saw in 2023. In general, home affordability remains low and housing activity is running at well below its prepandemic pace.

To conclude, the pace of economic activity appears to be healthy overall. Tight monetary policy has dampened growth, especially in interest-sensitive sectors such as housing, and is contributing to gradual disinflation. The labor market remains healthy and is largely in balance. The consumer has proven surprisingly resilient to higher interest rates, and consumer spending continues to power the economy. FOMC members' December projections of economic activity continue to anticipate modest growth and above-target inflation. For 2025, median expected real GDP growth is at 2.1 percent, down from 2.5 percent in 2024.

The unemployment rate is expected to end the year at 4.3 percent, not much changed from its current level. Expectations for PCE inflation are at 2.5 percent for headline and 2.5 percent for core in 2025. Thus, headline inflation is expected to be about unchanged from the 2024 pace, while core inflation is expected to edge down a bit. The median participant sees the federal funds rate reaching 3.9 percent at the end of 2025, up from a projection of 3.4 percent in September. This upward revision can largely be attributed to the strength of the real economy and lack of recent progress on disinflation.

## The Benchmark Model

To create our forecast, we use a structural forecasting model based on the 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, which allows 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. Although some economic effects of the pandemic linger through the lens of our model, 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,  $T\text{-year-}\bar{\pi}_t$  is the  $T$ -year-average inflation rate at an annual rate, and  $\varepsilon_t^R$  is a monetary policy shock.<sup>2</sup> The parameters  $\rho$ ,  $\Psi_\pi$ ,  $\Psi_y$ , and  $T$  determine how monetary policy reacts to economic conditions. We run forecast simulations under five different versions of the basic rule shown here:

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<sup>2</sup> The model calibration implies that the long-run equilibrium value of the federal funds rate is 2.8 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.

**Table 1**

<b>Rule</b>	<b><math>\rho</math></b>	<b><math>\Psi_\pi</math></b>	<b><math>\Psi_y</math></b>	<b><math>T</math></b>
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 third quarter of 2024, together with an assumption of how output growth, inflation, the federal funds rate, and unemployment will fare in the last quarter of 2024.<sup>3</sup> The forecast then begins in the first quarter of 2025 and extends through the fourth quarter of 2027. 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.<sup>4</sup>

The key features of the baseline forecast are as follows:

- Real output growth is forecast to be 2.3 percent in 2024 on a fourth quarter over fourth quarter basis. In the next two years, growth is also forecast to be 2.3 percent before slowing to 2.1 percent in 2027. This represents a small upward revision in the forecast compared with the September forecast (Figure 5a).
- Core PCE inflation falls from a 3.2 percent pace in 2023 to 2.7 percent in 2024, 2 percent in 2025, and 1.8 percent in both 2026 and 2027, on a fourth quarter over fourth quarter basis. The forecast has been little revised (Figure 5b).
- The unemployment rate is expected at 4.2 percent at the end of 2024, decreasing to 3.9 percent at the end of 2025 and 3.6 percent at the end of 2026. It edges down further to 3.5 percent at the end of 2027. The forecast is little changed until 2026 and revised down slightly for 2027 compared with the September forecast (Figure 5c).

<sup>3</sup> Our forecast was made prior to the most recent FOMC meeting.

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

- The federal funds rate averages 4.7 percent in the last quarter of 2024 before falling to 3.6 percent in the fourth quarter of 2025, 3.0 percent at the end of 2026, and 2.8 percent at the end of 2027. This path is slightly higher than it was in the September forecast (Figure 5d).

The forecast for output growth in 2024 is moderately stronger compared with the September forecast, as output growth in the third quarter came in higher than expected, driven by robust private domestic demand and surprisingly strong government consumption and gross investment. The forecast for the federal funds rate for the current quarter is determined by nowcasts and is in line with the Federal Funds Futures market. From 2025 onward, the federal funds rate forecast is completely data determined according to the model's policy reaction function. The model-implied federal funds rate over the fourth quarter of 2025 (on average) is 30 basis points below the median December Summary of Economic Projections (SEP) projection for the end of 2025 and 20 basis points below the value implied by the Federal Funds Futures market. By the end of the forecast horizon in 2027, the model-implied federal funds rate remains about 30 basis points below the median December SEP projection. Uncertainty about how the economy will evolve over the near term remains high due to several factors, including the uncertainty about possible changes in federal policies affecting spending, taxes, tariffs, and immigration.

