

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. The forecasts are generated with the federal funds at its effective lower bound (ELB) throughout the forecast horizon.

Economic Overview

Third-quarter economic activity increased by 33.1 percent at an annual rate, offsetting much of the first-half decline. The robust performance was underpinned by extremely strong growth in consumption of 40.6 percent and by 31.3 percent growth in business fixed investment. Economic lockdowns were greatly eased, and many firms learned to adapt to the virus.

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 Gillian Courtney and Catherine O'Donnell for their assistance.

Manufacturing and residential real estate were two sectors that experienced strong growth. However, this quarter's activity appears to have moderated, with growth expected to slow to around 5 percent. The virus is surging, and the health care system is under great stress. Lockdowns have been reinstated in many areas, although they are far less draconian than those of the spring. Sectors that continue to perform poorly involve those associated with person-to-person activity. Seated diners and airline passenger traffic have recently started trending down, with those eating in restaurants at the lowest level since June. As of December 11, revenue per available hotel room was down 58.4 percent from a year ago. Many businesses in those sectors, especially smaller ones, have shuttered, and many others are running out of resources. Both revenues and the count of small businesses declined in November, with revenues in the week ending November 25 at their lowest levels since early May. Additional fiscal support is sorely needed if the economy is to avoid a large decline in the first half of next year. But we have recent good news as two vaccines have shown very promising results. It is anticipated that most people who want to get vaccinated will receive the vaccine by summer.

After the exceptional economic reversal last quarter, economic activity is beginning to moderate. Residential investment remains fairly robust, and the manufacturing sector is still expanding. However, consumption has slowed noticeably, and the last two months have seen declining retail sales, with November posting a significant 1.1 percent decline. As of December 7, spending on Chase cards pulled back a bit, although other sources of card payment data have not shown the same decline. Some of this decline is no doubt due to the waning of the CARES Act stimulus. So, while December's consumer activity is still ongoing, it is clear that there has been a moderation in consumption growth. However, it still appears that overall growth will be positive this quarter, with the economy being projected to expand at a rate in the neighborhood of 5 percent.

Employment growth has moderated as well, with the economy adding only 245,000 net new jobs in November. While this is a healthy number in normal times, there still remain over 10 million unemployed workers. As well, unemployment claims remain elevated and, in the week ending December 5, were at their highest level since the middle of September. Additionally, job postings have been scaled back and remain 41.6 percent below their January average. Much of the third-quarter rebound in jobs was accounted for by those on temporary layoff returning to the firms where they were previously employed. That type of reduction in unemployment can happen rather quickly as firms reopen. Currently a greater fraction of the unemployed are permanently laid off, and that type of unemployment typically takes longer to unwind. Thus, labor market recovery is liable to be a bit more drawn out as we move into 2021. Successful rollout of the vaccine and the expected strengthening in the economy that will ensue will hopefully reaccelerate the process over the second half of next year.

A sector that experienced a strong third-quarter recovery was manufacturing; it continues to improve but at a more subdued pace. Industrial production increased in October and, starting in April, has recovered two-thirds of its earlier decline. Particular strength has occurred in motor vehicle and parts production. Orders were up 1.0 percent in October and are currently only 3.2 percent below their level in February. Shipments have consistently risen as well and are now a mere 1.8 percent below their pre-pandemic level. Relative to services, the demand for goods has been exceedingly strong. There is some indication in the soft data implying that manufacturing activity has slowed. The Philadelphia Fed's December survey showed a significant decline in current activity, although the index remained in positive territory. However, manufacturers in the region remain optimistic about future prospects. Nationally, the ISM index recently declined slightly, but at 57.5 it remains elevated.

Another area of strength continues to be housing, especially single-family home construction. Some measures of activity now surpass their pre-pandemic levels. Single-family starts increased 6.4 percent in October and, at an annual pace of 1.179 million starts, are at their highest level since May 2007. Single-family permits also increased for the seventh consecutive month and are at their highest level since December 2006. Low mortgage rates are likely contributing to the strength in this sector.

