

STRATEGIES *for* MONETARY POLICY



EDITED BY
JOHN H. COCHRANE
JOHN B. TAYLOR

CHAPTER FOUR

**PERSPECTIVES ON US
MONETARY POLICY TOOLS
AND INSTRUMENTS**

James D. Hamilton

1. INTRODUCTION

This paper discusses the policy instruments that the central bank uses in pursuit of its broader strategic objectives of influencing variables like inflation and output. For many decades, the primary instrument of US monetary policy was the federal funds rate, which is an interest rate on overnight loans of Federal Reserve deposits between depository institutions. When this rate fell essentially to zero in 2009, the Fed implemented massive purchases of Treasury securities and mortgage-backed securities as an alternative policy instrument with which it hoped to influence longer-term interest rates. Although the fed funds rate is no longer at the effective lower bound, today the Fed continues to treat both the fed funds rate and its holdings of securities as policy instruments.

I review the current operating procedures and conclude that neither instrument is well suited for achieving the Fed's broader strategic objectives. The fed funds rate has become a largely administered rate that is heavily influenced by regulatory arbitrage and divorced from its traditional role as a signal of liquidity in the banking system. To the extent that the size of the Fed's balance sheet matters today, it is primarily from the liabilities rather than the asset side

I thank Peter Ireland, Andrew Levin, and John Taylor for helpful suggestions.

of the balance sheet, with the size of the balance sheet at best a very blunt tool for influencing interest rates. I discuss alternative possible operating procedures such as a corridor system based on repurchase agreements.

Section 2 reviews the effects of the Fed's asset holdings on long-term interest rates over 2009 to 2019. I conclude that this instrument has less influence on interest rates than is sometimes believed. Section 3 describes a traditional corridor system such as that used by the European Central Bank. Sections 4 and 5 discuss the discount rate and interest on excess reserves, respectively, tools that could in principle operate like the ceiling and floor of a corridor system but in US practice have not. Section 6 discusses the reverse repo rate and argues that this policy rate is the true floor on short-term interest rates in the current system. Section 7 notes how the operation of the system changed in 2018. Section 8 concludes with some thoughts on how the United States could transition to a system that would give the Federal Reserve more accurate tools with which to influence inflation and output.

2. THE EFFECTS OF LARGE-SCALE ASSET PURCHASES

Figure 4.1 displays the Fed's holdings of Treasury and mortgage-backed securities. These rose from \$500 billion at the start of 2009 to \$4.5 trillion by 2017. These purchases are sometimes described as "quantitative easing" and were implemented in three phases popularly referred to as QE1, QE2, and QE3. In November of 2017, the Fed stopped some of its purchases of new securities, allowing its holdings of securities to gradually decline to a level of \$3.8 trillion as of May 2019.

In many standard macroeconomic and finance models, if the nominal interest rate is zero, purchases of securities by the central bank would have no effects on any real or nominal variable of inter-

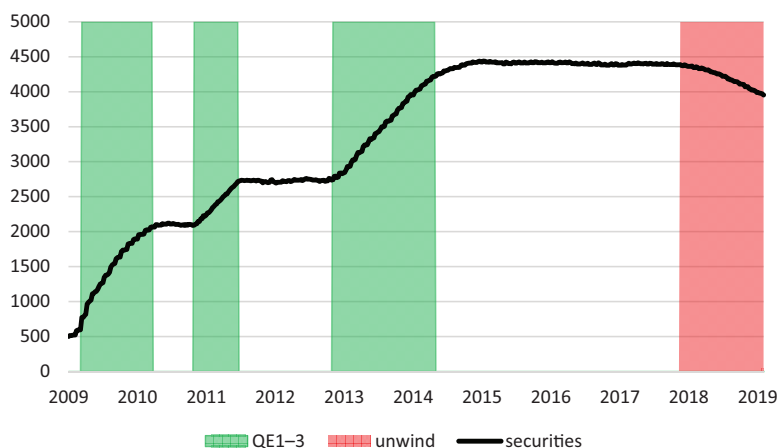


FIGURE 4.1. Federal Reserve Holdings of Securities, Billions of Dollars. Weekly Fed holdings of Treasury securities, mortgage-backed securities, and agency debt, plus unamortized premiums minus unamortized discounts, Wednesday values, January 7, 2009, to February 6, 2019

Source: Federal Reserve H.4.1 release. Shading dates for QE1: March 18, 2009, to March 24, 2010; QE2: November 3, 2010, to June 22, 2011; QE3: November 7, 2012, to April 30, 2014 (halfway through taper); unwind: November 22, 2017, to present.

est; see, for example, Eggertsson and Woodford (2003). As discussed by Hamilton (2018), adding various financial frictions to the models can change that prediction; see among others Cúrdia and Woodford (2011), Gertler and Karadi, (2011), Chen, Cúrdia, and Ferrero (2012), Hamilton and Wu (2012), Woodford (2012), Greenwood and Vayanos (2014), Eggertsson and Proulx (2016), and Caballero and Farhi (2018). However, it is not clear from theory how large the potential stimulus arising from these channels could be.

A number of empirical studies concluded that QE1–3 were successful in their goal of bringing down long-term interest rates; for surveys of this literature, see Williams (2014), Borio and Zabai (2018), and Swanson (2018). It is useful to put these claims in perspective. Figure 4.2, updated from Woodford (2012), plots the interest rate on 10-year Treasury bonds over this period. On net, this rate rose during QE1 when the Fed was trying to bring it down, fell when QE1 ended,

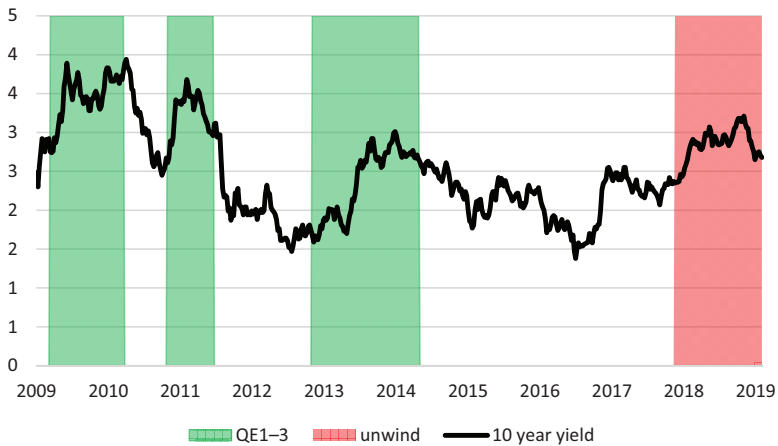


FIGURE 4.2. Interest Rate on 10-Year Treasury Bond

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

rose in QE2 when the Fed again resumed its efforts to lower long-term rates, and dropped after QE2 was halted, only to rise again in QE3. One can of course claim that if the Fed had not been purchasing bonds, the rate would have risen even more than it did during the QE1–3 episodes. But at a minimum, we are forced to conclude that Fed purchases were only one of many factors influencing bond yields during these episodes, and certainly not the most important factor.

One way we might try to isolate the effects of Fed actions is to focus only on the particular days when the Federal Open Market Committee (FOMC) issued a statement or released its minutes, or when the Fed chair gave a speech on the economy or monetary policy. Figure 4.3, adapted from Greenlaw et al. (2018), shows the cumulative change in the 10-year yield that occurred on those days alone. Figure 4.3 turns out to show the same broad pattern as figure 4.2—yields on average rose, not fell, during QE1–3, even if we focus on just days in which the Fed made an announcement.

Many researchers have conducted event studies using a subset of days on which there were particularly important announcements of the Fed’s intentions to implement additional large-scale

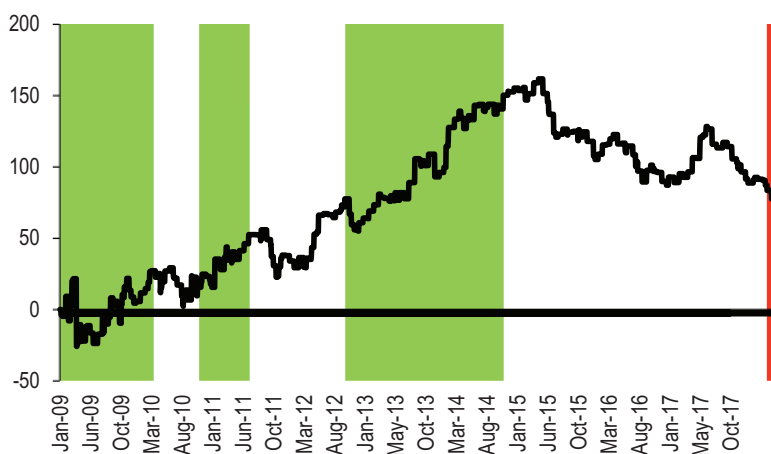


FIGURE 4.3. Cumulative Change in 10-Year Yield on Fed Days. Cumulative change in interest rate on 10-year Treasury bond on FOMC meeting days, days when FOMC minutes were released, or days with speech by Fed chair on economy or monetary policy, January 1, 2009, to December 29, 2017

Source: Adapted from David Greenlaw et al. (2018).

asset purchases. But the analysis of some of these days by Thornton (2017), Hamilton (2018), and Levin and Loungani (2019) suggests that previous studies may have overestimated the role of the purchases in moving interest rates. One key question is the extent to which interest rates were responding to the Fed's assessment of the economic situation rather than to the purchases themselves. See Melosi (2016), Nakamura and Steinsson (2018), and Miranda-Agrippino and Ricco (2018) for more discussion of this issue.

