

Implementing Monetary Policy in a Changing Federal Funds Market

As the Fed normalizes its balance sheet, it helps to understand how the federal funds market used to operate, how it changed in the wake of the crisis, and what comes next.

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BY BENJAMIN LESTER

Every six weeks or so, the financial world watches as the Federal Open Market Committee (FOMC) decides on a target interest rate in the federal funds market. But what happens next? How do policymakers make sure that interest rates in the fed funds market trade within the target range?

Though not widely discussed, the framework that the FOMC uses to implement monetary policy has changed over the last decade and continues to evolve today. Before the financial crisis—when reserves were scarce—policymakers used one set of instruments to achieve the target rate. However, several important policy interventions introduced soon after the crisis drastically altered the landscape of the fed funds market. This new environment—with ample reserves—necessitated a new set of instruments for monetary policy implementation. Now, as the FOMC begins to unwind the effects of these policy interventions, the question arises: What happens next as the fed funds market converges to a “new normal”?

Implementing Monetary Policy Before the Crisis

Banks hold reserves in an account at the Fed and are required to maintain a balance above a certain fraction of their deposits—so-called required reserves.¹ Prior to the onset of the Great Recession in December 2007, a defining feature of the fed funds market was that reserves were scarce. As a result, throughout the day a bank’s reserves would fluctuate as payments were made or received, and some banks would find themselves short of their reserve requirements at the end of the day. In order to avoid borrowing at the Fed’s discount window, these banks would look to borrow from other banks in the fed funds market.²

At the same time, some other banks would find themselves holding excess reserves at the end of the day. Since the Fed didn’t pay interest on excess reserves deposited overnight, these banks would look to lend in the federal funds market to earn a positive rate of return. As there were a significant number of banks on both sides of the market—some looking to borrow and

others looking to lend—trading volume in the fed funds market was substantial, and interbank trades dominated market activity. For instance, Afonso, Entz, and LeSueur estimate an average daily trading volume of approximately \$200 billion in the fourth quarter of 2006, of which approximately 60 percent was accounted for by bank-to-bank lending.

In this environment of scarce reserves, monetary policy implementation was fairly straightforward. The Open Market Trading Desk (the Desk) at the Federal Reserve Bank of New York would implement the desired target for the effective federal funds rate (EFFR) by adjusting the supply of reserves via open market operations.³ For example, if the Desk wanted to increase market rates, it would sell securities (such as Treasury bills) in the market, thereby decreasing the supply of cash held by banks. As banks’ supply of cash became scarcer, the rate at which they would be willing to lend would rise. Hence, as in the usual model of supply and demand, a reduction in the supply of reserves in the market would lead to an increase in the fed funds rate. (See Figures 1 and 2.) As the fed funds rate rose, market rates would rise as well.

