



20-5 A Program for Strengthening the Federal Reserve's Ability to Fight the Next Recession

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ABSTRACT

If the Federal Reserve does not decisively change the way it conducts monetary policy, it will probably not be capable of fighting recessions in the future as effectively as it fought them in the past. This reality helped motivate the Fed to undertake the policy framework review in which it is currently engaged. Researchers have suggested many steps the Fed could take to improve its recession-fighting ability; however, no consensus has emerged as to which of these steps would be both practical and maximally effective. This paper aims to fill that gap. It recommends that the Fed commit as soon as possible to a new approach for fighting recessions, involving two key elements. First, the Fed should commit that whenever it runs out of room to cut the federal funds rate further, it will leave the rate at its minimum level until the labor market recovers and inflation returns to 2 percent. Second, the Fed should commit that under the same circumstances, it will begin to purchase longer-term assets in volume and will continue such purchases until the labor market recovers. If the forces driving the next recession are not unusually severe, this framework might allow the Fed to be as effective at fighting that recession as it was in the past. If the next recession is more severe, however, the Fed will probably run out of ammunition even if it takes the two steps recommended here. Therefore, both monetary and fiscal policymakers should consider yet other steps they could take to enhance their ability to fight future recessions.

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The Federal Reserve probably will not be able to fight the next recession as vigorously as it would have a decade or two ago. The diminishment of the Fed's recession-fighting capability stems from the marked decline over the past several decades in the normal level of nominal interest rates.¹ With interest rates already close to zero, the Fed will have too little room to counteract the next economic downturn in the traditional manner—that is, by cutting the federal funds rate. If the Fed does nothing to restore its recession-fighting capacity, future recessions in the United States are likely to be longer and deeper, on average, than they otherwise would be.

Motivated in part by this reduced ability to fight recessions, the Federal Open Market Committee (FOMC) is in the midst of considering possible changes to its traditional policy framework.² As part of that process, according to the minutes the Committee has released, staff have been briefing the Committee on possible approaches to enhancing the toolkit available to monetary policymakers.³

Other commentators and analysts have contributed to the discussion of these issues. Former Fed Chair Ben Bernanke recently reviewed the Fed's experience with what he called “the new tools of monetary policy” during the Great Recession and assessed whether those tools will be capable of restoring the monetary policy space that was lost as a consequence of the decline in R^* , the level of the short-term real interest rate consistent with full employment and stable inflation.⁴ Looking back, he argues that by providing forward guidance about the future path of the federal funds rate and by purchasing large quantities of longer-term financial assets, the Fed prevented the financial crisis and Great Recession from developing into an even worse economic disaster. Looking forward, he argues that by building the use of these tools into its standard operating framework, the Fed will be capable of fighting future recessions with the effectiveness it had several decades ago, before the decline in R^* became a major factor.

We strongly agree that forward guidance and large-scale asset purchases will be essential components of the Fed's toolkit in coming years. However, forward guidance and large-scale asset purchases come in many different varieties. No consensus has emerged as to which of these varieties the Fed should adopt.

This paper aims to fill that gap. It recommends that at the conclusion of the current framework review, around mid-2020, the Fed commit to how it will fight recessions in the future. The recommended plan of action involves two key elements. First, the Fed should promise that once it has run out of room to cut the federal funds rate further, it will leave the rate at the minimum level

1 According to estimates generated by the Holsten, Laubach, and Williams (2017) model, the neutral level of the short-term real interest rate (often referred to as R^*) in the United States declined about 3½ percentage points over the past 50 years (see www.newyorkfed.org/research/policy/rstar.) The policy space available to central banks around the world, including in the United States, has shrunk by much more than indicated by the decline in R^* , because trend inflation declined markedly over the same period.

2 For more information about the Fed's framework review, see www.federalreserve.gov/monetarypolicy/review-of-monetary-policy-strategy-tools-and-communications.htm. Vice Chair Richard Clarida provided a useful update on the review in a recent speech (see www.federalreserve.gov/newsevents/speech/clarida20191114a.htm).

3 See, for example, p. 3ff in www.federalreserve.gov/monetarypolicy/files/fomcminutes20191030.pdf.

4 See www.brookings.edu/blog/ben-bernanke/2020/01/04/the-new-tools-of-monetary-policy/.

until the labor market recovers and inflation returns to 2 percent, and that after those two conditions are met, it will raise the federal funds rate only gradually. Second, the Fed should promise that under the same circumstances, it will begin to purchase longer-term assets in volume and will continue such purchases until the labor market recovers. Because clear communications will be key to making the recommended program effective, the paper provides a detailed roadmap for communicating key aspects of the strategy to the public.

Although these changes to the FOMC's policy framework would do much to mitigate the problems caused by the normal level of interest rates having become so low, they may not solve the problem entirely. Accordingly, fiscal policy may need to play a greater role in combating cyclical downturns than it has in the past. In addition, the Fed should consider raising its inflation objective by a moderate amount—a change that would, at least eventually, appreciably increase the FOMC's leeway for fighting future recessions by raising the normal level of nominal interest rates.

The rest of the paper is organized as follows. The next section examines the challenges the Fed confronts as a result of interest rates here and abroad having come down so markedly over the past several decades. It uses simulations of the Fed's FRB/US model to illustrate the added economic costs the low-rate environment imposes. Section 2 discusses in general terms how the Fed could use low interest rate guidance and quantitative easing (QE) to reduce those added economic costs. It briefly reviews the evidence on the effectiveness of those tools during the Great Recession and its aftermath. Section 3 uses model simulations to illustrate the potential capacity of specific forms of low interest rate guidance and QE to mitigate the macroeconomic impact of recessions. Section 4 broadens this analysis by reviewing results from various Monte Carlo simulation analyses that have assessed the likely ability of such tools to support real activity and check undesirable movements in inflation in response to a wide range of potential disturbances; this broader literature corroborates the view that the new tools could be quite effective. Section 5 turns to some of the practical considerations the FOMC would need to grapple with in designing a new policy framework that incorporates these tools. It lays the groundwork for the specific policy proposal provided in section 6. Reflecting the importance of clear communication, the recommendations in section 6 are organized around the communication vehicles the FOMC could use to inform the public about how it intends to conduct policy going forward. Section 7 offers some caveats as to why the new policy strategy—while clearly a big step in the right direction—may not take policymakers as far as they need to go. Section 8 therefore concludes that both monetary and fiscal policymakers may need to take other steps as well to prevent future recessions from becoming more severe and persistent.

1 THE PROBLEM UNDER THE STATUS QUO FRAMEWORK

Traditionally, the Fed has responded to economic downturns by cutting the federal funds rate. But if it continues in the traditional manner, without making any decisive changes to the way it conducts monetary policy, it will have less scope than it should have to counter the effects of the next recession. To illustrate this problem, we simulate the effects of a hypothetical recession that is roughly as severe as the typical post-World-War II recession in the United States.

For this exercise, as well as for the other simulations reported in this paper, we use FRB/US, a large-scale structural model of the US economy used extensively at the Fed for policy analysis. Several features of the model are worth highlighting. First, monetary policy influences real activity primarily through its effects on longer-term interest rates, equity prices, and the exchange rate; movements in short-term interest rates have little direct influence on spending. Second, aggregate spending responds only gradually to changes in financial conditions, because of adjustment costs and other frictions, limiting the Fed's ability to quickly offset adverse shocks to the economy. Third, inflation depends on expected inflation; movements in relative energy, food, and import prices; and resource utilization, as described by a New Keynesian Phillips curve. Fourth, the model allows for alternative assumptions about the manner in which households and firms form their expectations.⁵

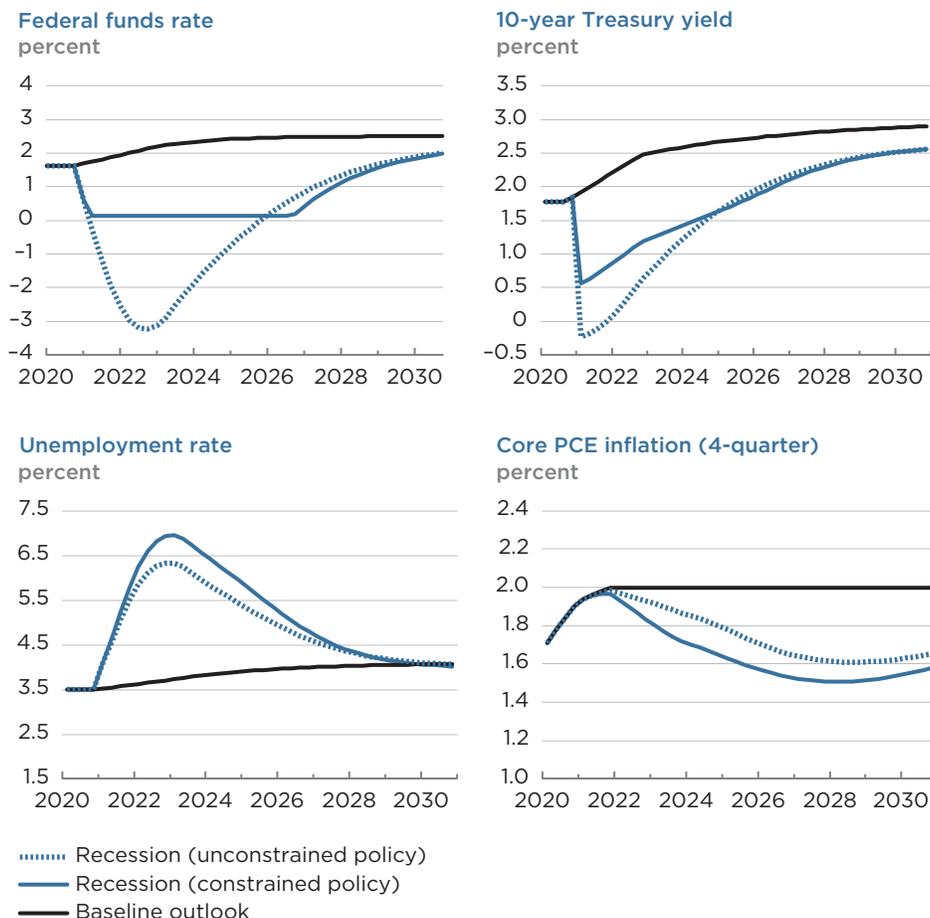
In the simulations reported in this paper, the baseline assumption is that expectations in financial markets are model-consistent and that investors fully understand the economic implications of changes in the way monetary policy is conducted. Households, nonfinancial firms, and wage and price setters are assumed to be less informed and to base their expectations on patterns in the historical data as reflected in the predictions of a small vector autoregression (VAR) model. (Later in the paper we consider the consequences of assuming that these agents are instead fully informed about monetary policy and its economic implications.)

In the absence of any recessionary shocks, as indicated by the black lines in figure 1, the economy would evolve in a way that is consistent with the medians of the projections released by FOMC participants in conjunction with their December 2019 meeting. This baseline outlook shows inflation converging to the FOMC's 2 percent target within the next two years and the unemployment rate and the federal funds rate somewhat more gradually edging up to their projected longer-run levels of 4.1 percent and 2.5 percent, respectively. Because FOMC participants do not release forecasts of longer-term interest rates, we base our projections of Treasury yields on the extended forecasts reported in the October 2019 Blue Chip survey, adjusted for actual readings through early December. These projections show nominal yields rising modestly over time, as the federal funds rate gradually rises and term premiums slowly return to levels more consistent with their historical averages.

We illustrate the challenges monetary policymakers will confront during the next recession by conducting two alternative simulations. In the first, monetary policymakers are free to conduct countercyclical policy roughly as they would have before the low level of nominal interest rates became a relevant aspect of the economic environment. Specifically, once the recession takes hold, the Fed adjusts the federal funds rate in the manner prescribed by a simple monetary policy rule known as the balanced-approach rule. We use this rule because it approximates the conduct of US monetary policy in the years before the Great

5 To generate the simulations reported in this paper, we use the version of the FRB/US model posted on the Federal Reserve Board's website in May 2019, except that the term premiums embedded in longer-term US Treasury yields have been exogenized. Full documentation of the FRB/US model is available at www.federalreserve.gov/econresdata/frbus/us-models-about.htm.

Figure 1
Recession scenario under traditional monetary policy as approximated by the balanced-approach rule, with and without the effective lower bound constraint on the nominal federal funds rate



PCE = personal consumption expenditures

Note: Results are based on simulations of the FRB/US model. The baseline outlook is designed to be consistent with the medians of Federal Open Market Committee (FOMC) participants' forecasts prepared for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Under the rule, monetary policy responds to changes from baseline in unemployment and inflation with coefficients of -2.0 and 1.5, respectively.

Recession.⁶ The dotted blue lines in figure 1 show the outcomes that could be achieved under this rule, assuming hypothetically that the FOMC is free to push the nominal federal funds rate below zero without limit. In this case, the policy rule prescribes responding to the rise in unemployment and fall in inflation by

6 The rule takes the form $I_t = R^* + \pi_t + 0.5(\pi_t - \pi^*) - 2(U_t - U^*)$, where I_t is the federal funds rate, R^* is the long-run level of the real federal funds rate, π_t is the four-quarter rate of core PCE inflation, π^* is the Fed's inflation target (currently 2 percent), U_t is the unemployment rate, and U^* is the rate of unemployment consistent with stable inflation in the longer run. The difference between U_t and U^* multiplied by -2 is approximately equal to the output gap, the percentage difference between real GDP and potential output. The balanced-approach rule was first proposed by John Taylor (1999). Then Vice-Chair Janet Yellen gave it its current name in 2012 (see www.federalreserve.gov/newsevents/speech/yellen20120606a.htm).

cutting the federal funds rate about 5 percentage points, much as it did in each of the past three recessions. The unemployment rate peaks at about 6.3 percent and averages 5.4 percent over the six years following the start of the recession. Core personal consumption expenditure (PCE) inflation eventually bottoms out at 1.6 percent.

