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**Long-Run Policy Implementation Frameworks**  
Chris Burke, Seth Carpenter, James Clouse, Spence Hilton,  
Todd Keister, Jamie McAndrews, and Steve Meyer<sup>1</sup>

**Summary**

In April 2008, staff prepared a report that analyzed several frameworks for implementing monetary policy that differ in how they would use newly enacted authority to pay interest on balances that depository institutions hold at Reserve Banks and to lower or eliminate reserve requirements. This new legal authority was scheduled to become effective on October 1, 2011; the effective date was accelerated in response to the financial crisis, and the Federal Reserve began to pay interest on reserves in October 2008.<sup>2</sup> Further consideration of the future operating framework was deferred, given the extraordinary economic and financial conditions at that time. As the Committee considers strategies for normalizing monetary policy going forward, members may want to review long-run policy frameworks that could be implemented once the current extraordinary policy accommodation has been unwound.

This memo summarizes earlier staff work by discussing two basic types of operating frameworks for implementing monetary policy, labeled *corridor* and *floor* systems.<sup>3</sup> It also summarizes some lessons about the effects of paying interest on reserves that we have learned in recent years and notes several recent and forthcoming legal and regulatory developments that could influence the choice of operating system. This memo does not consider issues related to the possibility of targeting a rate other than the federal funds rate, or whether to target a specific level of the federal funds rate or retain a target range.

In a corridor system, the target federal funds rate would be between the interest rate paid on excess reserve balances and the primary credit rate, likely at the midpoint of the corridor between those two administered rates, and the Desk would manage the supply of reserve balances so as to keep the actual funds rate close to this target. In a floor system, the target funds rate would be close to the rate paid on excess reserves, and the Desk would supply a substantial quantity of excess reserve balances which, in conjunction with market forces, would keep the actual funds rate very close to the rate paid on excess reserves.

Some key conclusions of this memo are:

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<sup>1</sup> Bill English and Brian Sack provided helpful comments.

<sup>2</sup> The Financial Services Regulatory Relief Act of 2006 authorized the Federal Reserve to pay interest on balances held by or on behalf of depository institutions beginning October 1, 2011, and the Emergency Economic Stabilization Act of 2008 accelerated the effective date to October 1, 2008. See Appendix A.

<sup>3</sup> This memo draws on the April 2008 staff report titled Interest on Reserves: A Preliminary Analysis of Basic Options, prepared for Board members and Reserve Bank presidents by the Interest on Reserves work group. That report provided background for the discussion of issues related to interest on reserves at a joint meeting of the FOMC and the Board of Governors on April 30, 2008.

- Operating either a corridor or a floor system would require a very substantial reduction in the supply of reserves from current levels.
- In general, we would expect that using a corridor system to implement U.S. monetary policy would entail a lower level of reserve balances and more frequent open market operations than would a floor system, though both the level of balances and the frequency of operations would depend on the details of the system.
- Central banks that use corridor frameworks have found them to be effective in controlling average overnight rates. Now that it can pay interest on reserve balances, the Federal Reserve could design a new corridor framework that might be even more effective than its historical framework in limiting rate volatility of the federal funds rate around the target.
- A floor system instead offers the possibility of controlling the federal funds rate without close management of the supply of reserves, and of loosening the link between the size of the balance sheet and the level of the funds rate. In addition, floor frameworks would likely entail lower operating costs than a corridor system, and having higher levels of reserves might improve payments system efficiency somewhat.
- During the exit process, the Federal Reserve will gain considerable insight into the behavior of rates in a floor system operating over a wide range of reserve balances. The Federal Reserve also will learn about the impact of upcoming structural and regulatory changes that could influence reserve demand or supply and interest rate dynamics.

## **I. Description of Operational Frameworks**

### *General Overview of Corridor vs. Floor Frameworks*

Under both corridor and floor systems, the central bank sets a higher rate on the standing facility through which it extends loans to commercial banks than the rate on the standing facility that it uses to absorb excess reserves.<sup>4</sup> The distinguishing feature of a corridor system is that the central bank typically sets its target for market rates towards the middle of the corridor established by the rates on its standing facilities.<sup>5</sup> It then keeps market rates around this target by controlling the supply of reserves with open market operations so that banks must balance the risk that they will face a reserve deficiency or be overdrawn at the end of the day, and thus need to borrow from the central bank or pay a high rate in the market, with the risk that they will hold unwanted excess reserves that pay a relatively low rate.

