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Monetary Policy Strategies and Tools: Financial Stability Considerations

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The analysis in this paper was presented to the Federal Open Market Committee as background for its discussion of the Federal Reserve's review of monetary policy strategy, tools, and communication practices. The Committee discussed issues related to the review at five consecutive meetings from July 2019 to January 2020. References to the FOMC's current framework for monetary policy refer to the framework articulated in the Statement on Longer-Run Goals and Monetary Policy Strategy first issued in January 2012 and reaffirmed each January, most recently in January 2019.

Abstract

This paper examines potential interactions between financial stability and the monetary policy strategies and tools considered in the Federal Reserve's review of monetary policy strategy, tools, and communication practices. Achieving the Federal Reserve's goals of full employment and price stability promotes financial stability. A key concern, however, is that with a low equilibrium real interest rate, a low policy rate will be necessary, and in turn, these low rates may contribute to an increase in financial system vulnerabilities. Our analysis suggests that there are typically significant macroeconomic and financial stability benefits of using these tools and strategies, but there are plausible situations in which financial vulnerabilities are such that it would be desirable to limit their use. A clear communications strategy can help minimize financial vulnerabilities. Should vulnerabilities arise, they are often best addressed with macroprudential tools.

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This paper examines potential interactions between financial stability and the monetary policy strategies and tools that the Federal Open Market Committee (FOMC or the Committee) considered in its review of the Federal Reserve's monetary policy strategy, tools, and communication practices. The paper also considers the role of macroprudential policy and supervisory tools in pursuing financial stability and discusses the limitations of these tools. Additionally, it explores issues related to financial stability considerations in monetary policy communications.

A stable financial system is resilient in the face of adverse shocks. An unstable system, by contrast, is characterized by vulnerabilities that may amplify adverse shocks and lead to substantial increases in unemployment or declines in inflation. Importantly, achieving the Federal Reserve's goals of full employment and price stability promotes financial stability, as such conditions support financial-sector resilience.

A key concern, however, is that with a low equilibrium real interest rate, r*, a low policy rate will be necessary for the Federal Reserve to achieve its dual-mandate goals. Indeed, a low r* implies that interest rates are likely to be low across any set of strategies and tools that achieves the Federal Reserve's objectives. In turn, these low rates may contribute to an increase in financial system vulnerabilities, including increased borrowing, financial leverage, and asset price pressures. The extent to which these benefits and costs arise may depend on the stage of the business cycle—intuitively, low rates in the middle of a recession could have different effects on financial vulnerabilities than during a long expansion, even while, in both circumstances, the partial macroeconomic effects of low rates on inflation and employment are beneficial to financial system resilience.

As a result, the question for this paper is the extent to which the alternative strategies and tools under consideration, on net, enhance stability by improving economic performance and supporting inflation or weaken stability by encouraging vulnerabilities such as elevated asset prices, excess borrowing, or excessive risk-taking by financial intermediaries. With the caveat that evidence is limited, our analysis suggests that there

are typically significant macroeconomic and financial stability benefits of using these tools and strategies, but there are plausible situations in which the vulnerabilities are such that it would be desirable to limit the use of these tools and strategies.

The paper makes four points:

1. Evidence on the link between low rates and financial vulnerabilities is limited and generally finds that interest rates, especially the policy interest rate, are not the primary contributor to financial vulnerabilities. That said, it is difficult to distinguish between the financial stability effects of low rates and the effects of accommodative policy. Indeed, available studies often do not make this distinction (section I).

2. Possible financial vulnerabilities generated by makeup strategies, forward guidance (FG), and balance sheet policy (BSP) are similar to those generated by traditional monetary policy, with vulnerabilities potentially growing when the economy is "running hot." Past experience is limited, particularly for times when the economy is at or close to full employment, but, nonetheless, suggests little evidence that FG or BSP contributed significantly to financial vulnerabilities (section II).

3. As previous communications by the Committee have stated, should vulnerabilities arise, they are often best addressed with macroprudential tools. That said, adjusting the settings of these tools and adjusting regulations in response to cyclical developments are relatively new strategies with practical limitations (section III).[1]

4. A clear communications strategy likely helps in achieving the Committee's goals of sustaining economic growth and minimizing financial vulnerabilities when using makeup strategies, FG, and BSP, in part by avoiding large, destabilizing changes in the level of interest rates. Some jurisdictions have

[1] See the minutes of the April 2016 FOMC meeting, available on the Board's website at https://www.federalreserve.gov/monetarypolicy/fomcminutes20160427.htm.

used financial stability "escape clauses" in conjunction with their monetary policy strategy (section IV).

I. Macrofinancial Considerations

This section reviews characteristics of the current macrofinancial environment that will likely prevail regardless of the monetary policy strategy and tools used to achieve the Committee's goals. First, we focus on the general macrofinancial backdrop and discuss possible implications for financial stability. Second, we discuss specific financial stability considerations connected to low interest rates and a flat yield curve.

The Macrofinancial Backdrop

The key feature of the macroeconomic backdrop is that standard estimates of r* have declined between 2 and 3 percentage points over the past two decades, with many estimates clustered around ½ percent. Low neutral rates are likely the result of persistent, structural factors such as productivity growth, demographic trends, and the reduced capital intensity of production. Therefore, it is unlikely that the decades-long decline in r* will reverse soon. A low neutral interest rate implies that achieving the dual mandate will require low interest rates in the future, regardless of the monetary policy strategy or tools chosen.

In this environment, the federal funds rate is likely to be more frequently at the effective lower bound (ELB), and the yield curve will likely be flatter relative to historical experience.[2] With the Committee's ability to provide accommodation limited to some extent by the ELB, macroeconomic risks are skewed to the downside. Consequently, recessions may become more likely and recoveries may be slower, which places pressure on financial system resilience. Additionally, well-anchored inflation expectations dramatically reduce the risk of the admittedly extreme situation of deflation,

[2] As discussed later, the yield curve will likely be flatter than historical experience because of a lower real short rate, lower inflation expectations, and a lower term premium in a world in which bad economic outcomes are correlated with low inflation.

which can substantially damage household and firm balance sheets. As such, strategies that mitigate such risks likely support macroeconomic and financial stability.[3]

The Link between Low Rates, a Flat Yield Curve, and Financial Vulnerabilities

In the current environment with low r*, a key question is how monetary policy strategies and monetary easing affect financial vulnerabilities, such as elevated valuation pressures, excessive household and business borrowing, and excessive financial leverage. It seems reasonable that there would be a link: All else being equal, low rates buoy asset prices, make borrowing for households and businesses cheaper, boost consumption and wealth, and increase incentives for leverage. Previous work has considered the effect of interest rates on a range of financial vulnerabilities, but more targeted research that distinguishes between the effects of alternative monetary policy strategies on financial vulnerabilities versus the effects of a decline in r* is limited to nonexistent. Against this backdrop, we survey relevant analyses and consider the implications of this evidence for the more specific questions related to alternative strategies and tools.