Regardless of one's position on whether large-scale asset purchases are an important tool when the traditional instrument of controlling the fed funds rate is unavailable, the case for its importance in 2019 when short rates are significantly above zero is far from compelling. I conclude below that the primary relevance of the size of the Fed's balance sheet today for the conduct of monetary policy comes from the liabilities side rather than any tangible consequences of its asset holdings for long-term interest rates. But

before returning to that issue, I first discuss alternative monetary procedures for controlling the short-term interest rate.

3. THE CORRIDOR SYSTEM FOR CONTROLLING SHORT-TERM INTEREST RATES

The European Central Bank (ECB) is one of many central banks that use a corridor system for controlling interest rates. The ECB stands ready to lend to banks as much as they want at a particular rate i_L that is set by policy. This sets a ceiling on short-term loans between banks. Why should I pay more than i_L to borrow from another bank when I can get all I want from the ECB at i_L ? The ECB sets another rate i_D on funds that are left on deposit with the ECB. One can think of these as short-term loans from private banks to the ECB. The rate i_D sets a floor on the interest rate on interbank loans. Why should I lend to another bank for less than i_D when I can earn i_D risk free just by leaving my funds with the ECB? The policy instruments are the ECB's choices for i_L and i_D , which define a corridor within which the interbank loan rate trades, as seen in figure 4.4. Since June 2014 the ECB has charged a fee rather than pay interest on deposits (essentially a negative value for i_D) and has used the fee to cause interest rates to become negative.

It's worth remembering that the core power that gives the central bank the ability to specify i_L and i_D as instruments of policy is its ability to create new deposits of private banks with the ECB. This is what enables the central bank to satisfy all demand for borrowing at the chosen i_L . By choosing particular values for i_L and i_D , the ECB is implicitly committing to a level and growth rate of the monetary base that may or may not be consistent with its broader strategic inflation objective. Indeed, one could think of monetary policy equivalently either as a decision for i_L and i_D or as a decision about monetary aggregates. Modern economic theory (e.g., Woodford 2003) and central bank practice usually adopt the for-

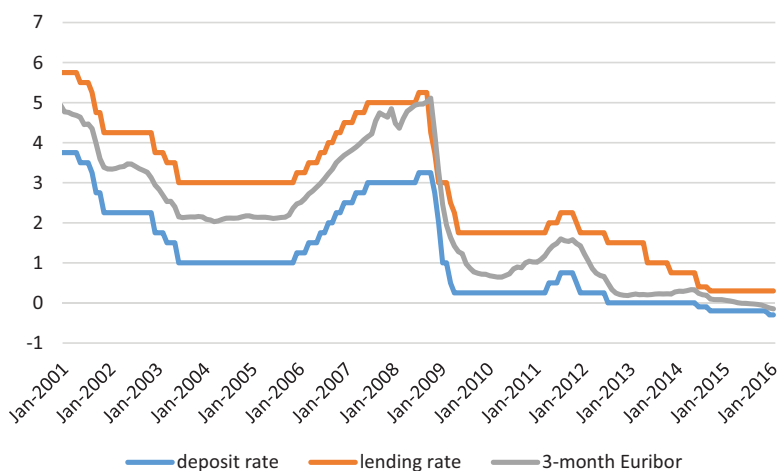


FIGURE 4.4. Corridor System for Controlling Interest Rates Used by the European Central Bank. End-of-month values for ECB marginal lending rate (orange) and deposit facility (blue) along with monthly average 3-month Euribor rate (gray), January 2001 to January 2016

Source: European Central Bank.

mer perspective, essentially for reasons described by Poole (1970): the demand for monetary aggregates can be very volatile, making targeting interest rates a more reliable tool than targeting monetary aggregates for purposes of stabilizing inflation and real activity.

4. THE FEDERAL RESERVE'S DISCOUNT WINDOW

Like the ECB, the US Federal Reserve historically offered to lend to banks at a policy-determined rate i_L through its discount window. Figure 4.5 compares the fed funds rate with the discount rate. Over most of the last half century, the fed funds rate was above the discount rate. In the United States, i_L served as a floor, not a ceiling, for the fed funds rate!

Why would I pay another bank an interest rate higher than i_L to borrow funds? The answer is that US banks traditionally imputed

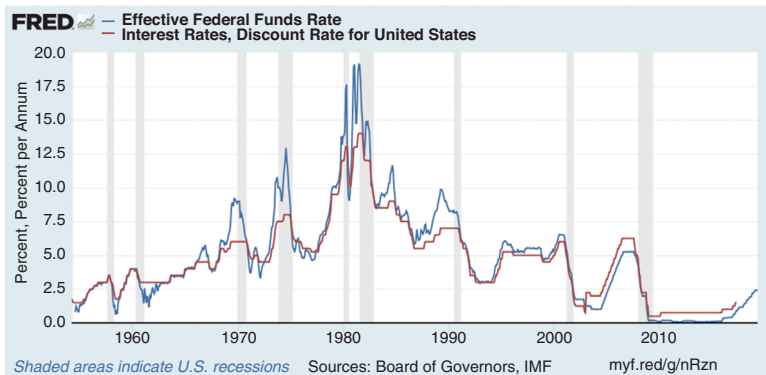


FIGURE 4.5. Fed Funds Rate and Discount Rate. Monthly average effective fed funds rate, April 1954 to April 2019 (blue) and discount rate, April 1954 to April 2017 (red)

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

some nonpecuniary costs to borrowing at the discount window. Although the identities of banks that borrowed at the discount window were not publicly released, other banks could usually find out who had borrowed, and borrowing from the discount window was associated with a certain stigma. Banks wanted to borrow at the discount window only if they had trouble borrowing fed funds from other banks, which could be a sign of weakness.

Banks differed in their perceived nonpecuniary costs and would turn to the discount window when the marginal nonpecuniary cost was less than the spread between the fed funds rate and the discount rate. Figure 4.6, adapted from Goodfriend and Whelpley (1986), illustrates how the fed funds rate was determined in this system. The Fed's open-market operations resulted in a certain level of nonborrowed reserves, which are deposits with the Fed that banks would have even if they do no borrowing at the discount window. As the fed funds rate rises above the discount rate, more banks would be willing to borrow at the discount window, thereby increasing the total supply of nonborrowed plus borrowed reserves until supply equals demand.

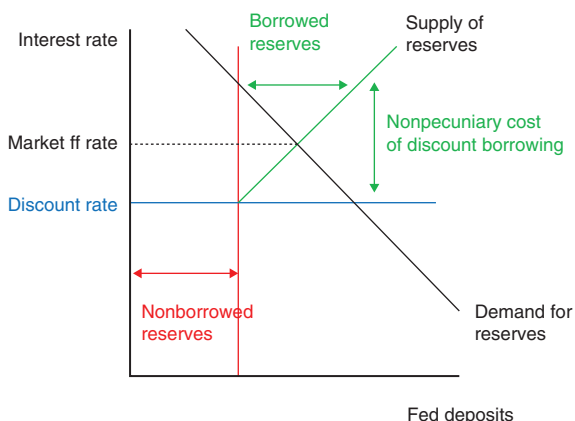


FIGURE 4.6. Determination of Fed Funds Rate in Historical US System
 Source: Adapted from Goodfriend and Whelpley (1986).

Figure 4.7 compares the gap between the fed funds rate and the discount rate (top panel) with the total volume of discount window borrowing (bottom panel), showing how the system worked in practice. A higher value for the fed funds rate relative to the discount rate was associated with a higher volume of borrowing. Indeed, some observers at the time thought of the operating system as one of borrowed reserves targeting rather than fed funds rate targeting.

5. INTEREST ON EXCESS RESERVES

Beginning in October 2008, the Federal Reserve began paying an interest rate on excess reserves (IOER), akin to the interest rate i_D in a corridor system. Figure 4.8 shows the recent relation between the fed funds rate and IOER. Whereas i_D acts as a floor in the traditional corridor system, until very recently IOER seemed to be a ceiling on the fed funds rate! Indeed, at times IOER looked like a deterministic ceiling. On most days, the average effective fed funds

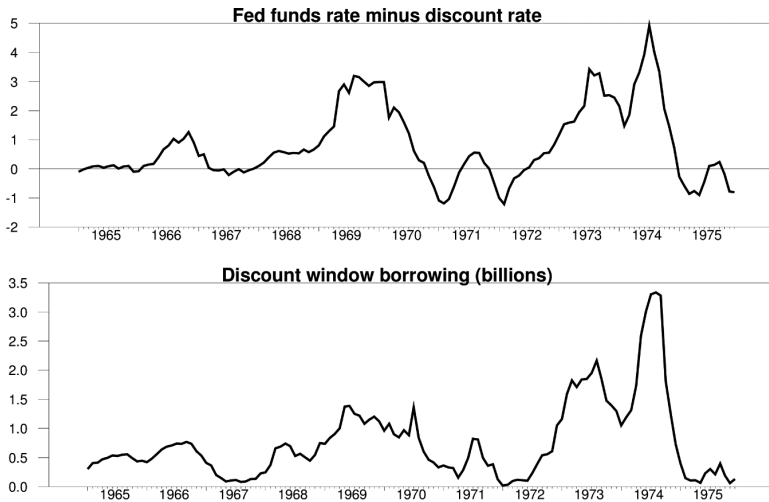


FIGURE 4.7. Volume of Borrowed Reserves and Gap between Fed Funds Rate and Discount Rate. The top panel shows monthly average effective fed funds rate minus discount rate, January 1965 to December 1975. The bottom panel shows discount window borrowings of depository institutions from the Federal Reserve, billions of dollars

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

rate would be exactly nine basis points below the interest on excess reserves, though it would drop significantly below on the last day of the month.

