

## MONETARY POLICY IN A NEW ERA

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In 2017, the flagship research conferences of the European Central Bank and the Federal Reserve—held in Sintra, Portugal, and Jackson Hole, Wyoming, respectively—had something in common: Both had official themes unrelated to monetary policy, or even central banking. The ECB conference (theme: Investment and Growth in Advanced Economies) did include an opening speech by President Mario Draghi on monetary policy and the outlook, before turning to issues like the prospective effects of technological advances on employment. However, the Fed’s meeting (theme: Fostering a Dynamic Global Economy), which included papers on topics ranging from fiscal policy to trade to income distribution, made almost no mention of monetary policy. Whether intended or not, the signal, I think, was clear. After ten years of concerted effort first to restore financial stability, then to achieve economic recovery through dramatic monetary interventions, central bankers in Europe and the United States believe that they see the light at the end of the tunnel. They are looking forward to an era of relative financial and economic stability in which the pressing economic issues will relate to growth, globalization, and distribution—issues that are the responsibility of other policymakers and *not* primarily the province of central bankers.

Would that it were so simple. Although central bankers can certainly hope that the next ten years will be less dramatic and demanding than the past ten, there will certainly be important new challenges to be met. In this note, I focus selectively on two such challenges: the implications of the secular decline in nominal interest rates for the tools and framework of monetary policy; and the status of central banks within the government, in particular, the questions of whether central banks should and will retain their current independence in making monetary policy. As I will explain, the two challenges are related, in that the low-inflation, low-interest-rate environment in which we now live calls into question some of the traditional rationales for central bank independence.

The long-term decline in nominal interest rates is well known and has been extensively studied (Rachel et al., 2015). The decline appears to be the product of many causes, including lower inflation rates; aging populations in advanced economies (Gagnon et al., 2016a); slower productivity growth and “secular stagnation” (Summers, 2015); global patterns of saving and investment (Bernanke, 2005); and increased demand for “safe” assets (Del Negro et al., 2017; Caballero et al., 2017). Some of these factors may reverse in the medium term—for example,

recent historically low rates of productivity growth could revert to more-normal levels (Byrne and Sichel, 2017), and there is some evidence that the global savings glut may be moderating (Chinn, 2017)—which could lead to somewhat higher rates in the future. For now, though, the combination of low nominal rates and the difficulty of reducing short-term interest rates (much) below zero implies that monetary policymakers may have limited scope to address deep economic slowdowns through the traditional means of cutting short-term interest rates. Recent research by Kiley and Roberts (2017) illustrates the potential severity of the problem. Based on simulations of econometric models, including the Fed’s main model for forecasting and policy analysis, these authors show that the use of conventional, pre-crisis policy approaches could lead to policy rates being constrained by the zero lower bound (ZLB) as much as one-third of the time, with adverse effects on the Fed’s ability to hit its 2 percent inflation target or to keep output near potential.<sup>1</sup>

How should central banks respond? Outside of making a stronger case for proactive fiscal policies, there are two broad possibilities (interrelated and not mutually exclusive). First, rather than relying on the management of short-term interest rates alone, as assumed by Kiley and Roberts, monetary policymakers could make greater use of new tools developed in recent years. In the first main section of this paper, I review some of these tools. I argue that both forward guidance and quantitative easing are potentially effective supplements to conventional rate cuts, and that concerns about adverse side effects (particularly in the case of quantitative easing) are overstated. These two tools can thus serve to ease the ZLB constraint in the future, as argued by Yellen (2016). Two other tools—negative interest rates and yield curve control—are less likely to play important roles, at least in the United States. European and Japanese policymakers have successfully employed negative rates, but overall they appear to have relatively modest benefits (because the option to hold cash limits how far negative rates can go), as well as some offsetting costs (related to their effects on certain financial institutions and markets). Yield curve control, or the direct management of longer-term interest rates, has been adopted by the Bank of Japan and makes sense in the current Japanese context. However, as I

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<sup>1</sup> As some major central banks have employed modestly negative rates, conventional usage now often refers to the “effective lower bound” (ELB) on interest rates rather than the ZLB. The Federal Reserve has not used negative rates, however. Since I am focusing on the Fed here, for simplicity I’ll stick with the ZLB acronym.

will discuss, the depth and liquidity of the markets for U.S. government securities would make it difficult for the Fed to peg rates beyond a horizon of two years or so.

Although unconventional tools can increase the potency of monetary policy, the ZLB is still likely to be a binding constraint on the monetary response to a downturn that is more serious, or which occurs when rates remain (like today) below neutral levels. A second broad response to the problem is to modify the overall policy framework, with the goal of enhancing monetary policymakers' ability to deal with such situations (Williams, 2017). Focusing on the case of the Federal Reserve, in the second principal section of the paper I briefly consider two proposed alternatives: (1) raising the Fed's inflation target from its current level of 2 percent, and (2) introducing a price-level target. I argue that a higher inflation target has a number of important drawbacks: It would, obviously, lead to higher average inflation (possibly inconsistent with the Fed's mandate for price stability); and, more subtly, it implies a Fed reaction function that theoretical analyses suggest is quite far from the optimal response. A price-level target performs better on both counts, as 1) it is fully consistent with the goal of price stability, perhaps even more so than an inflation target; and 2) it implies a "lower-for-longer" response to periods when rates are at their ZLB, which approximates what theory tells us is the optimal approach. However, a price-level target can be problematic in the face of supply shocks, and the switch to a price-level target from the current inflation targeting approach would be a significant communications challenge. In the latter part of the section, I propose and discuss a third possible alternative: a "temporary price-level target" that kicks in only during periods in which rates are constrained by the ZLB. I argue that the adoption of a temporary price-level target would be likely to improve economic performance, relative to the current framework. Importantly, it would do that while both maintaining price stability and requiring only a relatively modest shift in the Fed's framework and communication policies. However, this proposal is a tentative one at this stage, and more analysis would be needed before taking it further.

Beyond the problems arising from low nominal interest rates, monetary policymakers also face challenges to central bank independence (CBI). The challenge to CBI has been heightened by the political blowback that followed the financial crisis. But, as already noted, questions about CBI are also related to the change in the macroeconomic and interest-rate environment, linking this issue to the themes of the first part of the paper. In the United States, the doctrine of CBI emerged, in part, from the inflationary experience of the 1960s and 1970s,

which was blamed in part on undue political influence on monetary policymakers. Following these events, both formal models and informal conventional wisdom held that, to avoid pressures to overheat the economy and allow higher inflation, the Fed needed greater independence from politics. However, the inflation-centric rationale for CBI looks a bit outdated in a world in which inflation and nominal interest rates are too low, rather than too high; and in which politicians have criticized central banks for being too expansionary rather than not expansionary enough. Indeed, the same logic that holds that CBI is necessary to avoid excess inflation can be turned on its head, to imply that CBI is a barrier to the fiscal-monetary coordination needed to combat deflation (Eggertsson, 2013).

The last principal section of the paper briefly takes up these issues. I argue that the case for CBI has always been broader than the anti-inflationist argument, and that CBI should remain in place in the new economic environment. At the same time, I contend that the case for CBI is instrumental, that it depends on costs and benefits rather than on philosophical principles, so that the limits of independence appropriately depend on the sphere of activity under consideration and on economic conditions. The general principle of CBI thus does not preclude coordination of central bank policies with other parts of the government in certain situations.

## **DEFEATING THE ZLB: UNCONVENTIONAL POLICY TOOLS**

Central bankers in 2008 faced extraordinarily difficult challenges, in particular the combination of a deep recession—which made a sharp easing of monetary conditions necessary—and the proximity of short-term interest rates to zero, which made easing difficult. In response, monetary policymakers employed a number of unconventional policy measures. Which ones will become part of the standard toolbox? In what order or combination might the various tools of monetary policy be used in the future? In this section, I comment on these issues. I take as given that management of a short-term policy rate (e.g., the federal funds rate in the United States) will remain the primary tool, so long as the ZLB is not binding. I won't have much to say about the technicalities of monetary policy implementation (e.g., the distinction between a “floor” and “corridor” system for managing short-term rates), although unconventional policies (such as quantitative easing) can at times complicate implementation. I discuss, sequentially, forward guidance, quantitative easing, negative rates, and yield curve control (the management of longer-term yields).

### *Forward guidance*

The non-standard tool on which central bankers are most likely to rely in the next easing cycle is forward guidance, or communication about the expected or intended future path of the policy rate. The Fed used variants of forward guidance in the Greenspan era, for example, in references to keeping rates low for “a considerable period” (Federal Open Market Committee, 2003). Even earlier, a number of central banks experimented with forward-looking policy commitments, a notable case being the Bank of Japan’s zero-interest-rate policy (ZIRP), in which the BOJ said that it would not lift rates from zero until certain conditions had been met (Bank of Japan, 1999). The prices of longer-term financial assets (including those most closely tied to economic activity, such as corporate bonds, mortgages, and stocks) depend on not only the current setting of the policy rate but on its entire expected future path. Consequently, central bank “open-mouth operations” that influence market expectations of future policies can affect financial conditions today, even if the short-term policy rate is close to its effective lower bound (Guthrie and Wright, 2000).

Forward guidance comes in a number of forms. A useful distinction is between *Delphic* and *Odyssean* forward guidance (Campbell et al., 2012). Delphic guidance is a simple statement of how monetary policymakers see the economy and interest rates as likely to evolve. Delphic guidance is advisory only and makes no promises about future policy. In contrast, Odyssean guidance—the phrase is motivated by Odysseus’s decision to tie himself to the mast to be able to resist the calls of the Sirens—is intended to pre-commit the central bank to some (possibly contingent) set of future policies.

The goals of Delphic and Odyssean guidance are different. Delphic guidance—as for example seen in the Fed’s famous “dot plot,” which shows the interest-rate forecasts of individual FOMC participants—is designed primarily to help the public and market participants understand the committee’s outlook, reaction function, and policy plans. More informally, central bankers’ public remarks about the likely course of the economy and policy are usually Delphic in intent. Increasingly, central banks are incorporating Delphic guidance into their communication strategy during normal times; this development primarily reflects trends to increased transparency by central banks, rather than the emergence of the ZLB as an important

policy constraint. By improving the clarity of the central bank communication, Delphic guidance is intended to increase the predictability of monetary policy and make it more effective.

Odyssean guidance, in contrast, is most likely to be relevant when the policy rate is at or close to the ZLB, so that the scope for short-term rate cuts is limited. Typically, monetary policymakers use Odyssean guidance to communicate a promise to keep rates lower for longer than implied by their “normal” reaction function. If the promise is credible, then market participants should bid down longer-term yields and bid up asset prices today, effectively adding stimulus despite the ZLB constraint. The key word here is “commitment.” If prior commitment were impossible, for the reasons explored in the time-consistency literature (Kydland and Prescott, 1977), then Odyssean forward guidance could not materially change market expectations and would consequently be useless. In practice, central bank guidance does appear to have significant effects on asset prices (Campbell et al., 2012; Swanson, 2017) and thus, presumably, on the economy. Central bankers’ concerns for their own reputations and those of their institutions, as well as the tendency of market participants to look for focal points around which expectations can coalesce, appear in practice to provide monetary policymakers some ability to commit to future policy actions.