After increasing at a pace of 3.1 percent in 2023, nowcasts put output growth at 2.3 percent in 2024. Subsequently, the model anticipates that output growth will remain at 2.3 percent in 2025 and 2026 before edging down to 2.1 percent in 2027, on a fourth quarter over fourth quarter basis. The assumed growth of 1.9 percent (SAAR) in the current quarter is slightly below the Survey of Professional Forecasters (SPF) median projection for the fourth quarter of 2024, which is 2.2 percent (SAAR). For 2025, the forecast for output growth is slightly higher than the 2.0 percent projected by the median SPF participant. On an annual average basis, the model forecast is 0.1 to 0.2 percentage point above the latest SPF forecast, which calls for growth of the annual average of GDP of 2.1 to 2.2 percent from 2025 to 2027, compared with 2.2 to 2.3 percent for the model.<sup>5</sup>

The labor market is predicted to remain strong. We impose a nowcast for the unemployment rate of 4.2 percent for the current quarter. The model predicts that the unemployment rate will remain at that level at the end of this year and then decline gradually to 3.5 percent at the end of 2027. This is noticeably 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—and it is

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<sup>5</sup> The model features long-run real per capita output growth of 1.6 percent. We assume that population growth equals 1.2 percent in the second half of 2024, 0.9 percent in 2025, 0.7 percent in 2026, and 0.5 percent in 2027, on a fourth quarter over fourth quarter basis. This projection is roughly in line with the Congressional Budget Office's "Demographic Outlook: 2024–2054."

consistent with a more accommodative monetary policy stance relative to the previous forecasts. However, the latest SPF projection sees a small uptick to 4.3 percent in the unemployment rate for 2025, followed by a small decline of 0.1 percentage point in the unemployment rate in both 2026 and 2027.

Recent data have shown that inflation has decelerated from the uptick in the first quarter of this year and has resumed its overall downward trajectory toward the 2 percent target. The model anticipates that inflation will average 2.7 percent in 2024, decreasing further to 2 percent in 2025 and 1.8 percent in 2026 and 2027. Thus, inflation is expected at or slightly below the Federal Open Market Committee (FOMC) target of 2 percent average inflation for most of the forecast horizon. The SPF's core PCE inflation forecast is 2.7 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 broadly similar to the model baseline forecast.

The December 2024 SEP by FOMC participants shows the median projection for output growth edging down from 2.1 percent in 2025 to 2 percent in 2026 and 1.9 percent in 2027. The median forecast of the unemployment rate is 4.3 percent from 2025 through 2027. Core PCE inflation is projected at 2.8 percent in 2024 before edging down gradually by 0.2 to 0.3 percentage point a year to reach 2.0 percent in 2027. The median FOMC member forecast anticipates that the federal funds rate will decline from 4.4 percent at the end of 2024 to 3.9 percent at the end of 2025, 3.4 percent at the end of 2026, and 3.1 percent at the end 2027.

### **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 (AIT) 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 significantly above target in 2025 and 2026. The inertial Taylor 1999 rule leads to persistently below-target inflation, but slightly higher real output growth, and an unemployment rate similar to the baseline. Interest rates decline slightly faster than in the baseline. The AIT rule implies a slower decline in interest rates, slightly less real activity, and inflation that remains closer to 2 percent than the baseline rule.

As shown in Figure 4, the AIT rule implies a commitment to respond to an extended period of one-sided misses of inflation. However, this rule is symmetric and its commitment also implies a reaction to extended periods of below-target inflation, as is the case under the baseline rule from the second quarter of 2025 onward. For example, the two-year average inflation rate stands at 1.8 percent at the end of 2027 under the baseline rule. The AIT rule calls for slower cuts in the federal funds rate in 2025 at the cost of slightly lower real activity—the unemployment rate averages 0.1 percentage point more than under the baseline in 2025—but with the benefit of an average two-year inflation rate of 1.9 percent at the end of 2027. Overall, this rate calls for three cuts in 2025 as opposed to four under the baseline.

