

July 8, 2016

## **The Foreign Experience with Monetary Policy Implementation<sup>1</sup>**

### ***I. Executive Summary***

- Nearly all advanced economy central banks have implemented monetary policy with short term interest rate targets; other aspects of their policy implementation regimes vary widely, largely due to central banks' particular environments and institutional history.<sup>2</sup> Even so, all of the central banks studied seem to have control over the level of short-term interest rates and have been able to transmit policy effectively to longer dated yields. During the crisis, the generally effective outcomes reflected, in part, actions taken to respond to interest rate pressures, many of which were outside of existing frameworks. More recently, many central banks have operated with large balance sheets as a result of large scale asset purchase programs, and most feel that they have nonetheless been able to effectively control short-term rates.
- Advanced economy central banks have generally implemented one of two main types of monetary policy operating regimes. In corridor regimes, central banks maintain reserves at a level approximately equal to the demand for reserves at the target rate, and use lending and deposit facilities (or interest on reserves) to create a ceiling and floor to the corridor. In floor regimes, excess reserves are supplied so that rates trade near the rate of interest that the central bank pays on deposits or reserves.
- In recent years, central banks have changed policies for reserve requirements and reserve remuneration, softening some of the conceptual distinctions between corridor and floor regimes. Some countries have implemented tiered remuneration on reserves—applying

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<sup>2</sup> This study surveys the experience of 9 advanced foreign economy (AFE) central banks as well as some information from 4 emerging market economy (EME) central banks. The 9 AFE central banks are the Reserve Bank of Australia, Bank of Canada, Bank of England, European Central Bank, Bank of Japan, Reserve Bank of New Zealand, Norges Bank, Swedish Riksbank, and the Swiss National Bank. The 4 EME central banks are from Brazil, Mexico, Poland, and South Korea. The Foreign Experience workgroup prepared background papers that provide detailed studies of each AFE central bank's monetary policy implementation framework and a survey of the EME central banks.

lower rates of remuneration on reserves exceeding certain thresholds—to encourage interbank trading, which tends to decline in floor regimes, and to limit reserve hoarding behaviors. In the context of a corridor regime, the Bank of England (BOE) implemented a voluntary reserves target scheme that allowed banks to choose individual targets for reserves, reducing some of the costs associated with reserve requirements. In both cases, banks have significant choice in the level of reserves that they hold, but are remunerated at lower-than-market rates for reserves in excess of a threshold or target.

- Money market trading in floor and quota systems is of a somewhat different character than in corridor systems. Within quota systems and some floor systems, activity largely represents arbitrage to the remuneration rate, where account holders borrow from other institutions that face a lower remuneration rate in order to earn the spread.<sup>3</sup> In contrast, market activity in corridors and voluntary target regimes has a greater component of trading between account holders to meet requirements.
- Central banks significantly increased the scope of liquidity provision during the financial crisis by adding counterparties, accepting a wider range of collateral and introducing full-allotment or longer tenor operations. Many central banks expect to retain broad counterparties and collateral to ensure that they can implement policy effectively in stressed market conditions. These will be implemented either within their longer-run framework or by keeping ready facilities.
- Some central banks recognize liquidity insurance—the readiness to provide broad-based liquidity in the case of a market shock—as an explicit objective of the central bank. They see this as distinct from both monetary policy implementation and emergency lending to a specific institution, and they also explicitly indicate which central bank operations have been developed for this purpose. For others, central bank operations fulfill both policy implementation and liquidity insurance roles. Ex ante clarity about general principles and terms governing liquidity insurance is viewed by some central banks as limiting contagion during stress events. However, others prefer some ambiguity, and even central banks that provide more clarity leave some discretion about the circumstances under which these operations would be actively used.

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<sup>3</sup> For floor systems that provide access to central bank operations and remuneration to nearly all market participants, money market activity declines.

- Most central banks noted that future operating regimes should incorporate the flexibility to provide accommodation at the effective lower bound, given the expected generally lower level of policy rates going forward. Indeed, many central banks have implemented policies of this type, including large scale asset purchases, long term funding programs and negative policy rates.<sup>4</sup> These programs have been perceived as effective, although some central banks feel that there may be diminishing returns or increasing costs beyond some point. For negative rates, in particular, central banks are still learning about the overall effectiveness and impact on markets, as the policies are still relatively new.
- Central banks hold diverse views about the appropriate size and composition of their balance sheets in the long run, although they generally expect that the choice of operating regime and collateral policies would have the largest influence over the decisions. Some noted that the exceptionally large balance sheets that result from asset purchases can complicate relationships with the fiscal authorities.
- Central banks are still learning about the effects of regulation on money markets and are somewhat divided about how to respond. Most central banks note that, in the new regulatory environment, there will be an increased demand for high quality liquid assets (HQLA). In response, some central banks are developing facilities to help banks meet this demand, while others are structuring their operating regimes to discourage reliance on the central bank for HQLA. Some are also limiting their open market operation (OMO) collateral to tier 1 HQLA in order to moderate the influence of the regulation on monetary policy operations. Some central banks have already seen reduced market liquidity, which some market participants have attributed to higher balance sheet costs at banks.

## ***II. Operating Regimes***

Central banks have implemented monetary policy with a variety of operating regimes. Below we generalize these operating regimes by describing them in the broad categories of corridor and floor frameworks (Exhibit 1). We define corridors as operating regimes in which the central bank maintains reserves at a level approximately equal to the demand for reserves at the desired

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<sup>4</sup> Central banks also used forward guidance about the stance of policy to further accommodation, although this tool is outside the scope of this study.

target rate, with lending and deposit (or interest on reserve) rates to create a band around the target. Corridors are further categorized into regimes that operate with a structural deficiency, where the reserve balances of banks prior to central bank operations are at a deficit relative to demand, and regimes that operate at a structural surplus, where the initial reserve balances of banks are in excess of the requirements or targets.

We define floors as operating regimes where excess reserves are supplied in sufficient abundance that rates trade near a deposit or interest on reserves level. Floors are further distinguished as “liability-driven” or “asset-driven.” We characterized floors as “asset-driven” when reserve accumulation was the result of large scale asset purchase programs and/or large long term financing programs, the objectives of which were to reduce long term rates or bank financing costs, rather than to maintain short term rates near an interest on reserves level. In this type of regime, excess reserves often rise significantly beyond what is needed to achieve a floor. We viewed this framework as distinct from more traditional “liability-driven” floors, in which reserves are abundantly supplied through temporary open market operations (OMOs) to achieve an interest rate objective.

The variation of central banks’ implementation frameworks has been influenced by features of their environments, most notably market structure and market liquidity, as well as payment systems infrastructure and innovation in financial markets (Exhibit 2). In addition, the historical structure of the central bank, including its legal underpinnings and political economy environment, can have a strong influence on choice of framework. More recently, the global financial crisis shaped monetary policy implementation frameworks, as central banks expanded balance sheets to provide additional accommodation or, in the case of the Swiss National Bank (SNB), to limit currency appreciation.

**Structural Deficit Corridors:** Only three central banks—the Reserve Bank of Australia (RBA), the Bank of Canada (BOC), and the Riksbank—currently operate corridor frameworks. Within this group, the RBA and BOC have maintained narrow corridors with zero or no reserve

requirements since prior to the financial crisis.<sup>5</sup> These central banks conduct frequent operations, often multiple times a day, to ensure that rates stay within the desired ranges. Both of these central banks operate in countries that have a small number of banks, which simplifies daily reallocations of settlement balances among the banks. Indeed, established relationships among the banks, including conventions that have arisen between market participants, mean that banks trade reserves close to the policy rate, even when they do not need to. This allows the central banks to have systems with near zero clearing balances at the end of each day.

In general, these central banks appear to favor small balance sheets, even with the associated high frequency of operations. However, the shift to after-hours settlement has modified the RBA's choice, and it now operates a system with some excess reserves to accommodate settlement needs during off hours when the RBA does not provide intraday credit.<sup>6</sup>

**Structural Surplus Corridors:** The Riksbank also operates with a corridor. However, with a large, asset-driven balance sheet and associated high levels of excess reserves, the Riksbank drains liquidity by providing weekly central bank bills in a fixed rate full-allotment process and offering a deposit rate below the bill rate to implement the corridor. Three of the four EME central banks studied also operate with large balance sheets and corridor frameworks, and remove liquidity via bills, bonds, long term deposits, or OMOs. For most of these central banks the larger balance sheets resulted from asset purchases of bonds or foreign currency. (See below.)

**Liability-Driven Floors:** The Reserve Bank of New Zealand (RBNZ) and Norges Bank operated liability-driven floor systems prior to the crisis, although both of these countries have modified their floor frameworks in recent years to include features that limit growth in their balance sheets. The RBNZ decided to “cash up” their payment system—providing abundant reserves to banks—because there was not sufficient high quality collateral to secure daylight

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<sup>5</sup> During 2009 and 2010, the BOC transitioned temporarily to a floor framework as excess reserves were supplied to the banking system in response to financial market stress.

<sup>6</sup> In Australia, retail payments clear 23.5 hours per day, and banks require balances for clearing after wholesale markets are closed. See Sascha Fraser and Adriane Gatty, “The Introduction of Same-day Settlement of Direct-Entry Obligations in Australia,” Reserve Bank of Australia. *Bulletin*, June Quarter 2014.

overdrafts in their system, which caused delayed payments, and differences in overnight rates across markets. Norway chose a floor system because the volatility of government balances at the central bank made it difficult to forecast reserve supply. Both central banks subsequently implemented tiered remuneration policies, where the rate paid on reserves above a threshold is lower. This is intended to foster an active interbank market and create a more efficient distribution of reserves. Therefore, their balance sheets only grow as large as needed to maintain rates at desired levels.

**Asset-Driven Floors:** Before the crisis, the majority of central banks in larger economies used a corridor system. But currently many central banks—the BOE, European Central Bank (ECB), Bank of Japan (BOJ), SNB, and Federal Reserve—have de facto “asset-driven” floor systems as a result of large scale asset purchase policies and/or foreign exchange accumulation. More recently, the SNB and BOJ implemented tiered remuneration in the context of negative rate regimes and therefore operate a type of quota system. Many of these central banks indicate a desire to return to a smaller balance sheet in the future, even if they maintain a floor or quota system.<sup>7</sup>

**Other considerations:** In most cases, central bank legal frameworks provide a significant degree of flexibility in designing monetary policy implementation. However, in a few cases, details of central banks’ operating regimes are dictated by their legal frameworks. For instance, the BOC cannot, in most cases, take mortgages as collateral. The Norges Bank is not able to conduct outright purchases because of legal limitations.

But the operating regimes can also be influenced by political considerations even if these are not specified by law. Although operating with negative capital is not an economic or technical constraint for central banks, it does appear to shape some central banks’ choices such that they, in some cases, limit the risk of losses—shying away from outright holdings or large foreign exchange purchases and trying to reduce exposure to counterparties. This may reflect in part that in some cases central bank balance sheets are consolidated with the general government’s

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<sup>7</sup> For the SNB, their large foreign exchange holdings will make it more difficult to return to a smaller balance sheet, as they would have to sell Swiss francs in large quantities, which would have implications for the exchange rate.

balance sheet for reporting purposes. Another example is that the ECB faced some political constraints in buying sovereign debt. But in no cases have these considerations appeared to impede the implementation of policy or other objectives.

### **III. Interest Rate Targets**

Central banks generally communicate the stance of policy using a short term interest rate, but they differ in types of policy rates (Exhibit 3). Some central banks, like the SNB, BOC and RBA, communicate the stance of policy using a target for a market rate. Others use an administered policy rate, such as a central bank deposit rate (Norges Bank, BOJ, BOE, ECB<sup>8</sup>, RBNZ), or repo facility rate (Riksbank). Central banks targeting a market rate suggested that such an approach makes clear which money market the central bank primarily is seeking to influence and where it wants that market rate to be. Central banks using administered rates feel they provide a clearer signal of policy because the central bank has full control over the communicated rate. However, policy rates may confuse communications either when using a market target if the central bank consistently misses or when using an administered rate if market rates depart too much from it.<sup>9</sup> Some central banks also described using an administered rate because the relevant markets are illiquid, and calculation of a representative effective market rate would be difficult.

Most central banks using administered rates still make implicit or explicit reference to a market rate. Some central banks, such as the ECB and Riksbank, have administered rates with no explicit corresponding market rate as an operational target.<sup>10</sup> Not having an official operational target rate gives central banks greater latitude to ignore transitory shifts in any particular market rate and allows the central banks more easily to shift attention to other markets if they become more relevant.

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<sup>8</sup> The ECB has primarily used its Main Refinancing Operation (MRO) to communicate policy, but has shifted emphasis to the deposit rate as the crisis developed. It fully acknowledged the deposit rate as the “driver of our monetary policy” in December 2015.

<sup>9</sup> In particular, consistent misses in one direction can be perceived as tacit easing or tightening. EME central banks, in particular, can face the perception of weakening resolve in the stated objective if there are biased misses.

<sup>10</sup> Even so, ECB communications refer most often to EONIA, an index of overnight unsecured market rates.

Most central banks' explicit or implicit targets are for an uncollateralized market rate. However, central banks in Canada and New Zealand focus on collateralized markets because they have or had limited uncollateralized overnight money markets.<sup>11</sup> Most uncollateralized market rates are effectively interbank rates because wholesale market participants in many countries are mostly bank entities; however, the overnight call rate in Japan and the SONIA rate in the United Kingdom represent broader uncollateralized activity.<sup>12</sup>

Most central banks have policy rates with overnight maturities, although the Riksbank and ECB have used administered rates with a seven-day maturity.<sup>13</sup> The SNB is an exception, as it maintains a target range for the three-month Swiss franc LIBOR, in part because it feels that this rate is more economically relevant than an overnight rate. Although a longer maturity may be more relevant to economic activity, it also may be more difficult to control because factors outside of the central banks' direct influence, such as expectations for future policy or term premia, may regularly play a role in determining the rate. However, both before and during most of the crisis the SNB appeared to be able to keep 3-month Swiss franc LIBOR close to the center of its target range.<sup>14,15</sup> Most central banks have "point" targets, rather than ranges for the policy rate.

