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Liquidity Regulation

Remarks by

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The financial turbulence of 2008 was largely defined by the dangers of runs--realized, incipient, and feared. Facing deep uncertainty about the condition of counterparties and the value of assets serving as collateral, many funding markets ground to a halt, as investors refused to offer new short-term lending or even to roll over existing repos and similar extensions of credit. In the first instance, at least, this was a liquidity crisis. Its fast-moving dynamic was very different from that of the savings and loan crisis or the Latin American debt crisis of the 1980s. The phenomenon of runs instead recalled a more distant banking crisis--that of the 1930s.

Despite this defining characteristic of the last crisis, measures to regulate liquidity have by-and-large lagged other regulatory reforms, for at least two reasons. First, prior to the crisis there was very little use of quantitative liquidity regulation and thus little experience on which to draw. While the Basel Committee got to work quickly, senior central bankers and heads of bank supervisory agencies extended the timeline for implementation of liquidity standards to guard against unanticipated, undesirable consequences from these innovative regulatory efforts. A second reason liquidity regulation has followed other reforms is that judicious liquidity regulation both complements, and is dependent upon, other important financial policies--notably capital regulation, resolution procedures, and lender-of-last-resort (LOLR) practice. Work on liquidity regulations has both built on reforms in these other areas and occasioned some consideration of the interaction among these various policies.

But while perhaps a bit drawn out, the work has proceeded. A final version of a Liquidity Coverage Ratio (LCR) was agreed internationally and has been adopted by regulation

in the United States.¹ The Basel Committee's recently announced final Net Stable Funding Ratio (NSFR) is another significant milestone in building out a program of liquidity regulation.

Today I would like to take stock of the progress that has been made. I will first describe the role of liquidity regulation, including how it relates to those other dimensions of regulation I mentioned a moment ago. Next, I will review the specific liquidity regulatory and supervisory measures that have been put in place or are in the process of development. In concluding, I will offer an interim appraisal of our approach to liquidity regulation and identify some of the issues that remain.

The Role of Liquidity Regulation

Liquidity vulnerabilities are, of course, inherent to most forms of financial intermediation. The canonical case is that of maturity transformation by a very conventional bank, which takes demand deposits and uses the funds to make loans that are repaid only over time. Should an unusual number of depositors want to withdraw their funds, for whatever reason, the bank may not have sufficient cash on hand to meet those demands. And, because the value of most of the bank's loans will be difficult for outsiders to determine, they can be sold to generate more cash only at a significant discount and probably not as quickly as the bank's liquidity needs might dictate. If depositors other than those initially seeking to withdraw funds hear that the bank may have difficulty meeting the demand, they may be motivated to join the withdrawal line before the bank runs out of cash entirely or, even worse, becomes insolvent. This, of course, leads to a bank run.

¹ See Board of Governors of the Federal Reserve System, Federal Deposit Insurance Corporation, and Office of the Comptroller of the Currency (2014), "Federal Banking Regulators Finalize Liquidity Coverage Ratio," press release, September 3, www.federalreserve.gov/newsevents/press/bcreg/20140903a.htm.

The classic responses to this classic problem have been a combination of deposit insurance and discount window access. The former, established as part of New Deal banking reforms, assures depositors that they need not worry about insolvency, thereby presumably keeping out of the withdrawal line depositors who thought they might lose their funds entirely. The latter gives the bank access to short-term liquidity in order to meet the demands of depositors who have an immediate need for cash. Regulatory requirements were imposed to guard against the moral hazard that both programs could create. The resulting system meant that there were relatively few liquidity problems in the deposit-funded commercial banking system over the ensuing few decades.

Beginning in the 1970s, deposits began to decline as a proportion of funding for credit intermediation, as the separation of traditional lending and capital markets activities established by New Deal financial regulation began to break down. During the succeeding three decades, these activities became progressively more integrated, as credit intermediation relied more heavily on capital market instruments sold to institutional investors. Over time, these markets became--like traditional commercial banks--an important locus of maturity transformation, which in turn led to both an expansion and alteration of traditional money markets. Ultimately, there was a vast increase in the creation of so-called cash equivalent instruments, which were supposedly safe, short-term, and liquid.

