Special Report
Research Department
FEDERAL RESERVE BANK PHILADELPHIA

September 2025

# 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

## 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 (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

Economic growth rebounded in the second quarter of 2025, with real GDP rising at an annualized rate of 3.3 percent after a first quarter contraction of 0.5 percent. Stronger second quarter growth was driven by a rebound in consumption spending and reduced imports. However, business investment, residential investment, and export growth all weakened compared with the first quarter.

The labor market continues to show signs of slowing activity. In August, job creation came in at about 22,000 net new jobs and earlier months' figures were revised downward. Over the three months ending in August, total private nonfarm employment growth averaged 29,000 jobs per month compared with 58,000 in June and 100,000 in March. As well, the Bureau of Labor Statistics' (BLS) preliminary benchmark revision showed that job gains for the year ending in March were 911,000 lower than previously estimated. On balance, then, job growth has slowed markedly since the spring and employment gains are coming off a lower base than was previously thought. The unemployment rate ticked up to 4.3 percent in August but has largely moved sideways since the start of the year. Initial claims for unemployment insurance remain well below recession levels.

[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 Jack G. Bunge and Riley E. Thompson for their assistance.

Headline consumer price index (CPI) inflation ticked up in August, running at a 2.9 percent rate over the last 12 months. Core CPI inflation rose 3.1 percent over the same period. Core personal consumption expenditures (PCE) inflation was 3.3 percent at an annual rate in July and has now risen for four consecutive months. Inflation thus remains well above the Federal Open Market Committee (FOMC) target level and furthermore is expected to edge a bit higher over the next few months as the effects of higher tariffs on prices work their way through the economy.

Data on housing point to continued weakness. Home sales have edged up but remain depressed, and inventories of homes for sale are rising. Residential construction has shown little sign of rebounding after falling almost continuously since the spring. Compared to last year, residential investment spending is down about 8 percent. House price growth has moderated and may have peaked in February. Since that time, prices are down about 1 percent.

Real consumer spending surged in July on the strength of higher durable goods demand. But outside of durables, spending was weak. Services consumption was about flat in July, and over the last six months it has grown less than 1 percent at an annual rate. Consumer sentiment edged down in August, with households reporting that jobs are harder to find, according to the Conference Board. The University of Michigan Surveys of Consumers also reaffirmed that households expect the labor market to weaken.

Given relatively contained inflation and softening labor markets, the FOMC reduced its target range for the federal funds rate to 4 to 4.25 percent at its September meeting. In the Summary of Economic Projections (SEP) for September, projections for growth in 2025 were revised slightly higher while the projection for the unemployment rate was unchanged. Core PCE inflation is expected to come in at 3.1 percent in 2025, falling to 2.6 percent in 2026. The median federal funds rate projection calls for two additional rate cuts of 25 basis points each in 2025, putting the funds rate at 3.6 percent at year-end. The path of the federal funds rate was revised down through 2027 compared with the June SEP.

On balance, the economy appears to be growing moderately, but there are some warning signs, and downside risks seem more prevalent. Inflation may get a further boost in the months ahead from higher tariffs, but the worst-case scenarios for inflation seem to be less likely. Uncertainty about the near-term future of the economy remains elevated.

## 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

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

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, $\mathrm{T\_year}\_\bar{\pi}_t$ is the year-average inflation rate at an annual rate, and $\varepsilon_t^R$ is a monetary policy shock.[2] The parameters $\rho, \Psi_\pi, \Psi_y$, and

[2] The model calibration implies that the long-run equilibrium value of the federal funds rate is 3.2 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.