Starting in mid-2007, most central banks had difficulty keeping market interest rates close to target, because of steps taken during the crisis that expanded reserves and pushed rates to the lower end of the central banks' corridors. The ECB shifted emphasis from its main refinancing rate to its deposit rate, as the overnight interest rate, EONIA, declined.<sup>16</sup> And in several cases, the communication of policy shifted from a policy rate to other measures, such as large-scale

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<sup>11</sup> Historically, the BOE has also paid some attention to collateralized rates.

<sup>12</sup> SONIA tries to capture as much as 90 percent of all unsecured overnight transactions in sterling brokered by members of the Wholesale Market Brokers' Association.

<sup>13</sup> Sweden, which uses an administered rate to communicate policy, does not have observable market overnight rates as of yet, but rather has a next day rate.

<sup>14</sup> Since the SNB focused implementation on keeping the 3-month LIBOR rate within its target range, shorter-term money market rates were allowed to fluctuate. In fact, under this framework, the SNB could lower rates on its one-week to offset any increased risk and liquidity premia, and did so during the crisis to maintain its target.

<sup>15</sup> Marlene Amstad and Antoine Martin, "Monetary Policy Implementation: Common Goals but Different Practices," Federal Reserve Bank of New York, *Current Issues in Economics and Finance*, 2011.

<sup>16</sup> During the crisis, the BOE also began paying interest on all reserves at Bank rate, effectively moving to an interest on reserve target.



asset purchase, or in the case of the SNB, a floor for the exchange rate.

#### ***IV. Evidence Regarding Interest Rate Control***

Despite the wide variety of implementation practices, central banks appear to be able to execute monetary policy effectively. Empirical work suggests that most central banks have reasonable control over short-term rates and changes in the stance of policy are generally transmitted effectively to longer-term interest rates and overall financial conditions.<sup>17</sup> First, Table 1 in Exhibit 4 shows that, before the crisis, the volatility of the difference between policy rates and the most comparable overnight or short-term market rate appears to have been modest across central banks. Volatility was lowest in Australia and Canada, which have systems with “tight corridors” and few banks, but not much higher in many other economies. The volatility associated with the BOE’s pre-2006 framework was notably higher, which motivated the Bank to modify its framework in 2006. We also find no dramatic differences across foreign central banks in the transmission of policy rate changes to short-term (overnight and 3-month rates) rates.

In addition, we found broadly similar associations between policy rates and longer-term rates. We estimated a regression of changes in 10-year government bond yields on one-day changes in the 3-month OIS rate (a measure of surprise in the policy rate) and one-day changes in the difference between 3- and 12-month-ahead OIS rates (a measure of surprise in the slope of the expected path of policy) on central bank meeting dates. The estimated results of this regression are in Table 2, Exhibit 4. Note that policy actions by the major central banks had the largest impacts on long-term rates, with coefficients on the level and slope terms that are close to, though slightly smaller than, those of the Federal Reserve. At some central banks in smaller economies, policy surprises have smaller impacts on 10-year yields, but this may reflect in part the greater openness of these economies.

That said, the lack of large differences in interest rate outcomes despite a wide variety of practices may reflect central banks’ development of implementation practices in response to their

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<sup>17</sup> See LRF Foreign Experience background paper, “Foreign Monetary Policy Implementation Frameworks: Empirical Analysis.”

particular environment. The generally effective outcomes across frameworks also may reflect, in part, broad-based actions taken during the crisis to respond to interest rate pressures, many of which were outside of existing frameworks.

#### **V. Reserve Requirements and Remuneration**

In recent years, central banks have tried to address perceived drawbacks of corridor and floor frameworks by changing reserve requirement and reserve remuneration policies (Exhibit 5). Some floor countries have implemented quotas with tiered remuneration to limit incentives for “reserve hoarding” and the BOE implemented voluntary targets to reduce the costs of holding reserves.<sup>18</sup> These new policies soften some of the conceptual distinctions between corridor and floor frameworks as they are used in practice.

**Reserve Requirement Corridors:** Prior to the financial crisis, reserve requirements were fairly broadly used. In the panel of countries studied, five central banks (BOE, BOJ, ECB, SNB, and RBA) had reserve requirements in place in 2005, although the BOJ did not actively use the reserve requirements as they had effectively implemented a floor framework by that time. Requirements were generally used in corridor systems to establish a demand for reserves, although the RBA imposed a reserve requirement of zero to promote the use of interbank trading for settlement purposes.<sup>19</sup>

Reserve requirements were typically calculated as a percent of certain bank liabilities and were associated with an averaging feature to reduce market volatility. Reserve averaging allowed banks to arbitrage across days of the maintenance period, effectively damping interest rate volatility. The exception to reserve averaging was Australia, where the reserve requirement of

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<sup>18</sup> Some countries that have introduced quotas in the context of negative rates have also done so to reduce the costs of holding reserves.

<sup>19</sup> The RBA has a stated reserve requirement of zero, which has similar incentives, but is different in requirement than the BOC system which has no requirements and balances remunerated at the deposit rate. In practice, excess balances of around a \$1 billion existed in Australia on average, which were remunerated at a rate 25 basis points below the policy rate. More recently, the RBA also allows certain balances to be held outside of the reserve requirement system and remunerated at the policy rate.

zero balances was (and is) imposed at the end of each day.<sup>20</sup> Reserve requirements can impose financial opportunity costs on banks, as excess reserves are remunerated at lower-than-market rates. In addition, reserve requirements impose administrative costs and can also entail regulatory costs, as they may not be counted as HQLA.<sup>21</sup> To reduce the opportunity cost of holding required reserves, some countries (BOJ, ECB) remunerated required reserves at the policy rate. However, in all corridor frameworks, excess reserves were remunerated at a rate lower than that paid on required reserves, creating financial incentives to hold only the required amount of reserves and imposing costs on banks whose business models resulted in the need for more reserves.

**Voluntary Target Corridors:** In 2006, the BOE introduced voluntary targets as part of their new Sterling Monetary Policy framework. Voluntary targets allowed banks to choose a target level of reserves for the following maintenance period and reduced some costs to holding reserves.<sup>22</sup> The aggregate of these individual targets constituted the demand for reserves and formed the basis for monetary policy operations. Average balances over the maintenance period were remunerated at the policy rate, but amounts in excess or falling short of the target range ( $\pm 1\%$ ) were charged a penalty that effectively created symmetric incentives around the target level.<sup>23</sup>

Prior to the financial crisis, the BOE supplied reserves at the aggregated target level with good interest rate control. During the crisis, however, pressures emerged in the interbank market and the banks' chosen targets were not sufficient in aggregate to maintain trading in desired ranges. This may have reflected, in part, banks' concerns about establishing targets consistent with their

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<sup>20</sup> In addition, prior to the introduction of changes in 2006, the BOE operated with essentially zero reserves and there was no averaging feature to their system.

<sup>21</sup> Treatment of required reserves under the LCR can vary. The ECB does not currently count required reserves as HQLA, although this is up for review in later 2016. Please see Occasional Paper Series, Basel III and Recourse to Eurosystem Monetary Policy Operations, p. 14 <http://www.ecb.europa.eu/pub/pdf/scpops/ecbop171.en.pdf>.

<sup>22</sup> Several other changes were introduced under the Sterling Monetary Policy framework. These are described in detail in the BOE's Red Book, available on their website at <http://www.bankofengland.co.uk/markets/Pages/sterlingoperations/redbook.aspx>.

<sup>23</sup> The penalty was calculated as a deduction from reserve remuneration, calculated as Bank rate times the excess or shortfall, which created symmetrical incentives around the target. Banks could use standing facilities on the last day of the maintenance period to deposit the excess or borrow the shortfall, limiting the penalty to the spread of 25 basis points.

increased demand for reserves in stressed market conditions where they might have to borrow at elevated rates or in illiquid conditions to achieve their targets. In this environment, the BOE responded by providing excess reserves and widening tolerance bands for remuneration of reserve holdings.

In general, the BOE perceived the voluntary reserve target system as performing well, even with the need to supply excess reserves during the crisis, and consider it one of the viable choices for a long run framework. However, voluntary targets were suspended prior to the introduction of new liquidity regulations.<sup>24</sup> It is believed that voluntary reserves, as implemented by the BOE, would be considered HQLA. Nonetheless, should a system be developed where voluntary reserves are not considered HQLA, banks may be reluctant to set targets consistent with their need for reserves, as the targets would reduce the reserves counted toward their HQLA.<sup>25</sup>

**No Requirement Floor Systems:** Non-tiered floor frameworks typically reduce both the opportunity and regulatory cost of reserves by eliminating reserve requirements and remunerating all central bank balances at the policy rate. Among the countries studied, liability-driven floor frameworks are not currently used in practice. However, two central banks (BOE, ECB) have floor frameworks as a result of asset purchase programs, similar to the US.<sup>26</sup> In this environment, the ECB still maintains their reserve requirements, while the BOE has suspended voluntary targets; however, both central banks remunerate all reserves at a single rate.

**Quota Systems:** Up until 2007, the RBNZ and Norges Bank had maintained liability-driven floor operating regimes. However, both central banks found that individual banks were accumulating more reserves than necessary to achieve interest rate and payments system objectives. With reserves remunerated at market rates, banks had little incentive to maintain regular operational capacity to lend funds to each other as there was no opportunity cost to

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<sup>24</sup> The BOE suspended voluntary reserves targeting when they migrated to a floor system and began remunerating all reserves at the policy rate.

<sup>25</sup> In addition, if a bank needed to borrow in the interbank market to meet the target, the firm's net cash outflow would increase, worsening their LCR position.

<sup>26</sup> The BOE and the ECB originally began paying one interest rate on all reserves in 2009, as a result of excess liquidity provided during the crisis through lending and asset purchase programs.

holding the reserves. As a result, over time, banks that needed to borrow in the interbank market would have to bid up rates to acquire funds, and central banks felt the need to offset these pressures with additional reserves.<sup>27</sup>

Both the RBNZ and Norges Bank implemented quota systems to create a financial incentive to limit reserve holdings by establishing thresholds, above which reserves are remunerated at a lower rate. These thresholds, which are set at levels thought to maintain ample liquidity in the payments system, are intended to ensure a more efficient distribution of reserves by limiting accumulation of excess reserves by individual banks. The two tiered rates also provide incentives for interbank activity, as banks with reserves above their quota are incented to lend to banks that have capacity under their quota to earn the higher tier rate. Reserves are supplied near the aggregate quota level, resulting in money market trading that is close to the top tier of remuneration, which for both the RBNZ and Norges Bank is the policy rate. Both the central banks feel that quotas have been effective at encouraging interbank activity and thus limiting the need to expand reserves to offset interbank rate pressures.

More recently, quota systems have been adopted by some central banks (SNB, BOJ) in the context of negative rate regimes. In a negative rate environment, quotas can reduce the cost of holding reserves for banks by offering a level of exemption from negative rates, with amounts held above the quota being remunerated at the lower rate. In the context of negative rates, central banks have set thresholds with enough reserves above the quotas so that market rates trade at the lower tier of remuneration, reflecting the desired stance of policy. The SNB feels that tiers have been particularly effective at achieving its objectives of reducing costs to domestic banks and increasing money market activity.

In both types of quota implementation, central banks have been able to effectively steer market rates by establishing quotas and providing a level of reserves relative to the quota that is consistent with their policy stance. In the setting of these quotas, central banks have noted that it is important to understand the typical distribution of reserves in the system in order to create

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<sup>27</sup> The Norges Bank also operates with a wide collateral basket, so OMOs can allow for the transformation of non-HQLA collateral into reserves, further increasing demand for reserves.

effective incentives for lending and borrowing.<sup>28</sup>

## **VI. Money Market Activity**

Most central banks expressed a desire to maintain private money market trading in their domestic money markets, and structured incentives in their operating regimes to encourage activity.

Central banks cited several benefits to money market activity. Many suggested that information from money markets helps them better evaluate the transmission from policy rates to private interest rates. Some also believed that interbank borrowing and lending enhances firms' capacity to effectively evaluate credit and supports appropriate allocation of credit in the system.

Moreover, banks trading reserves with each other rather than the central bank can reduce the exposure of the central bank to the banking system in normal times.

During the financial crisis, central banks took a more active role when money markets ceased to function properly as a mechanism to distribute reserves. These interventions generally addressed market-wide liquidity stress in support of monetary policy implementation and, as discussed in the next section, central banks expect to maintain broad counterparties and collateral to keep capacity to distribute liquidity broadly. To encourage ongoing market-based liquidity distribution, central banks use less frequent operations, wider corridors and tiered remuneration.<sup>29</sup>

Money market activity in corridor regimes typically differs from that under floor regimes. Reserve requirements and voluntary targets in corridor systems establish symmetrical incentives for banks in the management of their reserve holdings. Within these systems, banks typically transact—either lending or borrowing—when their reserves holdings are in excess or short of target levels. Rates within the corridor are sensitive to the level of reserves supplied and, with

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<sup>28</sup> In particular, Norway established quota levels for classes of banks so that, within each group, there are some banks above and below the thresholds. The RBNZ establishes quotas for individual banks based on their highest payment flow days.