When, in 2007, questions arose about the quality of some of the assets on which this intermediation system was based--notably, those tied to poorly underwritten subprime mortgages--a classic adverse feedback loop ensued. Investors formerly willing to lend against almost any asset on a short-term, secured basis were suddenly unwilling to lend against a wide range of assets. Liquidity-strained institutions found themselves forced to sell positions, which

placed additional downward pressure on asset prices, thereby accelerating margin calls on leveraged actors and amplifying mark-to-market losses for all holders of the assets. The margin calls and booked losses would start another round in the adverse feedback loop. In short, the financial industry in the years preceding the crisis had been transformed into one that was highly susceptible to runs on the short-term, uninsured cash equivalents that funded longer-term extensions of credit.²

Designing and implementing a policy response in light of the vulnerabilities of short-term wholesale funding markets that were revealed in the 2007–09 crisis is an integral part of post-crisis reform. The key question is how to balance the important role these markets have come to play in funding economic activity with the need to contain the destabilizing risks of runs in these same markets. To get a better sense of the terms of this balancing effort, let me examine the implications, first, of relying completely on liquidity requirements to manage liquidity problems, and then of relying entirely on LOLR liquidity from a central bank. The shortcomings associated with either of these one-dimensional approaches demonstrate why liquidity regulation and LOLR should be viewed as complements and not substitutes.³

² Note that financial entities that do not use debt financing can nevertheless experience liquidity pressures that are structurally similar to bank runs. For example, in the context of various pooled investment vehicles, investors may have an incentive to redeem their shares early because the costs of the redemptions are effectively borne by remaining investors. The resulting “first-mover advantage” contributed to runs on money market mutual funds in the fall of 2008 and could, at least in theory, lead to runs on other open-end fund vehicles. The U.S. Financial Stability Oversight Council (FSOC) is currently developing a work plan to analyze potential risks associated with asset management products and activities (minutes of the October 6, 2014, meeting, [www.treasury.gov/initiatives/fsoc/council-meetings/Documents/October%206,%202014%20\(Meeting%20Minutes\).pdf](http://www.treasury.gov/initiatives/fsoc/council-meetings/Documents/October%206,%202014%20(Meeting%20Minutes).pdf)).

³ For a detailed discussion of many of the issues I mention here, see Mark Carlson, Burcu Duygan-Bump, and William R. Nelson (forthcoming), “Why Do We Need Both Liquidity Regulations and a Lender of Last Resort? A Perspective from Federal Reserve Lending During the 2007–09 U.S. Financial Crisis,” Finance and Economics Discussion Papers (Washington: Board of Governors of the Federal Reserve System).

Consider first a regime in which there is no LOLR and, thus, financial intermediaries are left to self-insure against liquidity risk. Absent regulation, in normal times firms might choose to “underhoard” liquidity, to use Jean Tirole’s term.⁴ As Tirole explains, firms may be incentivized to sacrifice some insurance in order to buy more illiquid (and presumably higher-yielding) investments. This choice raises the prospect of huge negative externalities, since each firm may hold a smaller buffer than is socially optimal. Were a liquidity stress to arise, particularly one following an asset price shock that broadly affected financial intermediaries, the result could be the kind of freezing up of financial system gears that took place a few years ago, with consequences for the broader economy that went well beyond the effects on specific markets or institutions.

Assume, then, that regulation is put in place to force intermediaries to internalize all the liquidity costs of even the most severe, low-probability systemic events. Firms would have to demonstrate that they either maintained more or less matched durations of their assets and liabilities in the steady state or, what in some circumstances could amount to much the same thing, have liquidity buffers sufficient to meet all liquidity demands even during a systemic event following a major shock to asset values. Such an approach would entail two major costs. First, such a requirement would significantly constrain the level of liquidity and maturity transformation in normal times, surely resulting in significant constraints on credit extension, with consequent negative effects on economic growth. A primary economic function of banks and other financial intermediaries is facilitating liquidity management throughout the economy.

⁴ Jean Tirole (2011), “Illiquidity and All Its Friends,” *Journal of Economic Literature*, vol. 49(2), pp. 287–325, at p. 295. Tirole introduces the term in a general discussion of firm incentives, not in the context of LOLR (which he addresses later). But the incentives would seem even stronger where LOLR is available.