As shown in the upper-left panel of figure 1, a notable feature of this first simulation is that the hypothetical unrestricted policy rule calls for responding to the recession by driving the federal funds rate more than 3 percentage points below zero. Because the nominal return on holding currency is zero, however, such a policy response would be impossible in practice. Although some foreign central banks have pushed their policy rates below zero in recent years (as low as -75 basis points, in the case of the Swiss National Bank), during the Great Recession and the subsequent slow recovery the FOMC took the target range for the federal funds rate only as low as 0-25 basis points. Such a floor is often referred to as the effective lower bound (ELB).

The second alternative simulation, the results of which are depicted by the solid blue lines, is conducted under the assumption that the FOMC will impose a similar floor under the federal funds rate during the next recession, assumed for simplicity to be equal to 12½ basis points.⁷ When the federal funds rate is prevented from falling below zero and the Fed does not take any other countervailing measures, the macroeconomic outcomes are distinctly worse: Between 2021 and 2026, the unemployment rate peaks at 7.0 percent and averages 5.9 percent.

The difference in macroeconomic outcomes between the two simulations gives a measure of the additional cost the ELB would impose if the Fed were to revert to the practice of fighting recessions strictly in the way that was traditional before the Great Recession—that is, using the current setting of the funds rate as the only tool of monetary policy. By this metric, the excess cost generated by the ELB is significant: The peak value of the unemployment rate is 0.7 percentage point higher when the ELB is imposed, and the average unemployment rate over the first six years is half a percentage point higher. In the wake of a deeper and more prolonged economic slump, the incremental unemployment cost of the ELB would be appreciably greater.⁸ The incremental cost imposed by the ELB would also be greater if policymakers wished to respond more vigorously to economic downturns than prescribed by the balanced-approach rule.⁹

7 Under this assumption, the rule guiding policy is $I_t = \max\{0.125, R^* + \pi_t + 0.5[\pi_t - \pi^*] - 2.0[U_t - U^*]\}$.

8 In the analysis below of the efficacy of low interest rate guidance and QE, we consider a more severe and persistent downturn, in which the unemployment rate peaks at 7.4 percent under the balanced-approach rule if there is no lower bound on the federal funds rate (see figure 5). When interest rates cannot fall below zero in this scenario, between 2021 and 2026 the unemployment rate peaks at 8.7 percent and average unemployment is 1.2 percentage points higher than under a traditional unconstrained policy.

9 Such would be the case, for example, if the FOMC were to choose the path of the federal funds rate that minimizes the discounted sum of squared deviations of unemployment and inflation from their baseline paths, subject to a penalty on quarter-to-quarter movements in interest rates. If not constrained by the lower bound on nominal interest rates, such an “optimal” strategy would call for cutting the federal funds rate much more than the balanced-approach rule would indicate during a moderate recession, causing unemployment to peak at only 5.2 percent. However, the success of this “optimal” approach deteriorates substantially with the imposition of the lower-bound constraint. In that case, even though the federal funds rate would stay near zero for many years, the unemployment rate would peak at 6.8 percent between 2021 and 2026 and average unemployment would increase by almost 1½ percentage points relative to the unconstrained “optimal” policy.

In contrast to its effects on unemployment, the excess cost imposed by the ELB in terms of inflation performance is relatively modest, primarily reflecting the marked decline in the sensitivity of inflation to economic slack over the past 30 years—a development manifested in the model’s relatively flat Phillips curve. But it also reflects an assumption that the long-run inflation expectations of wage and price setters in the simulation are partially anchored by the Fed’s announced 2 percent inflation objective.¹⁰

More comprehensive Monte Carlo analyses carried out using FRB/US and other models corroborate the illustrative results shown in figure 1. These studies, which estimate the distribution of possible future economic outcomes, taking account of a wide range of potential disturbances to the economy, find that when the normal level of interest rates is low and monetary policy follows the Fed’s traditional approach, ELB episodes occur frequently and cause average economic performance to deteriorate. For example, Kiley and Roberts (2017) estimate that if the normal level of the federal funds rate is 3 percent and the FOMC follows the prescriptions of the balanced-approach rule, then the federal funds rate will be stuck at zero at least one-third of the time, with the average ELB episode lasting almost three years. They also find that these frequent ELB episodes cause the mean unemployment rate (averaged across good times and bad) to be ½ to 1 percentage point above its sustainable level, mean inflation to be 0.8 percentage point below the FOMC’s target, and the variability of both real activity and inflation to be appreciably higher than if monetary policy were unconstrained.

Using an inertial version of the balanced-approach rule, Bernanke (2020) obtains even more alarming estimates for the frequency and duration of ELB episodes and the associated deterioration in economic performance if the normal level of the federal funds rate is only 2 percent, as some lower-end estimates suggest could now be the case. In contrast, Chung et al. (2019) estimate that the federal funds rate will be trapped at zero “only” 15 percent of the time if the normal level of interest rates remains as low as currently projected, but they too find that the ELB constraint causes future economic downturns to be appreciably deeper and longer under the Fed’s traditional policy framework.¹¹

10 Specifically, we assume that the long-run inflation expectations of wage and price setters and others outside the financial sector evolve according to the formula $\pi_t^e = 0.9\pi_{t-1}^e + 0.05\pi_{t-1} + 0.05\pi^*$, where π_t^e is the expected long-run rate of inflation, π_{t-1} is the lagged rate of core PCE inflation, and π^* is the FOMC’s inflation goal. Relative to purely adaptive expectations, this assumption is more consistent with the stability of survey measures of expected long-run inflation seen over the past 25 years.

11 As Chung et al. document, their lower estimate of the frequency of ELB events partly reflects a more powerful role for countercyclical fiscal policy in their analysis than in the Kiley-Roberts and Bernanke studies; it also reflects their assumption that only financial market participants and wage and price setters have model-consistent expectations (the other two studies assume that all agents in the economy have them). Earlier studies, such as Reifschneider and Williams (2000) and Williams (2009), were much more sanguine about ELB costs than recent studies, primarily because they employed estimates of the equilibrium real federal funds rate that were much higher than those currently estimated.

2 GENERAL EFFECTS OF LOW INTEREST RATE GUIDANCE AND QUANTITATIVE EASING

Researchers have proposed various ways to mitigate the adverse consequences of the ELB for macroeconomic performance. Two tools that have been studied extensively are low interest rate guidance and QE.¹² As Bernanke noted in his 2020 American Economic Association presidential address, the FOMC could integrate these tools into its policy framework by pledging to do two things whenever it has run out of room to cut the federal funds rate further. First, it could pledge to keep the federal funds rate near zero until the economy has substantially recovered. Second, it could initiate a QE program that involves buying substantial volumes of longer-term securities and financing those purchases by increasing bank reserves held at the Fed. Although the Fed and other central banks experimented with both tools during the Great Recession and its aftermath, no central bank has yet gone so far as to commit to employ them aggressively whenever necessary.

Why would committing to take these two steps help the Fed be more effective in combatting a future recession? For low interest rate guidance, the simple answer is that it would alter expectations of how the Fed will behave the next time a recession strikes. If financial market participants understand and believe the Fed's commitment to respond to a recession by holding the federal funds rate at the ELB until the economy has substantially recovered, they will drive longer-term interest rates lower than those rates would otherwise go when a recession takes hold. These altered policy expectations and lower longer-term interest rates would also cause stock prices to be higher, the exchange value of the dollar to be lower, and other financial conditions to be more favorable during the downturn. Such an easing in overall financial conditions would in turn provide more support for consumer spending, business and residential investment, and net exports, even though the federal funds rate was pinned at zero.¹³

As Bernanke (2020) notes, movements in financial data support the view that the interest rate guidance provided by the Fed in the wake of the financial crisis appreciably influenced policy expectations and helped to ease overall financial conditions, especially from 2011 on, when the guidance became more explicit and aggressive. For example, he finds that following the release of the FOMC statements for the August 2011 and January 2012 meetings, both of which contained important advisories about the likely date of liftoff, yields on longer-term Treasuries, mortgage-backed securities (MBS), and corporate bonds fell 10–27 basis points and stock prices rose 5.6 percent. Raskin (2013) documents

12 Studies that provide a theoretical analysis of one or both of these tools include Krugman (1998), Woodford (2012), and Bernanke (2020). Studies that provide a quantitative analysis of their efficacy (in general or after the financial crisis) include Reifschneider and Williams (2000); Williams (2009); Chung et al. (2012); Coibion, Gorodnichenko, and Wieland (2012); Engen, Laubach, and Reifschneider (2015); English, Lopez-Salido, and Tetlow (2015); Reifschneider (2016); Bernanke, Kiley, and Roberts (2017); Kiley and Roberts (2017); Burlon, Notarpietro, and Pisani (2018); Kiley (2018); Chung et al. (2019); Eberly, Stock, and Wright (2019); Sims and Wu (2019); and Bernanke (2020).

13 Conceivably, low interest rate guidance and large-scale asset purchases could also directly boost actual inflation, by raising the long-run inflation expectations of wage and price setters. Model-based studies of the effects of interest rate guidance and QE typically allow for this possibility. However, evidence for this type of expectational effect is slim at best outside of financial markets. We therefore make no provision for it in our baseline simulation analysis.

the effects of the FOMC calendar-based guidance on interest rate options. Carvalho, Hsu, and Nechio (2016) show that Fed communications about the future path of the federal funds rate from late 2008 on influenced long-term interest rates appreciably.

Large-scale asset purchases would enable the FOMC to put additional downward pressure on longer-term interest rates during recessions, although the mechanism is somewhat different. How do they work? Several channels appear to be relevant. One channel involves the interaction of supply and demand for different types of securities (in this context, often referred to as a portfolio-balance or preferred-habit mechanism; see Vayanos and Vila 2009). The Fed's purchases reduce the supply of long-duration assets to the market, causing the term premiums embedded in the prices of those assets to decline—an effect shown by Li and Wei (2013) to be empirically significant in the context of an arbitrage-free term structure model. A second channel is the improved financial market functioning induced by the asset purchases. This channel appears to have been operative from late 2008 through mid-2010, a time of heightened stress. During this period, the Fed's purchases of MBS appear to have eased strains in the residential mortgage market. A third channel is the signal of the central bank's determination to provide additional accommodation that asset purchases may provide, which may prompt investors to revise down their expectations for the future path of short-term interest rates.

As discussed in Kuttner's (2018) survey of the literature on QE, the Fed's purchases of longer-term Treasuries and agency MBS from late 2008 through 2015 appear to have directly reduced the yields on those securities appreciably. Those reductions in turn influenced corporate bond yields, equity prices, and other financial instruments, via arbitrage effects.¹⁴ Appreciable effects are also found for the QE actions taken by the European Central Bank (ECB), the Bank of England, and other central banks. Perhaps not surprisingly, given the limited experience with the use of this tool and the different techniques used to gauge its effects (which include event studies, arbitrage-free term structure models, and less restricted time series analyses), estimation results vary considerably across studies. That said, overall the empirical evidence is consistent with the rule of thumb used in Bernanke (2020) and several other studies that each \$1 trillion in purchases of longer-term assets by the Fed reduced the term premium on 10-year securities by about 40 basis points. The first QE program may have had somewhat larger effects because (as noted above) it came at a time of significant market dysfunction.¹⁵

Studies find that these QE-related financial market effects, combined with the FOMC's slowly evolving guidance about the future path of the federal funds rate, provided considerable support to real activity over time and checked

14 The Federal Reserve has the legal authority to buy only a limited range of securities; for the most part, it is restricted to securities issued by the Treasury and government-sponsored housing finance agencies. The ECB and the Bank of Japan have the authority to buy a wider range of securities, including privately issued ones.

15 During the Great Recession and the slow recovery that followed it, the Fed increased its holdings of longer-term Treasury and agency securities by about \$4 trillion, or roughly 20 percent of GDP. Several other central banks carried out similar or even larger QE operations relative to the size of their economies; in the case of the ECB and the Bank of Japan, such purchases are ongoing. Gagnon and Collins (2019) provide an overview of international experience with the use of QE, including recent actions by the ECB and the Bank of Japan.

disinflationary pressures in the wake of the Great Recession. For example, Engen, Laubach, and Reifschneider (2015) estimate that the Fed's interest rate guidance and asset purchases gradually reduced the unemployment rate by 1.2 percentage points and boosted inflation by 0.5 percentage point relative to what they would have been in the absence of these actions. Using a different evaluation procedure, Eberly, Stock, and Wright (2019) reach essentially the same conclusion about the overall effect of the Fed's policies on unemployment but obtain inflation effects that are much smaller, primarily because the model used in their analysis incorporates an extremely flat Phillips curve.

Because interest rate guidance works exclusively through expectations and the effects of QE depend importantly on market beliefs about the evolution of the Fed's portfolio, communication would play a critical role in making the two-pronged strategy maximally effective. If the FOMC does not make clear before a recession has begun that it intends to keep the federal funds rate very low for an extended period and implement an aggressive QE program, but instead waits until the downturn is underway or the economy has begun to recover, the effectiveness of this strategy will be impaired. Engen, Laubach, and Reifschneider (2015) estimate that the stimulus provided by the Fed's unconventional policy actions would have been larger and would have emerged much more quickly if financial market participants had fully anticipated in late 2008 just how long the FOMC would keep the federal funds rate unusually low and the extent to which it would ultimately expand its portfolio. In light of these considerations and history, it would be very much in the interest of the FOMC and the public to be as clear as possible about the factors that will guide its rate-setting behavior and asset purchases in the event of a recession.

