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The Potential Use of Balance Sheet Actions to Strengthen Forward Rate Guidance[1]

Over recent months, FOMC communications about the asset purchase program have at times been accompanied by movements in market interest rates that seemed outsized relative to the information content of those communications and that were difficult to reconcile with the Committee's forward guidance for the federal funds rate. In light of this experience, the FOMC might be interested in possibilities for strengthening forward guidance for the federal funds rate through the use of open market operations and other balance sheet actions. This note reviews five possible types of balance sheet actions that could be used for this purpose. As background, section 1 below provides information on the recent behavior of short-term interest rates. Section 2 below provides a brief description of types of balance sheet actions that could be used to strengthen forward guidance. Section 3 discusses some of the policy, operational, and legal issues that could be associated with the various alternatives.

As a brief summary, the discussion below considers several possibilities for balance sheet actions that the FOMC might employ to help keep near-term interest rate expectations reasonably well aligned with the Committee's forward guidance. Two of the alternatives discussed below would be aimed at providing primary dealers with greater certainty about the path of short-term interest rates, either by conducting long-term repurchase agreement operations or by establishing a standing facility for overnight repurchase agreement operations. In two other alternatives, the Federal Reserve could conduct open market operations in shorter-term Treasury securities, either by standard outright operations or through operations in forward markets. Some variations of these alternatives could involve announcing an explicit cap on shorter-term Treasury yields. A final alternative considers the possibility of lowering the IOER and establishing a full-scale, fixed-rate, overnight RRP facility. As discussed in the final section, all of these operations seem potentially useful, although there are a number of technical and operational issues that would need to be sorted through prior to implementing such programs. Two basic issues that merit further analysis for any of these alternatives would be how effective they are likely to be in influencing the path of short-term interest rates, and how the use of such tools would be incorporated into the Committee's overall monetary policy strategy and communications.

1. Background

Over recent months, news pointing to a sooner-than-anticipated reduction in the pace of asset purchases has been associated with notable upward revisions in money market futures rates. For example, following the Chairman's press conference last June, implied rates on Eurodollar futures maturing in late 2015 moved up 25 basis points; implied rates on contracts maturing in June and September 2014 also increased noticeably. More broadly, as shown in figure 1, the path of forward federal funds rate rates derived from OIS quotes moved up sharply from early May to early September but has since moved back down, largely following the September

[1] Board: Scott Alvarez, Alain Chaboud, Jim Clouse, Burcu Duygan-Bump, William English, Yuriy Kitsul, Michael Leahy, Robert Martin, William Nelson, Min Wei; FRBNY: Benson Durham, James Egelhof , Michelle Ezer, Joshua Frost, Frank Keane, Lorie Logan, Mike McMorrow, Simon Potter, Matthew Raskin, Julie Remache.

FOMC meeting. As shown in tables 1-3, judging from the results of primary dealer surveys, these shifts in forward rates did not seem to be occasioned by sharp revisions in investors' economic outlook.

Shifts in the forward federal funds rate curve can reflect revisions in the expected funds rate path and in term premiums, and news about the pace of purchases could affect both of these components. News about the pace of purchases could be associated with shifts in the expected path for the federal funds rate for several reasons. For example, if the reduction in the pace of purchases is taken by investors as a reduction in policy accommodation that would need to be offset through more accommodative funds rate policy, then all else equal, the expected date of liftoff might shift out or the trajectory after liftoff could shift down. On the other hand, if a prospective reduction in asset purchases is taken as news that the economic outlook is better than previously thought, investors' expected date of liftoff could move in and their expected funds rate path thereafter could shift up. Alternatively, if the reduction in the pace of purchases is seen as motivated by financial stability concerns related to the low level of interest rates, it might be natural for market participants to raise the odds that the date of liftoff for the funds rate will be sooner than previously thought and the post-liftoff trajectory for the funds rate could be steeper as well.

News about the pace of asset purchases could also affect term premiums. For example, news pointing to an increased likelihood of a reduction in the pace of asset purchases could spur an increase in uncertainty about the future path of short-term rates or an increase in investors' aversion to risk. Both of these factors could contribute to higher term premiums and thus increase yields.

While it is very difficult to disentangle all of these possible effects on expected federal funds rates and term premiums, a staff term structure model does suggest that a sizable portion of the increase in OIS rates over the summer was associated with an increase in term premiums. That conclusion seems consistent with an uptick in some measures of policy uncertainty. As shown in figure 2, the model also suggests a significant amount of variation in the model-implied expected path of the federal funds rate and the anticipated date of the initial increase in the target federal funds rate. For example, in early September, this model suggests that the expected funds rate path had moved up considerably relative to its level in early May and the date of the liftoff for the federal funds rate had been pulled forward appreciably as well.