The noninertial rules call for a much lower level of interest rates in early 2025, but then they call for interest rate increases as the output gap closes more than under the alternative rules and inflation rises temporarily. By the end of 2025, however, these rules have reached their peak and call for gradual rate cuts.

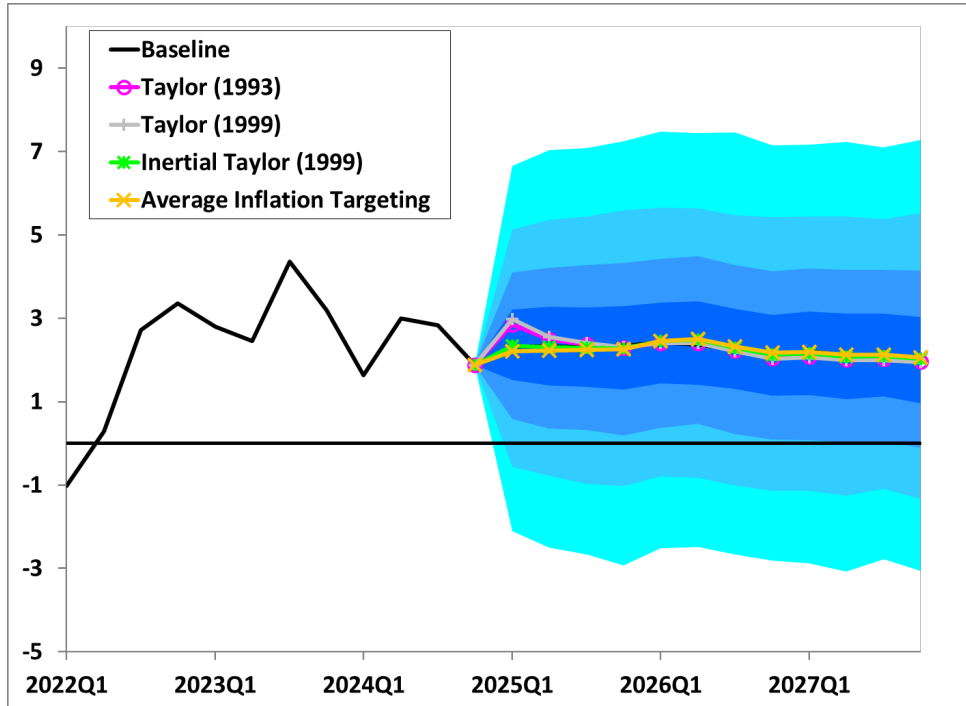
Overall, two rules—the AIT and the Taylor 1999—call for cuts of about 75 basis points by the end of 2025, whereas the baseline and the other two rules call for interest rates between 90 and 115 basis points lower by the end of 2025. The baseline rule and the AIT rule see the federal funds rate at around 280 basis points by the end of 2027, about 25 basis points above the other three rules.

Note that the inertial Taylor 1999 rule yields lower inflation and lower interest rates than in the baseline. This is because of the expectations channel: Households act on the expectation that monetary policymakers will respond more aggressively to the output gap compared with 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, allowing the monetary authority to not have to follow through on the threat of persistently higher rates.