Corridor systems are often used in conjunction with a reserve accounting system that includes reserve requirements or voluntary balance targets with multiday maintenance periods, although these systems can take many different forms and their use is not universal. These systems allow banks to vary the quantity of reserves they may hold from day to day without either having to borrow from the central bank or hold unwanted excess reserves, and this flexibility helps limit the impact that an unexpected reserve shortfall or surplus on a given day may have on market

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<sup>4</sup> Some central banks fix the rate at which they accept deposits from banks rather than pay interest directly on excess reserves. Also, some central banks do not operate their marginal lending facility as a true standing facility. The differences between these approaches are not important for our discussion.

<sup>5</sup> Many central banks that use either a corridor system or a floor system do not set a formal target for a market rate. However, they usually have at least an unofficial objective or a preference for the level of the overnight interbank rate or another market rate.

rates. Still, if banks are faced with the immediate prospect of being even just modestly deficient or accumulating modest amounts of excess reserves, market rates can fall or rise sharply towards the rates on the standing facilities.

In contrast, under a floor system, the central bank provides a relatively high level of aggregate excess reserves, which implies that the likelihood of a bank needing to borrow from the central bank is normally quite low. For this reason, market rates are likely to lie close to the rate the central bank pays on excess reserves and well below the rate charged at its lending facility. The substantial level of excess reserves puts downward pressure on market rates, and the rate paid on excess reserves provides a lower bound on the rate at which a bank would be willing to lend in the interbank market. Consequently, market rates are relatively insensitive to routine fluctuations in the level of reserve balances, and there is no need for any reserve requirements or voluntary reserve targets.

### *Variations of Corridor and Floor Systems*

While *corridor* and *floor* are general descriptions of two types of operating frameworks, there are many possible variations within these categories, especially in the design of the reserve requirements or voluntary reserve targets that might accompany a corridor system.

The Federal Reserve's pre-crisis operating framework may be described as a type of corridor framework with reserve requirements of 10 percent on a narrow set of bank deposits and two-week maintenance periods. Before October 2008, the Fed did not have authority to pay interest on reserves, so the lower bound of the Fed's corridor was zero.<sup>6</sup> In addition, the Federal Reserve's primary credit rate only sets a soft ceiling for the federal funds rate because concerns about being perceived as weak or troubled can lead banks to avoid the discount window and pay higher rates in the market. Similarly, the experience since 2008 when the Federal Reserve began to pay interest on excess reserves—discussed in detail below—suggests that the interest rate paid on excess reserves in a corridor system might only create a “soft” floor for the federal funds rate because many lenders in this and other overnight funding markets are not eligible to receive interest payments from the Fed.

The corridor framework used by the ECB before the financial crisis also featured reserve requirements, but with a 2 percent required reserve ratio applied to virtually all bank liabilities that have initial maturities up to 2 years, a reserve maintenance period of about one month, and with required reserves remunerated at the policy rate.<sup>7</sup> The Bank of England developed a corridor system in which there were no reserve requirements but depository institutions could set their own voluntary balance targets, which they were expected to meet on average over a one-month maintenance period. Balances held to meet the target were remunerated at the policy interest rate, while balances in excess of the target were remunerated at the lower floor rate. By allowing institutions to set their own targets, this system may have resulted in a more efficient level and distribution of reserves based on banks' own assessments of their liquidity needs rather

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<sup>6</sup> Because reserve requirements were not remunerated, depository institutions had an incentive to avoid them through the use of sweep arrangements and other accounting techniques.

<sup>7</sup> The operating frameworks of the ECB, the Bank of England, and Bank of Canada are described in more detail in Appendix B.

than on the subset of their deposit liabilities subject to reserve requirements. The Bank of Canada is one of a number of central banks that operate a corridor system with no reserve requirements or voluntary targets, with a single-day reserve maintenance period, and with a very small level of balances.<sup>8</sup> In the absence of mechanisms such as multi-day maintenance periods with reserve requirements or voluntary targets that create a flatter demand curve for reserves, a central bank may set a relatively narrow corridor between their lending and borrowing rates or operate to adjust the supply of reserves more frequently to help reduce the volatility of market rates.<sup>9</sup>

Floor systems are generally very simple in design, but some central banks that use this approach have placed upper bounds on the quantity of reserves that each individual bank may hold that are fully remunerated.<sup>10</sup> Central banks that have employed floor systems include the Reserve Bank of New Zealand and the Norges Bank. In addition, both the Bank of England and the ECB switched to *de facto* floor systems during the financial crisis.