$T$ 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 | $\rho$ | $\Psi_\pi$ | $\Psi_y$ | $T$ |
|---|---|---|---|---|
| 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 second quarter of 2025, together with an assumption of how output growth, inflation, the federal funds rate, and unemployment will fare in the third quarter of 2025.[3] The forecast then begins in the fourth quarter of 2025 and extends through the fourth quarter of 2028. 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 1.2 percent in 2025 on a fourth quarter over fourth quarter (Q4/Q4) basis, edging up to 1.8 percent in 2026. In the remaining two years of the forecast horizon, 2027 and 2028, growth is forecast to run at 2 percent. This outlook represents a 0.2 percentage point upward revision in the forecast for 2025, a 0.1 percentage point downward revision in the forecast for 2026, and almost no change for 2027, compared with the June forecast (Figure 5a).

- Core PCE inflation is forecast to be 3.1 percent in 2025 on a Q4/Q4 basis, edging down to 2.3 percent in 2026 before declining to 1.9 percent in 2027 and 1.7 percent in 2028. This forecast represents a 0.2 percentage point downward revision for 2025, a 0.2 percentage point upward revision for 2026, and a 0.1 percentage point upward revision for 2027, compared with the June forecast (Figure 5b).

- The unemployment rate is expected to be 4.3 percent at the end of 2025, inching up to 4.4 percent at the end of 2026 before decreasing to 4.1 percent at the end of 2027 and 3.9 percent at the end of 2028. This projection

[3] Our forecast was made prior to the most recent Federal Open Market Committee (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.

represents a 0.2 percentage point downward revision in the forecast for 2025, a 0.1 percentage point downward revision in the forecast for 2026, and almost no change for 2027, compared with the June forecast (Figure 5c).

- The federal funds rate is expected to decrease to an average of 4 percent in the last quarter of 2025 before falling further to 3.7 percent in the fourth quarter of 2026, 3.2 percent at the end of 2027, and 2.7 percent at the end of 2028. This forecast represents a 0.2 percentage point upward revision in the forecast for 2025 and a 0.4 percentage point upward revision in the forecasts for both 2026 and 2027, compared with the June forecast (Figure 5d).

The forecast for output growth in 2025 is a tad stronger compared with the June forecast, as a noticeably higher-than-expected reading on annualized output growth in the second quarter of 2025 is partially offset by a downward revision in the forecast for the second half of this year. The forecast for the federal funds rate for the current quarter is determined by nowcasts and is in line with the expectations of the Federal Funds Futures market as of early September. From the fourth quarter of 2025 onward, the federal funds rate forecast is completely determined according to the model's policy-reaction function. The model-implied federal funds rate over the fourth quarter of 2025 (on average) is slightly below 4 percent, consistent with two 25-basis-point interest rate cuts during the second half of this year. This projection is 40 basis points above the median September SEP projection for the end of the calendar year 2025, which is 3.6 percent, and 10 basis points above the value implied by the Federal Funds Futures market (as of early September) for the fourth quarter of 2025, on average. The model calls for additional gradual interest rate cuts in the remainder of the forecast horizon, with the federal funds rate averaging 3.7 percent in the last quarter of 2026, 3.2 percent in the last quarter of 2027, and 2.8 percent in the last quarter of 2028. The median SEP projection sees rates at 3.4 percent at the end of 2026, 3.1 percent at the end of 2027, and 3.1 percent at the end of 2028, implying a slightly lower federal funds rate path than the model over the next two years. Uncertainty about how the economy will evolve over the near term remains elevated due to several factors, including uncertainty about the size and effects of federal policy changes on tariffs and on immigration.

After expanding at a pace of 2.5 percent in 2024 (Q4/Q4), output slowed to an annualized pace of 1.4 percent in the first half of this year. We assume output will expand at a pace of 0.9 percent (annualized) in the third quarter of 2025. Thereafter, the model anticipates that annualized output growth will rebound to a below-trend pace of 1.5 percent in the fourth quarter of this year and then gradually converge to an about 2 percent pace by 2027. On an annual average basis, the forecasts for output growth in 2025, 2026, and 2027 (1.6 percent, 1.7 percent, and 2 percent, respectively) are in line with the 1.7 percent, 1.6 percent, and 2.1 percent growth projected by the median Survey of Professional Forecasters (SPF) participant for each of those years, respectively. For 2028, the model forecast is 0.2 percentage point higher than the SPF forecast of 1.8 percent.[5]