Inflation remains below the 2.0 percent target. For example, year-over-year to November the core consumer price index (CPI) rose by 1.6 percent, while the headline index increased a mere 1.2 percent. Inflation also has yet to overshoot the target, which is a goal expressed in the new framework adopted by the FOMC. Survey data from the Survey of Professional Forecasters (SPF) indicate that long-run inflation expectations remain well anchored and are consistent with the FOMC's inflation objective. However, most forecasters do not see inflation exceeding 2 percent anytime soon.

To conclude, the economy continues to recover, and there are now two vaccines that will likely be readily available as we move into 2021. But for the time being, cases, hospitalizations, and deaths are at alarming and tragic levels. The path of the virus is likely to dampen activity in the first half of next year, and hopefully when a sufficient number of people have been vaccinated, economic growth will proceed in a more robust manner. There are still many downside risks, with more aggressive lockdowns being called for. Also, disagreement on further fiscal stimulus could slow the recovery, resulting in additional economic scarring that could slow a return to a more normal economic environment. And until children return to school, virtual schooling will prevent many from returning to the job market. Despite all that has ensued, the economy has shown surprising resilience and vaccines are a reason to hope.

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 where 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 will return to a pre-pandemic state once the virus is mitigated. There is of course a high degree of uncertainty surrounding that assumption. This forecast might then best be described as having two parts: a judgmental estimate of pandemic dynamics and their persistence, and a model-based forecast for the aftermath of the pandemic. 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

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

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 personal consumption expenditure (PCE) inflation, $ygap_t$ is a measure of the output gap, and ε_t^R is a monetary policy shock.² The parameters ρ , Ψ_π , and Ψ_y determine how monetary policy reacts to economic conditions.

Table 1

Rule	ρ	Ψ_π	Ψ_y
Baseline	0.85	2.62	0.53

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. On its own, the baseline rule predicts a sharply negative federal funds rate over the forecast horizon. We add policy shocks to the model, which bring the funds rate up to the

² The model calibration implies that the long-run equilibrium value of the federal funds rate is 3.5 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.

ELB over the next three years. Note that this is tantamount to adding contractionary monetary policy shocks to the model.

Model Forecasts Under the Baseline

We generate a forecast assuming that monetary policy follows the baseline policy rule but that policy shocks pin the rate at the ELB. The forecast is generated using observed data through the third quarter of 2020 together with an assumption on how output growth and unemployment will fare in the fourth quarter of 2020. The forecast then begins in the first quarter of 2021 and extends through the fourth quarter of 2023. The forecast under the baseline is shown in Figures 1–4. The baseline forecast is represented by the dark solid line. The colored bands around the baseline forecast represent 10 percent confidence intervals of the predictive distribution around the median of the baseline forecast.³

The key features of the baseline forecast are as follows:

- Real output is forecast to grow at about a 1.3 percent annual rate in the first quarter of 2021, and a 2.3 percent pace in 2021.
- Core PCE inflation runs at a 1.2 percent pace in the first quarter of 2021 and an average 1.8 percent in 2021. Inflation does not rise to the FOMC target of 2 percent over the forecast horizon.
- The unemployment rate averages 6.6 percent in the first quarter of 2021, falling gradually to 5.2 percent at the end of 2023.
- By assumption, the federal funds rate remains at the ELB through the end of 2023.

The baseline forecast calls for output growth to move down from 3.6 percent in the fourth quarter of 2020 to an average of about 2 percent in the first half of 2021. Thereafter, growth moves up to about a 2.5 percent pace, on average, through the end of 2023. The model's current quarter forecast is lower than the Federal Reserve Bank of Atlanta's GDPNow forecast of 11 percent for the fourth quarter of 2020 and somewhat above the Federal Reserve Bank of New York's Staff Nowcast of 2.4 percent. As mentioned above, the NKDSGE model output forecast is made using quarterly data from the third quarter of 2020 and earlier. The incoming data since the start of the fourth quarter was initially stronger than expected. However, more recent data has indicated a slowing in the pace of growth in response to the third wave of the COVID pandemic.