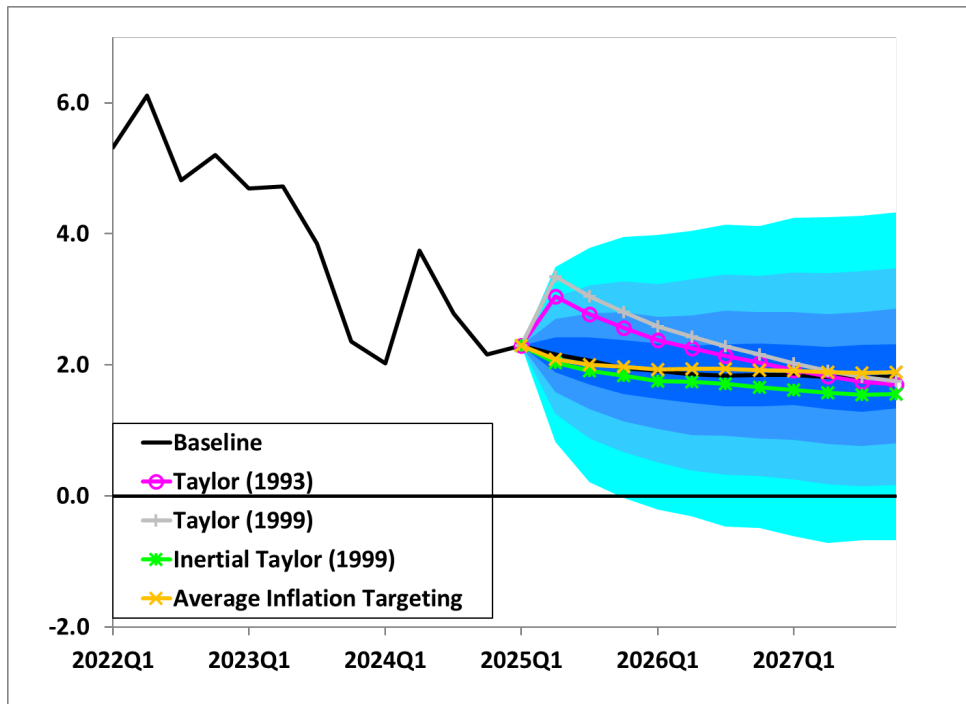
## Summary

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 that output will expand at about its trend pace over the forecast horizon and that inflation will continue to ease. It reaches the FOMC target of 2 percent in the second half of 2025. Forecast uncertainty remains high due to several factors, including the uncertainty about possible changes in federal policies affecting spending, taxes, tariffs, and immigration. These factors are not directly incorporated into the model forecast.

