Current Policy Perspectives

FEDERAL RESERVE BANK OF BOSTON™

No. 14-12

Let's Talk About It: What Policy Tools Should the Fed "Normally" Use?

Michelle L. Barnes

Abstract:

The use of a wide variety of monetary and credit policy instruments during the most recent crisis offers a singular opportunity to reconsider the tools the Fed could and should employ when pursuing its goals of supporting the dual mandate and ensuring financial stability. This paper discusses the conventional and unconventional tools that the Fed uses to implement its policies, reviewing what is and is not known about the relative costs and benefits of the different instruments used to achieve its monetary policy mandate and its possibly interdependent and newly enhanced responsibilities for financial stability. A broader reconsideration of these tools may result in a decision to alter the Fed's choice of the policy instruments it uses to support the dual mandate and financial stability. Once decisions are made about which tools are desired for use in the long run, transitioning to that long-run state, or "exit," becomes a more mechanical and technical discussion.

JEL Codes: E52, E58, G01, G12

Michelle L. Barnes is a senior economist and policy advisor in the research department at the Federal Reserve Bank of Boston. Her e-mail address is michelle.barnes@bos.frb.org.

The author thanks Jeff Fuhrer, Richard Kopcke, Giovanni Olivei, Joe Peek, and Geoff Tootell for insightful, constructive, and helpful suggestions and comments.

This paper, which may be revised, is available on the web site of the Federal Reserve Bank of Boston at http://www.bostonfed.org/economic/current-policy-perspectives/index.htm.

This version: December 29, 2014

1. Introduction

A few recent speeches by the Federal Reserve System (the "Fed") Bank presidents and other Federal Open Market Committee (FOMC) communications have highlighted the importance of FOMC decisions regarding the reinvestment of principal repayment receipts resulting from the Fed's extraordinary foray into large-scale purchases of Treasury securities and agency mortgage-backed securities (MBS), known as quantitative easing (QE), as part of its policy response to the Great Recession and its prolonged recovery. Taken as a whole, these communications have emphasized a range of concerns and considerations from different quarters. So far, though, the Fed's public discussion regarding this aspect of the Fed's "exit strategy"—meaning the reinvestment or rollover policy[1]—has put the cart before the horse, given the implicit assumption that the Fed should return to conducting monetary policy solely by using an interest rate policy tool like the conventional federal funds rate.[2] This stance was articulated in the "Exit Strategy Principles" outlined in the minutes of the June 2011 FOMC meeting, as well as in a pledge to "normalize" the Fed's balance sheet, a position ratified in the recent July 2014 FOMC meeting minutes and more fully articulated in the September 17, 2014, press release titled "Policy Normalization Principles and Plans." In essence, this evolving exit strategy largely appears to preclude considering that perhaps the Fed should retain its new balance sheet tools to use in pursuing the dual mandate (achieving maximum sustainable employment in the context of price stability) and in safeguarding financial stability, a responsibility that has been further augmented by the Dodd-Frank Act (DFA).[3] Instead, as described to date this strategy seems to assume that the desirable course of action is for the Fed to fully retreat or "exit" from the unconventional regime of using its balance sheet to conduct

[1] These terms—"reinvestment" and "rollover"—are used interchangeably and refer to what is done with the principal repayments received from the Fed's large-scale asset purchase programs. For some time now the Fed has been reinvesting these proceeds by rolling them over into similar securities.

[2] Or variants of the conventional asymmetric corridor system that use the federal funds rate as the policy tool target, such as a more explicit and symmetric corridor system for a federal funds rate target.

[3] In her press conference on June 18, 2014, Chair Yellen stated "the notion that we fully expect our balance sheet to shrink considerably over time back toward more normal levels, toward levels that would be consistent with *efficiently* conducting monetary policy, that's still an expectation" (emphasis added). She went on to say that "it's an expectation that eventually our portfolio will be —consist largely of Treasuries."

monetary policy via quantitative easing—with policy-determined objectives for the balance sheet's size, composition and duration—and to return to the conventional regime of implementing monetary policy largely by using the federal funds rate lever, while wielding a balance sheet consisting just of Treasuries and that is sized only to meet the demand for reserves "to implement monetary policy efficiently."[4, 5]

Before the FOMC finalizes its decision on the optimal exit strategy from the unconventional policies enacted in response to the Great Recession, it seems prudent first to establish what the tools of monetary policy, including the Fed's balance sheet, should be in the long run. This stance should refer to more than just the size of the balance sheet (or quantitative easing); it must also cover the asset composition (agency MBS versus Treasuries) and maturity structure (often termed "credit easing or credit policy"). If there are sound reasons for the Fed to preserve the option of using balance sheet tools in the long run, then it makes sense for the design of the roll-off or reinvestment strategy to first articulate what the optimal size, composition, and duration of the balance sheet would be in the long run, meaning during both crisis and "normal" times. In addition, undertaking a measured roll-off of the Treasury and agency MBS in the System Open Market Account (SOMA) portfolio without articulating a desire to maintain a balance sheet of a certain size, composition, and duration, might send a confusing signal to the markets, potentially leading to undesired and/or prolonged volatility in interest rates. In other words, the roll-off strategy also presents an opportunity for the financial markets to learn about the Fed's short-term and long-term goals with respect to the balance

[4] Yet the July 2014 FOMC minutes also stated that "a few of the participants noted that the appropriate size of the balance sheet would depend on the Committee's future decisions regarding its framework for monetary policy." The September 17, 2014, press release titled "Policy Normalization Principles and Plans" seems, however, to preclude the possibility that balance sheet tools should remain in the Fed's policy toolkit after "normalization."

[5] Here it is worth pointing out that the Fed, under the auspices of Section 14 of the Federal Reserve Act, has always been able to conduct outright purchases of Treasuries, agency securities, and agency MBS securities of various maturities in order to keep the supply of reserves in sync with the growth of demand for reserves, and that the Fed has held agency securities in the past. What has changed with the onset of these large-scale asset purchase programs is the magnitude of the Fed's purchases, hence the size of its balance sheet, as well as the portfolio's ratios of longer-term to short-term securities and of agency MBS to Treasury securities.

sheet's optimal size, composition, and duration after the economy returns to equilibrium. This learning includes forming an understanding of the issues related to the ways that that Fed intends to conduct monetary and/or credit policy, and how the conduct of such policy is influenced by financial stability considerations.[6]

In a *Financial Times* opinion piece published in June 2014, Benjamin Friedman argued that the Fed, along with other central banks, should permanently maintain the balance sheet tool, in terms of both its size and composition.[7] Extending this point, in evaluating what the central bank's optimal monetary strategy should be, the Fed's balance sheet tools must be compared with the conventional operational paradigm of the federal funds rate (or the corridor variant of an upper and lower bound for the policy rate that is possible now with the payment of interest on reserves), coupled with the Fed's use of forward guidance.[8] The debate should include an evaluation of the relative costs and benefits of the Fed reverting to business as usual in the long run (meaning a primary reliance on the federal funds rate) or permanently maintaining—in a fashion determined by rigorous analysis and debate—its newer arsenal of policy tools, along with the additional responsibilities and complexities that come with a macroprudential approach to ensuring financial stability. The outcome of such a debate need not conclusively determine that one tool or subset of tools should be maintained over others at all times, but it might have strong implications for the Fed's reinvestment strategy, or any transition to an end

---

[6] These considerations could relate to the Fed's extraordinary use of the balance sheet to achieve its monetary policy objectives; there is no reason for the Fed to have as a goal zero outright securities holdings, even if in the long run it has no desire to use balance sheet tools as part of its normal conduct of policy. Historically, before the start of this relatively recent era of using balance sheet policy tools, the Fed has held Treasuries and sometimes agency securities in order to meet the secular demand for reserves within the context of the federal funds rate being the only tool for conventional monetary policy implementation.

[7] See Benjamin Friedman, "The Perils of Returning a Central Bank Balance Sheet to 'Normal,'" *Financial Times*, June 19, 2014. Available at http://www.ft.com/intl/cms/s/0/47e50644-ea63-11e3-8dde-00144feabdc0.html#axzz3TGO6sjfY. Note that composition considerations include not just the more obvious Treasuries versus agency MBS distinction, but also the portfolio's duration.

[8] Forward guidance is another way—distinct from outright purchases of Treasury securities of varying maturities—of trying to affect both the level and slope of (some part of) the term structure of risk-free interest rates.

state regarding the size, composition, and duration of the Fed's balance sheet.[9] This debate takes on more importance because the DFA has effectively charged the Fed with additional financial stability considerations along with its other policy goals of achieving maximum sustainable employment in the context of price stability (the dual mandate). Since this legislation expands the Fed's policy objectives in new ways, additional policy tools may be necessary to satisfy all of its responsibilities.[10]

There are important open questions related to this debate. One is whether the Fed should include financial stability in its objective function when conducting monetary policy. On March 21, 2014, Governor Stein delivered a speech putting forth a justification for including financial stability in the Fed's objective function in the conduct of conventional monetary policy.[11] *Rethinking Central Banking*, a 2011 report issued by the Committee on International Economic Policy and Reform, contains additional arguments for achieving the same end goal. Moreover, Woodford (2012) also argues that along with the dual mandate, the Fed should explicitly consider financial stability in its objective function as it decides on the stance of conventional monetary policy. In contrast, Svensson (2012) argues that macroprudential tools should be used to ensure financial stability, and that the conventional interest rate lever should be used for such purposes essentially only under crisis conditions. Chair Yellen echoed this stance in a speech delivered on July 2, 2014. It is worth noting that all of these arguments are premised on the notion that the Fed's available policy tools are the short-term, risk-free interest rate along with macroprudential and microprudential policies; no consideration is given to how these

[9] It is noteworthy that many FOMC statements refer to the FOMC's perceptions of the relative costs and benefits of balance sheet tools when discussing decisions on how to use these tools going forward.

[10] Of course, this point depends on why or how the Fed should concern itself with financial stability. One could argue that the DFA's requirement that the Fed more actively ensure financial stability could (or should only) be satisfied with the Fed's usual reaction to the first and second moments (or perceived uncertainty) about inflation, unemployment, and/or growth objectives, as it usually does to ensure the dual mandate—and that therefore ensuring financial stability isn't really a new or additional objective of Fed policy. Below, an example is discussed for how financial stability could enter separately into the Fed's usual monetary policy reaction function.

[11] Note that such arguments could support the idea of having both monetary and supervisory responsibilities housed in the same institution to foster better cooperation across these historically separate functions.

arguments would change if additional balance sheet tools were also available. At any rate, it is clear that the DFA has enhanced the Fed's financial stability responsibilities; the question has now become how best to achieve these ends in view of the fact that the Fed must also pursue the dual mandate. This consideration is, among other things, intimately related to whether or how the Fed's use of conventional and unconventional policy tools can affect financial stability. Many argue, for example, that a low interest rate environment can engender "reaching for yield" behavior that may lead to financial instability, which could affect at least the variability of the inflation and unemployment outcomes that the dual mandate charges the Fed to take into consideration.

Since the debate about how best to ensure financial stability is largely premised on the use of a limited set of policy instruments, it is worth noting that Cúrdia and Woodford (2011) showed that employing such tools as an interest rate policy, quantitative easing to influence the size of the Fed's balance sheet, and credit policy to affect the composition of the balance sheet can all serve as independent policy levers. If the Fed's toolkit is expanded to include what would be potentially independent balance sheet tools, the tradeoffs inherent between achieving the dual mandate and financial stability with one monetary policy tool, the interest rate lever, may not be as severe, and might even be avoided if, for example, balance sheet tools could be used to achieve one goal and the interest rate lever used to achieve another. Beyond questions of the tools' absolute and relative efficacy in achieving the Fed's multiple objectives, another consideration in this debate is the degree of credit allocation that may be associated with the different policy tools. To this end, it is important to note that even the conventional federal funds rate lever allocates credit toward or away from interest-sensitive sectors of the economy, and that microprudential and macroprudential policy tools are even more precisely targeted forms of credit allocation. Part of the FOMC's overall deliberations should include being very clear and careful about the relative allocative effects of the different possible policy tools, and not just about their absolute and relative efficacy under different circumstances.

This policy paper discusses what is known and knowable about the effectiveness of these recently deployed balance sheet tools for the conduct of modern monetary policy, including how the tools affect the Fed's ability to achieve the dual mandate and maintain financial

stability. The paper begins with a synopsis of the evolution of the Fed's "Exit Strategy Principles," or what is also termed the "Monetary Policy Normalization" process, since June 2011, followed by a review of how the Fed conducted monetary policy before the crisis, and how and why it has deviated from this conventional practice since 2008. The paper then discusses the conduct of monetary and credit policy, including how other prominent central banks use balance-sheet-based policy tools. Some of the issues the Fed, and the public, should consider when assessing the desirability of returning to the exclusive use of the conventional federal funds rate tool, versus the alternative of keeping the new balance sheet tools in its policy arsenal, are then examined with a representative—but not exhaustive—discussion of how the balance sheet tools may and may not help to achieve the Fed's policy goals in the future. The paper concludes with the author's perspective on how these new balance sheet tools may improve the Fed's policy efficacy over time.

2. The Evolution of the Fed's Exit Strategy

Since the June 2011 FOMC minutes that first detailed the "Exit Strategy Principles," meaning the process of "normalizing the stance and conduct of monetary policy," there has been an evolution in this strategy as the size and composition of the Fed's balance sheet has changed dramatically over the ensuing three years.

At the June 2011 FOMC meeting, the process of normalizing the stance and conduct of monetary policy included an outline of the following steps, in this order: 1) Cease "some or all" reinvestments; 2) Simultaneously, or after that, "modify [the Committee's] forward guidance on the path of the federal funds rate" and "initiate temporary reserve-draining operations aimed at supporting the implementation of increases in the federal funds rate when appropriate"; 3) "Begin raising [the Committee's] target for the federal funds rate";[12] 4) Sell agency securities "sometime after the first increase in the target for the federal funds rate"; and 5) Ensure that the pace of such sales should "be aimed at eliminating the SOMA's holdings of agency securities

[12] It was also noted concurrently in these June 2011 "Exit Strategy Principles" that "from that point on, changing the level or range of the federal funds rate target will be the primary means of adjusting the stance of monetary policy."

over a period of three to five years, thereby minimizing the extent to which the SOMA portfolio might affect the allocation of credit across sectors of the economy."[13]

Later, amid wide-ranging discussions about the narrow goal of policy implementation through the use of targeting or by administering short-term money rates, and the broader discussion of what long-run tools the FOMC should maintain (among other related topics), two potential substantive changes were communicated to the public about this normalization process. First, in the minutes from the June 2013 FOMC meeting, it was noted that while participants believed the Fed should "hold predominantly Treasury securities" in the long run, "[m]ost, however, now anticipated that the Committee would not sell agency mortgage-backed securities (MBS) as part of the normalization process." Second, at the June 2014 FOMC meeting, the minutes record that "many participants agreed that ending reinvestments at or after the time of liftoff would be best, with most of these participants preferring to end them after liftoff."[14]

At its July 2014 meeting, the FOMC agreed on further aspects of its exit strategy. At this meeting, "almost all participants agreed that it would be appropriate to retain the federal funds rate as the key policy rate." They further "agreed that adjustments in the [interest on excess reserves] IOER rate would be the primary tool used to move the federal funds rate into its target range and influence other money market rates." Most participants also thought that during the normalization process the overnight reverse repurchase agreement (O/N RRP) facility's administered rate would be used as a floor below the IOER to help support the target federal

[13] This step was further explained: "Sales at this pace would be expected to normalize the size of the SOMA securities portfolio over a period of two to three years. In particular, the size of the securities portfolio and the associated quantity of bank reserves are expected to be reduced to the smallest levels that would be consistent with the efficient implementation of monetary policy." Interestingly, this prediction presupposes the idea that these types of policies in fact lead to greater credit allocation than does the more conventional policy of moving the federal funds rate and/or its path, but no academic studies are ever cited to support this view. It also presupposes that the balance sheet should return to a size supported by the economy's demand for reserves.

[14] Since its December 2004 meeting, the FOMC meeting minutes have been released three weeks after the FOMC meeting (see: http://www.federalreserve.gov/boarddocs/press/monetary/2004/20041214/). These June meetings were held June 18–19, 2013, and June 17–18, 2014, respectively.

funds range within that O/N RRP-IOER corridor.[15, 16] They further agreed that the O/N RRP facility should be "phased out when it is no longer needed" for "effective monetary policy implementation." Regarding the balance sheet, they agreed that its size "should be reduced gradually and predictably…to the smallest level consistent with efficient implementation of monetary policy and should consist primarily of Treasury securities to minimize the effect of the SOMA portfolio on the allocation of credit across sectors of the economy."[17] "Most" of the Committee agreed that it would be appropriate to cease or taper reinvestments "sometime after the first increase in the target range for the federal funds rate." "Most" also thought that MBS would not be sold "except perhaps to eliminate residual holdings." These principles were further agreed upon (with one dissent) and formalized in the FOMC's September 14, 2014, press release titled "Policy Normalization Principles and Plans." This release also indicated that the Fed intends to reduce its asset holdings "in a gradual and predictable manner primarily by ceasing to reinvest repayments of principal on securities held in the SOMA."[18]

---

[15] A reasonable interpretation suggests then that the corridor width in basis points (bp) would be equivalent to the width of the target range for the federal funds rate, or 25 bp. It could be argued, however, that there are additional costs, such as balance sheet costs, that have kept the federal funds rate well below the IOER. If the O/N RRP to IOER spread is too narrow, it could be a problem, since the viable range for the federal funds rate may be well below the IOER value.

[16] Although the FOMC has traditionally engaged in open market operations with just primary dealers, recently the Fed has tested a facility, the O/N RRP facility, which engages in draining large amounts of reserves temporarily with a much wider set of counterparties. This is operationally desirable not just because of the amount of reserves the Fed might need to drain to help support the federal funds rate in a rising rate environment with a large balance sheet, but also because it helps to form a floor under the target federal funds rate range as a result of there being a larger set of counterparties than those that can access the IOER rate. Right now—due to the fact that there are different counterparties who are able to hold reserves and who are able to earn interest on reserves, and that these different sets of counterparties may have different credit risk objectives and characteristics—to date the IOER rate has not acted as a floor on the federal funds rate as it was originally expected to do (see Bowman, Gagnon, and Leahy (2010) for further discussion of these issues).

[17] Interestingly, at the July 2014 FOMC meeting a "few participants" argued that the size of the balance sheet should depend on "the Committee's future decisions regarding its framework for monetary policy."