While clear communications should help investors better understand the distinct roles of asset purchases and the forward guidance for the funds rate, it is certainly possible that news about a possible reduction in the pace of asset purchases could once again prompt increases in the expected path of the federal funds rate or term premiums and thus produce an unintended tightening in overall financial conditions. That possibility provides an important motivation for possible steps the Federal Reserve could take with open market operations and other balance sheet actions to strengthen the forward guidance for the federal funds rate and push against shifts in short-term rates that run counter to the FOMC's intentions.

Figure 1: OIS-implied Instantaneous Forward Rates

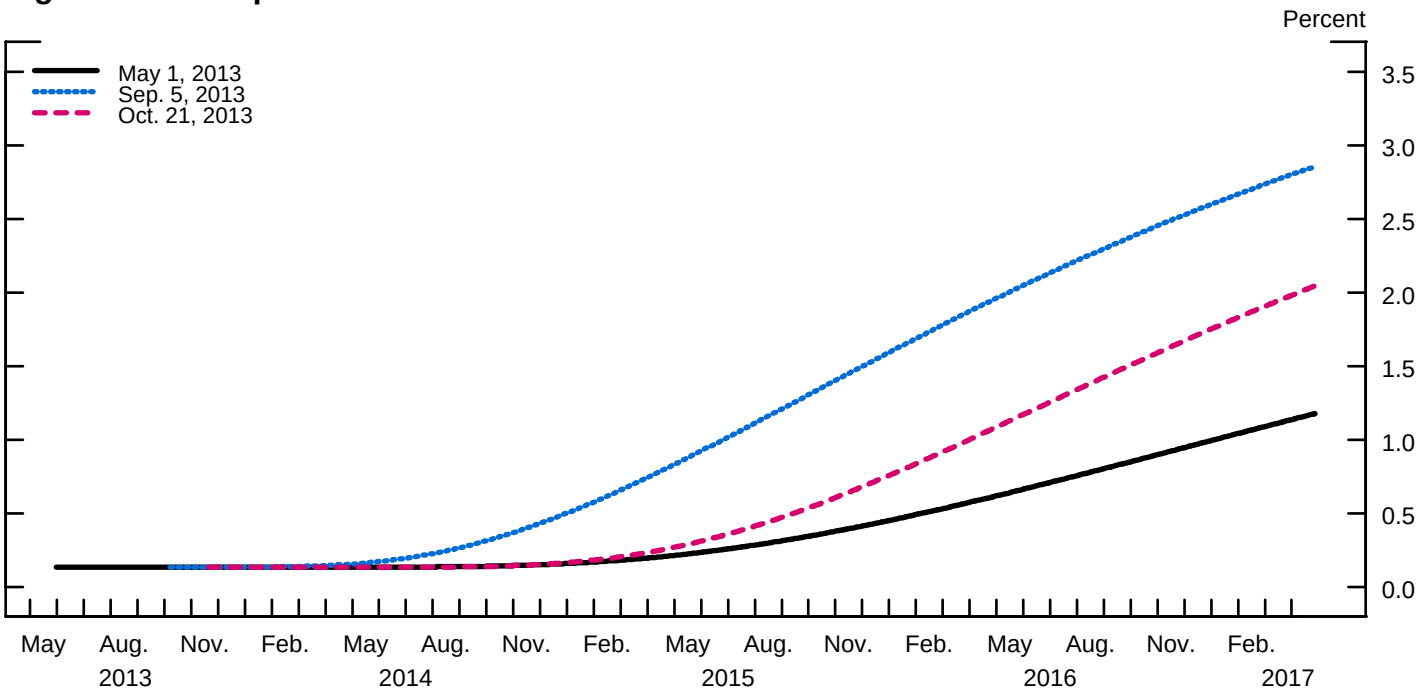
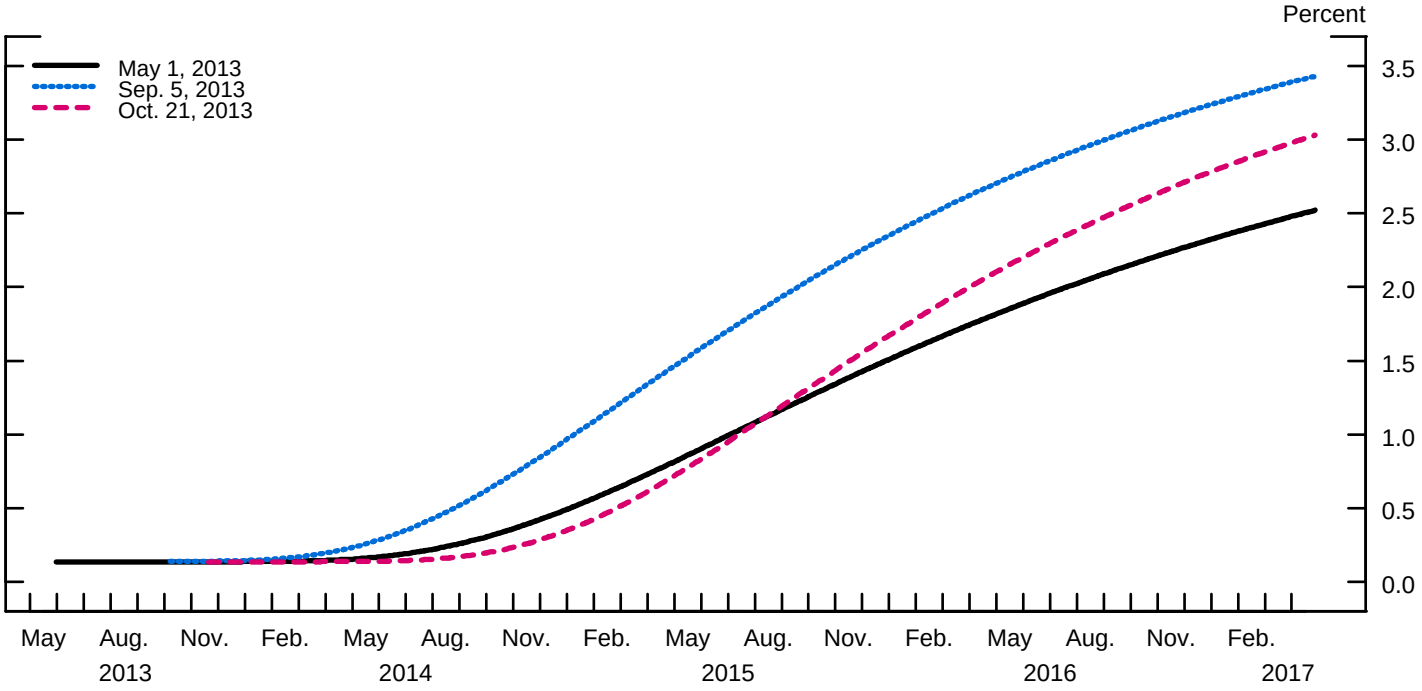