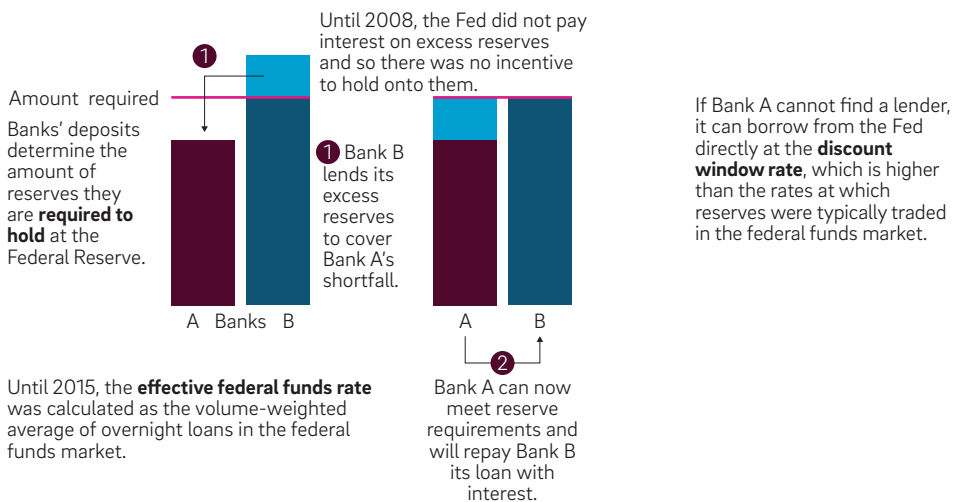
Three Important Changes

The landscape of the fed funds market was altered dramatically following the financial crisis. First, and most important, the Fed’s large-scale asset purchase programs left depository institutions awash with reserves. Over three rounds of “quantitative easing” in 2008, 2010, and 2012, the Fed purchased assets such as U.S. Treasury debt and agency mortgage-backed securities.⁴ As the Fed bought these assets, the banks that sold them saw their reserve balances soar. As a result, excess reserves held by depository institutions reached nearly \$2.7 trillion by August 2014. To put that in perspective, in the precrisis years, excess reserves typically hovered between just \$1 and \$2 billion.

Second, changes in the assessment of FDIC fees made borrowing in the interbank market more expensive for domestic banks. In response to the Dodd-Frank Act of 2010, the Federal Deposit

FIGURE 1

How Interbank Lending in the Fed Funds Market Worked Before the Crisis

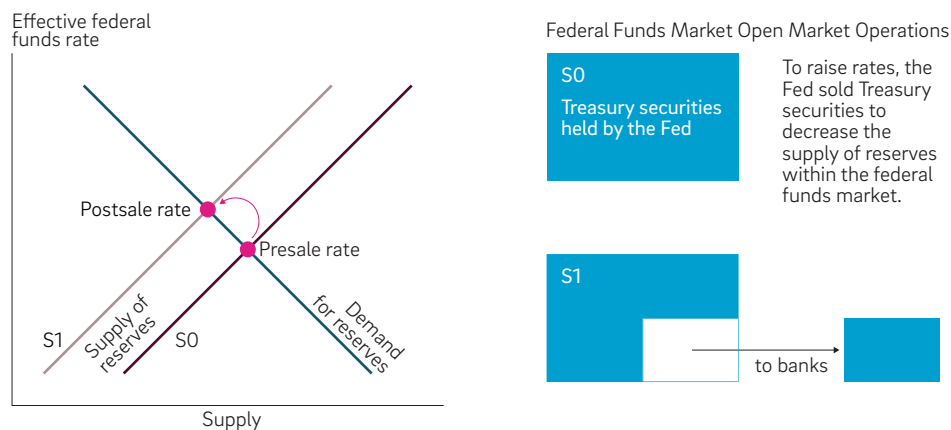


Insurance Corporation (FDIC) changed the basis for its fees from a bank's deposits to its assets. Since a bank's reserves are included in the calculation of its assets, this policy change increased FDIC fees and, hence, the cost of borrowing reserves on the interbank market. Economists estimate that these policy changes implied an additional cost between 4 and 7 basis points for each extra dollar of cash on a bank's balance sheet.⁵ However, FDIC fees are imposed only on banks with U.S. deposits, and branches of foreign banks typically don't hold U.S. deposits, so this policy change raised the cost of borrowing for domestic banks while leaving foreign banks with U.S. subsidiaries largely unaffected.

FIGURE 2

How the FOMC Raised Rates

The Federal Open Market Committee (FOMC) did not achieve the desired rate directly. Instead it used supply and demand for reserves to achieve a rate within the target range.



Third, in October 2008, in the hope of putting a "floor" beneath market rates, the Fed started paying an interest rate of 25 basis points on overnight reserves deposited by banks.⁶ However, this overnight rate was not made available to other financial institutions, including government-sponsored entities like the Federal Home Loan Banks (FHLBs) as well as money market funds. As a result, the introduction of interest on reserves (IOR), with eligibility restrictions, created a gap between the interest rates available to different types of financial institutions.