[18] The September 2014 press release titled "Policy Normalization Principles and Plans" went on to articulate that "the Committee intends that the Federal Reserve will hold primarily Treasury securities, thereby minimizing the effect of Federal Reserve holdings on the allocation of credit across sectors of the economy."

The estimates in Carpenter et al. (2013), based on the Fed's June 2011 articulated exit strategies, forecast that the Fed's balance sheet or SOMA portfolio would be between $3.5 and 4.0 trillion by 2015, roughly $2.0 trillion above the amount of reserves needed to support a "normalized" Fed balance sheet by 2018 or so (see Figure 1, excerpted from their paper; the left panel of this figure includes their projections for the total SOMA portfolio holdings whereas the right panel includes projections for only the Treasury portfolio component of the overall SOMA portfolio). By contrast, the Fed's balance sheet or SOMA portfolio stood at $780 billion at the end of 2006, $2.6 trillion by 2012:Q3, and $4.1 trillion by the end of June 2014. Comparing the two panels of Figure 1 demonstrates that, at least initially in the Carpenter et al. (2013) projections, much of the reduction in the balance sheet would come from agency MBS principal repayments.[19] This figure also shows that under the full roll-off strategy, the balance sheet would "normalize" to a size compatible with having just the conventional policy tool at the Fed's disposal in the early 2020s. Figure 1 indicates that by that time, in order to keep up with the secular demand for currency, which is assumed to grow with nominal GDP, the Treasury portfolio component of the Fed's balance sheet or SOMA portfolio, and hence the total SOMA portfolio, would return to its upward trajectory. By 2025, the level of this normalized balance sheet would be nearly $2.5 trillion. This is substantially larger than the size of the balance sheet before the Fed began its program of quantitative easing, and reflects not only the usual historical relationship between economic growth and the demand for reserves but also the fact that the Fed now pays IOER, increasing the demand for reserves by those parties that can earn IOER.[20] Thus, an important point to keep in mind is that as a result of the Fed now paying IOER, which began in October 2008, a normalized balance sheet (or supply of reserves) may

[19] Following the June 2011 "exit strategy principles," roll-offs are the first step, then the FOMC raises the target federal funds rate, and then assets are sold in order to normalize the balance sheet by 2018 or so, depending on assumptions about the value of assets purchased from 2013 on.

[20] So a hybrid idea for the long-run size of the Fed's balance sheet would be to avoid letting the balance sheet size drop below some long-run "normalized" equilibrium level, such as $2.5 trillion. While this would buy some time to evaluate and debate the relative efficacy and allocative effects of the different policy tools, it could risk signaling the wrong message if in fact it is deemed desirable to keep both the balance sheet and short-term policy rate tools in the Fed's toolkit. Holding to a long-run normalized equilibrium level could lead to undesired rate volatility even if it helps to preserve short-run optionality of the balance sheet tool to some extent.

well be much larger than it would have been as implied by the historical relationships between the demand for reserves and the growth in the economy. (Note that the level of reserves increased from about $33.5 billion at the end of 2008:Q2 to $222 billion by the end of 2008:Q3 to $860 billion by the end of 2008:Q4, which was before the Fed began executing any asset purchases for policy purposes, but after it began paying IOER, albeit in an highly uncertain financial environment). While there may be additional explanations for the increase in reserves after the Fed began paying IOER, Ireland (2012) provides evidence that changes in the interest paid on reserves can have large effects on the quantity of reserves.

To fix ideas further about what different exit strategies might imply for the evolution of the Fed's balance sheet, descriptive information is presented here under different assumptions about roll-offs, in addition to projections of where the balance sheet would be in the longer run when fully "normalized" to a size that no longer reflects the balance sheet being used as a separate monetary policy tool. Figure 2 depicts the decline in the stock of Treasury and agency MBS securities based on a full roll-off of these securities and some simplistic assumptions.[21] With this estimate used as a base, Figures 3a and 3b provide further detail on different roll-off strategies for these components of the SOMA portfolio over the next 11 and three years, respectively, from a flow perspective. Figure 3b also includes the median Primary Dealer Survey respondents' expectation as of April and July 2014.[22] The blue zero line represents

[21] These figures are for illustrative purposes only and use very simplistic assumptions. All values are at par or face value of the fixed-income security. These estimates are based on the SOMA portfolio and its components as of May 28, 2014, and no attempt was made from that point onward to guess at the amount, maturity structure, and timeframe of subsequent purchases undertaken during the tapering of QE3. Furthermore, it is assumed that the agency MBS component of the SOMA portfolio will shrink to $400 billion by 2025, and that this reduction is simply assumed to be geometric. There is no attempt, for example, to measure the relationship between a changing interest rate environment and mortgage prepayments. Also, all of the agency MBS securities are lumped together in this exercise without regard to whether their maturity structure is 30-years, 15-years, or "other." Other agency securities are not included. Detailed information on the SOMA holdings (par or face value) and maturity structure can be found here: http://www.newyorkfed.org/markets/soma/sysopen_accholdings.html.

[22] The surveys are conducted by the New York Fed before each FOMC meeting and results are published on the New York Fed's website: http://www.newyorkfed.org/markets/primarydealer_survey_questions.html. The survey aims to elicit and record survey respondents' expectations regarding the economy, monetary policy, and financial

complete reinvestment, or no roll-offs. The red line represents no reinvestment, meaning it depicts a full roll-off. The purple line represents what would happen if a complete roll-off of the Treasury portfolio occurred along with no MBS portfolio roll-off. It is worth noting that allowing a full roll-off according to the SOMA portfolio's maturity structure would result in a lumpy path that might be undesirable in the context of achieving the Fed's dual mandate and financial stability, and that for this reason alone—which is related to predictability and signaling—one might wish to avoid a full roll-off. The difference between the purple and red lines reflects the amount by which allowing full roll-offs of MBS principal repayments would alter the balance sheet. Finally, the teal line represents a strategy of fixed-share roll-off, namely, allowing 20 percent of the MBS and 80 percent of the Treasury principal payments to roll off the balance sheet. The choice of this example is purely illustrative, but such a strategy could represent a desire not to let the MBS portfolio roll off as much as it otherwise would. The full MBS roll-off shown here is much larger initially than that of the Treasury portfolio; obviously, different assumptions would imply different results. This last example is, however, broadly consistent with the Carpenter et al. (2013) figure reproduced here (Figure 1) which embeds more sophisticated and realistic assumptions in its projections.

In the various roll-off strategies presented in Figures 3a and 3b, by the end of 2016 about $650 billion would have been shed with the full roll-off, and a little over $200 billion would have been removed under the Treasuries-only roll-off strategy (so roughly $450 billion would roll off with a full agency MBS-only roll-off strategy). Compare this with the April 2014 Primary Dealer Survey where the median respondent expected about $200 billion each of Treasuries and agency MBS securities to be rolled off by the end of 2016, and the July 2014 Primary Dealer Survey where the roll-off in Treasuries and agency MBS securities was expected to be only $108 billion and $117 billion, respectively, by the end of 2016 (all these scenarios are shown in Figure 3b). So over the near term, the Primary Dealers seem to expect that there will be much less total roll-off over the next two and a half years than a full roll-off of both agency MBS and Treasuries would imply, and over time they have come to expect even less roll-off

market developments. Also provided on their website is a list of the primary dealer participants who are surveyed.

given that the Fed's public discourse about the "exit strategy" evolved from April through July of 2014.[23, 24]

It is important to keep in mind what market participants expect about the eventual roll-off strategy for the agency MBS portfolio in particular, given the size of the Fed's footprint in the stock and flow of the agency MBS market, as well as the Fed's desire to make sure rates are not unduly volatile for any sustained period of time in order to best support its implementation of monetary policy and to ensure financial stability through the uncharted territory of "policy normalization." Figures 4 and 5 provide some information about the FOMC's footprint in the MBS market's flow and stock, respectively. Figure 4 has historical data on the SOMA's MBS settlements' share of monthly eligible MBS issuance, and Figure 5 has its total share of the remaining pool balance of agency MBS. In March 2014, MBS settlements as a share of SOMA-eligible gross issuance were 99 percent, and in April 2014 this figure was 77 percent. Gross issuance ran at about $60 billion per month at that time. There are reasons why that issuance may decline as the U.S. housing market slows, especially in a rising interest rate environment as the Fed begins to increase the target for the federal funds rate, and reasons why it could also increase if the amount of cash-only purchases declines. As an illustration, by July 2015, full pay-downs of MBS principal amounts could be about $200 billion, or an average of about $33 billion a month between November 2014 and July 2015, which is about half the monthly gross issuance

[23] In April 2014, respondents to the Market Participant Survey expected, by the end of 2016, a roll-off of $205 billion in Treasuries and $190 billion in agency MBS securities; in the July 2014 survey, expectations were for a roll-off of $205 billion in Treasuries and $146 billion in agency MBS securities by the end of 2016. Again, this projection is substantially less than full roll-off of agency MBS would imply, although it is similar to the path of a full roll-off of Treasury securities. The Market Participant Survey is similar to that of the Primary Dealer Survey. A subset of questions from the larger Primary Dealer Survey is used to elicit the respondents' expectations. The survey respondents are market participants and not Primary Dealers. As with the Primary Dealer Survey, a list of market participant respondents is provided on the New York Fed's website.

[24] The April Primary Dealer Survey was distributed on April 17, 2014, and collected by April 22, 2014, with responses received from 21 primary dealers. The April Market Participant Survey had the same schedule but with 27 participants. The June surveys were distributed on June 5, 2014, and received by June 9, 2014. The July surveys were distributed on July 16, 2014, and were received by July 21, 2014. The July Primary Dealer Survey covered 22 participants, and the Market Participant Survey covered 28 participants.

cited above. Projecting the mortgage supply factors is not straightforward, but if one wanted to have very little footprint on the MBS spreads, presumably one could design the reinvestment strategy to be consistent with the projected supply of MBS.

One way to manage the risk that the Fed's roll-off strategy of agency MBS could disrupt the MBS market—even if one is still not sure about retaining the additional balance sheet policy tools for the long run—is to allow for only very slow, or even no, roll-offs. This strategy would buy a little more time to debate and evaluate the relative value of both the balance sheet and short-term rate policy tools versus just the short-term rate policy tool. A strategy of very slow roll-offs also buys some short-term flexibility to deal with any potential downside risks for real activity that might arise from a softer housing market and/or concerns about the market impact of a large pull-back in the Fed's investment in agency MBS securities. The Fed may be concerned about the latter possibility, even if in the long run it decides to go back to just the conventional policy tool, as Fed purchases will account for a large part of the flow in the agency MBS market. Regardless of these short-term considerations, the overarching point is that the reinvestment strategy will provide an opportunity to signal the Fed's desired role for the long-run use of balance sheet tools.

Finally, it is worth noting that there was no mention in the April, June, or July 2014 Primary Dealer or Market Participant Surveys of any expectations that the Fed might try to maintain a balance sheet consisting of a size, composition, and duration that would enable the FOMC to use these newer tools for achieving monetary or credit policy (including financial stability) objectives in the long run.

3. A Recent History of FOMC Policy Tools

The federal funds target rate was the primary tool of monetary policy through the 1990s until this rate hit the zero lower bound (ZLB) at the end of 2008. Since the Fed supplies bank reserves and has good estimates of the demand for such reserves, between the onset of the Great Recession in late 2007 and up until 2008 the FOMC was able to maintain the target federal funds rate with limited volatility through the combination of temporary and permanent open market operations (OMO) under the auspices of section 14 of the Federal Reserve Act (FRA). This "normal" approach to the conduct of monetary policy could be viewed as an asymmetric

corridor with zero as the lower bound and the discount window rate as the upper bound.[25] The Trading Desk at the New York Fed engaged in temporary, and largely overnight, withdrawals or injections of reserves to affect the federal funds rate on a daily basis after considering the balance of the supply and demand for such reserves.[26]

As the federal funds rate approached its perceived lower bound in 2003 (1.00 percent), the FOMC used its policy statements to indicate near-term forward policy guidance. The FOMC transcripts from that year include some discussions about the perceived value (or not) of keeping one's "powder dry" by not reducing rates further, even in the face of circumstances where normally such a move would have been advocated if not for the fear of reaching the ZLB.[27] The use of this forward guidance first occurred in the August 12, 2003, policy statement with the language: "the Committee believes that policy accommodation can be maintained for a considerable period." Then, to indicate that the policy stance would be changing, in its May 2004 statement, the Committee said it "believes that policy accommodation can be removed at a pace that is likely to be measured."[28] With its use of forward guidance, the FOMC sought to affect longer-term risky rates that help shape the behavior of interest-rate-sensitive components of real GDP, such as business and residential investment and consumption, in pursuit of

[25] As a practical matter, however, there is an impediment to this natural corridor in that there are stigma effects associated with borrowing at the Fed's discount window (see, for example, Klee 2011 and Armantier, Ghysels, Sarkar, and Schrader 2013), and not all holders of reserves can earn IOER, as is discussed further in this brief.

[26] This was done by way of overnight repos or reverse repos collateralized by Treasury and agency-backed fixed income securities. Depository institutions are also free to trade reserves in the federal funds market directly with one another. Outright purchases were also made to keep pace with the economy's demand for reserves.

[27] In the March 18, 2003, meeting transcript, pages 51 and 70 include mention of keeping one's "powder dry," as does the June 24–25, 2003, meeting transcript on page 96. For example, in the March 2003 meeting minutes, Boston Fed President Minehan argued that "given current levels of uncertainty and the imminent war, the right thing to do may be to say little, stay put, and keep our powder dry." She went on to add that she was "concerned about how long it really will be prudent to continue in this posture."

[28] Other notable changes to the FOMC statement over time that could bear on the market's perception of the path of policy rates are the inclusion of the Fed's risk considerations and its economic outlook. See Rudebusch and Williams (2008) for a more exhaustive discussion of the Fed's pre-crisis foray into forward guidance, in particular Table 6.1.

fulfilling its dual mandate of maximum sustainable employment and price stability.[29] At this juncture, the FOMC did not choose to operate directly in asset markets to affect longer-term rates.[30]

After the ZLB was reached in 2008, and in the midst of an ongoing financial and economic crisis of historic proportions, in a press release on November 25, 2008, the FOMC announced that it would purchase $500 billion of agency MBS securities "to reduce the cost and increase the availability of credit for the purchase of houses, which in turn should support housing markets and foster improved conditions in financial markets more generally." (This press release also stated that the FOMC would purchase $100 billion of agency securities.) Ostensibly, this ground-breaking move was largely to support the Fed's traditional dual mandate objective, as well as manage any financial instability concerns related to the pursuit of that objective. This initial purchase of agency MBS was the onset of what became commonly referred to as QE1 (quantitative easing, round 1).[31] Additionally, in the December 2008 FOMC statement, the Committee announced that it was "evaluating the potential benefits of purchasing longer-term Treasury securities" and "would continue to consider ways of using its balance sheet to further support credit markets and economic activity." By the end of January 2009, the Fed had announced that it was possible that it would in fact purchase long-term Treasuries.

In a January 2009 speech, however, Chairman Bernanke went to some pains to distinguish the MBS purchase program, as announced at the end of November 2008, from quantitative easing, instead preferring to refer to the MBS purchases as "credit easing." He emphasized that it was the composition of the Fed's balance sheet that policymakers were aiming to affect, and not so much the overall size, in order to ease "credit conditions for households and

[29] There are two types of transmission mechanisms embedded in the effectiveness of conventional monetary policy tools: the transmission from the short-run and risk-free interest rate to the long-term risk-free and risky interest rates, and the transmission from these interest rates to real economic activity. Both of these transmission mechanisms need to be operational for policy effectiveness.

[30] The Fed is to pursue these objectives while simultaneously ensuring a moderate interest rate environment. To the author, it seems to be an open question whether a very low interest rate environment is in fact a "moderate" one, given the consequences of coming close to or hitting the ZLB, as happened in 2003 and again in 2008.

[31] Initially, these asset purchase programs were referred to as large-scale asset purchase (LSAP) programs.

businesses."[32] By March 2009, the FOMC had not only expanded the scale of its agency and agency MBS asset purchase program to a then-total of $1.45 trillion, but also had announced that it would purchase $300 billion of longer-term Treasury securities to "help improve conditions in private credit markets." The August 2010 FOMC statement announced that principal repayments of agency and agency-backed MBS securities would be reinvested in Treasuries and that maturing Treasury securities would continue to be rolled over: at this point, the goal was to maintain the size of the balance sheet and slowly shift away from agency and agency-backed securities, or the pure "credit easing" aspect of Fed policy.[33]

The November 2010 FOMC statement announced an additional $600 billion of longer-term Treasury purchases would be completed by the end of 2011:Q2 and added that "the Committee will regularly review the pace of its security purchases and overall size of the asset-purchase program…and will adjust the program as needed to best foster maximum employment and price stability." Thus began the Fed policy phase termed "QE2" (quantitative easing, round 2). This statement voiced the FOMC's concern that it was continuing to miss on both sides of the dual mandate by characterizing the unemployment rate as "elevated," inflation measures as "somewhat low," and credit conditions as "tight."

In its August 2011 policy statement, the FOMC noted that economic growth during that year had been "considerably slower" than they had anticipated. On September 21, 2011, the FOMC statement indicated that the Fed would increase the maturity or duration, but not the size, of its SOMA portfolio by the end of June 2012—otherwise known as the "Maturity Extension Program" (MEP) by purchasing "$400 billion of Treasury securities with remaining maturities of 6 to 30 years and [selling] an equal amount of Treasury securities with remaining

---

[32] From Chairman Bernanke's speech: "Our approach—which could be described as 'credit easing'—resembles quantitative easing in one respect: It involves an expansion of the central bank's balance sheet. However, in a pure QE regime, the focus of policy is the quantity of bank reserves, which are liabilities of the central bank; the composition of loans and securities on the asset side of the central bank's balance sheet is incidental. Indeed, although the Bank of Japan's policy approach during the QE period was quite multifaceted, the overall stance of its policy was gauged primarily in terms of its target for bank reserves. In contrast, the Federal Reserve's credit easing approach focuses on the mix of loans and securities that it holds and on how this composition of assets affects credit conditions for households and businesses."

[33] This reinvestment strategy was announced a few months after the March 23, 2009, joint FOMC and U.S. Treasury statement affirming that the Fed should avoid taking on credit risk and allocating credit.

maturities of 3 years or less." This MEP was intended to "put downward pressure on longer-term interest rates and help make broader financial conditions more accommodative" as the FOMC continued to miss on both sides of the dual mandate.[34] This statement also indicated that the Committee would begin reinvesting agency and agency MBS prepayments back into agency MBS securities "to help support conditions in mortgage markets." There was also concern expressed about downside risks to the economic outlook arising from strains in global financial markets. In the June 2012 FOMC statement, the MEP was extended through the end of that year. With short-term rates effectively pegged at the ZLB, and more policy stimulus needed, the Committee decided to act more directly to reduce longer-term rates to promote stronger real activity growth.

