

CHAPTER SEVEN

**LIQUIDITY REGULATION  
AND THE SIZE OF THE  
FED'S BALANCE SHEET**

*Randal K. Quarles*

Thank you very much to the Hoover Institution for hosting this important conference and to John Taylor and John Cochrane for inviting me to participate. In my capacity as both the vice chairman for supervision at the Board of Governors and a member of the Federal Open Market Committee (FOMC), part of my job is to consider the intersection of financial regulatory and monetary policy issues, the subject of my discussion today. This topic is both complex and dynamic, especially as both regulation and the implementation of monetary policy continue to evolve.

One important issue for us at the Fed, and the one that I will spend some time reflecting on today, is how post-crisis financial regulation, through its incentives for bank behavior, may influence the size and composition of the Federal Reserve's balance sheet in the long run. Obviously, the whole excessively kaleidoscopic body of financial regulation is difficult to address in the time we have today, so I will focus on a particular component: the liquidity coverage ratio (LCR) and its link to banks' demand for US central bank reserve balances. Besides illuminating this particular issue, I hope my discussion will help illustrate the complexities associated with

---

The views I express here are my own and not necessarily those of the Federal Reserve Board or the Federal Open Market Committee.

the interconnection of regulatory and monetary policy issues in general. Also, let me emphasize at the outset that I will be touching on some issues that the Board and the FOMC are in the process of observing and evaluating and, in some cases, on which we may be far from reaching any final decisions. As such, my thoughts on these issues are my own and are likely to evolve, benefiting from further discussion and our continued monitoring of bank behavior and financial markets over time.

#### MONETARY POLICY AND THE EFFICIENCY OF THE FINANCIAL SYSTEM

Before I delve into the more specific, complicated subject of how one type of bank regulation affects the Fed's balance sheet, let me say a few words about financial regulation more generally.

As I have said previously, I view promoting the safety, soundness, and *efficiency* of the financial system as one of the most important roles of the Board. Improving efficiency of the financial system is not an isolated goal. The task is to enhance efficiency while maintaining the system's resiliency. Take, for example, the Board's two most recent and material proposals, the stress capital buffer and the enhanced supplementary leverage ratio (eSLR). The proposal to modify the eSLR, in particular, initially raised questions in the minds of some as to whether it would reduce the ability of the banking system to weather shocks. A closer look at the proposal shows that the opposite is true. The proposed change simply restores the original intent of leverage requirements as a backstop measure to risk-based capital requirements. As we have seen, a leverage requirement that is too high favors high-risk activities and disincentivizes low-risk activities.

We had initially calibrated the leverage ratio at a level that caused it to be the binding constraint for a number of our largest banks. As a result, those banks had an incentive to add risk rather

than reduce risk in their portfolios because the capital cost of each additional asset was the same whether it was risky or safe, and the riskier assets would produce the higher return. The proposed recalibration eliminates this incentive by returning this leverage ratio to a level that is a backstop rather than the driver of decisions at the margin. Yet, because of the complex way our capital regulations work together—with risk-based constraints and stress tests regulating capital at both the operating and holding company levels—this improvement in incentives is obtained with virtually no change in the overall capital requirements of the affected firms. Federal Reserve staff estimate the proposal would potentially reduce capital requirements across the eight large banks subject to the proposal by \$400 million, or 0.04 percent of the \$955 billion in capital these banks held as of September 2017.<sup>1</sup> So this recalibration is a win-win: a material realignment of incentives to reduce a regulatory encouragement to take on risk at a time when we want to encourage prudent behavior without any material capital reduction or cost to the system's resiliency. Taken together, I believe these new rules will maintain the resiliency of the financial system and make our regulation simpler and more risk-sensitive.

## LIQUIDITY REGULATIONS

Let me now back up to the time just before the financial crisis and briefly describe the genesis of liquidity regulations for banks. Banking organizations play a vital role in the economy in serving the financial needs of US households and businesses. They perform this function in part through the mechanism of maturity

---

1. Required capital at the bank subsidiaries of these firms would be reduced by larger amounts—and would only allow the firm to move that capital to different subsidiaries within the firm—but, more important, the overall capital regime prevents this capital from being distributed out of the banking organization as a whole except in this *de minimis* amount. Thus, the overall organization retains the same capital levels without the structure of capital regulation creating an incentive to add risk to the system.

transformation—that is, taking in short-term deposits, thereby making a form of short-term, liquid investments available to households and businesses, while providing longer-term credit to these same entities. This role, however, makes banking firms vulnerable to the potential for rapid, broad-based outflows of their funding (a so-called run), and these institutions must therefore balance the extent of their profitable maturity transformation against the associated liquidity risks.<sup>2</sup> Leading up to the 2007–09 financial crisis, some large firms were overly reliant on certain types of short-term funding and overly confident in their ability to replenish their funding when it came due. Thus, during the crisis, some large banks did not have sufficient liquidity, and liquidity risk management at a broader set of institutions proved inadequate at anticipating and compensating for potential outflows, especially when those outflows occurred rapidly.<sup>3</sup>

In the wake of the crisis, central banks and regulators around the world implemented a combination of regulatory reforms and stronger supervision to promote increased resilience in the financial sector. With regard to liquidity, the prudential regulations and supervisory programs of the US banking agencies have resulted in significant increases in the liquidity positions and changes in the risk management of our largest institutions. And, working closely with other jurisdictions, we have also implemented global liquidity standards for the first time. These standards seek to limit the effect of short-term outflows and extended overall funding mismatches, thus improving banks' liquidity resilience.

---

2. While deposit insurance helps mitigate the incentive for many depositors to run, it cannot fully eliminate this risk. For a discussion of this vulnerability, see Douglas W. Diamond and Philip H. Dybvig, "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy* 91, no. 3 (June 1983): 401–19.

3. "Risk Management Lessons from the Global Banking Crisis of 2008," Federal Reserve Bank of New York, October 21, 2009, accessed August 10, 2018, [https://www.newyorkfed.org/medialibrary/media/newsevents/news/banking/2009/SSG\\_report.pdf](https://www.newyorkfed.org/medialibrary/media/newsevents/news/banking/2009/SSG_report.pdf).

One particular liquidity requirement for large banking organizations is the liquidity coverage ratio, or LCR, which the US federal banking agencies adopted in 2014.<sup>4</sup> The LCR rule requires covered firms to hold sufficient high-quality liquid assets (HQLA)—in terms of both quantity and quality—to cover potential outflows over a thirty-day period of liquidity stress. The LCR rule allows firms to meet this requirement with a range of cash and securities and does not apply a haircut to reserve balances or Treasury securities based on the estimated liquidity value of those instruments in times of stress. Further, firms are required to demonstrate that they can monetize HQLA in a stress event without adversely affecting the firm's reputation or franchise.

The rules have resulted in some changes in the behavior of large banks and in market dynamics. Large banks have adjusted their funding profiles by shifting to more stable funding sources. Indeed, taken together, the covered banks have reduced their reliance on short-term wholesale funding from about 50 percent of total assets in the years before the financial crisis to about 30 percent in recent years, and they have also reduced their reliance on contingent funding sources. Meanwhile, covered banks have also adjusted their asset profiles, materially increasing their holdings of cash and other highly liquid assets. In fact, these banks' holdings of HQLA have increased significantly, from fairly low levels at some firms in the lead-up to the crisis to an average of about 15 to 20 percent of total assets today.<sup>5</sup> A sizable portion of these assets currently

---

4. For a full description of the US LCR, including which banks are covered, see Regulation WW—Liquidity Risk Management Standards, 12 C.F.R. pt. 249 (2017), accessed August 10, 2018, <https://www.gpo.gov/fdsys/granule/CFR-2017-title12-vol4/CFR-2017-title12-vol4-part249>.