The Federal Open Market Committee (FOMC), the Fed’s policymaking body, provided regular forward guidance during the recovery from the crisis. Some controversy has arisen about the FOMC’s approach. Michael Woodford (2009) and others have argued that the FOMC inappropriately used Delphic rather than Odyssean formulations in its guidance, limiting its benefit. For example, at the same meeting at which the policy rate was cut effectively to zero, the December 2008 FOMC statement indicated, “...the Committee anticipates that weak economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time” (FOMC, 2008). By speaking of “anticipating” or “expecting” rates to remain low, rather than using stronger language of commitment or intention, Woodford argues, the FOMC created less stimulus than it might have. Indeed, by signaling pessimism about the outlook, the FOMC’s guidance (in Woodford’s view) might have been counterproductive.

Woodford is right in principle, and all else equal, a policy committee whose intent is to provide Odyssean guidance should try to make its commitments as clear and as nearly ironclad as possible. A real-world complication is that policy committees are not typically unitary actors, but may include participants of diverse views, trying to reach compromise in an uncertain

environment. Some hedging or ambiguity in the committee’s official statements may therefore be difficult to avoid. In practice, however, the FOMC’s guidance after the crisis—as mediated by the public comments of policymakers—did seem to have Odyssean effects. Notably, the Fed’s introduction of forward guidance was typically followed by changes in longer-term interest rates, exchange rates, and equity prices consistent with substantial increases in monetary accommodation (Femia et al., 2013; Swanson, 2017) and by reduced sensitivity of near-term rate expectations to economic news (Williams, 2014). The increases in equity prices in particular suggested that markets were focused on the FOMC’s signal of greater policy patience (the Odyssean aspect) rather than on an indication of greater pessimism (Delphic). Moreover, professional forecasters reacted to FOMC guidance by repeatedly marking down the unemployment rate they expected to prevail at the time that the Committee began to lift the funds rate away from zero, implying a perceived shift in the Fed’s expected reaction function (Bernanke, 2012; Femia et al., 2013). The apparent success of the FOMC’s guidance, developed on the fly, is promising for the future use of verbal interventions. As both central bankers and market participants gain experience with forward guidance, the tool should become increasingly effective.

Another important distinction is between *qualitative* guidance (“considerable period”) and *quantitative* guidance, for example, describing specific economic conditions that would lead to a change in policy. Over the years, Fed guidance has evolved from qualitative towards quantitative, reflecting the desire to enhance transparency as well as the imperative of adding substantial accommodation during the ZLB period. Economic logic suggests that quantitative guidance will be more effective, because it is both more precise and more verifiable *ex post* (and thus easier to support by reputational concerns). However, again, a policy committee may not always be able to agree on quantitative guidance. It may also be the case that uncertainty about the economic situation favors the relative ambiguity of a qualitative formulation, at least initially. Experience suggest though that qualitative guidance, if maintained for a while, often morphs into quantitative guidance, as market participants, legislative committees, and other stakeholders press policymakers to clarify the meaning of key phrases.

Yet another dimension of forward guidance is *time-dependency* versus *state-dependency*. The FOMC used both types after the crisis, indicating first that it expected to hold rates low through a certain date, then tying rate increases to thresholds based on the prevailing



unemployment and inflation rates.<sup>2</sup> In principle, policy settings should depend on the state of the economy, and so state-dependent guidance should be the default in the future (Feroli et al., 2016).<sup>3</sup> As pointed out by Williams (2016) however, date-based guidance may at times be more effective, perhaps because it is more definitive and more credible to market participants. A particular situation in which date-based guidance might be desirable arises when policymakers and the market have different economic outlooks. Suppose the ideal guidance would hold rates at zero at least until unemployment fell to 6 percent; but suppose also that market participants expect unemployment to reach 6 percent in one year while policymakers believe that unemployment will decline more slowly, reaching 6 percent in two years. In that case, state-dependent guidance would be insufficiently stimulative from the policymakers' point of view, and time-dependent guidance (a promise that rates will remain low for two years) would achieve a greater reduction in current long-term rates and be more consistent with the policymakers' objectives.

I've been discussing forward guidance about rates, but guidance can be provided about aspects of policy other than rates, notably, about plans for asset purchases. Such guidance is a natural extension of rate guidance and can be Delphic or Odyssean in intent. The main point here is that guidance about the components of policy needs to be carefully coordinated, so that the planned sequencing of policy changes is clear. For example, the famous 2013 "taper tantrum" followed Fed guidance that it anticipated reducing the pace of its asset purchases, conditional on economic developments. However, the tantrum reflected not so much the expectation of reduced asset purchases per se, but rather the inference in some quarters of the market (as could be seen in futures quotes) that increases in short-term rates would quickly follow the slowing of asset purchases. (See below for more on the "signaling" aspects of quantitative easing.) Fed policymakers had communicated their intention to keep rates low for a long time after the end of asset purchases, but evidently those promises had not sunk in, and

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<sup>2</sup> The FOMC experimented with three variations of qualitative forward guidance in December 2008, March 2009, and November 2009. In August 2011, January 2012 and September 2012, the FOMC used different versions of calendar-based forward guidance in which they set a date in which they would keep rates 'exceptionally low'. In December 2012 the FOMC switched to a state-dependent form of forward guidance in which they committed to keeping interest rates 'exceptionally low' at least as long as the unemployment rate was above 6.5%, inflation was below 2.5% based on one to two year ahead forecasts, and inflation expectations remained anchored.

<sup>3</sup> In principle, optimal policy depends not only on the current state of the economy but on its history as well. I discuss this point further below.

coordinated reiterations of the point had to be made before market expectations re-adjusted and market conditions calmed.

A final observation on forward guidance: In this section I have been treating guidance, particularly of the Odyssean variety, as an ad hoc intervention, a supplement to management of the short-term rate. Alternatively, or in addition, the central bank could adopt an overarching framework that implies systematic Odyssean responses to ZLB episodes. I'll explore this possibility below, in the section on policy frameworks.

### *Quantitative easing*

Probably the most controversial form of unconventional policy adopted in recent years was what the Federal Reserve called large-scale asset purchases (LSAPs) but most of the rest of the world persisted in calling “quantitative easing”, or QE.<sup>4</sup> The Federal Reserve engaged in three rounds of QE, during which its balance sheet expanded from less than a trillion dollars to \$4.5 trillion. The Bank of England, European Central Bank, Swedish Riksbank, and Bank of Japan (which had pioneered asset purchases as a form of monetary policy well before the crisis) have also undertaken quantitative easing.

Quantitative easing involves central bank purchases of securities in the open market, financed by the creation of bank reserves held at the central bank. By law, the Fed was able to purchase only Treasury securities and mortgage-related securities issued by government-sponsored enterprises. Other central banks, in contrast, have been able to buy a range of private securities, including corporate bonds and equities. The limits on the Fed did not seem to prevent its version of QE from being effective, although it was perhaps fortunate that, following a crisis centered on housing finance, the law did permit Fed purchases of mortgage-related securities.

Research suggests that QE works through two principal channels, the signaling channel and the portfolio balance channel. The signaling channel arises to the extent that asset purchases serve to demonstrate the central bank's commitment to monetary easing, and in particular to keeping short-term rates lower for longer (Bauer and Rudebusch, 2013). As discussed above, the so-called taper tantrum in 2013 demonstrated the practical relevance of the signaling channel of

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<sup>4</sup> I also tried, without success, to name the program “credit easing,” to distinguish it from the Bank of Japan's earlier foray into asset purchases (Bernanke, 2009). I argued that “credit easing” focused on removing duration from bond markets, in contrast to BOJ-style quantitative easing, which had the primary goal and metric of increasing the high-powered money stock.

QE. As noted, because of the importance of the signaling channel, it is essential that asset purchases and interest rate policy be closely integrated, and that in particular the central bank be clear about its planned sequencing of the introduction and withdrawal of its various tools.

The portfolio balance channel depends on the premise that securities are imperfect substitutes in investors' portfolios, reflecting differences in liquidity, transactions costs, information, regulatory restrictions, and the like. Imperfect substitutability implies that changes in the net supply of a security affect asset prices and yields, as investors must be induced to rebalance their portfolios (Bonis et al., 2017). In principle, the two channels of QE can be distinguished by the fact that the signaling channel operates by affecting expectations of future policy rates while the portfolio balance channel works by changing term and risk premiums.

There have been many studies of the effectiveness of QE, mostly through event studies of the impact of QE announcements on interest rates and asset prices; for surveys, see, e.g., Gagnon (2016b), Bhattarai and Neely (2016), and Williams (2014). There is not a large sample of QE programs to study, and econometric identification of the unexpected (and thus not fully discounted) components of QE announcements is difficult. Consequently, disagreements remain among researchers about the magnitude and persistence of QE effects and about the relative importance of the two primary channels of effect. Nevertheless, the strong view that QE is ineffective has been pretty decisively rejected. There appears instead to be a broad consensus that QE has proven a useful tool, with demonstrable effects on financial conditions.<sup>5</sup> QE has been found to have significant effects on both rate expectations and term premiums, suggesting that both the signaling and portfolio balance channels are operative (Bauer & Rudebusch, 2013; Huther et al., 2017). And, although showing direct links to macroeconomic outcomes is not straightforward, the experiences of the U.S., U.K. Japan, and Europe all suggest that the use of large-scale QE has been followed, over the subsequent couple of years, by strengthening aggregate demand and improved economic performance (Engen et al., 2015).<sup>6</sup>

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<sup>5</sup> For example, Gagnon (2016b), Table 1, reports 18 estimates from 16 studies of the effects of QE bond purchases on bond yields. For U.S. data, the median effect of a hypothetical program sized at 10 percent of GDP on 10-year yields is 82 basis points. Using the conventional rule of thumb that a 10 basis point reduction in the 10-year yield is about equivalent to a 25 basis point cut in the federal funds, that's roughly equal to 200 basis points of funds rate reductions for a program of that size. (The Fed's program was considerably larger than 10 percent of GDP.) According to Gagnon's survey, the median effect of purchases programs on the term premium component of 10-year yields only is 44 basis points, suggesting that both signaling effects and portfolio balance effects operate.