Researchers have suggested other ways to mitigate the ELB problem (space limitations prevent us from exploring them in this paper). In a previous study (Reifschneider and Wilcox 2019), we discussed one frequently mentioned alternative to the Fed's current policy framework: average inflation targeting. We concluded that by itself this approach would probably not do much to improve the FOMC's ability to combat a recession and that it would have the unpalatable feature of often requiring the Fed to tighten in response to idiosyncratic wage and price shocks that posed no threat to longer-run price stability.¹⁶

Another possibility would be for the FOMC to push the federal funds rate somewhat below zero in the event of an economic downturn, as the ECB and several other central banks have done, thereby providing a modest degree of additional support to the economy. Although the FOMC declined to go this route during the Great Recession and FOMC participants have expressed little interest in the idea more recently, we view it as a viable option that the FOMC should not categorically rule out, even if we do not allow for it in our illustrative simulations.

¹⁶ As we note in Reifschneider and Wilcox (2019), related strategies that target the price level or the level of nominal GDP have the same drawback of calling for monetary policy to tighten (and thereby boost unemployment) in response to positive innovations in prices even when those innovations are not expected to have a persistent effect on inflation. Moreover, most of the analyses suggesting that such strategies would be effective in stabilizing the economy make the questionable assumption that most or all agents in the economy, not just financial market participants, have model-consistent expectations.

The FOMC could take another path to loosening the ELB constraint: raising its inflation target. Current and former policymakers have so far rejected this very consequential step, which could provide considerably more space to ease once expectations and interest rates fully adjust.¹⁷

3 ILLUSTRATIVE EXAMPLES OF LOW INTEREST RATE GUIDANCE AND QUANTITATIVE EASING IN ACTION

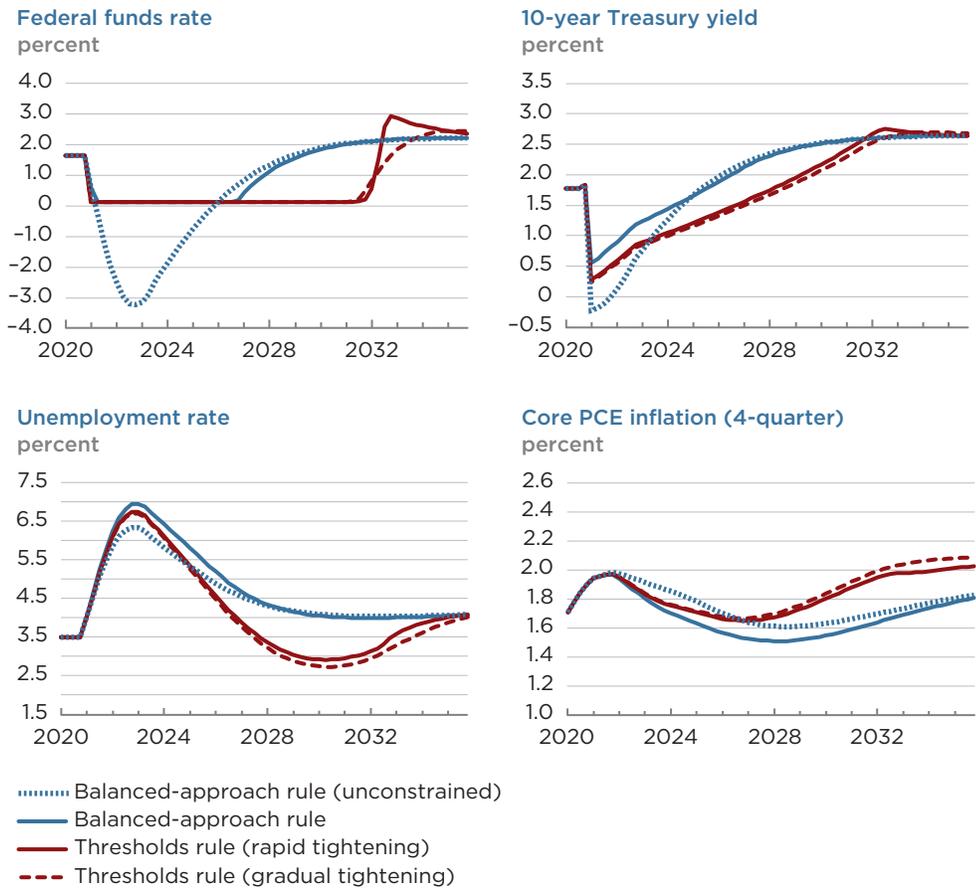
To provide a sense of the potential benefits of incorporating asset purchases and low interest rate guidance into the FOMC's standard approach for dealing with recessions, we consider some examples of how their deployment could affect outcomes in the recession scenario that formed the basis for figure 1. These examples are meant to be illustrative only, as they involve using the two tools in mechanical ways that the FOMC would presumably never adopt in the form represented here. But lessons gleaned from these illustrative simulations and more comprehensive studies inform the framework proposal we present later in the paper.

We begin by assuming that before the recession, the FOMC pledges that in the event weak economic conditions cause it to lower the target range for the federal funds rate to 0–25 basis points, it will maintain that target range until the economy has substantially recovered. Specifically, it commits to keeping the federal funds rate near zero until the four-quarter rate of core PCE inflation is at or above 2 percent and the unemployment rate is at or below the median FOMC participant's estimate of its long-run sustainable rate (4.1 percent as of December 2019). The FOMC also advises that once both of these conditions are satisfied, it will immediately revert to its normal policy, as described by the balanced-approach rule. Financial market participants are assumed to view this guidance as completely credible, to understand fully its economic implications, and to revise their expectations accordingly when the recession begins.

The solid red lines in figure 2 show the implications of committing to this “thresholds” rule in the event of a recession, assuming that the FOMC does not engage in asset purchases. Relative to the balanced-approach rule, this policy prescribes holding the federal funds rate near zero for much longer, because of the very slow return of inflation to 2 percent in the scenario (unemployment recovers much more quickly). However, once the inflation threshold condition is finally satisfied, policy quickly tightens. Financial market participants, who recognize these implications of this thresholds rule, immediately push the 10-year Treasury yield close to zero at the start of the recession and keep it on a lower trajectory thereafter. The accompanying greater decline in borrowing costs, increase in stock prices, and fall in the dollar in turn provide a bigger boost to consumption, investment, and net exports. As a result, the labor market rebounds more vigorously and inflation recovers more quickly.

17 For evidence of the Fed's apparent distaste for negative interest rates, see Chair Powell's remarks at his press conference in September 2019 (www.federalreserve.gov/mediacenter/files/FOMCpresconf20190918.pdf, p. 27). For FOMC views on the advisability of raising the inflation target, see Chair Powell's remarks at the post-meeting press conference in June 2019 (www.federalreserve.gov/mediacenter/files/FOMCpresconf20190619.pdf).

Figure 2
Recession scenario under the thresholds rule, with and without unusually gradual tightening post-liftoff



PCE = personal consumption expenditures

Note: Results are based on simulations of the FRB/US model. The baseline outlook is designed to be consistent with the medians of Federal Open Market Committee (FOMC) participants' forecasts prepared for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Monetary policy responds to changes from baseline in unemployment and inflation as prescribed by the various rules. For the thresholds rule, policy reverts to either the balanced-approach rule or an inertial version of that rule once both threshold conditions are satisfied (inflation > 2 percent and unemployment < 4.1 percent).

Under this policy, once the federal funds rate begins to rise, it does so very rapidly. Promising to proceed more slowly in removing accommodation—in fact, more slowly than typically seen in past tightening episodes—would have the advantage of marginally further increasing the downward pressure on longer-term interest rates. The dashed red lines in figure 2 illustrate the effects of such a modified thresholds rule, under which the FOMC only gradually brings the level of the federal funds rate back in line with the prescriptions

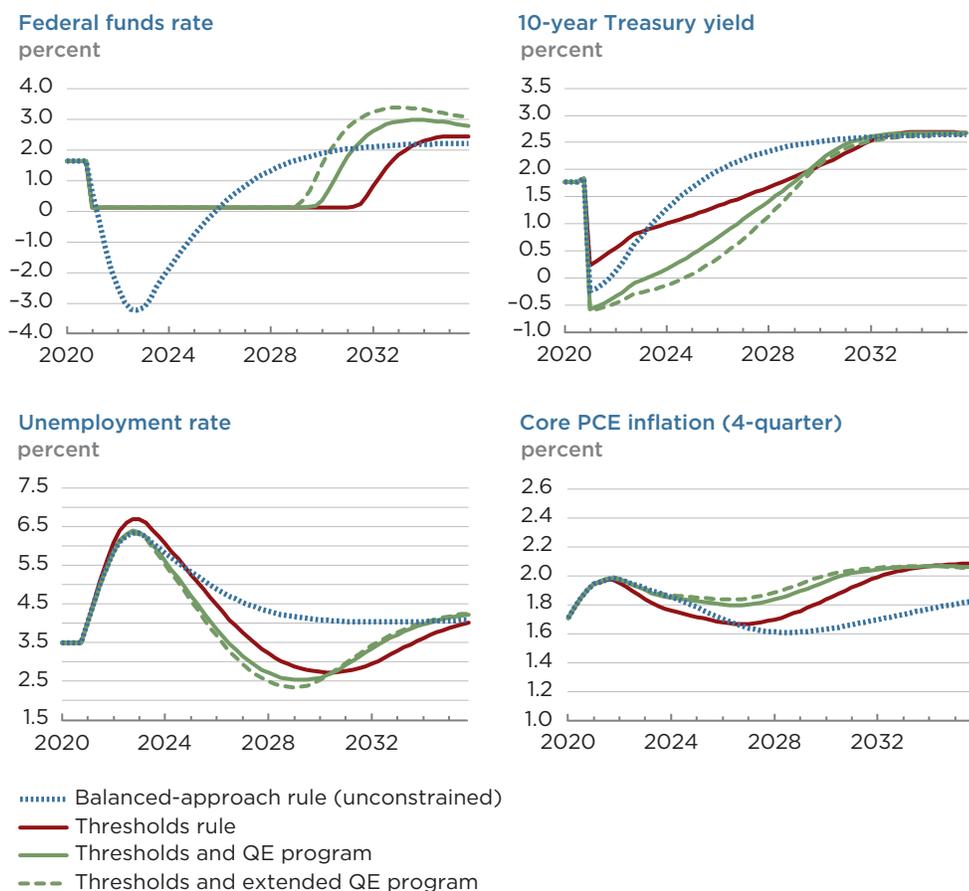
of the balanced-approach rule after liftoff.¹⁸ Because investors anticipate that the threshold conditions will not be satisfied until 10 years after the downturn begins, the promise to remove accommodation at an unusually slow pace has little effect on longer-term interest rates at the start of the recession. But market expectations for a more gradual approach to tightening eventually promote modestly easier financial conditions, which in turn result in somewhat stronger labor market conditions and higher inflation over time. The additional stimulus from a commitment to post-liftoff gradualism would be more frontloaded if financial market participants anticipated an appreciably earlier liftoff in the federal funds rate, as would be the case if factors not considered in this scenario led them to expect a faster return of inflation to 2 percent. Pledging to remove accommodation only gradually would also be more important if the thresholds guiding liftoff were less stringent than the illustrative ones considered here.

We build on these results by considering how outcomes in the recession scenario change when the modified thresholds rule is augmented by a commitment to buy longer-term assets in volume whenever the federal funds rate falls below 25 basis points. Specifically, we assume for purposes of this simulation that the FOMC pledges that it will begin buying longer-term securities at a pace of \$210 billion per quarter and will continue to do so until the unemployment rate has fallen back to its long-run sustainable level. Once that condition has been satisfied, the Fed keeps the overall size of its portfolio constant by reinvesting principal payments until the FOMC decides to begin raising the federal funds rate, at which point the Fed's holdings of longer-term securities are allowed to run off passively.

For simplicity, we assume that this illustrative QE program involves buying Treasury securities with effective maturities of 5–30 years but not agency MBS (in practice, the Fed would likely purchase both types of securities). We calculate the effects of these purchases on longer-term interest rates using a simplified version of the methodology developed and used by Federal Reserve Board staff. As described in Ihrig et al. (2018), the Board staff approach uses the term structure model developed by Li and Wei (2013) to link the level of the term premium embedded in an n -period bond to the (discounted) expected future path of the stock of Fed asset holdings, expressed as 10-year-equivalents and scaled by nominal GDP (for details, see appendix A). An important implication of the Li-Wei model is that when the recession hits, term premiums immediately drop markedly in response to the market's (correct) expectation that the Fed's portfolio will expand significantly over time under the QE program. Other than these term premium effects, the simulations do not incorporate any other direct influence of asset purchases on financial conditions, such as signaling or improved market functioning.

18 Specifically, the post-liftoff rule is $I_t = \max\{0.125, 0.9I_{t-1} + 0.1[R^* + \pi_t + 0.5(\pi_t - \pi^*) - 2.0(U_t - U^*)]\}$. The heavy weight placed on I_{t-1} implies that five years after liftoff, the federal funds rate would have moved about 90 percent of the way back to the level prescribed by the balance-approach rule. This degree of inertia would be greater than that observed during past Fed tightening episodes. For example, English, Nelson, and Sack (2003) report coefficients on the lagged federal funds rate in estimated Taylor-type rules that are in the vicinity of 0.7. Rudebusch (2006) presents evidence suggesting that estimates of the sort found by English, Nelson, and Sack are an artifact of omitted variables important to policymaking and that historically the FOMC has displayed little or no inertia in responding to changes in economic conditions.