The third phase of QE, known as QE3, began with the September 2012 FOMC meeting at which it was decided that the Committee "would increase policy accommodation by purchasing additional agency mortgage-backed securities at a pace of $40 billion per month." These purchases were in addition to the continued MEP extension, the purpose of these combined actions being to "put downward pressure on longer-term interest rates, support mortgage markets, and help to make broader financial conditions more accommodative." This policy change was precipitated by the Committee's judgment that "economic growth might not be strong enough to generate sustained improvement in labor market conditions," that "strains in global financial conditions" were exerting "significant" downside risks to the forecast, and that inflation "over the medium term likely would run at or below its 2 percent objective."[35] Some observers dubbed this action QE Infinity due to the fact that the statement also made it clear that such a purchase pace would continue until labor market conditions improved "substantially." In other words, the amount of the QE3 program was not to be dictated by total

[34] In January 2012, to help "keep longer-term inflation expectations firmly anchored, thereby fostering price stability and moderate long-term interest rates, the FOMC announced a longer-run inflation goal of 2 percent; this was reaffirmed in the January 2014 publication by the FOMC of its "Statement on Longer-Run Goals and Monetary Policy Strategy." Such longer-run policy goals are to be reviewed annually at each January FOMC meeting.

[35] According to the minutes of this meeting, these "strains in global financial conditions" were also discussed separately in the context of "potential risks to financial stability."

purchase amounts or by calendar dates, but by the achievement of the desired economic outcomes; in this sense QE3 was open-ended. By the December 2012 FOMC meeting, the Committee had further decided to add to its longer-term Treasury portfolio at a pace of $45 billion per month, for the same stated purpose. (See Figure 6 for a display of the Fed's asset accumulation since 2008, along with movements in the 10-year Treasury note and 30-year conventional mortgage rates.)

During his Congressional testimony on May 22, 2013, Chairman Bernanke began to hint at the tapering of QE3, and by his June 2013 press conference he stated that "the Committee currently anticipates that it would be appropriate to moderate the monthly pace of purchases later this year." This announcement led to what is commonly referred to as the "taper tantrum:" a notable increase in longer-term Treasury yields. At its December 2013 meeting, the FOMC announced that the tapering of its asset purchases would begin in January 2014, while the minutes from its June 2014 meeting indicated that the Committee expected that the final tapering purchase of $15 billion would occur after its October 2014 meeting and that this would be the end of the purchase program, a goal that the FOMC also announced in its September 2014 policy statement. See Figure 7 for an illustration of the movement in rates associated with the various balance-sheet related announcements since 2008, including the taper-tantrum period. Many of these announcements were coupled with changes in forward guidance, as noted in the figure.[36]

[36] For instance, in the January 28, 2009, FOMC statement, it was simultaneously noted that the federal funds rate would remain at the ZLB "for some time," and that the Fed was prepared to purchase Treasuries in addition to the MBS purchase program that began January 5, 2009. In its March 18, 2009, statement, the FOMC announced that the federal funds rate would remain at the ZLB for an "extended period," that the agency and agency MBS purchase program would be increased by $850 billion, and that $300 billion of Treasury securities would be purchased. In its September 13, 2012, announcement of QE3, the FOMC also changed its forward guidance to keeping the federal funds rate at its lower bound until "mid 2015." Similarly, in the December 12, 2012, FOMC statement, it was concurrently announced that the Treasury purchase program would become open-ended and that the federal funds rate would remain at the ZLB at least until an unemployment rate threshold of 6.5 percent was reached. Naturally, such concurrent announcements greatly complicate empirical efforts at sorting out the relative costs and benefits of these different policy tools.

During and after the financial crisis, the FOMC again experimented with forward guidance, and to a much greater extent than in 2004 under Chairman Greenspan. The forward guidance for the federal funds rate began with the January 28, 2009, FOMC statement—"economic conditions are likely to warrant exceptionally low levels of the federal funds rate for some time"—and was subsequently modified by stronger language—"extended period"—in the next FOMC statement issued on March 18, 2009. More specific calendar and economic guideposts were utilized in the FOMC statements issued on August 9, 2011 ("economic conditions… are likely to warrant exceptionally low levels for the federal funds rate at least through mid-2013"), January 25, 2012 ("at least through late 2014"), September 13, 2012 ("through mid-2015," announced along with the start of QE3), and December 12, 2012 ("this exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate remains above 6.5 percent"). The December 2012 statement also announced the open-ended purchases of Treasury securities. Then, such specific guidance was dropped in the March 19, 2014, FOMC statement in favor of stating that the federal funds rate would remain in this target range "for a considerable period after the asset purchase program ends." Williams (2014) provides a more thorough and deeper discussion of the effect of forward guidance on interest rates since the ZLB was reached in 2008; however, keep in mind that most of these changes in forward guidance were concurrent with changes to the balance sheet as well, as shown in Figure 7. In this chart, only the August 9, 2011, FOMC statement announcing a change in forward guidance—"mid 2013"—and the January 25, 2012, change in forward guidance—"mid 2015"—occur without simultaneous changes in the balance sheet policy tools, and even these changes occur in the context of an ongoing usage of balance sheet tools.

From the above discussion, it should be clear that the Fed employed quite a lot of different tools and strategies since the onset of the 2008 financial crisis, and often used these concurrently, thus complicating empirical efforts—particularly those based on pure time series analysis—to understand the relative efficacy and allocative effects of such tools (relative both to each other during the unconventional period and relative to the use of the federal funds rate

tool under the conventional period).[37] These difficulties notwithstanding, many FOMC announcements, such as the one in March 2013, state that "in determining the size, pace and composition of its asset purchases, the Committee will continue to take appropriate account of the likely efficacy and costs of such purchases." While this implicit cost-benefit analysis is described in absolute terms—and not relative to the use of alternative policy instruments—the whole premise of the Exit Strategy and Policy Normalization implies taking into account a cost-benefit comparison of these unconventional tools relative to the conventional policy tool, and effectively assumes that the cost-benefit analysis favors a return to business as usual. However, a thorough empirical analysis of the relative costs and benefits of the conventional federal funds tool compared with the balance sheet tools has not been conducted to the author's knowledge; it is not a straightforward task due to the issue of defining a consistent measure of a monetary policy shock across these different types of policy tools.

4. How Are Other Prominent Central Banks Conducting Monetary Policy?

Many prominent central banks around the world conduct monetary policy in an explicit symmetric corridor system whereby they target a short-term money market rate in the middle of a corridor bracketed at the lower end by the rate paid on reserves held at the central bank and at the upper end by a standing lending facility (discount window) that offers a more punitive rate (called the discount or Lombard rate). The idea is that with interest paid on reserves, depository institutions should never invest at the target rate should it fall below the interest paid on reserves because instead they could get the higher reserve rate. Thus, the reserve rate forms a floor. Depository institutions, similarly, would not want to borrow at the higher discount/Lombard rate if they could find reserves at the target rate, as they would be overpaying for the liquidity services. Consequently, the discount/Lombard rate forms a ceiling on the money rate target. Such a corridor system is said to be symmetric if the spread between

[37] In particular, given that the changes in the Fed's balance sheet were announced concurrently with changes in forward guidance, it would be very difficult to empirically distinguish between the effects of these two types of policy tools during the unconventional regime, let alone compare them with the conventional policy tool.

the target rate and the floor rate, and the target rate and the ceiling rate, are of the same size. See Kahn (2010) for a more complete description of the mechanics of a corridor system.

Central banks that follow a symmetric corridor system include the European Central Bank (ECB), the Bank of England (BOE), the Bank of Japan (BOJ), the Bank of Canada (BOC), the Reserve Bank of Australia (RBA), the Reserve Bank of New Zealand (RBNZ), the Swedish Riksbank, the Norges Bank (NB), the Swiss National Bank (SNB), the Bank of India and, now, interestingly, for the purposes of financial stability—stabilizing financial flows—the Bank of Turkey. Before Congress permitted the Fed to pay interest on reserves in 2008, the Fed effectively had an asymmetric corridor system, with the floor set at the ZLB. In practice, since hitting the crisis and hitting the ZLB, many central banks are operating under a floor system where their target rate is close to the interest paid on reserves: examples include the ECB, the BOJ, the BOE, the BOC, andthe NB.[38] With interest paid on reserves already in place, the Fed could also adopt an explicit symmetric corridor system. Much discussion has centered on this point, including the possibility of implementing an explicit corridor system while holding such a large amount of outstanding reserves.[39]

Bowman, Gagnon, and Leahy (2010) consider many of these different implementations of the corridor system and provide several relevant conclusions for the discussion here. First, they find both empirically and theoretically that the amount of reserves outstanding seems to have no impact on the effectiveness of a central bank's ability to hit the target within their corridor. In other words, tightening without draining reserves has not been a practical issue—and they back up their empirical analysis with some theoretical results—regardless of the amount of excess reserves.[40] Second, Bowman, Gagnon, and Leahy (2010) find that the porousness of the floor is affected by whether the set of counterparties to the lower-bound rate is different from

[38] Whitesell (2006) argues that pure corridor systems should have symmetric bands around the target to ensure that the opportunity costs of holding positive and negative reserve balances at the central bank are equal at the target rate so that no reserve balances, on net, are demanded at that rate.

[39] Usually, but not always, these operating procedures are complemented with an explicit inflation target. Some, like the BOJ and the Fed, also use reserve requirements to help manage their target rates and are not pure corridor systems.

[40] Some studies, such as Ireland (2012) and Kahn (2010), among others, note that the payment of interest on reserves can effectively separate the interest rate tool from the balance sheet tools.

the counterparties to the upper bound or target rate. Where there is differential access to central bank accounts and interest earned on reserves, there is less control over the target within the corridor system. Yet they conclude that in practice this generally has not been a worrisome problem because with the countries they considered that had these issues, the movements in the target were still meaningfully bound by movements in the floor for the purposes of conducting monetary policy.[41] However, Bowman, Gagnon, and Leahy (2010) do cite two notable exceptions where the policy rate has meaningfully and consistently traded below the floor rate: the Fed and the BOE. They further observe that in these two countries, the market for the overnight funds used to target the policy rate includes lenders that are unable to earn interest on reserves; in the United States these examples include the notable case of the government-sponsored enterprises, such as the Federal National Mortgage Association (Fannie Mae) and the Federal Home Loan Mortgage Corporation (Freddie Mac).

In terms of using the size and/or the composition of a central bank's balance sheet as a monetary policy tool, the BOJ, which officially began quantitative easing in 2001, offers the most famous case over the past several decades. Notably, the BOJ quickly moved from only purchasing government bonds to adding asset-backed securities and equities to its balance sheet in an attempt to ease credit conditions ("credit easing," see Ito and Mishkin 2004). On April 4, 2013, the BOJ announced a much more aggressive asset purchase program in a further bid to ward off deflation: it would nearly double the money supply in two years' time with total asset purchases worth USD 1.4 trillion. In the BOE's post-crisis foray into quantitative easing, it purchased not only U.K. sovereign debt (gilts), but also high quality private sector debt from financial institutions (credit easing). As a share of nominal GDP, the BOJ's central bank assets as of 2014:Q1 were relatively high, at about 50 percent. For the ECB, BOE, and the Fed, this

[41] As pointed out in Bowman, Gagnon, and Leahy (2010), to the extent that policymakers want the risk-free overnight target rate to influence other money market rates, and to be bound below by the floor in a corridor system, due consideration must be given to which institutions have access to borrowing and lending funds held with the central bank. The RBA, the ECB, and the BOJ, like the Fed, have target rates that are determined only by institutions with access to central bank deposit facilities. For the ECB and the BOJ, such access is broad-based so the target rate may well represent a broad set of market participants' actions.

share is 22 percent, 24 percent, and 25 percent, respectively (see Figure 8). As this section's discussion highlights, many central banks have found, at times, that balance sheet tools—in terms of both their size and composition—were useful in helping to achieve their policy objectives. Eventually the BOE, the BOJ, and the ECB, among other central banks, will be faced with the same issues that the Fed is now confronting in terms of what to do with their enlarged balance sheets and the tools deployed that resulted in such sizable balance sheets.

5. What Policy Tools Should the Fed Use to Conduct Policy?

In this section, some—but not all—of the arguments for and against the Fed maintaining its balance sheet tools are discussed in the hope that this exercise will spur further debate and study of this important and underexamined issue.[42] These four primary arguments are put forth in favor of keeping balance sheet tools in the Fed's policy toolkit, along with some associated counterarguments and related evidence: 1) The relative costs and benefits in terms both of efficacy and credit allocation of conventional versus unconventional policy tools are difficult to gauge, and we don't know enough about them as yet; 2) Charging the Fed with multiple policy objectives may require that it have more policy tools; 3) In a low inflation and a low interest rate environment where the ZLB is effectively reached, such tools are likely needed to further what may possibly be multiple policy goals; and 4) Maintaining the balance sheet tools can aid the Fed in communicating its policy stance in support of obtaining its (possibly multiple) objectives.

1) It is Difficult to Know the Relative Costs and Benefits of Conventional Versus Unconventional Monetary Policy Frameworks

In reality, very little is known about the relative efficacy and allocative effects of the balance sheet tools and short-term rates policy tools like the federal funds rate target. It is difficult to construct a consistent (or even comprehensive) measure of a monetary policy shock that is attributable to specific types of policy tools, particularly during the unconventional policy

[42] In its discussion of whether the balance sheet instruments that the Fed utilized during the crisis should be permanently incorporated into its normal monetary and credit policy arsenal once the economy returns to equilibrium, this paper sets aside to some extent a consideration of the additional forward guidance and inflation target tools the Fed adopted coincident with the balance sheet tools after the federal funds rate hit zero in 2008.

period, but even during conventional policy periods. This challenge limits the profession's ability to empirically sort out the issue of the relative merits of these two sets of policy tools: federal funds rate targeting (the conventional policy tool) and balance sheet adjustments (the unconventional policy tool). [43] Nonetheless, as the Fed moves from a period characterized by the use of unconventional monetary policies towards a more conventional period, it is important to make a best attempt to gauge the effects of both sets of tools.

Of course, if one is so inclined, the argument that it is difficult to know what the relative efficacy and allocative effects of the different tools are could be used to support returning to just the conventional federal funds rate tool. It is quite likely that policymakers would feel more comfortable arguing that the efficacy and allocative effects of the federal funds rate tool is known. So, in the absence of credible empirical evidence suggesting that the cost-benefit profile of unconventional policies is at least as good as that of the conventional policy tool, it could be argued that dealing with—and only with—the devil that everyone knows, as opposed to the devil they don't know, may be best. It may be received wisdom, in a sense, that the federal funds rate tool is well understood and works sufficiently well, at least most of the time. Yet a counterargument is that even narrow measures of the federal funds rate shocks propagated during the conventional policy period, such as the Kuttner (2001) measure or similar measures, suffer from a similar problem: as soon as FOMC communications change to include views of the outlook or forward guidance ("measured pace"), and so on, it becomes difficult to have a consistent (and comprehensive) measure of a federal funds rate shock.[44]

The Fed's use of balance sheet tools was an extraordinary response to an unprecedented crisis, and at the onset of the implementation, there was a fear that their use would result in hyperinflation or unhinged inflation expectations. However, because the Fed's balance sheet

[43] As noted above, this also holds for another important policy tool employed by the Fed—forward guidance.

[44] Though, clearly, measuring the federal funds rate shocks during the conventional policy period is not as problematic as trying to gauge these effects during the unconventional period, as the changes in the implementation are fewer and narrower during the conventional period. There are measures that have been developed to get at the near-term path of the federal funds rate in order to at least address forays into forward guidance; for instance, see Gürkaynak, Sack, and Swanson (2005), largely for the purposes of conducting time series analysis during the conventional policy period that preceded the 2008 crisis.

has been elevated since the end of 2008, if the size of the balance sheet alone were sufficient to incur such costs, it seems reasonable to expect that these consequences would have already emerged. Yet hyperinflation did not materialize; instead, we have had a long period of very low inflation. Here, it is worth noting that there was a persistent fear of surging inflation as the BOJ's balance sheet rose dramatically, yet this policy action was concurrent with an equally persistent deflation episode (see Figure 9). As Friedman pointed out in his recent *Financial Times* piece, with interest being paid on reserves, the Fed has tools to mitigate the cost of deflation should it ever actually arise.

Another widely asserted cost of these balance sheet tools is that their use could or would unhinge inflation expectations. Though the Fed's balance sheet has been elevated over a six-year period, inflation has remained below a 2 percent annual rate, and inflation expectations have not increased as feared. Perhaps such expectations remained anchored conditional on the Fed's stated intention that it could, and would, reduce the balance sheet when it began the process of policy normalization, meaning going back to using primarily the federal funds rate policy tool and not the balance sheet policy tools, as formalized in its June 2011 exit principles.[45]

There is also evidence—contrary to what is sometimes claimed—of the efficacy of these balance sheet tools, at least in absolute terms, if not relative to the use of conventional policy tools. Asset purchases did affect long-term and risk-free interest rates, as well as risky interest rates. In turn, the growth of real GDP relative to potential, and the improvement in the unemployment rate relative to the natural rate of unemployment, also known as the NAIRU (the non-accelerating inflation rate of unemployment), were very respectable compared with previous recessions. This is also evidenced in the fact that the rate of real activity growth in interest-sensitive sectors improved smartly during the unconventional monetary policy regime

[45] Along these lines, the November 3, 2010, FOMC statement noted: "[v]oting against the policy was Thomas M. Hoenig. . . . [who] was concerned that this continued high level of monetary accommodation increased the risks of future financial imbalances and, over time, would cause an increase in long-term inflation expectations that could destabilize the economy." Similarly, in the minutes of the January 30, 2013, FOMC meeting it was recorded that Esther L. George "dissented out of concern that the continued high level of monetary accommodation increased the risks of future economic and financial imbalances and, over time, could cause an increase in long-term inflation expectations."

of QE at the ZLB. (See Figures 7 and 10a and 10b, respectively). The following studies, among others, show the effects that balance sheet tools have on various interest rates: Gagnon, Raskin, Remache, and Sack (2011); Hamilton and Wu (2011); Hancock and Passmore (2011); Krishnamurthy and Vissing-Jorgensen (2011, 2012); and Wright (2012). Williams (2014) has a more thorough literature review of the effects of asset purchases on interest rates in his Table 1.[46] Fuhrer and Olivei (2011); Chen, Cúrdia, and Ferrero (2012); Chung, Laforte, Reifschneider, and Williams (2012); and Williams (2013), among other studies, report the effects of asset purchases on real activity. The point to emphasize is that none of these studies compare the relative efficacy of these balance sheet tools in terms of efficiency and allocative effects with that of the federal funds rate tool.