Asset valuations and investor risk appetite

Low rates are often intended to increase aggregate demand in part by boosting asset prices and spurring risk-taking. However, taken to excess, they can also increase financial vulnerabilities. For asset prices, there are two channels. First, low rates raise the value of future income streams by lowering the discount rate and, hence, raising asset prices. Second, low rates may compress risk premiums.[4] In the latter case, asset price "bubbles" may form, which could lead to heightened risks through outsized declines in asset prices, attendant forms of risk-taking, or both. This risk-taking could reflect rational behavior, but it might also reflect "animal spirits" or "irrational exuberance."[5]

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[3] See, for example, Chen, Engstrom, and Grishchenko (2016).

[4] See, for example, Borio and Zhu (2012) and Coimbra and Rey (2019).

[5] Theory suggests that asset price bubbles can determine when market participants are rational (Tirole, 1985; Martin and Ventura, 2018) but might also be driven by "animal spirits" or "irrational exuberance" (Bordalo, Gennaioli, and Shleifer, 2018). The presence of irrational traders can lead rational traders to try to "time the market" or "ride the bubble" (Abreu and Brunnermeier, 2002).

Of course, identifying bubbles in hindsight is easy—not so in real time. A particular concern would be rapid appreciation in real estate prices, as real estate has often been a factor in financial stability events.[6]

Estimating the relationship between changes in interest rates and changes in other asset prices is famously plagued by a host of econometric issues. As such, empirical estimates should be interpreted with an appropriate level of caution. Against this backdrop, the available empirical evidence suggests that asset prices increase when rates fall. Table 1 (located near the end of the paper) summarizes selected empirical evidence relating interest rates to asset valuations and risk premiums. Elasticity estimates across a range of models indicate that for every 100 basis point decline in the general level of interest rates, over the course of several years, house prices increase roughly 2 to 4 percentage points, the stock market rises 4 to 5 percentage points, and corporate bond spreads decline 20 basis points. The size of the house and equity price changes is notable, and, indeed, the response of asset prices is an important channel of monetary policy transmission. Nonetheless, these elasticities are modest in magnitude relative to the overall variation in house and equity prices. For example, between 2000 and 2006, house prices increased between 40 and 70 percent, depending on the house price measure used.

Some recent literature shows that a considerable portion of the response of asset prices to monetary easing reflects lower risk premiums.[7] Empirical estimates suggest that a 100 basis point easing in the general level of interest rates leads to a decline in the 10-year nominal Treasury term premium of about 10 basis points and a decline in the excess corporate bond premium of about 15 basis points. Of note, the magnitudes of the estimated changes in term premiums and the excess corporate bond premium are almost as large as the *total* changes in Treasury yields and corporate bond spreads, suggesting that monetary policy affects asset prices to a significant extent through risk premiums.[8]

[6] See, for example, Kindleberger (2015).

[7] See, for example, Bernanke and Kuttner (2005).

[8] Gertler and Karadi (2015) present evidence that unexpectedly accommodative monetary easings are associated with sizable declines in the long-term nominal term premium and the excess corporate bond

Relatedly, there is a range of evidence showing that banks and other intermediaries "reach for yield" when rates are low; selected works are summarized in table 2 (located near the end of the paper).[9] Reach-for-yield comes in a variety of forms; a typical example is holding assets with lower credit quality or less liquidity to earn a higher yield.[10] For example, banks often loosen credit standards in response to lower rates, which can also boost asset valuations. While some of this loosening represents the risk-taking channel of monetary policy and is the intended result of policy easing when the economy needs support, this can go too far when economic activity strengthens, leading to weak standards and terms and potential outsized credit losses in a subsequent downturn.

Despite this evidence, the longer-run effect of low rates on financial vulnerabilities is uncertain. Some part of reach-for-yield may be temporary, as financial intermediaries such as pension funds and insurers that made long-term commitments to pay high nominal rates face pressure to reach for yield. This incentive should fade as old commitments mature and new commitments are made at lower nominal rates. In addition, a strand of recent research has pointed to a channel through which lower rates might contribute to *lower* vulnerabilities, partly reflecting that lower rates reduce the migration of intermediation to institutions outside the banking system.[11]

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premium. Gilchrist, López-Salido, and Zakrajšek (2015) show that easings were associated with modest declines in the term premium during the pre–Global Financial Crisis period, but much larger declines post-crisis.

[9] Daniel, Garlappi, and Xiao (2018) present evidence of "reach for income" by dividend-seeking retail investors when interest rates decline, but the magnitude of portfolio reallocations (to high-yielding equities and mutual funds) is fairly modest. Using incentivized laboratory experiments with students and others, Lian, Ma, and Yang (2019) show that students make moderate shifts toward riskier assets when the risk-free rate is lower, even when risks and risk premiums remain the same.

[10] On reach-for-yield in the corporate bond market, see Becker and Ivashina (2014) and Chen and Choi (2019).

[11] See Drechsler, Savov, and Schnabl (2017, 2019) and Driscoll and Judson (2013).

Household and business leverage

Borrowing and bank credit have long been linked to monetary policy; traditional bank credit models made this link explicit.[12] More modern investigations of the relationship between monetary policy and borrowing focus on other ideas, such as the financial accelerator of monetary policy or the response of business borrowing to monetary policy surprises.

