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Special Report
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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

Real gross domestic product (GDP) growth in the second quarter of 2024 was up from 2.8 percent to 3 percent, with most of the upward revision due to revised consumption expenditures. Partly offsetting stronger consumption were weaker contributions from investment, net exports, and government expenditures.

[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.

Labor market tightness continues to ease. The unemployment rate ticked down in August as July's weather-related spike in temporary layoffs was reversed. Nonfarm payrolls rose by 142 thousand, but this number is likely overstated given the data on U.S. Bureau of Labor Statistics (BLS) preliminary revisions. BLS revised total nonfarm payrolls down by 818 thousand for the year ended in March 2024, suggesting that the economy averaged about 174 thousand jobs gained per month compared to the 242 thousand in the unrevised payroll data. The decline in payroll employment in recent months has been broad-based across sectors with the exception of leisure. Wage growth held steady in August, while job opening and hiring rates continue to edge down.

Inflation continues to edge down, though persistent inflationary pressures remain in shelter. Price increases for other services have slowed in recent months. Core personal consumption expenditures (PCE) inflation was up 2.6 percent year-over-year in July, with price increases entirely attributed to the services sector. The consumer price index (CPI) data released in August told a similar tale. On a year-over-year basis, core CPI inflation rose 3.2 percent, the same pace as in July but down significantly from a 3.8 percent pace in the spring.

The housing market continues to be affected by tight supply and low demand. House price growth has slowed appreciably in recent months, suggesting weak demand may be the stronger force. Existing home sales remain near historic lows, but new home sales are ticking up and hovering at near prepandemic levels. Possibly due to an anticipated deceleration in price appreciation, both housing starts and new permits have been trending downward.

To conclude, the pace of economic activity appears to be healthy overall but is slowing. Tight monetary policy has dampened 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. Federal Open Market Committee (FOMC) members' September projections of economic activity continue to anticipate modest growth and above-target inflation. For next year, median expected real GDP growth is at 2 percent, the same as in 2024. The unemployment rate is expected to end this year at 4.4 percent and remain steady in 2025. Expectations for PCE inflation are at 2.1 percent for headline and 2.2 percent for core in 2025, down from 2.3 percent for headline and 2.6 percent for core in 2024. The median participant sees the federal funds rate reaching 4.4 percent at the end of 2024, down from 5.1 percent in the June 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. 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

[2] 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.

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 2024, together with an assumption of how output growth, inflation, the federal funds rate, and unemployment will fare in the third quarter of 2024.[3] The forecast then begins in the fourth quarter of 2024 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.[4]

The key features of the baseline forecast are as follows:

- Real output growth is forecast to be 2.1 percent in 2024, edging slightly up to 2.2 percent in both 2025 and 2026 before slowing to 2 percent in 2027, on a fourth quarter over fourth quarter basis. This represents a moderate upward revision in the forecast, compared to the June forecast (Figure 5a).
- Core PCE inflation falls from a 3.2 percent pace in 2023 to 2.8 percent in 2024, 2 percent in 2025, and 1.9 percent in both 2026 and 2027, on a fourth quarter over fourth quarter basis. The forecast represents a moderate downward revision relative to the June forecast (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 to 3.7 percent at the end of 2026 before increasing to 3.8 percent at the end of 2027. This represents a moderate downward revision throughout the forecast horizon compared to the June forecast (Figure 5c).
- The federal funds rate averages 5.2 percent in the third quarter of 2024, falling to 4.9 percent in the fourth quarter of 2024, 3.4 percent in the fourth quarter of 2025, 2.8 percent at the end of 2026, and 2.5 percent at the end of 2027. This path is slightly higher than it was in the June forecast (Figure 5d).