<sup>29</sup> Reserves in many countries are not currently supplied through OMOs. However, prior to the crisis, the ECB operated weekly, consistent with its principle of market orientation. The BOE also conducted weekly operations after the Sterling Monetary Policy revisions in 2006. Norway provides uses both tiered remuneration and lower frequency OMOs to encourage interbank activity. The Riksbank also issues bills on a weekly basis, in part to encourage market activity in the context of a large balance sheet.

balanced liquidity provision, typically trade around the target (Chart 1, Exhibit 6).

In contrast, floor systems may limit interbank activity, as banks have ample reserves and little need to borrow in private interbank markets. Several central banks (Norges Bank, RBNZ, ECB and BOE) have noted that, as reserves increased, interbank activity did, in fact, decline. For bank-based financial systems, this results in an overall drop in money market activity.

In quota regimes and certain floor regimes, active money markets can exist, although activity primarily represents arbitrage to remunerated rates. Central banks that have employed quotas (Norges Bank, RBNZ, SNB) created incentives for market trading in the context of high reserve levels, as banks that exceed their thresholds after intraday payment activity are motivated to offer surplus reserves in the overnight market to banks below their thresholds, resulting in an arbitrage to the top tier remuneration rate. Additionally, for economies with significant non-bank participants outside of the reserve remuneration systems (BOJ<sup>30</sup>, BOE), floors need not reduce money market activity, as interbank activity is replaced by banks borrowing from non-bank market participants without access to remunerated accounts (Charts 2 and 3, Exhibit 6<sup>31</sup>). In these environments, rates typically trade below the remuneration rate. Limits to competition and balance sheet costs can create a wedge between the level of market rates and the remuneration rates. Central banks have noted that it is important to understand the competitive dynamics, as these frictions can enlarge the wedges.<sup>32</sup>

Central banks have different perspectives about the relative merits of money market activity created by the need to meet reserve requirements versus arbitrage created by tiered remuneration or lack of access to remuneration. Central banks that have implemented quotas have valued the increase in interbank activity created by arbitrage incentives. However, some central banks feel that trading based on reserve scarcity has somewhat greater information value for money market

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<sup>30</sup> This considers the BOJ prior to their recent move to a quota system in the context of negative rates.

<sup>31</sup> In Norway, the overnight rate, NOWA, trades above the deposit rate on reporting dates as banks hold additional reserves to meet regulatory requirements. On this date, the NOWA volumes typically fall and the rate is based on very little actual traded volumes.

<sup>32</sup> In particular, central banks have noted that factors that limit the number of borrowers, such as limited access to remuneration accounts or balance sheet costs, can amplify wedges. Norway structured its quotas to encourage competition.

conditions, as prices are actively negotiated based on liquidity needs.

## ***VII. Liquidity Provision and Distribution***

During the financial crisis, many central banks expanded the set of counterparties and collateral they used in liquidity provision operations. Others already had a broad framework (Exhibits 7 and 8). This expansion was largely associated with the need during the crisis to improve the impaired transmission of policy as some markets ceased to function properly. Having more counterparties enabled central banks to expand credit availability and the distribution of reserves to those who had previously obtained liquidity mainly or only through the banking system, and broader collateral eligibility eased access to central bank lending. Most central banks have not expressed plans to revert to the narrower pre-crisis frameworks.

**Counterparties:** Central banks see a broader set of counterparties as increasing their ability to provide liquidity to different parts of the financial system and strengthening the transmission of monetary policy, particularly in stressed market conditions. In addition, some central banks feel a broader framework reduces the competitive distortions or segmentation in money markets that can arise from market power conferred to a narrow set of central bank counterparties. It can also provide central banks with increased intelligence on the liquidity situation and collateral composition of the counterparty firms. The need for a broader set of counterparties for some central banks may also reflect in part the illiquidity of their money markets and the associated difficulties of some banks in trading reserves. For the ECB, having a broad set of counterparties ensures that institutions from all euro-area countries are eligible to participate in the ECB's operations, in keeping with its principle of equal treatment of financial institutions. Central banks do note some concerns about having too broad a set of counterparties, including the potential to reduce incentives for private market activity, to incur higher operational costs, such as monitoring, and to increase credit exposure for the central bank.

Central banks have taken different approaches to deciding which institutions to include. Some central banks have based their decisions on the principle of including systemically important institutions to at least some operation types and as a result have included some non-banks, such as broker-dealers and CCPs (BOE, RBNZ, and RBA) and insurance companies (SNB) in their



frameworks. While banks have access to all of the central banks' operations, some non-bank counterparties (e.g CCPs in BOE and RBNZ) do not have access to open market operations. The BOE has set out explicit principles for its expansion of counterparties: The Bank could have as a counterparty any entity that is exposed to liquidity risk, is systemically important for the provision of liquidity to the economy, and is appropriately regulated, though not necessarily by the Bank itself. In contrast, other central banks do not normally transact with non-banks, although almost all foreign economies have universal banks that include broker-dealers and investment banks, effectively incorporating these entities in the framework. Some central banks (SNB) transact directly with foreign institutions that have no legal presence in their jurisdictions.<sup>33</sup> For some counterparty expansion evolved during the crisis, without an explicit framework for considering specific criteria. In all cases, financial institutions are not required to transact with the central bank, and most eligible financial institutions can choose whether to apply to be a counterparty.

**Collateral:** Most central banks also expanded the set of acceptable collateral during the crisis to provide a larger volume and ensure broad distribution of reserves, and most have maintained this expanded set. In some cases, central banks expanded collateral because their financial systems had limited amounts and types of available higher-quality collateral, such as small government debt markets (see Exhibit 2). Especially in the case of a shortage of domestic-currency denominated assets, many central banks accepted foreign currency denominated assets subject to additional haircuts. During the crisis, to provide a larger volume of loans to banks in stressed markets, a wider variety of collateral was needed, and maintaining a wider range of collateral gives them more flexibility to respond to future shocks. Moreover, central banks note that having more counterparties often implies the need for a wider set of collateral. The ECB's collateral set, even before the crisis, reflects a desire to ensure that every member country's banks had access to operations.

Even though collateral policies have been broadened, central banks expressed reasons to be

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<sup>33</sup> Some central banks (ECB and SNB) have liquidity swap lines with other central banks (outside of the network of liquidity swap lines in which the Federal Reserve is participating), which were primarily used during the financial crisis to provide funding in their currencies in other economies.

cautious about expanding too broadly. In particular, they understood that accepting lower quality collateral came with risk to their balance sheets, though in all cases collateral acceptance is subject to a risk assessment, including in some cases accepting only collateral above a certain credit rating. Central banks generally aim to avoid distorting market incentives in favor of one collateral type, for example by trying to ensure consistent collateral valuation and haircut policies across asset classes. Some central banks are also concerned that having too broad a collateral policy has the potential to create moral hazard, encouraging banks to hold riskier assets than they otherwise would because they have the option to use them as collateral with the central bank. And finally, they note that a broader collateral policy increases the complexity and cost of operations as central banks have to maintain expertise to assess the risk of each collateral type. In particular, an inability to effectively value or haircut securities has been a limiting factor for expanding collateral eligibility to riskier or more complex assets.

### ***VIII. Scope and Flexibility of Liquidity Provision***

Although most central banks are retaining the broad counterparty and collateral frameworks that they adopted in recent years, their approaches to liquidity provision are diverse. Some recognize “liquidity insurance” as a mandate of the central bank—providing liquidity to financial institutions facing shocks to support financial stability—distinct from monetary policy implementation and emergency lending, and organize their operations accordingly.<sup>34</sup> Others make less of a distinction. Similarly, some central banks think liquidity insurance should be an ongoing part of their frameworks, while others prefer to keep facilities that can be rapidly deployed in case the need arises.

**Distinguishing OMOs from liquidity insurance:** Some central banks draw a distinction between “liquidity insurance” on the one hand, and monetary policy implementation and

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<sup>34</sup> Several central banks (currently BOC, ECB, BOE, BOJ, and SNB) also provide funding to their banks in foreign currency and conduct dollar funding auctions based on dollar liquidity swap lines with the Federal Reserve. These programs were initially instituted as temporary arrangements with several central banks, but in October 2013 were converted to standing arrangements. These arrangements are multilateral, meaning that each central bank has access to a swap line that provides liquidity in the other central bank’s currency.

emergency lending on the other. The BOE represents the clearest case.<sup>35</sup> It defines monetary policy operations as the exchange of high-quality assets for reserves. These include its OMOs, and standing lending and borrowing facilities. The Bank defines “liquidity insurance” as operations with clear criteria and broad access that allow for a “liquidity upgrade”—banks being able to exchange a wider set of collateral for liquid assets or reserves. These include its discount window, long-term repo facility (which auctions reserves for 6 month terms), and contingent term repo facility (with flexible terms). Finally, emergency lending is institution-specific lending on a case-by-case basis. The BOE distinguishes facilities and operations of the central bank according to these three objectives. The BOE hopes that drawing a clear distinction will reduce the stigma that might be associated with both monetary policy and liquidity insurance operations, and will reduce uncertainty about how the central bank will respond in more stressful times. Indeed, the BOE is trying to avoid the practice of “constructive ambiguity.”<sup>36</sup>

In contrast, while the ECB draws a distinction between emergency lending and other operations, it tries to not make a distinction between the objectives of its main operations.<sup>37</sup> The ECB justifies its “single list” of counterparties and collateral for all non-ELA operations on the basis of its principle of equal treatment—some counterparties, particularly if it benefitted those from one country over another, should not have privileged access to the ECB’s operations.<sup>38</sup>

Distinctions between monetary policy implementation and liquidity insurance operations are typically reflected in the collateral accepted in their operations, and to a lesser extent

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<sup>35</sup> Also see Paul Fisher, “Managing Liquidity in the System: The Bank’s Liquidity Insurance Operations,” September 2010: “the central bank provides back-stop liquidity insurance to both individual institutions and to the system as a whole under stress.... The objective is to reduce the cost of liquidity disruptions for solvent and viable institutions and so maintain the flow of payments services of the UK financial system.” <http://www.bankofengland.co.uk/archive/Documents/historicpubs/speeches/2010/speech450.pdf>

<sup>36</sup> In particular, the BOE cites the experience during the financial crisis where uncertainty about whether it would provide liquidity was believed to reduce the willingness of market participants to trade with each other, heightening the market stress.

<sup>37</sup> The ECB has stressed a concept that sounds similar, the so-called “separation principle”. But not distinguishing between monetary policy operations and liquidity provision operations is different from the distinction the ECB was articulating, which was its decisions about monetary policy were separate from its liquidity operations intended to carry out that stance. In other words, just because it was conducting a liquidity operation did not mean it was changing the stance of policy. But even this principle broke down during the crisis as full allotment operations meant that liquidity provision became a signal of monetary policy.

<sup>38</sup> Emergency lending operations are conducted by the national central banks in the Eurosystem, under the review of the ECB.

counterparties. As noted above, the ECB tries to keep operations uniform, with a single counterparty and a single collateral list for non-emergency lending operations. Most other central banks similarly have a single set for both types of operations, including the BOJ, Norges Bank, Riksbank, RBA, RBNZ, and SNB. In contrast, the BOE and BOC limit operations for monetary policy implementation to domestic government securities, whereas operations or facilities for liquidity insurance purposes take a wider set of collateral, consistent with the stated purpose of providing a liquidity upgrade. During the crisis, the lines between different kinds of operations became blurred as liquidity provision served both monetary policy and liquidity insurance purposes. Mostly, in the post-crisis environment, the BOE liquidity insurance facilities are not viewed as monetary policy tools and often take the form of a backstop, which is (to some extent) reflected in pricing.

More broadly, several central banks have taken steps to avoid the potential stigma attached to liquidity insurance tools. In particular, central banks have tended to use more auction mechanisms in their operations and have made the terms of lending more attractive than previously to combat the implicit cost of stigma. They have focused on the broad provision of liquidity rather than provision to one or a few particular institutions. And they have promised to not make public (or to delay publishing) information regarding particular institutions' usage of liquidity insurance facilities.

Central banks have also debated whether announced liquidity insurance operations should be embedded as part of the framework or kept "on the shelf."<sup>39</sup> For example, both the BOC and BOE have designed and announced a Contingent Term Repo Facility that would be activated at the Bank's discretion. Having an announced operation, whether or not it is active, provides transparency about the central bank's capacity to effectively respond to stressed market conditions and affords an opportunity to communicate principles about the operation's use. On the other hand, transparency about such operations may engender moral hazard. "On the shelf" tools leave the central bank with somewhat more discretion about when tools should be activated. That said, even for standing facilities and operations, some aspects may not be active.

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<sup>39</sup> Here we do not discuss operations or facilities that central banks used in the past but could bring back, or tools that they have developed, but have not made public.

For instance, the BOE has stated that it would be prepared to take equities as collateral should the need arise.

### ***IX. Policies near the Effective Lower Bound***

Even after interest rates fell to the effective lower bound during or after the crisis in many major economies, many central banks (BOE, BOJ, ECB, Riksbank, and SNB) employed policies to continue easing financial conditions.<sup>40</sup> Although some of these programs are still evolving, central banks generally perceive them as having been effective at furthering accommodation. Some central banks suggested that, if use of these tools is extended, their effectiveness may decline, or political or market functioning costs may increase. Nevertheless, nearly all central banks noted the desire to retain some capacity to use these tools given the expected proximity of short-term interest rates to the effective lower bound in the future. In particular, central banks perceived large scale asset purchases to be a permanent part of the toolkit, although none mentioned their use as part of the normal operating framework.

#### **Large Scale Asset Purchases:**

*Sovereign Purchases:* Several central banks (BOE, BOJ, ECB, and Riksbank) have employed large scale asset purchases of government debt (Table 1, Exhibit 9). The BOJ's program in the 2000s focused on the expansion of reserves and purchases of shorter-dated securities to maintain flexibility to reduce the balance sheet quickly by allowing assets to mature. Although more recent programs by central banks have also expanded reserves, the focus has been on purchases of longer term bonds that can have a more sizable portfolio rebalancing effect and signal a more durable commitment to providing policy accommodation.