Figure 3
Recession scenario under the thresholds rule, with and without quantitative easing

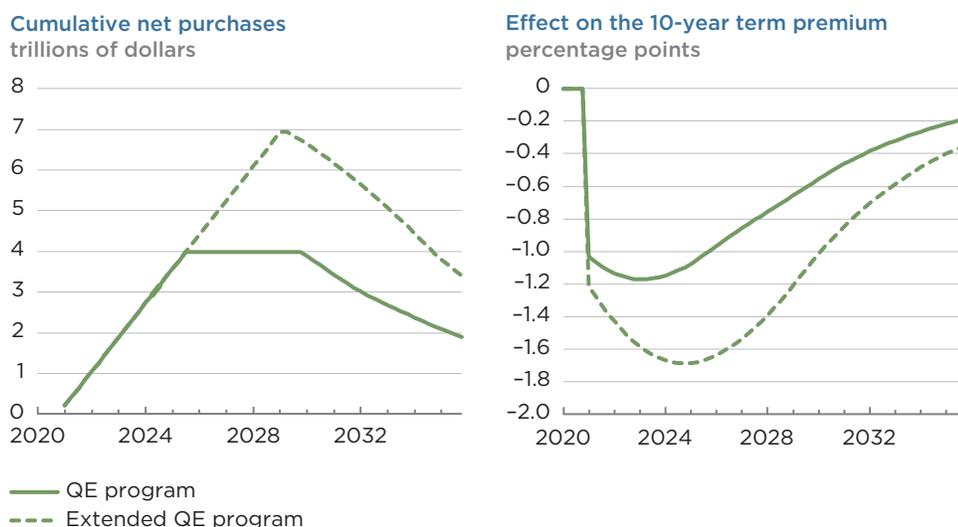


PCE = personal consumption expenditures; QE = quantitative easing

Note: Results are based on simulations of the FRB/US model. The baseline outlook is designed to be consistent with the medians of Federal Open Market Committee (FOMC) participants' forecasts prepared for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Monetary policy responds to changes from baseline in unemployment and inflation as prescribed by the various rules. For the thresholds rule, policy reverts to the prescriptions of the inertial version of the balanced-approach rule once inflation reaches 2 percent and unemployment falls below 4.1 percent. The quantitative easing (QE) program is to buy \$210 billion per quarter in longer-term Treasury securities until unemployment falls to 4.1 percent, while the extended QE program continues buying at this pace until inflation reaches 2 percent.

As indicated by the solid green lines in figure 3, the combined policy drives the 10-year Treasury yield substantially into negative territory at the start of the recession, by even more than occurs under the hypothetical policy described by the balanced-approach rule with no floor imposed on the federal funds rate. (In the discussion of possible limitations on the efficacy of QE and interest rate guidance below, we discuss the feasibility of negative bond yields.) As a result, the peak in unemployment is no higher than occurs under the unconstrained balanced-approach rule, and the subsequent recovery in labor market conditions is much stronger. Inflation remains closer to 2 percent during the recession and later overshoots the FOMC's long-run objective modestly, so that average inflation in 2021–35 is close to 2 percent. Overall, we view these outcomes under the combination strategy as clearly better than those achieved under

Figure 4
Quantitative easing program’s effect on the size of the Fed’s balance sheet and term premium in the recession scenario



QE = quantitative easing

Note: The quantitative easing (QE) program is to buy \$210 billion per quarter in longer-term Treasury securities until unemployment falls to 4.1 percent, while the extended QE program continues buying at this pace until core inflation reaches 2 percent. Under both programs, principal payments are reinvested until the federal funds rate rises above 25 basis points; holdings in 10-year equivalents scaled by nominal GDP, where the discounting weights are derived from the Li-Wei term structure model thereafter holdings run off passively. Term premium effects are inversely related to the weighted sum of current and future Fed holdings in 10-year equivalents scaled by nominal GDP, where the discounting weights are derived from the Li-Wei term structure model. See appendix A for additional details.

the other policies shown in figure 3, as there is no inherent drawback in having unemployment move well below its long-run sustainable level if inflation remains well contained (far from it). Moreover, the better economic performance in this simulation means that the threshold conditions are satisfied somewhat more quickly (within 8 years rather than 10), resulting in an earlier liftoff of the federal funds rate than occurred under the forward-guidance policy alone—an advantage from a credibility perspective.

The earlier initiation of tightening is made possible by the additional impetus provided by a large increase in the size of the Fed’s portfolio, as illustrated in figure 4. Under the QE program, asset purchases cumulate to \$4 trillion. Relative to baseline, the 10-year term premium falls by an estimated 100 basis points or so at the start of the recession and by somewhat more over the next few years.¹⁹ Thereafter, the term premium effect begins to dissipate, as the average duration

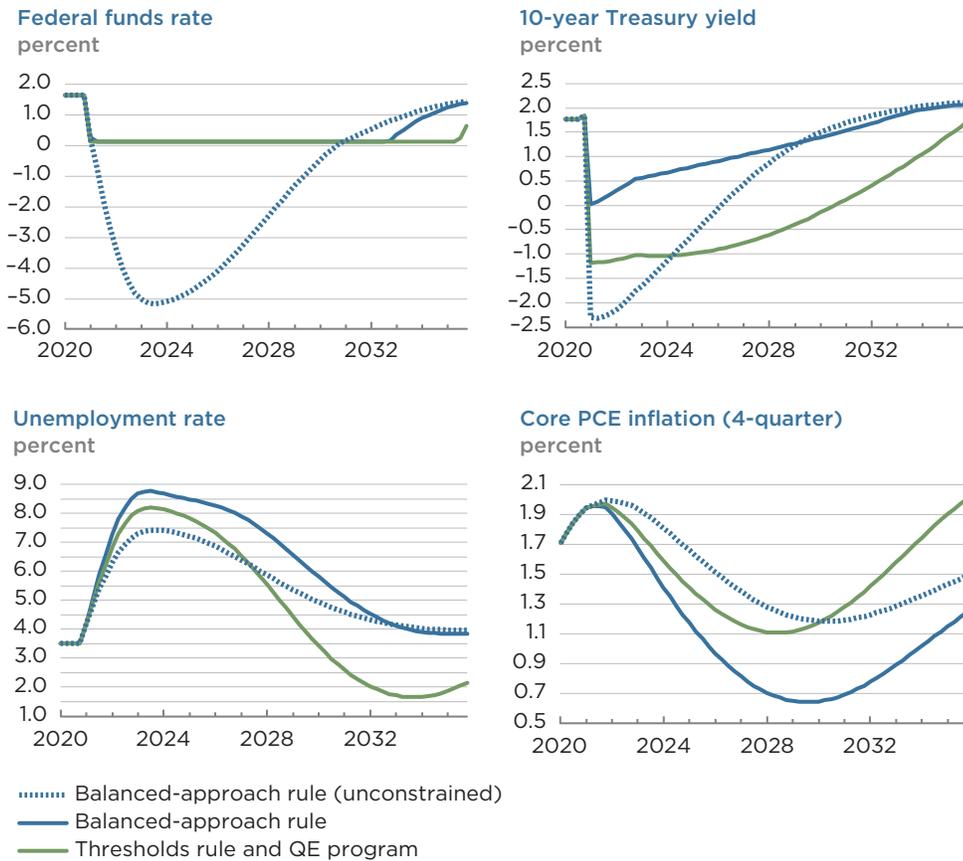
19 As noted earlier, discussions of QE effects often employ the rule of thumb that \$1 trillion in longer-term asset purchases reduces the 10-year term premium by about 40 basis points, a figure that is consistent with estimates from studies of the effects of the Fed’s past QE operations, including by Ihrig et al. (2018). Our term premium effects imply a figure closer to 30 basis points, even though we use the same general methodology as that study. The reason for the apparent discrepancy is that in the Li-Wei term structure model, Fed holdings are scaled by the size of the economy. As time passes, nominal GDP increases, implying that a cumulative \$4 trillion purchase program ending in 2025 is smaller relative to the size of the economy than the same-size program would have been in the past.

of the Fed's holdings under the program declines, the size of its balance sheet relative to nominal GDP gradually falls, and the date of renormalization draws nearer. On average, the combination of the thresholds rule and the QE program reduces the 10-year Treasury yield by 2.5 percentage points during the first four years following the onset of the recession relative to its trajectory under the baseline (no-recession) outlook; under the thresholds rule without any QE program, the average reduction from 2021 to 2024 is only 1.7 percentage points.

Given that the thresholds rule holds the federal funds near zero until both the labor market and inflation have fully recovered, why not impose a similar condition on buying assets? As illustrated by the dashed green lines in figure 4, because inflation is slower to recover than employment in the recession scenario, such an extended QE program would cause cumulative purchases to peak at \$7 trillion. Such a large increase in the size of the Fed's balance sheet in response to what is only a moderate recession might by itself be a concern to FOMC participants. But the value of extending buying by three and a half years seems especially questionable given that doing so provides little or no additional support to real activity and inflation, as indicated by the dashed green lines in figure 3. Even though the expected higher cumulative level of purchases under the extended QE program results in an appreciably lower level of the term premium over time, the effect on bond yields of the additional decline in premiums is offset by an upward shift in the expected future path of the federal funds rate. In essence, past some point the continuation of asset purchases in the scenario results in QE acting as a substitute for rather than a complement to low interest rate guidance (as is the case for purchases early on). Because an eventual swing from complements to substitutes is a general property of the use of these two tools, committing to a QE strategy that suspends asset purchases well before liftoff is probably advisable.

Taken at face value, these results would seem to suggest that a combination of low interest rate guidance and QE could readily overcome the ELB problem for a moderate recession. But that conclusion would not necessarily hold for a deeper and more persistent recession. Figure 5 presents a severe recession scenario in which, under the unconstrained balanced-approach rule, the unemployment rate peaks at 7.4 percent (still appreciably lower than in the Great Recession) and inflation gradually falls to 1.2 percent. Under these conditions, the combination strategy calls for holding the federal funds rate at the ELB for almost 15 years and expanding the Fed's balance sheet by more than \$7 trillion. Because financial market participants are assumed to be completely confident that the FOMC will undertake these extraordinary actions, the combination strategy causes the 10-year Treasury yield to run well below zero for more than nine years. But even that is not enough to prevent the unemployment rate from peaking at a level well above the one that could theoretically be obtained under unconstrained policy. That said, low interest rate guidance and asset purchases still produce much better outcomes than those obtained under the FOMC's traditional policy approach.

Figure 5
Severe recession scenario under the balanced-approach rule and the thresholds rule with quantitative easing



PCE = personal consumption expenditures; QE = quantitative easing
 Note: Results are based on simulations of the FRB/US model. The baseline outlook is designed to be consistent with the medians of Federal Open Market Committee (FOMC) participants' forecasts prepared for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Monetary policy responds to changes from baseline in unemployment and inflation as prescribed by the various rules. Under the thresholds rule and QE program, policy follows the prescriptions of the inertial version of the balanced-approach rule once inflation reaches 2 percent and unemployment falls below 4.1 percent. The quantitative easing (QE) programs is to buy \$210 billion in longer-term Treasury securities per quarter until unemployment falls to 4.1 percent.

4 GENERAL LESSONS FROM MONTE CARLO STUDIES

The moderate and severe recession scenarios are just two of the myriad ways economic conditions could unfold in coming years. They therefore do not reveal the degree to which low interest rate guidance and QE could improve macroeconomic performance on average. To provide a more complete assessment, several studies examine how the expected average severity of recessions and other performance indicators would differ under various strategies for mitigating the ELB problem, based on results from stochastic simulations of FRB/US and other economic models. Under this approach, a model is repeatedly simulated subject to a wide range of shocks drawn randomly from either those observed historically or from an estimated distribution consistent with the historical data, with monetary policy determined by specific

rules for setting the federal funds rate and the volume of asset purchases. From these repeated simulations, researchers construct probability distributions for future outcomes of real activity, inflation, and interest rates and then examine how altering the policy rules changes the means and other features of these distributions.