The labor market is predicted to soften a tad. We impose a nowcast for the unemployment rate of 4.3 percent for the current quarter, which is 0.1 percentage point lower than in the June forecast and in line with the upward revision for real GDP growth this year. Thereafter, the model predicts that the unemployment rate will edge up to 4.4 percent in 2026 before declining gradually to 4.1 percent at the end of 2027 and 3.9 percent at the end of 2028. Thus, in the near term the unemployment rate is expected to increase slightly 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 4.3 percent. The model near-term projection is broadly similar to the latest median SPF projection, which sees the unemployment rate rising to 4.5 percent in 2026.

Inflation edged down in the second quarter of 2025 but is expected to tick up to 3.5 percent (annualized) in the current quarter. Even so, based on historical data, the model anticipates that inflation will gradually ease a tad to 3.1 percent (annualized) at the end of this year. This puts inflation at 3.1 percent for the year as a whole (Q4/Q4) before edging down to 2.3 percent in 2026. In 2027 and 2028, the model sees inflation at 1.9 and 1.7 percent, respectively. Thus, inflation is expected to return to levels consistent with the Federal Open Market Committee (FOMC) target of 2 percent (annualized)

[5] The model features long-run real per capita output growth of 1.6 percent. We assume that population growth equals 0.7 percent in 2025, 0.6 percent in 2026, 0.5 percent in 2027, and 0.4 percent in 2028, on a Q4/Q4 basis. This projection is roughly in line with the Congressional Budget Office's "Demographic Outlook: 2024–2054."

average inflation at the end of next year. The SPF's core PCE inflation forecast is 3 percent (Q4/Q4) for 2025, edging down to 2.5 percent in 2026 and 2.1 percent in 2027. Thus, on inflation, the SPF forecast is slightly above the model baseline forecast from 2026 onward.

The September 2025 SEP by FOMC participants shows the median projection for output growth at 1.6 percent in 2025, 1.8 percent in 2026, 1.9 percent in 2027, and 1.8 percent in 2028. The median FOMC member forecast for the unemployment rate is 4.5 percent in the last quarter of 2025, gradually declining to 4.4 percent in the last quarter of 2026, 4.3 percent in the last quarter of 2027, and 4.2 percent at the end of the forecast horizon. Core PCE inflation, on a fourth quarter over fourth quarter basis, is projected to be 3.1 percent in 2025 before stepping down to 2.6 percent in 2026, 2.1 percent in 2027, and 2 percent in 2028. The median FOMC member forecast anticipates that the federal funds rate will decline to 3.6 percent at the end of 2025 and 3.4 percent at the end of 2026 before stabilizing at 3.1 percent at the end of both 2027 and 2028.

## 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 noninertial (Taylor 1993 and Taylor 1999) rules imply lower unemployment and higher interest rates, inflation, and output growth. The inertial Taylor 1999 rule leads to a gradual decline of inflation to target within one year, followed by below-target inflation in 2026 and 2027, with output growth and the unemployment rate broadly similar to the baseline. Under this rule, interest rates run a little above the baseline over the next two quarters. The AIT rule implies that interest rates remain unchanged this year, along with weaker real activity and higher unemployment over the next several quarters; inflation returns to the 2 percent inflation target faster than under the baseline rule.

By the end of 2025, the level of the federal funds rate implied by the alternative rules are all above the baseline projection of 4 percent, albeit to different degrees. The Taylor 1993 rule sees the rate at 4.6 percent and the Taylor 1999 rule sees the rate at 4.4 percent. The inertial Taylor 1999 rule sees the funds rate at 4.2 percent, while the AIT rule sees the rate at 4.4 percent. By the end of 2026, all the alternative rules except for the inertial Taylor 1999 rule remain slightly above baseline. By the end of 2027, the forecasts of the alternative rules are between 2.9 and 3.4 percent, close to the baseline of 3.2 percent.