Demand deposits and other short-term bank liabilities are safe, easy-to-value claims that are well suited for transaction purposes and provide money-like benefits to firms and households.⁵

Second, in a world without LOLR, shortages of liquid assets would be exacerbated during stress episodes. Banks would likely hoard their liquidity buffers. Knowing they must rely only on their own liquidity to meet demands even as market uncertainty is increasing and asset values suffer downward pressure, banks would have to reduce dramatically their core intermediation function. They would be reluctant to lend to firms and households that are themselves subject to the impact of the systemwide liquidity shocks. These real-economy actors would thus be unable to fulfill their own financial obligations in a timely fashion or would pare back their own activities out of concern about their ability to do so. Another adverse feedback loop could result. Even without liquidity regulation and with an LOLR, there is a tendency to hoard liquidity during periods of financial instability, as evidenced between 2007 and 2009 when banks actually increased their balance sheet liquidity instead of running down their liquidity buffers.⁶

It is worth noting that this very dynamic helped motivate the creation of the Federal Reserve. If solvent banks are confident that they will be able to borrow from the central bank against good collateral to meet any unforeseen funding needs, then they need not completely stop lending even amid increased uncertainty about future funding needs. Lending by the central

⁵ Banks also provide liquidity to operating firms via committed lines of credit, which are more efficient, in conditions of uncertainty, than an arrangement in which each operating firm attempts to hold sufficient funds in advance to meet potential liquidity needs, as discussed in Holmstrom and Tirole (1998), "Private and Public Supply of Liquidity," *Journal of Political Economy*, vol. 106(1), pp. 1–40.

⁶ See Carlson, Duygan-Bump, and Nelson (forthcoming). Mark Carlson (2013) presents evidence that this was also a very typical dynamic of liquidity crises historically, when reserve requirements were used to promote bank liquidity in the absence of a central bank that could add liquidity to the financial system; see "Lessons from the Historical Use of Reserve Requirements in the United States to Promote Bank Liquidity," Finance and Economics Discussion Papers 2013-11 (Washington: Board of Governors of the Federal Reserve System).

bank is an essential tool to address liquidity stress and to mitigate--though not eliminate--the externalities imposed on the real economy through defensive hoarding by intermediaries. The importance of lending by the central bank is emphasized in much of the economics literature, where LOLR is often viewed as the optimal policy tool.⁷

Consider now the opposite approach to dealing with liquidity stress, one that relies largely on the LOLR function of the central bank. If the problem with complete reliance on self-insurance is that firms would ration liquidity too tightly in normal times and hoard it in periods of stress, the obvious problem with a readily available LOLR is that firms would maintain only the liquidity needed for operations in normal times and do essentially no self-insuring for periods of stress.

Some might argue that this state of affairs is not actually problematic, so long as the intermediaries are sufficiently capitalized to remain solvent under stressed circumstances. The theory of LOLR lending rests on institutions being fundamentally solvent. Central bank provision of liquidity is not intended to prop up weak or insolvent institutions. Rather, the objective is to facilitate financial intermediation generally, and maturity transformation in particular, by relieving unusual liquidity strains associated with periods of financial stress. Indeed, to support their independence and to guard against their engaging in fiscal policy, central banks are correctly permitted to take on only a small amount of credit risk. Thus, most advocates of expansive LOLR programs would readily agree with the need for strong capital standards, so as to limit the number of occasions on which market participants run because they

⁷ For example, Douglas Diamond and Philip Dybvig (1983) argue that just the presence of the LOLR, without any actual lending, can eliminate run-risk altogether, increasing social welfare at zero cost; see "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy*, vol. 91(3), pp. 401–419. Similarly, Holmstrom and Tirole (1998) show that public provision of liquidity in the presence of aggregate shocks is a pure public good, with no moral hazard involved.

question the solvency of a firm, and to provide a solid basis for LOLR extensions of liquidity by insulating the central bank from credit risk.

It is surely important to maintain strong capital standards. And it is true that the prudential supervisory role of a central bank may at times give it greater insight into the balance sheet of regulated institutions, such as through well-developed supervisory stress tests. In practice, however, the line between illiquidity and insolvency can be very blurry. Particularly in periods of stress, when the value of important asset classes may be quite volatile and very difficult to determine, the central bank cannot always easily disentangle illiquidity and insolvency risks.