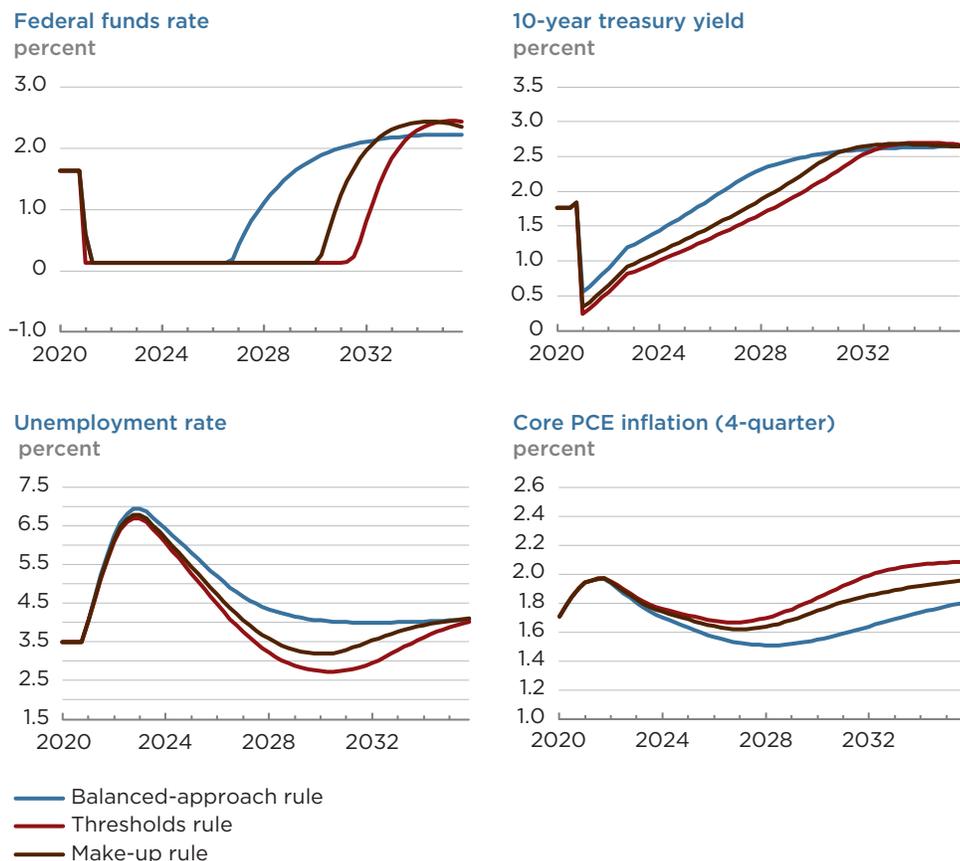
Research employing this Monte Carlo methodology has focused largely on the comparative ability of different interest rate rules operating in isolation (that is, not accompanied by asset purchases) to mitigate the effects of the ELB. Studies in this vein include Reifschneider and Williams (2000); Williams (2009); Coibion, Gorodnichenko, and Wieland (2012); Kiley and Roberts (2017); and Bernanke, Kiley, and Roberts (2017). The policy rules examined in these studies vary considerably but have the general property that once the FOMC can no longer cut the federal funds rate any further, it commits to keeping the rate very low for much longer than the Fed's traditional policy framework would prescribe until some specified economic conditions are satisfied. An example of such a state-contingent rule is the make-up strategy proposed by Reifschneider and Williams (2000), which calls for keeping the federal funds rate near zero until any past shortfall of policy accommodation from its desired unconstrained level has been made up. As indicated by the brown lines in figure 6, recession outcomes under a version of this make-up strategy are similar to those under the thresholds rule, because both rules call for holding the federal funds rate near zero for almost the same number of years in this scenario.²⁰ Other examples of state-contingent lower-for-longer rules include the change rule proposed by Kiley and Roberts (which would call for the federal funds rate to remain near zero even longer than the thresholds rule in the recession scenario); the asymmetric rule estimated by Chung et al. (2019); and the temporary inflation targeting rules considered by Bernanke, Kiley, and Roberts (2019).

Overall, Monte Carlo-style studies find that lower-for-longer strategies, including aggressive thresholds of the sort considered in this paper, appreciably outperform the balanced-approach rule when the normal level of nominal interest rates is as low as it currently appears to be and there is a limit to how low the federal funds rate will be allowed to go. Based on the analysis presented in Bernanke, Kiley, and Roberts, the Reifschneider-Williams make-up rule and the Kiley-Roberts change rule appear particularly effective. However, a thresholds strategy also performs well in these analyses and has the distinct advantages over other approaches of being both simple to communicate and easy for the public to monitor—features that would enhance the credibility of the FOMC's low interest rate guidance. For this reason, the proposal outlined below relies on threshold-based guidance.

There are fewer Monte Carlo-style studies of how the systematic use of asset purchases would influence macroeconomic performance, probably because the effects of QE depend on many factors, such as the volume and maturity composition of the Fed's purchases, market expectations for the evolution of the Fed's portfolio over time, the dependence of that evolution on changes in economic conditions, the quality of market functioning, and the degree to

20 The specific form of the rule is $I_t = \max\{0.125, 0.9I_{t-1} + 0.1[R^* + \pi_t + 0.5(\pi_t - 2) - 2(U_t - U^*)] + RW_t\}$, where the cumulative shortfall term is $RW_t = RW_{t-1} + R^* + \pi_t + 0.5(\pi_t - 2) - 2(U_t - U^*) - I_t$ if < 0 , else 0.

Figure 6
Recession scenario under the thresholds rule and the make-up rule



PCE = personal consumption expenditures

Note: Results are based on simulations of the FRB/US model. The baseline outlook is designed to be consistent with the medians of Federal Open Market Committee (FOMC) participants' forecasts prepared for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Monetary policy responds to changes from baseline in the unemployment rate and inflation as prescribed by the various rules. For the thresholds rule, policy reverts to the prescriptions of the inertial version of the balanced-approach rule once inflation reaches 2 percent and unemployment falls below 4.1 percent.

which rate-setting policy and QE are anticipated to reinforce or substitute for one another. Using simple rules to explore the ability of QE to mitigate the ELB problem, Kiley (2018) finds that the aggressive use of asset purchases could appreciably improve economic performance when the normal level of nominal interest rates is low. Bernanke (2020) builds on Kiley's analysis by combining his QE rules with low interest rate guidance in the form of an aggressive inflation threshold. Taken at face value, his quantitative results suggest that such a combination strategy could potentially overcome the ELB problem altogether unless the neutral federal funds rate is at or below 2 percent.

One technical issue with the studies by Kiley and Bernanke pertains to the way the effects of asset purchases are modeled. Both assume that QE-related term premium effects depend only on the current stock of assets held by the Fed. This assumption greatly simplifies the task of conducting their stochastic simulations but also has the effect of enabling the FOMC to tune the volume

of asset purchases (and hence movements in bond yields) from quarter to quarter in ways that enhance economic stability. In our view, a more realistic characterization of QE effects—and one that would greatly limit any advantages from trying to finetune the timing of purchases—is provided by the Li-Wei model, in which term premiums today depend on market expectations for the entire future path of the Fed’s duration-adjusted portfolio. Using this more computationally difficult approach, Chung et al. (2019) find that a combined guidance/QE strategy similar to the one recommended here materially improves macroeconomic performance on average but does not eliminate ELB-related costs altogether. For this reason, and because the Li-Wei model predicts an appreciably smaller effect of a given cumulative amount of purchases on term premiums than assumed by Kiley and Bernanke, we view the quantitative estimates of QE’s efficacy reported in the Kiley and Bernanke studies as probably somewhat overstated.²¹

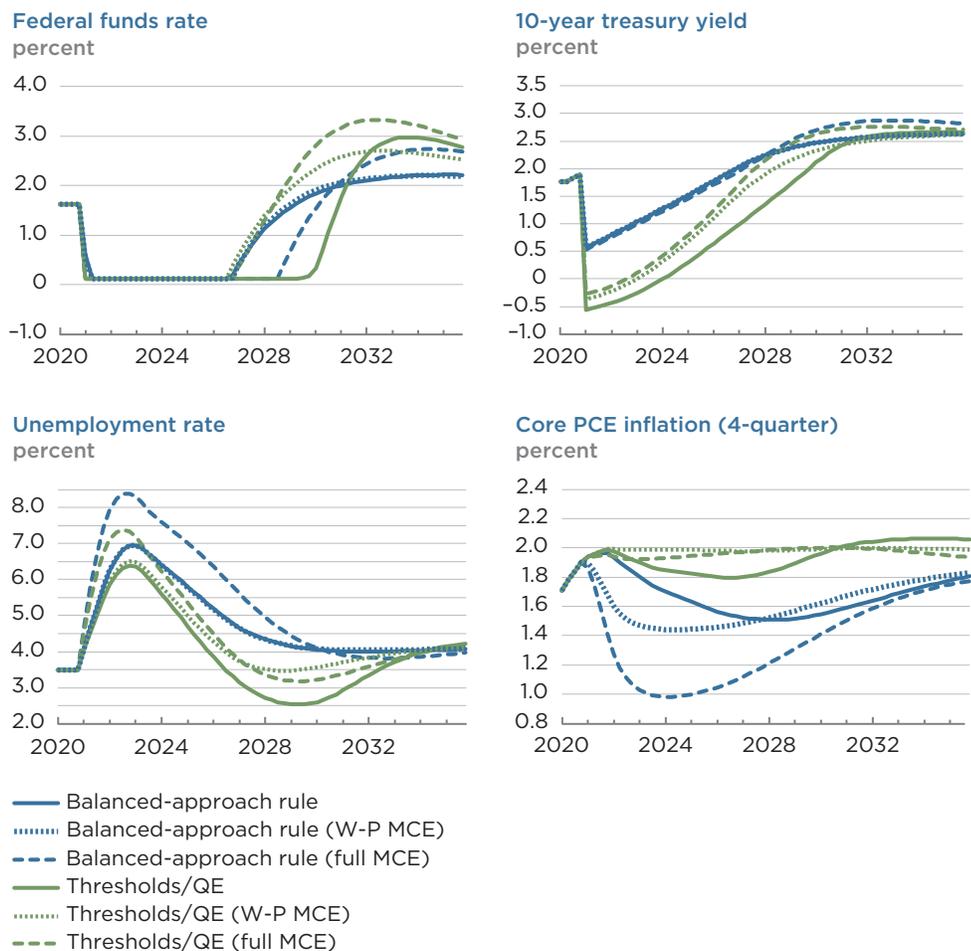
Expectational assumptions are another concern about the reliability of the quantitative estimates reported in most Monte Carlo studies of the efficacy of both QE and low interest rate guidance. In those studies, as in our illustrative simulations, financial market participants are assumed to have model-consistent expectations and to regard the interest rate guidance provided by the central bank as completely credible.²² However, those studies generally go further than we do by making the baseline assumption that wage and price setters also fully understand the implications of announced changes in monetary policy. And some of the studies, such as Kiley (2018) and Bernanke (2020), go further still, and assume that all agents in the economy, including households, have model-consistent expectations. These differences matter, because the ability of low interest rate guidance and asset purchases to improve economic conditions in model simulations tends to increase appreciably if agents outside the financial markets are also assumed to have a complete understanding of the effects of monetary policy on real activity and inflation.

Figure 7 illustrates this point by reporting recession outcomes under both the balanced-approach rule and the combination strategy conditioned on different expectational assumptions. The outcomes denoted by the solid lines show results when only financial market participants have model-consistent expectations; the dotted lines report outcomes when wage and price setters have them as well. Under the latter assumption, the combination of low interest rate guidance and QE is significantly more effective at stabilizing the economy: Inflation always stays close to 2 percent, and the unemployment rate undershoots its sustainable longer-run level by less in the out-years, even though the federal funds rate lifts off comparatively early because the inflation threshold never binds. (Cumulative asset purchases—at \$4.6 trillion—are somewhat higher, however, because the unemployment rate takes a bit longer to fall back to 4.1 percent.)

21 Burlon, Notarpietro, and Pisani (2018) also study the efficacy of open-ended state-dependent QE programs in a stochastic environment. They find that open-ended programs outperform fixed-size programs.

22 In his simulation analysis, Bernanke (2020) places a modest limit on policy credibility by assuming that agents expect the FOMC to hold the federal funds rate near zero for no longer than seven years.

Figure 7
Recession scenario under alternative assumptions for expectations formation



PCE = personal consumption expenditures; QE = quantitative easing

Note: Results are based on simulations of the FRB/US model using a baseline based on the median projections of Federal Open Market Committee (FOMC) participants for the December 2019 meeting. In the case denoted by the solid lines, financial market participants have model-consistent expectations (MCE) while others base their expectations on the predictions of a vector autoregression (VAR) model. In the case denoted by the dotted lines, wage and price setters also have MCE; in the case denoted by the dashed lines, all agents have MCE. The thresholds/QE policy is the thresholds rule with gradual tightening after liftoff and a QE program of buying \$210 billion in longer-term Treasury securities until unemployment falls to 4.1 percent.

The relative effectiveness of the combination strategy improves even further if we instead assume that all agents have model-consistent expectations, as shown by the dashed lines in figure 7. In this case, because households and nonfinancial firms have a better understanding of the severity of the adverse conditions they will confront—and are more reluctant to consume and invest as a result—the effects of the recession shocks on unemployment and inflation are more severe when monetary policy follows the prescriptions of the balanced-approach rule. But because households and nonfinancial firms also have a better understanding of the stimulus that would be provided by the combination strategy, the incremental ability of that policy to improve recession outcomes is enhanced. For example, under this expectational assumption—which we regard

as questionable—the combination strategy shaves 1.1 percentage points off peak unemployment during the recession relative to the balanced-approach rule, almost twice as much as it is able to do when only financial market participants are assumed to have model-consistent expectations; the incremental ability of the combination strategy to improve inflation outcomes is similarly increased. These improvements are obtained with the federal funds rate lifting off sooner and tightening more rapidly than occurs when only financial market participants have model-consistent expectations.

Conceivably, the expectations-formation process used by wage and price setters and perhaps others outside of financial markets could, with enough time, come to internalize the dynamics of the economy under a monetary policy that makes systematic use of low interest rate guidance and asset purchases during recessions. But the slow evolution in inflation dynamics from the late 1970s to the late 1990s suggests that such a learning process might require the experience of several business cycles. Accordingly, in assessing the likely efficacy of a combination strategy in dealing with the next recession, we think it is better to assume that only financial market participants have model-consistent expectations. Although various low interest rate strategies still deliver better macroeconomic performance than the constrained balanced-approach rule under this (in our view) more reasonable expectational assumption, the margin of improvement declines noticeably, as Bernanke, Kiley, and Roberts (2019) document.