Most central banks viewed the ability to lower term premia and expected forward rates embedded in sovereign yields as measures of success, although some noted that exact measurement of the impact was complicated, as initial declines in yields could be reversed by improving growth and inflation expectations. Central banks perceived clear communication and

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<sup>40</sup> For some small, open-economy central banks (Riksbank, SNB) this took the form of currency intervention to either limit appreciation directly or ease financial conditions more generally. The BOE perceived the effective lower bound to be at 50 basis points on their target rate.

commitment to the policies as enhancing effectiveness. Indeed, the ECB's Outright Monetary Transactions (OMT) program, created to purchase government bonds of euro area countries that were granted financial assistance under certain conditions, was perceived to meaningfully reduce yields through commitment alone, and no actual purchases were needed. Some recent programs, including those by the BOJ and ECB, also used state-contingent objectives linked to inflation outcomes to reinforce the commitment to an accommodative stance of policy.<sup>41</sup> However, central banks were also satisfied with programs that merely pre-announced a fixed quantity of purchases. Certain operational aspects of programs were also perceived as important to the effectiveness of the program. The ECB mentioned that having transparent purchase criteria and operations can minimize impact on market functioning.<sup>42</sup>

Asset purchases were considered successful at easing financial conditions, but some central banks believe there can be points of diminishing returns. In particular, the BOJ, whose government bond holdings are projected to be nearly 47 percent of government debt at the end of 2017, expect some constraint in their ability to purchase bonds without affecting market functioning as their holdings continue to expand. Indeed, bond market functioning has already deteriorated and, while bid-offer spreads have not widened materially, market depth has reportedly declined. In addition, as the risk on their balance sheet grows, the BOJ felt that private market participants' belief in their commitment to the program could potentially wane, limiting its effectiveness.

*Credit Purchase Programs:* Most central banks that initiated government purchase programs also purchased private sector securities (BOE, BOJ, ECB), although their holdings of these securities generally represent much smaller proportions of their overall balance sheets (Table 2 of Exhibit 9), reflecting the smaller size of credit securities markets in most other countries than in the United States. Central banks generally chose asset types considered important for

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<sup>41</sup> For example, the BOJ announced its QQE program on April 4, 2013 with stated goals of reducing both risk premia across asset classes and interest rates across the yield curve to achieve a 2-percent price stability target. The ECB announced in March 2016 that it would continue non-standard measures until it saw a sustained adjustment in the path of inflation consistent with its inflation aim.

<sup>42</sup> Some operational parameters can also place limits on effectiveness. For example, the ECB sovereign purchase program is based on a policy of 'deposit floors,' which only allow for purchases at negative yields above the deposit facility rate, potentially limiting the impact on long term yields.

economic activity. For the ECB, covered bond purchases were intended to free up bank balance sheet capacity for more lending. These purchases, although small in comparison to sovereign purchases, were generally of substantive size relative to the target market, and most were viewed as successful at reducing risk premia in those markets.

**Long-term Funding Programs:** Some central banks (BOE, ECB, BOJ) also used longer-term funding programs to enhance bank lending in sluggish economic environments (Table 3, Exhibit 9). Long-term refinancing programs support bank lending by providing funding at a fixed rate that is lower than private market rates, in some cases with additional discounts or more funding extended to banks that increase lending activity. The ECB, in particular, used these programs in large scale in 2011 and 2012, offering fixed-rate, full-allotment programs to substantially reduce euro-area bank funding costs. ECB staff studies show evidence that these programs were effective at lowering bank lending rates, especially in vulnerable countries. And, the programs also reduced yields of peripheral country sovereign debt. BOJ and BOE funding programs were more targeted than the ECB programs. The BOE studies also show that lending rates declined as a result of the programs; however, both BOE and BOJ perceived the effectiveness to have been somewhat limited by low demand for loans.<sup>43</sup>

**Negative Rates:** Since mid-2014, five central banks (BOJ, ECB, SNB, and Riksbank<sup>44</sup>) have brought policy rates into negative territory. For larger economies (BOJ, ECB), the motivation was primarily to provide accommodation to meet stated objectives for growth or inflation; for smaller open economies (SNB, Riksbank), some emphasis was placed on reducing currency appreciation pressures (Table 4 of Exhibit 9) to meet policy objectives.

Most central banks have implemented negative policy rates by paying negative interest on reserves. The two central banks with the highest levels of excess reserves (SNB, BOJ) provided exemption thresholds from the negative rates to reduce the direct cost to their banking systems of these policies. (Please see the Reserve Requirements and Remuneration section above.) The

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<sup>43</sup> Please see the BOE Inflation Report May 2014, article on page 14 entitled “Developments in credit conditions since the launch of the Funding for Lending Scheme.”

<sup>44</sup> In addition, the Danish central bank, which is outside the scope of this study, introduced negative rates.

ECB did not provide new exemption thresholds, as the level of excess reserves in its system was lower than in the systems of other central banks. However, as rates were cut further, they initiated new long-term funding programs that were viewed as lowering banks' net costs. The Riksbank implemented negative rates effectively in a corridor regime by offering central bank bills at a fixed, negative rate and remunerating reserves at a lower rate.<sup>45</sup>

Interest rate cuts into negative territory have appeared to reduce both short-term market interest rates and yields on longer-term sovereign and corporate debt securities.<sup>46</sup> However, banks have not passed negative deposit rates on to retail and most corporate depositors, and some central banks see this as hindering banks' profitability.<sup>47</sup> In some markets, lending rates for less competitive products such as mortgages have not fallen as banks try to recover these costs.<sup>48</sup>

The effectiveness and channels of transmission for negative rates are still being discussed among central banks and others. Central banks view part of the transmission as similar to a reduction in interest rates at levels above zero. However, they also generally believe that there are additional aspects to the transmission. Some believe there is a one-time decline in the yield curve associated with the removal of the perceived floor at zero for monetary policy. The ECB also feels there are greater decreases in longer term yields from a rate cut into negative territory, as investors express their aversion to negative yields. They also suggest that negative rates enhance asset purchase programs, as banks are more motivated to re-invest proceeds rather than holding reserves.<sup>49</sup> On the other hand, in the view of the BOJ, negative rates in their jurisdiction are posing some challenges to asset purchases, as banks are less willing to sell bonds when their alternative investments will yield negative income.<sup>50</sup>

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<sup>45</sup> The Riksbank operates a corridor system with a large balance sheet and therefore conducts draining operations to maintain this system.

<sup>46</sup> Please see the March 2016, FOMC memo "Negative Policy Rates: Lessons from the Foreign Experience" for a discussion of the rate transmission in each economy.

<sup>47</sup> In particular, banks believe that retail and small corporate depositors have greater difficulty accepting negative rates and could more easily withdraw deposits to hold cash instead.

<sup>48</sup> Central banks are not necessarily displeased about this, as some perceived their housing markets as fully priced.

<sup>49</sup> Please see remarks on April 7, 2015 by Peter Praet, member of the ECB Executive Board, in a speech entitled: "The ECB's Monetary Policy Response to Disinflationary Pressures."

<sup>50</sup> BOJ staff note that these behaviors are based on attention paid to certain accounting metrics. Implementation of negative rates also had an adverse effect on money market functioning in Japan, which has been attributed in part to technical issues related to rapid implementation.



**Effective Lower Bound Programs and Long Run Frameworks:** Although lessons from policies at the effective lower bound are still being learned, the general consensus is that they are effective and will be important to retain as central banks transition to long run frameworks. Some central banks feel that floor or quota regimes can make the transition to lower bound policies easier, as a change in operating regime is not necessary when there is an expansion in reserves. However, some central banks felt that the transition was smooth enough not to warrant a change in operating regime. Irrespective of the operating regime, central banks generally felt it is important to maintain readiness to implement effective lower bound policies. Some central banks that had not historically held certain securities outright suggested they may maintain some small level of outright holdings to preserve operational readiness.

**X. Balance Sheet Composition and Size**

Central banks have diverse opinions about the appropriate size and composition of their balance sheets in the long run. Prior to the crisis, central banks implemented policy with generally small balance sheets, using a wide variety of operating practices. On the asset side, some central banks (BOC, BOJ) held mostly government securities, which served as the counterpart of currency in circulation, the largest component of their liability structure. Others carried mostly shorter-term claims against the private sector, which arose either through repos, FX swaps, or loans to financial institutions. For central banks in small, open economies, assets were largely in foreign currency or gold (Exhibit 10, Chart 1).

During the crisis, the balance sheets of most central banks expanded substantially with greater holdings of short-term claims against the private sector arising from the provision of liquidity. And, more recently, while some central banks have returned to pre-crisis balance sheets, others have enlarged their balance sheets even further with domestic bond purchases or, in the case of the SNB, foreign exchange accumulation. The BOJ and SNB balance sheets now represent more than 75 and 100 percent of GDP, respectively. Other central banks that have conducted asset

purchases currently have smaller balance sheets, and the BOE, ECB, and Federal Reserve have balance sheets between around 20 to 25 percent of GDP.<sup>51</sup>

Some central banks have noted that the exceptionally large balance sheets created by asset purchase programs can complicate relationships with fiscal authorities, as they have the potential to create greater losses and further influence remittances. In some cases, remittance policies can affect the degree of risk the central bank is willing to take or the program structure. For example, the BOE remits most of its income back to the U.K. Treasury, and by legal requirement the Treasury bears risks to public funds. As such, their asset purchase program has been conducted through a special purpose vehicle indemnified by the Treasury. On the other hand, ECB remittances occur only after losses are made up on the balance sheet, and the BOJ is legally required to retain 5 percent of its profits each year.<sup>52</sup>

Many central banks that have expanded their balance sheets with asset purchases in recent years hope to return to some form of a smaller balance sheet in the future, either in the context of a corridor or liability-driven floor regime.<sup>53</sup> Although most of these central banks have developed greater comfort operating with a large balance sheet, and have confidence that they can control short term rates with higher levels of excess reserves, they generally felt that the elevated balance sheets created by asset purchases are not necessary to achieve monetary control in normal environments. The SNB is an exception, with their large foreign exchange holdings expected to be retained for some time, because balance sheet reduction would require an outright sale of foreign currency, which may not be consistent with their policy objectives.

## **XI. Regulatory Changes**

The ultimate effect of regulation on monetary policy implementation remains unclear to most central banks. As outlined in the accompanying memo entitled, “Money Markets”, regulations

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<sup>51</sup> These assets are measured as net assets of the central bank, excluding certain assets unrelated to monetary policy implementation. Figures are measured as of the most recent official reported numbers.

<sup>52</sup> That said, in 2015 the BOJ reportedly held back 25 percent of its profits to offset potential future losses.

<sup>53</sup> For instance, the Bank of England has indicated that it will likely maintain the stock of asset purchases until the Bank Rate reaches a level that it can be cut “materially.” The BOE expects, based on historical experience, that this level will be around 2 percent.

<http://www.bankofengland.co.uk/publications/Documents/inflationreport/2015/nov.pdf>

such as the Liquidity Coverage Ratio (LCR), the Net Stable Funding Ratio, the Supplementary Leverage Ratio, and money market mutual fund reforms may have different effects in different markets and the combination of regulations make it difficult to anticipate the full effect on financial markets and hence on policy implementation.<sup>54</sup>

One effect central banks expect is that the demand for reserves will increase relative to their pre-crisis levels with the LCR requirements, as excess reserves qualify for HQLA under the regulation, and that reserve demand will be more difficult to estimate. The foreign experience so far suggests that demand for reserves as HQLA will depend on the costs of reserves (either through haircuts or rates of central bank operations) relative to the costs of holding other HQLA assets. This may particularly affect central banks, such as the ECB, with wide collateral frameworks that accept non-HQLA, providing an opportunity for banks to swap riskier collateral for excess reserves.<sup>55</sup> For some jurisdictions, potential HQLA scarcity and asset encumbrance might arise because of increased reliance by financial institutions on collateralized funding markets, a shift that appears to have occurred in the wake of the financial crisis.<sup>56</sup>

Some smaller economies have already seen these effects of higher demand for HQLA, as outstanding government debt is relatively low. Although most large economies are currently operating in environments with plentiful reserves and government debt, they also anticipate some effects. For example, the BOE recently conducted a survey indicating that banks expect to have only somewhat lower demand for excess reserves in the near term even after the asset purchase program is wound down.<sup>57</sup> Although demand for reserves is uncertain and may shift over time, the BOE feels that a system of voluntary reserve balances may more easily reveal banks' desired level of reserves and adapt to changes.

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<sup>54</sup> See 2015 CGFS Paper No 54 entitled, "[Regulatory Change and Monetary Policy](#)".

<sup>55</sup> The LCR is the stock of unencumbered HQLA over a bank's total net cash outflows over a 30-day stress scenario. According to the LCR rules, banks borrowing from the central bank using non-HQLA collateral increase the numerator by the amount of the loan, but the denominator by 25 percent of the value of the loan, thus raising their LCR.

<sup>56</sup> See 2013 CGFS Paper 49 entitled, "[Asset Encumbrance, Financial Reform and the Demand for Collateral Assets](#)."

<sup>57</sup> This suggests significantly higher demand than in February 2007 just after the voluntary reserves target system was first implemented. As of the end of February 2016, currency was about £68 billion and reserves were about 4.5 times that at £315 billion. In 2007, reserves were £20.5 billion.