5. See Jane Ihrig, Edward Kim, Ashish Kumbhat, Cindy M. Vojtech, and Gretchen C. Weinbach, "How Have Banks Been Managing the Composition of High-Quality Liquid Assets?" Finance and Economics Discussion Series 2017-092, revised February 2018, Board of Governors of the Federal Reserve System, accessed August 10, 2018, <https://www.federalreserve.gov/econres/feds/files/2017092r1pap.pdf>.

consists of US central bank reserve balances, in part because reserve balances, unlike other types of highly liquid assets, do not need to be monetized, but also, importantly, because of the conduct of the Fed's monetary policy, a topic to which I will next turn.

#### HOW DOES THE LCR INTERACT WITH THE SIZE OF THE FED'S BALANCE SHEET?

With this backdrop, a relevant question for monetary policy makers is: What quantity of central bank reserve balances will banks likely want to hold and, hence, how might the LCR affect banks' reserve demand and thereby the longer-run size of the Fed's balance sheet? Let me emphasize that policy makers have long been aware of the potential influence that regulations may have on reserve demand and thus the longer-run size of the Fed's balance sheet. And, of course, regulatory influence on banks' behavior, my focus today, is just one of many factors that could affect policy makers' decisions regarding the appropriate long-run size of the Fed's balance sheet.<sup>6</sup> In particular, in augmenting its Policy Normalization Principles and Plans, the FOMC stated in June 2017 that it "currently anticipates reducing the quantity of reserve balances, over time, to a level appreciably below that seen in recent years but larger than before the financial crisis" and went on to note that "the level will reflect the banking system's demand for reserve balances and the

---

6. For example, a separate factor that is relevant for policy makers in this regard is the FOMC's choice of a long-run framework for monetary policy implementation. For policy makers' discussions of this factor, see Board of Governors of the Federal Reserve System, "Minutes of the Federal Open Market Committee, July 26–27, 2016," news release, August 17, 2016, accessed August 10, 2018, <https://www.federalreserve.gov/newsevents/pressreleases/monetary20160817a.htm>; and Board of Governors of the Federal Reserve System, "Minutes of the Federal Open Market Committee, November 1–2, 2016," news release, November 23, 2016, accessed August 10, 2018, <https://www.federalreserve.gov/newsevents/pressreleases/monetary20161123a.htm>.



FIGURE 7.1.1. Reserve Balances

Source: Federal Reserve Board, Statistical Release H.4.1, “Factors Affecting Reserve Balances,” <https://www.federalreserve.gov/releases/h41>.

Note: LCR is Liquidity Coverage Ratio.

Committee’s decisions about how to implement monetary policy most efficiently and effectively in the future.”<sup>7</sup>

With that said, it is useful to begin by examining banks’ current reserve holdings. Figure 7.1.1 plots the aggregate level of reserve balances in the US banking system, starting well before the financial crisis. As you can see, the current level of reserves—at around \$2 trillion—is many orders of magnitude higher than the level that prevailed before the financial crisis, a result of the Fed’s large-scale asset purchase programs or “quantitative easing.” The vertical lines in the figure show key dates in the implementation of the LCR, including the initial Basel III international introduction of

7. See Board of Governors of the Federal Reserve System, “FOMC Issues Addendum to the Policy Normalization Principles and Plans,” news release, June 14, 2017, paragraph 6, accessed August 10, 2018, <https://www.federalreserve.gov/newsevents/pressreleases/monetary20170614c.htm>.

the regulation followed by its two-step introduction in the United States. A key takeaway from this figure is that the Fed was in the process of adding substantial quantities of reserve balances to the banking system while the LCR was being implemented—and these two changes largely happened simultaneously. As a result, banks, in aggregate, are currently using reserve balances to meet a significant portion of their LCR requirements. In addition, because these changes happened together, it is reasonable to conclude that the current environment is likely not very informative about banks' *underlying* demand for reserve balances.

But now the situation is changing, albeit very slowly. Last October, the Fed began to gradually and predictably reduce the size of its balance sheet.<sup>8</sup> The Fed is doing so by reinvesting the principal payments it receives on its securities holdings only to the extent that they exceed gradually increasing caps—that is, the Fed is allowing securities to roll off its portfolio each month up to a specific maximum amount. This policy is also reducing reserve balances. So far, after the first seven months of the program, the Fed has shed about \$120 billion of its securities holdings, which is a fairly modest amount when compared with the remaining size of its balance sheet. Consequently, the level of reserves in the banking system is still quite abundant.

So, how many more reserve balances can be drained and how small will the Fed's balance sheet get? Let me emphasize that this question is highly speculative—we have not decided *ex ante* the desired long-run size of the Fed's balance sheet, nor, as I noted earlier, do we have a definitive handle on banks' long-run demand for reserve balances. Indeed, the FOMC has said that it “expects to learn more about the underlying demand for reserves during the

---

8. The FOMC announced this change to its balance sheet policy in its September 2017 post-meeting statement; see Board of Governors of the Federal Reserve System, “Federal Reserve Issues FOMC Statement,” news release, September 20, 2017, accessed August 10, 2018, <https://www.federalreserve.gov/newsevents/pressreleases/monetary20170920a.htm>.

process of balance sheet normalization.”<sup>9</sup> Nonetheless, let me spend a little time reflecting on this challenging question.

How banks respond to the Fed's reduction in reserve balances could, in theory, take a few different forms. One could envision that as the Fed reduces its securities holdings, a large share of which consists of Treasury securities, banks would easily replace any reduction in reserve balances with Treasury holdings, thereby keeping their LCRs roughly unchanged. According to this line of thought, because central bank reserve balances and Treasury securities are treated identically by the LCR, banks should be largely indifferent to holding either asset to meet the regulation. In that case, the reduction in reserves and corresponding increase in Treasury holdings might occur with relatively little adjustment in their relative rates of return.

Alternatively, one could argue that banks may have particular preferences about the composition of their liquid assets. And since banks are profit-maximizing entities, they will likely compare rates of return across various HQLA-eligible assets in determining how many reserves to hold. If relative asset returns are a key driver of reserve demand, then interest rates across various types of HQLA will adjust on an ongoing basis until banks are satisfied holding the aggregate quantity of reserves that is available.

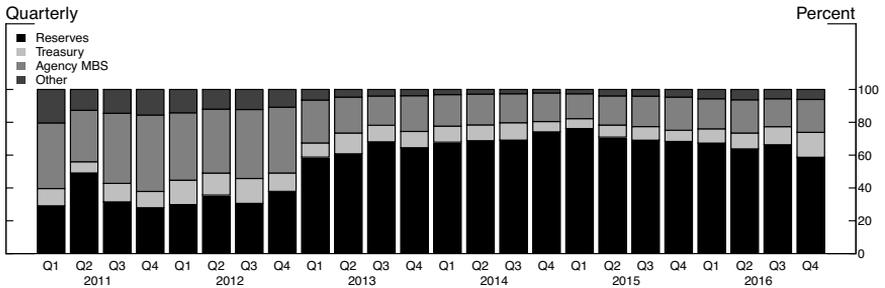
Recent research by the board staff shows that banks currently display a significant degree of heterogeneity in their approaches to meeting their LCR requirements, including in their chosen volumes of reserve balances.<sup>10</sup> Figure 7.1.2 shows a subset of this research to illustrate this point. The top and bottom panels represent estimates of how two large banks have been meeting their HQLA requirements over time. In each panel, the black portions of the bars denote the share of HQLA met by reserve balances, while the light, medium, and dark gray slices of the bars represent the

---

9. See Board of Governors, “FOMC Issues Addendum,” paragraph 6, in note 7.

10. Ihrig et al., “Managing the Composition of High-Quality Liquid Assets.”

Large Reserves Share



Small Reserves Share

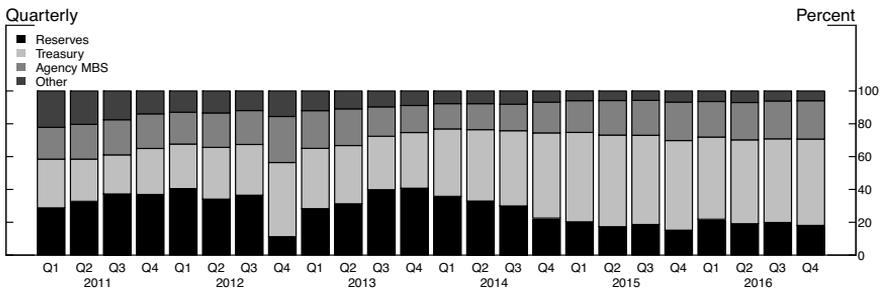


FIGURE 7.1.2. Reserve Balance Concentration in HQLA

Source: Jane Ihrig, Edward Kim, Ashish Kumbhat, Cindy M. Vojtech, and Gretchen C. Weinbach (2017), “How Have Banks Been Managing the Composition of High-Quality Liquid Assets?” Finance and Economics Discussion Series 2017-092 (Washington: Board of Governors of the Federal Reserve System, August; revised February 2018), <https://www.federalreserve.gov/econres/feds/files/2017092r1pap.pdf>.