Additional debt likely increases the financial system's vulnerability to an unexpected adverse shock. Of course, high rates make borrowing expensive; low rates make it cheap. With cheap debt comes more borrowing, which can be too much of a good thing if it creates financial vulnerabilities. Empirically, most financial instability events in the United States and abroad are characterized by large, debt-financed increases in asset prices that are followed by a sharp drop in asset prices.[13] Reflecting this empirical regularity, some evidence shows that debt growth increases vulnerabilities and significantly affects the probability of an ensuing financial crisis.[14] As has been the case in the United States, mortgage debt, in particular, appears linked to boom-and-bust cycles; effects can be magnified by interactions with liquidity supply.[15]

One way to gauge the importance of debt growth on financial vulnerabilities is the effect on the probability of a crisis. Empirically, the effect of debt growth on the probability of a crisis is not large. For example, the median of a range of estimates of the

[12] For example, the 1977 Federal Reserve Reform Act, which forms the basis of the dual mandate, directs the Federal Reserve to "maintain long run growth of the monetary and credit aggregates commensurate with the economy's long run potential to increase production, so as to promote . . . the goals of maximum employment, stable prices, and moderate long-term interest rates"; see Federal Reserve Reform Act of 1977, Pub. L. No. 95–188, 91 Stat. 1387 (1977), quoted text in § 202.

[13] The three most significant financial instability events in the United States, at least since the Federal Reserve was founded, are the stock market crash of 1929, the S&L (savings and loan) and banking and thrift crises of the 1980s, and the Global Financial Crisis of 2008 to 2009. All three episodes were characterized by a large fluctuation in asset prices, high leverage, and extensive maturity transformation.

[14] See Jordà, Schularick, and Taylor (2013) and Krishnamurthy and Muir (2017).

[15] See Mian, Sufi, and Verner (2017) and Goldberg (forthcoming).

response of mortgage credit to monetary policy suggests that a 100 basis point policy rate easing leads to only a 30 basis point increase in the probability of a crisis.[16]

Financial leverage and funding risk

Financial leverage and its connection to the level of the short rate has been cited not only as an important channel of monetary policy transmission, but also as a potential source of financial vulnerabilities.[17] Just as with businesses and households, low rates make borrowing cheap for intermediaries. As such, institutions such as dealers that rely on market funding can do so at lower cost when rates are low and then lend on these funds to other financial intermediaries or real investors. That said, some of the profitability of this trade depends on a reasonably steep yield curve. In a low r* environment, the yield curve may be flatter than historically was the case, which could damp vulnerabilities stemming from this channel.

More narrowly, an often-cited risk of low interest rates is related to the franchise value of banks and other institutions engaged in maturity transformation.[18] Bank profits depend partly on net interest margins. Because retail deposit rates are generally constrained at the ELB—and so would likely not fall as much as rates on loans—net interest margins could narrow. As a result, banks' future profitability could decline, thus negatively affecting capital levels and reducing franchise value. The erosion of capital levels could leave banks vulnerable to shocks. Furthermore, lower franchise value could lead to reach-for-yield and increased risk appetite, further exposing the financial system to the vulnerabilities described earlier.

While low rates may lead to reach-for-yield behavior, they may also reduce incentives to engage in liquidity and maturity transformation, as the yield curve will be

[16] See Jordà, Schularick, and Taylor (2017); Musso, Neri, and Stracca (2011); and Kiley (2018). These estimates may be subject to small sample problems; estimates should be interpreted accordingly.
[17] See Adrian and Shin (2010).
[18] See Bank for International Settlements (2018) for a detailed discussion of the effect of low rates on banks, insurance companies, and pension funds. For declines in franchise value and risk-taking by banks in the 1980s, see Keeley (1990).

flatter because of low real rates and low expected inflation.[19] Consequently, that particular source of financial vulnerability may decline. Which effect is quantitatively more important is not clear and may vary over time.

II. Financial Stability Implications of Strategies and Tools

This section reviews the potential financial stability implications of several of the strategies and tools reviewed in other papers.[20] It also discusses macroprudential and supervisory tools. With the caveat that the analysis is subject to a great deal of uncertainty, while use of these strategies and tools could entail some financial stability risks, these potential costs are likely small relative to the economic and financial stability benefits. Of course, there is likely a range of costs and benefits of using these strategies; prudent risk management suggests weighing the degree of accommodation against the potential for increased vulnerabilities. Relatedly, although monetary policy stimulates the economy in part by encouraging risk-taking, excessive risk-taking may be a greater or lesser concern at different points over the business cycle.[21]

We discuss makeup strategies, FG, BSP, and macroprudential and supervisory tools, reviewing the costs and benefits of each.

Makeup Strategies

We first focus on "makeup strategies," or monetary policy strategies that aim to offset, at least in part, past misses of inflation from its objective.

If makeup strategies generate financial stability vulnerabilities, intuition suggests these would most likely become salient during the makeup period, although experience with these strategies is minimal. In particular, makeup strategies may require accommodative monetary policy and thus low rates well into economic recoveries, possibly generating overly optimistic macroeconomic expectations and excessive risk-taking and leverage. Should leverage or other vulnerabilities become elevated, a drop in asset prices or other shocks may lead to financial instability. In addition, if financial

[19] See Woodford (2016).
[20] See Arias and others (2020) and Hebden and others (2020).
[21] See Chodorow-Reich (2014).

institutions acquire low-yielding assets during the low-inflation period, they may experience losses on these assets during the higher-inflation period. These risks could be important; however, we have little relevant experience with these conditions.

In addition, concerns about rising debt and excessive risk-taking should be evaluated in light of how much lower interest rates will be under makeup strategies than under the existing "bygones be bygones" framework. Makeup strategies may have modest effects on the level of interest rates over the business cycle. At the same time, scenario analysis suggests that interest rates under a makeup strategy would be lower than under the current framework over significant portions of an expansion. As shown in figure 1, following a mild recession under an average inflation targeting rule, the real 10-year yield deviates from the baseline path by up to 50 basis points during the recovery.[22] As shown in figure 2, FG that promises to delay departure from the ELB only after the economy returns to 2 percent inflation leaves rates lower for a protracted period: The real 10-year Treasury yield is 50 basis points below the baseline, on average, during the decade after the recession ends.

These lower yields would likely support a stronger recovery, and they could also generate additional borrowing and financial leverage. The magnitudes of the increases in vulnerabilities would likely be moderate relative to the types of credit booms that have preceded financial instability. As a result, such conditions do not seem to suggest makeup strategies should be avoided. However, they point to the potential value of escape clauses should vulnerabilities materialize in unexpected ways, as discussed later.