For the same reasons that an expansive LOLR can create the risk of central banks assuming more than small amounts of credit risk, it can also create moral hazard. Models in economic literature that conclude the socially optimal policy is for the central bank to backstop aggregate liquidity risk generally assume that credit risk is negligible (or can be priced perfectly) and the only source of risk is that related to liquidity. In this abstract world, there is no moral hazard, at least in the sense that the firm with access to the LOLR will hold an insufficient quantity of liquid assets. This is because all assets are effectively liquid, since the central bank can always lend against assets that may be illiquid in private markets.

Outside the world of theory, however, moral hazard is a significant problem. The central bank will sometimes be asked to lend to a financial institution precisely because its creditors are pulling back out of concern that the institution may not be able to meet its obligations. Even if the central bank were appropriately reluctant to increase moral hazard by stepping in for private funding when an institution is in fact insolvent, the prospect of a rapid, disorderly default could still motivate LOLR lending. The reasoning would be that central bank lending in such a

situation could provide a bridge to an acquisition, a more orderly failure, or an internally generated recovery of the institution. Any of these outcomes would forestall fire sales of assets or a default that could cascade across the financial system. But while LOLR lending might be the best of a bad set of choices when confronted with those circumstances, those frantic efforts are the very situations that pose the highest risk of the central bank taking on mispriced credit risk. The prospect--perhaps even expectation--of such action can foster significant moral hazard.

While the central bank can, to some extent, control the potential moral hazard by pricing credit risk correctly or, more practically, by reducing credit risk close to zero by taking a large amount of collateral, this approach could at times actually compound liquidity stress. If the central bank requires so much collateral that the risk to other short-term creditors rises, then those creditors have an even greater incentive to run, thereby exacerbating the situation and complicating a bankruptcy or orderly liquidation proceeding. Similarly, if central bank lending facilitates exit by the uninsured depositors of a troubled bank, the costs borne by remaining creditors or the deposit insurance fund will increase. Indeed, it is for this reason that the Federal Deposit Insurance Corporation Improvement Act of 1991 (FDICIA) placed restrictions on discount window lending by the Federal Reserve to undercapitalized banks.⁸

Thus, while liquidity regulation should not require self-insurance against low probability, severe systemic events, it has an important role to play alongside capital regulation and resolution mechanisms in reducing the likelihood of systemic events and making them more

⁸ A central bank can also increase liquidity in the financial system by reducing its target interest rate, at least until it reaches the zero lower bound. Like LOLR actions, this may well be the right policy choice when confronted with liquidity stress. Again, though, the potential costs of reliance on interest rate reductions--including risks of undesirably high inflation, excessive leverage leading to financial stability concerns, or both--argue for a regime of well-considered liquidity regulations.

manageable when they do occur. It can serve both as a tax and a mitigant to offset the externalities associated with liquidity risk.⁹

There is an additional role for liquidity regulation, one suggested by much of the preceding discussion. When a firm faces a run on its funding, it is likely either insolvent or in a condition that makes an assessment of its solvency difficult for counterparties, investors, and regulators. That is, by this point the capital position of the firm is perceived as sufficiently uncertain so as to call into question its continued viability. Liquidity regulation can ensure that, even in these circumstances, officials have at least a bit of time to assess liquidity troubles and the underlying condition of the firm, as well as the degree to which the troubles are idiosyncratic or systemic. With appropriate insolvency mechanisms available, authorities can then decide whether the firm will recover or needs to be placed into a resolution or liquidation regime, while proceeding in a manner consistent with the Dodd-Frank Act injunction that LOLR measures in exigent circumstances are not to be used for the benefit of a single firm.

This is not to say that everything will always proceed smoothly, of course. But such an approach can extend the proverbial runway for a troubled firm and help avoid repeats of the situation six years ago, when policymakers confronted with chaotic financial conditions had little time to react and few available tools other than government liquidity and, eventually, capital injections.

Bank Liquidity Regulation and Supervision

⁹ For discussions of the importance of liquidity regulation, see Tirole, “Illiquidity and All Its Friends”; Markus K. Brunnermeier and Martin Oehmke (2013), “The Maturity Rat Race,” *Journal of Finance*, vol. 68(2); Enrico Perotti and Javier Suarez (2011), “A Pigovian Approach to Liquidity Regulation,” *International Journal of Central Banking* (December); and Charles Goodhart (2008), “Liquidity Risk Management,” *Financial Stability Review*, no. 11.