Note: Key shows bar segments in order from bottom to top. HQLA is high-quality liquid assets; MBS is mortgage-backed securities; Other is other HQLA-eligible securities.

share met by Treasury securities, agency mortgage-backed securities, and other HQLA-eligible assets, respectively. Despite holding roughly similarly amounts of HQLA, the two banks exhibit very different HQLA compositions, with the bank depicted in the top panel consistently holding a much larger share of HQLA in the form of reserve balances than the bank shown in the bottom panel. This finding suggests that there likely is no single “representative bank” behavioral model that can capture all we might want to know about banks’ demand for central bank reserve balances.

Some of the differences we see in bank behavior likely relate to banks' individual liquidity needs and preferences. Indeed, banks manage their balance sheets in part by taking into account their internal liquidity targets, which are determined by the interaction between the specific needs of their various business lines and bank management's preferences. In any case, this picture illustrates the complexities that are inherent in understanding banks' underlying demand for reserve balances, a topic for which more research would be quite valuable to policy makers.

So, what does this finding say about the longer-run level of reserve balances demanded by banks? The answer is that there is a large degree of uncertainty. In fact, the Federal Reserve Bank of New York surveyed primary dealers and market participants last December to solicit their views about the level of reserves they expect to prevail in 2025.<sup>11</sup> A few features of the survey responses stand out. All respondents thought that the longer-run level of reserve balances would be substantially *lower* than the current level of more than \$2 trillion. In addition, there appeared to be a widely held view that the longer-run level of reserves will be significantly *above* the level that prevailed before the financial crisis. But even so, the respondents did not agree about what that longer-run level will be, with about half expecting a level ranging between \$400 billion and \$750 billion.

It is also important to point out that the Fed's balance sheet will remain larger than it was before the crisis even after abstracting from the issue of banks' longer-run demand for reserve balances. The reason is that the ultimate size of the Fed's balance sheet also depends on developments across a broader set of Fed liabilities. One such liability is the outstanding amount of Federal Reserve

---

11. The December 2017 Survey of Primary Dealers is available on the Federal Reserve Bank of New York's website at <https://www.newyorkfed.org/medialibrary/media/markets/survey/2017/dec-2017-spd-results.pdf>. The December 2017 Survey of Market Participants is available at <https://www.newyorkfed.org/medialibrary/media/markets/survey/2017/dec-2017-smp-results.pdf>. (Both accessed August 11, 2018.)

notes in circulation—that is, paper money—which has doubled over the past decade to a volume of more than \$1.6 trillion, growing at a rate that generally reflects the pace of expansion of economic activity in nominal terms. When I left my position in the Bush Treasury in 2006, by contrast, the total amount of paper currency outstanding was not quite \$800 billion. Other nonreserve liabilities have also grown since the crisis, including the Treasury Department’s account at the Fed, known as the Treasury’s General Account. Recent growth in such items means that the longer-run size of the Fed’s balance sheet will be noticeably larger than before the crisis regardless of the volume of reserve balances that might ultimately prevail.

Putting the various pieces together, figure 7.1.3 illustrates how the overall size of the Fed’s balance sheet may evolve. Given the uncertainties I have described, I have chosen to show three different scenarios, drawn from the most recent annual report released by the Federal Reserve Bank of New York, which was published last month.<sup>12</sup> These scenarios highlight the degree to which the longer-run size of the Fed’s domestic securities portfolio—also known as the System Open Market Account, or SOMA, which accounts for the vast majority of the Fed’s assets—will be affected by choices about the future level of reserve balances and the evolution of nonreserve liabilities. The assumptions underlying the scenarios are based on the distribution of responses from the surveys I described earlier, as those surveys also asked respondents to forecast the likely longer-run levels of several liabilities on the Fed’s balance sheet other than reserves. The “median” scenario, represented by the solid (middle) line in the figure, is based on the fiftieth percentile of survey responses, while the “larger” and

---

12. See Federal Reserve Bank of New York, *Open Market Operations during 2017*, April 2018, accessed August 11, 2018, [https://www.newyorkfed.org/markets/annual\\_reports.html](https://www.newyorkfed.org/markets/annual_reports.html). Among other things, the report reviews the conduct of open market operations and other developments that influenced the System Open Market Account of the Federal Reserve in 2017.

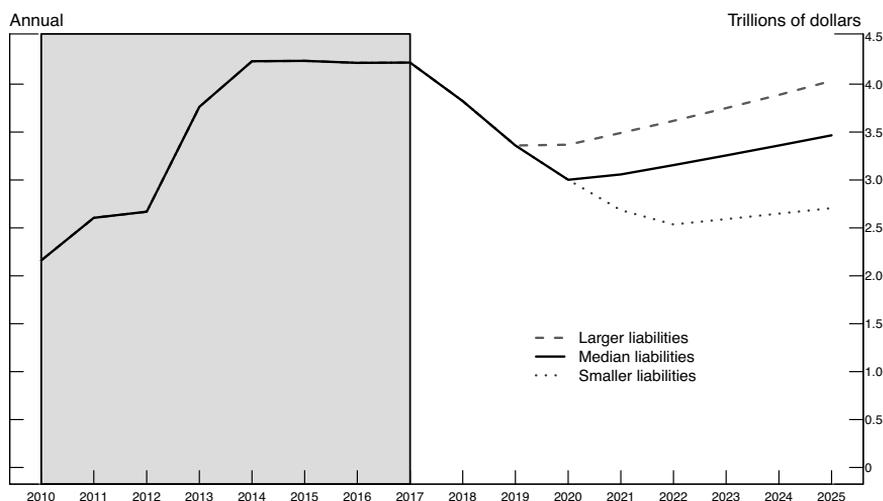


FIGURE 7.1.3. Projected SOMA Domestic Securities Holdings: Alternative Liabilities Scenarios

Source: Federal Reserve Bank of New York (2018), *Open Market Operations during 2017* (New York: FRBNY), <https://www.newyorkfed.org/medialibrary/media/markets/omo/omo2017-pdf>.

Note: Figures are as of year-end. Figures for 2010 to 2017 (shaded area) are historical settled holdings. Smaller and larger liabilities are based, respectively, on the 25th percentile and 75th percentile responses to a question about the size and composition of the Federal Reserve's long-run balance sheet in the Federal Reserve Bank of New York's December 2017 Survey of Primary Dealers and Survey of Market Participants. Projected figures are rounded. SOMA is System Open Market Account.

the “smaller” scenarios, denoted by the dashed (top) and dotted (bottom) lines, are based on the seventy-fifth and twenty-fifth percentiles, respectively.