### Figure 1: Real GDP Growth

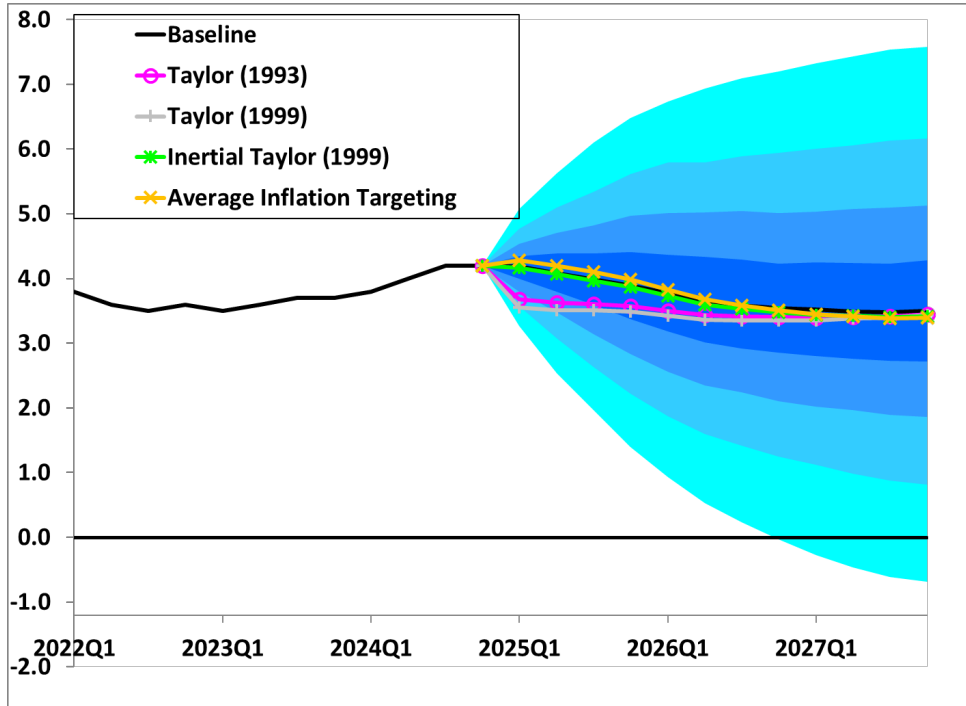


### Figure 2: Core PCE Inflation

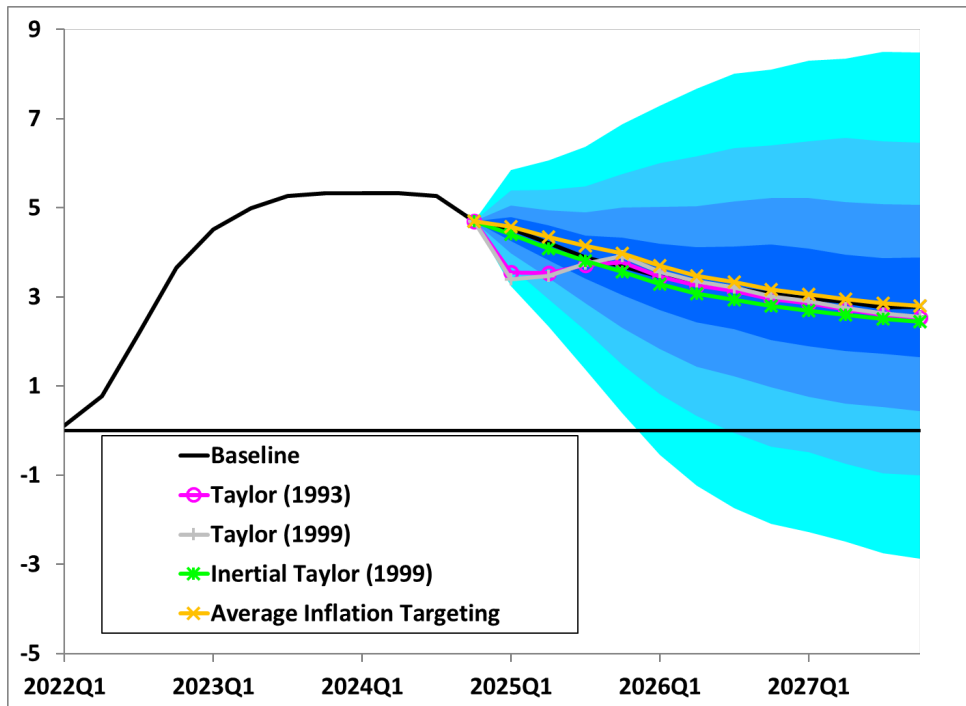




**Figure 3: Unemployment Rate**

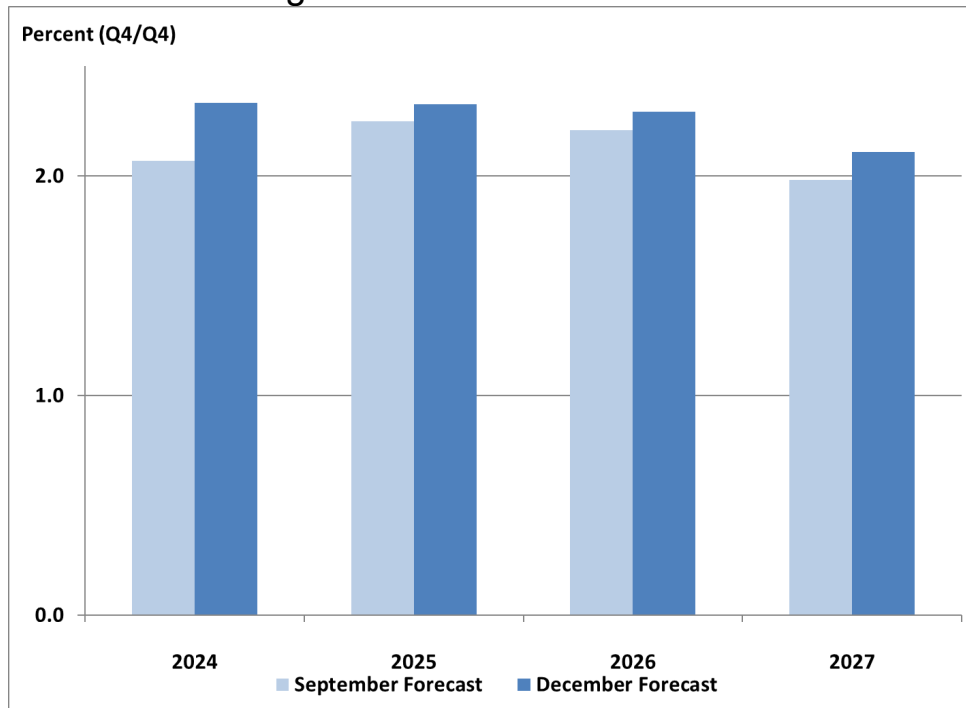