While central banks in larger economies have not yet felt the effects of regulatory change and are taking a “wait and see” approach, some central banks in smaller economies are responding, though in different ways. Some central banks feel a need to accommodate this higher demand for HQLA, as the level of HQLA available in their systems is largely exogenous and the potential impact on monetary policy operations potentially could be significant.<sup>58</sup> For example, the RBA notes that its government debt market is small. As a consequence, the RBA offers a Committed Liquidity Facility where banks can obtain an option to exchange non-HQLA for HQLA for a commitment fee.<sup>59</sup>

Other central banks have taken a more restrictive approach, contending that it is not the role of the central bank to facilitate banks meeting regulatory requirements and are taking steps to limit the influence of the effects of regulations on its monetary policy operations. For example, the balance sheet of the Norges Bank increased as banks used central bank operations to convert less liquid collateral into higher-quality liquid assets under the traditional floor system. In response, the central bank has considered increasing the difference between its top and lower tiers of remuneration on reserves to reduce the incentive for banks to accumulate reserves for this purpose.<sup>60</sup> Another example is the SNB. Although the SNB currently operates with abundant liquidity and does not currently face demand by banks for HQLA, it has proactively taken steps to make its OMOs more neutral to the demand for HQLA by limiting the collateral to AAA securities only.<sup>61</sup>

Another possible regulatory effect on institutions’ money market funding preferences is that banks may have higher demand for secured, longer-tenor funding relative to unsecured, short-term funding, in part as longer-term financing has a lower run-off rate in the LCR calculation.

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<sup>58</sup> Some observers have expressed the view that if central banks only take HQLA, it could limit the amount of good collateral in the banking system, increasing liquidity risk and deteriorating creditworthiness of banks.

<sup>59</sup> Under this program, banks pay a fee to the RBA in return for a commitment that they can borrow funds against a broad range of collateral. The facility allows banks to meet their HQLA requirements without materially changing the RBA’s operating framework. See “The Impact of Payments System and Prudential Reforms on the RBA’s Provision of Liquidity,” speech by Guy Debelle on August 16, 2013.

<sup>60</sup> Another option would have been to use haircuts, but the Norges Bank, in particular, feels this might reduce their ability to supply liquidity due to the limited availability of eligible collateral.

<sup>61</sup> Please see SNB press release dated July 7, 2014 entitled “Swiss National Bank Aligns Collateral Policy with New Liquidity Provisions.”

At the same time, the willingness to provide longer-term funding relative to short-term funding may decline as money market reforms are introduced in some jurisdictions. As a result of these changed incentives, the term structure of money market rates could steepen, and some foreign central banks mentioned the potential to conduct somewhat more monetary policy operations at term tenors.

Finally, new regulations may result in higher balance sheet costs for banks when transacting in certain markets. This may increase prices and/or reduce liquidity in markets and as a result, may increase banks' reliance on central bank intermediation if banks are unable to borrow from other institutions near policy rates. The RBNZ reported that the foreign exchange swap market has become less liquid as a result of global banks' efforts to shrink their balance sheets. In response, the RBNZ intervened more actively in foreign exchange swap markets to restore liquidity.

Exhibit 1: Operating Regimes

Operating Regimes	Bank of England	Bank of Japan	ECB	Federal Reserve	Bank of Canada <sup>1</sup>	Norges Bank	Riksbank <sup>2</sup>	RBA <sup>1</sup>	RBNZ	Swiss National Bank
Corridor - Structural Reserve Deficit	X		X	X	X			X		X
Corridor - Structural Reserve Surplus							X			
Floor - Liability-Driven		X				X			X	
Floor - Asset-Driven	X	X	X	X						X

Arrows indicate shifts from pre-crisis to post-crisis regimes.

<sup>1</sup>Operate narrow corridors with zero or no reserve requirements.

<sup>2</sup>Conducts draining operations to implement a corridor.

Exhibit 2: Central Bank Environment											
	Bank of England	Bank of Japan	ECB	Federal Reserve	Bank of Canada	Norges Bank	Riksbank	RBA	RBNZ	Swiss National Bank	
Economic Activity	Gross Domestic Product (trn \$, 2015)	2.9	4.1	11.5	17.9	1.6	0.4	0.5	1.2	0.4	0.7
	Consumer Prices (12-month % change) <sup>1</sup>	1.3	-0.3	-0.1	1.0	1.5	3.4	0.6	1.3	0.4	-0.4
Banking Sector	Trade (% of GDP, 2015)	57.0	37.0	47.0	28.0	65.0	69.0	86.0	41.0	56.0	115.0
	Banking Sector Assets/GDP <sup>2</sup>	269.0	393.3	289.9	75.8	221.9	123.6	316.8	241.2	177.7	421.7
Financial Market Structure	Banking Sector Concentration (% Top 5) <sup>3</sup>	65.1	97.6	26.5	47.4	83.6	94.6	60.8	90.5	99.7	61.2
	Banking Sector Credit (% of GDP) <sup>4</sup>	87.3	115.9	91.8	51.5	101.0	70.2	130.4	136.9	146.0	160.9
Payments System	Non-Financial Corporate Debt (% of GDP) <sup>5</sup>	18.5	15.1	10.6	30.7	27.1	20.0	NA	17.4	4.2	15.5
	Equity Market Capitalization (% of GDP)	89.5	67.4	46.0	105.3	97.9	42.9	111.6	100.5	44.9	161.0
Payments System	Government Debt (% of GDP) <sup>6</sup>	89.3	248.1	92.5	105.8	91.5	27.9	44.1	36.8	30.4	45.6
	Gross or Net Settlement	Gross	Gross	Gross	Gross	Gross	Gross	Gross	Gross	Gross	Gross
Payments System	Size of Intraday Overdrafts (USD) <sup>9</sup>	NA	29.3 bn	332 bn <sup>8</sup>	.661 bn	NA <sup>7</sup>	NA	NA	4 bn	NA	NA

1/ Consumer Prices: Measure targeted by each central bank. HICP inflation for the ECB and BOE. PCE inflation for the Federal Reserve. CPI inflation for all others. central banks. May figures for Canada, ECB, Switzerland, UK, US, Norway and Riksbank; April figures for Japan; Q1 figures for Australia and New Zealand.

2/ 2015 Total Banking Sector Assets (both foreign and domestic claims) from BIS, ECB, Norges Bank and RBNZ.

3/ Global Financial Development Database, World Bank. 2013 figures for all central banks, except Australia where 2011. Euro area is SNL/FRBNY Staff Estimate (1Q 2016)

4/ 2015 Credit to Private Nonfinancial Sector from Banks, BIS

5/ 2015 Debt Securities By Country, BIS

6/ 2015 General Government Debt, IMF WEO

7/ Bank of Canada does not operate the payment system

8/ Includes Belgium, France, Italy and Netherlands only.

9/ 2014 CPI statistics on payment, clearing and settlement systems

Exhibit 3: Policy Rates										
	Bank of England	Bank of Japan	ECB	Federal Reserve	Bank of Canada	Norges Bank <sup>3</sup>	RBA	Riksbank	RBNZ	SNB
Policy Rate	Bank Rate	Current Account Rate (+Monetary Base) <sup>4</sup>	Deposit Facility Rate <sup>1</sup>	Fed Funds Target Range	Overnight Target Rate (OTR)	Sight deposit rate (SDR)	Cash Rate Target	Repo Rate	Official Cash Rate (OCR)	3-month CHF LIBOR Range (100 bps)
Administered/Market Target	Administered	Administered	Administered	Market	Market	Administered	Market	Administered	Administered	Market
Administered Rate	IOR Rate	IOR Rate	IOR Rate	N/A	N/A	IOR Rate	N/A	OMO Rate	IOR Rate	N/A
Market Target	Implicit (SONIA)	Implicit (ON Call Rate)	Implicit (EONIA)	EFFR	CORRA	N/A	Cash Rate	N/A	Implicit (OICR)	3-mo CHF LIBOR
Secured/Unsecured	Unsecured	Unsecured	Unsecured	Unsecured	Secured	N/A	Unsecured	N/A	Secured/Unsecured	Unsecured

<sup>1</sup>The ECB continues to communicate all administered rates, but the Deposit Rate is the effective target. Since 2009, the Deposit Rate has been an effective IOR rate as all reserves are remunerated at this rate.

<sup>2</sup>The BOE has also historically looked to secured rates to assess the stance of policy. Their explicit mandate is a flat term structure to the next MPC meeting.

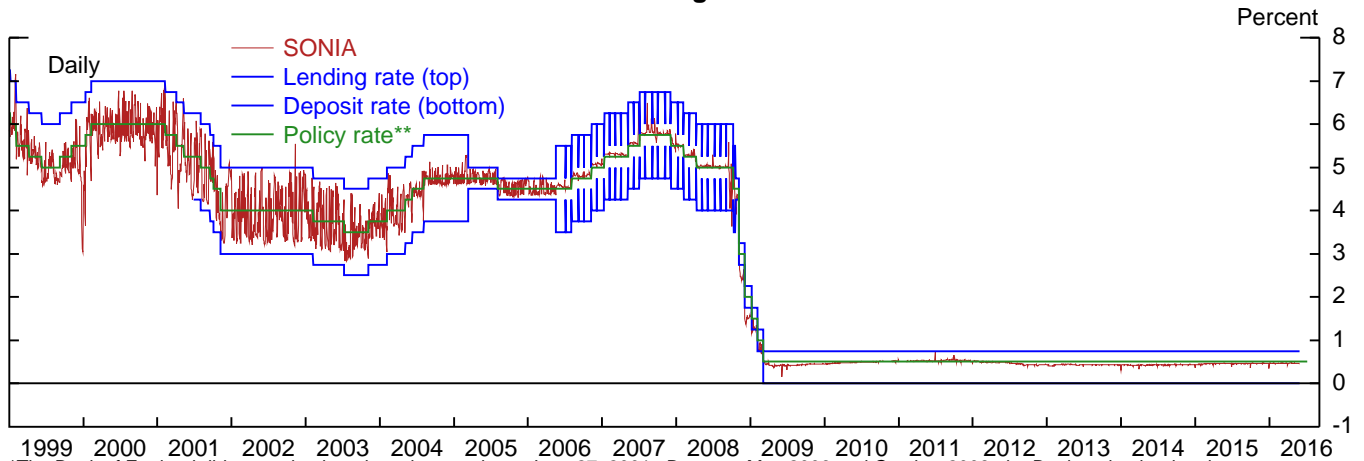
<sup>3</sup>The Norges Bank calculates and publishes the NOWA rate, but they do not target this rate.

<sup>4</sup>The BoJ also has an explicit target for expansion for the monetary base.



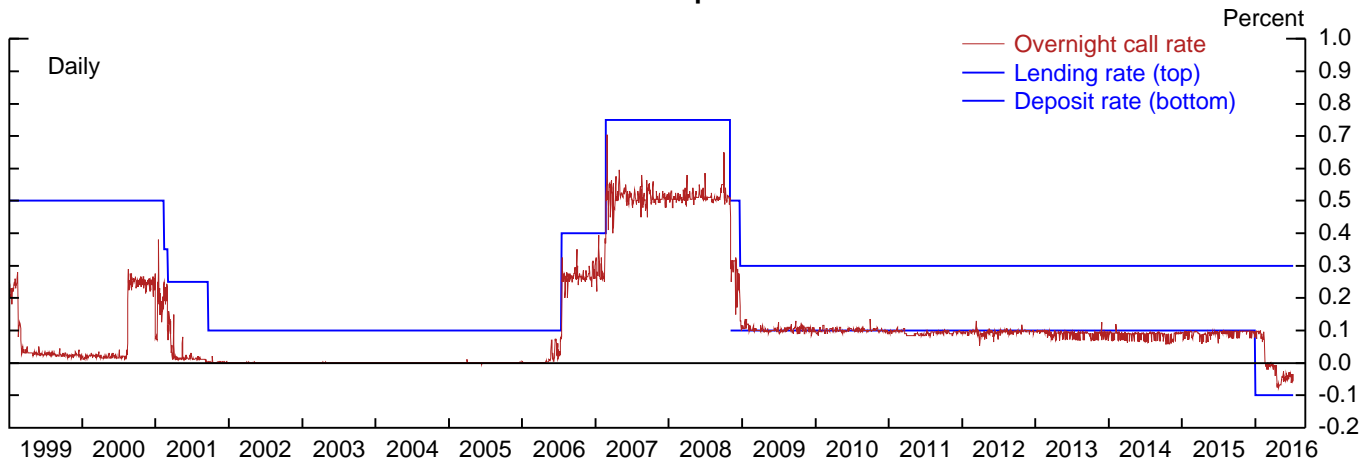
**Exhibit 4: Interest Rate and Target Rate History**

**Bank of England\***



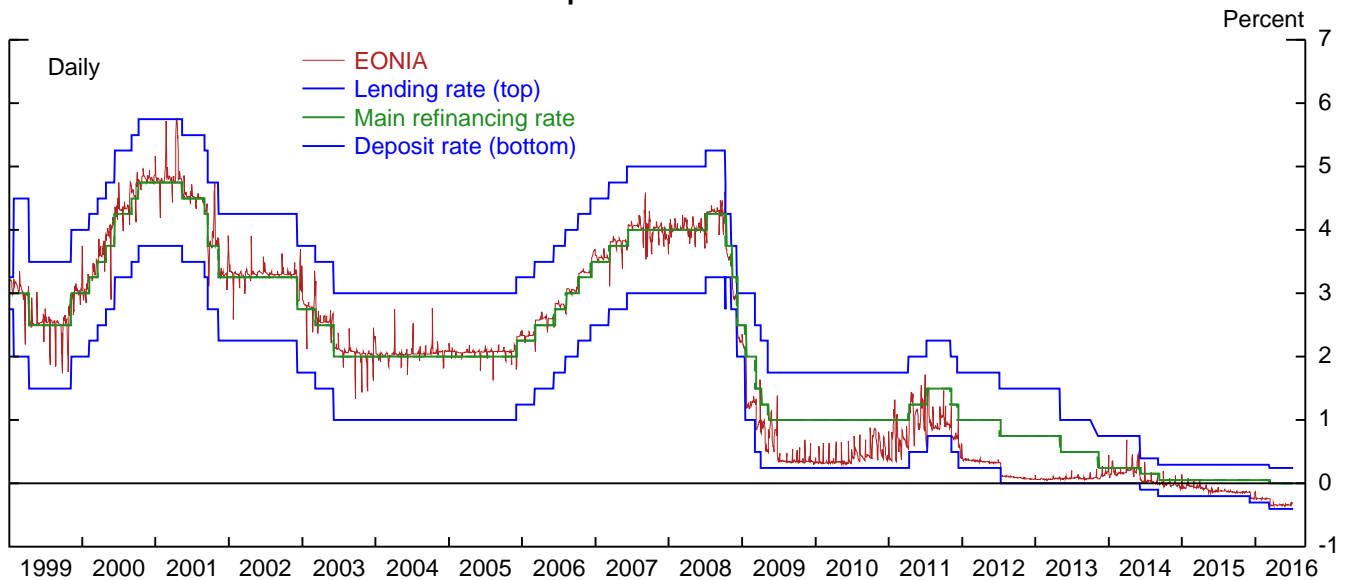
\*The Bank of England did not maintain a deposit rate prior to June 27, 2001. Between May 2006 and October 2008, the Bank maintained an interest rate corridor of 200 basis points, except on the last day of each reserve maintenance period, when it narrowed the corridor to 50 basis points.  
 \*\*The Bank rate starting in May 2006 is the interest paid on reserves. Prior to then, the policy rate was the repo rate.