<sup>6</sup> It is true that QE has not been sufficient in a number of those cases to return inflation to target. However, the weak link in the causal chain appears to be in the influence of declining slack on inflation, not the effect of monetary

Controversies about QE have focused less on whether the medicine works and more on the possible side effects. Many dark warnings accompanied the introduction of QE programs by major central banks after the financial crisis. In a memorable example, the Republican leadership of the U.S. Congress wrote to the Fed in November 2010 to express concerns about further asset purchases. Their letter argued that “such a measure introduces significant uncertainty regarding the future strength of the dollar and could result both in hard-to-control long-term inflation and potentially generate artificial [sic] asset bubbles that could cause further economic disruptions” (Herszenhorn, 2010). The Congressional leaders also were worried about foreign criticism of the Fed’s actions, noting that “any action...that impairs U.S. trade relations at a time when we should be fighting global trade protection measures will only further harm the global economy and could delay recovery in the United States.” As the legislators noted, there was indeed foreign criticism of Fed plans for more QE, including from Brazilian finance minister Guido Mantega, who argued that the Fed’s actions presaged a “currency war”, and German finance minister Wolfgang Schauble, who reportedly called the policy “clueless” (Garnham & Wheatley, 2010; Atkins, 2010). A subsequent letter from conservative economists and market participants echoed the themes of the Congressional letter, warning against “currency debasement and inflation” and adding that QE could “distort financial markets and greatly complicate future Fed efforts to normalize monetary policy” (Wall Street Journal, 2010). Less well remembered is that, in September 2011 the Republican Congressional leadership wrote a similar, follow-up letter, adding the concern that QE could “promote borrowing by overleveraged consumers” (Wall Street Journal, 2011). Of course, these themes were staples of *Wall Street Journal* and *Financial Times* op-eds throughout the period.<sup>7</sup>

I think it’s fair to say that these warnings, and many more like them, have not proved prescient. Certainly there has been no massive upsurge in inflation—quite the opposite, of course—or a collapse in the dollar, as predicted by proponents of crude monetarism (of a type, certainly, that Milton Friedman would never have endorsed). Without a sustained decline in the dollar, and with a stronger U.S. economy providing increased demand for imports, Mantega’s concern about a currency war also proved baseless. Household leverage has not risen as the

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policy (including QE) on aggregate demand. The apparent flatness (or downward shift) of the Phillips curve is a problem for any macroeconomic policy aimed at raising inflation.

<sup>7</sup> See for example Taylor and Ryan (2010).

second Congressional letter predicted; indeed, household debt and interest burdens have fallen significantly since the crisis.

Concerns about asset bubbles have been especially persistent (although these would appear to relate more to accommodative monetary policies in general than to QE in particular). To be clear, there is no doubt that monetary policy affects the prices of stocks and other assets; indeed, those effects are an important vehicle of monetary transmission. The intended effects of monetary easing on asset prices work through fundamentals, including the reduced discounting of future returns implied by lower interest rates, expectations of stronger economic performance, and moderate increases in risk-bearing capacity. Asset price increases due to those fundamental causes are desirable and pose no significant risks to economic or financial stability. Concern about bubbles is therefore properly focused on asset price increases that significantly exceed what can be justified by fundamentals. Claims that QE has generated asset bubbles in this relevant sense are difficult or impossible to disprove; and, of course, at some point there will inevitably be a downward correction in asset prices, as has happened periodically in the past. However, it's been seven years since the first Congressional letter, and the Fed stopped purchasing securities three years ago (although other central banks have continued it), so if QE has generated bubble dynamics we can at least conclude that some pretty long lags are involved.

What about other critiques? The claim that QE “distorts” financial markets, raised in the letter from economists and market participants, is heard fairly often. It's not clear exactly what that means. The goal of QE, and of monetary policy generally, is to set financial conditions consistent with full employment and stable prices, which can be thought of as trying to undo the economic distortions arising from price and wage stickiness, monopolistic competition, credit market frictions, and the like. In this respect appropriate monetary policy is “un-distorting;” in particular, allocations under active monetary policy should be closer rather than further from the competitive, free-market, flexible-price ideal.

A possible rationalization of the “distortion” claim is that QE works, at least in part, by affecting term premiums (and through them, the whole gamut of asset prices). From a market participant's point of view, when QE is active it feels as if government (central bank) decisions, rather than private-sector fundamentals, are setting asset prices. Moreover, in such situations it may appear that the highest returns go to the best Fed-watchers, rather than to those whose expertise is in evaluating economic fundamentals. Some frustration with this state of affairs on

the part of professional investors is understandable. Note, though, that QE affects term premiums by affecting the net maturity distribution of government debt held by the private sector. In this respect, a QE program—which amounts to a replacement of longer-term government obligations in private hands with shorter-term obligations (bank reserves, in the case of QE)—is not fundamentally different from a change in the maturity structure of debt issued by the Treasury. That government decisions about the maturity structure of its debt would affect term premiums seems natural and, since the government has to choose *some* maturity distribution, it's not clear what it would mean for government policy to be “neutral” with respect to the term premium (Greenwood et al., 2014). In short, there is no such thing as an “undistorted” value of the term premium, not so long as the mix of outstanding government liabilities is relevant to asset pricing.

A possible response to this point is that at least Treasury maturity decisions are largely non-responsive to short-term economic conditions, with issuance policies generally being smooth and set well in advance. In contrast, Fed QE programs are typically large in size and less predictable, responding to economic developments and (importantly) to how monetary policymakers choose to interpret those developments. To the extent that Fed decisions are hard to forecast, even conditional on the outlook, they add noise to asset prices. But of course that is true for any form of monetary policy. I think it comes down to whether Fed policy, inclusive of policy errors and misjudgments, is economically stabilizing on net, or not. If it is stabilizing, then though the unpredictable components of Fed policy and communication may be a nuisance for market participants, overall monetary policy (including QE) reduces rather than increases the overall level of distortions in the economy.<sup>8</sup>

Another common critique of QE is that it purportedly promotes increased inequality, primarily because of its effects on the prices of stocks and other assets. This claim is questionable on its face (Bernanke, 2015; Bivens, 2015). Empirically, it is far from obvious that QE (or easy money generally) worsens inequality in any meaningful way, once all the diverse effects of policy are taken into account. It is of course true that, all else equal, higher stock prices mean greater inequality of wealth—although the effect on *income* inequality is mitigated by the fact that easy money also lowers the rate of return on assets, so that income from capital

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<sup>8</sup> As James Tobin (1977) once said, “It takes a heap of Harberger triangles to fill an Okun gap.” Translated from economist, this aphorism suggests that distortions at the microeconomic level are hardly of consequence when the economy as a whole is operating far from its potential. The goal of monetary policy is to close Okun gaps.

risers by less than the rise in asset values.<sup>9</sup> However, QE also yields gains in income and wealth that are more broadly based, including 1) positive effects on house prices, the principal asset of the middle class; 2) the benefits of lower interest rates and higher prices for debtors, including homeowners able to refinance to lower payments; 3) the savings for taxpayers of lower government borrowing costs and (possibly) increased seigniorage; and 4) most importantly, the effects of monetary accommodation on jobs, wages, and incomes (Bivens, 2015; Engen et al., 2015). It's revealing that in public debates, advocates for workers—like the group Fed Up, which met with FOMC members in Jackson Hole in 2016—have tended to favor the continuation of easy money, while the typical op-ed about the adverse effects of easy money on the distribution of income and wealth is written by a hedge fund manager, banker, or right-wing politician—people who have otherwise not traditionally exhibited much concern about inequality (Fleming, 2016). That political alignment—workers' groups in support of easy money, financiers in favor of higher interest rates—is of course the historical pattern in the United States, going back to William Jennings Bryan and beyond.

In any case, whatever effects monetary policy has on inequality are likely to be transient, in contrast to the secular forces of technology and globalization that have contributed to the multi-decade rise in inequality in the United States and some other advanced economies. If the monetary effects on inequality are modest (indeed, of indeterminate sign) and mostly temporary, as seems most likely, then it makes sense for monetary policymakers to ignore distributional effects and to focus on their legal mandate to promote price stability and full employment, leaving distributional concerns be addressed by other policies, including fiscal policy. If, on the other hand, the effects of monetary policy on inequality are *not* transient, then presumably the reason is what economists have called hysteresis, the idea that a “hot” economy promotes higher long-term growth by promoting labor force participation, higher skills, and higher wages. However, the presence of significant hysteresis effects would likely imply that easy money during periods of economic weakness *reduces* inequality, rather than the reverse.

A final criticism of QE is that it exposes the central bank to capital losses, in the event that longer-term interest rates rise unexpectedly quickly. Although central banks don't have to mark to market, and they can operate perfectly well with negative capital, losses on their asset

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<sup>9</sup> Hence the apparently contradictory claims that QE both helps wealth-holders and hurts savers; see Bernanke (2015) for a discussion.

holdings would ultimately be reflected in reduced seigniorage payments to the treasury. Central banks naturally see this outcome as a political risk to their independence and institutional reputations which, all else equal, may make them more hesitant to use QE. However, political risk to the central bank is not equivalent to a loss in social welfare. From the perspective of society as a whole, the fiscal risks of QE have to be balanced against the substantial benefits of a tool that gives monetary policymakers additional scope to respond to a serious economic downturn or to unwanted disinflation.

Moreover, the fiscal risks of QE are not one-sided. QE programs can be quite profitable for the central bank and the Treasury, because on average the yields on the longer-term assets the central bank acquires are higher than those on its short-term liabilities, and because declining yields create capital gains on the central bank's existing bond holdings. Since 2009, the Federal Reserve has remitted more than \$650 billion in profits to the U.S. Treasury (Federal Reserve, 2017), a much higher rate of remittances than usual before the crisis. On the other hand, if fiscal losses do occur as the result of a QE program, it will likely be because the economy recovered more quickly and strongly than expected, resulting in higher interest rates; since losses are most likely to occur at times when the economy is unexpectedly strong, they are hedged, from a social perspective. Finally, and importantly, the beneficial fiscal effects of an effective QE program go well beyond seigniorage, as the government's budget also benefits from low borrowing rates, avoidance of deflation or very low inflation, and the higher revenues that result from increased economic activity.

All that said, the fiscal argument seems to me to be more balanced than some of the other criticisms of QE. There are difficult governance issues and competing values in play here, and people could reasonably come to different conclusions. One approach, similar to that taken by the United Kingdom, is for the central bank to consult with the Treasury on QE plans. I don't advocate that approach because of the implied reduction in central bank independence, but I appreciate that it may reduce the political risks associated with the use of QE.

#### *Negative interest rates and yield curve control*

I will comment briefly on two monetary tools in use outside the United States, but which I don't expect to be used by the Fed in the foreseeable future: negative (nominal) interest rates and pegging longer-term interest rates (so-called yield curve control).



Negative interest rates have been recently employed in Japan and a number of European countries (Bernanke, 2016a). To enforce negative rates, central banks generally charge a fee on the reserve holdings of commercial banks. Arbitrage ensures that the negative return to reserves translates into negative returns to other short-term liquid assets. Negative short rates need not imply negative rates on longer-term assets, particularly those that are less liquid or involve credit risk. Rather, negative short-term rates give the central bank a new tool for bringing down the longer-term rates, like mortgage rates, that matter most for economic activity. The evidence suggests that negative rates have helped to ease overall financial conditions in the countries in which they have been used, thereby promoting economic recovery (Dell'Ariccia et al, 2017).