Figure 2: OIS-implied Expected Policy Rate Path (Mean)



Primary Dealer Forecasts at Recent FOMC Meetings (Medians Across Dealers)

Table 1: Unemployment Rate (Q4 Level)	2013	2014	2015
May Meeting	7.40%	6.85%	6.30%
June Meeting	7.30%	6.80%	6.30%
July Meeting	7.30%	6.60%	6.20%
September Meeting	7.20%	6.60%	6.10%

Table 2: GDP Growth (Q4/Q4 Growth)	2013	2014	2015
May Meeting	2.40%	2.80%	3.00%
June Meeting	2.20%	2.80%	3.00%
July Meeting	1.90%	2.80%	3.00%
September Meeting	2.00%	2.75%	3.00%

Table 3: Inflation (Headline PCE, Q4/Q4 growth)	2013	2014	2015
May Meeting	1.60%	1.90%	2.00%
June Meeting	1.30%	1.90%	2.00%
July Meeting	1.30%	1.80%	2.00%
September Meeting	1.30%	1.80%	1.90%

2. Alternatives for Open Market Operations and Other Balance Sheet Actions

The discussion below reviews five possible types of balance sheet actions that could be used to strengthen the FOMC's forward guidance. Under the first program, the Federal Reserve would create a standing term repo facility for primary dealers with an announced rate and time period for which this facility would be operational. This facility could be structured to encourage counterparties to purchase shorter-dated Treasury securities, thereby driving down the yields on those securities. By establishing a low rate for term repurchase agreements through a given date, such a facility may also have an important signaling effect in influencing the expected future path of the target federal funds rate. Under the second program, the Federal Reserve would create a standing purchase facility to enforce an announced cap on yields at the short end of the Treasury yield curve. In this case, the Federal Reserve would stand ready to purchase Treasury securities with relatively short maturities, at prices that correspond to a predetermined yield to maturity. Under a third type of program, the Federal Reserve could create a cap on overnight repo rates by establishing a standing overnight repo facility. The Federal Reserve could announce that primary dealers may enter repurchase agreements with the Federal Reserve at a pre-determined rate that would be available as long as one of the thresholds in the forward guidance for the federal funds rate had not been crossed. Certainty regarding the rate for such repurchase transactions should help to counter any upward pressures on expected short-term rates that are not driven by changes in the economic outlook. As a variation on this approach, the Federal Reserve could consider auctioning options that provide the holder with the right to enter overnight repurchase agreements with the Federal Reserve at the pre-determined rate at any time before one of the thresholds is crossed. A fourth alternative for balance sheet actions would involve the Federal Reserve operating in forward markets for short-term Treasury securities as a way of putting direct downward pressure on forward yields and signaling the FOMC's intentions regarding the path of future short rates. The possibility of lowering the interest rate paid on excess reserves (the IOER rate), perhaps coupled with a fully operational fixed-rate, full allotment overnight RRP facility is discussed below as alternative 5.