**Bank of Japan\***



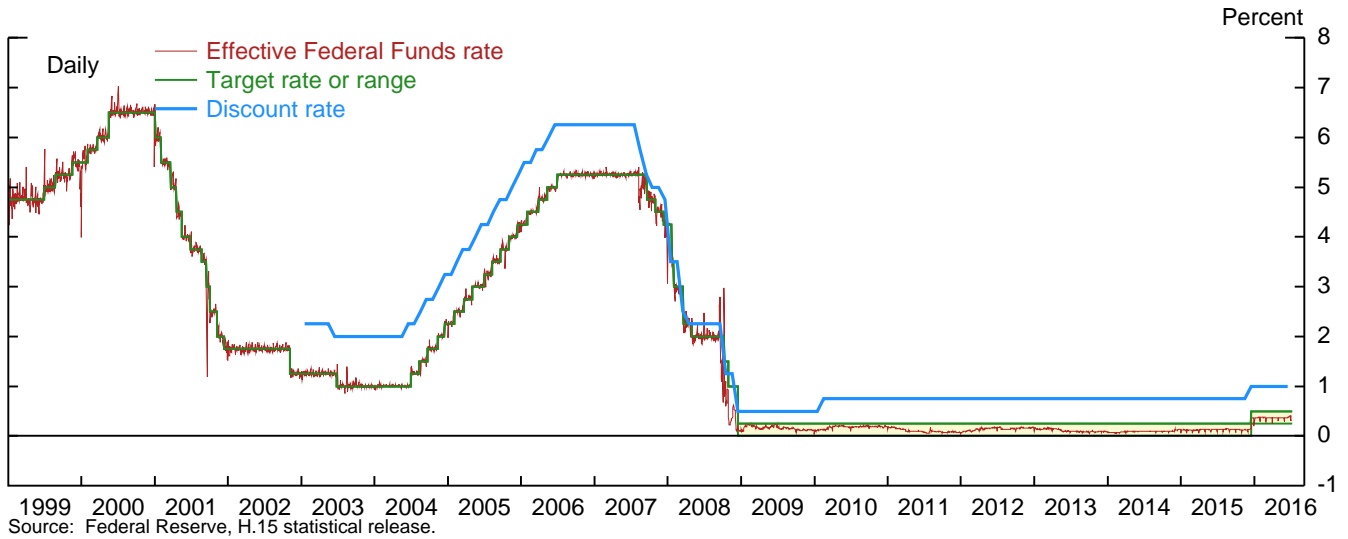
\*The deposit rate of -0.1 percent applies only to reserves outside of the "basic" and "macro" add-on balances, which receive 0.1 percent and 0.0 percent, respectively.

**European Central Bank**

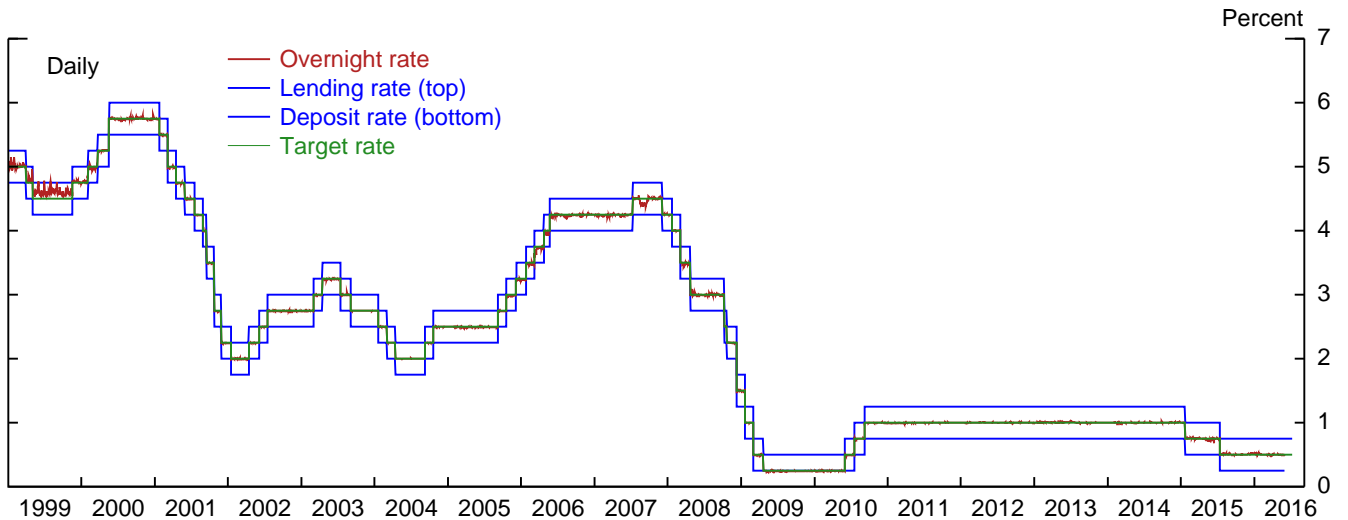


## Exhibit 4: Interest Rate and Target Rate History

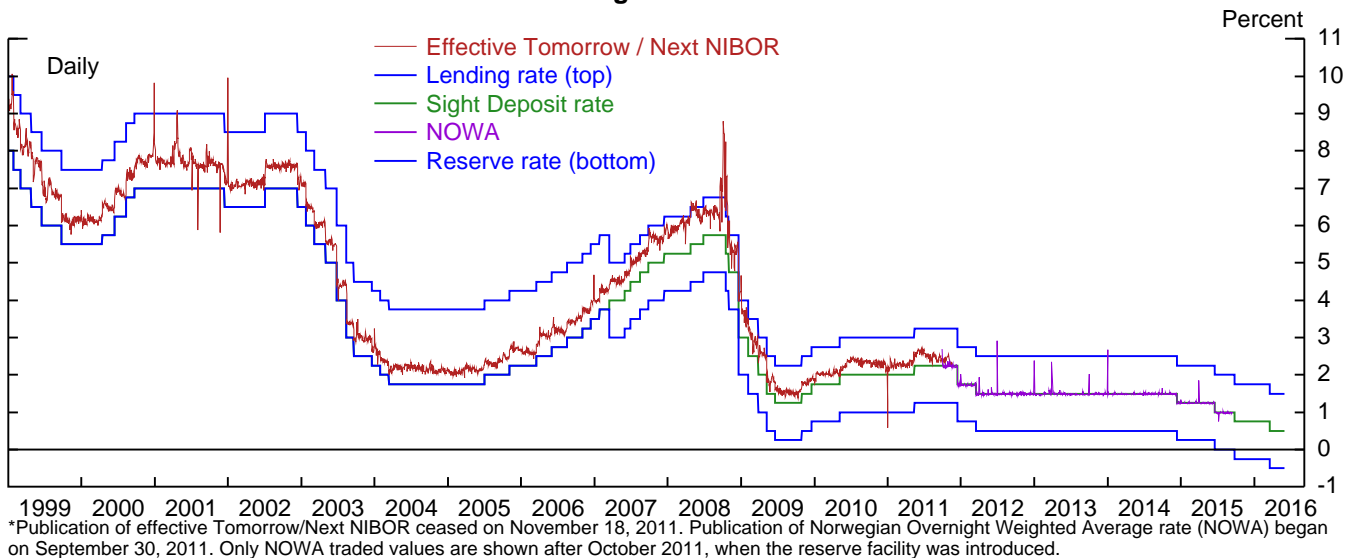
### Federal Reserve



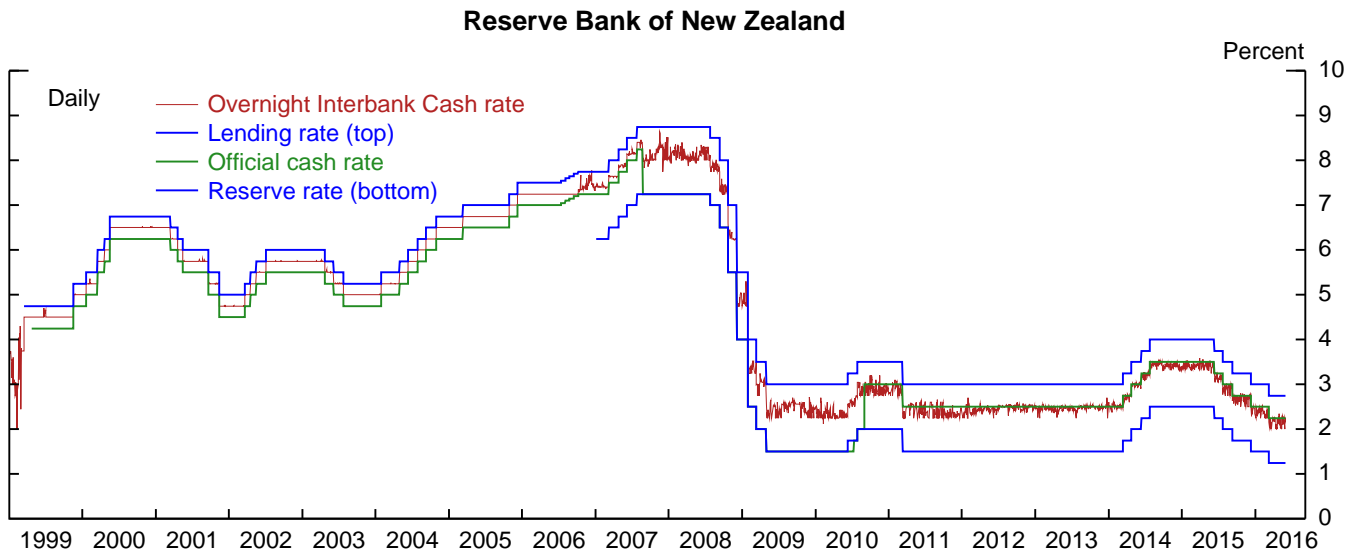
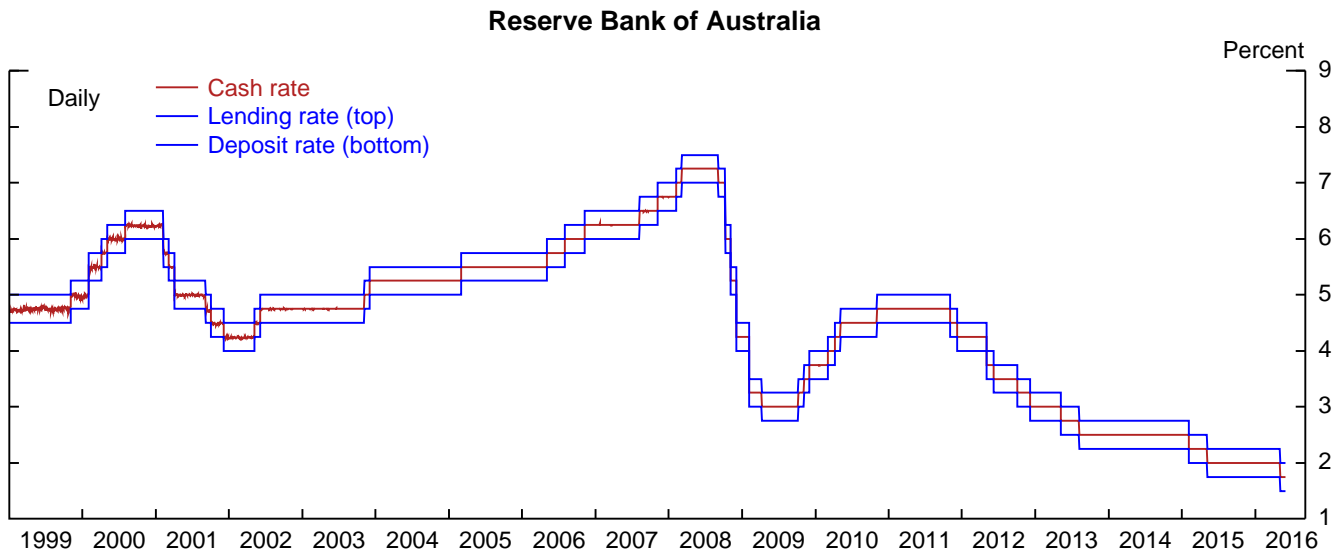
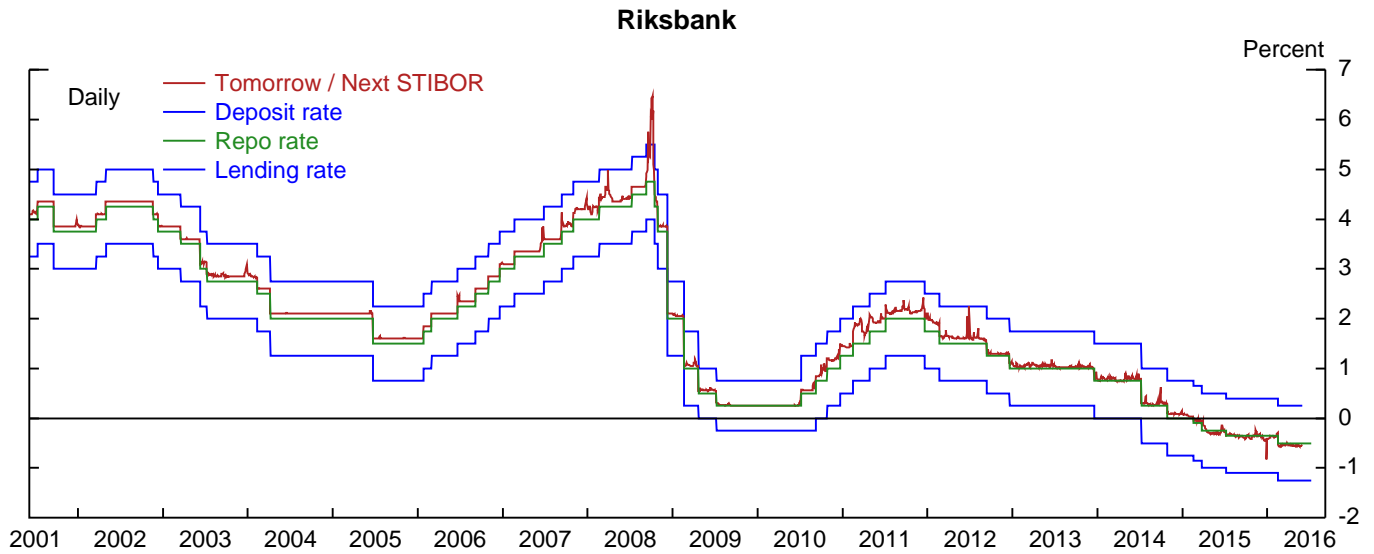
### Bank of Canada