The figure illustrates that the Fed's securities holdings are projected to decline about \$400 billion this year and another \$460 billion next year as Treasury and agency securities continue to roll off gradually from the Fed's portfolio. The kink in each curve captures what the FOMC has referred to as the point of “normalization” of the size of the Fed's balance sheet—that is, the point at which the balance sheet will begin to expand again to support the underlying growth in liabilities items such as Federal Reserve notes in

circulation. All else being equal, greater longer-run demand for currency, reserve balances, or other liabilities implies an earlier timing of balance sheet normalization and a higher longer-run size of the balance sheet, as illustrated by the top line. And the converse—smaller demand for these liabilities and a later timing of normalization, illustrated by the bottom line—is also possible. In the three scenarios shown, the size of the Fed’s securities portfolio normalizes sometime between 2020 and 2022. That is quite a range of time, so as the balance sheet normalization program continues, the Fed will be closely monitoring developments for clues about banks’ underlying demand for reserves.

What will the Fed be monitoring as reserves are drained and the balance sheet shrinks? I would first like to emphasize that the Fed regularly monitors financial markets for a number of reasons, so I do not mean to imply that we will be doing anything that is very much different from our normal practice. As reserves continue to be drained, we will want to gauge how banks are managing their balance sheets in continuing to meet their LCRs, watching in particular how the distribution of reserve balances across the banking system evolves as well as monitoring any large-scale changes in banks’ holdings of other HQLA-eligible assets, including Treasury securities and agency mortgage-backed securities.

And on the liabilities side of banks’ books, we will be keeping our eye on both the volume and the composition of deposits, as there are reasons why banks may take steps, over time, to hold onto certain types of deposits more than others. In particular, retail deposits may be especially desired by banks going forward because they receive the most favorable treatment under the LCR and also tend to be relatively low cost.

Retail deposits have grown quite a bit since the crisis, especially in light of the prolonged period of broad-based low interest rates and accommodative monetary policy, limiting the need for banks to compete for this most stable form of deposits. However, the

combination of rising interest rates and the Fed's shrinking balance sheet, together with banks' ongoing need to meet the LCR, may alter these competitive dynamics.

Of course, importantly, deposits will not necessarily decline one-for-one with reserve balances as the Fed's balance sheet shrinks. The overall effects of the decline in the Fed's balance sheet will depend both on who ultimately ends up holding the securities in place of the Fed and on the full range of portfolio adjustments that other economic agents ultimately make as a result.<sup>13</sup>

We will also be monitoring movements in interest rates. In part, we will be tracking how the yields and spreads on the various assets that banks use to meet their LCR requirements evolve. For example, to the extent that some banks will wish to keep meeting a significant portion of their LCR requirements with reserves, the reduction in the Fed's balance sheet and the associated drop in aggregate reserves could eventually result in some upward pressure on the effective federal funds rate and on yields of Treasury securities. This situation could occur if some banks eventually find that they are holding fewer reserves than desired at a given constellation of interest rates and, in response, begin to bid for more federal funds while selling Treasury securities or other assets. Interest rates will adjust up until banks are indifferent with regard to holding the relatively smaller volume of reserves available in the banking system.

Overall, we will be monitoring to make sure that the level of reserves the Fed supplies to the banking sector, which influences the composition of assets and liabilities on banks' balance sheets as well as market interest rates, provides the desired stance of monetary policy to achieve our dual mandate of maximum employment and stable prices. Of course, we will need to be very careful to

---

13. For a discussion of the overall effects of the decline in the Fed's balance sheet, see Jane Ihrig, Lawrence Mize, and Gretchen C. Weinbach, "How Does the Fed Adjust Its Securities Holdings and Who Is Affected?" Finance and Economics Discussion Series 2017-099, Board of Governors of the Federal Reserve System, September, 2017, accessed August 11, 2018, <https://www.federalreserve.gov/econres/feds/files/2017099pap.pdf>.

understand the precise factors that underlie any significant movements in these areas, because factors that are unrelated to the Fed's balance sheet policies might also cause such adjustments.

## CONCLUSION

To conclude, I would like to reemphasize that I have touched on some highly uncertain issues today—issues that, I would like to stress again, have not been decided by the FOMC. One such issue that closely relates to my remarks today, and one I believe the upcoming panel will likely address, is which policy implementation framework the Fed should use in the long run. That is, broadly speaking, should the Fed continue to use an operational framework that is characterized by having relatively abundant reserves and operate in what is termed a “floor regime,” or should it use one in which the supply of reserves is managed so that it is much closer to banks' underlying demand for reserves as in a “corridor regime”?

Of course, many complex issues underlie this decision, so I would just like to emphasize two general points. First, a wide range of quantities of reserve balances—and thus overall sizes of the Fed's balance sheet—could be consistent with either type of framework. Second, while US liquidity regulations likely influence banks' demand for reserves, the Fed is not constrained by such regulations in deciding its operational framework, because US banks will be readily able to meet their regulatory liquidity requirements using the range of available high-quality liquid assets, of which reserve balances is one type.

Importantly, additional experience with the Federal Reserve's policy of gradually reducing its balance sheet will help inform policymakers' future deliberations regarding issues related to the long-run size of the Fed's balance sheet, issues that will not need to be decided for some time.

The final and most general point is simply to underscore the premise with which I began these remarks: financial regulation and monetary policy are, in important respects, connected. Thus, it will always be important for the Federal Reserve to maintain its integral role in the regulation of the financial system not only for the visibility this provides into the economy but precisely in order to calibrate the sorts of relationships we have been talking about today.

## DISCUSSANT REMARKS

*Paul Tucker*

Thank you very much to Johns Taylor and Cochrane for inviting me back to this conference. It is a great pleasure to be able to comment on Federal Reserve Vice Chair Randy Quarles's speech.

I liked the speech very much for a simple reason, which is that it sets out to discuss banking regulation, monetary policy, the implementation of monetary policy, and the Fed's balance sheet all in a joined-up way. That used to be rather more common when, a long time ago, I started out in central banking. The speech gives me hope that some lost years are being put behind us.

In that spirit, I am going to try to frame what Vice Chair Quarles has been saying in the broader context of what central banks are for (what social purpose they serve) and of how the imperative of monetary system stability should be part of what I call a Money-Credit Constitution.<sup>1</sup> I shall then use that framework to discuss the liquidity coverage ratio and the choice of monetary policy operating regime. When I reach the latter, I am going to make some observations about recent statements by the New York Fed which I believe to be deeply flawed, conceptually and factually, and so do not provide an adequate basis for the debate the Fed (and other central banks) need to have about how to manage the quantity of reserves and the overnight rate of interest in the unknown new normal the United States is now, happily, heading toward. Finally,

---

Adapted from *Unelected Power: The Quest for Legitimacy in Central Banking and the Regulatory State* (Princeton, NJ: Princeton University Press, 2018), accessed August 17, 2018, <https://press.princeton.edu/titles/11240.html>. Reprinted by permission.

1. On the idea of a Money-Credit Constitution, see *Ibid.*, Part IV.

I am going to air an option for addressing that challenge which I think merits consideration.<sup>2</sup>

## WHAT CENTRAL BANKS ARE FOR

So, what are central banks for?

For an uncomfortable decade or so starting sometime in the 1990s, we lived in a world in which central bankers were seen as being for just one thing: price stability. Then early in the great financial crisis—in 2007, well before we reached meltdown in autumn 2008—the central banking community rediscovered that an awful lot of the monetary system is actually privatized, I might add for good reasons; and that, therefore, the stability of the issuers of private money, the banks, matters to the stability of the overall monetary system, including to the ability of the central bank to achieve price stability. For those central banks, such as the Fed, that had held onto their prudential supervision function over the decade leading up to the crisis, this amounted to recognizing that that work actually mattered and so deserved the attention of top management and the reassignment of some of the best staffers.

What is more, a new generation of top central bankers lived the reality that their monetary operations—as lender of last resort (LOLR) to the system as a whole and to individual intermediaries—were crucial to underpinning the stability of the private part of the monetary system. In other words, they discovered that they were actors in stability, not just more or less interested observers and commentators.