5 DESIGN ISSUES AND ESCAPE CLAUSES

The monetary policy that featured most prominently in the illustrative simulations relied on thresholds to specify the conditions that would trigger liftoff of the federal funds rate from the ELB and the cessation of net asset purchases. It also used an algebraic formula—an inertial version of the balanced-approach rule—to set the path of the federal funds rate after liftoff. For good reason, no FOMC has been willing to commit to setting monetary policy in such a mechanical fashion, and we do not expect any future one to be willing to do so. However, a strategy that operated much like the one we illustrated but featured a more judgmental approach to determining both the onset of tightening and the post-liftoff trajectory of the federal funds rate could be adopted, even by an FOMC that refuses to bind itself to the dictates of a simple mathematical formula. This section specifies more precisely the nature of a strategy that a real-world FOMC could adopt.

The FOMC has already demonstrated—by way of the 6½ percent unemployment threshold it maintained from December 2012 to January 2014—that it can agree on the key parameters of a thresholds-based strategy like the one we recommend below. It has also shown that it can communicate the relevant parameters and their implications to the public, including the important advisory that the thresholds would not operate as triggers. In contrast to the mechanical way they work in our simulations, in practice satisfying the threshold conditions would presumably only signal that the FOMC would then be willing to *consider* starting the process of gradually removing accommodation, with the actual date of liftoff chosen judgmentally on the basis of a range of factors.

Similarly, the FOMC's decisions about the actual pace of tightening post-liftoff would be made judgmentally, with a bias toward proceeding more gradually in removing accommodation than its historical behavior would suggest.

What threshold values should the Fed announce? To provide additional accommodation relative to the FOMC's traditional policy, the thresholds must be sufficiently stringent. Announcing ones that are relatively lax, such as an unemployment threshold well above its estimated long-run level or an inflation threshold well below the Fed's 2 percent objective, would not commit the FOMC to pursue a persistently looser policy than called for by the Fed's traditional framework and would therefore do little if anything to mitigate ELB costs. Results from Monte Carlo studies of the effects of different threshold settings, such as those reported in English, Lopez-Salido, and Tetlow (2015) and Chung et al. (2019), demonstrate that an effective threshold strategy would require setting the unemployment threshold at or modestly below the sustainable long-run rate of unemployment and the inflation threshold at or modestly above the Fed's 2 percent objective. (That said, English, Lopez-Salido, and Tetlow also report results suggesting that policymakers should be wary of setting thresholds too aggressively, as doing so can exacerbate unemployment undershooting its long-run level and inflation overshooting the Fed's 2 percent target in some circumstances.)

To employ threshold-based guidance effectively, the FOMC would have to settle several other important design issues. One is whether the inflation threshold should be expressed in terms of projected headline or core PCE inflation over the coming year or two rather than actual core inflation over the past 12 months (the assumption in our illustrative simulations). A forecast-based definition would arguably have the advantage of reducing the risk that core inflation could be temporarily boosted by idiosyncratic price shocks, resulting in premature liftoff. However, as the experience in the United States in recent years has demonstrated, the FOMC and forecasters in general can be persistently overly optimistic about the prospects for inflation picking up; a forecast-based threshold is thus no guarantee against tightening too quickly. For this reason, we recommend basing both thresholds on actual, observable conditions.²³ Moreover, because thresholds establish conditions that will need to be satisfied before the FOMC will consider tightening but do not obligate the Committee to move, such guidance would be consistent with the federal funds rate remaining near zero if the Committee judged that core inflation had been temporally elevated over the past year by transitory factors.

Another design issue concerns the advisability of setting a threshold for unemployment in addition to setting one for inflation. In both illustrative simulations, the onset of tightening depends only on when the inflation condition is met, because the unemployment threshold is crossed much earlier. Bernanke (2020) finds that low interest rate guidance based on an inflation threshold alone results in good economic performance when paired with QE. These

23 The ECB recently took the opposite view on this issue. Guidance issued in September 2019 explicitly links the onset of tightening to the inflation outlook: "We now expect the key ECB interest rates to remain at their present or lower levels until we have seen the inflation outlook robustly converge to a level sufficiently close to, but below, 2 percent within our projection horizon, and such convergence has been consistently reflected in underlying inflation dynamics" (see www.ecb.europa.eu/press/pressconf/2019/html/ecb.is190912-658eb51d68.en.html).

results notwithstanding, supplementing an inflation threshold with one for labor market conditions is necessary, for two reasons. First, the next recession could be accompanied by core inflation that only briefly, or even never, dips below 2 percent. Although the odds of this happening may seem low in light of the Fed's difficulty in recent years of bringing inflation back up to its target, inflation is routinely buffeted by idiosyncratic shocks, and confidence intervals around forecasts of core inflation are wide.²⁴ If the economy entered a recession in which inflation was on the high side, an inflation threshold alone would likely provide little if any stimulus. Second, the Fed has a dual mandate to promote price stability and maximum employment, so setting a threshold for one leg of the mandate and not the other would be difficult to defend.

An important consideration in defining an unemployment threshold is that it not simply be expressed as a number but tied to an assessment of the sustainable longer-run rate of unemployment, given that estimates of this rate (often referred to as U^*) can change gradually but appreciably over time in response to incoming data.²⁵ FOMC participants' views about the value of U^* do differ somewhat, but the problem of determining a single value to be used as the threshold can be solved by using the median of participants' projections of the longer-run unemployment rate that are published quarterly. Because most participants have fairly similar estimates of U^* , and thresholds would not operate as triggers, the Committee should be able to agree to base the announced threshold on the median projection and to revise it over time accordingly. And because the FOMC would be free to continue to hold the federal funds rate near zero after both threshold conditions were satisfied if they felt it was warranted, the FOMC would also presumably wish to take into account a broad range of labor market indicators in deciding precisely when to begin removing accommodation and at what pace.

The literature on the design of QE operations is less extensive than the literature on the design of interest rate rules, partly because asset purchases are thought to influence term premiums and other financial factors in many complicated ways. These complications make it difficult to analyze the properties of an "optimal" QE strategy.²⁶ For these reasons, the best strategy for the FOMC is probably to adopt a simple flow purchase program of the sort presented

24 As we note in Reifschneider and Wilcox (2019), the standard deviation of the 60-month moving average of core PCE inflation since the mid-1990s is about 0.4 percentage point. Stochastic simulations of the FRB/US model in which the model is repeatedly subjected to wage and price shocks of the sort experienced from 1995 to 2018, with real activity held fixed at its baseline values, suggest that idiosyncratic shocks accounted for essentially all of the observed variability in average five-year PCE inflation.

25 In a speech given at the Jackson Hole conference in 2018, Chair Powell provided information on the evolution of projections of the long-run unemployment rate made by both private forecasters and FOMC participants since 2012 (see www.federalreserve.gov/newsevents/speech/powell20190823a.htm).

26 Nevertheless, a variety of internal Fed staff studies—including Mausekopf and Sim (2009); Reifschneider, Roberts, and Sim (2011); and Durdu and Laubach (2013)—have considered the design of "good" QE rules. English, Lopez-Salido, and Tetlow (2015) provide an analysis of an optimal QE strategy using a stylized model that balances the costs and benefits of purchases. Gagnon and Sack (2018) propose a QE rule in which asset purchases would be conducted in a manner intended to mimic the way interest rate policy is conducted when the ELB is not binding. Sims and Wu (2013) use a dynamic stochastic general equilibrium (DSGE) model to explore the macroeconomic effects of a QE rule that is similar in spirit to the Gagnon-Sack proposal. The results of Kiley (2018) were already discussed.

above and discussed by Chung et al. (2019). Such a program would be easy to explain to the public and would not require the FOMC to make difficult decisions about how best to adjust the pace of purchases over time. Moreover, the value of adjusting the pace in response to changing economic conditions is not obvious: In the Li-Wei model, the term premium effects of quarter-to-quarter changes in the flow are considerably less important than the effects of the expected cumulative size of the program. Thus, our recommendation requires the FOMC only to commit to buying longer-term securities in volume at a constant rate until the labor market has substantially recovered. (For the reasons discussed earlier, we would not advise pledging to continuing purchases until inflation has returned to 2 percent, however.) Based on the Monte Carlo results presented in Chung et al. (2019), quarterly purchases in the vicinity of \$200–\$250 billion, with a stopping rule defined in terms of a return to normal labor market conditions, would likely deliver good macroeconomic performance without risking an unreasonable expansion in the size of the Fed’s balance sheet.

To avoid disrupting financial markets, the FOMC will probably want to set limits on how much it will buy. For example, it could cap its acquisition of individual Treasury issues at 70 percent, as it did in the QE operations during the recovery from the Great Recession; it may wish to explore setting a similar cap on its purchases of agency MBS. As a matter of prudence, the FOMC might wish to go further and specify an outer limit on the cumulative amount (across all individual issues) it would be willing to purchase. If asset purchases are split evenly between longer-term Treasury securities and MBS, a cumulative purchase of \$4 trillion in response to a recession of average severity would leave the Fed holding roughly 35 percent of the relevant Treasury market and roughly the same proportion of the available MBS supply.²⁷ In order to allow room to respond to a worse than average recession and yet cut off the possibility that it might end up owning a very large fraction of the relevant supply, the FOMC might specify that it will cap its aggregate holdings of longer-term securities at some specified percent of GDP.²⁸ Based on the review of central banks’ QE actions taken over the past decade, the Markets Committee of the Bank for International Settlements concluded that such limits, combined with a flexibility to temporarily adjust the pace of buying in some situations, have proven effective at avoiding market disruptions (Logan and Bindseil 2019).

Keeping interest rates very low for an extended period and letting the labor market become unusually strong could have unintended consequences. For this reason, the FOMC would presumably wish to establish “escape clauses” to protect against certain risks. Escape clauses would pre-specify circumstances

27 If the Fed bought only Treasuries, its cumulative volume of net purchases, when combined with its current holdings, would increase its share of outstanding federal debt held by the public with issuance maturities of five years and above to about 59 percent by late 2025, once allowance is made for the Congressional Budget Office’s projection that the baseline amount of federal debt held by the public will reach \$23.8 trillion by 2025 and that the illustrative recession described here would add an estimated \$1.3 trillion in cumulative borrowing. (This calculation assumes that the maturity structure of federal debt held by the public does not change; if the Treasury were to continue to raise the average maturity of the debt, the Fed’s share of longer-term debt would be somewhat smaller.)

28 In the severe recession scenario, cumulative purchases rise to \$7 trillion. A cap of 60 percent should accommodate purchases of that volume.

under which the FOMC could suspend its adherence to the basic form of the strategy. In principle, such clauses could allow the Committee to depart from the basic strategy without damaging its own credibility.

One risk the Committee should protect itself against is the possibility that the combination strategy could allow chronic inflation to emerge, perhaps because inflation expectations had become unmoored. To guard against this possibility, the FOMC could accompany the thresholds with an advisory that it would reconsider holding the federal funds rate at the ELB if core inflation moved up to a high level (say, 3 percent) even though the unemployment rate remained above its estimated long-run level. Such an advisory might also take into account accompanying movements in survey-based and financial market indicators of long-run inflation expectations, particularly if the FOMC judged them as rising to levels inconsistent with the Fed's longer-run 2 percent inflation goal. (In these circumstances, FOMC participants would presumably revise up their estimates of the longer-run sustainable rate of unemployment, which would also protect against the risk of keeping the federal funds rate too low for too long.)

Another escape clause could involve financial stability. A policy that kept nominal interest rates very low and stable for many years could prompt an imprudent reach for yield on the part of investors, excessive leveraging, and asset price bubbles. Such developments would increase the fragility of the financial system; under certain circumstances, it might eventually lead to a painfully deep and extended slump, as occurred in the wake of the financial crisis a decade ago. In principle, such stability risks are best addressed through robust capital standards, prudential supervision, and emergency lender-of-last-resort operations rather than by keeping interest rates persistently higher than inflation and the condition of the labor market would otherwise call for. The use of tight monetary policy to address financial stability risks seems especially problematic given that the resulting weaker economic conditions could themselves impair financial stability. However, the macroprudential toolkit available to US policymakers is extremely limited, so the FOMC could find itself forced to tighten the stance of its policy sooner than the alternative framework would otherwise call for if signs emerged that excessive risk-taking seemed to be laying the groundwork for a wider financial crisis.

Of course, there could be other risks of adopting the combination strategy, including ones that no one has yet thought about (the Rumsfeldian "unknown unknowns"). But comforting as it might be to have a general-purpose escape clause, the FOMC should avoid issuing one, for several reasons. For one, issuing such a clause would diminish the credibility of the FOMC's announced strategy, reducing its effectiveness. Moreover, past concerns about the risk of unintended consequences from large-scale asset purchases—such as rampant inflation, massive capital losses on the Fed's portfolio, adverse fiscal effects, and financial instability—proved to be unfounded. Finally, the FOMC's declaration of a general-purpose escape clause from the open-ended QE3 program related to efficacy

and cost considerations had at best mixed success, because it was sufficiently vague that the public did not appear to have understood its importance to many FOMC participants.²⁹

6 A SPECIFIC PROPOSAL FOR A NEW POLICY FRAMEWORK

This section lays out the main elements of a policy strategy the FOMC could actually adopt that would be markedly more effective in fighting recessions than the precrisis approach. Because the effectiveness of this strategy will depend on communicating clearly exactly what the new strategy entails and convincing financial market participants that the FOMC will be fully committed to it, its communications-related dimensions are critical. In line with that emphasis, we structure the advice around the vehicles the FOMC would use to get its message out.