³ The forecast simulations are generated using Bayesian methods. The fan charts show 10 percent quantiles around the median of the posterior predictive distribution.

The baseline model shows output growth running at a pace that is somewhat higher than its longer-term trend over the forecast horizon.⁴ The unemployment rate averages 6.6 percent in the first quarter of 2021 and then falls slowly to 5.5 percent in the fourth quarter of 2021 and 5.3 percent in the fourth quarter of 2022. By the end of 2023, the unemployment rate is forecasted at 5.2 percent.

Healthy growth and anchored long-run inflation expectations lead to an acceleration of core PCE inflation, from 1.2 percent in the first quarter of 2021 to 1.9 percent at the end of 2023. Thus, the model anticipates that inflation will run below the FOMC target of 2 percent average inflation over the forecast horizon. Under the baseline policy parameterization, the output growth and inflation outcomes are consistent with a federal funds rate that remains at the ELB over the next three years.

The baseline forecast is somewhat weaker than the median projections from the fourth-quarter 2020 SPF over the forecast horizon. The respondents expected real output growth of 4 percent in 2021, 3 percent in 2022, and 2.1 percent in 2023. (Note that the SPF reports GDP growth as annual average over annual average.) The SPF's core PCE inflation forecast is 1.8 percent (Q4/Q4) for 2021, edging down to 1.7 percent in 2022. The forecasters' path for the unemployment rate is somewhat lower than in the baseline model: The median SPF forecast for the unemployment rate is similar to the baseline forecast, averaging 6.3 percent in 2021, 5.2 percent in 2022, and 4.6 percent in 2023.

The December 2020 Summary of Economic Projections (SEP) by FOMC participants shows the median projection for output growth at 4.2 percent in 2021, falling to 3.2 percent in 2022 and 2.4 percent in 2023. The median forecast of the unemployment rate is 5 percent at the end of 2021, 4.2 percent at the end of 2022, and 3.7 percent at the end of 2023. Core PCE inflation is projected at 1.4 percent in 2020, rising to 1.8 percent in 2021 and 1.9 percent in 2022. For 2023, inflation reaches the target rate of 2.0 percent. Headline inflation is projected to run at the same pace as core inflation over the next three years. The forecast model's baseline forecast for the federal funds rate (Figure 4) is at the central tendency of the December 2020 SEP over the forecast horizon. The baseline forecast is as well at the market expectations, which call for the funds rate to remain at the ELB over the next few years.

Summary

The baseline NKDSGE model uses historical correlations in the data to generate its forecasts and does not incorporate significant judgmental adjustment. To model the economic effects of the pandemic, we have introduced judgement via short-lived shocks tailored to explain the

⁴ 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.

pandemic dynamics. The NKDSGE model also does not include released data—besides the federal funds rate—after the third quarter of 2020, and it does not explicitly account for any structural changes that may be induced by the economic response to the pandemic. Based on staff judgement, the model predicts a significant slowdown from the exceptionally strong growth in the third quarter. This is entirely expected as the economy moves toward more average growth. Near-term risks surrounding the third wave of the COVID pandemic are significant, however. The exercise in this document is best thought of as what might happen if the virus begins to wane and the economy steadily returns to its pre-virus structure. Those assumptions, however, remain in question. Congress appears ready to pass an additional fiscal stimulus bill—a development that is not incorporated in the current forecast. The fiscal package will likely boost growth modestly in the first half of 2021.