### Norges Bank\*



### Exhibit 4: Interest Rate and Target Rate History



### Exhibit 4: Interest Rate and Target Rate History

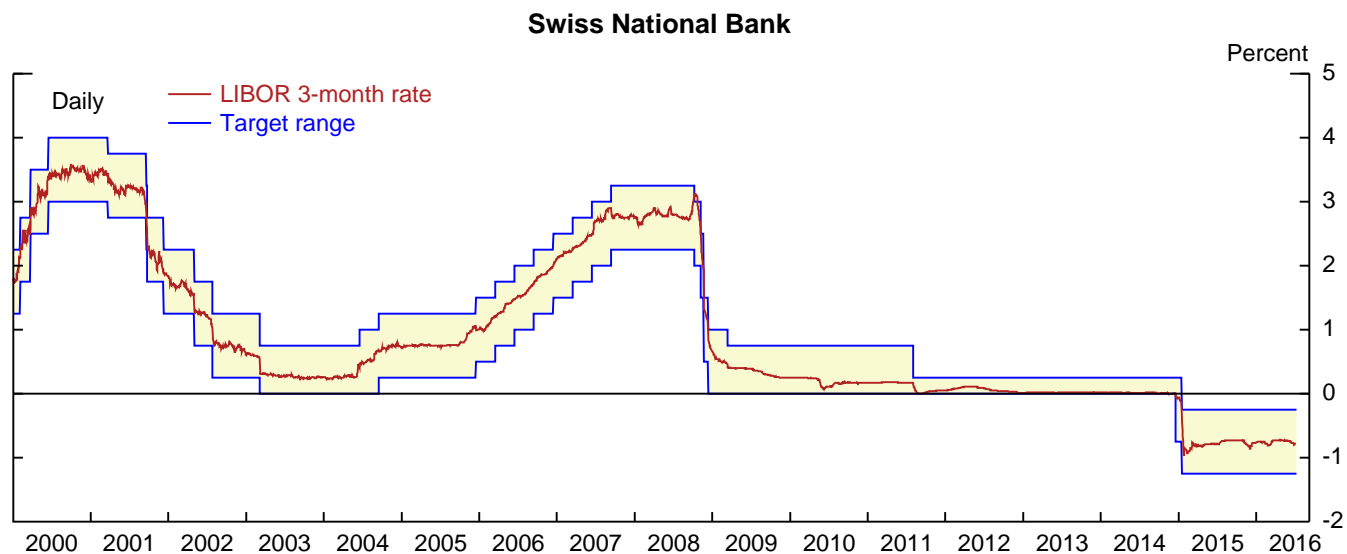


Exhibit 4

Table 1: Volatility of Short-Term Rates Around Central Bank Targets\*

	Pre-Crisis (2000-06)		Crisis (2007-09)		Post-Crisis (2010-15)**	
	Overnight Rate	3-Month Rate	Overnight Rate	3-Month Rate	Overnight Rate	3-Month Rate
<b>Cross-Country Average</b>	18	19	21	29	11	16
Australia	8	19	1	25	3	13
Canada	8	20	3	17	3	6
Euro area	16	16	29	34	11	18
Japan	10	11	9	13	5	6
Norway	18	29	24	31	13	25
New Zealand	9	21	15	21	10	7
Sweden	9	14	17	23	11	26
Switzerland	13	7	40	11	11	6
United Kingdom	44	16	20	49	5	17
United States	14	20	17	38	5	9

\* Standard deviation from central bank policy rate, in basis points. \*\* Post-crisis period for euro area is 2014-15 (recognizing the 2010-13 euro area crisis).

Exhibit 4

Table 2: Long-Term Interest Rate Responses to Central Bank Announcements\*

	United Kingdom	Japan	Euro area	United States	Canada	Norway	Sweden	Australia	New Zealand	Switzerland
Level Surprise	31.6***	87.0***	26.8***	48.3***	12.3**	17.0	50.0*	15.6	1.7	33.5***
Slope Surprise	81.3***	20.5	74.7***	105.5***	56.3***	28.9*	53.8	0.3	12.5	42.7***
Note: Total (Level + Slope)	113***	108***	102***	154***	69***	46*	104***	16	14	76***
Observations	179	194	213	105	103	54	126	157	107	68
Adjusted R <sup>2</sup>	0.331	0.117	0.341	0.368	0.276	0.033	0.142	-0.003	-0.001	0.216

\* Level Surprise is the estimated basis point reaction to a 100 basis point change in the 3-month OIS rate, and the Slope surprise in the estimated reaction to a 100 basis point change in the 12-month versus 3-month OIS differential, on the central bank policy decision days. QE announcements days excluded. \*\*\* p>0.01, \*\* p>0.05, \* p>0.1

	Exhibit 5: Reserve Requirements and Reserve Remuneration									
	Bank of England	Bank of Japan	ECB <sup>1</sup>	Federal Reserve	Bank of Canada	Norges Bank	Riksbank	RBA	RBNZ	Swiss National Bank
<b>Reserve System</b>	No reserve requirement	Quota	Required reserves	Required reserves	No reserve requirement	Quota	No reserve requirement	Required reserves	Quota	Quota
<b>Reserve Ratio Requirements</b>	N/A	0.75% <sup>4</sup>	1% <sup>4</sup>	10% for balances in excess of threshold <sup>4</sup>	N/A	/	N/A	0%	No hard requirement	2.5% <sup>4</sup>
<b>Maintenance Period (length)</b>	N/A	1 month	6 weeks (Intermeeting)	14 days	N/A	/	N/A	1 day	N/A	1 month
<b>Base Remuneration Rate (Required/Target Reserves or Reserves up to Quota)</b>	Policy Rate (IOR)	Higher Tiers of IOR	Higher Tier IOR (IOIR)	Top of Policy Range (IOR)	N/A <sup>3</sup>	Policy Rate (Higher Tier IOR)	N/A <sup>2</sup>	N/A <sup>3</sup>	Policy Rate (Higher Tier IOR)	Higher Tier IOR
<b>Remuneration of Excess (Above Quota, Target or Requirement)</b>	Same	Policy Rate (Lower Tier IOR)	Policy Rate (Lower Tier IOR)	Same	Lower Tier IOR (Deposit Rate)	Lower Tier IOR	Fine Tuning Operations (Deposit Rate)	Lower Tier IOR	Lower Tier IOR	Policy Rate (Lower Tier IOR)
<b>Opportunity Cost of Excess Other Remuneration</b>	N/A	10-20 bps	N/A <sup>1</sup>	N/A	25 bps	100 bps	Up to 10 bps	25 bps	100 bps	75 bps

<sup>1</sup>The difference between the higher tier remuneration (paid at the MRO rate) and the deposit rate is 40 basis points. However, given the high levels of excess reserves opportunity cost to holding reserves is low.

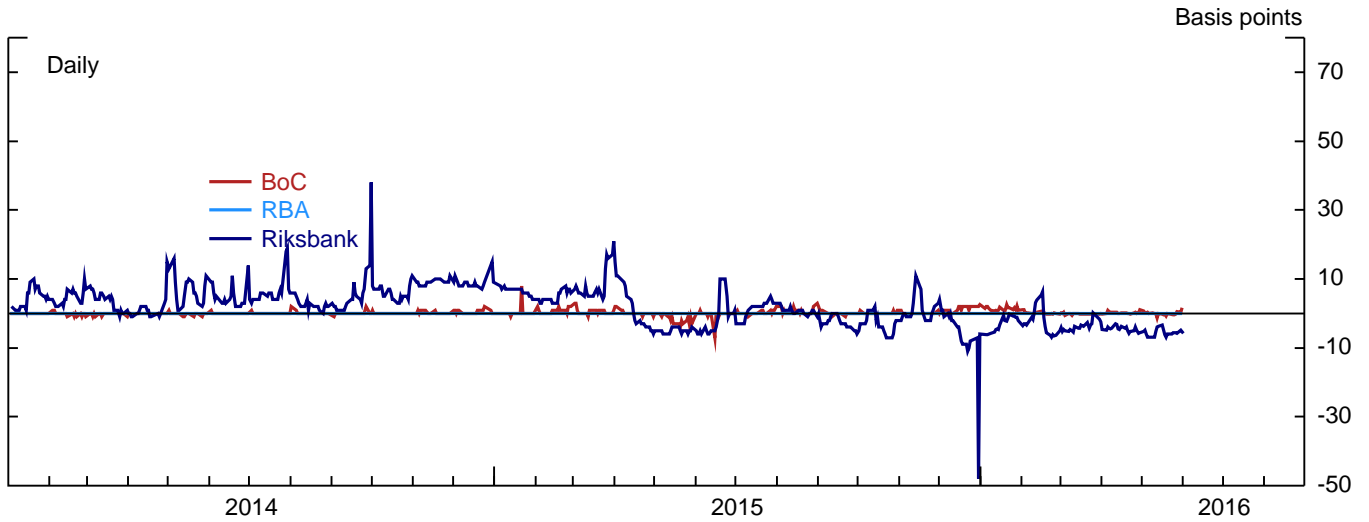
<sup>2</sup>The Riksbank offers 1 week bills at the policy rate, which is 10 basis points higher than the rate offered on fine tuning operations. The latter serves as an effective deposit rate since the standing deposit facility (which remunerates at 75 basis points below the policy rate) is not currently used.

<sup>3</sup>The RBA and the BOC do not remunerate reserves at the policy rate. Their policy rate is 25 basis points above the reserve remuneration, creating a cost to holding reserves.

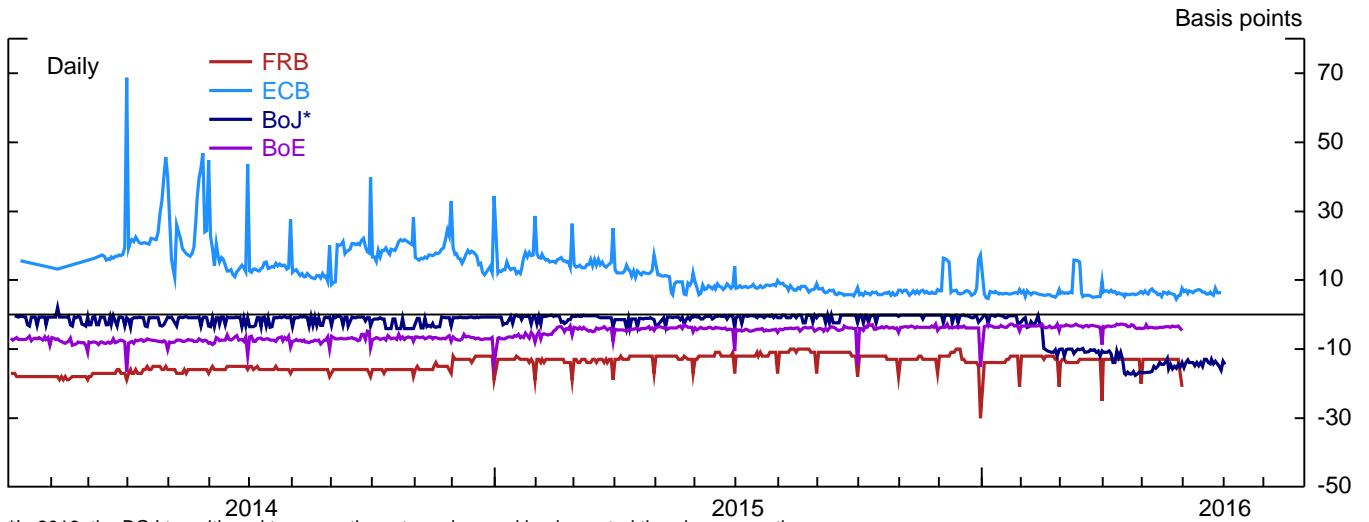
<sup>4</sup>Reserve requirements are still calculated, but not actively used in these countries to establish a demand for reserves.