**Figure 4: Federal Funds Rate**



## Figure 5: Baseline Forecast Comparisons

### Figure 5a: Real GDP Growth



### Figure 5b: Core PCE Inflation Growth

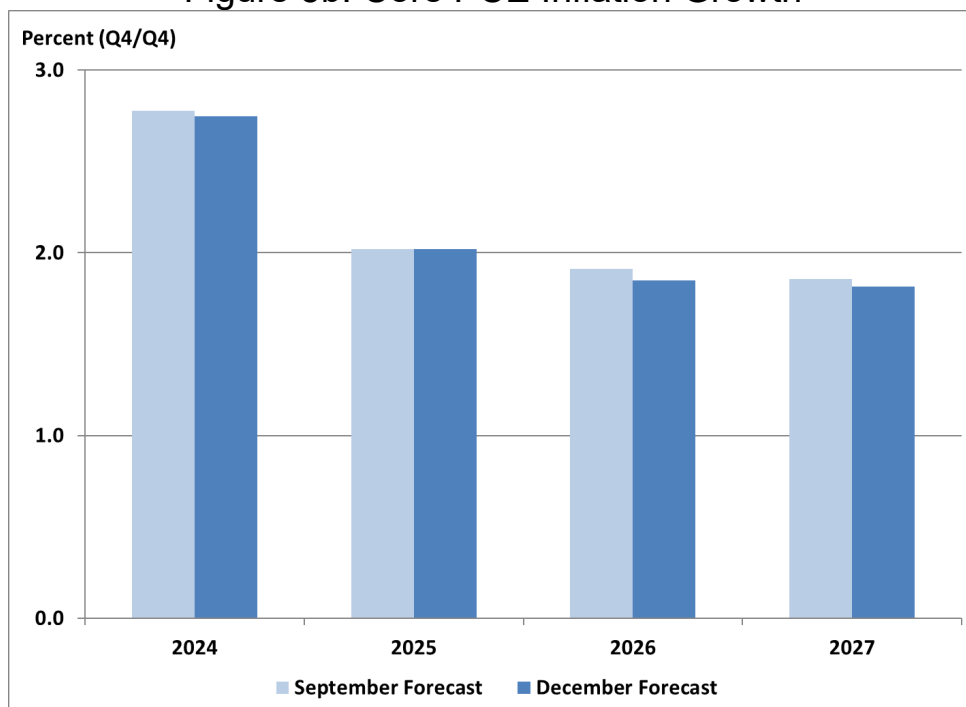