Figure 1: Real GDP Growth

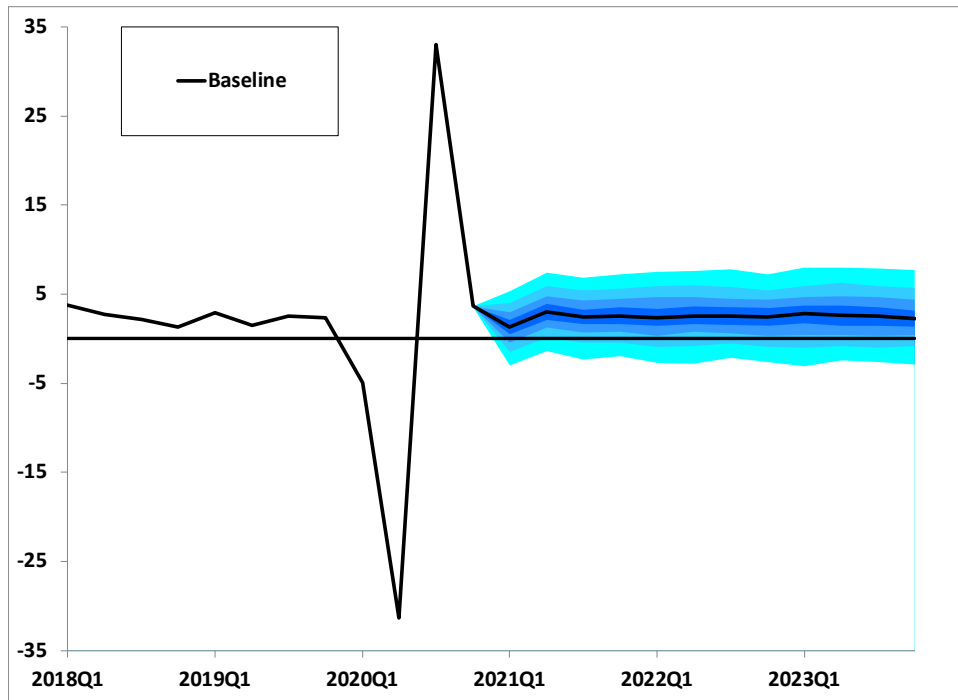


Figure 2: Core PCE Inflation

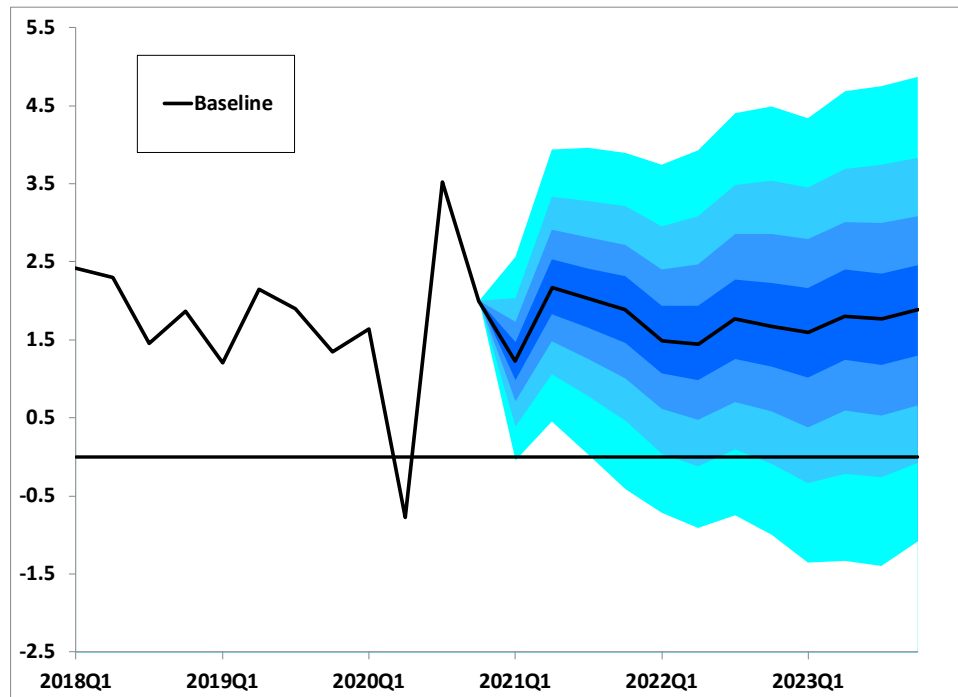


Figure 3: Unemployment Rate