For economists, used to thinking about negative real interest rates, moderately negative nominal rates are not a big deal. There is very little practical difference between a 0.1 percent return and a return of negative 0.1 percent, for example. However, many non-economists find the idea of negative nominal rates disorienting, a reaction that has contributed to political resistance and on the margin has probably made central bankers more hesitant to use this tool. Putting aside the politics, and excluding limitations on the use of currency (Rogoff, 2016) as beyond the scope of this note, negative interest rates appear to provide relatively modest benefits and have modest costs. So while the tool may well be appropriate and useful in some contexts, it does not merit the overheated public attention it has received.

Under current institutional arrangements, the potential benefit of negative rates are relatively modest because attempts to push rates too far below zero will induce substitution into cash. The most negative rate yet imposed is minus 75 basis points, by Denmark (Danmarks, 2015). To date, negative rates have so far not triggered much movement into cash, as best as we can tell, but it is likely that more such adjustment would occur if rates were to go much further below zero, or if negative-rate policies were perceived to be recurring or persistent.

The costs of negative rates mostly arise from their interaction with certain institutional features of financial markets. For example, in the United States, money market mutual funds (MMMFs) generally guarantee a nominal return of no less than zero, and failure to meet that standard (called “breaking the buck”) led to a run on MMMFs in 2008, after the Lehman failure. Concerns about possible destabilization of MMMFs were an important reason that the Fed did not employ negative rates during the post-crisis period (Burke et al., 2010). Reforms undertaken since the crisis have reduced this risk, by forcing many money market funds that invest in private

assets to shift to a system of floating net asset values (which allows for a negative nominal return) and by inducing a shift toward lower-risk government funds (SEC, 2014; Chen et al., 2017).

A more frequently heard concern is that negative rates could decapitalize the banking system, because banks are supposedly unable to pass negative rates on to depositors and thus would have to absorb the loss. There is little evidence from the European or Japanese experiences that modestly negative rates have actually hurt bank profits or bank lending. Retail deposits are only a portion of bank funding; presumably, banks can pass on negative yields to wholesale funders or institutional depositors. Moreover, central banks can implement negative rates in ways that mitigate the effects on bank profits; for example, the Bank of Japan exempts a significant portion of bank reserves from its fees, which are applied only on the margin. Overall, there are few costs of negative rates that could not be managed over time through institutional reform or alternative approaches to enforcing negative rates by central banks. Whether undertaking such changes is worthwhile, given that political resistance to negative rates appears disproportionate to their generally modest benefits, is an open question. At the Fed, there was little support for negative rates during the post-crisis period, a situation that does not appear to have changed.<sup>10</sup>

Yield curve control, recently introduced by the Bank of Japan, is the targeting of yields on longer-term bonds; e.g., the BOJ is currently targeting the yield of ten-year government bonds at around zero. Yield curve control is “dual” to conventional QE: Instead of setting targets for securities purchases and letting the market determine yields, as in ordinary QE, under yield curve control the central bank targets the yield on one or more securities and adjusts its purchases as necessary to hit the targets (Bernanke, 2002; Chaurushiya & Kuttner, 2003; Bernanke, 2016b).

Yield curve control has some potential advantages: Because yields directly affect borrowing and investment decisions, a rate-targeting strategy affords greater precision in estimating the amount of financial accommodation delivered than does ordinary QE. A credible yield target may also be enforceable with reduced quantities of purchases by the central bank, because deviations from the target will be arbitrated away by market participants. Yield curve

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<sup>10</sup> John Williams, the president of the San Francisco Fed, said in 2016 that negative interest rates “are at the bottom of the stack in terms of net effectiveness” (Mui, 2016). However, interestingly, Chair Yellen has indicated that she believes that the Fed has the legal authority to impose negative interest rates should it choose to do so (United States, 2016).

control can also be an efficient strategy when the securities available for purchase are potentially limited in quantity and supplied with less-than-perfect elasticity, as is the case with the Japanese government bonds that make up the bulk of the BOJ's purchase program. In particular, the adoption of yield curve control by the BOJ has allowed the Japanese authorities to maintain substantial stimulus, even as the supply of bonds available for purchase by the BOJ has shrunk (Bernanke 2016d).

On the other hand, in jurisdictions with deep and liquid securities markets, like those for U.S. government bonds, a rate-targeting central bank might have to buy up most of the market if the target it set were not fully credible. A rate target for a security whose maturity exceeded the expected duration of the targeting program would be particularly hard to enforce, as incoming news would affect investors' views of the time of exit from the targeting regime and of the post-regime yield. For that reason, Fed staff considering rate-targeting strategies concluded that only relatively short-term yields—perhaps up to a couple of years—could be fixed, potentially limiting the utility of the program (Bowman et al., 2010; Bernanke 2016b). An intriguing possibility, however, is that a relatively short-horizon peg could be used to complement forward guidance about future short rates.<sup>11</sup>

### *Policy sequencing*

What policy tools will be used, and in what sequence, when the next recession hits? Yellen (2016) has described the Fed's prospective toolbox. In the face of an economic slowdown, the FOMC would respond first with conventional rate cuts. In an environment of super-abundant bank reserves, in practice that would involve reductions in the Fed's key administered rates, including the interest rate paid to banks on excess reserves, the rate offered to money market funds and others on overnight reverse repurchase agreements, and the lending rate at the discount window. Current thinking is that, when the ZLB looms, rate cuts should be aggressive (no "saving ammunition"); see Reifschneider and Williams (2000). However, in practice, uncertainty about the state of the economy might lead the Fed to put off decisive action until the situation becomes clearer.

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<sup>11</sup> For example, a promise to keep rates low for two years would be reinforced by a commitment to peg yields out to a date two years from the announcement. This strategy would be difficult to implement for state-dependent (as opposed to time-dependent) guidance, however.

Forward guidance, of the Odyssean variety, would come next (substantial Delphic guidance is already in place). Relative to earlier experience, I would expect a much earlier adoption of state-contingent, quantitative commitments to hold rates low.

What about QE? Fed policymakers have been clear that QE is now part of the toolkit and that it would be used if necessary (United States, 2017; FOMC, 2017). I am sure that's true, but I would not be surprised if there is a period of hesitation before the FOMC starts up new rounds of asset purchases. The effects of QE on financial markets and the economy are less well understood and less precisely estimated than those of more-conventional policies. QE's effects likely vary over time, depending for example on whether financial markets are stressed or operating normally. Moreover, because some significant part of its power comes through signaling effects, QE is also a difficult tool to use in a continuous, graded manner. I expect that QE will be used only occasionally in the future, during more severe downturns, and then typically in large discrete chunks.

Speaking positively rather than normatively, I don't see much likelihood that negative rates or yield curve control will be employed in the United States in the foreseeable future, unless circumstances become dire. Given current institutional arrangements, negative rates have only modest benefits and may create problems for some financial institutions. Targeting longer-term interest rates, at least at maturities out beyond a couple of years, could be a hazardous undertaking given the deep and liquid markets for U.S. government obligations. It is not inconceivable though that the Fed might consider targeting yields at somewhat shorter horizons, particularly as a way of reinforcing its forward guidance on rates.

## **DEFEATING THE ZLB: THE POLICY FRAMEWORK**

As discussed in the previous section, the Fed and other central banks retain a number of effective monetary tools, even if the current low level of neutral rates persists. In particular, the experience gained in recent years with forward guidance, quantitative easing, and (in some jurisdictions) negative interest rates should at least partly compensate for the reduced scope for conventional rate cuts. We should also not ignore the countercyclical potential of fiscal policy. Political and ideological constraints, as well as constraints on fiscal space in some jurisdictions, limit the flexibility and timeliness of fiscal tools; that's why monetary policy has normally been the first line of defense against short-term economic instability. But recent experience suggests

that fiscal policy can provide some backstop in the most severe slowdowns, as in the United States in 2008 and 2009 (Matthews, 2011; Auerbach and Gorodnichenko, 2017).

All that said, I am less sanguine than Yellen (2016) that the current monetary toolbox would prove sufficient to address a sharp downturn. In particular, there is no guarantee that the next recessionary shock will occur only when policy rates are at or above neutral levels. If the Fed had to react to a new slowdown today, it would have only 100 basis points or so of room to cut short rates, and other major central banks (such as the ECB and BOJ, whose short rates are already negative) would have virtually no room to cut, even at the long end of the curve. I am consequently sympathetic to the view of Williams (2017) and others that we should be thinking now about what can be done to enhance the potency of monetary policy. In this section I'll discuss some recent proposals to improve the effectiveness of monetary policy by changing the policy target/framework. I'll focus here on two leading options: raising the inflation target and switching to a price level target.<sup>12</sup> After discussing some pros and cons of these two leading options, I'll suggest a compromise approach.

As noted, one proposal for modifying the policy framework is to keep the current inflation targeting framework of the Fed and other major central banks, but to raise the level of the target—from 2 percent or so to 3 or even 4 percent. Presumably, after a period of transition, an increase in the inflation target would result in a comparable increase in nominal interest rates. Higher nominal rates would in turn expand the scope for short-term rate cuts and reduce the salience of the zero lower bound at all points of the yield curve.<sup>13</sup> Most recently, a group of economists signed a letter to the Fed arguing for a higher inflation target, and the aforementioned Fed Up group held a seminar at this year's Jackson Hole conference endorsing the idea (Baker et al., 2017; Leubsdorf, 2017).

As a measure to increase the potency of monetary policy, raising the inflation target has some advantages: It's a straightforward step, one that should be easy to communicate and explain, and it would allow the Fed and other major central banks to stay within their established

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<sup>12</sup> An option that deserves further study, but which I don't have space to discuss here, is nominal GDP targeting. A practical issue with this approach is that measurements of nominal GDP are not as timely as those of inflation and unemployment, and more subject to revision.

<sup>13</sup> Should the increase be to 3 percent or 4 percent? The literature offers limited guidance (Diercks, 2017). An increase to 4 percent provides more room for future rate cuts, but it might be difficult to defend 4 percent inflation as being consistent with central bank mandates for price stability. An increase to 3 percent adds only modest scope for rate cuts; if that is the increase contemplated, it would be desirable to compare the costs and benefits of that increase with the adoption of negative rates, which add similar amounts of policy space (Bernanke 2016c).

policy frameworks. These are important benefits. At the same time, I see some problems with this proposal:

First, proponents may be underestimating the costs, uncertainties, and delays associated with the transition to a higher target. We have seen, most recently in Japan, that managing inflation expectations through central bank announcements can be tricky. Given that inflation expectations in advanced economies seem well anchored at two percent or below, trying to raise expectations and to re-anchor them at a higher level could well be a protracted and uncertain process, with side effects including financial volatility and increases in risk premiums. (Inflation uncertainty would be particularly challenging for bond markets, where investors would be simultaneously skeptical of the central bank's statements and fearful of capital losses.) If inflation expectations were to remain sticky near current levels, then the Fed would have to demonstrate its commitment to the higher target by intentionally overheating the economy for an extended period. It's possible that sustained overheating could have beneficial effects—through hysteresis channels, for example—but it might also prove to be destabilizing and difficult to manage, particularly if inflation expectations became volatile.