While so far the Fed has roughly doubled its yearly remittances to the Treasury as a result of its balance sheet expansion, the Fed could suffer larger capital losses with a larger balance sheet (and payment of IOER) as interest rates rise. This is another potential cost to using these tools that is often put forth as an argument to curtail their use as we return to a more conventional period for monetary policy. Moreover, an overarching theme of the DFA is that the Fed should not engage in lending that could cost the taxpayers money (or, more generally, engage in credit allocation). Although the letter of the law speaks to Section 13(3) on lending facilities, the Fed could, and arguably should, take to heart the motivation of the DFA and apply it also to its Section 14 open market operations, which strictly interpreted, would then preclude using credit policy by allocating the Fed's balance sheet toward agency MBS.[47]

---

[46] Williams (2014) also provides evidence of the effectiveness of the Fed's use of forward guidance on interest rates since the federal funds rate hit the ZLB in 2008. As a practical matter, though, more work needs to be done to isolate the effects of forward guidance from balance sheet tools since these actions have been largely intertwined since 2008. The importance of one versus the other may be reminiscent of the debate about whether central banks need to put their money where their mouth is in order to effectively control their interest rate targets.

[47] Though, ironically, such an action could possibly be in conflict with the FRA's intention to protect consumers from distributional—or credit allocation—effects that can arise as a result of financial instability; namely, the distributional effects of bailing out "too-big-to-fail" institutions. The macroprudential policies encouraged by the DFA could be viewed as credit allocation as well. The public debate needs to be clear about these nuances.

However, it is worth reemphasizing that conventional monetary policies, microprudential policies, and macropudential policies are all actions that engage in credit allocation to some degree. The debate should be clear about this point when seeking to understand the relative costs and benefits of such policies in terms of their allocative effects as opposed to just their efficacy. It is clear that the DFA does not want the Fed picking winners and losers in the narrow sense of particular financial institutions, but it also is clear that the Fed should not pick classes of institutions to win or lose either; similarly, the recent statement on "Policy Normalization Principles and Plans" goes so far as to suggest that the Federal Reserve should not hold assets in such a way that might affect the "allocation of credit across sectors of the economy."[48] Of course, there is a continuum between the credit allocation implicit in the financial institutions deemed "too-big-to-fail" or even the microprudential policies and the credit policies the Fed enacts, for example, when trying to dampen the interest-sensitive sectors of the economy by tightening monetary policy or through its use of macroprudential policies. Not being clear about where it is desirable to fall along this continuum, under what sort of circumstances, and whether it should be the Fed's regulatory or monetary policy arm (or both in tandem) that implements these specific policies hinders the clarity of the debate about what policies the Fed should have in its toolkit to support the dual mandate and financial stability. It would be constructive to have more examination and discussion of these points.

In sum, it is hard to develop an evidence-based argument for using the conventional federal funds rate tool to the exclusion of balance sheet tools, or vice versa. Much more research is needed on this important aspect of the debate. In the short term, the debate about the relative efficacy of these different tools may ultimately just be argued based on qualitative beliefs rather than the use of more quantitative evidence. Still, such limitations notwithstanding, more research into the relative efficacy and allocative effects of these different types of monetary policy tools—conventional and unconventional—should be conducted and debated before the

[48] Of course, this effectively is what the Fed does when it uses changes in the federal funds rate target to affect interest-sensitive sectors of the economy in order to achieve the dual mandate, even when the Fed is engaging in conventional policy conduct to achieve its "normal" policy objectives.

Fed shuts the door on the regular use of these unconventional policies in a normal economic environment.

2) Multiple Policy Objectives May Require More Policy Tools

Now that the Fed is charged with achieving multiple objectives—promoting financial stability now also from a macroprudential perspective in addition to the dual mandate—fulfilling these goals may require that it use multiple policy tools. Having balance sheet and interest rate policy tools (and more if, for example, forward guidance is also considered part of its toolkit) instead of just the federal funds rate lever should give policymakers more flexibility in supporting the dual mandate and its augmented financial stability responsibilities, responsibilities that may well be interdependent with its traditional monetary policy goals. It would be difficult to address financial stability concerns, the pricking of housing market (or other asset) bubbles, or the desire to separately impact private real residential investment from the rest of the economy just by using the federal funds rate target, even if that tool is coupled with forward guidance, because the federal funds rate (and even its path) is a very blunt instrument. Another way of thinking about these potentially competing objectives is to ask, "What should the Fed do if its financial stability and dual mandate objectives are in conflict?" In such a case, the ability to differentially affect monetary and credit policies would be helpful for furthering all of the Fed's policy objectives. It is possible that by having more independent policy tools than are typically considered in discussions of monetary policy and financial stability, some of the tradeoffs widely put forth between fulfilling the dual mandate's objectives and financial stability may not be as pronounced; in fact, with the availability of independent instruments, such tradeoffs may not even arise.

With the independent use of balance sheet tools, fine-tuning (and hence signaling) would be possible along various points of the Treasury yield curve (and/or agency MBS spreads). One of the financial stability issues President Rosengren highlighted in his speech on June 9, 2014, is the controversial one of pricking asset bubbles (such actions can be viewed as another form of

credit allocation).[49] Related to this consideration is the potential desirability of slowing down investment in one economic sector, say real residential investment, without slowing down activity in the rest of the economy. Having multiple tools in hand may better support undertaking monetary policy objectives related to fulfilling the dual mandate.

Arguably, having more than one policy tool at the Fed's disposal would have been desirable in 2003, when the U.S. housing market was sizzling and the rest of the economy was growing at a rate closer to full potential (see Figure 11). Policymakers may not have been willing to dampen the whole economy with the blunt instrument of the federal funds rate in order to skim the froth from the housing market.[50] However, if the Fed had agency MBS securities to sell, it could have tried to differentially slow the housing market, as well as signal its beliefs about the froth in the residential real estate sector with more than just words delivered from the bully pulpit. (Stated differently, policymakers could have tried to differentially affect longer-term mortgage rates and other longer-term risk-free and risky rates). Another way of thinking about the potential benefits of the Fed having more weapons in its toolkit is that possessing more than one tool may well be an answer to the dilemma policymakers sometimes face between raising or lowering rates when the only tool they can deploy is the federal funds rate.

---

[49] In his speech on March 21, 2014, Governor Stein went to great lengths to argue that the Fed could instead focus on credit spreads, and that this action is more legitimate than focusing on pricking bubbles. But these concerns focus on two sides of the same coin. Determining that a risk premium is too low is not all that different from saying that an asset is overvalued. The authors of *Rethinking Central Banking* go even further and argue that it really isn't too hard to identify bubbles of worrisome proportions. The committee that wrote this report was "a nonpartisan, independent group of experts, comprised of academics and former government and central bank officials." Among these authors are Barry Eichengreen, Mohamed El-Erian, Raghu Rajan, Carmen Reinhart, and Ken Rogoff. These committee members have a range of different views on how to conduct monetary policy, so the fact that that the authors of this document agree that central banks have the ability to identify potentially destabilizing bubbles is pathbreaking, as a previous but now-questionable tenet held that central banks should refrain from taking any action to contain asset price bubbles.

[50] Please see Chair Yellen's speech delivered on July 2, 2014, for a more detailed description of the dilemma facing policymakers during this period of time.

Although the concern regarding credit allocation is usually raised when these types of arguments are made, recall that by definition, when the Fed changes rates, it allocates credit toward or away from the interest-sensitive sectors of the economy. Enacting such policy actions constitutes a form of broad credit allocation, and then the multiplier effects are expected to level out this credit allocation effect over time. There is no *a priori* reason to believe that these allocative effects should be all that different if the Fed decides to slow the housing market when it is frothy or—for those who don't believe the Fed can know when there is a housing bubble and/or who believe that the Fed should stay out of those types of discussions—when the real growth of residential investment seems persistently and substantially out of equilibrium. As argued above, more empirical research should be done on the credit allocation effects of the blunt federal funds rate tool versus more precisely targeted balance-sheet-based tools before drawing strong conclusions that such balance sheet tools constitute the Fed's unwarranted foray into credit allocation; these tools may, in fact, not be so unusual in terms of their actual effects.

Pozsar (2014) argues that the Fed could use its balance sheet for the purpose of ensuring financial stability by using its new overnight reverse repo facility (O/N RRP). He contends that the O/N RRP balances held by dealers and money funds—institutions at the heart of the shadow banking system as argued by, among others, Pozsar (2008); Pozsar (2011); Pozsar and Singh (2011); Pozsar et al. (2013); and Pozsar (2014)—could evolve to become the minimum liquidity requirements for those shadow banking institutions engaged in maturity transformation. Note that the O/N RPP facility was developed in the context of the Fed engaging in QE and accumulating substantial reserves as a result of these asset purchases.[51, 52]

---

[51] The use of the O/N RRP balances in the policy normalization process likely will be as a floor under the federal funds target, with IOER acting as a ceiling. Again, this is a result of the fact that in practice the IOER has not acted as an effective floor to the federal funds rate in the United States due to there being different sets of counterparties that can hold reserves versus receive IOER.

[52] Perhaps another way of thinking about this is that to the extent that the shadow banking system increases the money—or near-money—supply, perhaps the Fed should also accommodate the demand for this type of money and not just the demand for money that is generated by the formal banking system. It is not just the net supply of money or the price of money that matters, but also how it is levered not only by financial institutions but also by households and businesses.

Yet the minutes of the June 2014 FOMC meeting provide some counterpoints to Pozsar's argument. This record documents concern among the FOMC members that the O/N RPP facility would attract investors during times of financial stress, thus exacerbating the potential decrease in credit supply to businesses and consumers at a time that could worsen the stress, and that a sizable facility could "expand the Federal Reserve's role in financial intermediation and reshape the financial industry in ways that were difficult to anticipate." As noted in the minutes, though, there are ways of limiting this behavior; for example, by limiting the aggregate amount of reverse repo the facility conducts, limiting the amount extended to any particular counterparty, or increasing the spread between the O/N RRP rate and the IOER rate.

Largely because of the DFA's insistence that the Fed not take on credit risk with any institution or set of institutions that could lead to a loss of taxpayers' money, but also because it requires the Fed to reveal the identities of the institutions using its emergency lending facilities and the terms governing such borrowing—the DFA now limits the Fed's 13(3) lending facilities in ways that in the future may make it hard for the Fed to deal with a large-scale liquidity squeeze that leads to a credit freeze or vice versa. The spirit of the DFA is that the Fed should not engage in credit allocation with its 13(3) facilities and that it should not incur credit-related losses.[53] For liquidity risk that might engender widespread credit risk, or vice versa, a scenario analysis could be done to show that with a liquidity boost from 13(3) facilities, the potential credit risk event could be avoided.[54] However, performing such scenario analysis under the auspices of the 13(3) lending facilities could be more problematic than being able to stand ready to lend large amounts of reserves or safe securities of various maturities to a broad set of counterparties through open market operations as authorized under section 14 of the Federal

[53] Compared to the spirit of the law, its letter draws a bolder line; according to the DFA, the Fed should not lend in a 13(3) facility to any institution that is in bankruptcy proceedings or is known to be going into such proceedings. It is an open question how narrowly the Fed's lawyers would interpret this law should the need arise.

[54] At a broader level, while many would be comfortable with the Fed trying to respond to a liquidity squeeze that could engender credit shortages leading to default issues, but not vice versa, another aspect of monetary policy one must confront is the fact that when the Fed conducts monetary policy, it generally also impacts the credit cycle—albeit through the blunt short-term interest rate tool—for macro-stabilization purposes.

Reserve Act, since lending for liquidity purposes under 13(3) could still require releasing the identity of the borrower(s) and the terms of the lending. Moreover, the uncertainty around which institutions would be able to borrow, at what terms, and when, would be large due to the opacity and complexity of such scenario analysis. Furthermore, the opposite conclusion could be drawn: if the scenario analysis shows circumstances under which an institution could fail, then that possibility might be deemed to be too much credit risk to take on to fulfill the intended spirit of the DFA. Such issues are worthy of further analysis and debate, particularly since due to the DFA's enactment, the next time a financial crisis shocks the economy, the Fed's abilities to respond will be curtailed relative to its abilities to respond during the last crisis.

By having a large amount of safe assets on hand to lend out anonymously through its reverse repo facility to a wide range of counterparties, the Fed's ability to deal with such causes of financial instability could be maintained. In other words, having a larger balance sheet could enable the Fed, under the auspices of section 14, and not section 13(3), of the Federal Reserve Act, as amended by the DFA, to provide safe securities when they are needed in an auction framework; effectively, this would operate as sort of a Term Securities Lending Facility (TSLF) redux. (Alternatively, such a facility also could be used to purchase assets and inject liquidity into the financial system as needed.)

Of course, such an extreme event might be better managed by engaging in fiscal policy. But if the Fed is required to do something, as it is by Congressional mandate, and in the absence of fiscal action being undertaken, having more policy tools at hand may help the Fed to better ensure the safety and soundness of the financial system while also fulfilling its dual mandate.

For some financial stability concerns, though, it could be argued that the Fed's new DFA-sanctioned ability to set fees according to the complexity, and so on, of systemically important financial institutions could be an alternative way to curb the types of behavior which incite the Fed's concerns about these institutions' potential impact on financial stability. So a plausible counterargument is that before using balance sheet tools for the purpose of ensuring financial stability, perhaps such fees should be tried. These fees could be levied in conjunction with the Fed using other macroprudential and microprudential tools such as enhanced risk-based capital and leverage requirements, stress testing, activities restrictions, living wills, liquidity

requirements, single-counterparty credit limits, and the like that are now available under the DFA.[55] An objection to this stance is that in times of crises, these types of tools work too slowly to instill the necessary confidence in the financial system. (In addition, these macroprudential tools and tools involving fees and oversight carry their own degree and type of credit allocation.) Such methods, could, however, be preventative and help avoid the need to use the Fed's balance sheet for the purposes of ensuring financial stability, even if such supervisory tools cannot completely eradicate the need for using balance sheet tools in certain circumstances.

Rethinking Central Banking argues that the Tinbergen principle of having separate instruments for separate policies has been upended. However, all the conclusions therein, as well as in Woodford (2012), and in the 2014 speeches given by Chair Yellen and Governor Stein on the topic of financial stability and monetary policy are premised on the notion that only interest rate, microprudential, and macroprudential policies are to be used in pursuit of the Fed's dual mandate and financial stability objectives. Essentially all of these various arguments are predicated on the idea that at times the monetary authority will have to lean against the wind with interest rate policy and accept a shortfall in achieving the dual mandate in order to safeguard financial stability, or that these sets of monetary and regulatory tools are not purely independent and induce tradeoffs in pursuing the objectives of fulfilling the dual mandate and financial stability. In their arguments, all of these above authors fail to consider the potential that balance sheet tools would offer in helping to achieve goals tied to both monetary policy and financial stability. On the other hand, Cúrdia and Woodford (2011) show that balance sheet tools and interest rate policy can be used independently. Even if in certain cases some tradeoffs still remain, it seems unlikely that in order to secure financial stability, the sacrifices needed on the goal of achieving price stability in the context of maximum sustainable employment would be as large when the set of policy instruments is expanded to include balance sheet tools.

3) Balance Sheet Tools Are Likely Needed When the Effective ZLB Is Reached

[55] This argument is in the spirit of Chair Yellen's July 2, 2014, speech as well as Svensson (2012), as was previously pointed out in the paper's introduction.

Several types of monetary policy tools may be desirable to have in an environment characterized by low inflation and interest rates, conditions when the Fed is likely to hit the ZLB on the federal funds rate target. Given a scenario that renders the Fed's interest rate policy tool ineffective, it could be very useful to have balance sheet tools at its disposal. There could even be a symmetric need for balance sheet tools in the event that inflation or inflation expectations drift above the preferred target rate longer than desirable. Regardless of the prevailing economic conditions, if the Fed's balance sheet is not already sufficiently large enough to buy or sell securities in the amounts needed to affect interest rates and market expectations, it would be difficult for the FOMC to use the balance sheet for the purpose of managing inflation and/or inflation expectations in either an abnormally low or high inflation environment.

Of course, in the event of a need to lower interest rates, it is not necessary to have a larger balance sheet already in place; the Fed could simply do what it did in 2008 when it reached the ZLB, or the Fed could try more aggressive forward guidance than it used during the 2004 episode. Yet in principle, having balance sheet tools in the Fed's arsenal, with market participants expecting that the Fed could and would use such tools to the extent necessary, could lead to less policy uncertainty, better-aligned policy (and inflation) expectations, and, hence, better economic outcomes.

As already discussed, an effective or actual ZLB has been reached twice in the last 10 years, and we may well be faced again with this same scenario in the near future. To the extent that the Fed maintains a 2 percent inflation target, future interest rates on average will be lower than before this era of setting low inflation targets—thus, there will be less room for declines in interest rates before approaching the ZLB. Williams (2014) argues that much of the previous academic work examining the probability of hitting and staying at the ZLB was impeded by its focus on a small and unrepresentative historical sample. He argues that the probable frequency of hitting the ZLB and then experiencing a significant duration at this level is much greater than previously appreciated. Cúrdia and Woodford (2011) argue that the use of balance sheet tools, and in particular the composition of the Fed's balance sheet, can be effective even in circumstances where the ZLB does not bind. Both Williams (2014) and Cúrdia and Woodford

(2011) thus offer support for the value of having balance sheet tools to deploy, irrespective of whether current economic conditions are affected by the ZLB.

4) Balance Sheet Tools Can More Precisely Transmit and Communicate the Fed's Desired Policy Stance

Traditionally when conducting monetary policy, the Fed has adjusted the federal funds target rate when attempting to exert pressure on various long-run, risk-free, and risky interest rates. Instead of employing the traditional lever of the risk-free, short-term interest rate, enacting this same intended policy action by varying the balance sheet's size, duration, and composition may lead to less leakage in the transmission from short rates to long rates and from risk-free to risky rates. Balance sheet tools could enable the Fed to better control the long-term interest rates (both risk-free and risky, depending on the composition of the balance sheet) that it seeks to affect in pursuit of fulfilling its dual mandate (and now, possibly in new ways, financial stability). In sum, using balance sheet tools could potentially let the Fed achieve more precise fine-tuning of its multiple policy objectives.