## II. Comparative Features of Corridor versus Floor systems

In this section, we review important features of corridor and floor systems and note areas in which one type of framework may have advantages over the other. Before highlighting these differences and uncertainties, it is important to note that corridor and floor systems share many important characteristics. For example:

- Both are consistent with an implementation regime that sets a target for an overnight money market rate, e.g., the federal funds rate, and that uses open market operations to keep the rate at or near its target;
- Both would use authority to pay interest on reserves to facilitate maintaining the federal funds rate around its target, and so would require coordination between decisions to set the target rate and administered rates;<sup>11</sup>
- Under both systems, the “reserve tax” associated with banks holding unremunerated balances to meet reserve requirements would be eliminated;
- Both are consistent with an eventual return to a Treasury-only SOMA portfolio, or with any other objective for the composition of the portfolio.

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<sup>8</sup> Frameworks with a target rate in the center of the corridor and with either (1) fully remunerated reserve requirements or (2) voluntary targets having a multiday maintenance period, or with (3) no such reserve accounting system correspond to Options 1, 2, and 3, respectively, in the April 2008 report.

<sup>9</sup> Multi-day maintenance periods that allow banks to “average” daily reserve holdings to meet either requirements or voluntary targets tend to flatten the reserve demand curve on a particular day by allowing banks to arbitrage across days of the maintenance period.

<sup>10</sup> In the April 2008 report Option 4 was a basic floor framework, and limits on the quantity of reserves individual banks could hold were considered. Option 5 was a framework that used a tolerance band around a voluntary daily reserve target, rather than a multi-day maintenance period, to help smooth rates. Depending on the width of the tolerance band and other parameters, such a framework could mimic a corridor system or a floor system.

<sup>11</sup> Some frameworks would also use the authority to reduce required reserve ratios to zero. For example, reserve requirements would be unnecessary in a corridor system based on voluntary balance requirements or in a floor system.

### *Implications for the Normal Level of Reserves*

Under either a corridor or a floor framework, the level of reserve balances that would be associated with maintaining the federal funds rate at its target level during normal operating circumstances would be far below current levels, although balances could be significantly higher than their pre-crisis levels. With a corridor system, the eventual level of reserves will be largely a function of the details of any regime of reserve requirements or voluntary reserve targets. Under a floor system, the supply of reserve balances would be substantial enough to ensure the federal funds rate traded near the interest rate paid on reserves, and so the Federal Reserve would likely be operating with higher levels of aggregate reserves than under a corridor system. It is very difficult to know what level of reserve balances would keep the funds rate close to the target in a floor system. As a point of reference, prior to the crisis, excess reserve levels of only a few billion dollars could easily push the funds rate close to zero at the end of the maintenance period. Although banks may now wish to hold much higher levels of excess reserves than in the past, it seems likely that the level of reserve balances required to keep the funds rate close to the target in a floor system could be on the order of \$100 to \$500 billion. And, of course, the Federal Reserve could operate with higher levels of reserve balances under a floor system if desired.

### *Operating Costs*

Under a corridor framework, depository institutions would still incur costs associated with managing their reserve positions to conform to any requirements and to avoid the costs associated with being reserve deficient or holding unwanted excess reserves. Moreover, a system with requirements or reserve targets could entail significant administrative costs for the Federal Reserve, particularly if it continued to include features such as multi-day maintenance periods, carryover and asof adjustments. However, a new corridor operating framework could be designed to reduce these burdens from current levels.<sup>12</sup> A new system of reserve requirements or voluntary targets within a corridor framework could also reduce the frequency of fine-tuning open market operations below historical levels, assuming it were designed to provide banks more flexibility to manage their daily reserve positions than our current system of reserve requirements allows. A corridor system with no reserve requirements or voluntary targets would eliminate all these administrative costs, but likely would require frequent adjustments in the supply of reserve balances to keep the interbank rate close to the target.

A floor system in its simplest form would involve few operating costs. Depository institutions would not need to worry about meeting any sort of requirement over defined maintenance periods, and the Federal Reserve's role in managing such a system would likely be less complicated than for a corridor system based on requirements and a multi-day maintenance period. Moreover, a floor system would reduce the frequency of "fine tuning" open market operations of the type the Federal Reserve frequently employed in the past to offset the impact on the federal funds rate of even relatively small-scale, transitory shocks to reserve supply or demand. Periodic use of open market operations would still be required to ensure that reserve levels remained within the relatively elastic range of the reserve demand schedule.