Second, to be fully effective in raising longer-term nominal yields, the increase in the inflation target must be perceived as permanent and irrevocable. However, that perception would be undermined by the apparent willingness of the Fed to raise its target for what might appear to be tactical reasons. Looking forward, it is likely that the determinants of the “optimal” inflation target—such as the prevailing equilibrium real interest rate, the costs of inflation, and aspects of the monetary transmission mechanism—will change over time. If the Fed raised its inflation target today based primarily on the low level of real interest rates, would it change the target again in response to future changes in fundamentals? That would be important to clarify when making the first change to the target, but it is not an easy matter on which to commit, since the membership of the policy committee and the state of knowledge about monetary policy and the economy both change over time.

Third, although quantifying the economic costs of inflation has proved difficult, we know that inflation is very unpopular with the public. This unpopularity may be due to reasons that economists find unpersuasive—various forms of money illusion, for example. Or perhaps the public perceives costs of inflation—the greater difficulty of planning and calculation when inflation is high, for example—that economic models don't well capture. In any case, it's not a

coincidence that the promotion of “price stability” is a key part of the mandate of the Fed and most other central banks. Certainly, a substantial increase in targeted inflation would invite a backlash, perhaps even a legal challenge. Proponents have suggested convening a national commission to approve the increase in the inflation target, to increase its legitimacy and durability. Those proponents should be careful what they wish for. In the United States, rather than validating a higher inflation target to afford scope for discretionary monetary policy, I suspect that the political process would be more likely instead to reaffirm the centrality of “price stability” and possibly even eliminate the “maximum employment” component of the Fed’s dual mandate. Even if the political process supported the higher target in the first instance, market participants would put some weight on a future reversal, undermining the target’s credibility.

Fourth, and importantly, we know from a great deal of insightful theoretical work that an increase in the inflation target is an inferior response to the problems created by the ZLB (Krugman, 1998; Woodford and Eggertsson, 2003; Werning, 2011). Rather, the theoretically preferred response is for the central bank to promise to follow a “make-up” policy (or, in Woodford’s term, for policy to be “history-dependent”). Specifically, suppose the ZLB binds for a period, keeping monetary policy tighter than it otherwise would have been. Then (speaking very loosely) the optimal policy involves the central bank promising to keep rates lower for longer than it otherwise would have, where the length of the “make-up” period increases with the severity of the episode and the cumulative shortfall in monetary ease. If the public understands and believes this promise, then the expectation of easier policy and more rapid growth in the future should act to mitigate declines in output and inflation during the period in which the ZLB is binding. Note, by the way, the close analogy to Odyssean forward guidance, discussed earlier. The difference is that, rather than being implemented by ad hoc guidance, the optimal policy is conceptualized as part of the central bank’s permanent policy framework, about which the public is supposed to learn over time.

In comparison to this theoretically optimal policy, an increase in the inflation target is inefficient in at least two respects. First, as Woodford (2009) has pointed out, it forces society to bear the costs of higher inflation at all times, whereas under the optimal policy, inflation should rise only temporarily, following ZLB episodes. Second, a one-time increase in the inflation target does not optimally calibrate the vigor of the policy response to a given ZLB episode to the duration or severity of the episode.

A somewhat better option than raising the inflation target is to adopt a price level target, an approach advocated by a number of economists and policymakers (Svensson, 1999; Gaspar et al., 2007; Williams, 2017). Effectively, a price-level targeting central bank tries to keep the long-run average inflation rate close to a targeted value, say 2 percent. The principal difference between price-level targeting and conventional inflation targeting is the treatment of “bygones.” An inflation-targeting central bank aims to keep inflation stationary around its target, an approach that allows policymakers to “look through” a temporary change in the inflation rate, so long as inflation returns to target after a time. A price-level targeter, by contrast, commits to reversing temporary deviations of inflation from target, by following a temporary surge in inflation with a period of inflation below target; and, likewise, following an episode of low inflation with a period of inflation above target. Importantly, both inflation targeters and price-level targeters can be “flexible.” That is, they can take output and employment considerations into account, in that the speed at which they return to target can depend (and in formal models, usually optimally depends) on the state of the real economy.<sup>14</sup> In this section I consider only “flexible” variants of policy rules.

Switching to a price level target has at least two principal advantages over raising the inflation target. The first is that price-level targeting is consistent with low average inflation (say, 2 percent) over time and thus with the price stability mandate. Indeed, price-level targeting arguably promotes price stability better than does inflation targeting, because its commitment to stabilizing long-run average inflation should lead to considerably less uncertainty about the level of prices far in the future. The second advantage is that price-level targeting has the desirable “make-up” feature of the theoretically optimal monetary policy. In particular, under price-level targeting, periods of below-target inflation (as is likely to happen when interest rates are stuck at their ZLB) are followed by periods in which the central bank shoots for inflation above target, leading to “lower for longer” rate-setting.

Adopting a price level target seems preferable to raising the inflation target, but this strategy too is not without its drawbacks. It would amount to a significant change in the central bank’s policy framework and reaction function, and it is hard to judge how difficult it would be to get the public and markets to understand and accept the new approach. In particular,

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<sup>14</sup> Erceg, Kiley, and Lopez-Salido (2011) show that strict price-level targeting, which ignores fluctuations in output and employment, does not perform well.



switching from the inflation concept to the price level concept might require considerable education and explanation by policymakers. How quickly, for example, would markets and the public adjust to the implication of price-level targeting that a burst of inflation today should lead them rationally to expect lower-than-normal inflation in the future?

Another possible concern about price-level targeting is that the “bygones are not bygones” aspect of this approach is a two-edged sword. Under price-level targeting, the central bank cannot “look through” supply shocks that temporarily drive up inflation, but must commit to tightening policy in order to reverse the effects of the shock on the price level. This reversal could be gradual and responsive to real-side conditions, as indeed the theory suggests it should be, but it would nevertheless imply a possibly painful tightening even as the supply shock depresses employment and output. Although a once-and-for-all commitment to such an approach is theoretically optimal (under full credibility), in practice the commitment to reverse the effect of supply shocks by engineering a period of below-target inflation might not be credible; if not, efforts to offset positive inflation shocks would likely be costly.

Is there a compromise approach? One possibility, that I will describe briefly here, is to apply a price level target and the associated “make-up” principle only to periods around ZLB episodes, retaining the inflation-targeting framework and the current 2 percent target at other times. As I will explain, the central bank can explain this combined policy in familiar inflation-targeting terminology, which I take to be an advantage.

So, to be concrete, at some moment when the economy is away from the ZLB, suppose the Fed were to make an announcement like the following:

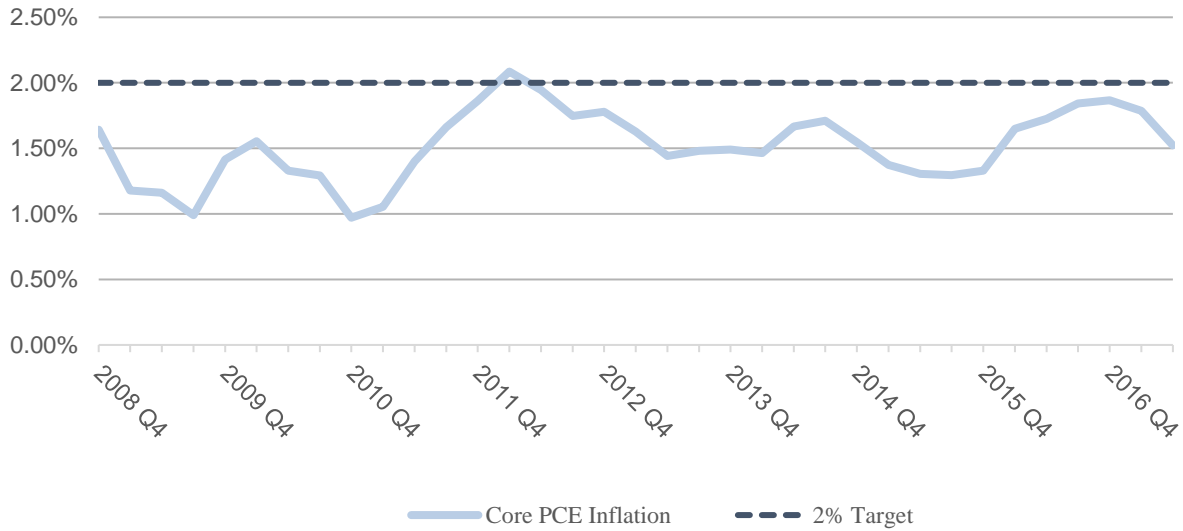
- (1) The FOMC has determined that it will retain its inflation-targeting framework, with a symmetric inflation target of 2 percent. The FOMC will continue to pursue its balanced approach to price stability and maximum employment, meaning in particular, that the speed at which the FOMC aims to return inflation to target will depend on the state of the labor market and the outlook for the economy.
- (2) However, the FOMC recognizes that, at times, the zero lower bound on the federal funds rate may prevent it from reaching its inflation and employment goals, even with the use of unconventional monetary tools. The Committee agrees that, in future situations in which the funds rate is at or near zero, a *necessary* condition for raising the funds rate will be that average inflation *since the date at which the funds rate first*

*hit zero* be at least 2 percent. Beyond this necessary condition, in deciding whether to raise the funds rate from zero, the Committee will consider the outlook for the labor market and whether the return of inflation to target appears sustainable.

The figures below illustrate the necessary condition above as it might have been applied to the recent ZLB episode. To be clear, *nothing in this illustration should be taken as a commentary on current Fed policy*. I am considering instead a counterfactual world in which the announcement above had been made, and internalized by markets, prior to 2008. In that counterfactual world, it would be important for the Fed to follow through on that commitment. However, in reality, no such commitment was made, of course, and actual policy today is not constrained by earlier promises.

Figure 1 shows the behavior of (core PCE) inflation since 2008 Q4, the quarter in which the federal funds rate first reached zero, or effectively zero. (I assume for this illustration that the FOMC relies on the core inflation measure, excluding food and energy prices, to better capture the underlying inflation trend.) As the figure shows, since 2008, inflation has been below the 2 percent target most of the time. Figure 2 shows the cumulative, annualized inflation rate—roughly, the average inflation rate—from 2008 Q4 to the present. Consistent with Figure 1, the average inflation rate since 2008 Q4 is also below 2 percent, by about a half percent. As average inflation *since the beginning of the ZLB period* is below the 2 percent target, by the criterion in paragraph #2 above, the FOMC would not have yet lifted the federal funds rate from zero. Again, I am using the recent episode to illustrate my suggested rule, not to make a recommendation about what the FOMC should do now. Note though, that if this policy rule had been in place prior to 2008, and if it had been understood and anticipated by markets, then longer-term yields would likely have been lower and the effective degree of policy accommodation during the past decade might have been significantly greater. In that counterfactual world, inflation might have been higher and the average-inflation criterion might have already been met. This is because the Fed would have already communicated their intention to be more accommodative going into the ZLB episode.