The key elements of our recommended strategy include the following:³⁰

1. **Revised consensus statement.** The first step would involve the FOMC modifying its annual consensus statement to include an explicit commitment that whenever the FOMC finds itself constrained by the ELB, it will pursue a two-pronged policy involving (a) keeping the federal funds rate at the lower bound longer than traditional practice would have called for and (b) purchasing longer-term assets until the labor market has substantially recovered.³¹ The consensus statement would not have to go into details about exactly how the Committee intends to implement this strategy but could instead be general in nature:

When economic activity is particularly weak or inflation is particularly low, the lower bound on nominal interest rates may limit the ability of the Committee to provide sufficient accommodation through reductions in the federal funds rate alone. In such circumstances, the Committee will use other tools to provide additional accommodation as warranted. These tools include guidance that the federal funds rate will stay exceptionally low until economic conditions have substantially recovered, and large-scale purchases of longer-maturity securities.

29 FOMC guidance about the QE3 program regularly included advisories that the pace and the continuation of purchases depended in part on assessments of their efficacy and costs. As discussed at the January 2013 FOMC meeting, few respondents to the Federal Reserve Bank of New York dealer survey thought that these assessments would influence the decision to end asset purchases, possibly because market participants viewed the advisories as “boiler plate” (see www.federalreserve.gov/monetarypolicy/files/FOMC20130130meeting.pdf). However, concerns about the marginal efficacy and potential costs of asset purchases were, right from the start, an important element in FOMC deliberations about when to begin winding down the QE3 program. See the extended discussion of these concerns in the transcripts of the December 2012 meeting (www.federalreserve.gov/monetarypolicy/files/FOMC20121212meeting.pdf, pages 12–32,) and the March 2013 meeting (www.federalreserve.gov/monetarypolicy/files/FOMC-20130320meeting.pdf, pages 117–215). Many of the specific concerns expressed by participants at these and other FOMC meetings have not been borne out in practice, although one cannot dismiss the possibility that a further large expansion of the Fed’s balance sheet could have inadvertent adverse side-effects.

30 The strategy recommended here shares some elements with proposals from former Chair Yellen (2018) and by Governor Brainard in a recent speech. For Brainard’s proposal, see www.federalreserve.gov/newsevents/speech/brainard20191126a.htm.

31 For the current version of the consensus statement, known as the “Statement on Longer-Run Goals and Monetary Policy Strategy,” see www.federalreserve.gov/newsevents/pressreleases/monetary20190130b.htm.

In addition, once the Committee decides to begin removing accommodation, it intends to do so very gradually. These steps should help put additional downward pressure on longer-term interest rates and improve overall financial conditions, thereby promoting a faster recovery in employment and inflation.

2. ***An addendum to the consensus statement.*** The FOMC could lay out the specific details of the policy framework it intends to use in an addendum to the consensus statement, as suggested by Yellen (2018). The addendum could spell out the thresholds that have to be met before the Committee would consider raising the federal funds rate off the floor, discuss in general terms what the post-liftoff gradualist policy with respect to the funds rate will entail, and provide the basic parameters of the large-scale asset purchases that will accompany the low-funds-rate policy.
 - A. *The thresholds framework governing the federal funds rate.* The addendum should lay out the threshold framework described above and specify the threshold values the Committee will use. As Chung et al. (2019) note, if a thresholds-type framework is to be effective in alleviating the challenge posed by the floor on nominal interest rates, the thresholds will need to be set aggressively. The unemployment threshold will need to be set close to or at the Committee's estimate of its long-run sustainable rate, and the inflation threshold will need to be set close to or at the long-run target rate of inflation. The addendum should also state that once the thresholds have been met, the Committee will consider whether to raise the funds rate up off the floor but may choose not to do so for a time—consistent with these settings being thresholds rather than triggers. Furthermore, in returning the federal funds rate to a more normal alignment relative to inflation and unemployment, the Committee will proceed in a much more gradual manner than was typical of post-World War II tightening cycles. The addendum could also note that the Committee intends to provide further guidance about its intentions regarding the post-liftoff behavior of the federal funds rate by other means (staff white papers, speeches by the chair, and so forth).
 - B. *The parameters of the asset-purchase program.* Specifying the details of the asset-purchase program will be difficult, in part because there is not an extensive research literature on the properties of “good” QE rules to guide the Fed in making these choices. Nonetheless, the following considerations seem reasonable:
 - i. The FOMC should commit that once the federal funds rate falls to the ELB, it will immediately start buying longer-term securities on a flow basis (for example, some set amount per quarter) and continue doing so until the labor market has recovered. Although a variety of indicators could be used to define when the labor market has “recovered,” one easy-to-communicate approach would be to pledge to continue asset purchases until the unemployment rate has fallen back to the median of FOMC participants' estimates of its long-run sustainable level.

- ii. The addendum should specify the average monthly or quarterly pace of purchases the FOMC intends to undertake. Based on our simulations and the analysis presented in Chung et al. (2019), an average pace of total purchases (Treasuries plus MBS) in the range of \$200–\$250 billion per quarter seems advisable; this pace would imply about \$4 trillion in cumulative purchases in the event of a typical post-World War II recession.³² If the Committee foresees limits on the cumulative amount of securities it would be willing to buy, it should state what these limits are.
 - iii. The addendum should specify that once net purchases have ended, principal payments will be reinvested until the federal funds rate begins to rise, at which point the size and composition of the portfolio will be allowed to normalize passively.
- C. *Escape clauses.* Circumstances could plausibly arise that would cause the FOMC to want to tighten the stance of policy sooner or more steeply than its commitments would otherwise allow. Such circumstances could include signs of increasing financial fragility or evidence that a chronic inflation problem is emerging. To accommodate that reality, the addendum should include “escape clauses,” specifying the conditions under which the Committee would temper the aggressiveness of its funds-rate or asset-purchase policy under the two-pronged approach. This step is important because it would protect the FOMC against the reputational damage that would occur if the FOMC were seen as having broken a promise that it had represented as having been inviolable.

The addendum could also make plain, as Yellen (2018) notes, that the FOMC understands that the two-pronged policy framework could result in inflation temporarily overshooting its objective and unemployment temporarily moving below its longer-run sustainable level. Such moves in inflation and unemployment would help cement in the public consciousness the idea that the inflation target is symmetric and that episodes of inflation above the target should be approximately as frequent and extensive as episodes below it.

3. ***Post-meeting statements.*** Whenever it finds itself constrained by the floor under the federal funds rate, the FOMC would revise its post-meeting statements to bring them into line with the consensus statement and the addendum. Post-meeting statements would reiterate the economic conditions that would need to be satisfied before the Committee would consider raising the federal funds rate and reaffirm the FOMC’s intention to tighten only gradually once liftoff occurs. They would also confirm the Committee’s pre-established QE strategy and reiterate specific details, including the pace

³² Rather than hold the quarterly pace fixed through time, the FOMC may prefer to vary it in response to changing economic conditions; it would probably also want to taper purchases as the economy nears full employment, to reduce the risk of market disruptions. Nevertheless, to better guide market expectations, the Committee would still want to provide information ahead of the recession about the initial purchase rate and the expected average pace over the life of the program.

and composition of purchases, the conditions that will determine when net purchases will cease, and the plan for subsequent reinvestment and eventual normalization of the portfolio.

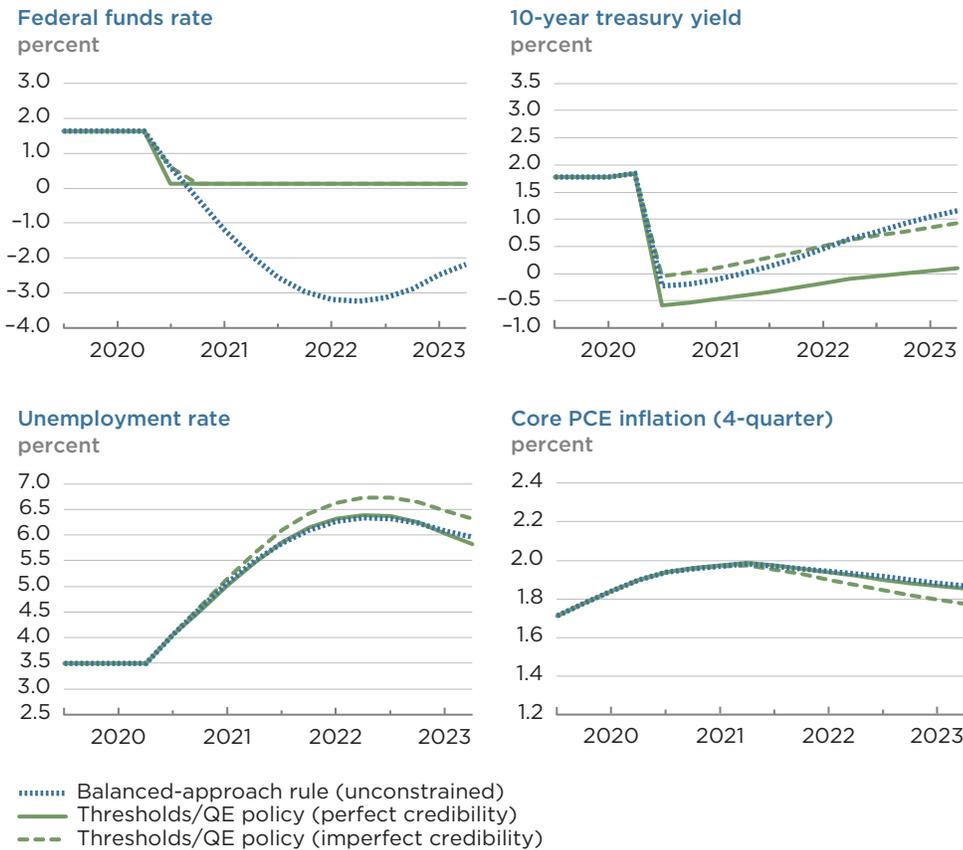
4. **Other communication vehicles.** If the framework is to be maximally effective, the Committee will need to be clear from the outset about how quickly it intends raise the federal funds rate after the inflation and unemployment thresholds are met. The best way to address that question will probably be to use outlets such as the *Monetary Policy Report*, as well as speeches and testimonies by the chair and other policymakers. The key point to be conveyed will be that the Committee commits to removing accommodation only gradually once the thresholds have been met. This point could be driven home by regularly showing the prescriptions of a variety of policy rules developed specifically to deliver good performance in a low interest rate environment. A “benchmark suite” of policy rules for this purpose could include the thresholds rules and the make-up rule shown in figure 6, as well as other rules from the literature, such as the flexible temporary inflation targeting rule discussed in Bernanke, Kiley, and Roberts (2019); the asymmetric rule estimated by Chung et al. (2019); and the change rule proposed by Kiley and Roberts (2017). Including the flexible temporary inflation rule could be especially useful if the FOMC wants to emphasize its commitment to making up any past shortfalls of inflation from 2 percent that occurred in the wake of the recession.

7 POTENTIAL LIMITS ON THE EFFICACY OF THE PROPOSED STRATEGY

As part of their evaluation of the merits of the strategy, policymakers should assess the odds that the framework will prove to be either more or less effective than portrayed in the illustrative simulations and suggested by the Monte Carlo studies. For several reasons, we think the strategy, while definitely worth undertaking, will turn out to be somewhat less effective than portrayed above. Therefore, prudence suggests that policymakers should look for yet other ways to ensure that they have enough policy firepower to fight the next recession.

One reason why the strategy may prove less effective than portrayed in the analysis discussed earlier is that the Fed may not command the complete credibility with financial market participants that we have assumed. In the recession scenarios, financial market participants are entirely confident that the Fed will follow through on its commitments to the letter. If instead they believe the FOMC might eventually renege on those commitments, the strategy will deliver less favorable outcomes. A lack of complete credibility is a real possibility, partly because financial market participants may doubt the ability of current FOMC members to bind the actions of future FOMC members. Many years may elapse between the onset of the next recession and the time when the strategy would finally call for the federal funds rate to lift off from the ELB. During that long period, substantial turnover might occur among Committee participants, and future participants might not share the convictions of current ones. Even if Committee turnover were not a factor, financial market participants might doubt whether the FOMC would be rock solid in continuing to hold the federal funds rate at the ELB as the prospect of an inflation overshoot becomes more likely.

Figure 8
Recession scenario under the combination policy, with and without perfect credibility



PCE = personal consumption expenditures; QE = quantitative easing
 Note: Results are based on simulations of the FRB/US model. The baseline outlook is designed to be consistent with the medians of Federal Open Market Committee (FOMC) participants' forecasts prepared for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Monetary policy responds to changes from baseline in unemployment and inflation as called for by the various rules. Under perfect credibility, investors are completely confident that the FOMC will follow the prescriptions of the thresholds rule and will cease purchases only when the unemployment rate reaches 4.1 percent. Under imperfect credibility, investors instead anticipate only \$2.5 trillion in cumulative purchases and expect policy to revert to the prescriptions of the balanced-approach rule once unemployment falls to 5 percent.