Why would anyone offer to lend at a fed funds rate below IOER if they could earn IOER just by parking the funds with the Fed? The answer is that not all depository institutions can earn IOER. Federal Home Loan Banks (FHLBs) have deposits with the Fed but are not paid IOER, so they have an incentive to lend to banks that can earn IOER. But why wouldn't banks that can earn IOER bid up the fed funds rate so as to earn the risk-free arbitrage from borrowing at the fed funds rate and earning IOER? Part of the answer is on the supply side; individual FHLBs set limits on to whom and how much they lend. Afonso, Armenter, and Lester (2019) modeled these frictions using a search and matching model for the fed

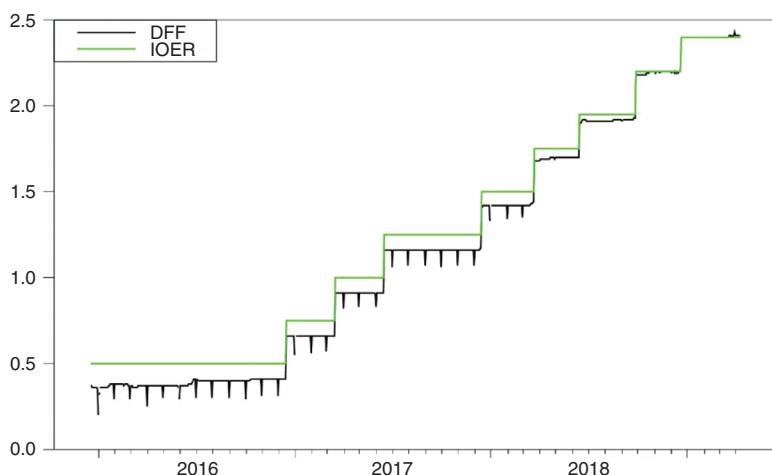


FIGURE 4.8. Fed Funds Rate and Interest on Excess Reserves. Daily effective fed funds rate (black) and interest on excess reserves (green), December 17, 2015, to April 10, 2019

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

funds market. Another factor is nonpecuniary costs on the demand side, as discussed by Klee, Senyuz, and Yoldas (2016), Banegas and Tase (2017), and Anbil and Senyuz (2018). If a bank tries to arbitrage by borrowing fed funds and holding fed deposits to earn IOER, it expands its balance sheet. A larger level of assets exposes US banks to higher fees from the Federal Deposit Insurance Corporation. For this reason, foreign banks are a more natural counterparty than domestic banks to borrow the fed funds from the FHLB. In addition, both domestic and foreign banks are subject to complicated capital requirements, another source of nonpecuniary costs associated with borrowing fed funds. A larger balance sheet may require the bank to make other adjustments to meet capital requirements, which imposes another nonpecuniary cost on arbitraging the IOER–fed funds spread. For European banks, the capital requirements are primarily based on end-of-month assets. This explains why before 2018 there was usually a sharp spike in the gap between IOER and the fed funds rate on

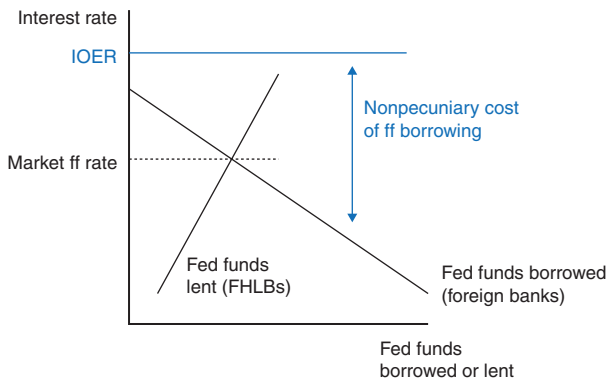


FIGURE 4.9. Determination of the Fed Funds Rate in 2017

the last day of a month; this was the one day those banks didn't want to borrow fed funds.

One can think about the determination of the fed funds rate in this setting as in figure 4.9. Banks differ in their marginal nonpecuniary costs of borrowing fed funds and would be willing to borrow more the bigger the gap between IOER and fed funds. The apparent deterministic nature of the IOER–fed funds gap in early 2017 arose from the fact that, on days other than the last day of the month, and over the range of volume traded at that time, there was a sufficient volume of borrowers with fixed nonpecuniary costs of nine basis points. In other words, the demand curve was flat over that range, resulting in essentially a constant gap between IOER and the fed funds rate.

6. REVERSE REPO RATE

The true floor in the current operating system comes not from IOER but instead from a different facility. The Fed offers to conduct reverse repurchase (RR) agreements with a broader group of financial institutions that includes money market funds. These are essentially short-term loans from the institution to the Fed at a

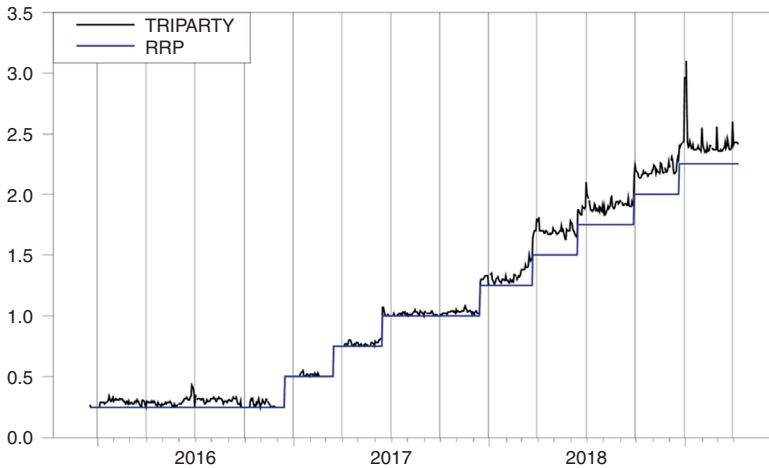


FIGURE 4.10. Tri-Party Repo Rate and Interest on Excess Reserves. Daily interest rate on tri-party repurchase agreements based on Treasury securities (black) and Fed reverse repo rate (blue), December 17, 2015, to April 10, 2019. Vertical lines denote last day of a quarter

Source: Tri-party repo rates from Bank of New York Mellon (<https://repointdex.bnymellon.com/repointdex>).

policy-determined rate RR. Figure 4.10 compares RR with the tri-party Treasury repo rate. In a typical tri-party repo transaction, a money market fund would lend overnight to a primary security dealer (one of the large financial institutions authorized to be a counterparty to transactions with the trading desk of the Federal Reserve Bank of New York). The agreement is settled through one of the large clearing banks (Bank of New York Mellon or JPMorgan Chase), with the security dealer temporarily delivering Treasury securities to the clearing bank, essentially as collateral for the loan. Unlike the fed funds rate, the tri-party repo rate is a true market rate that varies daily with market conditions. But RR puts a floor under the tri-party repo rate for the same reason that i_D functions as a floor in a traditional corridor system. Why should a money-market fund lend to a private counterparty at the private repo rate when it can earn RR risk-free from the Fed?

7. CHANGES IN 2018

But while RR puts a floor under the tri-party repo rate, as seen in figure 4.11, IOER does not set a ceiling. Up until the end of 2017, the tri-party repo always traded in between RR and IOER. This fact could give the impression that the system was functioning something like a corridor system. But there's nothing that prevented the private repo rate from going above IOER, and indeed throughout 2018 it often did.

Figure 4.11 also plots another market-determined short-term interest rate, the Treasury general collateralized finance rate (GCF). These are also repurchase agreements collateralized with Treasury securities that are cleared through a third party, in this case the Fixed Income Clearing Corporation.¹ A typical transaction here would be a loan from a primary security dealer to a nonprimary security dealer, again collateralized by Treasuries, with the primary dealer often rehypothecating the Treasury securities for purposes of its own borrowing through tri-party repos. The GCF rate is generally above the tri-party repo rate. It's interesting to compare the 2018 portion of figure 4.11 with figure 4.8. GCF started to trade consistently above IOER at the same time that IOER stopped being the *de facto* ceiling on the fed funds rate.