Makeup strategies may affect financial stability in the opposite manner—by being too successful and generating an unwelcome rise in inflation that requires a sharp tightening in policy and potentially abrupt shifts in expectations and financial markets. One longer-term financial stability risk from a makeup strategy could arise if, during the

[22] Figure 1 reproduces analysis in Arias and others (2020). Figure 2 reproduces analysis of Chung and others (2020). Of note, there are several differences between the scenarios and models studied in figures 1 and 2. The purpose here is to provide an assessment of the potential quantitative effects of these alternative strategies rather than to compare the effects of threshold-based FG and average inflation targeting strategies.

high inflation period, inflation expectations become unanchored and drift significantly above 2 percent.[23] The probability of a high inflation outcome depends heavily on the credibility of the Committee; with credibility, the probability of inflation expectations becoming unanchored is likely to be small.

Even with these potential concerns, it is important to recognize that makeup strategies may contribute positively to financial stability. Forgoing a makeup strategy could result in low nominal rates for even longer, perhaps reflecting a drift down in inflation expectations or subdued growth. Lower inflation expectations and a weak economy can be problematic for financial stability through a number of channels, including debt deflation or weaker intermediary and borrower balance sheets.[24]

Monetary Policy Tools

We next turn to the monetary policy tools that could be used to achieve the goals of a makeup strategy once the policy rate has reached the ELB, and we discuss the implications of their use for financial stability. Broadly, a number of these tools support the goals of the strategy by affecting the level of interest rates and the slope of the yield curve. Whether these tools affect financial vulnerabilities depends on whether the changes to interest rates are large enough to affect asset valuations and financial intermediaries' balance sheets. Consequently, an overarching question is, "Are potential changes in the level or slope of the yield curve large enough to affect asset values or financial institution balance sheets?" The available empirical evidence suggests those changes are not large enough to contribute materially to financial vulnerabilities. That said, there are a few potential exceptions, which we review below.

[23] The high inflation of the 1970s, combined with the prevailing set of financial regulations (Regulation Q, for example), was a major factor in the financial instabilities of the 1970s and early 1980s.

[24] Sheedy (2014) argues that nominal gross domestic product (GDP) targeting, which, in part, is a makeup strategy, improves the functioning of financial markets because most debt is nominal. Koenig (2012) highlights the connection between nominal GDP targeting and a traditional Taylor rule. Gomes, Jermann, and Schmid (2016) present evidence that debt deflation is an important channel for the transmission of shocks.

Forward guidance at the effective lower bound

Forward guidance at the ELB intends to reduce uncertainty about the future path for the federal funds rate and drive the expectations of the private sector toward the announced path. By doing so, FG can provide additional policy accommodation despite the ELB constraint. In turn, this accommodation supports the economy, which is a force for reducing financial stability concerns.

With FG leaving rates low for long at the ELB, financial institutions may come under pressure to reach for yield, which raises the concerns discussed earlier regarding low interest rates. Some evidence suggests that U.S. money funds apparently responded to FG by extending into riskier assets, holding less diverse portfolios, reducing fees, and exiting the market.[25]

Another concern is that low uncertainty about monetary policy can lead to muted financial market volatility and a buildup in leverage. One channel identified in a pre-crisis context for this development to occur is through value-at-risk considerations. Specifically, the ratio of value at risk to equity is observed to be relatively constant over the business cycle. Should market volatility decrease, this decline has the effect of both pushing down value at risk and increasing the value of equity. In turn, intermediaries lever up to bring the ratio back toward its steady-state value.[26]

Formal empirical evidence regarding the financial stability effects of FG at the ELB is scant. In broad terms, however, the federal funds rate was held at the lower bound for nearly seven years, with a number of episodes of FG used to communicate to the public information about the FOMC's reaction function and views regarding the future path of policy. While pockets of vulnerabilities appeared during this period—most notably in leveraged lending—overall vulnerabilities were assessed to be moderate. A caveat to this episode is that the economy was recovering from the Global Financial Crisis for the bulk of that period, and so some of the excesses that could be associated with an economy "running hot" would be less likely to materialize. Furthermore, the FG

[25] See Di Maggio and Kacperczyk (2017).

[26] See Adrian and Shin (2010). The Basel Accords have replaced value at risk with expected shortfall, but both measures are sensitive to decreases in market volatility.

was used during a period in which bank supervision and regulation were being tightened, which limited banks' ability to take additional risk until they could identify new gaps in the rules.

Balance sheet tools

BSP is a tool that the Committee could use to provide monetary policy stimulus in situations in which the federal funds rate is at or near its ELB. BSP has been used only during a few episodes of the Federal Reserve's history, leading to limited empirical evidence of its effects.[27] However, this evidence, plus some theory, has identified a number of costs and benefits of BSPs.[28]

BSPs reduce longer-term interest rates. Because many businesses and households borrow long term, quantitative easing (QE) might encourage borrowing disproportionately more than changes to the policy interest rate. In addition, the reduction in longer-term interest rates can flatten the yield curve. A flatter yield curve can disrupt the business models of financial institutions (such as pension funds and life insurance companies) that depend on positive long-run returns. Although a relatively flat yield curve has not, to date, constrained the Committee's actions much, it has reportedly constrained the aggressiveness of the Bank of Japan's asset purchases.

At the same time, a flatter yield curve can lessen the quantity of maturity transformation. Because the interest rate spread between longer-term assets and shorter-term liabilities narrows, intermediaries find it less profitable to engage in this activity.[29]

Likely related to the flat yield curve, there is some evidence that QE leads to reach-for-yield behavior and narrowing of risk premiums for both Treasury securities and other instruments.[30] Some empirical research suggests that banks most affected by QE

[27] The three major episodes that used BSPs were large-scale open market operations during the Great Depression, Operation Twist in the 1960s, and the large-scale asset purchases during the Global Financial Crisis.

[28] See Carlson and others (2020) on issues in the use of the balance sheet tool.

[29] Of course, maturity transformation has its pluses, too—maturity transformation is one of the principal activities of banks, and this activity supports economic growth.