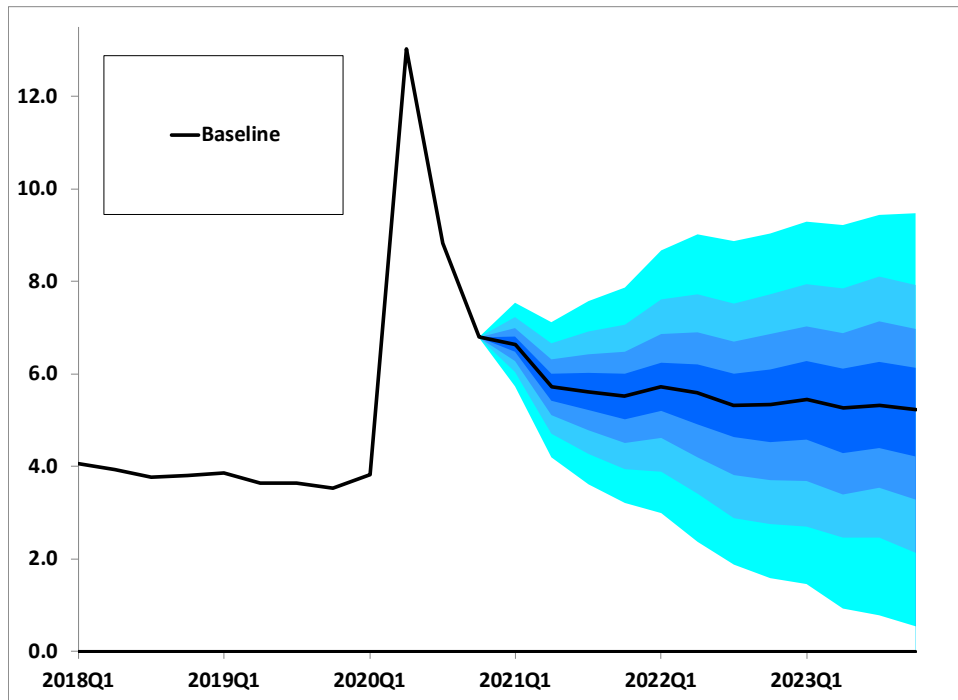


Figure 4: Federal Funds Rate

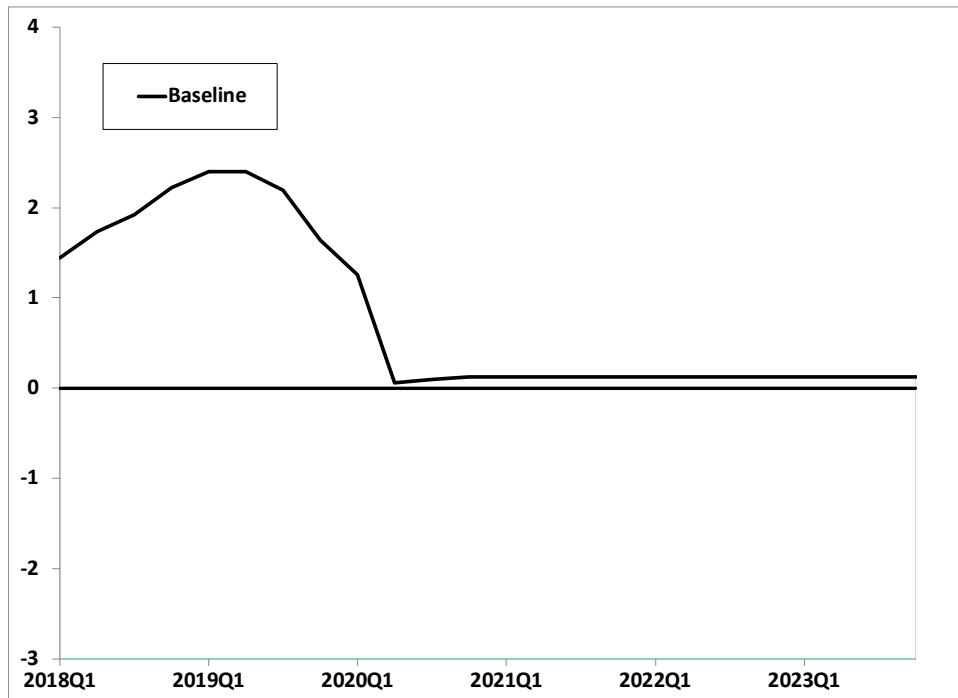


Figure 5: Baseline Forecast Comparisons

Figure 5a: Real GDP Growth