If the Fed is able to operate more directly on the interest rates it would like to see changed, a potential related benefit is that this ability could lead to better communication about its monetary policy intentions and objectives, and better learning by market participants. So retaining the size, composition, and duration of the balance sheet to use as policy tools could provide very valuable signaling and communication gains.

Both of these arguments offered in favor of the Fed retaining its newer balance sheet tools—that doing so might (depending on the situation at hand) better equip the central bank to target its monetary policy and better enable it to communicate these policy intentions to the public—are grounded more in educated speculation rather than in actual empirical evidence, so more rigorous work is needed on these points. Yet it is worth reviewing the experience that occurred over the two-year period between June 2004 and June 2006, when long-run interest rates stayed low even in the face of tightening by the Fed—a situation that Chairman Greenspan characterized as the "conundrum" in his February 16, 2005, testimony before the U.S. Senate Committee on Banking, Housing, and Urban Affairs. Figure 12 illustrates how longer-term rates normally rise with increases in the federal funds rate. This anomalous episode offers a

specific example of a time when the Fed was trying to use the federal funds rate to affect longer-term rates but those rates were not moving in the desired direction. If the Fed had been able to act directly on long-term interest rates, its monetary policy during that period may have been more efficacious; too, the markets could have formed a more precise understanding of the Fed's desired path for long-term interest rates. (See Roley and Sellon (1995) and Fama (2013) for evidence against the Fed's ability to predictably affect long-term rates using the federal funds target, and Aristei and Gallo (2014) for evidence that money market rates in the euro area experience reduced pass-through to bank lending rates to households and businesses during periods of financial distress.)

It may also be desirable for the Fed to maintain a larger balance sheet to support the O/N RRP, since this facility provides the central bank with access to a wider set of counterparties than it would have through, for example, the discount window or the primary dealers that it engages with for repos and reverse repos to affect the federal funds rate. Therefore, balance sheet tools may foster a more effective corridor system and more control over the transmission from a rate controlled or administered by the Fed to nearby money market rates than is achieved by using the conventional federal funds policy tool (for example, see Bowman, Gagnon, and Leahy 2010).

The Fed began the practice of releasing forward-rate guidance in 2003 and in October 2007 started publishing the Summary of Economic Projections (of the Federal Reserve Board Members and the Federal Reserve Presidents), the latter of which now gives detailed forecasts of the long-run equilibrium federal funds rate. So the Fed already engages in attempts to affect not just the level of short-term (risk-free) interest rates and the general level of all (risk-free) interest rates, but also the slope of at least part of the term structure for these interest rates.[56]

[56] The first Summary of Economic Projections (SEP) was released at the time of the October 30-31, 2007, FOMC meeting and can be found here: http://www.federalreserve.gov/monetarypolicy/files/FOMC20071031SEPcompilation.pdf. In 2008 the SEP began being collected and published four times a year; it can be found on the Board of Governor's website either here: http://www.federalreserve.gov/monetarypolicy/fomccalendars.htm, or, for 2008 and before, here: http://www.federalreserve.gov/monetarypolicy/fomc_historical.htm. Over time, these forecasts began to include the FOMC participants' projections for the path of the federal funds rate, as well as their long-run estimates of real GDP growth, the unemployment rate, and PCE inflation; hence

Retaining the balance sheet tools would just be another step in this direction. Another argument in favor of keeping the balance sheet tools is that since the Fed is already trying to give such forward guidance on interest rates, putting its money where its mouth is by undertaking balance sheet actions to reinforce these projections may both improve the effectiveness of its other policy tools and offer additional clarity as to what the Fed's policy intentions are (depending, of course, on the expected evolution of the outlook and the risks around that evolution).

One counterargument, adopting a different perspective on signaling and learning than the one offered above, is that all market players have much more experience with, and hence a better understanding of, the conventional policy tool. Thus, reverting back to just the federal funds rate tool (or this tool coupled with forward guidance) may result in better communication of the FOMC's actions and desired economic outcomes. Another way of thinking about this is that the transmission of short-term, risk-free rates into longer-term and riskier rates may be better achieved through use of the conventional policy tool. Since market participants have now had more than six years of experience wth alternative instruments and greater Fed transparency, however, this counterargument is not as strong as it would have been at the onset of the Fed's foray into such unconventional policy tools. However, in order to truly have a debate about this issue, it would be ideal to have more evidence on how both conventional and unconventional monetary policy shocks transmit to the term structure of risk-free and risky rates. Yet conducting such research would suffer from the same problems discussed above: how narrowly can a shock be attributed to certain types of policy tools, and how does one construct a consistent and comprehensive measure of a shock across conventional and unconventional monetary policy regimes.[57]

---

they are providing information not only about the expected path of the future federal funds rate, but also about their expectations for long-run rates of real potential growth, the NAIRU, the implicit inflation objective, and their estimates of the long-run equilibrium federal funds rate.

[57] One could take a simple approach of collecting all the Fed's monetary policy actions into one basket during the conventional and (separately) the unconventional periods in order to analyze the efficacy or the allocative effects of the Fed's collective policy actions, but this method precludes making distinctions among the different types of policy tools. While this approach would let researchers distinguish more broadly between, say, the conventional and unconventional periods, the conclusions drawn from such an

In a contractionary policy environment where the Fed is trying to raise short-term interest rates, the presence of a large and/or relatively long-duration SOMA portfolio might lead to a flatter yield curve and lower long-term rates than would typically occur in a rising federal funds rate environment managed with a smaller and/or shorter-duration balance sheet. Having a balance sheet composed of longer-duration maturities may be desirable in circumstances where there is a higher than usual uncertainty about the recovery's momentum, but such a portfolio could also complicate the usual transmission of short-term, risk-free interest rates to long-term and riskier rates. Any complications could be mitigated, however, by issuing forward guidance about the Fed's entire toolkit and its overall policy objectives.[58]

Finally, there is the more conventional position contending that the only asset that the Fed should have or does have any control over—and therefore the only asset that the Fed should have any ability to set the interest rate on—is required bank reserves. This argument holds that all other interest rates should be set in the open market without the Fed's intervention, and relies on various supporting points to bolster its main claim. Prominently, these supporting points include the idea that the Fed does not have better knowledge than any other economic actors about what relative asset prices should be (this position is consistent with the ideas that the Fed should not engage in credit allocation or prick asset bubbles, and that it cannot affect long-term, risk-free interest rates or short- or long-term, risky rates or their spreads), and that as a governmental agency, the Fed should stay out of the market for pricing any assets except the one that it creates.

A notion worth considering, however, is that financial intermediation originates not only from the actions of depository institutions but also from the actions undertaken by other financial institutions, households, and firms, that all these actors ultimately require a cash claim

---

analysis would be limited by the fact that the monetary policy shocks are not measured consistently, so one will not really be comparing like with like. For example, if the conventional period just consisted of a federal funds rate hike of 25 bp and the unconventional period just consisted of a federal funds rate easing of 25 bp, or even a hike of 50 bp, then, if the macro outcomes were hypothetically the same across the two regimes, the researcher would still not be able to say the outcomes were the same per unit of effort, as measured by intensity, quality, or both.

[58] In practice and going forward, this possible effect should also be mitigated by the continued shortening of the overall SOMA portfolio duration over time.

to manage the risks of their positions, and that how this cash liquidity is leveraged can vary by sector and over time. In other words, it is not just the price of money, the money-like quality of a financial instrument, or the traditional money multiplier operating on bank reserves that matters for transmitting monetary policy, but—importantly—the households, businesses, and nonbank financial intermediaries also engaging in financial intermediation that affects the amount of liquidity and leverage that needs to be maintained in the entire financial system. This system is wider than the one demarcated by depository institutions, so there is a much greater need for liquidity (and leverage) than what is implied by the traditional view that only depository institutions like banks engage in financial intermediation. Hence, the reserve requirements and money multipliers associated with this banking part of the financial sector means that the central bank, acting through the channel of required bank reserves, has only a limited ability to create the liquidity needed to support the overall financial system. Therefore, it is worth thinking harder about how this broader-based transmission mechanism of financial intermediation works and what tools are best poised for dealing with the imbalances, both macro and financial, that can arise from these nonbank entities (and hence nonreserve-based) making portfolio allocation decisions that lead to different ways of leveraging money and similar forms of liquidity.

6. Conclusion

Once a decision is made on the long-run size and composition of the Fed's balance sheet, it makes sense to design a reinvestment strategy consistent with the use of these tools in furthering the Fed's dual mandate and financial stability objectives over both the short run and the long run. Such short-run goals may include mitigating financial stability concerns in the mortgage market; supporting the housing market by keeping MBS spreads compressed (although one may believe that holding back residential investment would help achieve the desirable effect of a soft landing); or maintaining the balance sheet's current size and composition for as long as possible—even if it is ultimately deemed undesirable to permanently retain this balance sheet tool—as insurance against short-run downside macro or financial stability risks during the process of "policy normalization." As the Fed begins to remove policy accommodation, it is important to articulate the short-term and long-term goals for the different

policy tools ahead of time, and to explain how the FOMC's reinvestment strategy helps achieve those goals, whatever they may be. In fact, the Fed already is attempting to give such explanation and guidance with its various communications on these issues.

Since 2008, the Fed has chosen to adopt balance sheet tools in its pursuit of fulfilling the dual mandate; retaining these tools would provide more flexibility going forward as policymakers continue to make decisions under uncertainty about what economic conditions will prevail. There is also considerable uncertainty about the relative costs and benefits of the different policy tools that may arise under different circumstances. In an uncertain economic climate, there may be a positive option value to maintaining some access to these types of balance sheet tools. Moreover, by maintaining the size and composition of the balance sheet to a larger degree than just the amount needed to keep pace with the growing demand for reserves as the economy improves, the Fed may benefit from being able to show that it is willing to put its money where its mouth is in order to carry out the monetary policy it deems necessary.

If the debate about the Fed's long-run policy tools leads to a consensus that these balance sheet tools are indeed worth maintaining, then the broader consideration of what the balance sheet's optimal mix of size, composition, and duration should be is an important question for future study. The author's view is that balance sheet tools in practice have led to benefits not available from using the federal funds rate tool alone, particularly because none of the feared costs from using these newer tools have yet materialized. Given that the Fed must make decisions under uncertainty, possibly under circumstances where the federal funds rate target is not a helpful tool, while now also concerning itself with additional financial stability responsibilities, it seems prudent for the Fed to retain and be willing to use as many policy tools as may be needed to fulfill all its policy goals.

To add value to society, the best action that the Fed can undertake is to do what is needed to execute appropriate policy, however that end is reached. Forgoing the use of potentially valuable policy tools because such tools are unconventional and the full cost and benefits as yet unknown seems to miss the point entirely; witness the handwringing about the political costs arising from decreased remittances to the Treasury as the Fed winds down the program of QE. Of all the risks that the Fed may undertake, there would be no bigger policy cost than the loss of

the Fed's reputation should it lack the ability or will to conduct policy as it should (even in the face of dissent). Arguably, as the Fed reached the ZLB during the last recession, it was not as comfortable and confident in wielding the balance sheet tool as it could have been. (This critique could be applied even more strongly to the Bank of Japan, which only recently changed its policy to engage in more aggressive quantitative easing—undertaken to fight a deflationary slump that has persisted for the better part of two decades). If the Fed were to keep its newer balance sheet tools, the future conduct of monetary policy may be more effective than in the recent past, and, ultimately, this better success would help the Fed burnish its reputation for true credibility in fulfilling the dual mandate and preserving financial stability. While the long-run allocation of credit possibly may become the Fed's policy choice, the fears expressed that the Fed would misallocate this credit in the long run, or even that this would be a departure from business as usual, seem overblown. In equilibrium, ensuring that all economic sectors grow at potential is a form of credit allocation, and may not be a "natural" outcome.

References

Aristei, David, and Manuela Gallo. 2014. "Interest Rate Pass-Through in the Euro Area during the Financial Crisis: A Multivariate Regime-Switching Approach." *Journal of Policy Modeling* 36(2):273–295.

Armantier, Olivier, Eric Ghysels, Asani Sarkar, and Jeffrey Schrader. 2013. "Discount Window Stigma during the 2007-2008 Financial Crisis." Staff Report No. 483. Original: January 2011, revised: September 2013. New York: Federal Reserve Bank of New York.
Available at http://www.newyorkfed.org/research/staff_reports/sr483.pdf.

Bank of England. 2014. "Asset Purchase Facility" Website Description.
Available at http://www.bankofengland.co.uk/monetarypolicy/Pages/qe/facility.aspx.

Bernanke, Ben S. 2009. "The Crisis and the Policy Response". Speech delivered at the Stamp Lecture, London School of Economics. London, England, January 13.
Available at http://www.federalreserve.gov/newsevents/speech/bernanke20090113a.htm.

Bernanke, Ben S. 2013. Testimony on "The Economic Outlook" to the Joint Economic Committee, U.S. Congress, Washington, DC.
Available at: http://www.federalreserve.gov/newsevents/testimony/bernanke20130522a.htm.

Board of Governors of the Federal Reserve System. 2003. "Transcript of FOMC Meeting March 18." Washington, DC.
Available at http://www.federalreserve.gov/monetarypolicy/files/FOMC20030318meeting.pdf.
("Powder dry," pages 51 and 70.)

Board of Governors of the Federal Reserve System. 2003. "Transcript of FOMC Meeting June 24-25." Washington, DC.
Available at http://www.federalreserve.gov/monetarypolicy/files/FOMC20030625meeting.pdf.
("Powder dry," page 96.)

Board of Governors of the Federal Reserve System. 2003. FOMC Statement issued August 12, Washington, DC. Available at
http://www.federalreserve.gov/boarddocs/press/monetary/2003/20030812/default.htm.
(FOMC "considerable period" Statement.)

Board of Governors of the Federal Reserve System. 2004. FOMC Statement issued May 4, Washington, DC. Available at
http://www.federalreserve.gov/boarddocs/press/monetary/2004/20040504/default.htm.
(FOMC "measured pace" Statement.)

Board of Governors of the Federal Reserve System. 2004. FOMC Statement issued December 14, Washington, DC. Available at http://www.federalreserve.gov/boarddocs/press/monetary/2004/20041214/).
(FOMC minutes to be released 3 weeks after meeting.)

Board of Governors of the Federal Reserve System. 2008. FOMC Statement issued November 25, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20081125b.htm.
(LSAP1 - or QE1 - agency MBS purchase only announcement.)

Board of Governors of the Federal Reserve System. 2008. FOMC Statement issued December 16, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20081216b.htm.
(Longer-term Treasuries being evaluated as part of LSAP1 (QE1).)

Board of Governors of the Federal Reserve System. 2009. FOMC Statement issued January 28, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20090128a.htm.
("For some time" forward guidance for the federal funds rate and that they stand prepared to buy Treasuries as well.)

Board of Governors of the Federal Reserve System. 2009. FOMC Statement issued March 18, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20090318a.htm.
($300B Treasury purchases announced along with $750B increase in agency MBS and $100B increase in agency securities, and "extended period" forward guidance.)

Board of Governors of the Federal Reserve System, and U.S. Treasury. 2009. Joint Statement on March 23: "On the Role of the Fed in Preserving Financial and Monetary Stability." Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20090323b.htm.
(Joint Statement by Fed and Treasury making clear that the Fed should avoid credit risk and credit allocation.)

Board of Governors of the Federal Reserve System. 2010. FOMC Statement issued August 10, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20100810a.htm.
(Announcement of reinvestment of agency and agency-backed MBS principal paydown to be reinvested in Treasuries.)

Board of Governors of the Federal Reserve System. 2010. FOMC Statement issued November 3, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20101103a.htm. (Announcement of further purchase of $600B longer-term Treasuries by the end of second quarter of 2011 – QE2; President Thomas M. Hoenig dissent.)

Board of Governors of the Federal Reserve System. 2011. "Minutes of FOMC Meeting on June 22," Washington, DC. Available at http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20110622.pdf. ("Exit Strategy Principles" first outlined.)

Board of Governors of the Federal Reserve System. 2011. FOMC Statement issued August 9, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20110809a.htm. (Mid-2013 provided as calendar guidance for low target federal funds range.)

Board of Governors of the Federal Reserve System. 2011. FOMC Statement issued September 21, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20110921a.htm. (Maturity Extension Program (MEP) announcement. And reinvestments of prepayments on agency and agency MBS securities to be reinvested back into agency and agency MBS securities instead of Treasuries.)

Board of Governors of the Federal Reserve System. 2012. "Federal Reserve Issues FOMC Statement of Longer-Run Goals and Policy Strategy." Press release issued January 25, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20120125c.htm. (2 percent inflation goal announced.)

Board of Governors of the Federal Reserve System. 2012. FOMC Statement issued January 25, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20120125a.htm. ("Through late 2014" forward guidance.)

Board of Governors of the Federal Reserve System. 2012. FOMC Statement issued June 20, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20120620a.htm. (MEP extended through 2012 end.)

Board of Governors of the Federal Reserve System. 2012. FOMC Statement issued September 13, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20120913a.htm. (More open-ended purchases of MBS – QE3, maturity extension, federal funds horizon extended to mid-2015 announced.)

Board of Governors of the Federal Reserve System. 2012. FOMC Statement issued December 12, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20121212a.htm. (Announcement of $45B of longer-term Treasuries being purchased each month – open-ended QE3 for Treasuries - and 6.5% threshold unemployment rate for federal funds forward guidance.)

Board of Governors of the Federal Reserve System. 2013. FOMC Statement issued January 30, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20130130a.htm. (President Ester L. George dissent.)

Board of Governors of the Federal Reserve System. 2013. "Minutes of FOMC Meeting on March 19," Washington, DC. Available at http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20130320.pdf.

Board of Governors of the Federal Reserve System. 2013. "Minutes of FOMC Meeting on June 19," Washington, DC. Available at http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20130619.pdf. (Announced not likely selling agency or agency MBS debt as part of exit strategy.)

Board of Governors of the Federal Reserve System. 2013. "Transcript of Chairman Bernanke's Press Conference, June 19," pp. 13–14. Washington, DC. Available at http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20130619.pdf.

Board of Governors of the Federal Reserve System. 2013. FOMC Statement issued December 18, Washington, DC. Available at http://www.federalreserve.gov/newsevents/press/monetary/20131218a.htm. (Official QE3 Taper announcement – to begin January 2014.)

Board of Governors of the Federal Reserve System. 2014. "Statement on Longer-Run Goals and Monetary Policy Strategy as amended effective January 28, 2014." Press release issued January 28, Washington, DC. Available at http://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf.

Board of Governors of the Federal Reserve System. 2014. FOMC Statement issued March 19, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20140319a.htm.
(Removal of unemployment rate threshold.)