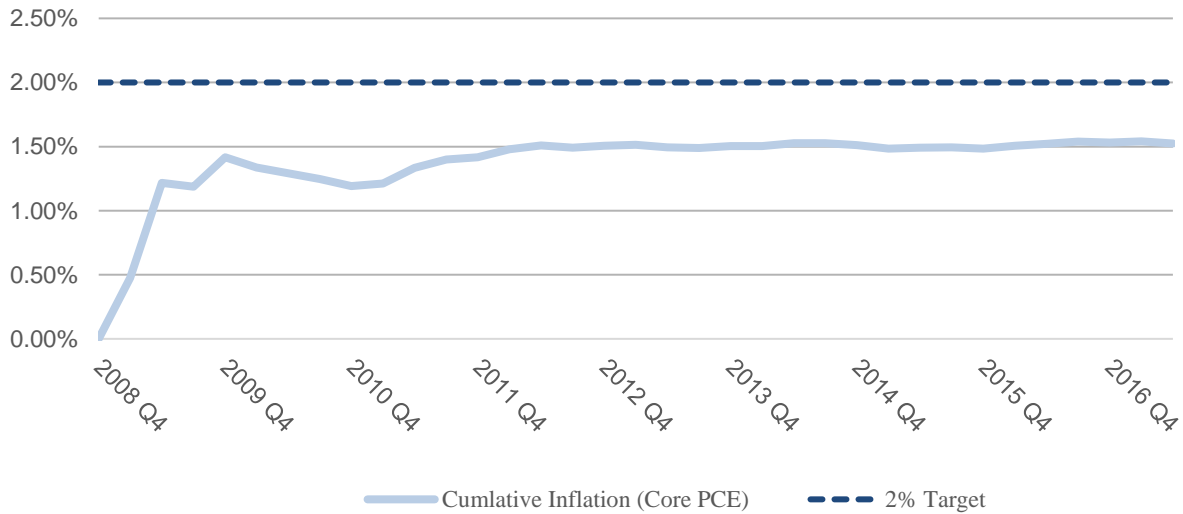
Figure 1: Inflation Since 2008 Q4 (Annual Rates)



Source: FRED.



Figure 2: Cumulative Inflation (Annualized) Since 2008 Q4



Note: Data shows the cumulative annualized inflation rate of the core PCE price index since 2008 Q4.

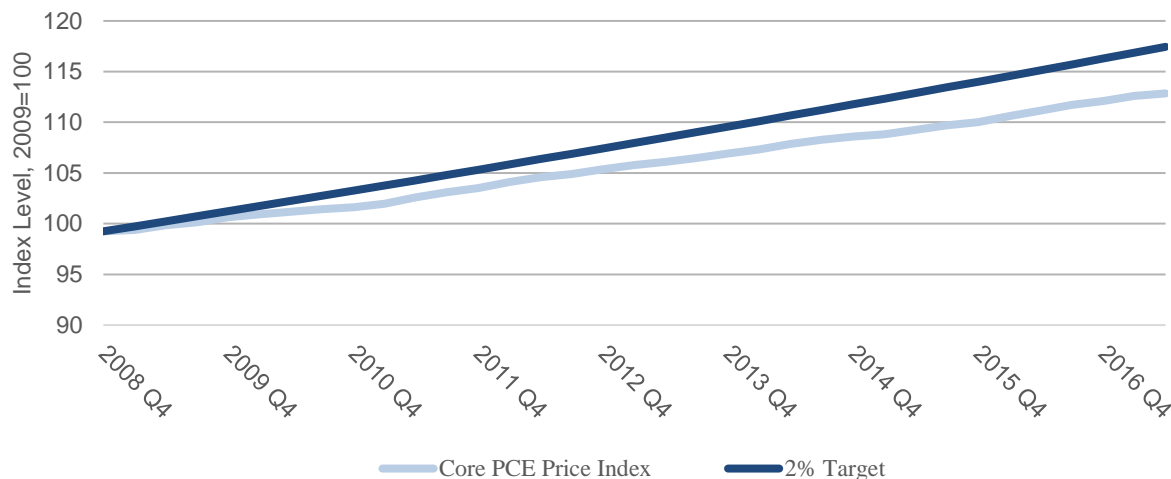
Source: FRED, Author's calculations.



The average-inflation criterion, in (2) above, is couched in the language of inflation targeting, which I take to be an advantage from a communications perspective. My readers will recognize, though, that the average-inflation criterion is equivalent to a *temporary price-level target*, which applies only during the ZLB episode. Expressing this in terms of the price level,

rather than inflation, Figure 3 below shows recent values of the (core PCE) price level, relative to a 2 percent trend starting in 2008 Q4. (Again, 2008 Q4 is the base quarter because that’s when the federal funds rate first reached the zero lower bound.) The necessary condition, that average inflation over the ZLB period be at least 2 percent, is equivalent to the price level (light blue line) returning to its trend (dark blue line). As Figure 3 suggests, a period of inflation exceeding 2 percent would be necessary to satisfy that criterion.

Figure 3: Price Level Since 2008 Q4 vs. 2% Target



Note: Figure shows the core PCE price level against the target core PCE price level, assumed to rise at a 2% annual rate since 2008 Q4. Equivalently, the target price level is the level implied by a 2% cumulative (annualized) inflation target during the ZLB period. Data are seasonally adjusted.  
Source: FRED.



I should emphasize that, in my proposal and as stated in paragraph (2), meeting the average-inflation criterion is a necessary but not sufficient condition to raise rates from the ZLB. There are at least two additional considerations: First, monetary policymakers would want to be sure that the average inflation condition is being met on a sustainable basis and not as the result of a transitory shock or measurement error. Expressing the condition in terms of core rather than headline inflation, as in the figures above, would help on that score. Second, consistent with the concept of “flexible” targeting, policymakers would also want to factor in real economic conditions in deciding whether it was time to raise rates. Specifically, even if the average-inflation criterion is met, the FOMC might delay liftoff until labor market conditions are or are expected soon to be healthy. For example, they might stipulate the additional necessary

condition that the unemployment rate be at or below estimates of the natural or sustainable rate. I elaborate on this point and its rationale in the Appendix.

What I have called a temporary price level target shares several advantages with an ordinary, permanent price-level targeting regime. As already noted, it has the critical “make-up” feature, that it delays the exit from the ZLB relative to the prescriptions of conventional policy rules, like the Taylor (1993) rule. Moreover, the make-up period will generally be longer following more severe ZLB episodes, thereby delivering more stimulus when it is most needed. It’s also worth reiterating the distinction between this approach and the Odyssean forward guidance described in the previous section. The key difference is that, under a temporary price level target, the lower-for-longer strategy is an integral part of the policy framework and thus can be explained (and, one hopes, anticipated by market participants) *in advance* of an encounter with the ZLB. If this strategy is understood, it should serve to make encounters with the ZLB not only shorter and less severe but also less frequent in the first place.

The temporary price level target also shares with the ordinary price level target the benefit of preserving price stability, in contrast to the strategy of simply raising the inflation target. In particular, under this approach, inflation during both ZLB and non-ZLB periods should average about 2 percent.

My proposal has two potential advantages over an ordinary price level target, however. First, it does not require a major shift in existing policy frameworks, since 1) inflation targeting would continue to define policy away from the ZLB and 2) the temporary price-level target could be reinterpreted as part of an inflation-targeting regime, in that, as we have seen, it amounts to targeting the average inflation rate over the ZLB period. Second, like inflation targeting, it avoids the need to tighten policy in the face of temporary inflation shocks away from the ZLB.

In their recent paper on the effects of the ZLB, Kiley and Roberts (2017) propose a “shadow rate rule,” under which the timing of the exit from the ZLB is determined by the evolution of a (unobserved) shadow interest rate, which in turn depends on economic outcomes. They show by via simulations of econometric models that, if understood and anticipated by markets, the shadow rate rule could substantially eliminate the macroeconomic costs of the ZLB. My proposal for a temporary price level target has substantial affinities with the Kiley-Roberts rule, as applied to ZLB episodes only. A principal difference is that my proposed framework

would be framed in terms of macro outcomes, rather than in terms of a hypothetical shadow interest rate. In the Appendix I develop further the linkage between the two approaches.

To summarize this section, a temporary price-level target, invoked only during ZLB episodes, appears to have many of the benefits of ordinary price-level targeting, including the preservation of price stability and the implication that ZLB episodes are followed by “make-up” periods of low rates. Among its additional advantages are that it could be folded into existing inflation-targeting regimes in a straightforward way, minimizing the need to make changes in longstanding policy frameworks and communications practices; and that it would not require the reversal of inflation shocks that occur away from the ZLB.

## **CENTRAL BANK INDEPENDENCE AND INSTITUTIONAL REFORM**

Of course, monetary policy decisions are not made in a vacuum and any changes, particularly to the framework, need to be discussed in a political and institutional context. The future of monetary policy depends in part on the structures and powers of central banks themselves. The political blowback from the financial crisis and the ensuing recession raises the possibility that legislatures will impose institutional change, including additional constraints on central bank independence. In this last section, I revisit the case for central bank independence in a world of low inflation and interest rates.

The term “central bank independence” (CBI) is sometimes used loosely, so it’s worth spelling out what it means in a contemporary context. In particular, in a modern pluralist democracy, CBI does *not* mean full autonomy or lack of accountability for monetary policymakers, nor does it mean that political actors have no role in influencing policy, at least over the longer term. Although institutional details differ quite a bit across countries and jurisdictions, I associate contemporary CBI with four elements:

**First, democratically elected representatives establish the central bank’s institutional structure, including its authorities and powers; set its broad objectives; and appoint its leadership.** For example, the Federal Reserve’s Congressional mandate is to promote maximum employment and price stability. The Fed has an idiosyncratic structure, which includes regional Reserve Banks with private-sector boards, but it is ultimately accountable to the President and to the Congress, who determine the Fed’s authorities and the membership of the Federal Reserve Board. The Fed’s monetary and lending authorities, established by the

Congress, are generally narrower than other advanced-economy central banks—for example, under normal circumstances and unlike other central banks, the Fed cannot buy private-sector assets like corporate bonds or stocks, or lend outside the banking system—but it has some emergency powers that can be called on.

**Second, elected representatives regularly review the central bank’s monetary policy decisions and progress toward mandated goals. To facilitate effective review, the central bank provides extensive information about its plans and policies, and in general is as transparent as possible consistent with the effective implementation of policy.** It is not a coincidence that the global trend toward greater central bank transparency has occurred at the same time that monetary policy has assumed a more prominent role in managing the economy. In particular, a critical motivation for the rise of inflation targeting and similar frameworks is the communication enhancements they bring, including the regular release of forecasts and policy projections, as well as the accountability that is facilitated by explicit objectives. The Fed’s steps toward increased transparency in recent years include adoption of an explicit inflation target; releasing the forecasts, including interest-rate forecasts, of FOMC participants; and the institution of a quarterly press conference by the chair. The FOMC also releases the minutes of its meetings after three weeks and full transcripts with a five-year lag.