### *Control over the Federal Funds Rate*

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<sup>12</sup> Reserve requirement simplification efforts currently underway are discussed in Appendix C.

Corridor frameworks have generally been effective in maintaining overnight market rates close to the levels desired by policymakers. Even the pre-crisis framework used by the Federal Reserve, which was hampered by an inability to remunerate reserve balances, was generally effective in keeping the federal funds rate close to its target level “on average.” At times in the past, rates could be volatile around the average in the face of reserve supply and demand shocks, with stigma associated with borrowing from the discount window being a contributing factor. The Federal Reserve could undoubtedly revise its reserve requirements and use authority to pay interest on reserves to design a new corridor framework that would be even more effective in limiting this kind of rate volatility. Use of maintenance period averaging systems, however, can introduce complications for rate control when money market participants see the rate target as likely to change within a maintenance period, because such expectations can severely skew the demand for reserves within that period.

The relatively few central banks that have adopted floor type frameworks also have been generally satisfied with their effectiveness in keeping market rates close to the desired level.<sup>13</sup> Our understanding of how floor type systems are designed to operate suggests that short-term rate volatility arising from transient reserve supply and demand swings should be fairly muted. Our experience since 2008 supports this view, although interest rates close to the zero bound and exceptionally high levels of balances have undoubtedly also been factors. Perhaps most importantly for the Federal Reserve, we have not observed the relationship between the interest rate paid on reserves and the federal funds rate at levels of reserves close to what we would expect to prevail in more normal circumstances. In particular, with the level of reserves very high, market rates have fallen well below the rate we pay on reserves, a result not generally experienced by other central banks with floor systems. However, we expect to gain considerable insights into these relationships as the Federal Reserve exits the period of extraordinary monetary accommodation and gradually reduces the size of its balance sheet and the level of reserves.

#### *Adaptability to extraordinary circumstances*

Floor systems should in principle provide scope to adjust the level of reserves over a broader range than corridor systems in response to extraordinary circumstances, while still maintaining normal procedures for controlling the level of short term interest rates. It is this advantage of a floor framework that prompted the Bank of England and the ECB to effectively jettison their corridor frameworks in 2008-2009. That said, having a corridor system in place proved to be no real impediment to quickly shifting to a floor-type system to respond to exigent circumstances that called for an expanded balance sheet.<sup>14</sup> In the wake of the financial crisis, further study would be needed regarding how a corridor framework should be structured to provide desired flexibility while still controlling the level of short term market rates.

#### *Implications for functioning of money markets and payments systems*

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<sup>13</sup> As part of their floor frameworks, the Reserve Bank of New Zealand and the Norges Bank have either imposed or are planning to impose an upper bound on the level of reserves remunerated at the policy rate that an individual bank may hold, with any additional balances held earning a lower rate.

<sup>14</sup> So far, none has reverted to their pre-crisis framework, so we do not know what hurdles might be encountered in returning to a corridor type operating framework after temporarily abandoning it.

As noted above, a floor system would likely give greater scope to maintain a somewhat higher level of reserves under ordinary circumstances than a corridor framework, which could improve somewhat the settlement and clearing of payments. The experience in payments systems since 2008, which is discussed below, provides some support for this view. However, the level of reserves under a floor system would likely be far lower than current levels, and at least some of the benefits that might be associated with maintaining higher reserve levels might be captured in any event by the recently implemented changes in the payment system framework. With these changes, banks in sound financial condition have access to free collateralized daylight credit from the Federal Reserve, so the value of large end-of-day reserve balances as a means of reducing daylight overdrafts may be lower than in the past.

Some central banks that have experienced substantial increases in excess reserves since the onset of the crisis, including the Federal Reserve, have also seen substantial declines in the level of interbank trading activity in overnight markets. However, trading activity involving nonbanking institutions, which account for much of the activity in U.S. overnight bank funding and other financing markets, does not seem to have been directly affected by even the current exceptionally large levels of reserves. We would expect more interbank trading in a normal operating environment with a level of reserves well below current levels.<sup>15</sup>

### **III. Experience Since 2008**

Since late 2008, the Federal Reserve's asset purchase programs have led to extraordinarily high levels of reserves in the United States. These levels are far above the amounts we would associate with a floor system that has as its objective maintaining the federal funds rate at a target level near the interest rate paid on excess reserves. Nonetheless, the recent experience may provide some insight into how a floor system might function.<sup>16</sup>