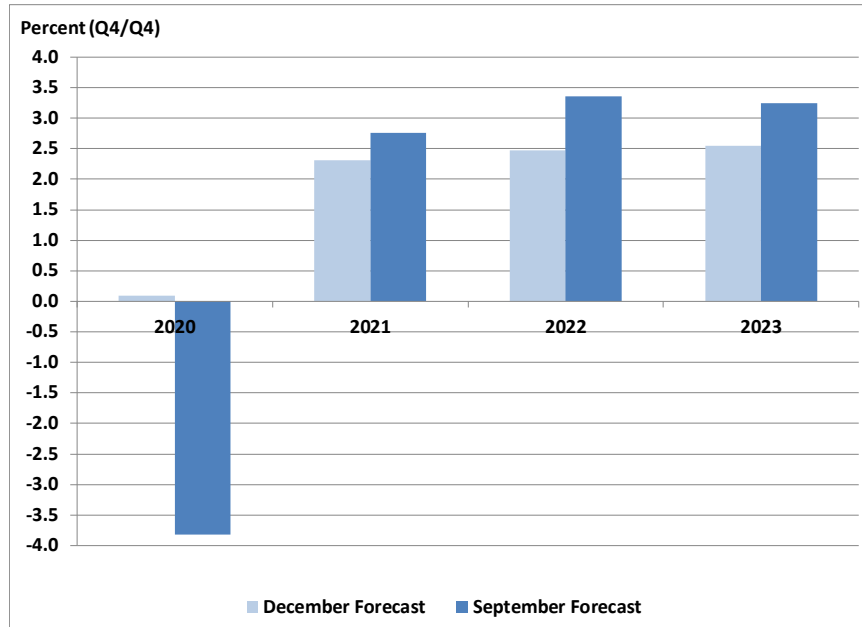


Figure 5b: Core PCE Inflation Growth

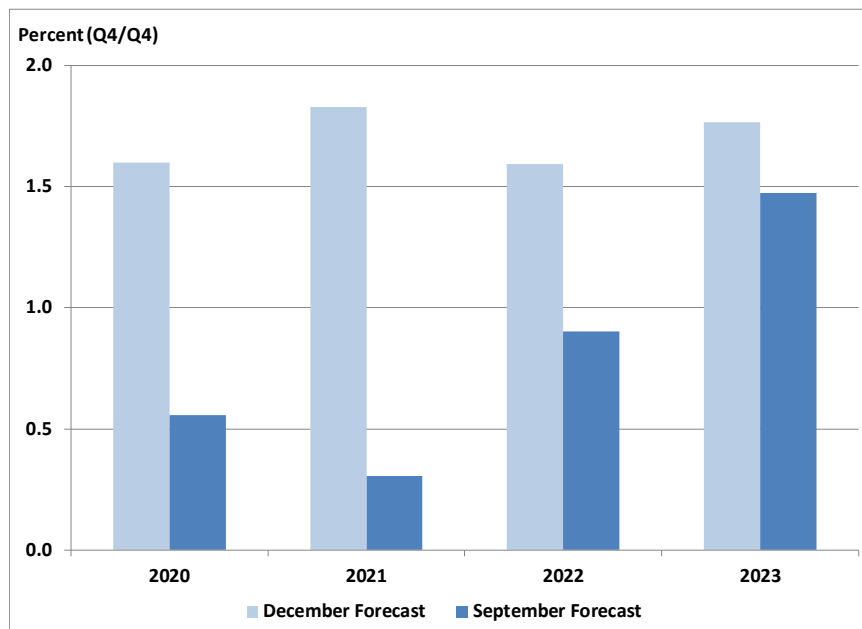


Figure 5c: Unemployment Rate