Reflecting that, there has been a growing realization that the public policy purpose of central banking is the preservation of

---

2. My thanks for comments from Roger Clews, my former colleague and co-architect of a decade-long series of reforms (from mid-1990s to late 2000s) to the United Kingdom's monetary operations and money markets.

*monetary system stability*.<sup>3</sup> While most certainly broader than the dominant pre-crisis view that all that mattered was low and stable inflation, this way of seeing central banking is still a lot narrower than a new habit of thinking that central banks are in the business of fixing or remedying all frictions and pathologies in financial economy-real economy interactions. That way lies nemesis.

Thought of in terms of monetary system stability, central banks have two related missions or objectives. One is to maintain stability in the value of their money in terms of goods and services. The other is to maintain an exchange rate of unity between money issued by the private sector monetary system *as a whole* and central bank money. The latter captures the objective of ensuring that the *aggregate* supply of monetary services to the real economy (payment transfers, liquidity insurance, credit) is maintained through distress. It does not imply that *individual* banking intermediaries should not be allowed to fail.

### A Money-Credit Constitution

Now, if you accept that stability in the monetary system is a precondition for the operation of a market economy, then households and firms need to be highly confident that the monetary regime will not chop and change. That means that what central banks do and what private banks do need to be framed and constrained by a *Money-Credit Constitution*. This is somewhat broader than the late James Buchanan's proposal of a money constitution, for the simple but profound reason that we must face up to the existence of fractional-reserve banking (FRB).<sup>4</sup>

The broad concept of a monetary constitution will be familiar from the nineteenth century. This is what the gold standard

---

3. Again, see Part IV of *Unelected Power*.

4. For an example relatively late in his life, see James M. Buchanan, "The Constitutionalization of Money," *Cato Journal* 30, no. 2 (2010): 251–58.

became. It had three components. It imposed a particular kind of nominal anchor. It set a *de facto*, sometimes *de jure*, requirement that the core banks hold reserves with their central bank, which were an indirect claim on gold. And it was buttressed by the availability of emergency liquidity assistance to sound banks and other monetary-system intermediaries (Bagehot's lender of last resort).

I would suggest that a modern Money-Credit Constitution (MCC) needs not three but five components. One is a nominal target of some kind. That's what John Taylor was talking about at lunchtime. The second is a requirement for banks, and possibly what today are called "shadow banks," to hold reserves with the central bank or, alternatively, assets that can be readily converted into reserves. The third is a liquidity reinsurance regime, which normally goes by the name of lender of last resort but which I find helpful to think of in terms of liquidity reinsurance as it reminds us that the commercial banks are themselves, deep down, in the business of providing liquidity-insurance services via demand deposits and committed lines of credit. Fourth, a resolution regime, designed to ensure that fundamentally unsound intermediaries do not get bailed out by the monetary authority's loans but, also, that their distress and demise do not rupture the supply of core services. (That was missing in the nineteenth century for reasons that are worth discussing, but which I won't get into here.) And fifth—and this starts to build a bridge to the next session of this conference—constraints on the structure and uses of the central bank's balance sheet, given that the central bank's balance sheet is latently a fiscal instrument and so could in theory be used for almost anything, going well beyond the goal of monetary system stability.

In the light of Vice Chair Quarles's remarks, I will say something about the second, third, and especially fifth of those five MCC components.<sup>5</sup>

---

5. On how the second, third and fourth could become more joined up, via a second round of reforms, see Paul Tucker, "Is the Financial System Sufficiently Resilient?"

## THE PLACE OF THE LCR IN A MONEY-CREDIT CONSTITUTION

In terms of the framework I have sketched, the liquidity coverage ratio (LCR) plainly performs a role in a money-credit constitution because, big picture, it specifies the level of reserves or other liquid assets that banks (and, at least conceptually, others) must hold relative to their short-term liabilities.

As I understand it, the matter at the heart of the vice chairman's speech is the relationship between the LCR and the Federal Reserve's monetary operations. From the regulatory end of the telescope, what proportion of the LCR should be met by banks holding reserves with the central bank? From the monetary policy and balance-sheet-management end, what quantity of reserves should be supplied to the system, and so end up being held by banks?

Big picture, there are two ways of ensuring that (sound) banks can meet a required degree of resilience against liquidity drains, enabling a unitary public/private-money exchange rate to be maintained. One is bottom-up, focused on individual intermediaries; the other top-down, starting from the system as a whole

The first is to require *each individual* bank to cover a specified minimum proportion (x%) of its short-term liabilities with assets that are eligible for discount at the central bank. The limiting case is what Mervyn King has called the "pawnbroker for all seasons," where *all* short-term liabilities must be covered ( $x = 100\%$ ).<sup>6</sup> The

---

A Research and Policy Agenda on Informationally Insensitive 'Safe' Assets within a Money-Credit Constitution," BIS Working Papers (forthcoming).

6. Mervyn King, *The End of Alchemy: Money, Banking and the Future of the Global Economy* (London: Little Brown, 2016). An idea of full "liquid-assets" cover for short-term liabilities was first floated in the Bank of England by David Rule when, before the great financial crisis, we were thinking about contingency plans for a 9/11-type disaster. Under such a scheme, ongoing industry lobbying (and associated political pressure) would be directed at the definition of "short term liabilities," the population of eligible instruments, and the level of haircuts.

LCR does not currently go nearly so far, but the sooner we have another crisis that looks like 2007 and early 2008, the more policy will move in that direction. It would give center stage to official policy on haircuts (or excess collateral), as among other things that would determine the proportion of assets that must be funded by equity (and longer-term debt liabilities).<sup>7</sup>

The second approach to effecting a desired liquidity standard is for the central bank to inject a quantity of reserves equal to or exceeding a specified proportion (x%) of the private banking sector's *aggregate* money-like liabilities. Conceptually, at the level of the system as a whole, that amounts to the central bank preinsuring against liquidity stress by buying or lending against eligible assets in advance rather than providing liquidity assistance only when needed to individual firms.

The two approaches are not mutually exclusive. Specifically, under the second, it would not be possible credibly to rule out *bilateral* liquidity assistance to sound banks, as reserves might not always be efficiently distributed via the market. But that could, in principle, be addressed by requiring each individual banking intermediary to hold the requisite level of reserves (x% of short-term liabilities) with the central bank. As will be clear, in that case the LCR is recast as a reserves requirement.

The higher the chosen rate of aggregate liquidity cover (x%), the larger would be the size of the central bank's balance sheet, *permanently* (rather than, as over recent years, temporarily in response to particular market and macroeconomic stresses and strains). As a thought experiment, then, this drives us to the vice chairman's question: Even with the current LCR, just how big should the central bank's balance sheet be?

---

7. Tucker, "Is the Financial System Sufficiently Resilient?"

## THE MONETARY OPERATING FRAMEWORK UNDER A MONEY-CREDIT CONSTITUTION

To find our way through these questions, we need to think about monetary-policy operating regimes and, in particular, to be alert to the transformation brought about by the move to paying interest on reserves (during the crisis in the United States, before the crisis in the euro area and United Kingdom).

### Three Policy Instruments and a Principle of Parsimony

Paying the policy rate of interest on reserves gives a central bank more degrees of freedom. Most obviously, it can supply gigantic amounts of reserves (for example, via QE to stimulate aggregate demand as now, or to cover the banking system's liquid liabilities as described above) and so run a massive balance sheet while still keeping control of money market rates, since its policy rate provides a floor.

More generally, a central bank paying interest on reserves has not one but three policy instruments. The first and most familiar is the policy rate itself. The second is the size of the central bank's balance sheet. And the third is the composition of its asset portfolio (the instruments it has bought or the secured loans it has made in order to inject the desired level of reserves). The deep question—a political economy question, not just a matter for positive economics—is whether the Fed is going to adopt three objectives to go with those three instruments.