While each of these alternatives is discussed separately below, some could be used in combination. For example, the Federal Reserve could establish a standing overnight repo facility as in alternative 3 and also conduct purchases of shorter-term Treasury securities as in alternative 2 or in forward markets as in alternative 4. Moreover, all of the alternatives for open market operations could be coupled with other actions, such as a reduction in the IOER rate or changes in statement language that could further emphasize the Federal Reserve's intention to keep rates at exceptionally low levels at least until the unemployment or inflation thresholds are reached.[2]

[2] For example, the forward guidance language in the last paragraph of recent FOMC statements could be strengthened to more clearly rule out situations in which the federal funds rate might be increased prior to the time when one of the thresholds has been reached. This might be accomplished by stating that the Committee "will" keep the target rate at its current level (rather than "currently anticipates") until one of the thresholds has been crossed. Moreover, as discussed in the Tealbook, the FOMC could clarify that other factors that will determine how long the FOMC maintains an exceptionally low federal funds rate will come into play only after a threshold has been crossed.

Alternative 1: Standing Fixed-Rate Term Repo Facility

Description: Under this program, the Federal Reserve would establish a standing term repo facility that would provide term repurchase agreements to primary dealers at a single, fixed rate established by the FOMC. Term repurchase agreements under the facility would be provided to primary dealers until an announced date, with the tenor of repos extending up to that date. The Committee could, of course, choose whatever date it wished, but for the purpose of this discussion we will assume that term repos are provided with maturities at the end of 2014.[3] Under the most straightforward version of this facility, the Federal Reserve would accept any OMO-eligible collateral in these term repo operations. Under another variation, the collateral eligible to be pledged in these operations could be limited to only Treasury securities that mature prior to the end of 2014. In some ways, this version of the program would act like a "funding for lending" facility aimed specifically at lowering the yields on shorter-term Treasury securities.[4] Under either version of the program, primary dealers would have an incentive to bid up the prices of any eligible securities with yields exceeding the Federal Reserve's term repo facility rate. Ultimately, yields on shorter-term securities should be driven down close to the Federal Reserve's term repo rate if investors are confident that the term repo facility would remain open until the end of 2014 (the announced date for the conclusion of the term financing facility).

An Example: Based on current quotes, the yields on Treasury securities maturing from now to the end of 2014 rise from about 0 basis points in the very near term to about 20 basis points on those maturing at the end of 2014. Based on these quotes, if the Federal Reserve offered term repo agreements at 15 basis points to the end of 2014, primary dealers would currently have an incentive to bid up the prices for Treasury securities with maturities close to the end of 2014 and pledge those securities in Fed term RP operations.[5] Primary dealers should continue to purchase such securities to eliminate any risk-free arbitrage, and that process should drive yields on these securities to a rate just a little above 15 basis points, with the spread over the Federal Reserve's term repo rate reflecting dealers' intermediation costs.[6]

Alternative 2: A Standing Purchase Facility

Description: As a closely related alternative to a term repo facility, the Federal Reserve could announce a cap for yields on Treasury securities that mature prior to the end of 2014 and then

[3] As discussed in more detail in section 3, there are significant complications associated with combining a date-based market mechanism such as this with the FOMC's threshold-based forward guidance for the federal funds rate.
[4] One distinction between this proposed program and funding for lending programs is that the latter are aimed at increasing the aggregate supply of bank loans. In contrast, the aggregate supply of Treasury bills is largely exogenous, but the availability of term repurchase agreements for primary dealers could induce them to hold more Treasury bills in their inventories than would otherwise be the case and drive down the yields on Treasury bills in the process. For more information on funding for lending facilities, see the memos on this topic prepared for the September 2012 FOMC meeting entitled "Discount Window Options to Boost Bank Lending," and "Recent Initiatives to Boost Bank Lending by the Bank of England and the Bank of Japan."
[5] If the Federal Reserve wished to offer term repo at 15 basis points, policymakers presumably would choose to lower the interest rate on excess reserves (IOER). This possibility is discussed in more detail in alternative 5.
[6] The average spread between the rates on repurchase agreements and reverse repurchase agreement is one common measure of dealer intermediation costs; current repo-reverse spreads are about 5 basis points.

conduct open market operations so as to keep yields on eligible securities below the cap.[7] Under this type of program, the Federal Reserve could announce a cap of, say, 20 basis points, on all Treasury securities maturing prior to the end of 2014 and conduct open market operations to keep yields on short-dated securities below that cap.