Board of Governors of the Federal Reserve System. 2014. "Minutes of FOMC Meeting on June 18," Washington, DC.
Available at http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20140618.pdf.
(Announced tapering will conclude in October 2014; June 2014 policy normalization discussion —roll-off likely after lift-off, not before.)

Board of Governors of the Federal Reserve System. 2014. "Transcript of Chair Yellen's Press Conference, June 18, "pp. 13–14. Washington, DC.
Available at http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20140618.pdf.

Board of Governors of the Federal Reserve System. 2014. "Minutes of FOMC Meeting on July 29-30," Washington, DC.
Available at http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20140730.pdf.

Board of Governors of the Federal Reserve System. 2014. FOMC Statement issued September 17, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20140917a.htm.
($15B purchase pace after October 2014.)

Board of Governors of the Federal Reserve System. 2014. "Policy Normalization Principles and Plans." Press release issued September 17, Washington, DC.
Available at http://www.federalreserve.gov/newsevents/press/monetary/20140917c.htm.

Board of Governors of the Federal Reserve System. "The Federal Reserve System: Purposes and Functions." Available at http://www.federalreserve.gov/pf/pdf/pf_3.pdf.
(Background information about things like reserves and OMOs.)

Bowman, David, Etienne Gagnon, and Mike Leahy. 2010. "Interest on Excess Reserves as a Monetary Policy Instrument: The Experience of Foreign Central Banks." International Finance Discussion PaperNo. 996. Washington, DC: Board of Governors of the Federal Reserve System.
Available at http://www.federalreserve.gov/pubs/ifdp/2010/996/ifdp996.pdf.

Carpenter, Seth B., Jane E. Ihrig, Elizabeth C. Klee, Daniel W. Quinn, and Alexander H. Boote. 2013. "The Federal Reserve's Balance Sheet and Earnings: A Primer and Projections." Finance and Economics Discussion PaperNo. 2013-01. Washington, DC: Board of Governors of the Federal Reserve System.
Available at http://www.federalreserve.gov/pubs/feds/2013/201301/201301pap.pdf.

Chen, Han, Vasco Cúrdia, and Andrea Ferrero. 2012. "The Macroeconomic Effects of Large Scale Asset Purchase Programmes." *The Economic Journal* 122(564): F289–F315.

Chung, Hess, Jean-Philippe Laforte, David Reifschneider, and John C. Williams. 2012. "Have We Underestimated the Probability of Hitting the Zero Lower Bound?" *Journal of Money, Credit and Banking* 44(Supplement S1):47–82.

Committee on International Economic Policy and Reform. 2011. *Rethinking Central Banking*. Brookings Institution, Washington, DC. Available at http://www.brookings.edu/~/media/research/files/reports/2011/9/ciepr%20central%20banking/rethinking%20central%20banking.pdf.

Cúrdia, Vasco, and Michael Woodford. 2011. "The Central-Bank Balance Sheet as an Instrument of Monetary Policy," *Journal of Monetary Economics* 58(1): 54–79.

Dodd-Frank Wall Street Reform and Consumer Protection Act. Public Law 111-203, July 21, 2010.
Available at http://www.gpo.gov/fdsys/pkg/PLAW-111publ203/pdf/PLAW-111publ203.pdf.

Federal Reserve Act, Section 13. "Powers of Federal Reserve Banks."
Available at http://www.federalreserve.gov/aboutthefed/section13.htm.

Federal Reserve Act, Section 14. "Open-Market Operations."
Available at http://www.federalreserve.gov/aboutthefed/section14.htm.

Fama, Eugene F. 2013. "Does the Fed Control Interest Rates?" *Review of Asset Pricing Studies* 4(1): 39–77.

Fuhrer, Jeffrey C., and Giovanni P. Olivei. 2011. "The Estimated Macroeconomic Effects of the Federal Reserve's Large Scale Treasury Purchase Program." Public Policy Brief No. 11-2. Boston: Federal Reserve Bank of Boston.
Available at http://www.bostonfed.org/economic/ppb/2011/ppb112.pdf.

Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack. 2011. "The Financial Market Effects of the Federal Reserve's Large Scale Asset Purchases." *International Journal of Central Banking* 7(1): 3–43.

Greenspan, Alan. . 2005. Testimony of before the Committee on Banking, Housing and Urban Affairs, U.S. Senate, on February 16, Washington DC.
Available at http://www.federalreserve.gov/boarddocs/hh/2005/february/testimony.htm.

Gurkaynak, Refet S., Brian Sack, and Eric T. Swanson. 2005. "Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements." *International Journal of Central Banking* 1(1): 55–93.

Hamilton, James, and Jing Cynthia Wu. 2011. "The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment." *Journal of Money, Credit and Banking* 44(Supplement S1):3-46.

Hancock, Diana, and Wayne Passmore. 2011. "Did the Federal Reserve's MBS Purchase Program Lower Mortgage Rates?" *Journal of Monetary Economics* 58(5): 498–514.

Ireland, Peter N. 2012. "The Macroeconomic Effects of Interest on Reserves." Working Paper No. 18409. Cambridge, MA: National Bureau of Economic Research.

Ito, Takatoshi, and Frederic S. Mishkin. 2004. "Two Decades of Japanese Monetary Policy and the Deflation Problem." Working Paper No. 10878. Cambridge, MA: National Bureau of Economic Research.

Kahn, George A. 2010. "Monetary Policy under a Corridor Operating Framework." *Economic Review* (Fourth Quarter). Kansas City, MO: Federal Reserve Bank of Kansas City.
Available at http://www.kc.frb.org/publicat/econrev/pdf/10q4Kahn.pdf.

Klee, Elizabeth. 2011. "The First Line of Defense: The Discount Window During the Early Stages of the Financial Crisis." Finance and Economics Discussion Series Paper No. 2011-23. Washington, DC: Board of Governors of the Federal Reserve System.
Available at http://www.federalreserve.gov/pubs/feds/2011/201123/201123pap.pdf.

Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. 2011. "The Effects of Quantitative Easing on Interest Rates." *Brookings Papers on Economic Activity* (Fall): 215–265.

Krishnamurthy, Arvind, and Annette Vissing-Jorgensen. 2012. "The Aggregate Demand for Treasury Debt." *Journal of Political Economy* 120 (2): 233–267.

Kuttner, Kenneth N. 2001. "Monetary Policy Surprises and Interest Rates: Evidence from the Federal Funds Futures Market." *Journal of Monetary Economics* 47(3): 523–544.

Pozsar, Zoltan. 2008. "The Rise and Fall of the Shadow Banking System." *Regional Financial Review* (July): 13-25.

Pozsar, Zoltan. 2011. "Institutional Cash Pools and the Triffin Dilemma of the U.S. Banking System." IMF Working Paper 11/190. Washington, DC: International Monetary Fund.
Available at http://www.imf.org/external/pubs/ft/wp/2011/wp11190.pdf.

Pozsar, Zoltan, Tobias Adrian, Adam Ashcraft, and Hayley Boesky. 2013. "Shadow Banking." *Economic Policy Review* 19(2): 1–16.
Available at http://www.newyorkfed.org/research/epr/2013/0713adri.pdf.

Pozsar, Zoltan, and Manmohan Singh. 2011. "The Nonbank-Bank Nexus and the Shadow Banking System." IMF Working Paper WP/11/289. Washington, DC: International Monetary Fund. Available at http://www.imf.org/external/pubs/ft/wp/2011/wp11289.pdf.

Pozsar, Zoltan. 2014. "Shadow Banking: The Money View." Office of Financial Research Working Paper 14-04. Washington, DC: United States Department of the Treasury.
Available at
http://www.treasury.gov/initiatives/ofr/research/Documents/OFRwp201404_Pozsar_ShadowBankingTheMoneyView.PDF.

Roley, V. Vance, and Gordon H. Sellon, Jr. 1995. "Monetary Policy Actions and Long-Term Interest Rates." *Economic Review* 80(4): 73–89.
Available at http://www.kansascityfed.org/PUBLICAT/ECONREV/pdf/4q95role.pdf.

Rosengren, Eric S. 2014. "New Monetary Policy Tools: What Have We Learned?" Speech delivered at the Central Bank of Guatemala. Guatemala City, Guatemala, June 2009.
Available at http://bostonfed.org/news/speeches/rosengren/2014/060914/060914text.pdf.

Rudebusch, Glenn D., and John C. Williams. 2008. "Revealing the Secrets of the Temple: The Value of Publishing Central Bank Interest Rate Projections." In *Asset Prices and Monetary Policy*, ed. John Y. Campbell, 247–289. Chicago: University of Chicago Press.

Stein, Jeremy C. 2014. "Incorporating Financial Stability Considerations into a Monetary Policy Framework." Speech delivered at the International Research Forum on Monetary Policy, Sponsored by the European Central Bank, the Federal Reserve Board, the Center for Financial Studies at the Goethe University, and the Georgetown Center for Economic Research at Georgetown University. Washington, DC, March 21.
Available at http://www.federalreserve.gov/newsevents/speech/stein20140321a.htm.

Svensson, Lars E. O. 2012. "Comment on Michael Woodford, 'Inflation Targeting and Financial Stability.'" *Sveriges Riksbank Economic Review* (Issue 1): 33–39. Available at
http://www.riksbank.se/Documents/Rapporter/POV/2012/rap_pov_artikel_2_120210_eng.pdf.

Whitesell, William. 2006. "Interest Rate Corridors and Reserves." *Journal of Monetary Economics* 53(6): 1177–1195.

Williams, John C. 2013. "A Defense of Moderation in Monetary Policy." *Journal of Macroeconomics* 38 (Issue PB): 137–150.

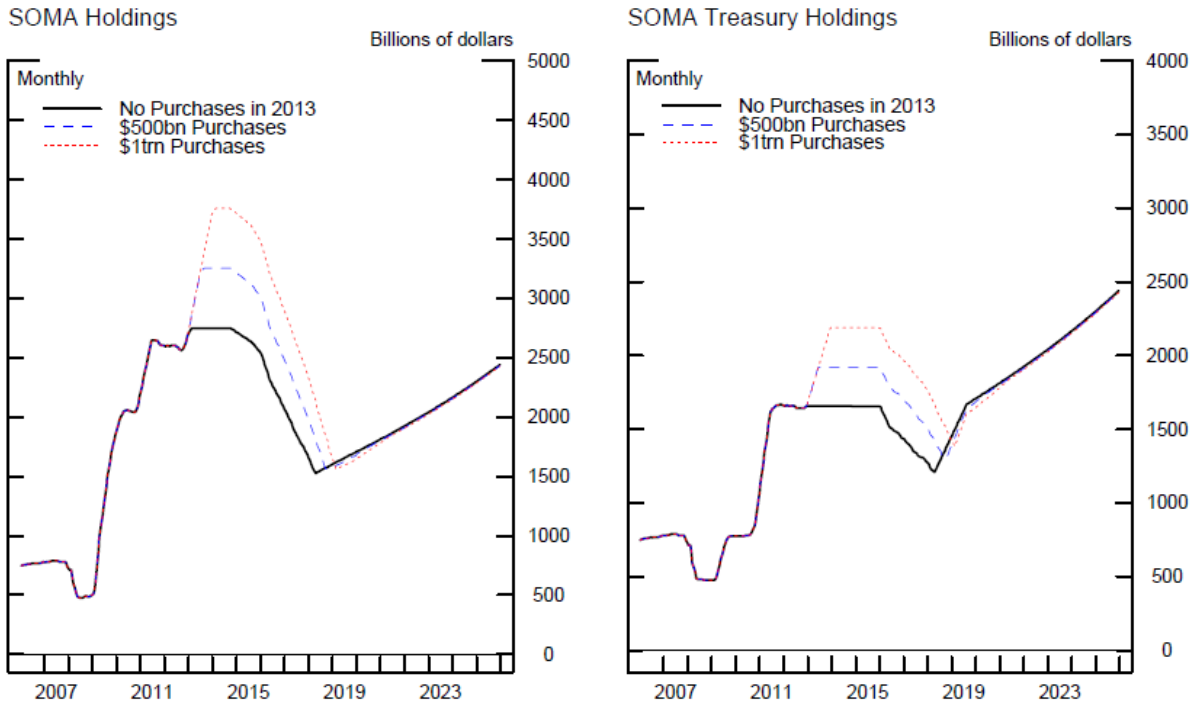
Williams, John C. 2014. "Monetary Policy at the Zero Lower Bound: Putting Theory Into Practice." Hutchins Center on Fiscal & Monetary Policy at Brookings Working Paper 2014-3. Available at http://www.brookings.edu/~/media/research/files/papers/2014/01/16%20monetary%20policy%20zero%20lower%20bound/16%20monetary%20policy%20zero%20lower%20bound%20williams.pdf.

Woodford, Michael. 2012. "Inflation Targeting and Financial Stability." *Sveriges Riksbank Economic Review* (Issue 1): 7–32. Available at http://www.riksbank.se/Documents/Rapporter/POV/2012/rap_pov_artikel_1_120210_eng.pdf.

Wright, Jonathan H. 2012. "What Does Monetary Policy do to Long-Term Interest Rates at the Zero Lower Bound?" *The Economic Journal*, 122(564): F447-F466.

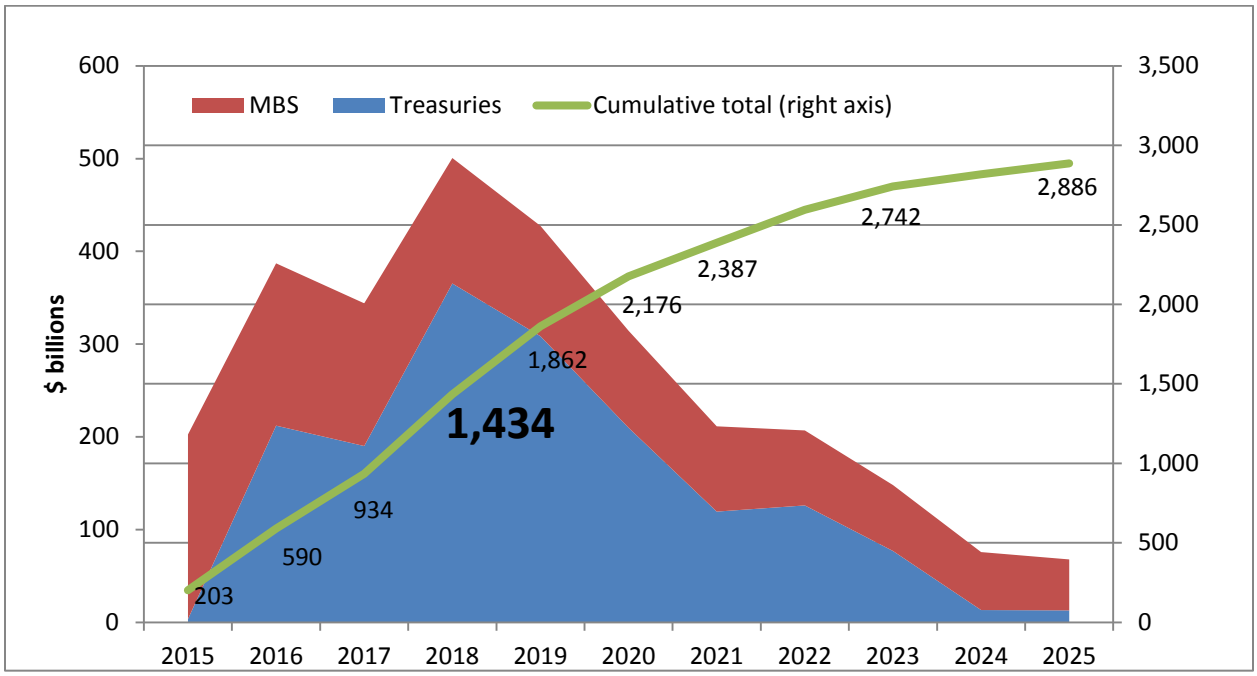
Yellen, Janet. 2014. "Monetary Policy and Financial Stability." Speech delivered at the 2014 Michel Camdessus Central Banking Lecture, International Monetary Fund. Washington, DC, July 2. Available at http://www.federalreserve.gov/newsevents/speech/yellen20140702a.htm.

Figure 1: Fed Balance Sheet Projections from Carpenter et al. (2013): Total SOMA Holdings (Treasury, Agency and Agency MBS) in Left Panel and SOMA Treasury Holdings in Right Panel



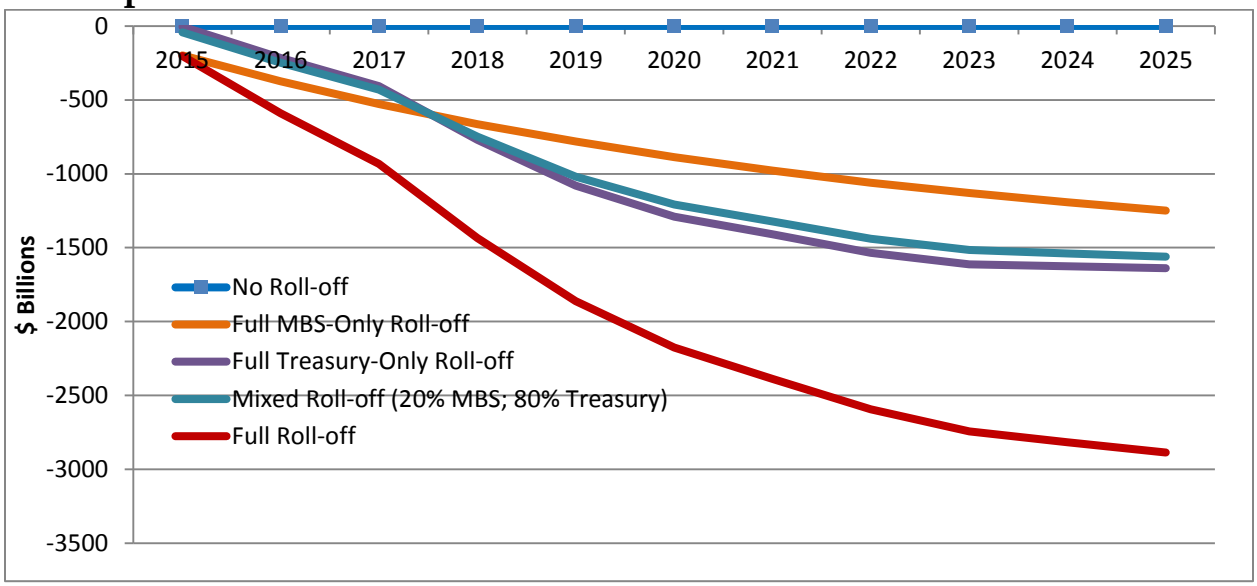
Source: Carpenter et al. (2013).