The forecast for output growth in 2024 is moderately stronger compared to the June forecast, as output growth in the second quarter came in higher than expected, driven by resilient private domestic demand. The forecast for the federal funds rate is completely data

[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.

determined according to the model's policy reaction function. The model-implied federal funds rate for the fourth quarter of this year is about 50 basis points above the financial market expectation and the median September SEP projection. By the end of 2025, the model-implied federal funds rate remains above the rate implied by the fed funds futures, but it is identical to the median September SEP projection. Uncertainty about how the economy will evolve over the near term remains high due to several factors, including the lingering effects of restrictive policy and the possibility of renewed supply-chain strains.

After increasing at a pace of 3.1 percent in 2023, the model anticipates that output growth will slow down to 2.1 percent in 2024, edging up to 2.2 percent in 2025 and 2026 before slowing a tad to 2 percent in 2027, on a fourth quarter over fourth quarter basis. The assumed growth of 1.7 percent (SAAR) in the current quarter is a tad below the Survey of Professional Forecasters (SPF) median projection for the third quarter of 2024, which is 1.9 percent (SAAR). On an annual average basis, the forecast for output growth is broadly similar to that of the median SPF projection throughout the forecast horizon except for 2025, when the SPF projection is a tad below the baseline model: While the median SPF projection is 2.6 percent in 2024, 1.9 percent in 2025, 2.3 percent in 2026, and 2 percent in 2027, the baseline model shows output growing at an average pace of 2.6 percent in 2024, subsequently slowing down to an about 2.2 percent pace in the remaining years of the forecast.[5]

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 edge down to 3.9 and 3.7 percent at the end of 2025 and 2026, respectively, before ticking up to 3.8 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 consistent with a more accommodative monetary policy stance relative to the previous forecasts.

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 quarter. The model anticipates that inflation will average 2.8 percent in 2024, decreasing further to 2 percent in 2025 and to 1.9 percent in both 2026 and 2027. Thus, inflation is expected to run slightly above the FOMC target of 2 percent average inflation until mid-2025 and to undershoot the target by a little in the remainder of the forecast horizon.

[5] 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."

The baseline forecast for real GDP growth in 2024 on a fourth quarter over fourth quarter basis is nearly identical to the median projection from the third-quarter 2024 SPF, which is 2 percent. Looking ahead, on an annual average over annual average basis, the median SPF forecast is 1.9 percent in 2025, 2.3 percent in 2026, and 2 percent in 2027—roughly in line with the implied growth of annual averages in our forecasts save for 2025, when the baseline forecast is 0.4 percentage point higher than the SPF projection. The SPF's core PCE inflation forecast is 2.8 percent (Q4/Q4) for 2024, edging down to 2.2 percent in 2025 and 2 percent in 2026. Thus, on inflation, the SPF forecast is broadly similar to the model baseline forecast. The baseline forecast for the unemployment rate in the last quarter of 2024 is 0.1 percentage point below the SPF median projection of 4.3 percent. However, the forecast paths differ more noticeably thereafter: While the baseline forecast for the annual average of the unemployment rate in the out years of the forecast is 4.1 percent in 2025, 3.8 percent in 2026, and 3.7 percent in 2027, the median SPF forecast is 4.3 percent in 2025 and 4.2 percent in both 2026 and 2027.

The September 2024 SEP by FOMC participants shows the median projection for output growth at 2 percent throughout the forecast horizon. The median forecast of the unemployment rate is 4.4 percent at the end of 2024; it remains at that level at the end of 2025 before edging down to 4.3 percent at the end of 2026 and to 4.2 percent at the end of 2027. Core PCE inflation is projected at 2.6 percent in 2024, 2.2 percent in 2025, and 2 percent in both 2026 and 2027. The median FOMC member forecast anticipates that the federal funds rate will go down to 4.4 percent at the end of 2024, 3.4 percent at the end of 2025, and 2.9 percent at the end of both 2026 and 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 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 persistently above-target inflation. The inertial Taylor 1999 and average inflation targeting rules lead to persistently below-target inflation, slightly lower real output growth, and a higher unemployment rate (peaking at 4.5 percent in the inertial Taylor 1999 rule and at 4.6 percent in the average inflation targeting rule).