What changed in 2018? The elimination of the gap between IOER and fed funds could have come either from a rightward shift of the demand curve in figure 4.9—the nonpecuniary costs of borrowing fed funds decreased, leading borrowing banks to bid up the cost of fed funds—or from a leftward shift of the supply curve—FHLBs are less willing to lend fed funds. If the first explanation was correct, we would expect to see an increase in the volume of fed funds lending, whereas if the second was correct, we would expect to see a decrease. Figure 4.12 plots the effective fed funds rate together

1. For more details on GCF, see Agueci et al. (2014).

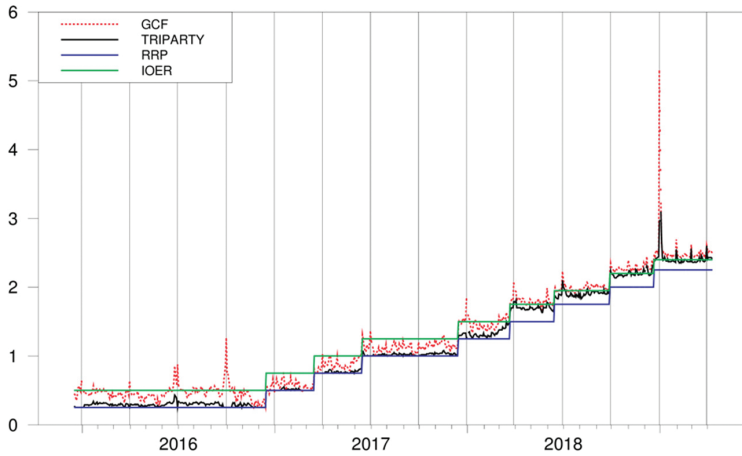


FIGURE 4.11. GCF Rate, Tri-Party Repo Rate, Reverse Repo Rate, and Interest on Excess Reserves. Daily general collateralized finance rate for repurchase agreements based on Treasury securities (dashed red), rate on tri-party repurchase agreements based on Treasury securities (black), interest on excess reserves (green), and Fed reverse repo rate (blue), December 17, 2015, to April 10, 2019

Source: GCF data from DTCC (<http://www.dtcc.com/charts/dtcc-gcf-repo-index#download>).

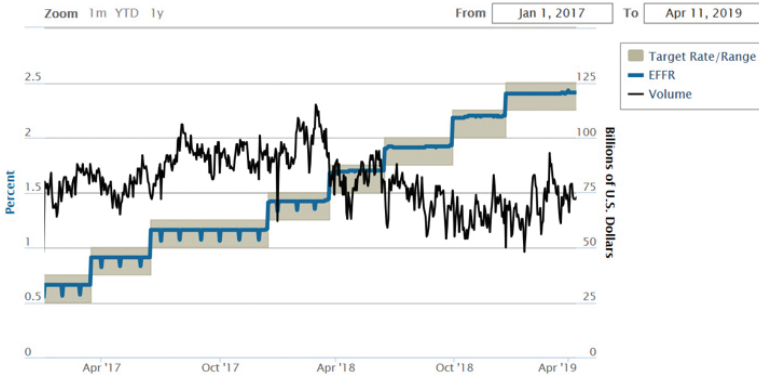


FIGURE 4.12. Daily Effective Fed Funds Rate and Volume of Fed Funds Lending
 Source: Federal Reserve Bank of New York (<https://apps.newyorkfed.org/markets/autorates/fed%20funds>).

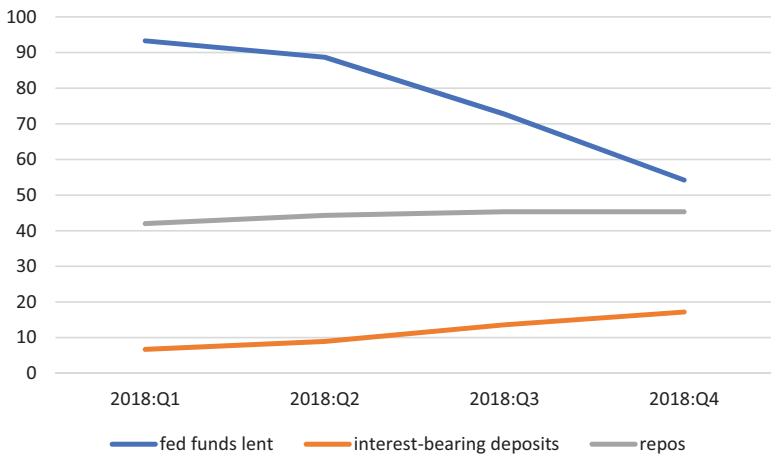


FIGURE 4.13. Selected End-of-Quarter Assets of Federal Home Loan Banks (billions of dollars)

Source: FHLB end-of-quarter financial reports (http://www.fhlb-of.com/ofweb_userWeb/pageBuilder/fhlbank-financial-data-36).

with the volume of borrowing. It shows that the disappearing gap between IOER and fed funds coincided with a decreased volume of fed lending, favoring the second explanation based on the supply side. Figure 4.13 plots selected assets held by the FHLB. It paints a picture of the FHLB turning from lending fed funds to alternative ways of investing short-term funds that presumably provide a higher yield.

8. PERSPECTIVES ON THE CURRENT AND POTENTIAL FUTURE OPERATING SYSTEMS

I've described the current operating system as one with a floor but no ceiling. What then is holding rates down? I think the answer is twofold. First, there has been weak demand for investment both in the United States and around the world for some time. Second, there remains a huge volume of reserves in the system. Figure 4.14 summarizes the implications of the Fed's balance sheet from the

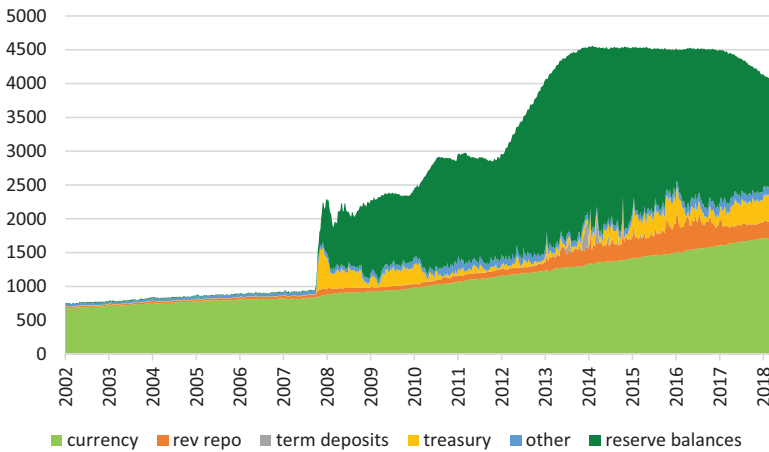


FIGURE 4.14. Weekly Federal Reserve Liabilities (billions of dollars)
 Wednesday values, December 18, 2002, to February 6, 2019. Currency: currency in circulation; rev repo: reverse repurchase agreements; treasury: US Treasury general account plus supplementary financing account; reserve balances: reserve balances with Federal Reserve Banks

Source: Federal Reserve H.4.1 release.

perspective of its liabilities. The large security purchases of figure 4.1 were primarily financed by an expansion of bank deposits with the Fed. Banks so far have been willing to hold these reserves as a result of IOER. As the Fed’s balance sheet contracted (and as demand for cash gradually climbed), excess reserves have slowly been coming down.

Another important development in 2018 was increasing demand for borrowed funds, in part arising from an elevated level of borrowing by the US Treasury to finance the federal government budget deficit. This could be one of the factors that has driven GCF up in 2018 and that pulled lending away from the fed funds market. As we look ahead, we should expect demand for loans to continue to change. The Fed will want some more accurate policy tools to respond to these changes.

One option would be to allow reserves to shrink until we are back in something like the historical system in figure 4.6. That

system worked when fluctuations in the Treasury's balance with the Fed (which are a choice of the Treasury, not the Fed) were on the order of a few billion dollars. But one sees in figure 4.14 that fluctuations today are in the hundreds of billions. It's also far from clear how we would make a smooth transition from the current operating system to something like figure 4.6.

A more natural transition from the current system would begin by acknowledging that something like the tri-party repo rate is currently a more relevant market measure than the fed funds rate. The Fed could introduce an open repo facility from which the same institutions that currently use the reverse repo facility could also use direct repos to borrow all the funds they usually wanted at a chosen policy rate. This would establish a corridor system for controlling the private repo rate. I specify "usually" here because it would not be necessary, or even desirable, to fully smooth out the "window dressing" that one sees in the end-of-quarter spike in private repo rates. The end-of-quarter spikes arise because some institutions do not want to acknowledge the extent of their exposure to private counterparty repos in their publicly available statements, which are based only on assets as of the last day of a quarter. There's no compelling policy reason why the Fed should accommodate that seasonal demand. Indeed, historically a specified fed funds target was viewed as perfectly consistent with end-of-month spikes in the effective fed funds rate above the target arising from such forces.

The drawback of such a system would be that it puts the Fed in the position of effectively insuring a broader set of institutions than those over which it has regulatory authority. The longer-run goal should therefore be to return both the ceiling and the floor for the policy rate to offers to lend or borrow from only regulated institutions. The Fed could initially implement a repo corridor system with a broad range of counterparties at the same time that it continues to reduce the volume of excess reserves. As we reach a level

when banks are more actively managing their reserve balances, the Fed could restrict access to both repo facilities to regulated institutions. This could be a practical path toward the goal of replacing the discount window with a stigma-free facility.