FIGURE 3

Federal Funds Trade Volume

Federal funds lending, USD, bn



Source: Federal Reserve Bank of New York (<https://www.newyorkfed.org/fed-funds-lending/index.html>)

Postcrisis Implications

These changes altered the fed funds market in a number of important ways, including the types of financial institutions that were trading, the rates at which they were borrowing and lending, and the tools available to the FOMC that could effectively influence these market rates.

Because banks were awash with reserves, their desire to borrow effectively vanished, and bank-to-bank lending largely disappeared. However, once the Fed started paying interest on reserves to some (but not all) financial institutions, a new lending opportunity emerged. To understand this opportunity better, consider a financial institution ineligible to receive interest on reserves at the Fed, such as an FHLB.⁷ At the end of the day, it likely holds some amount of cash, but the highest overnight interest rate it could receive—what economists call its "outside option"—was a zero percent net return.

Eligible financial institutions, however, had a better outside option, since they could deposit money at the Fed and earn the IOR rate (initially set at 25 basis points), less any costs associated with expanding their balance sheet. Because only domestic banks incurred FDIC fees from increasing their asset position, foreign banks faced smaller costs and thus had an advantage in borrowing.

Hence, an opportunity for arbitrage emerged: The FHLB could lend to an eligible bank at a rate above zero (its outside option) but less than the IOR rate, and the eligible bank could lend those reserves to the Fed at the IOR rate (its outside option). “Arbitrage in the Fed Funds Market” describes in greater detail the arbitrage opportunity that emerged because of differing outside options, the effects of borrowing costs like FDIC fees, and the determination of a mutually agreeable interest rate.

As a result of the many changes in the immediate aftermath of the crisis, the

majority of trading in the fed funds market was occurring between ineligible financial institutions, like FHLBs, and eligible financial institutions with low costs of borrowing, like U.S. branches of foreign banks, at rates below the IOR rate being offered at the Fed. Moreover, with no bank-to-bank lending, the overall market volume dropped precipitously, to \$80 billion or less per day. (See Figure 3.)

Implementing Monetary Policy After the Crisis

These changes to the fed funds market required policymakers to devise a new system for implementing monetary policy. Since the market rate was no longer primarily determined by banks’ supply and demand for reserves, typical open market operations would have essentially no effect on market rates.⁸ Instead, when the FOMC decided to raise interest rates after a long period at zero, it did so by adjusting the outside options of the lenders and the borrowers in this market via administered rates.

The Fed had been controlling the outside option of eligible banks via the IOR rate since October 2008. However, if the Fed adjusted this rate alone, the gap between the two outside options would widen as the IOR increased and, as a result, market rates might not rise in sync with the IOR. So in September 2013 the FOMC introduced an instrument to adjust the outside option of ineligible institutions, too, via the overnight reverse repurchase agreement facility, or ON RRP. In a reverse repurchase, the Desk sells a security to an eligible counterparty with an agreement to buy the security back at a specified date and price, with the interest rate computed from the difference between the original purchase price and the (higher) repurchase price. Importantly, the FOMC included a wide range of market participants as eligible counterparties at the ON RRP facility, including FHLBs and key money market funds.⁹ By adjusting the rate being offered at the ON RRP facility, the FOMC was thus adjusting the outside option of essentially all major financial institutions ineligible to earn IOR at the Fed.