After a somewhat lengthy gestation period, there has been considerable recent progress on measures that reflect the role for liquidity regulation I have just described. The U.S. banking agencies have worked with other regulators in the Basel Committee on Banking Supervision to develop two quantitative liquidity standards--the LCR and the NSFR. These standards complement the bank capital framework and resolution mechanisms that have been agreed internationally. They will also help central banks limit the use of LOLR. In addition, as I have previously noted, the Federal Reserve is working on a proposal to tie risk-based capital surcharges for each U.S. global systemically important bank (G-SIB) to that G-SIB's reliance on short-term wholesale funding.¹⁰ Together, these standards are designed to mitigate the risks associated with banks' reliance on unstable funding structures and to encourage them to embrace more resilient funding models.

Under the LCR, banking organizations¹¹ must hold a buffer of high-quality liquid assets sufficient to cover net cash outflows during a 30-day stress scenario. This requirement serves several of the purposes discussed earlier. A buffer of high-quality liquid assets is a form of self-insurance against liquidity risk that allows banks to meet short-term needs in the event of creditor runs. Because holding the buffer is likely to be somewhat costly, the LCR should also encourage banks to reduce use of very short-term wholesale funding that increases buffer requirements. The buffer will also provide central banks and other national authorities time to assess the financial condition of a firm encountering liquidity difficulties and to determine the

¹⁰ See Daniel K. Tarullo (2014), "Dodd-Frank Implementation," testimony before the U.S. Senate Committee on Banking, Housing, and Urban Affairs, September 9, www.federalreserve.gov/newsevents/testimony/tarullo20140909a.htm.

¹¹ Under the U.S. rule implementing the LCR, the LCR would apply to banking organizations with total consolidated assets of \$250 billion or more or total consolidated on-balance-sheet foreign exposures of \$10 billion or more. In addition, a simpler, less stringent version of the LCR would apply to other banking organizations with \$50 billion or more in total consolidated assets. LCR requirements would not apply to banking organizations with total assets of less than \$50 billion.

extent to which these difficulties are a function of essentially firm-specific factors or a harbinger of market-wide funding stress.

A revised version of the NSFR has recently been released by the Basel Committee.¹² It complements the LCR by looking beyond a 30-day period to achieve a stable funding profile for firms more generally. In this regard, it is important to recall that the deterioration of funding markets began well before the financial crisis reached its acute stages. In the summer of 2007, responding to signs of trouble in the subprime mortgage markets, creditors reduced the maturities of funding they were willing to provide to financial intermediaries that had been creating and holding securities backed by subprime--and eventually other--mortgages.¹³ This process left those intermediaries in increasingly fragile funding positions, and by the time Lehman Brothers collapsed in September 2008, the system was primed for a devastating run. Given the possibility of this type of sustained erosion of firm funding structures over an extended period, simply requiring firms to hold a liquidity buffer against 30-day outflows, as required by the LCR, would be insufficient.

While there is thus a need for a longer-term structural standard such as the NSFR, the conceptual challenges in crafting it were greater than in designing the LCR. Simply extending the LCR to one-year--that is, requiring firms to hold enough liquidity to survive a one-year funding market freeze--seemed the kind of excessive self-insurance that would lead to undesirably reduced maturity transformation and financial intermediation. So a different set of standards needed to be developed, which themselves occasioned considerable discussion about the effects and incentives they would create. Also, one could argue that the NSFR should have

¹² See www.bis.org/bcbs/publ/d295.htm.

¹³ Gary Gorton, Andrew Metrick, and Lei Xie (2014), "The Flight from Maturity," NBER Working Paper No. 20027 (April), www.nber.org/papers/w20027.pdf.

aimed for a more complete term structure in order to protect against maturity mismatches within and beyond the one-year mark, and to create stronger incentives for firms to extend the maturity of their funding arrangements.

Considerable attention was paid to these and other concerns during the consultative and deliberative processes in the Basel Committee. As I mentioned earlier, the seriousness with which central bankers and regulatory agencies took these concerns is evidenced by the fact that the NSFR was subject to considerable revision over the last four years. I anticipate we will hear similar, and perhaps additional concerns, from a variety of perspectives when the federal banking agencies issue a proposed rule next year to implement the NSFR in the United States. This process should result in a regulation that reduces the probability of banks coming under short-term funding pressures. Maintaining more stable funding, such as retail deposits and term funding with maturities of greater than six months, will help avoid the spiral of fire sales of illiquid assets that deplete capital and exacerbate market stress.