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 decrease to 1.7 percent in the fourth 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, remaining above the natural rate until mid-2025. Thereafter, unemployment gradually declines to 3.7 percent at the end of 2026 and to 3.6 percent toward the end of 2027. Output growth on a fourth quarter over fourth quarter basis slows slightly to 2 percent in 2024 and rebounds to about 2.2 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. These rules call for an about 130 basis point cut by the fourth quarter of 2024, followed by smaller interest rate cuts until converging to the baseline path in the second half of 2025. The interest rate is at about 2.2 percent by the end of 2027, about 0.6 percentage point below the long-run level of 2.8 percent 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 0.6 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 above 3 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 baseline forecast until the second half of 2025 and runs approximately 25 basis points lower than the baseline in 2026 and 2027. 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 slightly below-trend output growth over the forecast horizon. Inflation eases gradually and finally reaches the FOMC target of 2 percent in the second half of 2025. Forecast uncertainty remains high as the economy deals with tighter financial conditions from the latest tightening cycle, geopolitical risks, and the possibility of renewed supply-chain strains. These factors are not directly incorporated into the model forecast. On balance, the forecast calls for slightly below-trend output growth and inflation moving closer to the 2 percent target.

Figure 1: Real GDP Growth

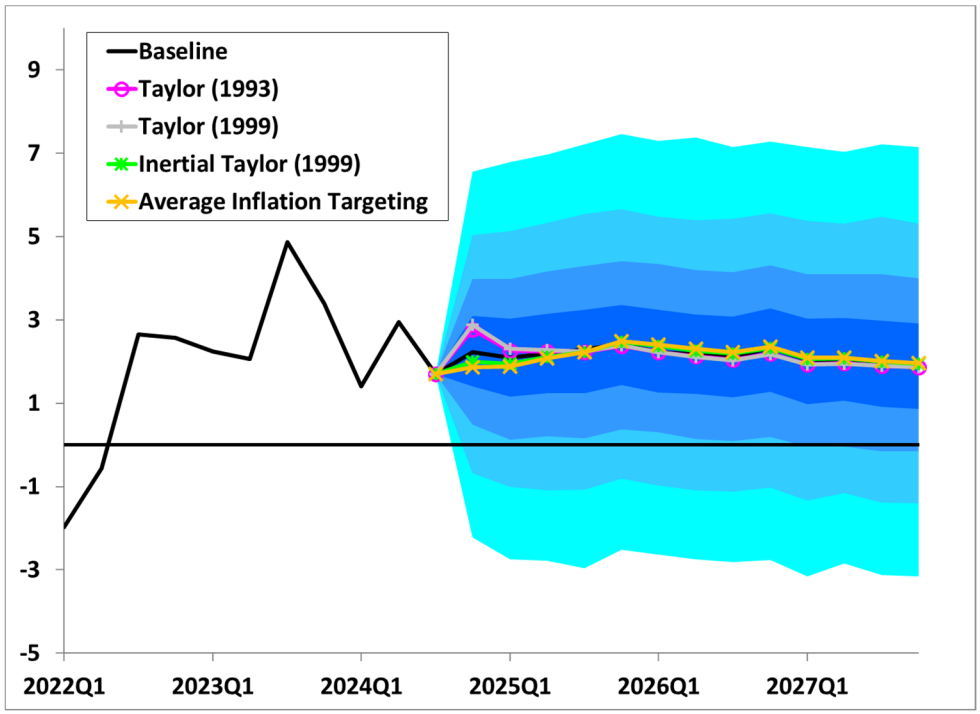


Figure 2: Core PCE Inflation

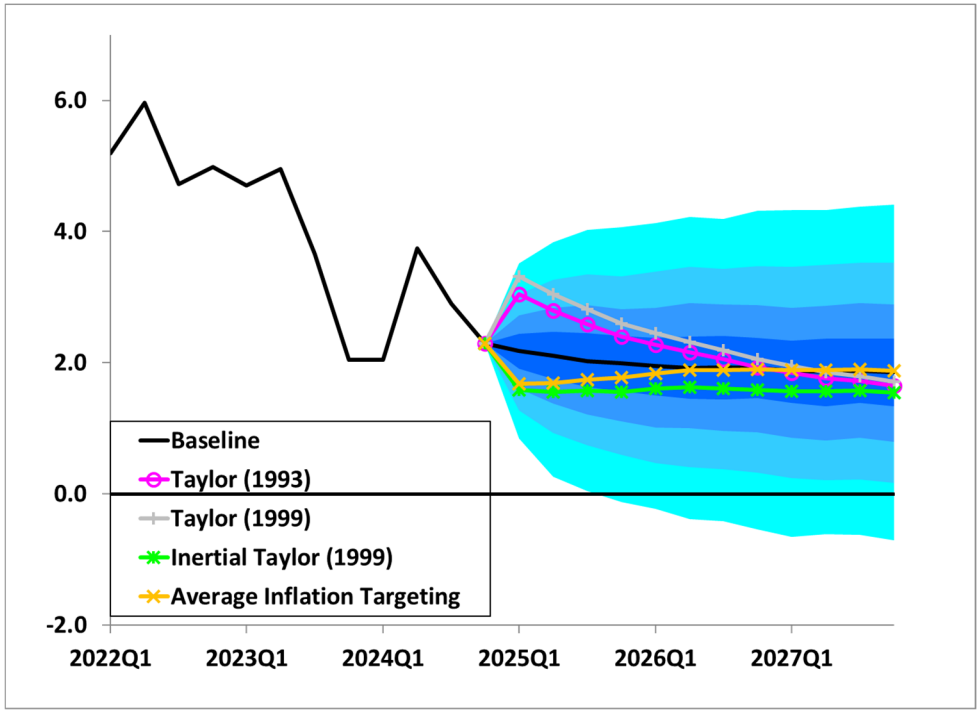


Figure 3: Unemployment Rate

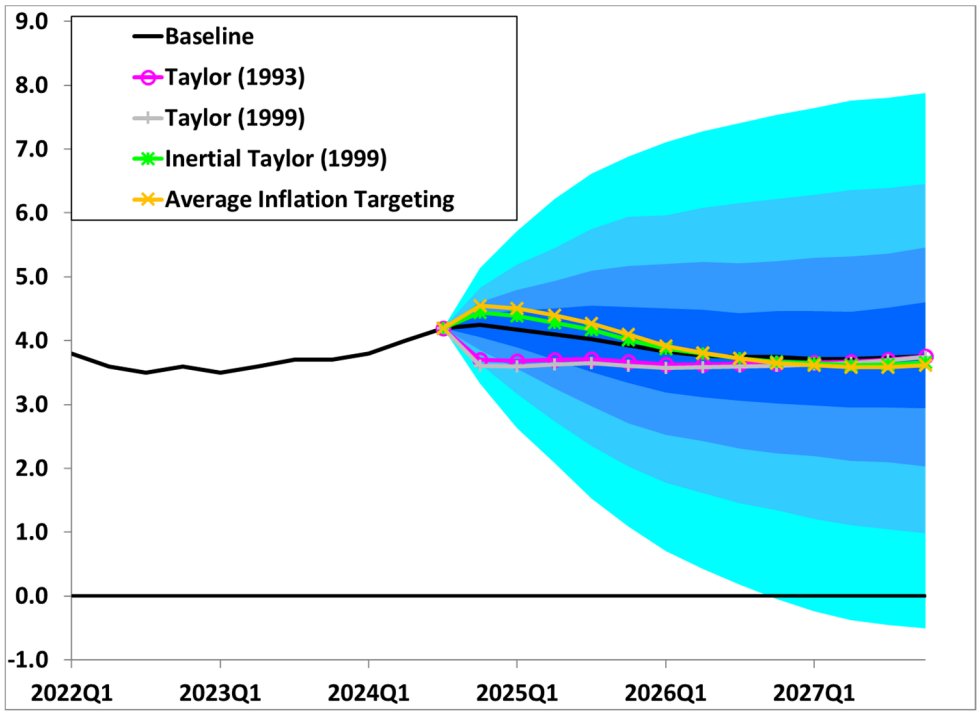