While the interest rate paid on reserves has effectively set a floor on rates at which banks are willing to lend overnight, experience since late 2008 demonstrates that nonbank firms may still have to lend at rates below the interest rate paid on reserves, as they are not eligible to earn interest by holding reserves.<sup>17</sup> Banks can potentially earn profits by borrowing at rates below the interest rate they earn holding excess reserves, and competition for those profits should pull overnight market rates nearer to the rate paid on excess. However, since 2008, limits to arbitrage have resulted in market rates typically being in a range of 10 to 15 basis points below the rate paid on excess reserves.<sup>18</sup> Moreover, the degree to which the federal funds rate has fallen below

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<sup>15</sup> Examining the relationship between the level of reserves and the value of fed funds traded, both call report and Fedwire-derived estimates suggest that the amount of fed funds traded did not decrease rapidly with the injection of reserves until more than \$500 billion of reserves was outstanding.

<sup>16</sup> While historical reserve requirement and maintenance period reserve accounting rules have been maintained, they have had essentially no impact on the behavior of market rates.

<sup>17</sup> This includes banks borrowing from GSEs and securities dealers in the federal funds market and from money market funds and other institutional lenders in Eurodollars, and securities dealers borrowing in repo markets.

<sup>18</sup> Limits to arbitrage could arise from several sources. First, lending federal funds or Eurodollars is not a risk-free transaction, and GSEs and other lenders in these markets have reduced the number of their counterparty banks since late 2008. Imperfect competition by banks that are eligible to purchase funds from the GSEs and others could also explain the existence imperfect arbitrage. In addition, banks may

the interest rate on excess reserves may have been limited by the zero bound. The recent change in the assessment base for deposit insurance premiums seems to have created another impediment to arbitrage that has put additional downward pressure on the funds rate relative to the IOER rate.

The experience since late 2008 suggests that the reserve demand schedule is quite flat, although with slight downward slope, even at levels of reserves much lower than current levels. The average spread between the interest rate paid on reserves and the federal funds rate has been only slightly sensitive to even large movements in aggregate reserve levels, and short-term rate volatility has been exceptionally low compared to pre-crisis experience, characteristics we would expect in a floor framework.<sup>19</sup>

The current regime of high reserve balances has caused a substantial decrease in daylight overdrafts extended by the Federal Reserve and a significant quickening of the settlement of Fedwire payments during the day relative to the prior period.<sup>20</sup> Most models suggest that payments quickened because of the high levels of reserves. The decrease in daylight overdrafts has reduced credit risk for the consolidated public sector, and underscores one benefit of having an operating regime that allows for higher levels of reserves than otherwise.<sup>21</sup> However, it remains to be seen whether these effects would be observed in a floor system with a level of reserve balances much lower than that at present.

#### **IV. Factors that May Influence Reserves Demand and Supply**

A number of structural factors are expected to affect reserve demand and supply in the future. The net effect of these changes on the level and elasticity of reserve demand or supply is difficult to gauge, as is how they might influence the Committee's ultimate choice of a long-run policy implementation framework. But their effects are seen as potentially having implications for that decision. Much of the uncertainty surrounding these effects is expected to be resolved in the next year or two.

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face high capital costs when expanding their balance sheet by acquiring federal funds, even if regulatory capital constraints are not strictly binding. And banks may also be concerned about the implications of sizable levels of overnight federal funds liabilities on various measures of bank liquidity. Finally, some banks, especially foreign banking organizations, report a reluctance to engage in this arbitrage for fear that regulatory authorities might find the attempt to earn additional interest on reserves an undesirable activity for the bank.

<sup>19</sup> Undoubtedly, operating near the zero bound has also contributed to reduced rate volatility.

<sup>20</sup> Using regression analysis, FRBNY staff finds that the changes in reserve balances explain a significant amount of the speed-up in payments in the period since November 2008.

<sup>21</sup> Under the current Payment System Risk policy of largely collateralized overdrafts, credit risk exposure of the Federal Reserve Banks is reduced. But the credit risk for the consolidated public sector may not be reduced as the Federal Deposit Insurance Corporation, which is liable for payouts to a failed institution's insured depositors, could as a result have claim on less collateral at failed banks. Hence, reducing daylight overdrafts, even if collateralized, reduces the public sector's overall risk exposure. Prior to March 2011, the Federal Reserve offered priced, uncollateralized daylight credit to banks, within overall limits.