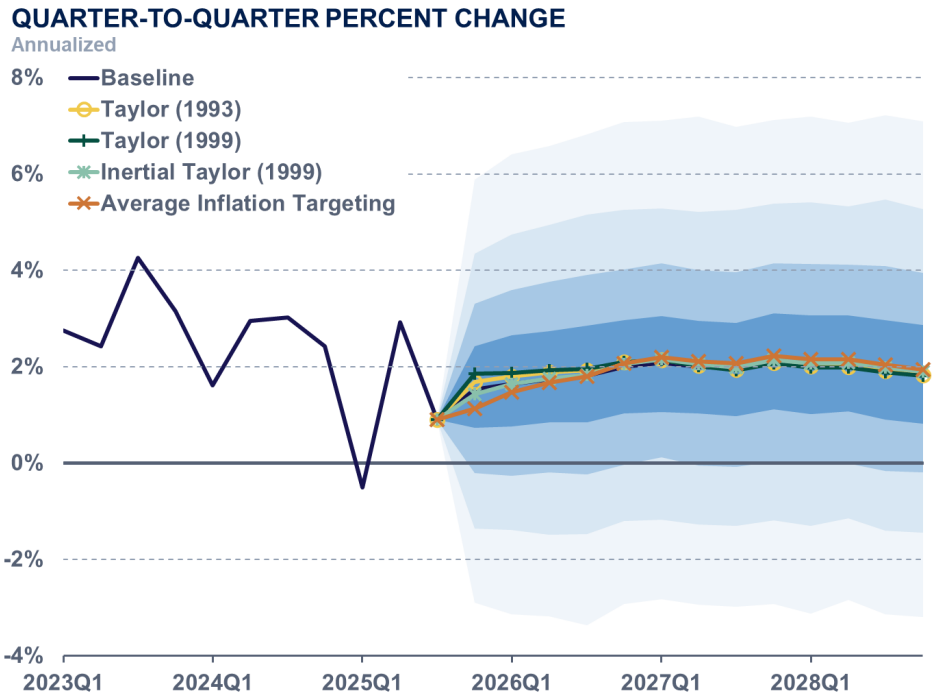
The Taylor 1993 and Taylor 1999 rules call for a somewhat higher level of interest rates in 2025 and 2026 relative to the baseline. These rules are noninertial and place more weight on the output gap. As a consequence, they support output growth, leading the output gap to close faster than in the baseline. Higher output growth is consistent with lower real rates on average over the forecast horizon. The federal funds rate under these rules peaks in the second quarter of 2026. The rules call for subsequent, gradual rate cuts.

Throughout the forecast horizon, the inertial Taylor 1999 rule yields lower inflation than in the baseline even though the interest rate path under this rule is only slightly above the baseline for about a year. This is because of the expectations channel: Households act on the expectation that monetary policymakers will keep rates higher for longer compared with the baseline. All else equal, the inertial Taylor rule implies that interest rates would remain high even after inflation has been brought down. Instead, forward-looking households and firms adjust their demand and prices immediately, which lowers the output gap and inflation, allowing the monetary authority to not have to follow through on the threat of persistently higher rates. The AIT rule operates by committing to holding higher rates for longer until inflation averages 2 percent over a two-year window. Consequently, inflation returns to the 2 percent target more quickly than under the baseline at the cost of lower output and higher unemployment.