Figure 4: Federal Funds Rate

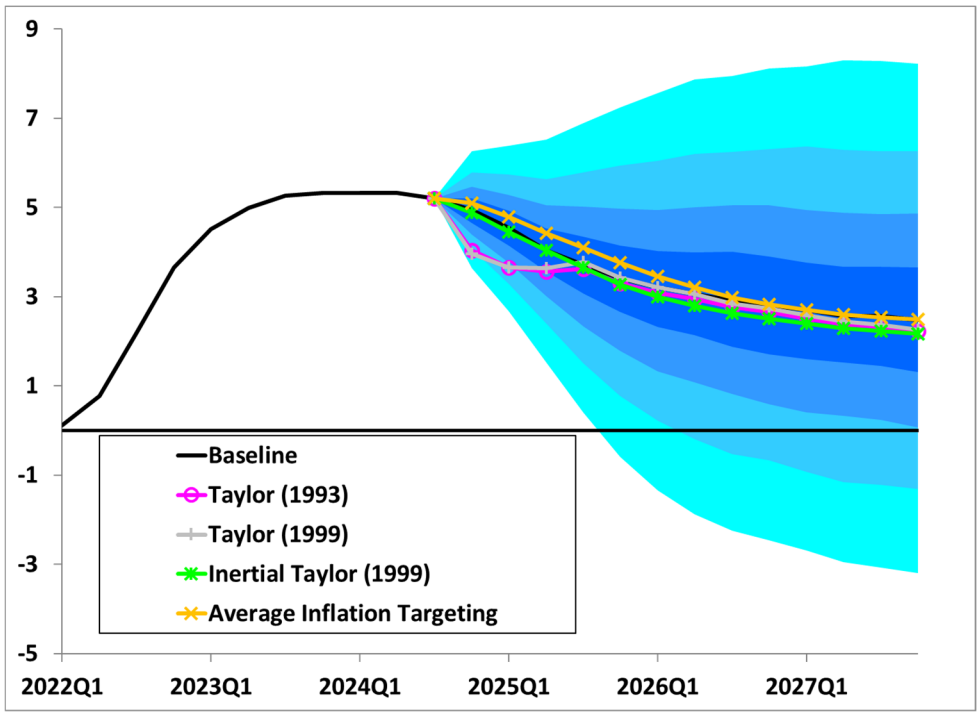


Figure 5: Baseline Forecast Comparisons

Figure 5a: Real GDP Growth

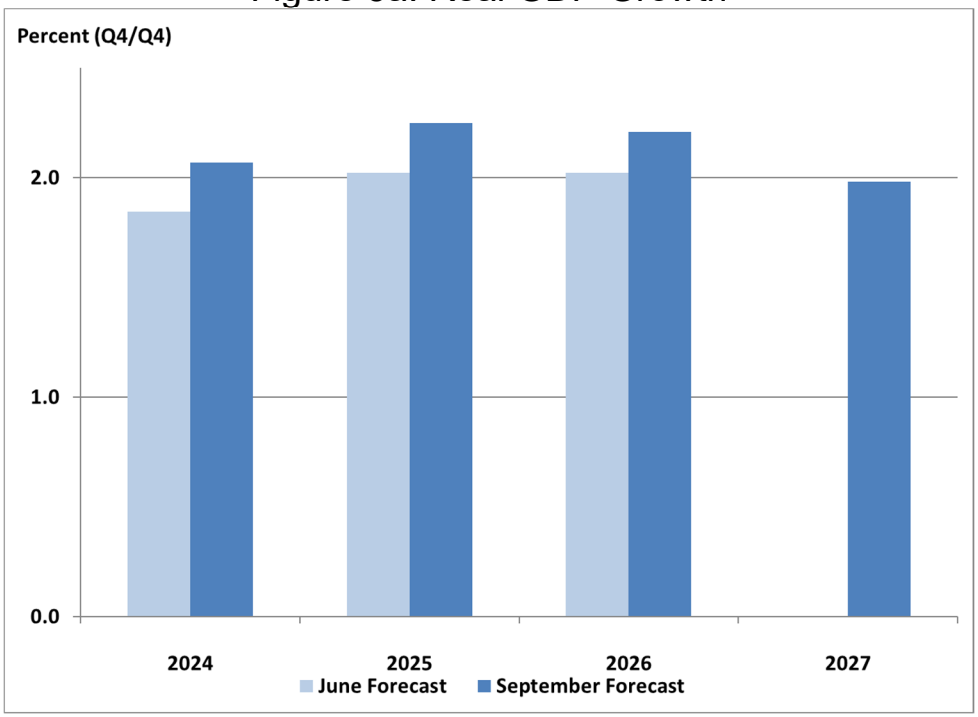


Figure 5b: Core PCE Inflation Growth

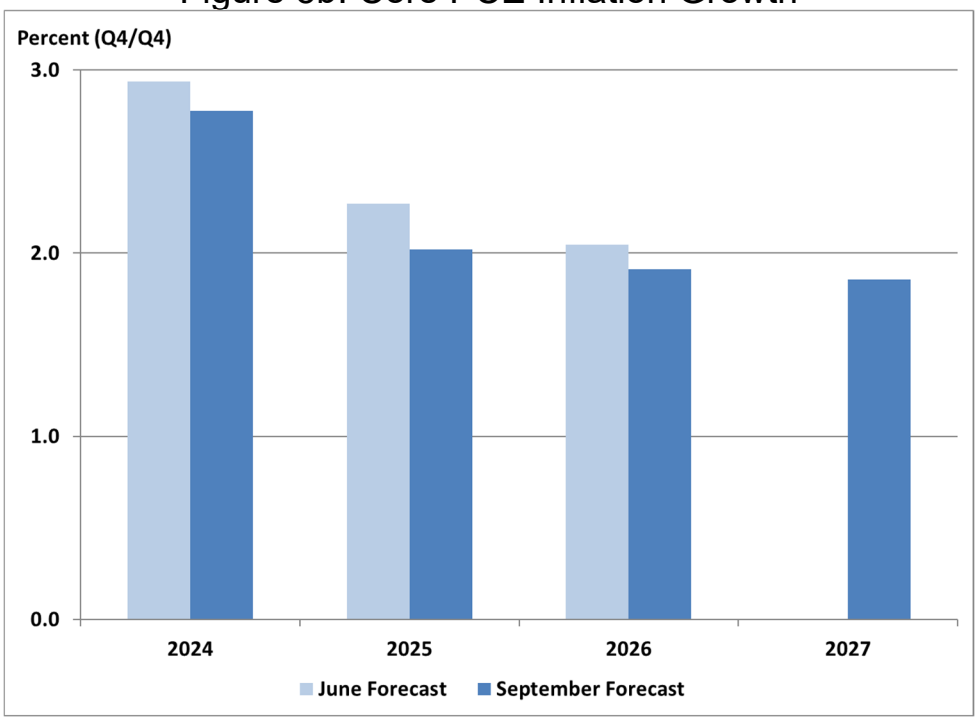


Figure 5c: Unemployment Rate

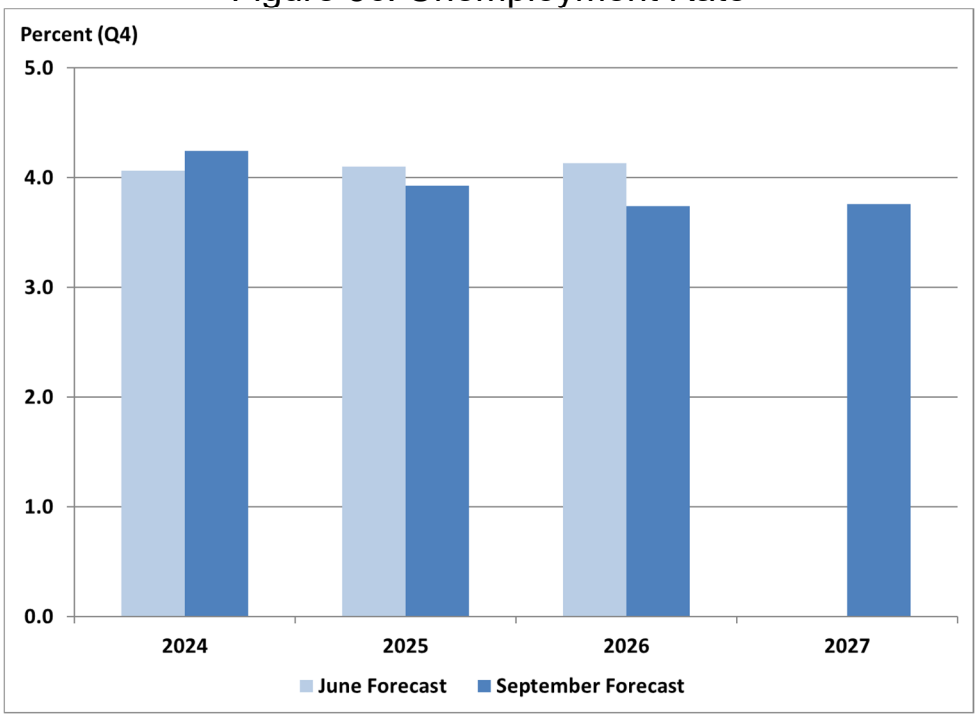
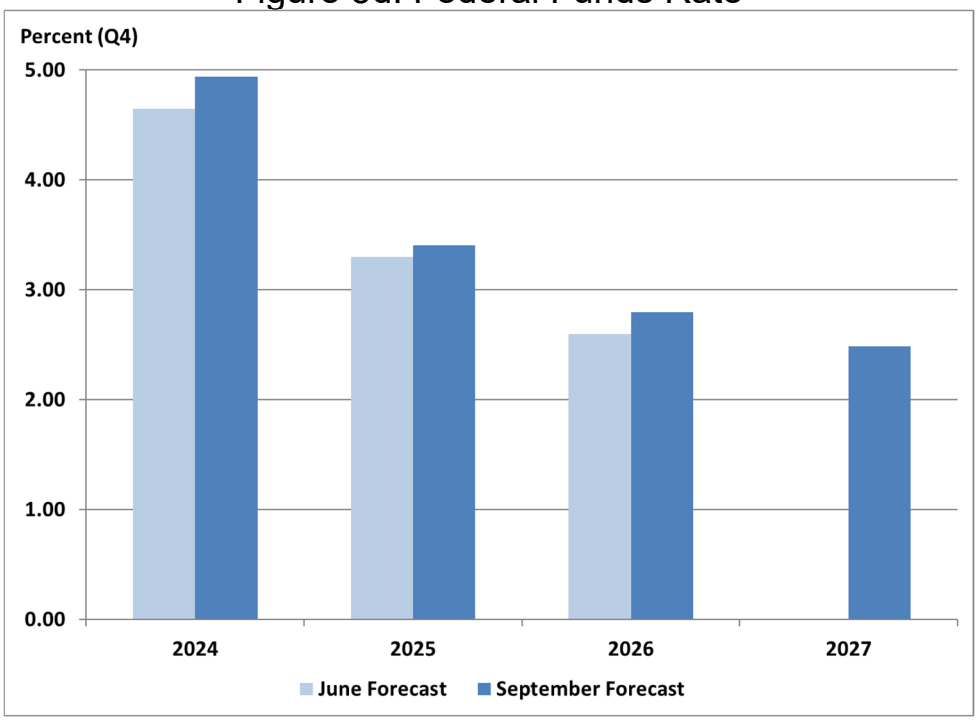


Figure 5d: Federal Funds Rate



Note: Historical data have been retrieved from Haver Analytics.