To take a specific example, the Federal Reserve could announce that, until further notice, it stood ready to purchase any nominal Treasury security that matured on or before December 31, 2014, at a price consistent with a yield of 20 basis points. As time passed, the maturity date of securities eligible for purchase would not necessarily change. Any program with explicit caps of this sort raises questions about the extent of Federal Reserve operations necessary to enforce the cap and the behavior of interest rates in cases when market participants anticipate the cap could be eliminated.[8]

Alternative 3: Overnight Repo Operations– Standing Facility or Options

Description: Under this type of program, the Federal Reserve would stand ready to provide overnight repos against all OMO-eligible collateral at a pre-determined rate to primary dealers as long as one of the thresholds in the forward guidance for the federal funds rate had not been crossed. The program could be implemented either as a standing fixed-rate overnight repo facility or through the sale of options that provided the holder with the right to obtain overnight repos from the Federal Reserve at a pre-determined rate.

Under the standing facility approach, the Federal Reserve would announce that it would conduct fixed-rate, full allotment, overnight RP operations every day at, say, 20 basis points until one of the thresholds is reached. The availability of repos from this facility and the expectation that such transactions would remain available at this rate until one of the thresholds is crossed should help to establish a cap on current and expected future repo rates at 20 basis points.

Under the option approach, the Federal Reserve would auction options that provide the holder with the right to enter overnight repurchase agreements with the Federal Reserve at 20 basis points as long one of the thresholds had not been breached.[9]

[7] The Federal Reserve operated such a regime during the 1940s as part of government-wide efforts to facilitate war time finance. For more information on this historical episode, see the memo prepared for the June 2003 FOMC meeting entitled "Targeting the Yield Curve: The Experience of the Federal Reserve, 1942-51."

[8] Additional information on the use of open market operations and caps to target points on the yield curve is provided in the memo prepared for the October 2010 FOMC meeting entitled "Strategies for Targeting Interest Rates Out the Yield Curve."

[9] The Federal Reserve has sold options on two previous occasions. In the months leading up to Y2K, the Federal Reserve sold options that provided dealers with the right to obtain overnight repos from the Federal Reserve over specified periods at a rate set 150 basis points over the target federal funds rate. The options sold at a low price, reflecting market confidence that interest rates would be kept low, but they were an effective means to bolster market confidence that repo financing would be available over the century date change. The Federal Reserve also sold options during the financial crisis under the TOP program. Options under this program provided the owner with the right to obtain short-term TSLF loans at a predetermined fee over selected dates. The TOP was largely intended to ease dealer financing pressures around key dates such as quarter-ends and year-ends. All TOP auctions offered TSLF loans against so-called "schedule 2" collateral—a basket that included standard OMO eligible collateral along with other private investment-grade securities that met the requirements of the TSLF program.

Alternative 4: Operations in Forward Markets

Description: Analogous to the operations of some central banks in forward FX markets, the Federal Reserve might be able to use operations in near-dated forward markets for Treasury securities to provide a signal about its expected path of short-term rates.[10] Under this alternative, the Federal Reserve would enter into forward agreements to purchase, say, six-month Treasury bills at some point in the future. For example, the Federal Reserve could agree today to purchase six-month bills at selected points in the future—perhaps 12 months from now, 18 months from now and so on.[11] The purchase of six-month bills would allow operations targeting fairly narrow segments of the yield curve. This type of program could be implemented with announced caps on forward yields or, alternatively, through discretionary operations. In the latter case, the Federal Reserve's actions to purchase short-term securities on a forward basis could provide a strong signal that it considered forward short-term yields to be too high, thus putting downward pressure on expected future short rates.

A forward operation of this sort could have some advantages relative to purchasing securities today with 18 to 24 month maturities. For example, forward purchases could be concentrated on the particular parts of the yield curve where pressures seemed to be mounting.[12] Moreover, when the Federal Reserve took delivery of the short-term securities upon settlement of forward contracts, these securities would mature quickly, so the size of the Federal Reserve's balance sheet would not be affected for a lengthy period.