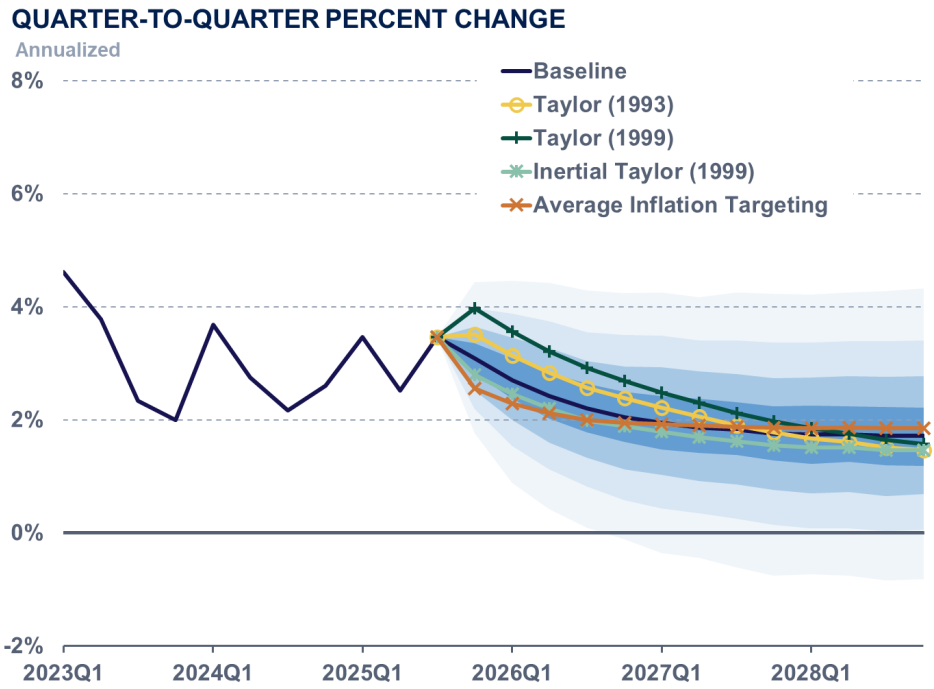
# Summary

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 a below-trend pace over the forecast horizon and that inflation will gradually ease—despite an uptick in current-quarter inflation—toward the FOMC target of 2 percent in 2027. Forecast uncertainty remains high due to several factors, including uncertainty about the size and effects of federal policy changes on tariffs and on immigration. These factors are not directly incorporated into the model forecast.