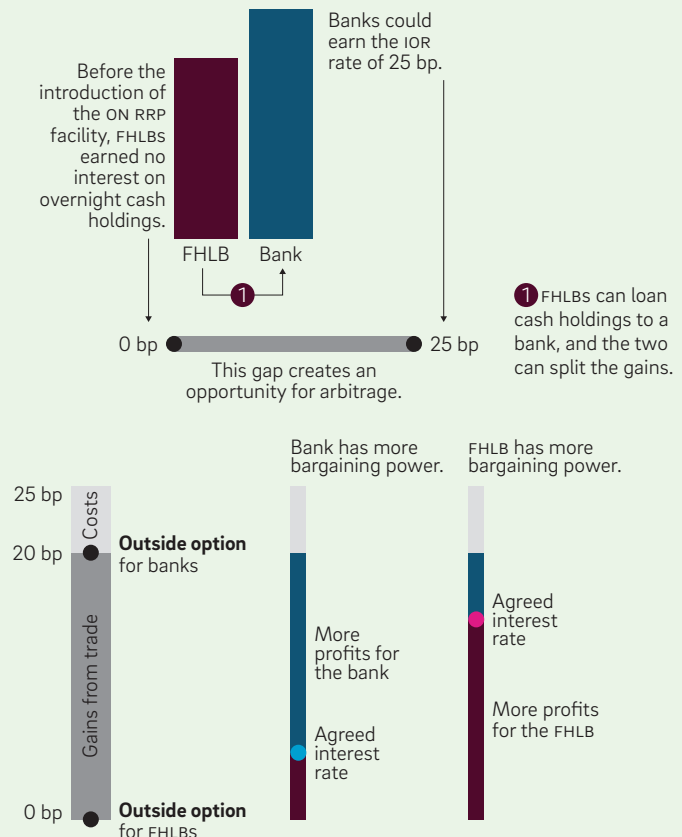
See *Arbitrage in the Fed Funds Market*

Arbitrage in the Fed Funds Market

Between October 2011 and September 2013, an FHLB could earn a zero net return on any cash it held at the end of the day. However, it could lend that money to a bank eligible to earn the IOR rate, 25 basis points, less any costs associated with expanding its balance sheet. Suppose these costs were 5 basis points, so there were “gains from trade” between the FHLB and the bank of $25 - 5 = 20$ basis points. This means the two parties would agree to trade at any interest rate between 0 and 20 basis points.

What determines the interest rate at which they actually trade? In bilateral transactions like this, we often assume that the two parties negotiate or “bargain.” Moreover, we assume that the interest rate at which they agree to trade depends on each party’s relative negotiating skill or “bargaining power.” If the bank has more bargaining power, it negotiates an interest rate r closer to zero so that its profit, $20 - r$, is relatively large. If the FHLB has more bargaining power, it negotiates an interest rate closer to 20 so that it earns more profit on its overnight loan.

A number of factors could determine the bargaining power of a bank or an FHLB. For example, an FHLB that can quickly and easily find an alternative bank to trade with would be in a relatively strong bargaining position. However, a bank that was desperate to borrow to avoid violating reserve requirements would be in a relatively weak bargaining position.



Since the FOMC began raising the target rate in December 2015, it has used these two instruments—the IOR and ON RRP rates—to raise and control the fed funds rate in a market characterized by ample excess reserves. In particular, as Armenter and Lester (2017) describe, the FOMC has raised rates by increasing both the ON RRP and IOR rates at the same time, while it has adjusted where the fed funds rate falls within the target range by adjusting the IOR rate.

The top panel of Figure 4 illustrates the relationship between the ON RRP rate, the IOR rate, and the fed funds rate between December 2015 and September 2018. The bottom panel of Figure 4 plots the

spread between the IOR and ON RRP rates between June 2017 and September 2018, and it plots where the EFFR rate falls within this spread (the red line).

From the time it “lifted off” from zero until 2018, the FOMC raised the IOR and ON RRP rates in tandem, with a 25 basis point spread between the two. The EFFR followed suit, staying safely within the target range until the second quarter of 2018. At that time, however, the outside option of ineligible financial institutions began rising, putting upward pressure on the EFFR. In response, when the FOMC raised the target range in June 2018, it increased the ON RRP rate by 25 basis points but the IOR rate by only 20 basis

points. Decreasing the spread between the IOR and ON RRP rates puts downward pressure on the fed funds rate, helping to keep it within the target range.