Figure 2: Estimated Par Value of Roll Offs Per Year And Cumulative Total



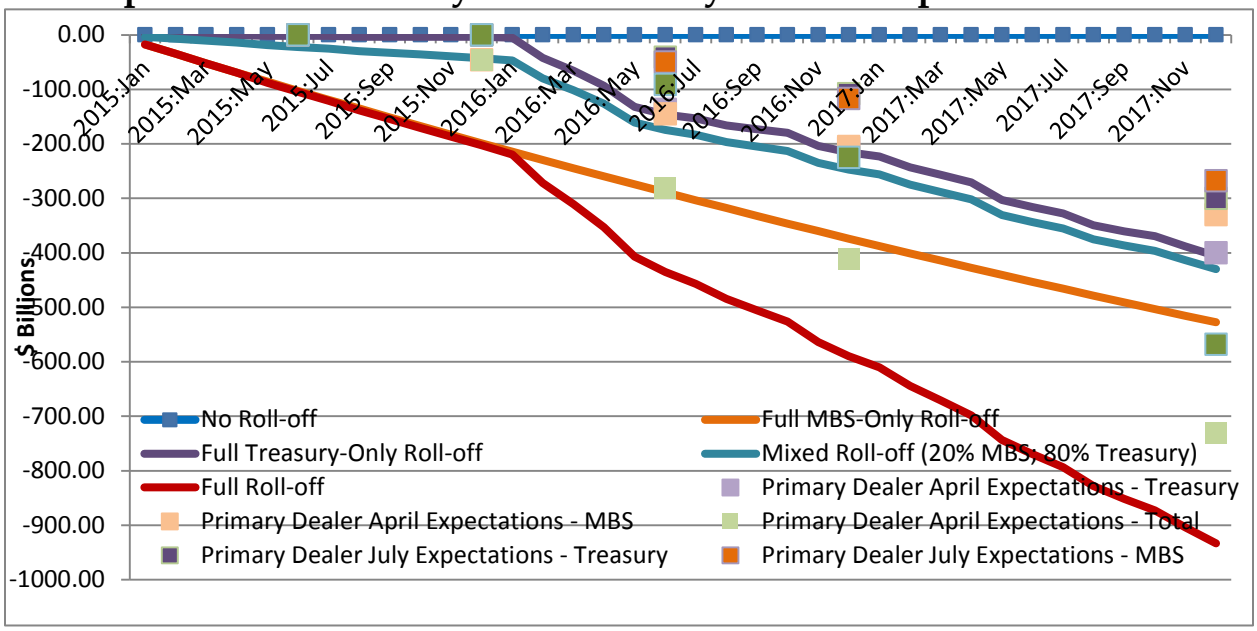
Source: Author's calculations based on Carpenter et al. (2013) and the H.4.1 release on balance sheet data posted on the NY Fed 's website for the monthly schedule of maturing Treasury securities. Par (face) value of roll-offs according to maturity structure. Assumes a fixed monthly prepayment rate of agency MBS principal such that an Agency MBS balance of $400 billion is reached by 2025.

Figure 3a: Projected Year-end Par Value of Roll-Offs Under Different Assumptions



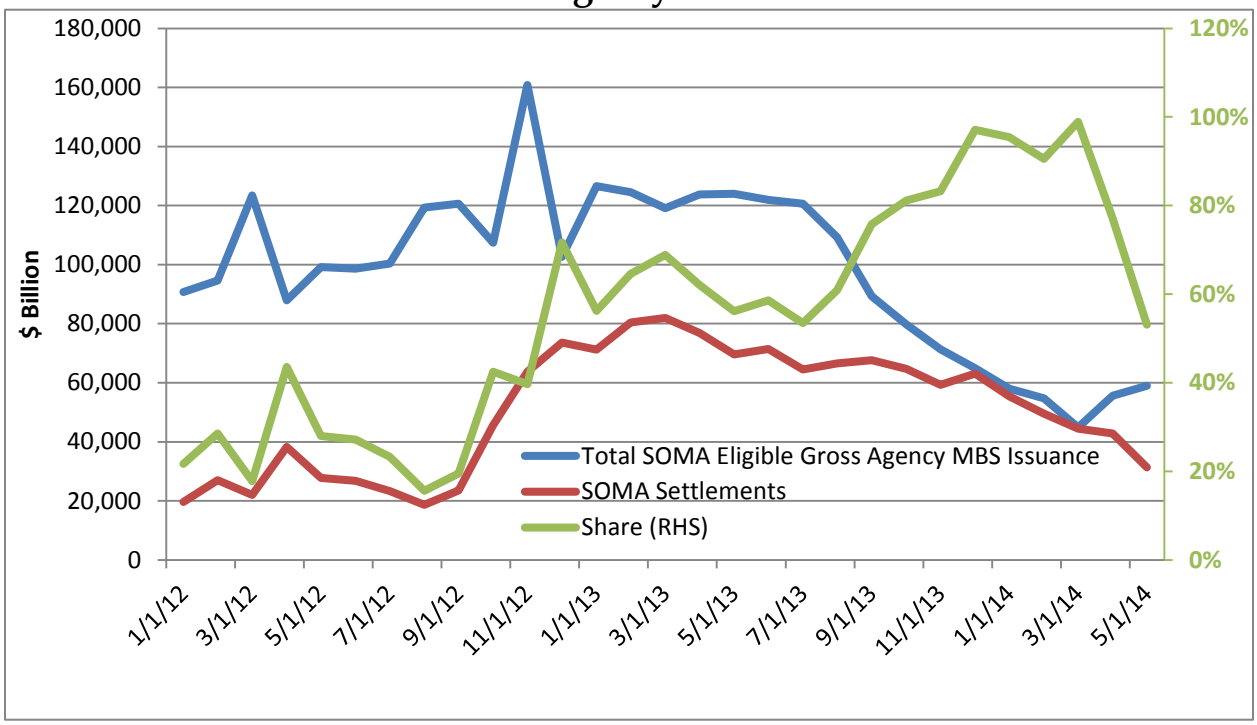
Source: Author's calculations based on Carpenter et al. (2013) and the H.4.1 release on balance sheet data posted on the NY Fed 's website for the monthly schedule of maturing Treasury securities. Par (face) value of roll-offs according to maturity structure. Assumes a fixed monthly prepayment rate of agency MBS principal such that an Agency MBS balance of $400 billion is reached by 2025.

Figure 3b: Projected Year-end Par Value of Roll-Offs Under Different Assumptions With Primary Dealer Survey Median Expectations



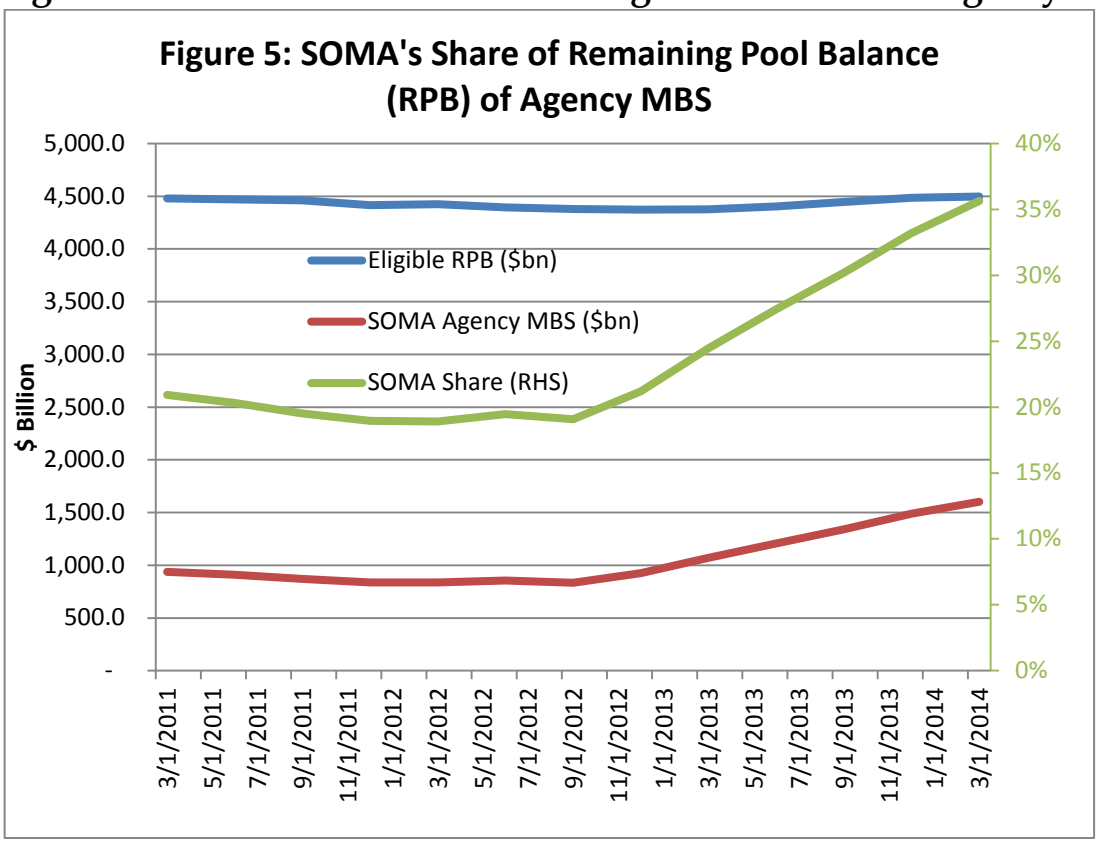
Source: Author's calculations based on Carpenter et al. (2013) and the H.4.1 release on balance sheet data posted on the NY Fed 's website for the monthly schedule of maturing Treasury securities. Par (face) value of roll-offs according to maturity structure. Assumes a fixed monthly prepayment rate of agency MBS principal such that an Agency MBS balance of $400 billion is reached by 2025.

Figure 4: SOMA Agency MBA Settlements, Total Eligible Agency MBA Issuance and SOMA's Share of Agency MBS Issuance



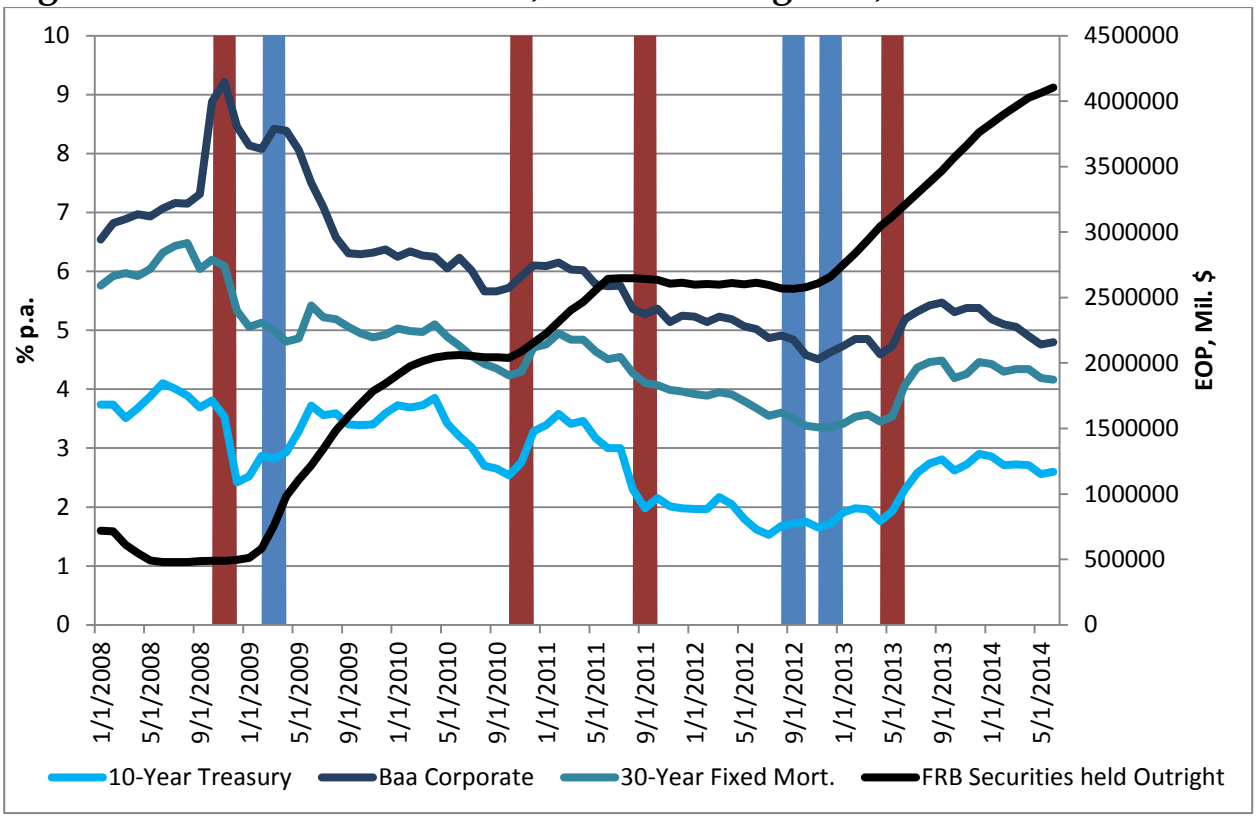
Source: eMBS, FRBNY. Eligible issuance means 15- and 30-year Fannie Mae and Freddie Mac MBS plus 30-year Ginnie Mae MBS.

Figure 5: SOMA's Share of Remaining Balance Pool of Agency MBS



Source: eMBS, FRBNY.

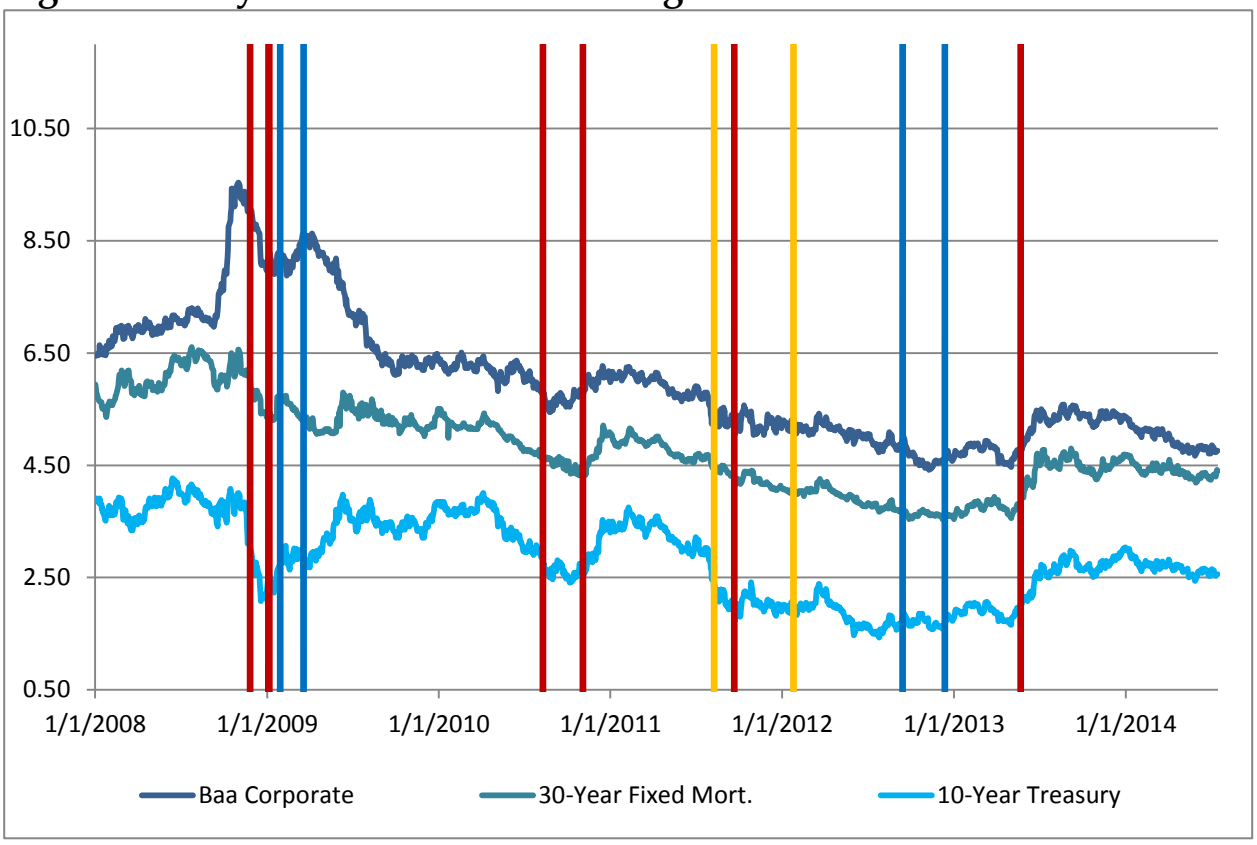
Figure 6: Fed's Asset Purchases, Purchase Programs, and Interest Rates



Source: Federal Reserve Board. Please note the vertical lines are announcements, and that once announced, these announced policies generally were ongoing throughout subsequent periods.