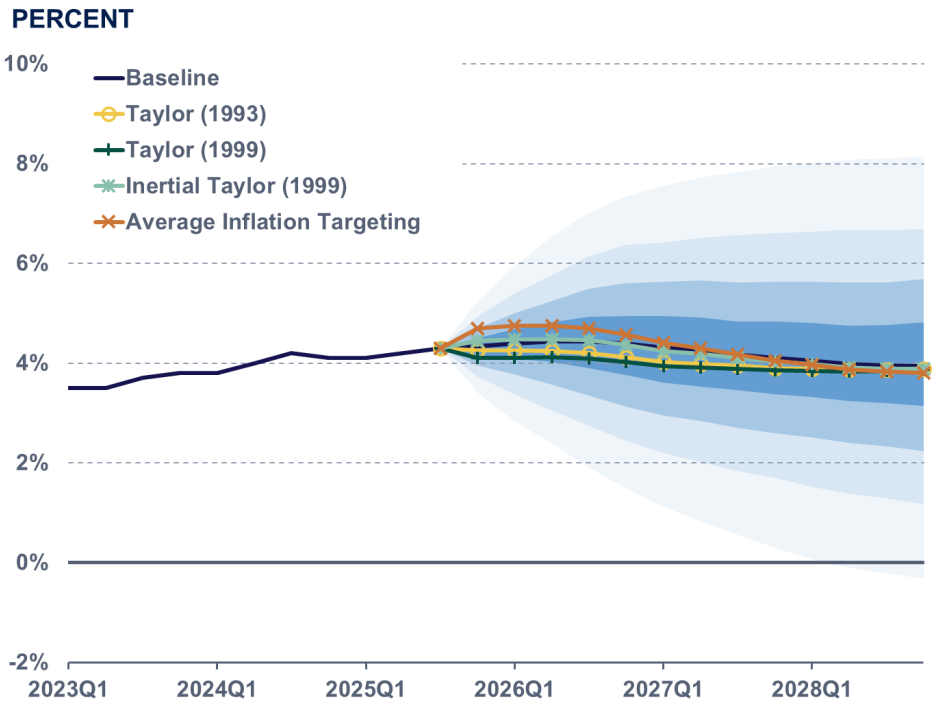
## Figure 1: Real GDP Growth



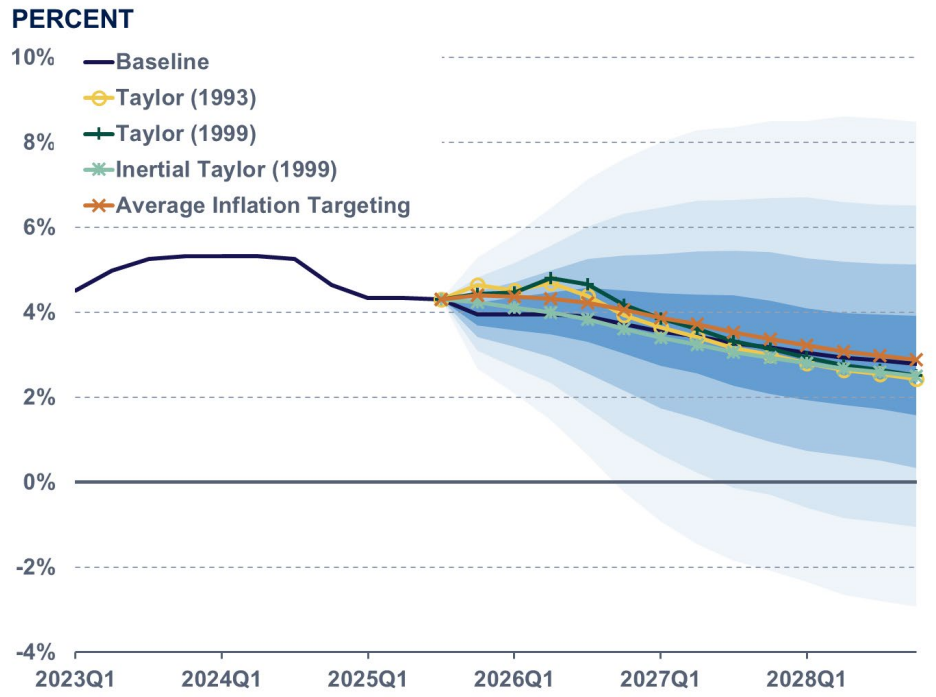

## Figure 2: Core PCE Inflation



## Figure 3: Unemployment Rate

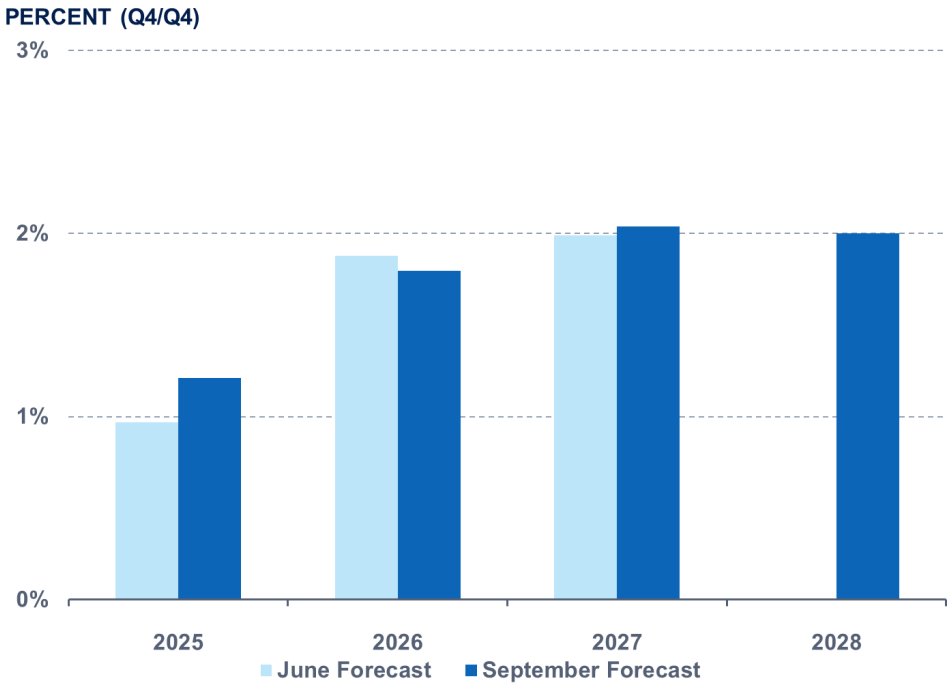