Alternative 5: Reduction in IOER and Full Scale ON RRP Facility

Another possibility that the Federal Reserve could consider as a way to underscore its intention to keep the target federal funds rate low until the thresholds are crossed is to lower the IOER rate. For example, the Committee might contemplate taking this action at the time when it begins to reduce its pace of asset purchases. Currently, the IOER rate is set at 25 basis points and the Federal Reserve could consider cutting this rate to, say, 15 basis points. In the past, policymakers have been somewhat reluctant to reduce IOER because of possible adverse effects on market functioning. For example, very low levels of short-term interest rates have been associated in the past with elevated levels of fails to deliver in securities markets. And there have been concerns that short-term rates very close to – or below – zero could cause liquidity pressures for Treasury-only money funds. Now, however, the issue of fails to deliver has largely been addressed by the fails charges that have been implemented in the Treasury, agency debt,

[10] For example, as discussed in the appendix, the Central Bank of Brazil has conducted forward FX operations as part of its efforts to support the value of the *real*.

[11] Such operations would be similar to taking a long position in federal funds futures or other money market futures. The focus here on forward purchases of bills is purely illustrative. There may be technical reasons that the Federal Reserve would wish to take a broader approach by purchasing any outstanding Treasury security with a remaining maturity of six months. For example, the six-month bill that will be issued twelve months from now is not currently in existence; as a result, trades based on such a security could be heavily influenced by uncertainties about potential future Treasury supply decisions and other idiosyncratic aspects of the bill market.

[12] The targeting of specific points along the yield curve could be achieved in other ways. For example, a forward purchase of six-month bills six months from now is approximately equivalent to the purchase today of a 12-month bill that is financed with term repo for six months.

and agency MBS markets. Moreover, short-term Treasury bill yields have been close to zero for some time with no major adverse consequences for money funds. Nonetheless, the FOMC might remain concerned that additional downward pressure on money market yields stemming from a cut in IOER could create strains for some markets and institutions.[13] To address this issue, the FOMC could implement a full-scale version of the fixed-rate, full-allotment overnight RRP facility that is currently being tested.[14] For example, the FOMC could set a rate of 5 or 10 basis points at this facility and eliminate the current per-counterparty cap of $1 billion. That should help to set a floor on repo rates at about 5 or 10 basis points. The combination of a reduction in the IOER along with the introduction of the full-scale overnight RRP facility likely would be seen as providing a modest additional degree of policy accommodation. This action could also help to provide a signal that the Federal Reserve intends to keep rates at current levels at least until the thresholds are crossed.[15] As noted above, that interpretation could be amplified through appropriate wording changes to the last paragraph of the FOMC statement.

3. Policy, Operational, and Legal Issues

The alternatives discussed above could be helpful tools that the FOMC could use to strengthen its guidance for the federal funds rate and to lean against unwelcome increases in the expected path of short-term rates. While the alternatives above could be useful additional tools for the FOMC, a number of policy, operational and legal issues would require further analysis before any of these alternatives could be implemented. The discussion below reviews some of these issues.

Efficacy: There are many questions that should be investigated regarding the likely efficacy of the various programs discussed above, including their potential effects on longer-term yields and private yields. Moreover, it would be useful to conduct further analysis regarding the different channels through which these various operations might affect yields. On a related point, further analysis of potential effects across markets and institutions would be useful. For example, the potential impact of an overnight or term RP program could have implications for other cash lenders in repo markets.

Challenges for Date-Based Mechanisms: Because the Committee's forward guidance is expressed in terms of economic thresholds, there are challenges associated with designing dated-based mechanisms to harden the guidance such as the term repo facility or standing purchase facility. A key challenge is picking the terminal date for such facilities in light of the inherent uncertainty about the date when one of the thresholds will be crossed. For example, based on the confidence bands around the staff forecast, even though the unemployment rate is not projected to fall below 6½ percent until the first quarter of 2015, there is about a 15 percent chance that it will do so by the second quarter of 2014. As a result, if the FOMC chose to

[13] For more information on possible issues associated with lowering IOER, see the memo prepared for the October 2011 FOMC meeting entitled "Reconsidering Lowering the IOER Rate."
[14] For more information on experience to date with the overnight RRP tests, see the memo for this meeting entitled "Analysis of Overnight Repurchase Agreement Operations."
[15] Such a program would also provide useful insight into how the overnight RRP facility would impact market rates. That experience could be quite useful in assessing the potential role of this tool in normalizing the stance of policy in the future.

establish a date-based program like those discussed above with an announced end-date beyond the middle of 2014, it would run the risk of committing to a program aimed at putting downward pressure on short-term yields at a time when one of the thresholds had been crossed. This type of complication underscores a significant advantage of some of the alternatives discussed above that are based on the economic thresholds.