[30] See Kashyap and Seigert (2020), Li and Wei (2013), and Gagnon and others (2011).

eased lending standards and made riskier loans. Other evidence suggests that corporate bond portfolios move toward riskier instruments.[31] While this risk-taking channel is one way in which monetary policy can be effective, that same channel can generate financial vulnerabilities. The evidence on excessive risk-taking by financial and nonfinancial firms during QE suggests that while some reaching for yield may have occurred, it did not pose a serious concern.[32]

There are some financial stability benefits from QE. The increase in reserves from QE boosts bank liquidity. Furthermore, in past experience, much of the rise in reserves occurred at the largest banks and at branches of foreign banks, the institutions with the largest effect on financial stability. In addition, and on net, overall private-sector duration risk is reduced by BSPs.[33] The provision of safe assets by the central bank through reserves and reverse repurchase agreements, or repos, has the potential to "crowd out" unstable private-sector money creation.[34] And, finally, many of the possible financial stability concerns that were raised in advance of the implementation of QE did not materialize.

Yield curve control tools

Yield curve control (YCC) tools are a type of BSP that can be used in conjunction with FG and can be directed at the short or long end of the yield curve. Financial stability concerns for YCC tools are similar to those for BSPs. One difference is the extent to which preferred habitat motives coincide with financial stability concerns. For example, pension funds and other institutional investors reportedly prefer specific maturities—if they did not, BSPs generally and YCC tools specifically would be less effective. To the extent that these institutions were unable or unwilling to switch to

[31] Chen and Choi (2019) demonstrate that yields on bonds that were more likely to be subject to reach-for-yield behavior reacted more to LSAP (large-scale asset purchase) announcement effects than bonds that were not.
[32] See Kuttner (2018).
[33] See Woodford (2016).
[34] See Greenwood, Hanson, and Stein (2016). Gorton and He (2016) offer a caveat: If QE is concentrated in Treasury securities, safe collateral is removed from the market, and investors will create risky alternatives to satisfy collateral needs.

assets of similar safety but different maturity, and instead substitute assets with less safety and similar maturity, YCC could have financial instability implications.

The most salient evidence regarding YCC comes from recent Bank of Japan operations. There, the commitment to target 10-year bond yields created some operational and liquidity problems because of the dominance of the Bank of Japan in market segments where purchases were concentrated. In addition, the flat yield curve led pensions and life insurance companies to take on somewhat greater risk by purchasing foreign bonds and super-long Japanese government bonds.

Negative interest rates

Financial stability risks from negative interest rate policy (NIRP) are similar to those from low rates but with a few additional concerns. For example, the implementation of NIRP in the United States could cause some problems for the operation of money markets. Evidence from the Comprehensive Capital Analysis and Review (CCAR) stress tests and from experience abroad suggests that NIRPs reduce bank profitability at exposed institutions.[35] Negative rates have squeezed banks' profit margins as their lending rates have declined more than their funding costs, because retail deposit rates have generally remained nonnegative. That effect was partly offset by improved bank balance sheets, as asset values increased and nonperforming loans were contained.[36] However, with these positive effects likely transitory, there is concern that bank profits could come under greater pressure as negative rate regimes persist.[37]

[35] Regarding euro-area banks, Heider, Saidi, and Schepens (2019) provide evidence that the introduction of NIRP by the European Central Bank in mid-2014 led to increased risk-taking (and less lending) with a greater reliance on deposit funding. However, Arce and others (2018) find that banks with net interest income that are adversely affected by negative rates take less risk and adjust loan terms and conditions to shore up their risk-weighted assets and capital ratios. Ampudia and Van den Heuvel (2018) find that accommodative monetary policy shocks, on average, boost bank equity prices, but this effect is reversed when interest rates are already low. Regarding the United States, Arseneau (2017) finds that the effect of negative rates depends importantly on bank business type.

[36] In general, NIRP has modest profitability effects on banks that rely relatively more on activities that generate fee income. See Arseneau (2017).

[37] Brunnermeier and Koby (2018) and Eggertsson and others (2019) argue that NIRP can lead to a contraction in lending and output through negative effects on bank profitability. They use the term "reversal rate" to refer to the (negative) level of the interest rate at which these contractionary effects on bank lending outweigh the stimulative effects through other channels.

III. Macroprudential and Supervisory Tools

The Federal Reserve and other regulatory agencies have a range of regulatory and supervisory tools to build financial resilience and mitigate financial vulnerabilities. Tools to build resilience include capital and liquidity requirements, along with requirements that banks make structural changes to facilitate resolution. Tools for addressing cyclical vulnerabilities include the countercyclical capital buffer (CCyB), the CCAR stress tests, bank supervisory guidance, and changes to margin requirements. The CCyB, in particular, can be activated to boost capital during good times when vulnerabilities build and released when the economy weakens to promote continued lending.

The appeal of using macroprudential and supervisory tools rather than monetary policy to address financial vulnerabilities is twofold. First, it reduces potential conflicts with macroeconomic monetary policy goals. Monetary policy is already tasked with maximum employment and price stability, and trying to meet a third goal may require sacrifices to other goals even if it was effective at dealing with financial vulnerabilities. Second, macroprudential tools can be more narrowly tailored toward a set of vulnerabilities than monetary policy tools can be. For example, in the wake of the financial crisis, regulators raised capital requirements for the largest, most interconnected institutions. In addition, in 2006, supervisory guidance was used to limit banks' commercial real estate exposures as valuations increased and terms weakened. This guidance was reiterated in late 2015 and is widely viewed as having helped tamp down commercial real estate prices.[38] In addition, the 2016 money market reform appears to have eliminated much of the run risk associated with these institutions.

As the Committee has noted previously, there are, however, limits to the effectiveness of macroprudential and supervisory tools, which may be a justification for using monetary policy to address financial vulnerabilities. The first is that many of the tools, such as bank capital rules or supervisory guidance, affect only banks. Consequently, the effect on vulnerabilities may be limited if the vulnerabilities stem from or can migrate to the nonbank sector. In contrast, monetary policy affects all lenders. As

[38] See Glancy and Kurtzman (2018), Basset and Marsh (2017), and Glancy and others (2019).
For additional details, see the 2015 interagency statement (SR 15-17), available on the Board's website at https://www.federalreserve.gov/supervisionreg/srletters/sr1517.htm.

former Governor Stein observed, "while monetary policy may not be quite the right tool for the job, it has one important advantage relative to supervision and regulation—namely that it gets in all of the cracks."[39]

The second limit is that many of these tools require coordination with other agencies and some delay in implementation. For example, changing banking regulations usually requires some coordination and agreement among the three federal bank regulators. In addition, the Administrative Procedures Act requires that regulations go through a public process of rule proposal and public comment that, by construction, easily lasts six months or longer.[40] The primary exceptions to these processes are the CCyB and the Dodd-Frank stress tests (mandated by the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010) where the stress scenario can be tailored to focus on emerging vulnerabilities, subject to the Board's framework for scenario design.