Normalization

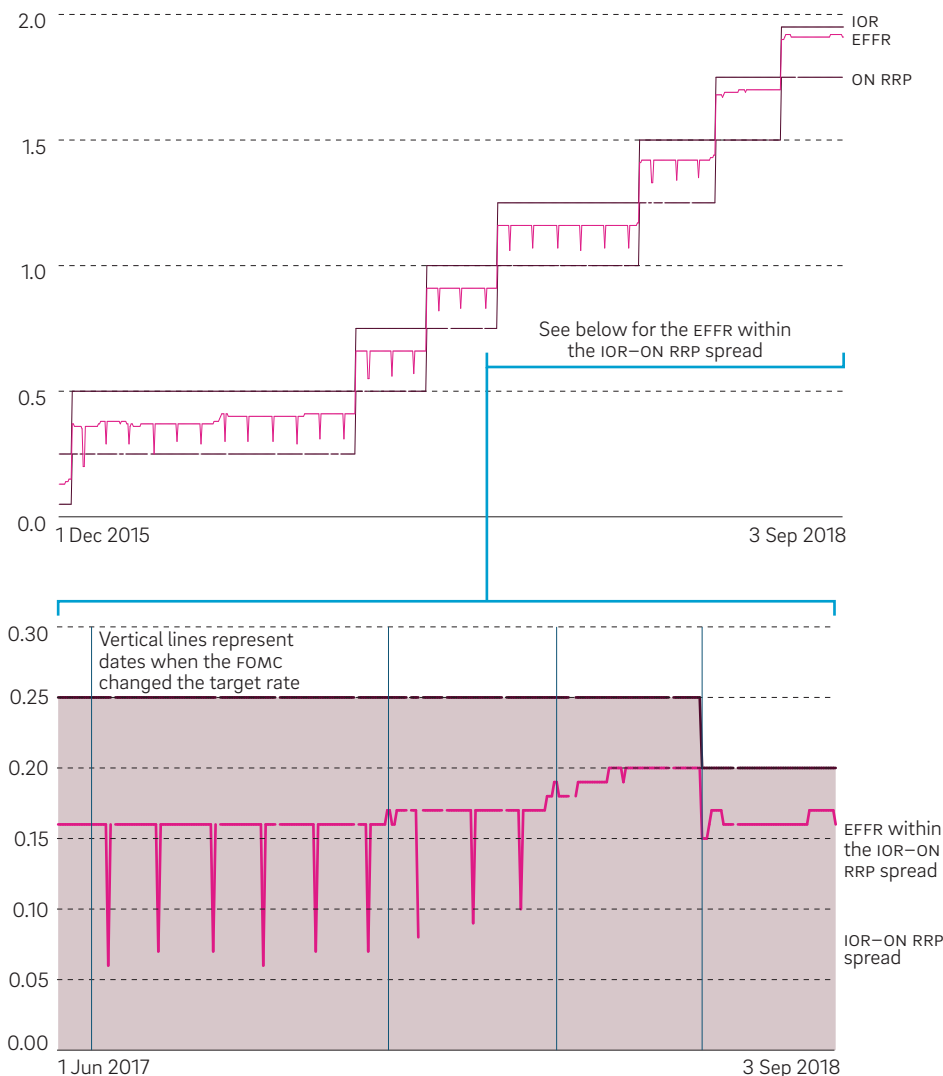
In the summer of 2017 the FOMC announced its intention to stop reinvesting the proceeds from maturing assets (such as mortgage-backed securities) on its balance sheet. This decision marked the beginning of the Fed unwinding or “normalizing” its balance sheet. As the Fed’s balance sheet shrinks, excess reserves in the banking sector decline. However, at the time, the FOMC did not provide an explicit endpoint for this process.¹⁰

More recently, in January 2019 the FOMC announced *how* it planned to hold “no more securities than necessary to implement monetary policy efficiently and effectively”: by using a “regime in which an ample supply of reserves ensures that control over the level of the federal funds rate and other short-term interest rates is exercised primarily through the setting of the Federal Reserve’s administered rates, and in which active management of the supply of reserves is not required.”¹¹ In other words, the FOMC decided to shrink the balance sheet until reaching the minimal size still consistent with “ample” excess reserves, and to use the ON RRP and IOR rates to achieve the target fed funds rate.