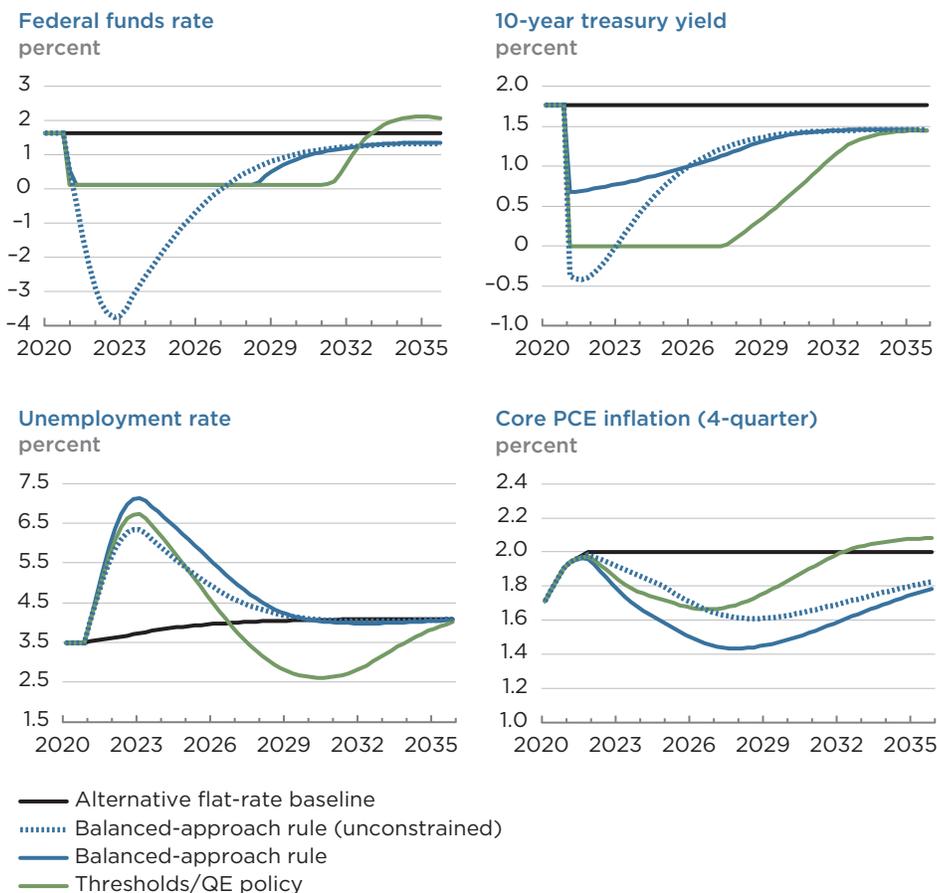
To illustrate this point, figure 8 reports outcomes during the first three years of the moderate recession scenario under the assumption that financial market participants doubt that the Fed will fully follow through on its interest rate guidance and QE commitments (the green dashed lines). Initially, financial market participants believe that the FOMC will cap the total amount of purchases at \$2.5 trillion, hold the federal funds rate near zero only until unemployment reaches 5 percent, and thereafter move quickly to realign policy with the prescriptions of the balanced-approach rule. These doubts about the Fed's commitment cause the peak unemployment rate to be 0.5 percentage point higher than if the FOMC enjoyed perfect credibility, even though the FOMC's actual actions during the first three years of the recession are fully consistent with the announced strategy.

Another reason why the proposed strategy may provide insufficient policy space pertains to the evolution of nominal interest rates over the next decade or so. The baseline outlook used in the analysis envisions the federal funds rate gradually rising to 2.5 percent, up from its current level of about 1.6 percent, and the 10-year Treasury yield gradually rising from about 1.8 percent to 3 percent. In the recession scenarios, the predicted rise in the baseline path of the federal funds rate provides the Fed with increasing scope over time to use forward guidance to stimulate real activity and inflation by driving down longer-term interest rates relative to their baseline path. If the FOMC turns out to have only limited (or no) ability to push nominal bond yields below zero, the predicted rise in the baseline paths of longer-term interest rates has a similar implication for the ability to use large-scale asset purchases down the road. Unfortunately, nothing guarantees that the baseline outlook is correct. The forces determining the neutral level of the federal funds rate and the steady-state levels of term premiums are poorly understood; a plausible risk is that the equilibrium levels of interest rates across the board will turn out to be lower in the future than we have assumed, continuing the trend over the past decade or two.

A third reason why the strategy may prove less effective than shown in the illustrative simulations is that the Fed may not be capable of pushing bond yields below zero if investors believe it will never drive the federal funds rate below zero. The question of whether the Fed will have that capability is difficult to answer, and a full discussion is beyond the scope of this paper. On the one hand, if investors firmly believe that the FOMC will never push the federal funds rate below zero, they might be reluctant to purchase a longer-term security with a negative yield when they could instead purchase a sequence of short-term securities, each expected to pay a minimum return of zero. Intensifying that reluctance would be the fact that, in an environment in which the federal funds rate is near zero and the distribution of future interest rates therefore extremely one-sided, Treasury notes and bonds would no longer provide a particularly effective hedge against future downside risks to the economy. (See Gagnon and Jeanne 2020 for a formal exposition of these effects.) On the other hand, investors would presumably be more willing to accept negative yields if they thought the FOMC might reconsider its position on the appropriate setting of the floor on its policy rate if future economic conditions were to become sufficiently dire—a not unreasonable belief in light of the European experience. In addition, Treasury yields could fall below zero if deteriorating global financial conditions caused the demand for safe assets to soar, especially given that the Treasury would not increase the supply of its securities in response to the decline in rates.

Figure 9 shows the consequences of assuming that both the second and third limitations on policy effectiveness pertain. It shows macro outcomes for the moderate recession scenario when (a) the baseline features a flat rather than rising profile of short- and longer-term interest rates and (b) the Fed cannot drive longer-term interest rates below zero. Under these circumstances, the combination of low interest rate guidance and QE no longer produces outcomes as good as hypothetically obtainable under the unconstrained balanced-approach rule during the first few years of the recession. In the event of a severe recession, the shortfall would be more pronounced.

Figure 9
Implications of a flat-rate outlook for the effectiveness of the combination policy



PCE = personal consumption expenditures; QE = quantitative easing
 Note: Results are based on simulations of the FRB/US model. The alternative flat-rate baseline assumes that, absent a recession, interest rates remain at their current levels while unemployment and inflation gradually converge to long-run values consistent with forecasts prepared by Federal Open Market Committee (FOMC) participants for the December 2019 meeting. Financial market participants have model-consistent expectations but elsewhere expectations are based on the predictions of a vector autoregression (VAR) model. Monetary policy responds to changes from baseline in unemployment and inflation as prescribed by the various rules. Except in the unconstrained policy case, the lower bound on nominal bond yields is assumed to be zero.

Still other factors may cause the proposed framework to be incapable of completely offsetting the adverse macroeconomic consequences of the ELB in the event of a moderate recession, let alone a severe one. For example, FRB/US may overstate the extent to which lower long-term interest rates will stimulate household and business spending in the future, especially if recession and recovery periods are marked by impaired balance sheets, strains in credit markets, and heightened uncertainty about future income and sales. Similarly, the model may overstate the influence of QE on Treasury term premiums and their pass-through to other asset prices. Additionally, the Fed itself might flinch from pursuing the program to the letter if mounting cost and efficacy concerns pertaining to asset purchases persuade it to stop expanding its asset holdings by as much as the stated policy would call for.

Even if none of these concerns turns out to be accurate, it is important not to lose sight of how hard the new tools of monetary policy were being pushed to generate the favorable results shown in figure 3. Even to fight the merely average recession hypothesized in that figure, the Fed would have to hold the federal funds rate at zero for about eight years and would add as much to its portfolio of longer-term assets as it did in response to the Great Recession. Worse yet, the next recession could be much more severe than average, in which case the Fed might simply run out of countercyclical firepower.³³ For all these reasons, prudence strongly suggests that policymakers should seek yet other ways to expand the capacity of the federal government to engage in countercyclical policy.

8 CONCLUSIONS

If the structure of interest rates remains as low as it currently is and the Fed takes no countervailing steps, it will be hard-pressed to fight future recessions as vigorously as it would in the past. To restore at least part of its recession-fighting capacity, the Fed should commit as soon as possible to a new framework governing how it will conduct monetary policy whenever it has run out of room to drive the federal funds rate lower. Specifically, the Fed should pledge that it will not lift the federal funds rate above the ELB until the unemployment rate is as low as its estimated longer-run sustainable rate and core inflation is as high as the target rate. In addition, it should commit to using QE aggressively in such circumstances, preferably through an open-ended program of asset purchases that would continue until the labor market had fully recovered.

These steps would help restore at least some of the policy space that has disappeared as a consequence of the decline in the global structure of nominal interest rates. Indeed, if enough factors break in the right direction, these steps might allow the Fed to fight the next recession as effectively as it would have a few decades ago. However, the risks are asymmetric: If the next recession is unusually severe, or if the tools suggested here turn out to be less potent than assumed, the Fed will run out of countercyclical ammunition. The consequence of such an outcome could be very costly: a recession that is deeper and longer than it needs to be.

The asymmetric nature of the risks implies that additional policy steps should be taken now to lay the groundwork for battling the next recession more effectively. First, the Fed should raise the target rate of inflation from 2 to 3 percent (we will lay out the case for this policy step in detail in a future paper). Second, fiscal policy needs to be prepared to play an even larger role in fighting recessions in the future than it has in the past. Other authors have advanced a

33 Gagnon and Collins (2019) arrive at a similar conclusion: Although it has sufficient monetary ammunition “to counter a mild recession, the Fed does not have enough firepower to fight a severe recession.” If they rule out the possibility of a negative policy interest rate, as we do, then Gagnon and Collins reach a more guarded conclusion, even closer to the view expressed here. They conclude that the ECB and the Bank of Japan are in much worse shape than the Fed in terms of their capacity to fight a recession. For an even more pessimistic assessment, see Kiley (2019).

range of practical ideas for fortifying the automatic stabilizers, with the goal of ensuring that fiscal stimulus can be delivered in a timely and well-calibrated manner when the need arises.³⁴

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34 For specific ideas about how automatic stabilizers could be fortified, see Furman (2019) and Boushey, Nunn, and Shambaugh (2019), among others. In a recent speech, Blanchard emphasizes the need for fiscal policy to play a larger role in fighting recessions in Europe (see www.ecb.europa.eu/pub/conferences/shared/pdf/20190617_ECB_forum_Sintra/speech_Blanchard_en.pdf). Blanchard and Summers (2020) argue that "semiautomatic" stabilizers (fiscal policy changes that are triggered when output growth or unemployment crosses a prespecified threshold) should play a larger role in helping combat business cycle fluctuations.

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APPENDIX A EVALUATING THE EFFECTS OF ASSET PURCHASES ON TERM PREMIUMS

Our methodology for estimating QE-related term premium effects is based on a simplified version of the procedure discussed in Ihrig et al. (2018), which exploits the estimated term structure model developed by Li and Wei (2013). In the Li-Wei model, the effect of an asset-purchase program on the term premium embedded in the yield on an n -period bond (TPE_t^n) evolves over time according to the formula:

$$TPE_t^n = b_n^{ss} u_t + \sum_{i=1}^{n-1} \left\{ \left(\frac{n-i}{n} \right) b_{n-i}^{ss} [u_{t+i} - \rho^{ss} u_{t+i-1}] \right\}.$$

In this expression, u_t is a vector of QE-related supply shocks to private holdings of Treasury securities and agency MBS at time t —specifically, Fed holdings of longer-term Treasury securities, expressed in 10-year equivalents as a percentage of nominal GDP; the par amount of holdings of MBS as a ratio of nominal GDP; and the average MBS duration. The vector b_n^{ss} and the diagonal matrix ρ^{ss} are derived from the estimated parameters of a five-factor arbitrage-free term structure that includes the elements of u_t as three of the factors. Because the elements of $\left(\frac{n-i}{n} \right) b_{n-i}^{ss}$ decline as i increases and the elements of ρ^{ss} are all less than 1.0, the formula implies that the effect of a QE program depends not only on its effects on the current stock and duration of longer-term assets held by the Fed but also on the discounted present value of expected future changes to the portfolio. We use this formula to compute term premium effects separately for 5-, 10-, and 30-year securities.

To facilitate the calculation of the evolution of the Fed's holdings over time under the QE program, we make several simplifying assumptions relative to the Fed staff's detailed balance-sheet accounting employed by both Ihrig et al. and Chung et al. (2019). We assume that the maturity distribution of the Fed's purchases is fixed at 30 percent for 5- to 7-year securities, 30 percent for 7- to 10-year securities, 30 percent for 10- to 20-year securities, and 10 percent for 20- to 30-year securities. Purchases are treated as if they were all Treasuries, implying that principal payments are received only when a security fully matures. This assumption means that we can ignore the two MBS-related supply factors in the Li-Wei valuation formula. Securities are valued at par. Principal payments are reinvested as long as the federal funds rate remains at or below 25 basis points; once the federal funds rate lifts off, holdings are assumed to run off passively. Holdings are translated into 10-year equivalents using fixed adjustment factors equal to the ratio of the current Macaulay duration of a generic n -year Treasury security to that of a generic 10-year Treasury security.

The procedure's estimate of the effects of the illustrative QE program yields a time profile for the 10-year term premium that is similar to that reported by Chung et al. for a similar \$4 trillion package. However, the average level of the path is somewhat smaller than their estimate, after controlling for a lower average level of nominal GDP in their analysis. This difference largely reflects our implicit treatment of all purchases as Treasuries, rather than the mix of MBS and Treasuries in their analysis, as well as their more detailed balance-sheet accounting. To facilitate comparison of our results with theirs, and to control for the likelihood that a future QE program would likely involve buying both MBS

and Treasuries, we calibrated our term premium effects to theirs (adjusted for differences in the level of nominal GDP) by applying a fixed scaling factor to the estimates provided by the Li-Wei formula.



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