A third limit is that in the United States, unlike in some other countries, there cannot be underwriting standards that apply to borrowers, regardless of lender. Examples include minimum down-payment requirements on a mortgage or limits on corporate debt service ratios.[41] Here, the problem is that if regulators try to impose such limits indirectly, by restricting lending terms used by a bank, lending can migrate to a nonbank—a potentially less prudentially regulated—entity.

IV. Communication Strategies

The effects of monetary policy on financial stability will depend importantly on the expectations of households and firms about economic and policy variables.

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[39] See Stein (2013), quoted text in paragraph 41. In addition, the Committee has previously debated potential situations in which monetary policy could be used to address financial vulnerabilities; many of the limitations of macroprudential tools were raised on that occasion. For more information, see the minutes of the April 2016 FOMC meeting in note 1.

[40] For more detailed descriptions of these tools and their limitations, see the discussions of the two tabletop exercises undertaken by the Conference of Presidents Committee on Financial Stability (Adrian and others, 2017, and Duffy and others, 2019).

[41] The Federal Reserve Board has had the authority to set margin requirements on purchases of equities since 1934 but has not used this power since the early 1970s. This decision may be because these requirements were viewed to be ineffective; see, for example, Hsieh and Miller (1990).

Communication about monetary strategies and tools can help shape those expectations and thus influence the effect on financial stability. More narrowly, if markets do not understand how monetary policy will respond to changing economic conditions, they may position themselves in ways that make them vulnerable to interest rate changes. Thus, clear communication of the monetary policy strategy is important to reduce surprises that could lead to financial instability. Of course, certainty poses risks as well. In particular, if policymakers remove too much uncertainty regarding the expected policy path, financial intermediaries could take on positions that then lead to outsized losses with broader knock-on effects if the strongly expected path does not come to pass.[42]

International Experience

Some foreign central banks have incorporated financial stability issues into their monetary policy communications to varying degrees. Although most foreign central banks have a primary mandate for price stability, many also have financial stability among their secondary mandates. For example, the ECB Treaty requires it to "contribute to the smooth conduct of policies pursued by competent authorities relating to the prudential supervision of credit institutions and the stability of the financial system" (Article 127(5)), and the Bank of Japan Act says one of its purposes "is to ensure smooth settlement of funds among banks and other financial institutions, thereby contributing to the maintenance of stability of the financial system" (Article 1).

Central banks have varied in terms of how they sought to promote financial stability. Some banks, such as the Bank of England, have a separate financial policy committee with authority over macroprudential tools, leaving the monetary policy committee to focus on macroeconomic objectives. Other central banks, such as the Swedish Riksbank and the Norges Bank, have at times incorporated financial stability considerations into how they conduct and communicate about monetary policy. In particular, both of those central banks went through periods during the past decade when they kept monetary policy tighter than was consistent with their inflation goal in order to lean against perceived financial stability risks from rapidly rising house prices and household debt. That experience is generally seen as problematic, because the monetary

[42] See De Pooter and others (2018).

policy stance could not be explained based on the inflation-targeting framework, and those central banks provided insufficient guidance on how they would balance their inflation and financial stability goals. Most foreign central banks have stated that they would use monetary policy as a response to perceived financial stability risks only if they believed that macroprudential and supervisory tools would be inadequate.

Financial Stability "Escape Clauses"

The foreign experience also provides insights regarding the use of financial instability "escape clauses." Because the evolution of financial vulnerabilities may be uncertain, the escape clause allows the central bank to deviate from a monetary policy strategy or rule if financial vulnerabilities become significant. An example of an escape clause is the Bank of England's (BOE) 2013 forward guidance linking interest rates and asset purchases to a threshold for the unemployment rate. That guidance had a "knockout" saying that such a link would cease to hold if the BOE's Financial Policy Committee judged that the stance of monetary policy posed a significant threat to financial stability that could not be contained through macroprudential and supervisory tools.[43]

[43] Specifically, the BOE indicated that the forward guidance would cease to hold if one of three conditions were breached, including if "the Financial Policy Committee (FPC) judges that the stance of monetary policy poses a significant threat to financial stability that cannot be contained by the substantial range of mitigating policy actions available to the FPC, the Financial Conduct Authority and the Prudential Regulation Authority in a way consistent with their objectives." See Bank of England (2013), quoted text in paragraph 5.

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Table 1: Estimated Effects of 100 Basis Point Monetary Policy Shock (unexpected easing) on Asset Valuations	
Measure and source	Effect
Corporate bond spread	
Caldara and Herbst	20 bps
Excess corporate bond premium	
Gertler and Karadi	15 bps
Stock prices	
Bernanke and Kuttner	4.7%
Swanson	3.6%
House prices	
Del Negro and Otrok	3.3%
Jarociński and Smets	4.4%
Kiley	2.0%
Musso, Neri, and Stracca	1.5%
10-year Treasury yield	
Gertler and Karadi	16 bps
Gilchrist, López-Salido, and Zakrajšek	14 bps
10-year Treasury term premium	
Gertler and Karadi	16 bps
Gilchrist, López-Salido, and Zakrajšek	7 bps

Note: The estimates in this table are from models that use a range of identification methods (including changes in futures prices around Federal Open Market Committee announcements, vector autoregressions (VARs) using such changes as external instruments, and VARs using sign restrictions), use different sample periods and definitions of monetary policy shocks, and are estimated with some imprecision. Some papers measure monetary policy shocks as unexpected changes in the one- or two-year Treasury yield; where possible, these estimates are adjusted so that the estimated effect shown in the table can be interpreted as the effect of a 100 basis point unexpected decline in the federal funds rate. The estimates in this table are most reasonably applied to policy interventions that do not represent a large deviation from historical practice (Antolín-Díaz, Petrella, Rubio-Ramírez, 2019).