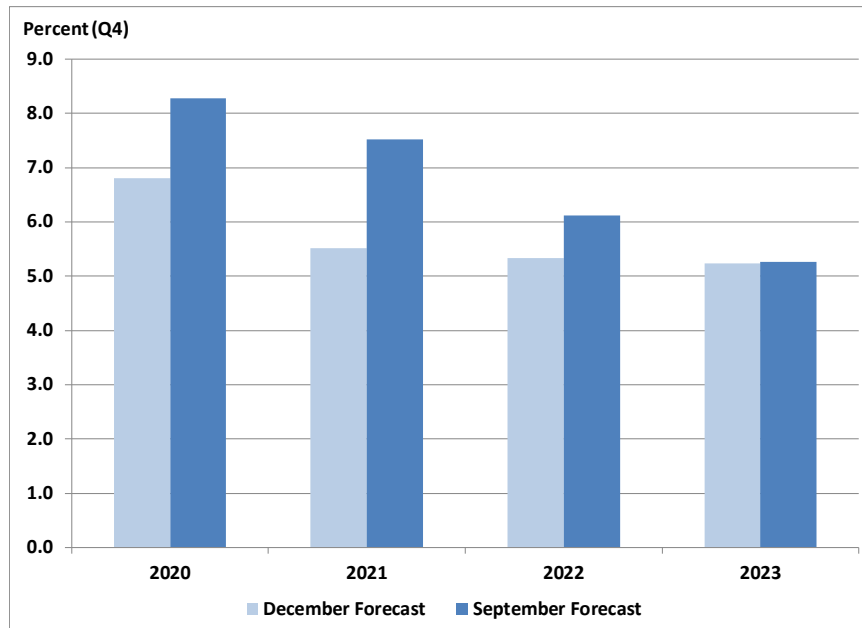
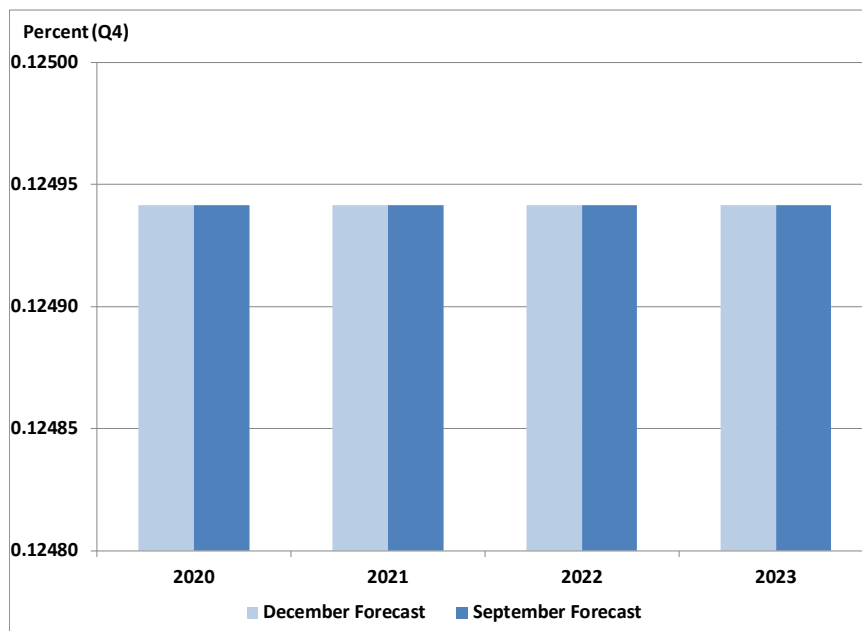


Figure 5d: Federal Funds Rate



Note: Historical data have been retrieved from Haver Analytics.