I want to argue that the answer should be: most of the time, definitely not. That is partly because I want to urge central banks to live by a *principle of parsimony* in order to aid public comprehensibility and accountability.<sup>8</sup> Central banks are very powerful bodies

---

8. Tucker, *Unelected Power*, chap. 21, 490–91, 501–02.

led by unelected technocrats who are insulated from day-to-day politics. In our democracies, the delegation of government power can be legitimate only if we can track what the legislature's agents are doing. Central banks should make that as straightforward as possible. And, in jurisdictions that have chosen to have a market economy, they should distort market mechanisms no more than required to achieve their objectives.

This precept entails that *central bank balance-sheet operations should at all times be as parsimonious as possible consistent with achieving their objectives*. Thus, if price stability can be achieved using only interest rate policy, it should be; and if banking system resilience can be maintained without a permanently enormous central bank balance sheet, it should be.

But if that general precept and its implications are reasonable, is it feasible here in the United States as the Fed eventually gets back to(ward) normality? I am going to argue that it is.

In doing so, I need to say something about the technicalities of monetary operating systems, as this will help to align the positive economics with my political economy precept of parsimony.

### Monetary Operating Systems

In passing, Vice Chair Quarles noted that the New York Fed has framed the debate about the operating system in terms of whether the Fed should carry on with a kind of “floor system” or whether it should adopt what is described as a “corridor system.”

Under a floor system, as touched on already, the central bank injects more reserves than are demanded so that the market rate falls to the rate the central bank pays on the marginal dollar of reserves. In consequence, if there are other options, a floor system violates the principle of parsimony as it involves the central bank choosing to have a larger balance sheet than is necessary for monetary policy.

The other option typically mentioned is a corridor system. Sadly, the New York Fed's discussion of corridor systems was highly misleading in three respects.<sup>9</sup> First of all, it is said that a corridor system relies on a scarcity of reserves. It need not do so at all. That is a defining requirement of a "ceiling system": a third type of system which, although unsuitable for prospective conditions in the United States, will help to explicate what is distinctive about a corridor system.

A ceiling system was used by the Bank of England in the early part of the twentieth century (with variants persisting until the early 1980s, when a mangled form of monetary-base control was introduced and conceptual confusion set in).<sup>10</sup> Under a ceiling system, the policy rate—Bank Rate, as it was called historically—is the rate charged on what the Fed calls (primary) discount window credit. When the market rate is not in line with what the central bank thinks is necessary to achieve its monetary objective, it undersupplies reserves via open market operations, creating scarcity and so pushing the banks into the window. Given reasonably efficient arbitrage, this asserts central bank control over the market rate, as banks will not pay a premium to square their books in the market when they could pay less at the window. The rate at which the open market operations are conducted does not matter very much, because that is a quantity exercise, designed to squeeze the banking system into the window.

A ceiling system would be quite inappropriate now and prospectively in the United States because, in common with other central banks, there is a structural surplus of reserves in the system (relative to demand) as a result of quantitative easing (QE). Expositionally,

---

9. William C Dudley, "Important Choices for the Federal Reserve in the Years Ahead" remarks at Lehman College, Bronx, New York, April 18, 2018.

10. I sometimes wonder whether similar confusions crept into US debates. For the UK saga, see Paul Tucker, "Managing The Central Bank's Balance Sheet: Where Monetary Policy Meets Financial Stability," *Bank of England Quarterly Bulletin*, Autumn 2004, especially Annex 3.

the concept is useful, however, because when thought about alongside a floor system it reminds us of the general economics of central banks' monetary operations.

### What is a Corridor System?

To establish its policy rate in the money markets, the central bank needs to be either the marginal taker (floor system) or the marginal provider (ceiling system) of overnight money, or both. A corridor system simply combines the two: the central bank acts as *both* the marginal provider and marginal taker of funds, standing ready to borrow or lend in unlimited amounts at epsilon around its policy rate. Epsilon could be twenty-five basis points, the standard unit of change for monetary policy in most advanced economies, or less than that, or a bit more than that. The wider the corridor, the more an efficient money market is needed, which not all countries have.

This puts into relief the two other assertions made by the New York Fed about the characteristics of a corridor system. One was that such a system requires incredibly accurate forecasting of the demand for reserves and the other was that it requires the central bank to operate in the market frequently. Conceptually, neither proposition is true in general. Nor, for what it's worth, are they true in practice other than in rather particular circumstances.

Those circumstances are, broadly, where banks are set a reserves target; they have to meet it very precisely; the spread between the lending rate and deposit rate is large; and the maintenance period is effectively short (so that there is little or no intertemporal arbitrage across days). As it happens, nearly all those conditions held in the Fed's pre-crisis operating system, but they were *choices*.<sup>11</sup> Having

---

11. Technically, the Fed's maintenance period was not one day. But the low level of the reserves requirement and the system of penalties combined to make it operate somewhat like a one-day system so that large autonomous flows between the Fed and the banking system had to be offset via daily (or more frequent) OMOs.

to conduct frequent open market operations and to strive for precision in their forecasts of reserves-demand were consequences of those choices, nothing to do with corridor systems as such. When the governors debate the merits of floor versus corridor systems, they do not need to be constrained by the Fed's rather idiosyncratic pre-crisis system (which, as it happens, was not dissimilar to the equally idiosyncratic Bank of England system jettisoned in the 2000s).

So, specifying things more generally:

- (a) Any system with two or more operating rates can be considered a "corridor," especially where the two rates are symmetric around the policy rate.
- (b) There is a wide class of such systems, with none having an exclusive right to the label.
- (c) Particular systems within the "corridor" family are distinguished by their other characteristics—daily or averaging and length of maintenance period, target range, etc., or not, and the distance between the two rates.
- (d) These other characteristics powerfully influence the frequency and accuracy that are required or desirable in open market operations.

For example, the smaller epsilon relative to twenty-five basis points, say five basis points, the more the implementation of monetary policy—defined to mean establishing overnight money market rates broadly in line with the policy rate—does not require *any* open market operations at all or, indeed, any forecasting of the demand for reserves. The central bank just lets individual banks and the banking system as a whole come and borrow from it when the market rate is more than epsilon above the policy rate and, symmetrically, to place money with it when the market rate is more than epsilon below the policy rate. Instead, the size of the balance sheet fluctuates to the extent that banks square their books via the

central bank's two facilities rather than meeting as counterparties in private markets.

Thus, it is possible for the central bank to set the overnight rate without having any kind of reserve system (or open market operations—OMOs) at all. That, broadly, is the setup in New Zealand.

This poses a big question: Why should a central bank want banks to hold a positive level of reserves? The arguments, I think, are twofold, perhaps threefold. First, the smaller the epsilon, the more banks will meet each other to balance their books across the central bank's balance sheet rather than in the money markets. The central bank might see positive value in the existence of a market. Second, a pure corridor system will not work effectively to implement monetary policy if stigma attaches to using the borrowing facilities of the central bank. Indeed, the greater the stigma of drawing on the borrowing facility in normal or exceptional circumstances, the more it is desirable in terms of the stability of the private part of the monetary system to ensure that the banks have *preinsured* themselves against liquidity shocks by holding reserves with the central bank.<sup>12</sup> And, possibly, third, the central bank might want to have some control, indirect or direct, over day-to-day fluctuations in the size of its balance sheet.

The prudent approach returns us, then, to the question: How to determine the level of reserves that the banking system should hold? Typically, that is debated in terms of: How should the central bank *set* the reserves requirement (direct control)? But, in fact, the central bank does not need to do that. The key is the design of the

---

12. In my view, stigma arises partly because a central bank can develop a reputation for being ready to lend to unsound banks. Fairly or unfairly, the Fed has that reputation with some members of Congress and some commentators. Shedding that perception is vitally important to giving the Fed space to choose its operating system and, of course, politically. The new resolution systems provide the basis for the Fed to bring about regime change in its LOLR function. For that and other reasons, together with other central banks it would rationally be a great advocate of resolution regimes and planning.

incentives to meet a target (and so how the target is specified), not who sets it: a form of *indirect control*.