Source: Authors' calculations.

Table 2. Connections between Interest Rates, Vulnerabilities, and Vulnerability-Related Measures

	This paper studies the effect of . . .	This paper studies the effect on these vulnerability-related measures	Studies specifically low rate environment	Findings
Banking system vulnerabilities				
Jiménez, Ongena, Peydró, and Saurina (2014)	Changes in interest rates, controlling for unobserved time-varying characteristics of firms and banks. Data are from Spain.	Lending approval rate, lending amount, collateral requirements, and default propensity for loans to "risky" firms (firms that have defaulted recently). Focuses on how lowly capitalized banks respond differently than highly capitalized banks.	No	Lower interest rates increase risk-taking; relation is *more* pronounced for low-capitalized banks. Following a 1 percent decrease in overnight rate, loan approval rate for risky borrowers increases 3 percentage points more for poorly capitalized banks than for well-capitalized banks (mean approval rate is 36 percent). Following a decline in interest rates, poorly capitalized banks reduce collateral requirements and make more loans that lead to default relative to well-capitalized banks.
Dell'Ariccia, Laeven, and Suarez (2017)	Changes in interest rates. United States	Internal ratings on loans to businesses, from the Survey of Terms of Business Lending	No	Lower interest rates modestly increase risk-taking; relation is *less* pronounced for low-capitalized banks. Following a 1 percent decrease in overnight rate, loan risk ratings for new loans rise 0.1 standard deviation.

Short term funding/maturity transformation

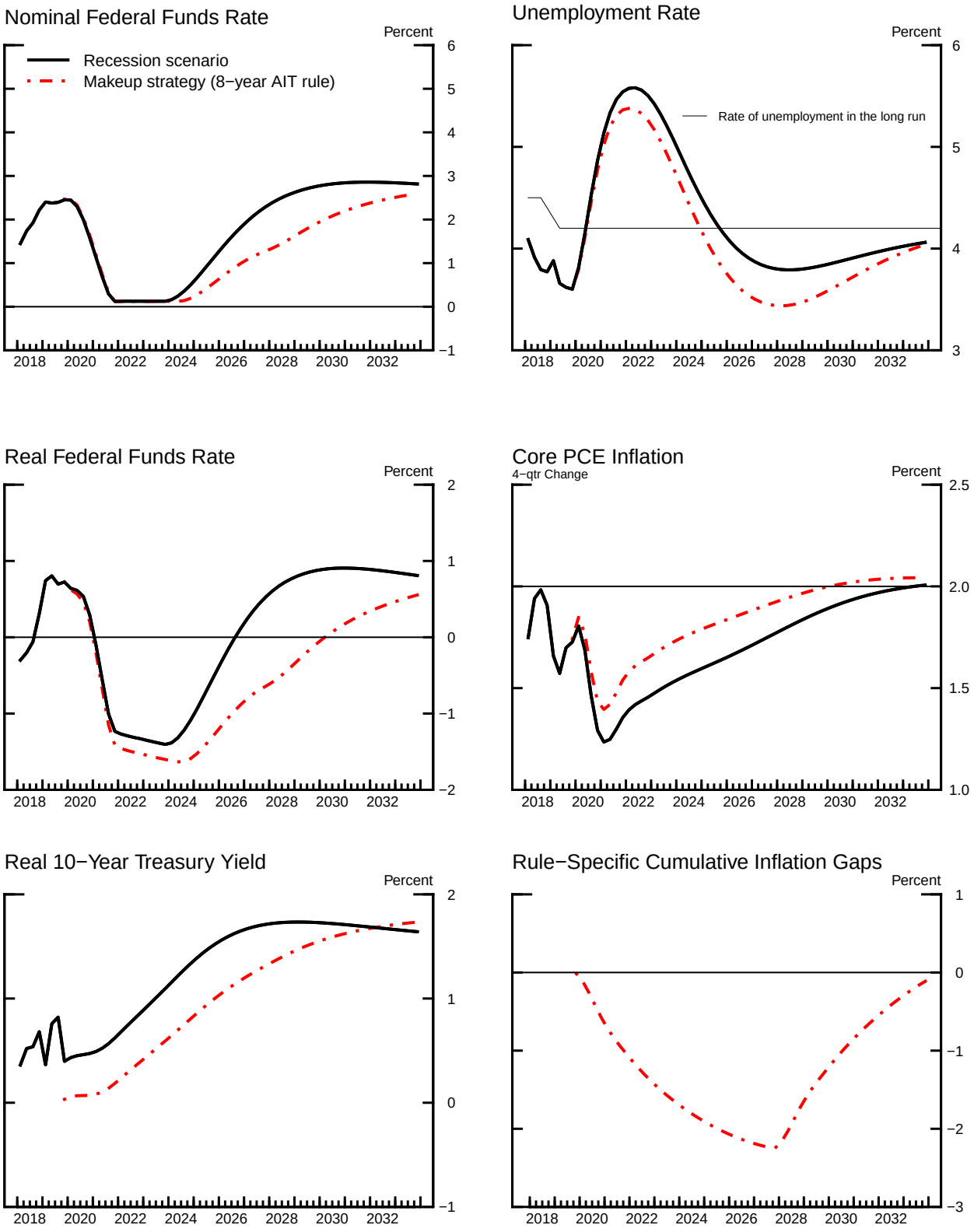
Di Maggio and Kacperczyk (2018)	Five Federal Open Market Committee announcements from 2008 and 2012 at which "lower for longer" forward guidance or the federal funds rate target were lowered. United States	Prime money market funds' maturity transformation and portfolio composition	Yes	When close to the effective lower bound, lower-for-longer announcements led to higher risk-taking by money market funds. A reduction in the federal funds rate from 1 percent to 0 percent increases the spread over T-bills for prime money market funds 57 basis points; weighted-average maturity increases by 1.7 days.
Drechsler, Savov, and Schnabl (2019)	Changes in deposit rates driven by 2003–06 hikes in the federal funds rate. United States	Rate hikes do not pass one-for-one into deposit rates, thereby leading investors to shift from deposits into shadow banks, ultimately leading to a shift in the composition of mortgage finance.	No	Hikes in the federal funds rate between 2003 and 2006 caused aggregate deposits to shrink by 12 percent, leading to a 13 percent decline in bank real estate loans and a corresponding 10 percent increase in loans through private-label securitization.