This decline in aggregate excess reserves changes the individual behavior of market participants, and this in turn affects overall market conditions in the fed funds market, including interest rates and trading volume. In particular, if total excess reserves decline enough, the market will transition from the ample-reserve regime—in which open market operations have little effect—to the precrisis scarce-reserve regime. However, it is difficult to forecast when this transition will occur because it depends not only on the level of excess reserves in the market but also on the distribution of these reserves across banks, which is hard to predict.

FIGURE 4
How the Fed Changes Rates Post-Great Recession

The Fed uses the IOR and ON RRP rates to adjust the EFFR.



Source: FRED, Federal Reserve Bank of St. Louis.

Who Trades with Whom, and at What Price?

In the fed funds market, a bank can try to find a counterparty to borrow from (either an ineligible financial institution, like an FHLB, or another bank), it can try to find a counterparty to lend to (another bank), or it can remain idle. When all banks are awash with reserves, there is no motive to lend, since nobody in the market is willing to pay more than the IOR rate. Hence, when reserves are ample, banks with sufficiently low balance-sheet costs (such as banks not subject to FDIC fees) will borrow from institutions such as FHLBs at a rate between the ON RRP rate and the IOR rate, and the remainder of banks (with higher costs from expanding their balance sheets) will remain idle.

However, as total reserves decline, some banks will find themselves close to their reserve requirement. To avoid coming up short of required reserves—and being forced to borrow at the discount window, where rates are typically 50 basis points higher than the IOR rate—these “desperate” banks will look to borrow from either an FHLB or another bank. If there are only a few desperate banks looking to borrow, they can likely satisfy their reserve requirements by borrowing from FHLBs at a rate below the IOR rate. But as total reserves decline further, there will be more and more desperate banks looking to borrow.

When this occurs, banks that are far from their reserve requirements will face a choice. These “nondesperate” banks can continue looking to borrow from an FHLB at a rate below the IOR rate, pocketing the difference (less any balance-sheet costs), or they can try to lend to desperate banks at a rate above the IOR rate. As the Fed’s balance sheet shrinks and reserves become increasingly scarce, the demand for reserves from desperate banks will grow, the supply of reserves from nondesperate banks will shrink, and lending to desperate banks will become more attractive. At some point, nondesperate banks will once again find themselves lending in the fed funds market, and they will do so at rates above the IOR rate.


This shift in the behavior of individual market participants has several important implications for the fed funds market as a whole. First, the fed funds rate, which is an average of all rates in the fed funds market, will no longer reside within the corridor formed by the ON RRP and IOR rates. It will instead lie within the corridor formed by the IOR and discount-window rates. Second, as bank-to-bank lending resumes alongside trades between FHLBs and banks, trading volume should also increase. Lastly, since the market rate will be determined by supply and demand once again, the fed funds rate will be sensitive to relatively small changes in the supply of reserves.

When Are Reserves No Longer ‘Ample’?

How much must total reserves shrink before we see these changes? Because the logic above suggests that the fed funds rate should move from one corridor to another when enough banks find themselves with scarce reserves, it is not sufficient to know the total level of reserves. In addition, we need to know the distribution of those reserves across banks! To see why, consider what would happen if the total amount of excess reserves declined by \$100 billion and the entirety of this decline came off the balance sheets of banks already close to their reserve requirements. This would immediately force a number of banks to enter the fed funds market as borrowers, prompting other banks to lend above the IOR, thus raising rates. However, if this decline in reserves came off the balance sheets of banks far from their reserve requirements, it would have little effect; all banks would continue to borrow from FHLBs at rates below the IOR.