References

- Afonso, Gara, Roc Armenter, and Benjamin Lester. 2019. "A Model of the Federal Funds Market: Yesterday, Today, and Tomorrow." Working paper, Federal Reserve Bank of Philadelphia.
- Agueci, Paul, Leyla Alkan, Adam Copeland, Isaac Davis, Antoine Martin, Kate Pingitore, Caroline Prugar, and Tyisha Riva. 2014. "A Primer on the GCF Repo[®] Service." Staff report no. 671, Federal Reserve Bank of New York.
- Anbil, Sriya, and Zeynep Senyuz. 2018. "Window-Dressing and the Fed's RRP Facility in the Repo Market." Finance and Economics Discussion Paper Series 2018-027. Washington Board of Governors of the Federal Reserve System.
- Banegas, Ayelen, and Manjola Tase. 2017. "Reserve Balances, the Federal Funds Market and Arbitrage in the New Regulatory Framework." October 18. Available at SSRN 3055299.
- Borio, Claudio, and Anna Zabai. 2018. "Unconventional Monetary Policies: A Re-appraisal." In *Research Handbook on Central Banking*, edited by Peter Conti-Brown and Rosa Maria Lastra, 398–444. Cheltenham: Edward Elgar Publishing.
- Caballero, Ricardo J., and Emmanuel Farhi. 2018. "The Safety Trap." *Review of Economic Studies* 85, no. 1 (January): 223–74.
- Chen, Han, Vasco Cúrdia, and Andrea Ferrero. 2012. "The Macroeconomic Effects of Large-Scale Asset Purchase Programmes." *Economic Journal* 122, no. 564 (November): F289–F315.
- Cúrdia, Vasco, and Michael Woodford. 2011. "The Central-Bank Balance Sheet as an Instrument of Monetary Policy." *Journal of Monetary Economics* 58, no. 1 (January): 54–79.
- Eggertsson, Gauti B., and Kevin Proulx. 2016. "Bernanke's No-Arbitrage Argument Revisited: Can Open Market Operations in Real Assets Eliminate the Liquidity Trap?" National Bureau of Economic Research working paper 22243.
- Eggertsson, Gauti B., and Michael Woodford. 2003. "The Zero Bound on Interest Rates and Optimal Monetary Policy." *Brookings Papers on Economic Activity* 2003, no. 1: 139–233.

- Gertler, Mark, and Peter Karadi. 2011. "A Model of Unconventional Monetary Policy." *Journal of Monetary Economics* 58, no. 1 (January): 17–34.
- Goodfriend, Marvin, and William Whelpley. 1986. "Federal Funds: Instrument of Federal Reserve Policy." *Federal Reserve Bank of Richmond Economic Review* 72, no. 5 (September/October): 3–11.
- Greenlaw, David, James D. Hamilton, Ethan Harris, and Kenneth D. West. 2018. "A Skeptical View of the Impact of the Fed's Balance Sheet." National Bureau of Economic Research working paper 24687, June.
- Greenwood, Robin, and Dimitri Vayanos. 2014. "Bond Supply and Excess Bond Returns." *Review of Financial Studies* 27, no. 3 (March): 663–713.
- Hamilton, James D. 2018. "The Efficacy of Large-Scale Asset Purchases When the Short-Term Interest Rate Is at Its Effective Lower Bound." *Brookings Papers on Economic Activity* (Fall): 543–54.
- Hamilton, James D., and Jing Cynthia Wu. 2012. "The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment." *Journal of Money, Credit and Banking* 44 (February): 3–46.
- Klee, Elizabeth, Zeynep Senyuz, and Emre Yoldas. 2016. "Effects of Changing Monetary and Regulatory Policy on Overnight Money Markets." Working paper, Federal Reserve Board.
- Levin, Andrew, and Prakash Loungani. 2019. "Reassessing the Efficacy and Costs of Quantitative Easing." Unpublished manuscript, Dartmouth College.
- Melosi, Leonardo. 2016. "Signaling Effects of Monetary Policy." *Review of Economic Studies* 84, no. 2 (September): 853–84.
- Miranda-Agrippino, Silvia, and Giovanni Ricco. 2018. "The Transmission of Monetary Policy Shocks." Working paper, Bank of England.
- Nakamura, Emi, and Jón Steinsson. 2018. "High Frequency Identification of Monetary Non-neutrality: The Information Effect." *Quarterly Journal of Economics* 133, no. 3 (August): 1283–1330.
- Poole, William. 1970. "Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model." *Quarterly Journal of Economics* 84, no. 2 (May): 197–216.
- Swanson, Eric. 2018. "The Federal Reserve Is Not Very Constrained by the Lower Bound on Nominal Interest Rates." *Brookings Papers on Economic Activity* (Fall): 555–572.
- Thornton, Daniel L. 2017. "Effectiveness of QE: An Assessment of Event-Study Evidence." *Journal of Macroeconomics* 52 (June): 56–74.
- Williams, John C. 2014. "Monetary Policy at the Zero Lower Bound: Putting Theory into Practice." Brookings Institution.

- Woodford, Michael. 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton, NJ: Princeton University Press.
- . 2012. “Methods of Policy Accommodation at the Interest-Rate Lower Bound.” In *The Changing Policy Landscape: A Symposium Sponsored by The Federal Reserve Bank of Kansas City, Jackson Hole, Wyo.*, 185–288. Kansas City: Federal Reserve Bank of Kansas City.

DISCUSSANT REMARKS

Peter N. Ireland

**Monetary Policy Implementation:
Macro and Micro Questions**

James Hamilton's conference paper does an excellent job of describing how the Federal Reserve currently implements its federal funds rate-targeting strategy by manipulating the interest rate it pays on its own liabilities—reserves issued to banks and reverse repurchase agreements with nonbank financial institutions—as well as the size of its balance sheet. His paper usefully compares the implementation procedures used today with those employed in the past and proposes changes to make the new procedures more effective in the future.

Since the paper's descriptions of the Fed's operating procedures and their effects on financial markets are so clear and informative, they require few additions or improvements. Thus, these comments are directed instead at answering three broader questions that the paper's analysis raises. First, at the macroeconomic level, what do the details of the Fed's current implementation procedures have to do with monetary policy? Very little, it turns out. Instead, these procedures appear to be directed more specifically at eliminating high-frequency volatility in short-term nominal interest rates, that is, at interest-rate smoothing.

Answering this first question therefore leads to two more. What macroeconomic or microeconomic concerns make it desirable for the Fed to smooth interest rates in this way? And what microeconomic modifications to the current operating procedures would allow the Fed to smooth interest rates more efficiently in the future?

WHAT IS “MONETARY POLICY”?

Monetary policy can be defined most clearly with reference to two basic macroeconomic principles: the classical dichotomy, which draws the distinction between real and nominal variables; and the doctrine of long-run monetary neutrality, which assigns to monetary policy the principal task of determining the behavior of the aggregate nominal price level.

In a capitalist system, prices play a key role in allocating scarce resources. Specifically, prices adjust to keep in balance the supply of and demand for individual goods and services, thereby allowing real variables—physical quantities of those same goods and services—to respond efficiently to all kinds of shocks.

The prices that play this resource-allocating role, however, are relative prices. Therefore, some additional institutional arrangement must be imposed to pin down the absolute level of prices and to determine, by extension, the behavior of nominal variables: those denominated in the economy’s unit of account.

Under our fiat money system, this institutional arrangement is embodied by the Federal Reserve. It is up to the Fed to conduct monetary policy in a way that pins down the aggregate nominal price level. The Fed achieves this goal by exercising its monopoly control over the supply of base money: currency plus bank reserves.

Today, as before the crisis, the Fed implements monetary policy by targeting the federal funds rate. The federal funds rate, however, is a market rate of interest, charged by one bank to another on a very short-term loan of reserves. The Fed does not set the funds rate directly. Instead, the Fed’s operating procedures must link the federal funds rate, which the Fed can only influence, to the monetary base, which the Fed can precisely control.

Before the financial crisis of 2007–2008, the link between the funds rate and the supply of base money was more immediate and therefore more obvious. Whenever the Fed wanted to lower its

target for the funds rate, it conducted an open market purchase, buying US Treasury securities to inject new reserves into the banking system. The increased supply of bank reserves put downward pressure on the equilibrium funds rate, moving it lower in line with the new target. Conversely, whenever the Fed wanted to raise its target for the funds rate, it conducted an open market sale of US Treasury securities to drain reserves from the banking system and put upward pressure on the funds rate.

Since December 2015, however, the Fed has gradually lifted its federal funds rate target off its zero lower bound using a floor system. Under this floor system, the Fed uses its newly granted ability to pay interest on reserves to manipulate the federal funds rate, without having to conduct open market operations right away. By raising the interest rates paid to banks on reserves and nonbank financial intermediaries on reserve repurchase agreements, the Fed has successfully moved the federal funds rate up in lockstep. And, presumably, when the next easing cycle begins, the Fed will lower the interest rates on reserves and reverse repurchase agreements to bring the federal funds rate back down.

Even under a floor system, however, all monetary policy actions taken to influence the trajectory for the aggregate nominal price level must be supported, sooner or later, by open market operations that change the supply of base money. Although the floor system relieves the trading desk at the Federal Reserve Bank of New York from having to actively manage the supply of reserves on a day-to-day basis, it still implies that the Fed accomplishes its principal macroeconomic function—pinning down the aggregate nominal price level—by exercising its control over the supply of base money.

A simple thought experiment illustrates why this must be true.² Suppose, first, that the market for reserves begins in a long-run

2. Ireland (2014, 2017, 2019a) presents richer and more realistic examples of how, even under a floor system, the Fed must continue using open market operations to bring about

equilibrium, in which the Fed is satisfied with the dollar volume of reserves it has supplied to the banking system and banks, in turn, are happy to hold the same dollar volume of reserves supplied. Suppose, next, that starting from this initial equilibrium, nominal GDP grows at an average annual rate of 5 percent.

Looking ahead, five years beyond the initial equilibrium point, 5 percent annual growth translates, after allowing for compounding, into an increase in the level of nominal GDP of more than 25 percent. Thus, if the Fed uses a floor system to target the federal funds rate over this five-year period without ever conducting an open market operation, it is easy to see that the initial equilibrium will be severely disturbed. Banks will not want to hold the same dollar volume of reserves when the nominal size of the economy is more than 25 percent larger! This thought experiment confirms that, indeed, over the five-year period, the Fed will still have to conduct open market operations to allow the monetary base to grow at approximately the same 5 percent annual rate as nominal GDP.