### Voluntary Reserves Averaging

This brings me to the option I want to air. A central bank can adopt what I am going to call “voluntary reserves averaging.” Ahead of the start of a monetary maintenance period running from one Federal Open Market Committee (FOMC) meeting to the next, the central bank invites each reserve bank to specify the level of reserves it would like to target, on average, over the forthcoming period. They each set a target,  $t$ . The central bank then adds those up, to get an aggregate target,  $T$ . It must now provide something like that level of reserves over the maintenance period as a whole (technically,  $T$  times the number of days in the averaging period).

The system does not require daily (or more frequent) open market operations, because what matters is the final day of the maintenance period. So long as the policy rate is expected to prevail on that final day and provided the money markets are reasonably efficient, the policy rate will prevail on earlier days through the martingale properties of intra-maintenance-period arbitrage.

Nor does the central bank need to achieve pinpoint accuracy in the supply of reserves on the final day of the maintenance period, because it can create a very narrow de facto corridor by remunerating reserves at the policy rate so long as they fall, on average, within a range around each bank's target  $t$ . The wider the range, the less pinpoint forecasting is needed. More or less equivalently, the narrower the corridor between borrowing and deposit rates on the final day, the less super accurate reserves-demand forecasting is needed.

Further, because banks individually, and hence in aggregate, have an opportunity to reset their reserve targets at the beginning of each maintenance period, the system can accommodate swings in the demand for central bank money, and hence LOLR oper-

ations, without automatically having to conduct OMOs to drain “excess” reserves. Contrary to the New York Fed's statement, such draining operations are automatically needed only when reserves targets are static and so cannot accommodate shifts in demand.

The Bank of England employed this kind of system before the crisis, including a narrow corridor on the final day of the maintenance period, a wider corridor on earlier days, weekly OMOs plus a fine-tuning OMO on the final day, and reserves targets specified as a range. After the money-market liquidity crisis began in August 2007, banks progressively raised their reserves targets and we widened the permitted range around the targets. The system was, of course, suspended after the move to QE, when banks' own demand for reserves became irrelevant.

There are, of course, some practical constraints on utilizing this kind of system in normal conditions. First, and this might be relevant to the United States, it is important not to let nonbanks bank with the central bank unless they are subject to a system that replicates in some form the reserves system for banks. This might be relevant to the terms on which Fannie Mae and Freddie Mac are permitted to bank with the Fed.

Second, the integrity of collateral policy matters. If haircuts are too low or collateral valued richly, OMOs provide a cheap source of financing. In those circumstances, banks have incentives to choose high reserves targets simply in order to increase the aggregate size of OMOs. That would distort the allocation of resources in the economy and might help create debt bubbles. To be consistent with broad monetary system stability, banks need to choose their individual reserves targets guided only by their assessment of stochastic shocks to their payments flows and various other things that intrinsically matter (notably the system of penalties for missing reserves targets).

Provided those conditions are satisfied, the operating system I have been describing offers a solution to the problem outlined by Vice Chair Quarles.

That is because surely the answer to the vice chairman's question of what level of reserves the banking system will want to hold as conditions normalize is, absolutely: no one knows. But I am suggesting that the Fed does *not* need to know. It can find out through giving the banks the choice of selecting their own reserves targets.

I would not do that until the Fed's balance sheet has shrunk quite a bit. When introduced, the Fed would not know the extent to which the stock of reserves might still be massively greater than underlying demand. But a floor system could be synthesized, as a transitional measure, by remunerating reserves in a very wide range around the banks' targets.

The important thing, however, is that in steady state the Fed does not need to choose both the stock of reserves (the size of its balance sheet) and their price (the policy rate). Just as the public's holding of notes is demand-driven, so the banks' holding of reserve balances can be too. That fits with the principle of parsimony. Or put another way, do not try to control *both* the price and the quantity of reserves except where you really need to do so due to extraordinary circumstances.

There is, of course, a lot more to be said about the various options open to the Fed (and other central banks). But in evaluating them, the governors need not be worried that a corridor system entails creating a shortage of reserves, conducting OMOs very frequently, or forecasting the demand for reserves with pinpoint accuracy. The Fed is not condemned by those things to stick with a giant balance sheet and a "floor system" for rates forever.

#### SUMMING UP

It has been a great pleasure to respond to Vice Chair Quarles's remarks today. In doing so, I have offered some thoughts on how the LCR fits into an economy's Money-Credit Constitution and on the range of options available for operating monetary policy.

More important, however, are adopting a principle of parsimony in pursuing central banking's mission of monetary system stability and ensuring that the various arms of Fed policy are joined up and coherent.

By way of conclusion, I should perhaps stress that choosing the joined-up liquidity regime that complements the central bank's nominal target does not suffice to complete a money-credit constitution. Even a liquidity-reinsurance system providing 100 percent cover, in aggregate and individually, for the banking system's money-like liabilities would not cater for all seasons. That is because central banks cannot (legally or decently) lend to fundamentally insolvent firms (as to do so gives short-term creditors preference over similarly ranked longer-term creditors).<sup>13</sup> So while the LCR fits into the kind of MCC framework I have described, it needs to be supplemented with policies for the orderly resolution of intermediaries, which need to cover the permitted creditor hierarchy of operating banks and banking groups, and the availability of liquidity provision to recapitalized intermediaries. But that is another story.<sup>14</sup>

---

13. On the “no lending to fundamentally unsound firms” precept and the insufficiency of good collateral, see Tucker, *Unelected Power*, chapter 23; and Paul Tucker, “The Lender of Last Resort and Modern Central Banking: Principles and Reconstruction,” BIS Papers No. 79, October 8, 2014. The important distinction between fundamentally sound and unsound borrowers arises because time-subordination exists while a firm is alive but not when in bankruptcy. Upon entry into bankruptcy, some debt claims are accelerated by their contractual terms and, more generally, liquidators are not permitted to pay out to short-term creditors if longer-term creditors of the same seniority would be left worse off as a result.

14. See Tucker, “Is the Financial System Sufficiently Resilient?”

## GENERAL DISCUSSION

ANDREW LEVIN: The Federal Reserve regularly conducts stress tests for major banks. You ask them to consider how they would respond to key material risks. In my 2014 Hoover paper, I proposed that the Fed should also engage in stress tests for monetary policy, i.e., contingency planning for its policies and balance sheet. The Fed would refer to a benchmark scenario, like the ones that you've shown us, and then provide information about some salient risks over the medium run.

One obvious risk is the onset of a recession. The Fed will have some scope to cut interest rates or to launch a QE4 program. What would that look like in terms of the Fed's balance sheet? Another plausible risk is that paper cash could diminish much more quickly than in the benchmark scenario. As an analogy, when I visited Finland in 2007, everyone was confident that Nokia would continue to be the world's leading cellphone producer for many years to come, but then the iPhone was introduced and Nokia's business completely vanished within a couple of years. Don't we think that there's some nontrivial possibility that the same thing could happen to paper cash over the next five years or so? And if that happened, wouldn't it have major implications for the Fed's balance sheet? Again, you're asking the banks to do these sort of stress tests, so it seems sensible for monetary policy makers to start engaging in similar exercises regarding the central bank's balance sheet. What do you think?

RANDAL QUARLES: I guess there are two questions. One, is it worth considering those scenarios? And obviously, internally, we consider a lot of scenarios to be prepared for. And then the second question is, as we do with the stress tests on the financial sector, what's the public transparency around those considerations?

I think that there are pros and cons of that. Our current level of transparency, I think, sometimes results in an excessive level

of Kremlinology around whose “dot” is whose [in the FOMC’s periodic Summary of Economic Projections] and over parsing relatively arbitrary choices of words in statements. And so I shudder to think about the level of potentially misleading analysis that could come from transparency around how we were thinking about those other potential eventualities. But on the other hand, transparency, at least in the abstract, is a good, so I think it’s something worth reflecting on.