Hence, to forecast the level of reserves at which the market transitions from ample to scarce reserves, we need to predict the distribution of reserves across banks as the Fed’s balance sheet shrinks. Several factors determine this distribution, including each bank’s size and the regulatory costs they face. In a recent paper with Afonso and Armenter, we estimate the total quantity of reserves consistent with the fed funds rate returning to a corridor between the IOR and discount-window rates. Our benchmark model suggests an answer of approximately \$900 billion. However, we find that our estimates are quite sensitive to what we assume about the evolution of the distribution of reserves. In particular, assuming that the majority of the decline in aggregate reserves is absorbed by the smallest or largest banks, respectively, produces estimates as large as \$1.1 trillion and as small as \$500 billion.

Conclusion

In response to the financial crisis, the Federal Reserve introduced new programs and policies to stabilize markets, restore liquidity, and spur economic activity. However, a byproduct of these changes was that the fed funds market was dramatically altered, necessitating a new framework for monetary policy implementation. More recently, as the Fed began to unwind some of these programs, it was forced to reassess the long-run size of its balance sheet—and the tools it intended to use for monetary policy implementation—given the current economic and regulatory environment. It has chosen to maintain a balance sheet that is sufficiently large to support a market with ample reserves, and to use the administered (IOR and ON RRP) rates to achieve the target range. A lingering challenge is identifying the minimum balance-sheet size consistent with these goals, as this requires forecasting the evolution of the distribution of reserves across banks. 

Notes

1 Although not all banks are depository institutions, and not all depository institutions are banks, we will use “bank” to refer to depository institutions trading in the fed funds market, including bank holding companies, standalone commercial banks, and thrifts. However, institutions other than banks also trade in the federal funds market. Under current regulation, once deposits exceed a minimal threshold, these banks are required to hold at least 10 percent of any additional deposits as reserves at the Fed.

2 Banks would try to avoid borrowing at the discount window because the rate was higher than the typical rate being offered in the fed funds market, and because there was a stigma associated with borrowing at the discount window. See Ennis and Weinberg (2013).

3 For a more detailed description of open market operations, see <https://www.federalreserve.gov/pubs/bulletin/1997/199711lead.pdf>.

4 For more details on quantitative easing, see Yu (2018).

5 A basis point equals one hundredth of 1 percent. McCauley and McGuire (2014) estimate a cost of 4 basis points, while Banegas and Tase (2016) find a cost of 7 basis points.

6 This policy change was made possible when Congress passed the Financial Services Regulatory Relief Act in 2006, clearing the way for the Federal Reserve to start paying interest on reserves to eligible depository institutions effective October 1, 2011. This date was later moved up to October 1, 2008, as a result of the Emergency Economic Stabilization Act of 2008.

7 The Federal Home Loan Banks provide funds to depository institutions in the form of loans collateralized by real estate. They were initially set up to provide liquidity to savings and loans but are now a source of funds for all banks.

8 If the Fed tried to conduct policy on precrisis terms, it would have had to execute very large open market operations to drain reserves in relatively short order. Selling large quantities of certain assets in a very short period would have negative side effects, as prices in these markets would likely experience sudden declines.

9 For more information about eligible counterparties at the ON RRP facility, see https://www.newyorkfed.org/markets/rrp_counterparties.

10 In its June 14, 2017, statement, the FOMC announced only that “the Federal Reserve’s securities holdings will continue to decline in a gradual and predictable manner until the Committee judges that the Federal Reserve is holding no more securities than necessary to implement monetary policy efficiently and effectively.”

11 See <https://www.federalreserve.gov/monetarypolicy/policy-normalization.htm>.

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