### Exhibit 6: Spread of Overnight Rates over Reserves Remuneration Rates

#### Corridor countries



#### Floor countries



\*In 2016, the BOJ transitioned to a negative rate regime and implemented tiered remuneration.

#### Quota countries

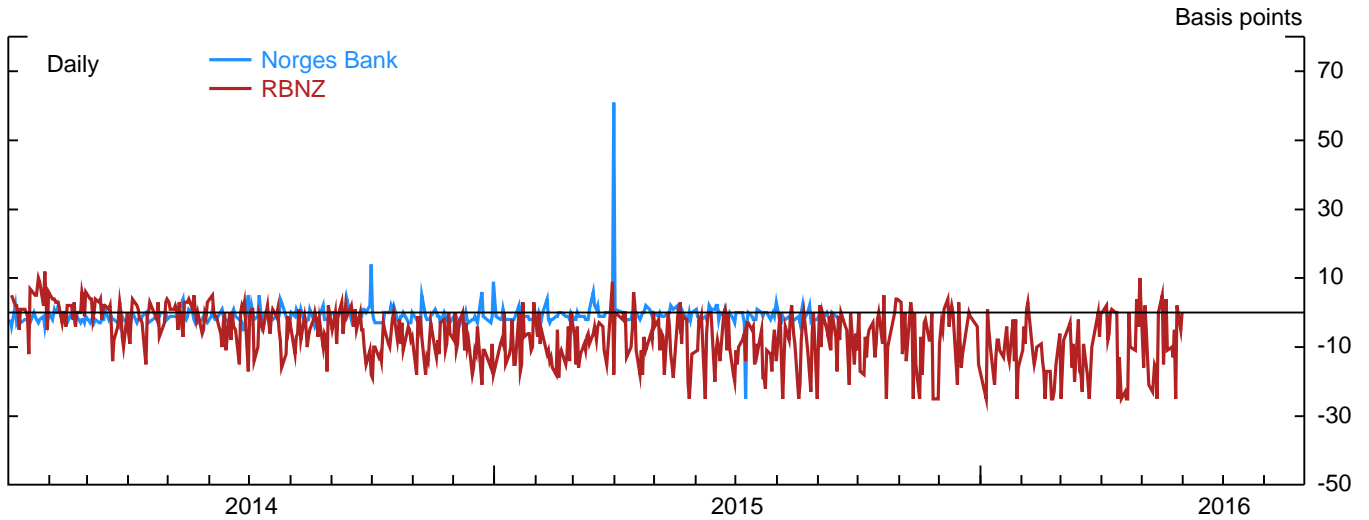




Exhibit 7: Counterparties												
Counterparties	Bank of England		Bank of Japan		European Central Bank		Federal Reserve					
	OMO (Repo)	SF (Overnight Standing Facility)	LI (Indexed LT Repo)	LI (Discount Window)	LI (Contingent Term Repo)	OMO (Funds Supplying Operations)	SF/LI (Complementary Lending Facility)	OMO (Main Refinancing Operation)	OMO (TLTRO)	SF/LI (Marginal Lending Facility)	OMO (Repo)	SF/LI (Discount Window)
Domestic Banks <sup>1</sup>	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FBO - Domestic Branch	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
FBO - No Domestic Branch					✓	✓						
Broker/Dealer	✓	✓	✓	✓	✓	✓	✓				✓	
Financial Market Utilities (incl CCPs)		✓										
Other Credit Institutions					✓	✓						
Other / Non-Categorized							✓	✓	✓	✓		

<sup>1</sup> Most advanced foreign economies have universal banks that include other financial functions such as broker/dealers and investment banking.

<sup>2</sup> Counterparties for reserve draining only.

Notes:

OMO= Open market operations used to provide reserves

SF = Standing facilities that are used to form an upper band on money market rates

LI = Liquidity Insurance defined as non-OMO operations that provide high quality collateral or reserves against a broad basket of collatera

Exhibit 7: Counterparties																									
	Bank of Canada			Norges Bank			Riksbank		Reserve Bank of Australia				RBNZ		SNB										
Domestic Banks <sup>1</sup>	OMO (Repo/Reverse)			OMO (Repo/Reverse)			OMO (Repo)			OMO (Repos)			OMO (Repos)			OMO (Repos)			OMO (FX Swaps)			SF/LI (Liquidity Shortage Facility)			
	OMO (Term Repo)			OMO (FX Swap)			OMO (Repos/Certificates)			OMO (FX Swaps)			OMO (Repo)			OMO (Repos)			OMO (FX Swap)			OMO (Repos)			
FBO - Domestic Branch	SF (Standing Repo Facility)			OMO (Fixed rate-Loans/deposits)						SF (Open Repo)			OMO (Repo)												
FBO - No Domestic Branch	SF/LI (Standing Liquidity Facility)			SF/LI (D-Loans)						SF/LI (Lending Facility)															
Broker/Dealer	LI (Contingent Repo)																								
Financial Market Utilities (incl CCPs)																									
Other Credit Institutions																									
Other / Non-Categorized																									

<sup>1</sup> Most advanced foreign economies have universal banks that include other financial functions such as broker/dealers and investment banking.

Notes:

OMO= Open market operations used to provide reserves

SF = Standing facilities that are used to form an upper band on money market rates

LI = Liquidity Insurance defined as non-OMO operations that provide high quality collateral or reserves against a broad basket of collateral

Exhibit 8: Collateral												
	Bank of England				Bank of Japan		European Central Bank			Federal Reserve		
	OMO (Repo)	SF (Overnight Standing Facility)	LI (Indexed LT Repo)	LI (Discount Window)	LI (Contingent Term Repo)	OMO (Funds Supplying Operations)	SF/LI (Complementary Lending Facility)	OMO (MRO)	OMO (TLTRO)	SF/LI (Marginal Lending Facility)	OMO (Repo)	SF/LI (Discount Window)
Domestic Government Securities	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
Domestic Government Agency Securities						✓	✓	✓	✓	✓	✓	✓
Domestic Municipal Securities						✓	✓	✓	✓	✓		✓
Foreign Exchange (Swaps)												
Foreign Government Securities		CA, FR, DE, NL, US	Western Europe, AU, CA, CH, JP, NZ, US			✓	✓					✓
Foreign Corporate Securities			US, EEA			✓	✓					✓
Supranational Agency Securities	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Corporate Securities			✓	✓	✓	✓	✓	✓	✓	✓		✓
Structured Products			✓	✓	✓	✓	✓	✓	✓	✓		✓
Mortgage Products			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bank Loans			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes:

OMO= Open market operations used to provide reserves

SF = Standing facilities that are used to form an upper band on money market rates

LI = Liquidity Insurance defined as non-OMO operations that provide high quality collateral or reserves against a broad basket of collateral



Exhibit 9: Effective Lower Bound Programs

Sovereign Debt Purchase Programs		Bank of England		Bank of Japan		European Central Bank		Federal Reserve		Riksbank	
		2009-2010	2011-2012	2001 - 2006	2013 - present	2010-2012	2015 - present	2009 - 2011	2011 - 2012	2012 - 2014	2015-2016
<b>Dates</b>	Reduce longer-term interest rates	Reduce longer-term interest rates	Provide liquidity	Reduce longer-term interest rates	Address acute market stress	Reduce longer-term interest rates <sup>4</sup>	Reduce longer-term interest rates	Reduce longer-term interest rates	Reduce longer-term interest rates	Reduce longer-term interest rates	Reduce longer-term interest rates
<b>Policy Objective</b>	£200 bln	£175 bln	¥30-35 trn <sup>3</sup>	¥288 trn	€11.1 bln	€1.5trn <sup>5</sup>	\$900 bln	\$667 bln	\$790 bln	SEK200 bln	
<b>Total Program Size</b> <sup>1</sup>	n/a	n/a	n/a	¥7 trn	n/a	€70 bln	n/a	n/a	n/a	n/a	
<b>Committed Monthly Size</b> <sup>1</sup>	13%	11%	7%	58%	1%	10%	6%	4%	5%	5%	
<b>Program Size as % of GDP</b> <sup>2</sup>	No	No	No	No	Yes	No	No	Yes, with sales of Treasuries w/ <3yr	No	No	
<b>Sterilized?</b>	≥3 years	≥3 years	Mostly shorter dated	Target 6-40 years	N/A	2-31 years	2 - 30 years	6-30 years	4 - 30 years	N/A	
<b>Maturity Range</b>	Fixed quantity	Fixed quantity	Fixed quantity	Contingent on inflation goal	Until end of acute market stress	Contingent on inflation goal	Fixed quantity	Fixed quantity	Contingent on labor market goal	Fixed quantity	
<b>Commitment</b>	Asset Purchase Facility (Gilts only)	Asset Purchase Facility (Gilts only)	Quantitative Easing Policy	Quantitative and Qualitative Monetary Easing (JGBs only)	SMIP/OMT <sup>6</sup>	Public Sector Purchase Programme	LSAP 1 and 2 (Tsy only)	MEP	LSAP3 (Tsy only)	Government Bond Purchasing Programme	
<b>Program Name(s)</b>											

<sup>1</sup> For ongoing programs, represents amount purchased to date.

Exhibit 9: Effective Lower Bound Programs

Credit Purchase Programs\*

	BOE	BOJ	ECB		Federal Reserve	
Dates	2009 - 2013	2013 - present	2009-2012	2014 - present	2008-2010	2012 - 2014
Assets Purchased	Commercial Paper, Corporate Bonds	Exchange-Traded Funds, Real Estate Investment Trusts, Commercial Paper, Asset-backed Commercial Paper, Corporate Bonds	Covered Bonds	ABS, Covered Bonds, Corporate Bonds	Agency MBS, Agency Debt	Agency MBS
Policy Objective	Improve corporate access to capital markets	Ease financial conditions; increase bank lending	Increase bank lending	Ease financial conditions; increase bank lending	Support mortgage and housing markets	Ease financial conditions
Total Program Size <sup>1</sup>	£11 bln <sup>3</sup>	¥6.6 trn	€76 bln	€300 bln	\$1.43 trn	\$823 bl
Program Size as % of GDP <sup>1</sup>	1%	1%	1%	2%	10%	5%
Sterilized?	Partially	No	No	No	No	No
Maturity Range	Commercial Paper: <3 mo; Corporate Bonds: >1 yr****	Corporate Bonds: 1-3 yrs	Maximum residual maturity of 10.5 years	Corporate Bonds: 6 mo-31 yr; ABS and Covered Bonds: None	15- and 30-year fixed rate	15- and 30-year fixed rate
Commitment	Fixed quantity	Fixed quantity	Fixed quantity	Contingent on inflation goal	Fixed quantity	Contingent on labor market goal
Program Name(s)	APF (Commercial Paper, Corporate Bonds only)	QQE (non-JGB assets)	Covered Bond Purchase Program (CBPP)1, CBPP2	CBPP3, Asset-Backed Securities Purchase Program, Corporate Sector Purchase Program	LSAP1 (Agency MBS and Debt only)	LSAP3 (Agency MBS only)

<sup>1</sup> For ongoing programs, represents amount purchased to date.

Long Term Funding Programs

	Bank of England		BOJ	ECB	
Dates	2008 - 2009	2012 - present	2013	2011-2012	2014- present
Policy Objective	Reduce risk premia, Increase bank lending	Increase bank lending	Increase bank lending	Reduce risk premia, Increase bank lending	Increase bank lending
Quantitative Target	No limit	No limit, as long as amount corresponds to net lending during reference period	No limit	No limit	No limit
Total Funding Provided <sup>1</sup>	£185 bln	£70 bln	¥20 trn	€1 trn	€425 to date
Tenor of Funding	Up to 3 years	4 years	4 years	3 years	~4 years
Funding Rate	Market-based rate	Fee of 25 bp	10 bp	MRO	MRO (or less) <sup>2</sup>
Collateral Basket	Legacy ABS and G10 sovereign or agency debt <sup>3</sup>	Regular operations	Regular operations	Regular operations	Regular operations
Program Name(s)	Special Liquidity Scheme	Funding for Lending Scheme	Loan Support Program	Very Long-Term Refinancing Operations I and II	Targeted Long-Term Refinancing Operations I and II

<sup>1</sup> Maximum amount of outstanding loans over the life of the program.

Negative Rates

	BOJ	ECB	Riksbank	SNB
Dates	From Feb. 2016	From June 2014	From July 2009	From Dec. 2014
Systemwide Reserves (% of Banking Assets)=A	14%	3%	2%	15%
Reserves Subject to Negative Rate(% of Total)=B	9% <sup>1</sup>	85%	100% <sup>2</sup>	35%
Reserves Subject to Negative Rates	1%	2%	2%	5%
Negative Policy Rate	-10 bp	-40 bp	-50 bp	-75 bp

<sup>1</sup> Approximately 80 percent of reserves fall into tier 1 and about 9 percent of reserves fall into each of the remaining tiers.

Exhibit 10: Balance Sheets