Figure 5c: Unemployment Rate

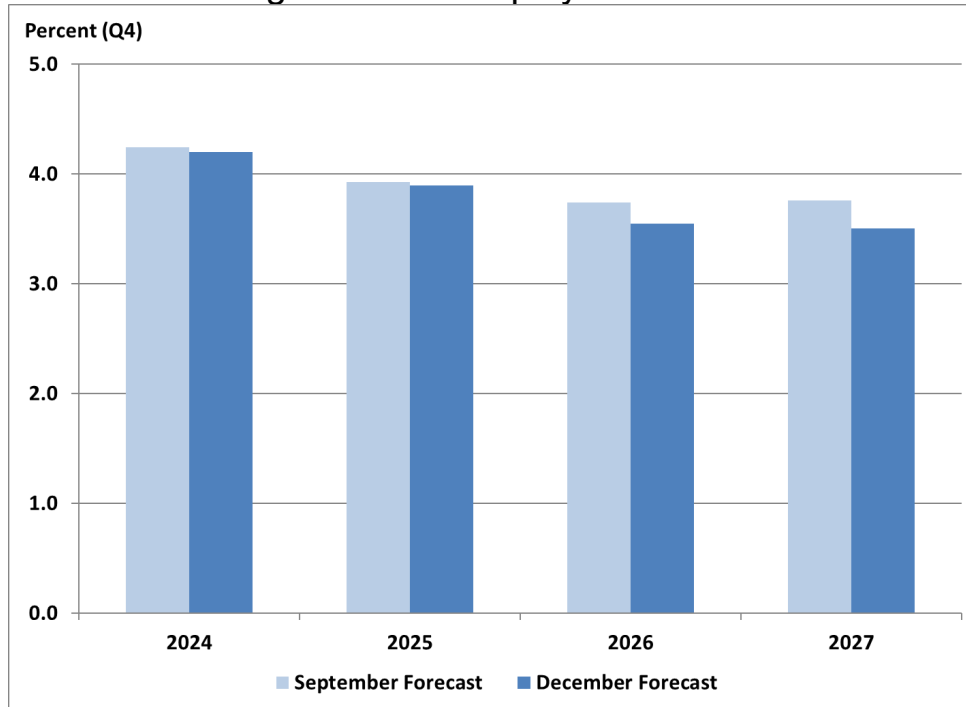
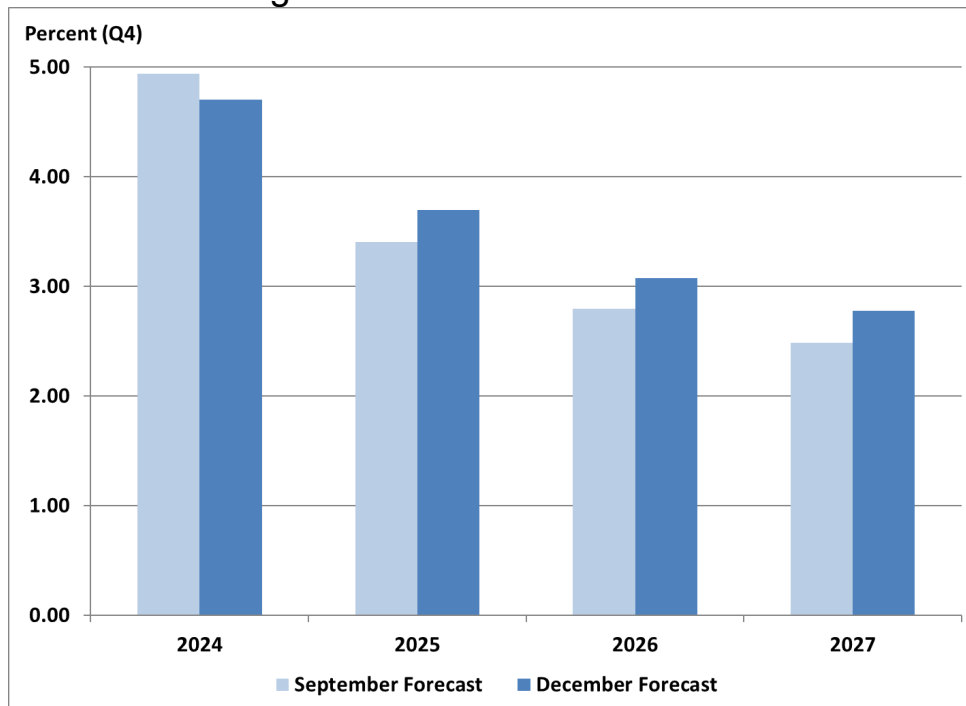


Figure 5d: Federal Funds Rate



Note: Historical data have been retrieved from Haver Analytics.