Challenges for Threshold-Based Programs: Developing economic criteria that would determine the availability of some of the operations discussed above would present some complications. While it would be relatively straightforward to determine if the unemployment threshold had been crossed, the FOMC statement is not specific about the definition of projected inflation between one and two years ahead. Moreover, the forward guidance for the federal funds rate in the FOMC statement also includes a reference to well-anchored long-term inflation expectations. Defining economic criteria for a standing facility and for options that are fully consistent with this statement language could be difficult. One possibility for sidestepping some of these complications could be to base the criteria for these programs on the FOMC's own judgment that one of the thresholds had been crossed. For example, the FOMC could indicate in a post meeting statement whether it views either of the thresholds as having been crossed. On the other hand, allowing the condition describing option expiration or the end of the facility to be determined by the FOMC rather than by explicit, exogenous economic criteria may create some uncertainty for market participants about the availability of the program.

Discretionary Operations and Soft Caps: Some of the alternatives discussed above involve the FOMC announcing a hard "cap" on yields at particular maturities or on forward rates. It may be possible to establish versions of these facilities that would involve only "soft caps." For example, under the standing purchase facility or the operations in forward markets, the FOMC could indicate that it would conduct operations, as appropriate, to keep yields at levels generally consistent with its forward guidance for the federal funds rate, but it would not announce a specific target for yields. While discretionary operations of this type may have some advantages, there would also be challenges. In particular, the governance for such discretionary operations and the directive to the Desk would need to be designed carefully. Another issue with such operations is that the discretion and flexibility associated with conducting operations in this way would also likely entail some lack of transparency and uncertainty for market participants. These effects could undermine the goals of the program to some extent.

Risk Tolerance and Capacity of Counterparties: Some of the programs described above—the term and overnight repo programs and the operations in forward markets—could require counterparties to take on potentially large positions in transactions with the Federal Reserve. New regulatory requirements may limit the extent to which primary dealers and other possible counterparties are willing to take on risk positions to take advantage of "low spread" arbitrage opportunities. Given the possible constraints on arbitrage faced by primary dealers, the Federal Reserve may need to expand the list of counterparties for some of the programs to be effective. Of course, the process of vetting and onboarding new types of counterparties could require some time to evaluate reputational, credit and other risks.

Uncertainty about Uptake: It is difficult to assess how large the operations under these programs might need to be to achieve their objectives. As one benchmark, some estimates

suggest that the Federal Reserve's sales of $600 billion of short-maturity Treasury securities under the maturity extension program pushed up yields at the front end of the yield curve by roughly 10 basis points. That experience suggests that pushing down short-term Treasury yields through market operations could require sizable operations. The period during the 1940s in which the Federal Reserve acted to keep Treasury yields below caps may also be instructive. In 1947, reflecting its efforts to defend the cap on Treasury bill yields of 3/8 of one percent amid mounting inflationary pressures, the Federal Reserve's holdings of Treasury bills rose sharply, reaching more than 90 percent of outstanding Treasury bills at one point. On the other hand, it's possible that the signaling value of some of these operations could be quite powerful in the current environment, perhaps reducing the need for the Federal Reserve to conduct large scale operations to achieve a desired change in shorter term yields.

Legal Issues: The legal basis for some of the types of operations described above would require additional study. For example, the Federal Reserve has no explicit authority to sell options. In the past, sales of options (for example, the Y2K options) have been authorized under the "incidental powers provision" of the Federal Reserve Act. Other legal issues could be associated with standing facilities or purchases at pre-announced rates. The Federal Reserve's authority for open market operations requires that purchases and sales of securities must be conducted "in the open market." As a result, legal analysis would need to determine whether these programs can be considered operations "in the open market."

Credibility: Most of the alternatives described above would depend on investors' confidence that the facilities would remain available for a period of time defined by either a date or economic threshold. If investors came to believe that operations under any of these programs might be stopped sooner than expected, those expectations could undercut the power of these programs in strengthening the Federal Reserve's forward guidance and could lead investors to question other aspects of the Committee's communications as well. Similarly, if a strengthening of the economy resulted in the Federal Reserve seeking to enforce a cap on term interest rates that was lower than the average expected overnight rate over that term, the Federal Reserve could end up conducting a very large amount of transactions as the market sought to test the Federal Reserve's resolve to defend its cap.

Other Operational Issues: There are a host of other operational issues associated with various programs involving topics such as accounting complications, margining practices, choosing appropriate rates and tenors for operations, determining auction formats, evaluating counterparties, and upgrading automated systems. In some alternatives, there may also be operational and legal issues to contend with in establishing margin accounts and working out the details of legal contracts underlying term repo, options, and forward transactions.