Balance Sheet Only	Both Balance Sheet and Forward Guidance
•QE1 MBS-Only 11/25/09 •QE2 Treasury -Only 11/3/10 •MEP 9/21/11 •***Taper Tantrum 5/22/13***	•"extended period"/agency and agency MBS increased to $1.44T and $300B Treasuries 3/18/09 •"through mid 2015"/QE3 for MBS-Only 9/13/12 •6.5% unemployment rate threshold/QE3 Extended to Treasuries 12/12/12

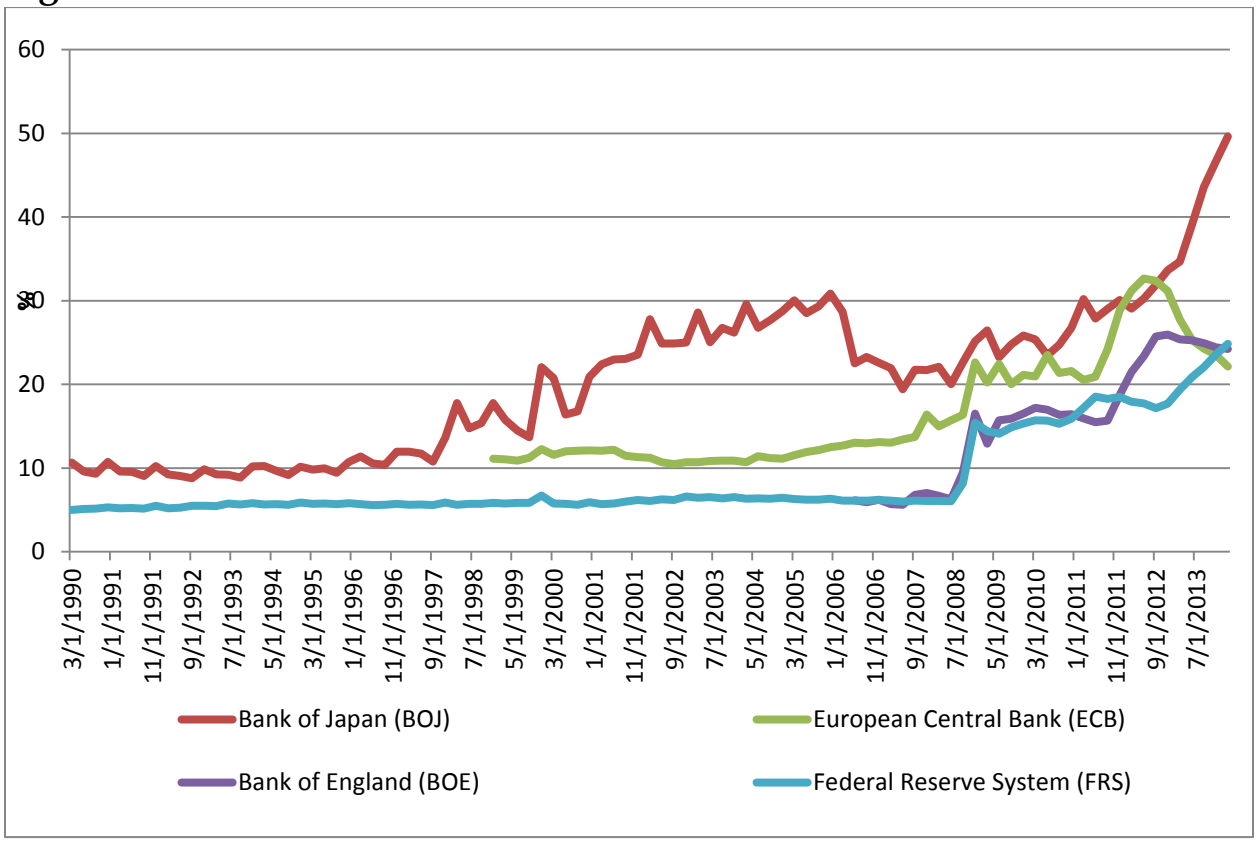
Figure 7: Daily Rates and Purchase Programs



Source: Federal Reserve Board and *Wall Street Journal*. Please note the vertical lines are announcements, and that once begun, these policies generally were ongoing throughout subsequent periods.

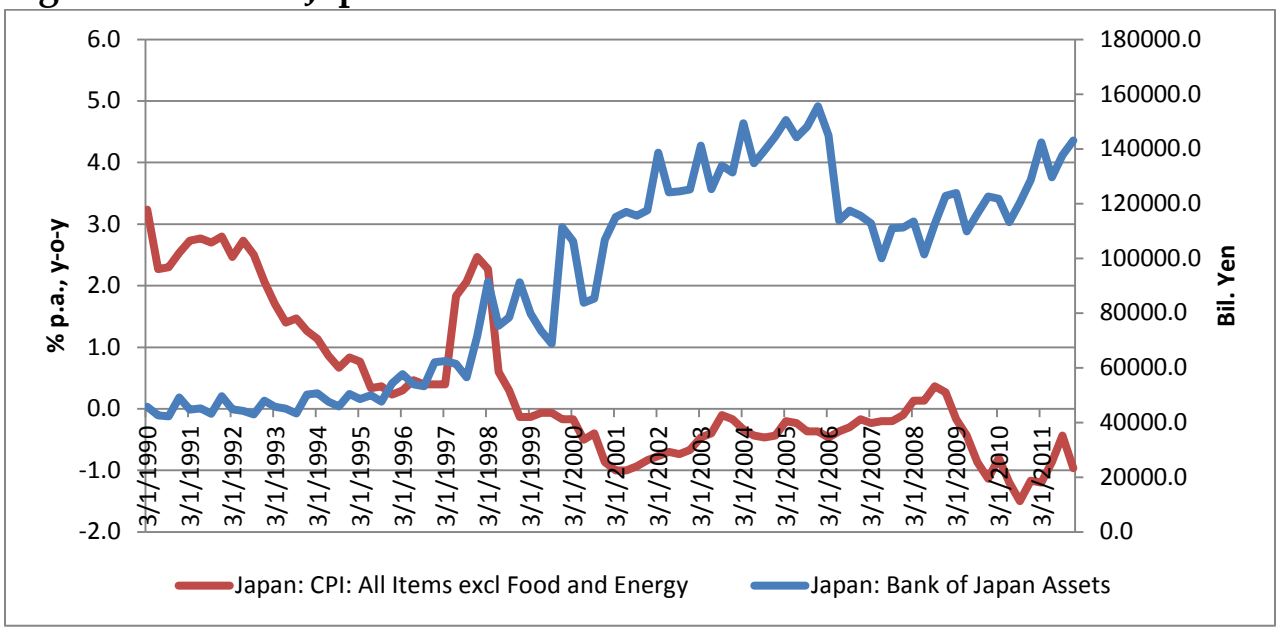
Balance Sheet Only	Forward Guidance Only	Both
•QE1 MBS-Only 11/25/08 •Reinvestments Begin 8/12/10 •QE2 (More Treasury) 11/3/10 •MEP 9/21/11 •***Taper Tantrum 5/22/13***	•"Mid 2013" 8/9/11 •"Late 2014" 1/25/12	•"for some time"/ready to purchase Treasuries 1/28/2009 •"extended period"/agency and agency MBS increased to $1.44T and $300B Treasuries 3/18/09 •"through mid 2015"/QE3 for MBS 9/13/12 •6.5% unemployment rate threshold/QE3 for Treasuries 12/12/12

Figure 8: Select Central Bank Assets as a Share of Nominal GDP



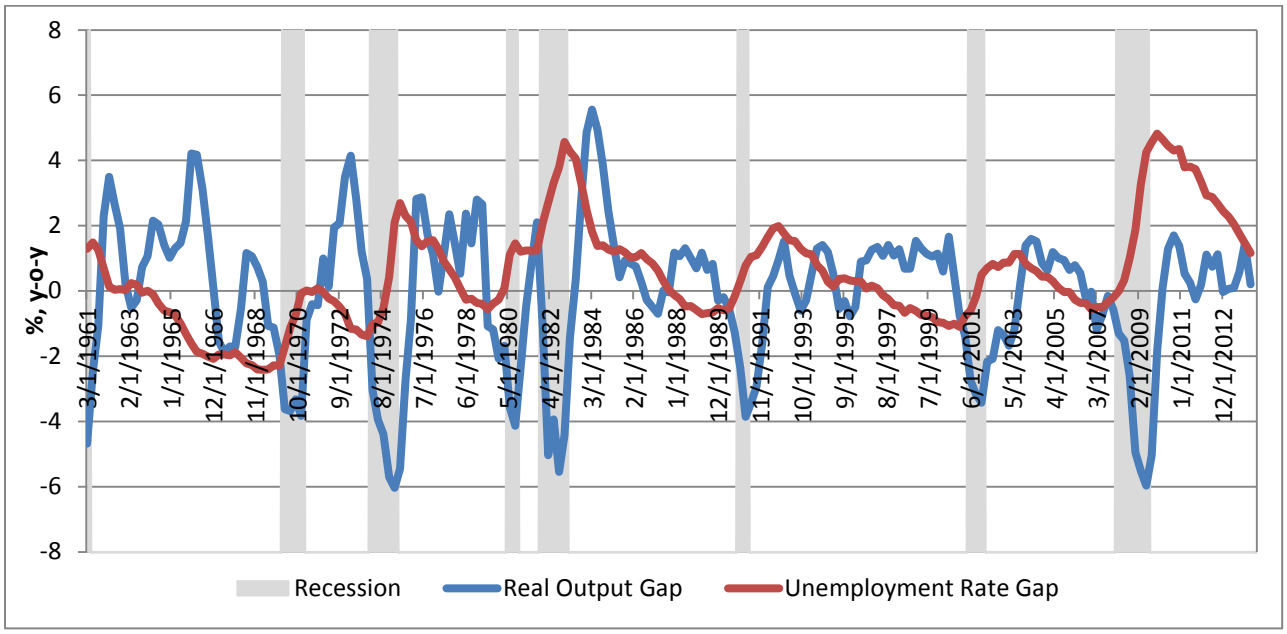
Source: State Secretariat for Economic Affairs, Bank of Japan, Cabinet Office of Japan; European Central Bank, Statistical Office of the European Communities; Bank of England, Office for National Statistics; Federal Reserve Board; and the Bureau of Economic Analysis.

Figure 9: Bank of Japan Asset Accumulation and Deflation



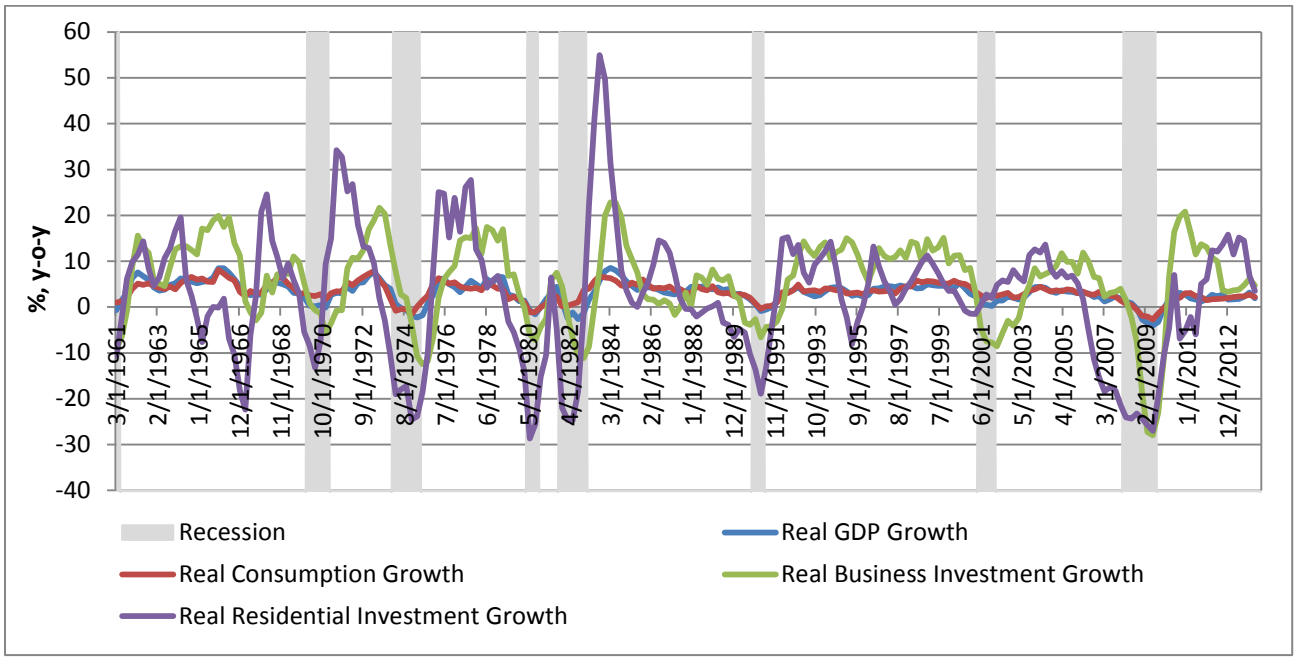
Source: Organisation for Economic Co-operation & Development and the Bank of Japan.

Figure 10a: Real Output Growth and Unemployment Rate Gaps (also at the ZLB)



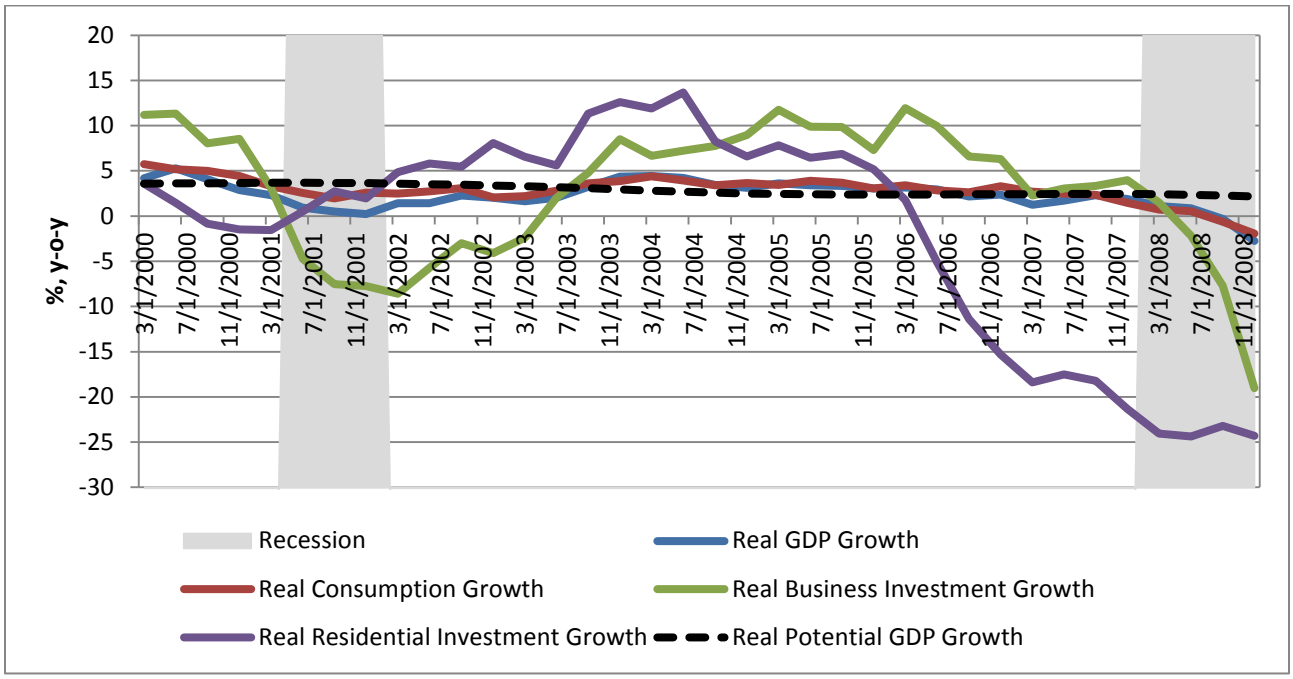
Source: Author's calculations, Bureau of Economic Analysis, Bureau of Labor Studies, Congressional Budget Office, and the National Bureau of Economic Research. Gap defined to be actual real y-o-y GDP growth minus real potential (CBO) growth or the unemployment rate less the NAIRU (CBO).

Figure 10b: Real Output, Consumption, and Business and Residential Investment Growth (also at the ZLB)



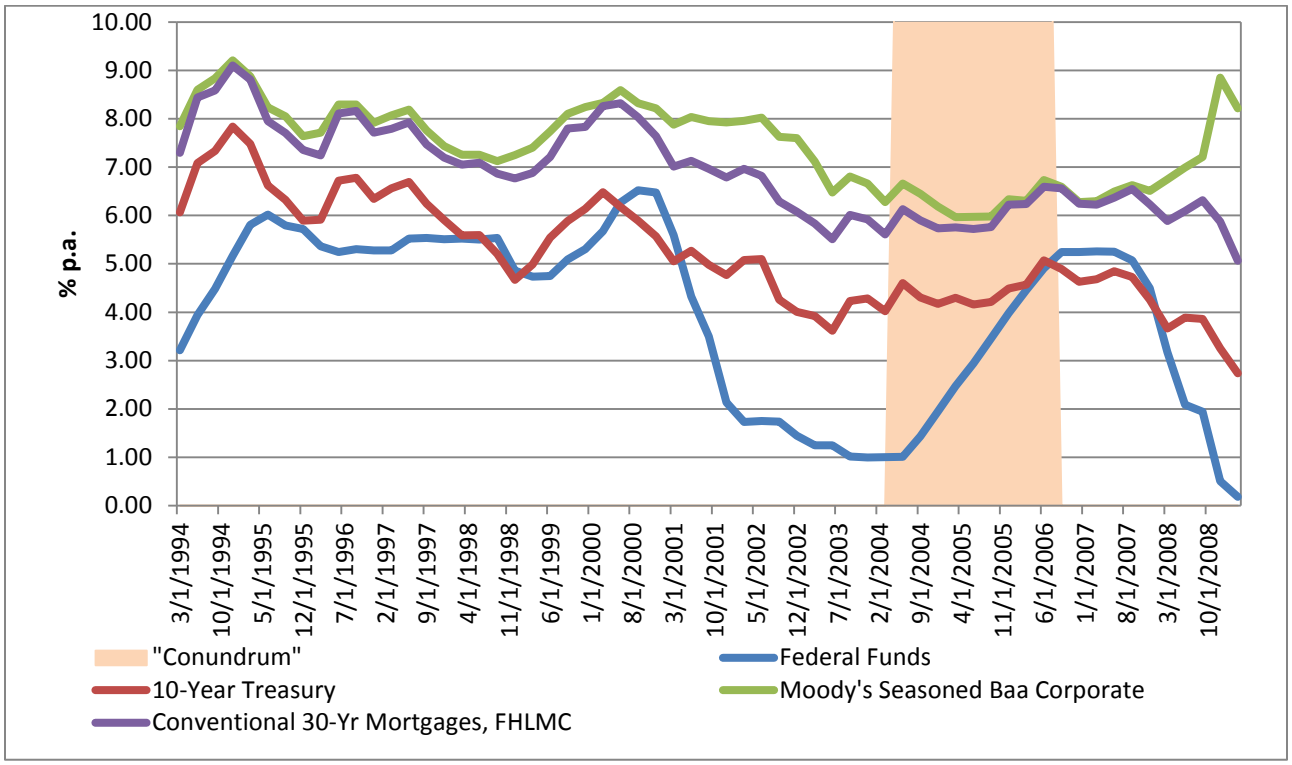
Source: Author's calculations, Bureau of Economic Analysis, and the National Bureau of Economic Research.

Figure 11: Real Output, Consumption, and Business and Residential Investment Growth (also at the ZLB)



Source: Author's calculations, Bureau of Economic Analysis, Congressional Budget Office, and the National Bureau of Economic Research.

Figure 12: The "Conundrum" Period (When Long Rates Did Not Rise with the Federal Funds Rate)



Source: Federal Reserve Board.