Investor risk appetite

Lian, Ma, and Wang (2019)	Lower risk-free rates, using an incentivized lab experiment. The lab experiment participants are Harvard Business School (HBS) students and others. Lab experiments offer very clean identification but raise questions of applicability in real-world settings.	The share of a hypothetical portfolio that HBS students allocate to risk assets	Yes	In the lab, HBS students demonstrate a stronger preference for risky assets when the risk-free rate is low. Keeping risk premiums and risks the same but reducing the risk-free rate from 5 percentage points to 1 percentage point, HBS students increase allocation to the risky asset by 9 percentage points.
Daniel, Garlappi, Xiao (2018)	Local deposit rates. United States.	Allocation to high-dividend stocks for individual investors	No	Lower interest rates are associated with modest changes in aggregate retail investor allocations. A 1 percent decrease in the federal funds rate leads to a 1 percent increase in holdings of high-dividend stocks and a 5 percent increase in assets under management for high-income equity mutual funds. Effects are more pronounced for retirees.

Source: Authors' taxonomy based on the cited papers.

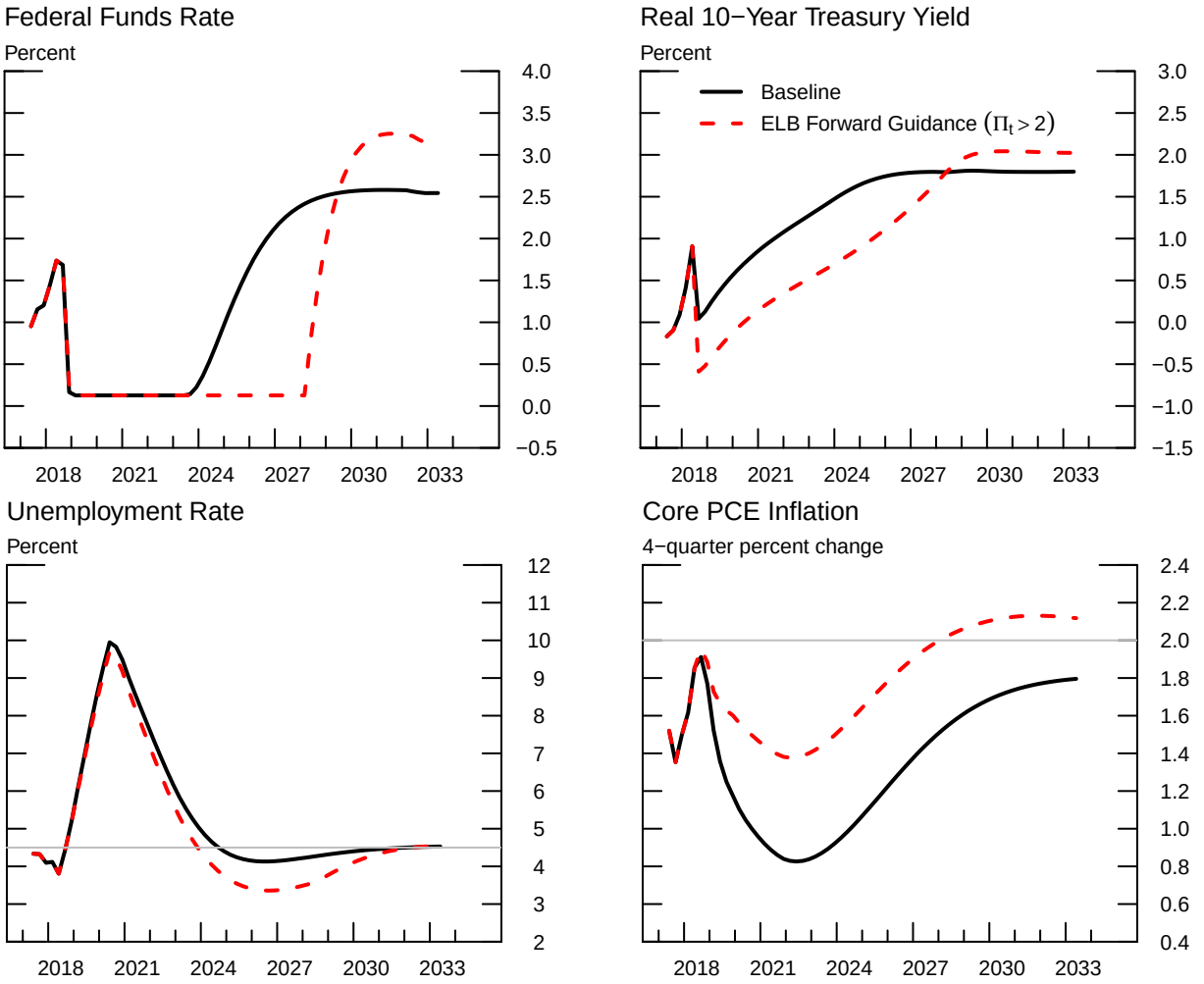
Figure 1: An Average Inflation Targeting Rule in a Recession Scenario



Note: AIT is average inflation targeting; PCE is personal consumption expenditures.

Source: Jonas Arias, Martin Bodenstein, Hess Chung, Thorsten Drautzburg, and Andrea Raffo (2020), "Alternative Strategies: How Do They Work? How Might They Help?" Finance and Economics Discussion Series 2020-068 (Washington: Board of Governors of the Federal Reserve System, August).

Figure 2: Forward Guidance with an Inflation Threshold in a Recession Scenario



Note: ELB is effective lower bound; PCE is personal consumption expenditures.

Source: Hess Chung, Etienne Gagnon, Taisuke Nakata, Matthias Paustian, Bernd Schlusche, James Trevino, Diego Vilán, and Wei Zheng (2019), "Monetary Policy Options at the Effective Lower Bound: Assessing the Federal Reserve's Current Policy Toolkit," Finance and Economics Discussion Series 2019-003 (Washington: Board of Governors of the Federal Reserve System, January), https://dx.doi.org/10.17016/FEDS.2019.003.