## Figure 4: Federal Funds Rate

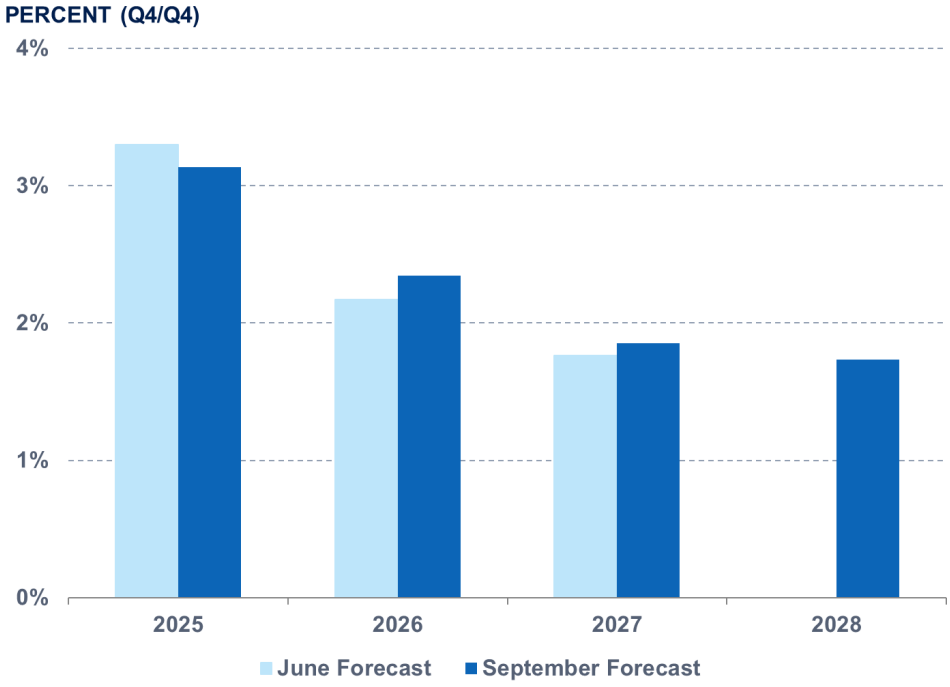


## Figure 5: Baseline Forecast Comparisons

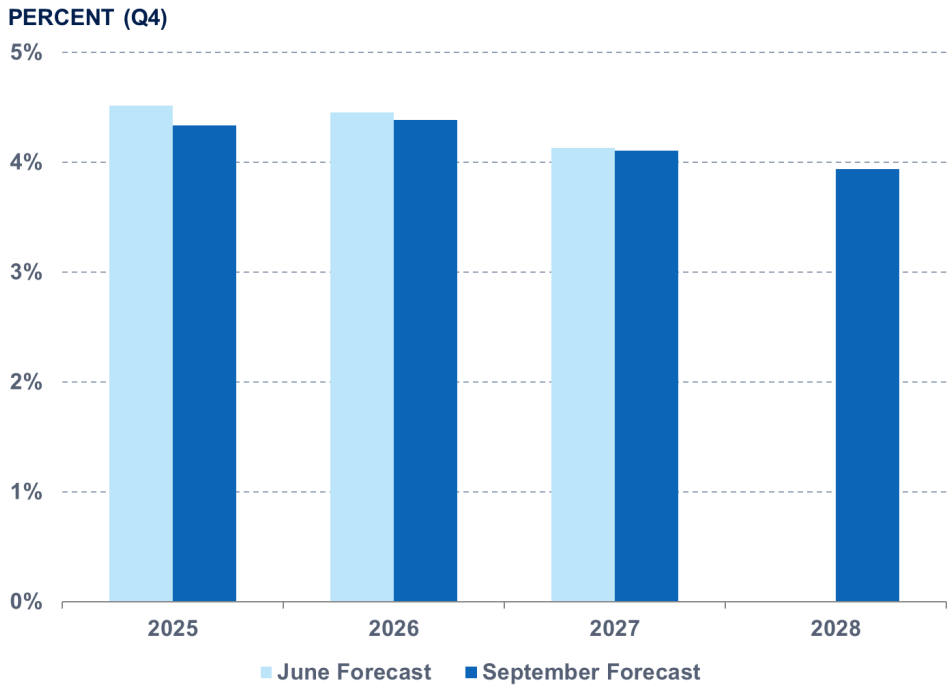
### Figure 5a: Real GDP Growth