An important regulatory development that may affect the demand for reserves is the liquidity coverage ratio (LCR) envisioned under the Basel III framework. Under the LCR, banks will be required to hold liquid assets equal to or greater than their potential liquidity needs in a stress scenario. Interest-earning reserves may be an attractive asset to hold for this purpose. This incentive may be particularly high under a floor-type system in which banks can hold sizable levels of reserve balances that are remunerated at close to a market rate.

The Dodd-Frank Act includes a provision that repeals the statutory limitations of the payment of interest on demand deposits. As a result, the Board's Regulation Q will be eliminated as of July of this year. The market effects of this change are uncertain at this point. The Board published a Federal Register notice that included some questions about the effects of the elimination of Regulation Q on bank balance sheet management. Some aspects of the change could reduce demand deposits (and therefore required reserves); for example, if banks no longer thought it was necessary to offer compensating balance arrangements to their customers, the level of demand deposits could fall. On the other hand, banks could use interest-bearing demand deposits to compete more aggressively for short-term funding with money funds and nonbank issuers of overnight RPs, Eurodollars, and other short-term investments.

The Dodd-Frank Act also includes a provision that makes the Federal Reserve the primary federal regulator for financial market utilities (FMUs) that are designated as systemically important by the Financial Stability Oversight Council. Utilities designated as systemically important may then be eligible to establish accounts at the Federal Reserve and to earn interest on balances maintained in those accounts. Access to Federal Reserve accounts by designated FMUs should boost the demand for reserve balances. Such balances could be utilized by FMUs, for example, as a short-term investment of balances maintained in margin accounts and also as an investment vehicle for funds held to meet potential liquidity needs. Indeed, a number of FMUs are reportedly studying how reserve balances could be incorporated into their overall business plans.

GSE reform efforts could have an impact on the activities of these institutions in short-term financing markets, such as federal funds and repo markets. A significant change in their participation could affect interest rate dynamics in these markets.

The Federal Reserve recently implemented a change in its Payment System Risk policy to allow banks to access free collateralized daylight credit from the Federal Reserve. Given the extraordinarily high level of reserve balances at present, it is difficult to anticipate exactly how this change will affect reserve demand in the longer-run. Under the previous daylight credit regime, banks may have wished to hold some end-of-day reserve balances as a way of reducing daylight overdraft charges on the subsequent day. This sort of precautionary motive for holding end-of-day reserve balances would presumably be lessened by the change in PSR policy. Potentially working in the opposite direction, triparty reform efforts that create a single, late afternoon settlement time for all triparty repo transactions could prompt investors that need funds early in the day to leave more balances uninvested overnight ahead of those occasions.

Effective April 1, the Federal Deposit Insurance Corporation revised the rules governing its deposit insurance assessments. The new insurance assessment base for domestic institutions was

changed from deposit liabilities to assets minus tangible equity, and the insurance assessment rates for insured depository institutions (IDIs) were adjusted. The expanded assessment base now includes reserve balances that IDIs hold at the Federal Reserve. This change has already increased the spread between the interest rate paid on reserves and overnight market rates and decreased the level of arbitrage activity of some banks. The magnitude of the longer-run effect on spreads and arbitrage is uncertain.

Recent Federal Reserve disclosures of discount window borrowing, coupled with Dodd-Frank requirements for the ongoing disclosure of information about discount window borrowing, suggests that banks may be far more reluctant to utilize the discount window in the future than they were in the past. A marked increase in the reluctance of banks to utilize the discount window would mean that the primary credit rate would become an even less effective ceiling on the federal funds rate.

## **V. Transition to the Long Run Framework**

The Committee will ultimately need to decide whether it wishes to implement monetary policy using some type of corridor system or a floor system. A key question in this regard is how effective the interest rate on reserves would be in anchoring the level of short-term interest rates under a floor framework. It seems very likely that the Committee will learn a great deal about the efficacy of such a framework during the exit period from the current highly accommodative stance of policy, as the federal funds rate target is likely to rise before the balance sheet of the Federal Reserve is fully normalized and reserves fall to levels expected in a normal operating environment. Moreover, some of the uncertainty regarding the various demand and supply factors discussed above may be resolved during the exit period. As a result, the Committee might conclude that it would not be prudent to commit to a particular long-run implementation framework until it has made significant progress on exit, at which time the Federal Reserve could transition to any of the new operating frameworks.