Appendix: Intervention in the Forward Market by the Central Bank of Brazil

Brazil's Central Bank (BCB) has in recent months taken a number of measures designed to counter the depreciation of the *real* against the dollar, including several increases in its main policy interest rate and frequent interventions in the foreign exchange market. Even though the BCB has ample foreign exchange reserves (more than 15 percent of GDP) with which to buy its own currency in the spot market, the central bank has intervened almost exclusively using operations that essentially amount to intervention in the forward market. In these operations, the BCB auctions to financial institutions contracts that increase in value with the depreciation of the Brazilian *real* against the dollar. [1] In effect, these operations alter the stock of dollar hedging instruments available in the market, allowing the private sector to transfer exchange rate risk to the central bank. This provides support for the foreign exchange value of the *real* against the dollar.

The BCB announced in late August that it would increase the use of these contracts, committing to conduct daily auctions of $500 million four days a week until at least the end of 2013. The BCB stated at the time that these operations would "provide an FX hedge to agents and liquidity to the FX market." Since that announcement, the *real* has appreciated substantially against the dollar, and dollar interest rates in Brazil have declined, both viewed as evidence of success by the BCB, albeit amid a broad-based appreciation of emerging market currencies. We note, however, that the BCB had begun to offer large amounts of these contracts in May of this year, with little apparent effect on the value of the *real* at the time.

Brazil's forward intervention may work through two channels, a forward guidance channel and a risk transfer channel. First, issuing these contracts likely allows the BCB to provide forward guidance that is more credible than merely announcing the Bank's expectations of future exchange rate movements. The extra credibility arises because the Bank bears a cost if the *real* depreciates more than is priced into its contract. Note, however, that the guidance is not precise, as the BCB does not target a specific level of the exchange rate, but only exerts pressure on the exchange rate in a certain direction. Second, these contracts transfer the risk of *real* depreciation from market participants to the BCB by providing market participants with a synthetic long dollar position. The contracts therefore reduce the incentive for those market participants to buy dollars now, removing some of the immediate pressure on the exchange rate.[2]

These forward transactions by the BCB have no immediate impact on its balance sheet; the initial value of the contracts is zero and there is no immediate transfer of funds. Nor is there any

[1] The contract is officially called the "Selic x U.S. Dollar Swap with Reset" (the Selic rate is Brazil's equivalent of our effective federal funds rate). It is often referred to as an FX swap contract, but it is not a standard FX swap or a standard FX forward. The exact specifications of the contract are complex (it is a fixed for floating swap where the floating leg has an exchange rate component), but the BCB presents the contract as "for all practical purposes" a cash-settled futures contract on the dollar-*real* exchange rate, a description that we find to be accurate. It is a futures contract because it is a forward instrument that is exchange-traded and margined. The contract results in a loss to the BCB if the *real* depreciates more than is implicit in the forward exchange rate, or in a gain to the BCB in the case of a smaller depreciation or an appreciation of the *real*. The BCB first used this type of transaction in 2002.
[2] This is important, for instance, for the large number of Brazilian firms that have issued dollar-denominated debt and have upcoming principal or interest payments.

exchange of principal when the contracts mature. Nonetheless, these contracts expose the BCB to exchange rate risk. Since May 2013, the Bank has accumulated a notional position of almost $60 billion in these contracts (a short dollar position of 2.7 percent of GDP), and the BCB is expected to issue another $20 billion by year end.[3] The BCB has argued that its current exposure is offset by the fact that it holds a large amount of foreign currency reserves (worth $370 billion at present). Therefore the domestic-currency value of the BCB's dollar reserves would rise with a weaker *real*, more than compensating for the drop in value of its forward contracts. In the past, however, the BCB took the other side of these contracts to fight *real* appreciation. In that case, if the *real* were to appreciate, the BCB's losses on its foreign reserves would be compounded by its forward position, as if its holdings of foreign exchange reserves had been leveraged. Of course, in either case, the Bank could also potentially derive a net profit from its transactions.

The BCB currently issues these contracts through single-price auctions, announcing the quantity to be auctioned ahead of time; it does not announce a goal for the price that it may be trying to achieve. The Bank also reserves the right to call additional auctions on short notice. The recent maturity of the contracts has varied from 60 to 225 days. Most Brazilian financial institutions can participate in the auctions, even those not authorized to maintain foreign exchange positions, as the contracts are cash-settled in *real*, not by physical delivery of dollars. After being auctioned by the BCB, these contracts are freely tradable on Brazil's main futures exchange[4] until maturity. As such, the positions are marked to market every day, and they are subject to margin calls. Although the forward positions themselves do not appear on the BCB's balance sheet, the Bank immediately records in its financial accounts the gains or losses incurred on its outstanding contracts.

[3] The size of these operations may be evidence that the risk transfer channel is more important than the forward guidance channel, although the two channels are clearly complementary.
[4] The BM&F Bovespa SA- Securities, Commodities, and Futures Exchange