CHARLIE SIGULER: I have a question for Vice Chair Quarles. I was thinking, in the world of post-QE2, we sort of had extraordinary monetary policy, and perhaps extraordinary moral hazard, and I’m wondering if the Fed put exists, and if the stock market were to fall by, let’s say, 10 percent for no discernible reason, would the Fed be forced to take action?

RANDAL QUARLES: In general, I think it is not only our articulated stance, but I think it also actually reflects the fact that it’s a complicated system of governance. But the Fed’s decisions don’t really reflect a targeting of asset levels. And certainly not equity market asset levels. You could come to some correlation, I suppose, to the extent that sudden changes in the value of equities are viewed as reflecting developments in the real economy that require a response. But I don’t think that anyone should be expecting that a change in valuation, even a rapid change in equity valuations, that simply reflected sort of a reversion of asset prices to the mean as opposed to some signal about developments in the real economy, would result in action by the Fed.

DONNA BORAK: This question is for the vice chair. In the event that you don’t take Paul’s suggestion here at the end of his presentation, I’m curious, what do you think is a perfectly reasonable amount of time for the Fed to answer the two questions that you laid out in terms of what is the right size of the balance sheet and in terms of determining the deliberate demand that the banks have on these reserves? And second, are there external

considerations that are weighing on your mind that might hasten how quickly you arrive at those answers?

RANDAL QUARLES: What I tried to walk through today was the mechanism through which we're essentially going to let the banks themselves reveal their demand for reserve balances as the balance sheet shrinks. It's one of the reasons for the gradual policy, precisely because we don't have a good handle on what that demand for reserve balance is going to be, and as the balance sheet shrinks, we will come to one of those inflexion points depending on where the underlying demand for reserves is, as well as some of these other factors, demand for paper currency and so forth. And when we hit that point, then the balance sheet will begin to grow and, essentially, we will see through the banks' actions what their demand for reserve balances is. We'll say, "Well, okay, it's not going down any lower." I view that as, essentially, we're going to allow the market to tell us through a gradual change in the environment when we have hit that inflexion point. We're changing it gradually so people sort of have a chance to change their practices and, indeed, discover their own preferences as the environment changes around them.

So, I don't know that it's really necessarily up to us to set the time frame on which that will happen. We're shrinking the balance sheet at a rate that's . . . with this batch, it could be faster, it could be slower. But it's one that's at least predictable, quite regular how that's going to happen. So, we've set kind of a very clear path for shrinking the balance sheet. And as that balance sheet shrinks, we will hit the point where we intersect the banks' underlying demand for reserves, which right now we think is unclear for a variety of reasons. And we will see it when we see it.

SEBASTIAN EDWARDS: This is a question for Paul. As you were talking about average voluntary reserves, it clicked in my mind that Mexico had such a system just before the last crisis. I quickly searched, and I found a paper by Moisés Schwartz. He used to

be the head of the Independent Evaluation Office at the IMF and is a Mexican—a very good economist. And I find that there are a number of countries that have had zero reserve requirements, which in some way it is voluntary average reserve requirements. Because zero would be the lower bound. What is the evidence historically of these systems? I know that in Mexico, that story ended up badly, with a huge crisis. What is the story, the evidence in other countries—New Zealand and so on—and how would that affect your policy recommendation?

PAUL TUCKER: So, New Zealand is (or at least in the past has been), I believe, pretty close to operating a pure corridor system with no reserves requirement (voluntary or stipulated) at all, but instead just acting as the marginal provider and taker of funds. For normal times, I prefer the system of “voluntary reserves averaging” I described when responding to Vice Chair Quarles because it gives the banking system the option of *preinsuring* against liquidity runs. In terms of the voyage of discovery to gauging the demand for reserves that the vice chairman described, I think the difficulty that the Fed will intrinsically have is that (a) under a floor system, you cannot judge how far your (net) supply of reserves has exceeded demand; and (b) if, moving away from the floor system, you set a reserves target but the overnight unsecured rate (and perhaps also secured rate) falls below (or rises above) the policy rate, that is still not going to tell you very much about the elasticities. It’s just going to tell you that you’re in the zone when something’s happening that you don’t much like, and so those would be circumstances where open market operations *would* have to be actively used to discover the “right” quantities. Moving toward a system of voluntary reserve averaging would, by contrast, reveal to you the level of system-wide demand for reserves. (There are parameters that could be tweaked during the transition, including the permitted range around reserves targets, but that is getting rather techy for this discussion.)

The other thing about having that kind of system is that as conditions get more difficult but not terrible—I'll come back to that—the banking system will endogenously opt to have higher reserves targets (when each bank sets its target for a new monetary maintenance period). That is exactly what happened in the United Kingdom during the second half of 2007. The voluntarily chosen reserves targets doubled to tripled *before* we started QE. The point about QE, i.e., when you reach the zero lower bound, is that it's a game changer—because then the central bank is saying (precisely because it is at the zero lower bound), “We are not interested in demand for reserves anymore. We're actually trying to do something else in other markets through portfolio balance effects, etc.” So, you have to think about a regime for normal times and one for non-normal times, and how you might design a system so as to be in receipt of signals that conditions are moving away from normal. And I want to underline, therefore, that the system I described gives you information through the choice that the banks make during normal times that non-normal times threaten.

WILLIAM NELSON: I have a question for Vice Chairman Quarles. So, as you noted, under the liquidity coverage ratio you can meet your liquidity requirements with reserves or with Treasury securities, other securities are, of course, limited, but you can use them to some extent. The most binding liquidity requirements right out there now are probably RLAP and RLEN and the liquidity requirements under living wills, resolution plans, we don't really know the details about, because those, of course, are secret. But one thing that I frequently heard back from banks or bank consultants is that, despite how the LCR is written, banks are told that they have to meet a material part of their high-quality liquid assets requirements with reserves. Now, of course, as you note, that does constrain the Fed, because if there's two trillion in HQLA out there, and say half of that has to be met with reserves,

then you can't provide less than a trillion in reserves. I'd be curious to hear your thoughts on that and your reassurance that in fact it's Fed policy that banks can meet their liquidity requirements with alternatives and not just with the reserves.

RANDAL QUARLES: I do know that that message has been communicated at least in some supervisory circumstances in the past. I would say that that's in the process of being rethought.

PAUL TUCKER: Can I add something on this? Imagine that the QE had been so much bigger that the quantity of reserves had exceeded the aggregate LCR requirement. Well, then, assuming money markets are reasonably efficient, all of the LCR requirement would be met by every bank's holding of reserves. So, this isn't the LCR in normal monetary conditions, when reserves supply is lower than the aggregate LCR requirement.

WILLIAM NELSON: There are plenty of institutions that aren't banks that don't meet the LCR with reserves.

PAUL TUCKER: Well, there's a very deep, technical, but important question about the US monetary system in terms of who is allowed to have an account with Federal Reserve Banks and who is allowed to hold reserves. In terms of steering the overnight rate, that is a bigger question probably than anything we've discussed on this panel, but it is peculiar to the Fed's banking facilities.

MICHAEL BORDO: This is for Paul Tucker. It is an esoteric economic history question. When you were discussing the Bank of England in the 1930s, you should be aware of a new book by William Allen of the Bank of England which analyzes the history of the gilt market. It seems to me that what the Bank of England did in the 1930s is pretty close to what the Federal Reserve did in the 1920s: the Fed's main policy tool was the discount window, and it used open market operations to pressure the commercial banks to go to the window.

PAUL TUCKER: That's exactly right. I gave a speech in 2004 with, as I recall, more or less the same title as Randy's today. And, for

me, the most interesting bit of the speech wasn't what I said but Annex 3, which is a series of extracts from notes written in the 1920s/30s and 1950s/60s, and so not my words at all. It operated exactly as you say: it was what, using today's metaphors, I called a ceiling system.