## Appendix A: Legislative Language

### Extract from Financial Services Regulatory Relief Act of 2006

## TITLE II—MONETARY POLICY PROVISIONS

### SEC. 201. AUTHORIZATION FOR THE FEDERAL RESERVE TO PAY INTEREST ON RESERVES.

(a) IN GENERAL.—Section 19(b) of the Federal Reserve Act (12 U.S.C. 461(b)) is amended by adding at the end the following:

“(12) EARNINGS ON BALANCES.—

“(A) IN GENERAL.—Balances maintained at a Federal Reserve bank by or on behalf of a depository institution may receive earnings to be paid by the Federal Reserve bank at least once each calendar quarter, at a rate or rates not to exceed the general level of short-term interest rates.

“(B) REGULATIONS RELATING TO PAYMENTS AND DISTRIBUTIONS.—The Board may prescribe regulations concerning—

“(i) the payment of earnings in accordance with this paragraph;

“(ii) the distribution of such earnings to the depository institutions which maintain balances at such banks, or on whose behalf such balances are maintained; and

“(iii) the responsibilities of depository institutions, Federal Home Loan Banks, and the National Credit Union Administration Central Liquidity Facility with respect to the crediting and distribution of earnings attributable to balances maintained, in accordance with subsection (c)(1)(A), in a Federal Reserve bank by any such entity on behalf of depository institutions.

“(C) DEPOSITORY INSTITUTIONS DEFINED.—For purposes of this paragraph, the term ‘depository institution’, in addition to the institutions described in paragraph (1)(A), includes any trust company, corporation organized under section 25A or having an agreement with the Board under section 25, or any branch or agency of a foreign bank (as defined in section 1(b) of the International Banking Act of 1978).”.

(b) CONFORMING AMENDMENT.—Section 19 of the Federal Reserve Act (12 U.S.C. 461) is amended—

(1) in subsection (b)(4)—

(A) by striking subparagraph (C); and

(B) by redesignating subparagraphs (D) and (E) as subparagraphs (C) and (D), respectively; and

(2) in subsection (c)(1)(A), by striking “subsection (b)(4)(C)” and inserting “subsection (b)”.

**SEC. 202. INCREASED FLEXIBILITY FOR THE FEDERAL RESERVE BOARD TO ESTABLISH RESERVE REQUIREMENTS.**

Section 19(b)(2)(A) of the Federal Reserve Act (12 U.S.C. 461(b)(2)(A)) is amended—

(1) in clause (i), by striking “the ratio of 3 per centum” and inserting “a ratio of not greater than 3 percent (and which may be zero)”; and

(2) in clause (ii), by striking “and not less than 8 per centum,” and inserting “(and which may be zero),”.

**SEC. 203. EFFECTIVE DATE.**

12 USC 461 note.

The amendments made by this title shall take effect October 1, 2011.

Extract from Emergency Economic Stabilization Act of 2008

**SEC. 128. ACCELERATION OF EFFECTIVE DATE.**

Section 203 of the Financial Services Regulatory Relief Act of 2006 (12 U.S.C. 461 note) is amended by striking “October 1, 2011” and inserting “October 1, 2008”.

## **Appendix B: Experiences of Other Central Banks:**

Other central banks have altered their implementation of interest rate policy during the crisis. Here we briefly review the experiences of the European Central Bank (ECB), the Bank of England (BoE), and the Bank of Canada since late 2008.

### *The European Central Bank's experience*

Before the crisis, the ECB operated a corridor system with a deposit rate 100 basis points below the level of the minimum bid rate in the ECB's "main refinancing operations" (the MRO rate), which is the ECB's key policy rate, and a marginal lending facility rate 100 basis points above the MRO rate. The ECB generates a large demand for reserves by requiring banks to hold reserves against all of their short-term liabilities. The ECB makes the demand elastic by allowing banks to meet their reserve requirements on average over a month-long reserve maintenance period and by paying interest on required reserves at the minimum bid rate in the MROs; excess reserves do not earn interest unless banks place them in the ECB's deposit facility. Typically, prior to the crisis, the "Euro Overnight Index Average," or EONIA, rate, the effective one-day interbank rate in the Euro zone, was very close to the minimum bid rate in the ECB's MROs. The ECB maintained very low levels of excess reserve balances, generally in the €0.5 to 1.0 billion range.