**Third, subject to the system of mandated objectives and regular review and oversight, the central bank is allowed to manage the instruments of monetary policy without overt political interference.** So, for example, the Fed manages its policy interest rate without Congressional or executive branch intervention, so long as its policy decisions can reasonably be seen to be in pursuit of its mandated objectives. (In economists’ parlance, the Fed has instrument independence but not goal independence.) This operational independence is enforced in large part by norms (in the U.S., presidential acceptance of the norm of Fed independence has been particularly important) but also by speed bumps to intervention that are part of the institutional design. In the Fed’s case, these speed bumps include the long, overlapping terms of Fed governors; the fact that governors can only be discharged before the ends of their terms for inappropriate behavior, not for policy reasons; the Fed’s budgetary independence; the long terms and non-political appointment of Reserve Bank presidents; the political influence of the Reserve Banks’ private-sector directors; and other factors. Notably, though, the protections of the Fed’s independence are mostly indirect or implicit and are not

explicitly guarded by statute or treaty, as is the case in some other jurisdictions, including Japan, the United Kingdom, and the euro area.

A standard description of the terms of central bank independence might end here; but I think we should recognize that, at least in the medium term, democratically elected officials must be able to respond to institutional deficiencies of or poor execution by the central bank.

**Fourth, in the medium term, elected representatives may react to inadequate central bank performance by changing leadership or, as necessary, through institutional reform.**

A viable principal-agent relationship requires the possibility of rewards or punishments for realized outcomes, and for the possibility that the agent's contract itself must change in light of changing circumstances. Thus, I don't consider periodic changes to the structure or powers of the central bank to be necessarily inconsistent with CBI, unless the reform either directly constrains policy decisions (for example, by giving the legislature a veto of interest-rate changes) or eliminates key bulwarks of CBI (for example, by allowing governors to be dismissed for political reasons).<sup>15</sup> The most dramatic reform of the Fed, in 1935, generally increased the independence and effectiveness of its monetary function; the Dodd-Frank reforms of 2010 focused on lending and regulatory authorities and did not materially change the Fed's monetary role. Likewise, it is not inconsistent with CBI that the reappointment of a policymaker depends on his or her success at meeting mandated goals, so long as the promise of reappointment is not used to influence or politicize particular policy decisions. This latter distinction is admittedly not always sharp, but it is supported by the tradition of appointing central bank governors based on professional qualifications rather than political experience and by cultures of professionalism and nonpartisanship at central banks, including the Fed of course.

This description of CBI captures, in general terms, the current institutional and political equilibrium in most advanced economies, and it remains an influential principle constraining the relationship between politicians and central bank governors in many countries. Several questions arise: (1) What is the rationale for CBI in the current environment? (2) Should CBI apply equally to all central bank activities? (3) Will CBI continue to be a key principle of monetary policymaking in the future?

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<sup>15</sup> Binder and Spindel (2017) provide evidence for a political cycle in which Congress largely ignores the Fed during good times but acts to reform the institution after episodes of poor economic or financial performance.



On the first question, the most prominent argument of the research literature is that CBI helps to solve time consistency problems of monetary policy (Kydland and Prescott, 1977; Barro and Gordon, 1980). The basic story, with some simplification, posits that promises of low inflation may be difficult to make credible if decisionmakers are too focused on the short term. In particular, if the public expects low inflation, then policymakers may be tempted to achieve a short-run increase in output by engineering a near-term inflation “surprise.” But the public will come to expect such surprises, with the result in equilibrium being that inflation and inflation expectations are higher than desired, with no ultimate benefit in terms of higher output. CBI addresses the inflation credibility problem, in this traditional view, because independent central bankers—perhaps because they are selected for their hawkish tendencies, or because of professional or institutional incentives—will be seen by the public as less inclined than politicians to push for short-term output gains at the expense of higher inflation. The canonical example of “credibility through delegation” is Jimmy Carter’s appointment of Paul Volcker to the Fed (Rogoff, 1985), and, indeed, it’s very plausible that central bank independence has contributed to the global reduction in inflation of the past couple of decades. Essentially, in this view, an independent central bank is a commitment device by which politicians control their own inflationary biases.

The general thesis that independent central bankers have longer horizons, and are thus better able than short-term-oriented politicians to take into account the longer-term interests of the economy, rings true, as I’ll discuss. However, the specific argument that CBI reduces inflation bias is looking shaky these days. In recent years, the problem faced by central banks has been too little, rather than too much, inflation. Moreover, some of the strongest political opposition to the strong monetary measures of the Fed and other major central banks have come not from those who wanted the monetary authorities to do more, but from those who wanted them to do less. I have already mentioned the 2010 letter from Congressional leaders to the Federal Open Market Committee warning against embarking on a new round of quantitative easing. Similar objections to monetary easing have been raised in Europe—especially in Germany, where quantitative easing and low interest rates have provoked popular protest and court cases—and elsewhere. The phenomenon of intense political opposition to easy money has diverse causes, including the political power of creditors (savers and financial institutions), but in any case it is difficult to reconcile with the traditional time consistency story.

One might be tempted to conclude that, in a low-inflation world, CBI is no longer desirable, and that central banks should coordinate directly with governments when needed to get higher inflation (Eggertsson, 2013). I'll return to the issue of central bank-government coordination below. But the point I want to make here is that the time consistency argument for CBI was never the complete rationale, and that there are other good reasons to delegate monetary policy to an independent central bank:

*First, monetary policymaking can be highly technical.* Congress hires the Fed to manage monetary policy in part for the same reasons that I hire a professional to solve my plumbing problems—and while I hold the plumber accountable for fixing the problem, I don't second-guess the specific actions that he takes, because I recognize that my kibitzing would only worsen the outcomes.

*Second, monetary policy is also often time-sensitive.* It needs to be managed by a body that can respond quickly and accurately to changing economic and financial conditions.

*Third, effective monetary policy requires consistent, coherent, and timely communication with financial markets.* Legislatures are not equipped to do this, and even ex post interference with central bank decisions or communication will create uncertainty in markets and reduce the effectiveness of monetary policy.

If monetary policy's technical aspects, need for timeliness, and market sensitivity were the only reasons for delegating this responsibility, then it might be sufficient to have monetary policy run out of the finance ministry or Treasury, rather than by an independent central bank. Indeed, there have been significant examples of monetary policy oversight by developed-economy finance ministries, as recently as the 1990s in the United Kingdom and Japan for example. An argument for delegating monetary policy to the Treasury is precisely that it might be more democratically responsive, at least in the short run. Moreover, as noted earlier, monetary policy (including quantitative easing) can have fiscal implications, including for seigniorage revenue, debt management, and the functioning of government debt markets, providing some additional rationale for leaving monetary policy to finance ministers.

However, these points notwithstanding, the longstanding global trend toward entrusting monetary policy to independent central banks rather than finance ministries seems justified by the weight of experience. First, monetary policy operates with substantial lags, and campaigns of policy easing and tightening can play out over a number of years. So, even if inflation bias is

itself not a problem, it is important that *monetary policymakers keep a longer-term perspective and ensure policy continuity and coherence over time*. Finance ministers (who in most jurisdictions are elected politicians) may turn over quickly—as Fed chair I worked with had four Treasury secretaries (two Republicans and two Democrats), and Alan Greenspan worked with seven—and changes in government shorten time horizons as well. For similar reasons, independent central banks are better placed to develop long-run institutional credibility—to anchor inflation expectations, establish a reputation for carrying through on forward guidance, to establish a predictable reaction function, and to avoid policy lurches. Second, even beyond their effects on time horizons, *political considerations would create other problems for a Treasury-led monetary policy*. For example, there would be suspicions of (and temptations toward) “spin” around economic forecasts and the timing of key policy actions or announcements. Would a finance ministry be tempted to cut interest rates to distract from an unrelated political setback? Even if not, would the markets suspect that that might happen? Fiscal considerations, mentioned above as an argument for keeping monetary policy in the Treasury, might cut the other way in a short-run political context: Would there be concerns, for example, that the Treasury is setting interest rates to influence the size of the government’s current deficit?

In sum, the avoidance of inflation bias is far from the only rationale for delegating monetary policy to an independent central bank. Other reasons include the technical, time-sensitive, and market-sensitive aspects of monetary policy-making; the benefits of the longer-term perspective on the economy that apolitical central bankers bring; the development over time of institutional credibility and predictability; and the avoidance of incentives to react to short-term political developments. The delegation of monetary policy to central banks may also be in the interest of politicians, as well as in the public interest, which helps explain why it’s sustainable. For example, delegation provides distance, allowing politicians to enjoy the benefits of a good economy while having someone else to blame if things go wrong (Binder and Spindel, 2017). Less cynically, politicians may recognize that delegation, by putting policy in the hands of specialists and eliminating their own incentives to over-react to short-term political pressures, is good for the economy and their constituents as well as for themselves (Eggertsson and Le Borgne, 2007).

These arguments for CBI pertain primarily to monetary policy. What about other central bank activities? Should they be carried out with the same presumption of independence as monetary policy?

CBI is an instrumental principle, not an ideological or philosophical proposition: It makes sense when it leads to better policy outcomes (on average) and not otherwise. Thus, the applicability of CBI may vary according to policy function or to economic circumstances. In its supervisory functions, for example, the central bank should not make special claims to independence, over and above that afforded to other regulators. Independence seems well justified in some aspects of supervision; for example, allowing political interference in the determination of (say) the capital adequacy of a particular bank would involve obvious risks and potential conflicts of interest. But legislators may appropriately weigh in on regulatory and supervisory policies applied to the banking system broadly. In the response to a systemic crisis, the case for CBI is that it may allow the central bank to fulfill its vital lender-of-last-resort function rapidly and effectively, making use of supervisory and other confidential information. However, in a financial crisis, coordination of the central bank with the executive (including other agencies) and the legislature may be essential for achieving stability. In the 2007-09 crisis, the Fed and other central banks worked closely with finance ministers, without compromising their independence in monetary policy or as lenders of last resort.

A special case of interest arises when an economy faces significant deflation risk, and when monetary policy is unable to contain the problem on its own. As Eggertsson (2013) has pointed out, that situation turns the traditional “inflation bias” argument for independence on its head: If the purpose of CBI is to avoid inflation bias in normal times, then it would seem to follow that CBI should deliberately be sacrificed when more rather than less inflation is desired. Historically, of course, inflation has often been associated with the subjugation of the central bank to the fiscal authorities.

The perspective of the present paper offers a somewhat different take on this issue. CBI does not depend only on the inflation bias argument, I have argued; there are other reasons to delegate monetary policy to an independent, technocratic institution. Accordingly, the absence of inflation is not in itself a reason to abandon CBI. However, in my view, CBI does not necessarily preclude coordination of monetary policymakers with the fiscal authorities, if two conditions are satisfied:

First, the goals of the coordination should be both consistent with the central bank's mandate and not achievable in the absence of coordination. So, if fiscal-monetary coordination is essential for meeting the central bank's inflation goal or to preserve financial stability, then it's better to coordinate than to fail to meet the mandated objectives. In contrast, the central bank should not coordinate if the result is inconsistent with or outside of its mandates, or if its mandated objectives can be achieved without coordination. In particular, explicit fiscal-monetary coordination to raise inflation should not be considered except as a last resort, when the central bank has determined that it cannot independently achieve its inflation target.