Many economists would prefer to describe the chain of events that unfold in this story in a different way. They would point to the Federal Open Market Committee's (FOMC 2019a, 2019b) own policy statements to reemphasize that the Fed now uses a floor system to target the funds rate, and that the Fed's monetary policy strategy is to target the funds rate in order to achieve its statutory dual mandate for price stability and maximum sustainable employment. From this more popular perspective, the open market operations that appear in the thought experiment appear as technical details, necessary only to accommodate the increased demand for currency and bank reserves that reflects the slow but steady growth of the US economy as a whole.

changes in the supply of base money that support desired changes in the aggregate nominal price level.

This popular view of the Fed's operation procedures and policy strategies is not inaccurate or incorrect. But it remains incomplete in one key respect and, as a consequence, risks confusing cause and effect. This is because it fails to explain why nominal GDP would be growing at a 5 percent annual rate in the first place. It totally ignores the fact that nominal GDP is growing because everyone expects the Fed to conduct monetary policy in a way that allows for the same slow but steady growth in the stock of base money!

From the viewpoint of macroeconomic theory, therefore, open market operations remain a critical part of the Fed's implementation procedures. Managing the monetary base to determine the behavior of the aggregate nominal price level still constitutes the clearest and most accurate description of the Fed's monetary policy strategy. From this perspective, it is the floor system that appears as the set of technical details, intended to accomplish something else: to clamp down on what would otherwise be high-frequency fluctuations in short-term nominal interest rates. This raises the next question: why would the Fed want to smooth interest rates in this way?

WHY SMOOTH INTEREST RATES?

There are, in fact, both macroeconomic and microeconomic reasons why the Fed might wish to adopt operating procedures that minimize short-term fluctuations in interest rates even as it also manages the monetary base to ensure price-level stability in the long run.

From a macroeconomic perspective, Poole (1970) shows that in a Keynesian model, which describes events over a time frame short enough to take the aggregate nominal price level as fixed, nominal interest rate instability may create real instability. To assess the relevance of this result to issues relating to the design of the Fed's floor system, however, one must decide first on an interpretation of

“the interest rate” in Poole’s model. Does Poole’s result imply only that the Fed should aim to stabilize the federal funds rate, on average, around a constant target over each six-week period between Federal Open Committee Meetings? Or does his result also mean that the Fed should strive to eliminate even daily fluctuations in the funds rate? Only in the latter case would the Fed’s new floor system offer advantages over the more traditional procedures used before the financial crisis.

Microeconomic arguments, therefore, provide more compelling support for interest rate smoothing of the kind the Fed wishes to pursue. Under our fiat money system, liquidity can be created by the Fed at constant, zero marginal cost. Therefore, economic efficiency dictates that the opportunity cost that households, businesses, and financial institutions incur when they hold stocks of liquid assets should remain low and stable as well. This can be accomplished partly by paying interest on bank reserves as advocated by Tolley (1957) and Friedman (1960) but also by keeping market rates of interest rates low and stable, as prescribed by Friedman (1969).³

Professional funds managers, in particular, should be directing the bulk of their time and effort toward identifying the most productive investment projects that provide the highest private and social rates of return, not gambling on day-by-day movements in money market rates. Thus, these microeconomic efficiency arguments provide good reason for the Fed to smooth interest rates, even at very high frequencies.

3. Plosser (2018) describes how interest on reserves, as used by the Federal Reserve to maintain an exceptionally large balance sheet even after the financial crisis and Great Recession of 2007–2009, exposes the Fed to a myriad of economic and political risks. For many of the same reasons cited by Plosser, Ireland (2019b) argues that microeconomic efficiency in the markets for currency, bank reserves, and other liquid assets would be maintained better through Friedman’s (1969) proposal for low and stable market rates of interest than through Friedman’s (1960) proposal for paying interest on reserves.

HOW TO SMOOTH INTEREST RATES MORE EFFICIENTLY?

In theory, the idealized corridor or floor systems described in Hamilton's paper should make it easy for the Fed to do all three of these things at once: manage the stock of base money to stabilize the aggregate nominal price level, target the federal funds rate so as to achieve the Fed's stabilization objectives for the real economy, and eliminate high-frequency interest rate volatility that leads to socially wasteful but privately lucrative trading activity in the money markets. Moreover, these systems have the advantage of using market mechanisms to achieve automatic smoothing of short-term interest rates without daily intervention from the trading desk.

In a corridor system, the Fed's discount rate, at which it stands ready to lend reserves to the banking system, sets a ceiling above which the federal funds rate will not rise. This is because if, to the contrary, the funds rate was to exceed the discount rate, any bank could borrow at the discount window, lend the funds out in the interbank market, and thereby book instantaneous profits. Excess supply of loans in the interbank market would then push the funds rate back below the discount rate.

Similarly, in either a corridor or a floor system, the interest rate that the Fed pays on bank reserves sets the floor below which the federal funds rate will not fall. If, to the contrary, the funds rate was to drop below the interest rate on reserves, then any bank could borrow funds in the interbank market, deposit the funds in its account at the Fed, and again book instantaneous profits. Excess demand for loans in the interbank market would then drive the funds rate back above the interest rate on reserves.

Hamilton's paper usefully notes, however, that historically, the discount rate hasn't always set a ceiling for the federal rate and, more recently, the interest rate on reserves has not set the floor. As his paper explains, regulatory and institutional constraints have often

prevented banks and other financial institutions from exploiting the arbitrage opportunities as required to make the system work.

Again, microeconomic concerns loom largest. Unexploited arbitrage opportunities—just a fancy term describing specific deviations from what more generally would be called “the law of one price”—are almost always a sign of microeconomic inefficiency. They mean that different economic agents face budget constraints with different slopes. Marginal rates of substitution and transformation will then differ across agents as well, implying that there are gains from trade that would make everyone better off but have gone unrealized.

The most useful and important message of Hamilton’s paper is exactly this. If Federal Reserve policy makers really wish to smooth interest rates, they should clean up their floor system. Less encumbered by formal and informal regulatory constraints and institutional complications, an ideal corridor or floor system lets freely functioning financial markets automatically smooth out high-frequency movements in short-term interest rates. Relieved from the task of intervening daily in those financial markets, Federal Reserve officials can then focus on their more basic macroeconomic objective of creating and maintaining an environment of aggregate price stability. Within this most favorable monetary environment, our capitalist system can do what it does best: delivering robust and sustainable long-run growth in real incomes and jobs for all Americans.

References

- FOMC (Federal Open Market Committee). 2019a. “Statement on Longer-Run Goals and Monetary Policy Strategy” (adopted effective January 24, 2012; amended as effective January 29, 2019). Washington, DC: Board of Governors of the Federal Reserve System. https://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf.
- . 2019b. “Statement Regarding Monetary Policy Implementation and Balance Sheet Normalization.” January 30. https://www.federalreserve.gov/news_events/pressreleases/monetary20190130c.htm.

- Friedman, Milton. 1960. *A Program for Monetary Stability*. New York: Fordham University Press.
- . 1969. “The Optimum Quantity of Money.” In *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine Publishing.
- Ireland, Peter N. 2014. “The Macroeconomic Effects of Interest on Reserves.” *Macroeconomic Dynamics* 18 (September): 1271–1312.
- . 2017. “A Monetarist View of Policy Normalization.” Position Paper. New York: Shadow Open Market Committee, September 15. https://www.shadowfed.org/wp-content/uploads/2017/09/IrelandSOMC_September2017.pdf.
- . 2019a. “Monetary Policy Implementation: Making Better and More Consistent Use of the Federal Reserve’s Balance Sheet.” Position paper. New York: Shadow Open Market Committee, March 29. <https://www.shadowfed.org/wp-content/uploads/2019/03/IrelandSOMC-March2019.pdf>.
- . 2019b. “Interest on Reserves: History and Rationale, Complications and Risks.” *Cato Journal* 39 (Spring/Summer): 327–37.
- Plosser, Charles I. 2018. “The Risks of a Fed Balance Sheet Unconstrained by Monetary Policy.” In *The Structural Foundations of Monetary Policy*, edited by Michael D. Bordo, John H. Cochrane, and Amit Seru. Stanford, CA: Hoover Institution Press.
- Poole, William. 1970. “Optimal Choice of Monetary Policy Instruments in a Simple Stochastic Macro Model.” *Quarterly Journal of Economics* 84, no. 2 (May): 197–216.
- Tolley, George S. 1957. “Providing for Growth of the Money Supply.” *Journal of Political Economy* 65 (December): 465–85.

GENERAL DISCUSSION

JAMES HAMILTON: Thanks a lot, Peter. Of course, you're right. At a deeper philosophical level, the ultimate power of the central bank comes from it being the monopoly supplier of base money. But the reason you can run a corridor system, a traditional corridor system, the only way you can offer to lend as much as anybody wants at a fixed rate is if you have the power to create those funds. Without that power, you can't do it. So, yeah, that's behind the traditional system, absolutely.