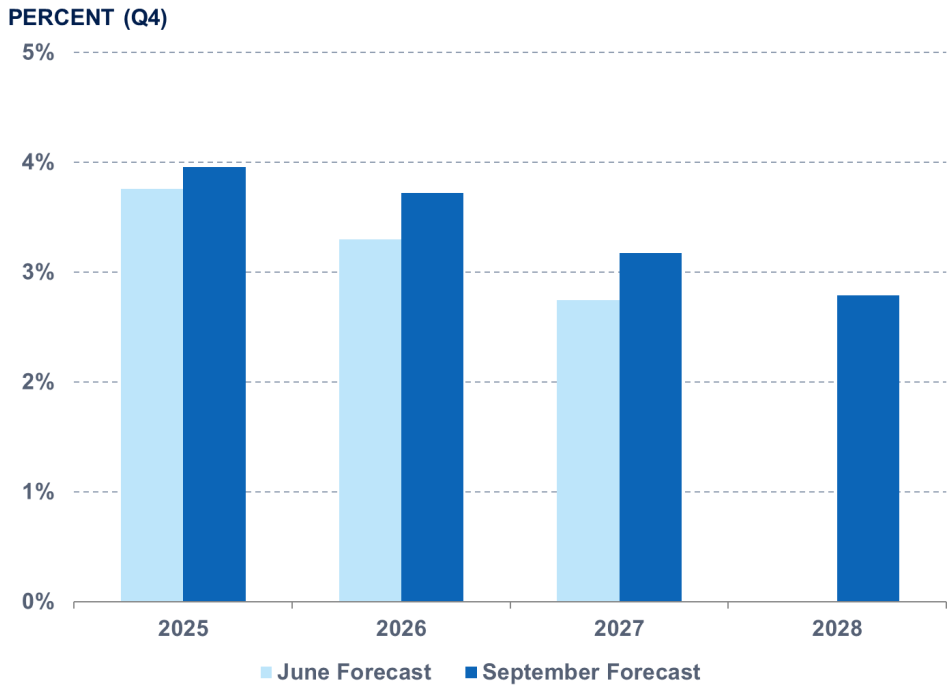

### Figure 5b: Core PCE Inflation Growth



## Figure 5c: Unemployment Rate




## Figure 5d: Federal Funds Rate




Note: Historical data have been retrieved from Haver Analytics.