During the crisis, the ECB responded to intense demands for term funding by greatly expanding financing provided through open market operations. It enacted numerous changes in its refinancing procedures in October 2008 and again in June 2009. In particular, it offered full allotment, fixed-rate refinancing operations, expanded the list of assets banks were eligible to use as collateral, lengthened the maturity of their refinancing operations, and initiated a €60 billion government bond purchase program. It also narrowed the corridor by placing the deposit rate and the marginal lending facility rate 75 basis points away from the minimum bid rate in the MRO, rather than 100 basis points as in normal times. Especially starting in June 2009 when the ECB held a one-year, fixed rate, full allotment tender, banks began using the deposit facility in large amounts (excess reserves varied over the course of the last 18 months from €60 to 180 billion). Coincident with the large use of the deposit facility, the EONIA rate fell to slightly above the deposit facility interest rate. In summary, although there are various complications to the system, the ECB moved from its corridor system, which had low excess reserves and market rates centered in the middle of the corridor, to an effective floor system with market rates stabilizing at a small spread, roughly 10 basis points, above the bottom of the corridor.

### *The Bank of England's experience*

In 2006, the BoE adopted a new operational framework for its implementation of monetary policy. The framework was based on banks receiving interest on voluntarily targeted reserves, symmetric borrowing and lending facilities, and open market operations. Each bank chose its own reserve target in advance of each monthly maintenance period. To the extent that a bank's average reserves during the maintenance period were within a symmetric range (i.e., tolerance band) of two percent around the bank's chosen target, the bank would receive interest on its reserves at the "bank rate," which is the BoE's policy interest rate. Any amount of reserves held

by a bank greater than two percent above its target received zero interest. Any shortfall of reserves larger than two percent below its target was charged the bank rate.

During the maintenance periods of September 2007 and March, September and October 2008, the BoE took the nonstandard step of increasing the aggregate reserves it supplied in lending auctions during the middle of the period. To allow banks to accommodate the increases in reserves, BoE increased the range for which reserves received remuneration around banks' targets to 20-60 percent during these four maintenance periods. In addition, for each maintenance period after September 2007, the range around banks' targets for which reserves received remuneration was a minimum of 20 percent. The main reasons for the additional reserves and higher ranges were a sudden increase in precautionary demand for reserves, frictions to borrowing in the interbank market, and accommodating what the BoE called market stigma associated with the standing lending facility.

The BoE engaged in substantial quantitative easing during the later stages of the crisis, expanding its balance sheet from slightly below £100 billion to a height of approximately £250 billion. Nonetheless, market interest rates remained quite close to, though somewhat below, the BoE's bank rate.

#### *The Bank of Canada's experience*

The Bank of Canada is an example of a central bank that operates a corridor system with no reserve requirements, with a single-day reserve maintenance period, and with a very low level of balances. It sets a relatively narrow corridor between its lending and borrowing rates to help reduce the volatility of market rates. In addition, the Bank of Canada typically adjusts the supply of reserve balances every business day, sometimes twice per day. In contrast to the experience of the ECB and Bank of England, the Bank of Canada was able to maintain its corridor system during the financial crisis, perhaps because it did not find it necessary to implement policies that resulted in an extraordinary increase in the level of reserve balances.

### **Appendix C: Reserve Requirements Simplification**

The staff is in the process of rewriting the current automated system that supports the existing system of reserve requirements. The existing system is complex and many key members of the programming staff that supports the system are nearing retirement. The new automated system is being designed so that it can support a system based on reserve requirements, if desired, as well as a wide range of other monetary policy implementation frameworks that the Committee might choose (including all of those discussed in this memorandum).

As part of this overall effort, several simplifications of the existing reserve requirements and reserve administration have been proposed. These simplifications would have little overall impact on the monetary policy framework, but would greatly reduce the complexity and operational burden associated with the current system. The proposed technical changes include eliminating several aspects of the current system, including carryover, as-of adjustments, the required clearing balance program, and waivers for penalties for reserve deficiencies. In addition, all depository institutions would have identical maintenance periods.

The Federal Reserve's authority to pay interest on reserves undercuts the original rationale for many of the features included in the simplification. Carryover, for example, was intended as a way of providing banks some flexibility in meeting reserve requirements and as a way to damp volatility in the federal funds rate. But these same objectives can now be achieved more simply by allowing banks to meet reserve requirements within a narrow band along with the payment of interest on excess reserve balances. Similarly, the possibility of making explicit interest payments obviates the need for as-of adjustments and required clearing balances.

Proposed changes along these lines will be published in a Federal Register notice this summer. The development schedule for the new system is aggressive, so there is some potential for slippage. At present, however, the business requirements for the new application are complete and System staff are ready to oversee the development and testing of the new system. The new system is planned for completion in early 2012.