Now, as far as the demand for base money, the game we've been playing is if we've been paying interest on reserves, maybe there's an essentially infinite demand. I mean, we go from one trillion to two trillion to whatever. And my point is, well, that worked for a while. That worked in a certain environment when there really aren't other opportunities. But it's not fundamentally a system for controlling the interest rate. And so, that's why my conclusion is we do need the discount window, something as a real corridor system, and we might be thinking about it that way. But actually, thank you for pointing out the value of the market allocation. The point is when the fed funds rate is the set interest rate minus 9 basis points every day, this is not a market allocation of anything. It's sort of a crazy system to be thinking that was our target for influencing the price level or economic activity.

JOHN TAYLOR: So, neither of you referred too much to how it worked before 2008. The Fed set a federal funds rate. They voted on it. They adjusted the supply of reserves so it would come in to meet pretty close to the target. Peter Fisher ran the desk pretty well at that time. It seemed to work. So why not just go back to that? It worked. Policy was good. We had good economic performance. I think in a way it was more market determined. You didn't have an administered rate, right? You had the market. And the market

allocated capital to different banks. And you also had a connection between the monetary aggregates and the banks, which has disappeared at this point. So it seems to me that's a possible way to go. I don't know if we're going to get back to that, but why not consider that?

HAMILTON: That system we were talking about, \$5 billion was sort of the level of reserves. So now we're talking about \$2 trillion. There's a big gap between those. A big gap before you get back to the point where reserves are so precious that you get to balance supply and demand based on changing the volume. One technical issue is how do you deal with the other sources of volatility? The Treasury balance, for example, used to just vary by a billion from one day to the next, and now we're talking about hundreds of billions of dollars over the course of a few months there. So, there would be technical issues with that. We definitely have to get away from the reverse repo on demand, because that puts huge volatility into the level of reserves. So, I think that's a harder place to get to from where we are now, relative to just saying, okay, a corridor system.

PETER IRELAND: Right. My answer to your question, John, would say: that simply rephrases my first point, which is that I think a lot of this doesn't have to do with monetary policy at all. If you want to join me in thinking about policy as controlling the base to stabilize the price level, that's fine. If you want to think about it as following a Taylor rule in order to stabilize nominal spending, or some other linear combination of output growth and inflation, to achieve the dual mandate, basically, that's fine too. There's nothing about the new system that says we have to have it and can't go back to the old way. But conditional on having a giant balance sheet, conditional on the New York Fed saying we don't want to have to play the game of estimating the demand for reserves on a day-to-day basis, and conditional on saying that you're going to continue targeting the federal funds rate with a

floor system, my response would be: okay, if that's where you're at, then why not run a better version of what you have now that lets markets do most the work for you. By that I mean a floor or corridor system held together based on arbitrage opportunities. Why should we be stuck with a flawed system where the floor isn't the floor and there is no ceiling?

JEFF LACKER: It seems simpler than you make it sound, Jim. In the period before the crisis that you explained with such clarity, the RP rate varied significantly from the funds rate target, at times 10, 20 basis points below, at times 10, 20 basis points above, and in fact was pretty volatile day-to-day, week-to-week, month-to-month. Now, we seem to care about the gap between the RP [repurchase] rate and the funds rate or whatever the interest rate on excess reserves, and I never heard at the FOMC [Federal Open Market Committee] a coherent reason why. The federal funds rate used to be our target. Now we set an interest rate on excess reserves. And as you rightly point out, the federal funds rate is sort of a niche market, an anachronistic appendage in some sense. So, from my point of view, interest rate control seems simple. The Fed controls the interest rate on excess reserves, period. And the spreads between the interest rate and excess reserves and other rates are determined by the vagaries of the various regulatory constraints on various classes of participants in financial markets, and we let that do what it does for various reasons, as you illustrated with the federal funds rate. But equally cogent regulatory constraints, as you pointed out, affect the RP rate on a day-to-day, week-to-week, month-to-month basis. So, why don't we just set the interest rate on excess reserves and go home? Now, there is a coherent reason, and that has to do with Fed governance. The law that gave the Federal Reserve the authority to set interest on reserves gave that authority to a subset of the Federal Open Market Committee, the Board of Governors. And setting the federal funds rate target has always been the purview

of the Federal Open Market Committee. So, in some sense, targeting the federal funds rate is really window dressing around this inconvenient governance arrangement around the interest rate on excess reserves. The obvious solutions would be a very simple, one-line bill that reassigns authority to the Federal Open Market Committee rather than the board.

HAMILTON: So, I was using an RP rate not so much because I was wanting to say that's what the target should be, but because that's a true market rate, unlike the fed funds rate, which is kind of a meaningless signal here. But I think ultimately, the issue is what we care about are things like the three-month commercial paper rate. That's what ultimately is going to influence economic activity. If you have a tight link between your policy rule and that, then you have an ability to get the price level and economic activity where you want. I'm not sure I see how just a pure interest on reserves, with no upper bound, would really give the Fed the ability to hit its target. So your answer is, if they've set the interest on reserves, and we see commercial paper too much above that, we'd just flood more and more reserves out there until it comes down? Is that it?

LACKER: Well, we never in the past, I think, at the Fed, engaged in some feedback from the CP [commercial paper] rate. I mean, it was looking at the entire macroeconomy. Commercial paper rate would vary. But setting the funds rate is equivalent to now setting the interest rate on reserves. Why don't we just say we've set the interest rate on reserves. We don't need the RRP [reverse repurchase] facility. And we could back away from the funds market as a target. In the end, it's about the banks' indifference about keeping money as reserves or in other investments or about lending and the funds market, as it was under the other system.

JOHN COCHRANE: I'd like to ask the opposite of John Taylor's question, in part because this is one issue on which we disagree, and in part because it's the elephant in the room. It's a central issue for

the Fed's strategy question. We've learned in the last ten years that you can pay interest on reserves, and the economy can be satiated in reserves, and guess what? That doesn't cause inflation. Second, the Fed targets interest rates. If you want to target the price of tomatoes, you have to say, "Tomatoes are three bucks a pound, come and get them." Offer to buy and sell infinite amounts. But, somehow, the Fed wants to target an interest rate and also target the quantity.

Why not have a narrow corridor, with a flat supply curve? Bring us your treasuries, we'll give you as many reserves as you want. Conversely, we'll lend you as many reserves as you want. If you want to target an interest rate, that's what you've got to do. It seems like the logical conclusion to all of these problems is just to target the rates. Don't, as Jim said later, limit the RP project. Let anyone who wants have to them at the same rate as anyone else. Given that we're trying to target interest rates, why bother controlling the level of reserves at all?

Leaving aside political considerations, why limit the size of the balance sheet? There's some sort of vague memory of $MV = PY$ and so forth. But that has disappeared from our models and experience. The Fed has just been targeting interest rates. So, why limit the size of the balance sheet at all? That seems to me the elephant in the room.

HAMILTON: I think that was the point I was trying to make in response to Peter, that you are committed. If you have the upper and lower bound, lend to all the people you want. You are committing to a quantity from that. You can't choose the two things separately.

And then the question is what's the interest rate and implicit quantity that's consistent with price stability. So, that's where it all comes down. But just in terms of the mechanical question of how do you do it, I think what you do is announce "come and get it," and make sure the price you've announced is one that's consistent with everything else you want to see happen.

IRELAND: Right. Remember, the one added degree of freedom that the Fed has received since 2008 is the ability to pay interest on reserves. So now, you've got the overall level of nominal interest rates economy wide, which we think through some Keynesian interest rate channel on aggregate demand is what really matters for monetary policy. And then, as you say, either you can decide how much reserves you want in the banking system and peg the spread, the opportunity cost to banks of holding reserves, or you can peg the spread and you accept the dollar volume of reserves. But let me say that even under that system, here's what I was trying to get at: as a logical matter, no one should care whether we're measuring reserves in dollars or cents. What we're talking about with reserves demand is a real demand for reserves. So in a macroeconomic model, if you have a dynamic stochastic general equilibrium with a steady-state growth path for nominal variables where they grow at 2 percent per year, my point is that after the transition is done, you've either set the spread and accepted the real quantity or set the real quantity and accepted what the spread has to be. From that moment forward, it is still true that the monetary base is going to grow, is going to have to grow, at a rate proportional to the price level. The only reason why I bring this up again is that it's an element of incompleteness that runs the risk of letting the system that you say works well unravel completely. This is what you hear from central bankers during a hyperinflation. They'll say, "But we have to keep printing money to keep up with the demand, because the price level is rising so fast." I'm uneasy about an intellectual framework that appears to suggest, in exactly the same way, that an expansion in a nominal magnitude is just done exclusively to accommodate demand.

SEBASTIAN EDWARDS: Should we be worried about the cost of paying for the very large excess reserves? I think it's about \$2 trillion now? At 2.5 percent, it's nontrivial. My region of interest has

been Latin America, where central banks basically have to be bailed out every four years. Is this something we should worry about?

IRELAND: I think we should, and to support that view I would just refer you to Charlie Plosser's article from this conference, I guess it was two years ago. If I was deciding, I would say, as Charlie did, there are just so many economic and political costs and complications of working with a big balance sheet. There's the direct cost, and there's also the political cost, because the Fed is seen as an institution that can issue interest-earning liabilities and use the proceeds to purchase interest-earning assets. That starts to make the Fed look less and less like a central bank and more and more like a commercial bank. And you mentioned MMT, which feeds into that entire mentality. So, from a long-run perspective, I'd rather just work the balance sheet back down and do it, as John Taylor said, in the old way. But just to go back to what Jim said earlier, given that the balance sheet is so big at this moment, and given that the consensus seems to be the adjustment has to take place over time, you have to pay interest on reserves for now. Otherwise, you'll get inflation right away.