Second, the central bank must continuously evaluate whether the first condition is satisfied, retaining the power to stop coordinating at any point if it is not. These two criteria seem to me to protect CBI, which has long-run value for the economy, while not ruling out temporary periods of monetary-fiscal coordination that may be essential for achieving key policy goals.

As a positive matter, will CBI survive? There are certainly worrying signs. In the United States, the Fed remains unpopular in many quarters, and hostility between some members of Congress and Fed leadership has been frequently evident. The Fed also has fewer institutional protections than most other advanced-economy central banks; in particular, as noted, its policy independence is not explicitly protected by law or treaty (except indirectly, through the speed bumps mentioned earlier).

However, there are also reasons to be guardedly optimistic: First, recent economic performance—at least the dimensions of it amenable to monetary policy—has been good, with the Fed near its inflation and unemployment objectives. At the same time, post-crisis reforms have addressed many aspects of the crisis response, including the most unpopular interventions. The objective case for major institutional change at this point thus seems rather weak. Second, as is normal in a democracy, the winners of recent elections are in the process of appointing new leadership at the central bank, with the result that the Fed's current political opponents will now find themselves with a stake in the institution's success. Since CBI is important for that success, the new political leadership may increasingly appreciate see the value of preserving that norm.

Continued vigilance is essential, of course. The greatest danger is short memories. The financial crisis and the ensuing recession were fought with financial and monetary policies that, while ultimately successful, engendered political backlash. After the crisis, necessary reforms

helped to strengthen the system and to rationalize crisis-fighting authorities. The risk is that politicians may be tempted to constrain or eliminate some of the powers, including monetary powers, that proved essential in the past decade. Such changes might have little immediate effect, but unless carefully thought through they could expose the American and world economies to severe financial and economic risks in the future.

## CONCLUSIONS

Even as central banks emerge from the shadow of the global financial crisis and the ensuing recession, they face new challenges. Among the most important of these are the constraints on conventional monetary policy posed by low inflation and low nominal interest rates. In this note, I have argued that unconventional tools, especially forward guidance and quantitative easing, can provide significant additional scope for monetary policy.

However, even with additional tools, and absent reliable fiscal support, existing monetary frameworks may prove insufficient to offset a severe economic slowdown. That leads to the question of whether alternative monetary frameworks could increase the potency of monetary policy. One leading suggestion, to keep the current inflation-targeting regime but to raise the inflation target to 3 or 4 percent, raises a number of concerns. Targeting the price level is a better approach, but it also has drawbacks, including the communications challenge of making such a large change in the policy framework and the requirement that central banks reverse (rather than “look through”) temporary inflation shocks. In this paper I have proposed for consideration a “temporary price-level targeting” approach, which applies only at times at which policy rates are at or very close to zero; at other times, standard inflation targeting would prevail. Under this approach, monetary policymakers would commit in advance not to raise rates from zero at least until 1) average inflation over the entire ZLB period is at target and 2) unemployment has returned to normal ranges. This approach involves only modest changes to the current framework, and it is consistent with the Fed’s current mandates for maximum employment and price stability.

The low-inflation, low-rate environment also raises questions about central bank independence, which the economics literature has rationalized as a bulwark against high inflation. I agree with Eggertsson (2013) that fiscal-monetary coordination, rather than independent monetary policy, may at times be necessary to fight persistent deflation or low

inflation. However, I argue that the case for CBI goes well beyond the avoidance of inflation bias and is based on factors that include technical competence, institutional credibility, and the need for a longer-term perspective. I am hopeful that CBI will survive in the United States and other advanced economies, but memories are short and thus vigilance in defense of CBI will be important.

#### APPENDIX: THE RELATIONSHIP BETWEEN THE TEMPORARY PRICE LEVEL TARGET AND THE KILEY-ROBERTS SHADOW RATE POLICY

As noted in the text, Kiley and Roberts (2017) postulate a so-called shadow rate policy rule, which they show by simulations to reduce (indeed, largely eliminate) the effects of the ZLB on macro outcomes. A potential disadvantage of their approach, however, is that it relies on unobservables and may be difficult to explain. In this appendix, I show that my temporary price level target is closely related to the Kiley-Roberts (KR) policy as applied to ZLB periods. However, unlike KR, who assume that the shadow rate rule applies at all times, my approach assumes that a conventional policy rule is used away from the ZLB.

To be concrete, suppose that the *ordinary policy rule* followed by the central bank (away from the ZLB) is a Taylor rule with a lagged interest rate term:

$$(1) i_t = r + \pi_t + a(\pi_t - 2) + by_t + ci_{t-1}$$

The notation is as usual ( $i$  is the policy rate,  $\pi$  is inflation,  $y$  is the output gap;  $r$ ,  $a$ ,  $b$ , and  $c$  are parameters; the subscript  $t$  is time, measured say in quarters). This rule is incomplete, however in that it does not specify how the rate is set when the notional rate implied by equation (1) is negative. The usual solution is to assume that the actual rate is the maximum of the rate implied by equation (1) and zero. However, as KR show, when the neutral nominal interest rate is low, the use of policy rules like equation (1), modified only by the non-negativity constraint, can lead to frequent encounters with the ZLB and poor economic performance.<sup>16</sup>

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<sup>16</sup> Note, though, that Kiley and Roberts looks specifically at the case in which there is no lagged interest rate term,  $c = 0$ . I include the lagged term both for realism and because lagged responses tend to improve policy performance when the ZLB is relevant. Empirical evaluations of this approach should therefore allow for the lagged term.

An alternative means of dealing with the ZLB constraint, explored by KR, begins by specifying a *shadow policy rate*, which is non-zero (negative) only when the actual policy rate is constrained by the ZLB. Following KR, I define the shadow rate by:

$$(2) i_t^* = d(\pi_t - 2) + ey_t + i_{t-1}^*$$

where  $d$  and  $e$  are parameters. As in KR, the evolution of the shadow rate is specified in first differences. The shadow rate is not directly observable but is instead a device for determining when the central bank lifts the actual policy rate,  $i$ , from zero. In analogy to KR, I assume the actual and shadow policy rates interact as follows.<sup>17</sup> Suppose the economy starts out in a “normal” (non-ZLB) regime, with the actual policy rate above zero and given by the Taylor rule, equation (1). In this normal regime, with  $i > 0$ , set  $i^* = 0$ . The economy evolves over time until, at some point, the Taylor rule implies a negative policy rate. In that period, there is a regime switch: Now  $i = 0$  and  $i^*$  is determined by equation (2), with the lagged value of  $i^*$  initially equal to zero. Presumably, in this regime  $i^*$  is negative because inflation and output are low.

Now assume that the economy remains in the ZLB regime (with the actual interest rate  $i = 0$ ) until the shadow rate returns to (crosses) zero from below, at which point the Taylor rule takes over again ( $i$  is determined by equation (1) if it is non-negative, and is equal to zero otherwise) and the shadow rate is once again set to zero. In short, the basic idea is that the Taylor rule applies when the policy rate is away from zero, while the shadow rate determines the time of exit from the ZLB. Importantly, in its first-difference form, the shadow rate reflects the cumulative departures of inflation and output from target during the ZLB period, i.e., it is history-dependent in Woodford’s sense. Accordingly, as the KR simulations confirm, the introduction of the shadow rate delays the exit from an adverse ZLB episode, improving performance significantly relative to purely forward-looking policy rules.

The shadow rate formulation is appealing, but in practice, it could prove challenging to try to communicate policy to the public in terms of a shadow rate. As noted, the shadow rate is

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<sup>17</sup> Kiley-Roberts assume that a policy rule of the form of (2) applies at all times. I differ from their treatment by letting the shadow rate rule apply during ZLB episodes and setting policy by the inertial Taylor rule, equation (1), at other times.



not directly observable by the public, and its value depends on specific choices of the form and parameter values of the equation determining  $i^*$ , equation (2). If possible, it seems preferable to express the central bank's necessary condition for exiting from the ZLB in terms of macro observables, rather than in terms of the shadow rate. I show now how to do that.

Suppose the economy enters a ZLB episode in period 0. In what period, call it period  $k$ , will the economy exit from the ZLB? Recursively solving equation (2), the exit period  $k$  is determined endogenously by the condition that the shadow rate in period  $k$  crosses zero:

$$(3) \quad i_k^* = d \sum_{t=0}^k (\pi_t - 2) + e \sum_{t=0}^k y_t \geq 0$$

Suppose for the moment that the weight on the output gap in the shadow rate equation is zero ( $e = 0$ ). Then equation (3) is satisfied when average inflation over the ZLB period is at 2 percent, or, alternatively, when the cumulative inflation shortfalls from target are made up. So, under the admittedly restrictive assumption that  $e = 0$ , the shadow rate policy is equivalent to a temporary price level target, applied only during ZLB episodes.

If  $e \neq 0$ , then the criterion for exit from the ZLB, equation (3), is a weighted average of the inflation shortfall and the cumulative output gap, with an explicit relative weight. I'm not sure that a weighted-average criterion for exiting the ZLB would be workable in practice, although it should not be ruled out. A simpler alternative in the spirit of equation (3) is to add a condition on the unemployment rate to the exit criterion, as discussed in the main text. So, for example, if both inflation and output drop below target/potential during the ZLB period, then a necessary condition for exit in period  $k$  would be  $y_k \geq 0$ , or, equivalently,  $u_k \leq u^{NAIRU}$ . In practice, then, the central bank could stipulate in advance two necessary conditions for exit from the ZLB: that (1) average inflation over the entire ZLB period is (at least) back to target and (2) the current unemployment rate is no higher than the central bank's (publicly announced) estimate of NAIRU. This conditionality is similar to the FOMC's (Odyssean) forward guidance a few years ago when it tied rate increases to the inflation goal and to the level of the unemployment rate (FOMC, 2012).

The shadow-rate specification ties the exit date from the ZLB to the temporary price level target. After the exit, in this approach, the policy rate is determined by the standard Taylor rule.

An alternative would be to add the cumulative inflation shortfall since the beginning of the ZLB period directly to the Taylor rule:

$$(4) i_t = r + \pi_t + a(\pi_t - 2) + by_t + f[\sum_{i=t_1}^t (\pi_i - 2)] / (t - t_1)$$

where  $t_1$  is the period in which the economy last entered the ZLB regime (so the last term is the average inflation shortfall since then) and  $f$  is a parameter. This formulation does not require a shadow rate computation; instead, the policy rate is the max of the value of equation (4) and zero. The inflation shortfall term is to be understood to be present in equation (4) only during and immediately after a ZLB episode, and to drop out at other times. Qualitatively, the thrust of (4) is that central bankers would take the cumulative inflation shortfall as an additional consideration for policy during and immediately after a ZLB episode.

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