HAMILTON: Let me just add, if you're asking should we be worried that the Fed's going to make a loss, the answer to that on average is clearly no. The Fed is borrowing short and lending long at a higher rate. They're raking in money with this carry trade. On average. Now, it's not always that way, and you can imagine a situation where they have a pretty big loss, and there's a political economy question of does the Treasury actually bail them out? How mechanically do you run the loss? And there are the various issues that Peter raises. But there's no doubt, currently, it's very profitable for the Fed to have this huge volume of short-term borrowing that it essentially does with interest on reserves and then earning a higher rate on their portfolio.

EDWARDS: Unless it gets inverted.

HAMILTON: Unless it gets inverted, yeah. So on average, it isn't.

ANDY LEVIN: Yeah, it's a really great panel. I wanted to follow up on Jeff Lacker's question. So, you want to have a simple corridor system. You need to use a large, liquid market, which the fed funds market is not anymore. What about using the repo market? So the floor would be the reverse repo offer rate, which they already have, and you'd have a ceiling of a repo offer rate, which I think they're contemplating. And then you'd shoot for a midpoint. But ECB [European Central Bank] and other central banks do this. They call it fine-tuning operations. So, sometimes you hit the floor. Sometimes you hit the ceiling. You adjust the reserves. You can do it once a week or once a month. It's not a big deal even if you're running at the ceiling or the floor, if the floor and the ceiling aren't too far apart. And this would become an FOMC decision, because historically open-market operations are set by the FOMC. And so the FOMC could set the repo offer rate and the reverse repo offer rate and avoid the governance problems that have been mentioned. The setting of IOER [interest rate on excess reserves] would be pushed much further into the background. And a lot of the Fed's liabilities and the assets would become repos and reverse repos. Maybe bank reserves would also shrink a lot. I'm just wondering, would that be a direction that's worth considering?

IRELAND: Yes. Very much.

UNIDENTIFIED SPEAKER 1: Jim, I had a quick comment on something you said, because I think it's a bit of an urban myth. It's actually a New York myth. You said that the volatility of the TGA [treasury general account] makes it hard to go back to a corridor. But that's not the right story. When they went to a floor system, the TGA, the Treasury understood that it didn't have to worry about smoothing the TGA account. It stopped using the TT&L [Treasury and Tax Loan Program] accounts. So this is a perfect example of where Lucas's critique applies. The Treasury balance

is volatile because they've gone to a floor system. It would be less so if the Treasury had an incentive to manage the TGA as it used to when it was necessary to help a corridor system or corridor-type system work. So, I don't think that should be treated as a deep parameter.

HAMILTON: Yeah, as we were discussing last night, I think there is definitely something to that. But I think there's also the political factors with the debt ceiling and so on that are also playing a role in those very huge buildups of the Treasury account that we see.

UNIDENTIFIED SPEAKER 2: Let's say for the sake of argument that despite the Fed's best efforts, nothing comes out of this year's review. So, they're the same tools, the same framework, and we go into a recession. It seems likely QE [quantitative easing] is going to be an important tool. We're going to see the balance sheet expand even more, because we have low interest rates. So this is going to be an increasingly important issue; the size of the balance sheet is going to get larger and larger. And to me, this is consequential, because it gets into the question of how big of a footprint do you want the Fed to have? Do you want to crowd out the money markets? I think that's the first question. The second one would be, do you want the Fed to get into the role of public debt management? I mean, by taking treasury securities out and putting reserves onto the market, you're substituting one form of government liability for the other, and reserves aren't as fungible as treasuries. And I think that's a question that needs to be wrestled with as an implication of sticking with a large balance sheet.

IRELAND: That was a statement, not a question. But I agree with it.

UNIDENTIFIED SPEAKER 3: Jim, you talked a lot about the corridor. But how would you feel about shrinking the size of the corridor until it becomes a line? And at that point the Fed just borrows and lends at one rate?

HAMILTON: Well, as Peter was saying, I think it's very helpful to the Fed to have a real market signal of something. And so, we've got

a range, and we see it's bumping against the top of that range, and that tells us something. And also I want to underscore what Peter was saying. There is a long-run equilibrium, what this volume of reserves ought to be and how it ought to grow over time. And watching that feedback is the essence of what monetary policy has to be. So, I'm in favor of a range. I'm in favor of a real market signal within that range, giving the Fed guidance as to whether their plans are consistent with where they want to take the economy.

UNIDENTIFIED SPEAKER 3: I think you'd have more of a signal and less noise with a line, because then—

HAMILTON: Will you get your line back, when you get a line?

UNIDENTIFIED SPEAKER 3: —because then you would observe the quantity, and that would tell you just how much the reserves demand curve had moved horizontally. So instead of getting a mixed signal, that would be a clean one.

HAMILTON: Well, that gets us back to the whole Friedman debate. Are the quantities the more useful signal or the interest rates? I think interest rates are pretty useful signals.

UNIDENTIFIED SPEAKER 4: I just want to follow up on John Taylor's comment earlier. It may seem because of the current size of the fed funds market that it's irrelevant and that it can't be used as a tool. But that's very much a consequence of policy decisions. So, let me remind you how you could bring back the fed funds market.

So, first, it wouldn't be too hard to raise required reserves on large banks with little consequence, because currently they face under the Basel requirements very high liquid asset requirements. So you could soak up a lot of the excess reserves by just making required reserves for banks bigger. You could avoid your micro problem, Peter, by paying interest on required reserves only, like fed funds less 10 basis points. And then you could pay zero interest on excess reserves. And then it would also be helpful to shut the GSEs [government-sponsored enterprises] out of

the fed funds market. So if you did those things, it wouldn't be too hard to go back to the world of pre-2008. Now I understand that some people have other worlds in mind. But I think it's an attractive world in a lot of ways. And I think we got away from that world because of, in my view, political reasons and that the Fed wanted to use adjustments to monetary policy that didn't cause their balance sheet to change size. So reverse repos are an obvious example of a way that you can shrink and contract your monetary policy without actually reducing your reported size and having the accounting consequences of capital losses that go along with that.

So, I think the political consequences are more of a driver than maybe our discussion is indicating. And I think returning to the pre-2008 environment is not so inconceivable if we had the will to do that.

ANDY FILARDO: We haven't yet talked about the LCR [liquidity coverage ratio] requirement and its implications for the monetary policy operating system. To satisfy the LCR regulatory requirement, banks are currently free to choose to hold US treasuries, reserves, or a mix of the two. This makes me wonder if such uncertainty about the demand for reserves may be one of the reasons why a floor system appears to be more attractive to some than a traditional corridor system. One popular approach proposed to resolve this uncertainty is to ask banks for their demand for reserves. But we may never be able to elicit how much banks truly need. There is an incentive for banks to inflate their estimates because reserves that are remunerated at or close to the policy rate implicitly provide subsidized liquidity insurance relative to treasuries. To reduce the avoidable uncertainty, should the Fed specify the amount of the LCR requirement banks can fulfill by using reserves? If so, might this approach strengthen the case for a corridor system or for a return to something akin to the pre-2008 operating regime?

HAMILTON: Well, my point was not so much the uncertainty about it but the deterministic nature of it, at least at these volumes. Rather than an equilibrium marginal regulatory cost, it was just essentially some fixed number for quite a while. And the key aspect of that was that the fed funds signal is nothing other than that input you put in through the interest on excess reserves. So, I was talking about it from a more mechanical point of view. Now, there are other questions. I mean, this whole idea of you're only going to worry about your capital requirements the last day of the month is very strange to me. And that's introducing all kinds of volatility daily in these interest rates.

JAMES BULLARD: I want to push back a little bit on the idea of returning to the 2008, or earlier, operating procedure. First, it's not at all clear to me that that's the optimal way to do things. It's not like it's a holy grail. The size of the balance sheet is going to be much bigger. Currency is much bigger today: it's about \$1.7 trillion. The Treasury general account used to be \$5 billion, now it is \$250 billion. That's a decision of the US Treasury, not of the Fed. I guess that's something we've just got to take on board. You also have the regulatory environment changing with Dodd-Frank: the emphasis on high-quality liquid assets has driven the demand for reserves from \$30 billion or \$40 billion up to a trillion dollars or more. I guess you could push back against that, but the Milton Friedman side of me says, well, if the world needs liquidity, supply the liquidity. That's going to put you up at \$3 trillion or more right off the bat, and you're not going to go back to that earlier size of the balance sheet. When I look at central banks around the world, they've got corridor systems, just like Jim [Hamilton] was talking about. By putting in a repo program to complement the reverse repo program, you would meet an international standard, which seems to work well for other central banks. We get rid of our kind of jerry-rigged system that we had before the crisis. So all of this seems OK to me,

even if you're a Chicago monetarist. I don't think evil things are happening, except that I do buy the political critique that there's room for more mischief.

IRELAND: But that was my message to the Fed, which you seem to have fully absorbed. I mean, if that's what you want to do, run with the big balance sheet and smooth out interest rates, then the corridor system makes a lot of sense, because it lets the market do it for you. So yes, why not work toward a system that is unencumbered by all of these institutional and regulatory constraints? Workarounds like targeting the GCF [General Collateral Finance]/RP rate instead of the federal funds rate as Jim suggested, and introducing a replacement for the discount window without stigma, like what David Andolfatto and Jane Ihrig have proposed, that would harness market forces to do exactly what you want to do.