Unlike the LCR--and the originally finalized version of the Basel NSFR--the newly finalized NSFR also begins to address the risks associated with matched books of securities financing transactions. On its face, a perfectly matched book might seem to pose little risk to the firm, since it could run off assets as it lost funding. In reality, however, a firm may be reluctant to proceed in so symmetrical a fashion. In such a context, "running off assets" may mean denying needed funding to clients with which the firm has a valuable relationship. Moreover, even if the firm does run off assets, a firm with a large matched book will almost surely be creating liquidity squeezes for these other market actors. To partially address these risks, the NSFR will require firms to hold some stable funding against short-term loans to financial firms.

Under the enhancement of the international G-SIB surcharge being developed by the Federal Reserve, the formula used to set risk-based capital surcharge levels for U.S. G-SIBs would incorporate each U.S. G-SIB's reliance on short-term wholesale funding. Greater reliance on short-term wholesale funding leaves firms more vulnerable to runs that impose externalities on the entire financial system. Requiring higher capital levels at such firms will improve their chances of maintaining access to market funding in periods of stress by providing greater assurance of their solvency to counterparties.

The LCR and NSFR developed in the Basel Committee are path-breaking measures that create quantitative liquidity requirements. Still, they do not fully cover all facets of liquidity risk. We are trying to address those residual risks in two ways--first, by adding certain requirements in our domestic implementation of the international standards and, second, through our supervisory program.

As to augmenting the international standards, let me give two examples. First, the Basel LCR does not impose any regulatory charge on a bank's use of overnight funding to fund assets that mature in less than 30 days. This lacuna leaves open the possibility of a significant maturity mismatch within the 30-day LCR window. The U.S. LCR fills this gap by imposing a regulatory charge on maturity mismatch within the 30-day period.¹⁴ Second, because the Basel LCR and the NSFR each calculate the liquidity position of a firm on a fully consolidated basis, neither adequately addresses the risk that stress could occur in one part of the organization while the liquidity needed to deal with that stress is trapped in another. In the U.S. LCR, a holding

¹⁴ While the original version of the NSFR had a similar shortcoming, the newly finalized version partially redresses that problem by giving banks an incentive to reduce maturity mismatches within the one-year window. More specifically, the NSFR now allows firms to recognize as stable funding 50 percent of certain liabilities with a residual maturity between six months and one year, including funding from central banks and financial institutions, and requires them to hold some stable funding against most assets that mature in under one year.

company may include in its consolidated liquidity buffer only qualifying assets held by a subsidiary U.S. bank that are in excess of the amount of the projected net cash outflows of the subsidiary bank and that can be transferred to the holding company without statutory, regulatory, supervisory, or contractual restrictions. The Federal Reserve has also adopted rules requiring certain foreign banking organizations (FBOs) with large U.S. operations to hold financial resources in the United States commensurate with their U.S. liquidity risk.¹⁵

Supervisory programs are also being used to supplement the Basel measures, in a manner roughly comparable to our practice in the area of capital regulation. The very nature of quantitative liquidity standards means the effectiveness of the rules could wane over time because of changes in funding markets, reductions in the liquidity of assets previously deemed liquid, or regulatory arbitrage. Furthermore, it is difficult for any standardized quantitative liquidity regulation to capture all relevant risks. For instance, a bank's short-term funding can be more or less stable depending on the structural characteristics of a firm's funding providers. The LCR distinguishes between broad categories of funding counterparties, such as financial institutions and non-financial companies. But it does not differentiate in a more granular way among entities that may behave very differently under stress, such as traditional banks and money market mutual funds.¹⁶

¹⁵ FBOs with combined U.S. assets of \$50 billion or more must meet liquidity risk-management standards and conduct internal liquidity stress tests. An FBO's U.S. intermediate holding company must maintain a liquidity buffer in the United States based on the results of a 30-day liquidity stress test. The U.S. branches and agencies of an FBO must maintain a liquidity buffer in the United States equal to the liquidity needs for 14 days, as determined by an internal liquidity stress test. In addition, the Board has indicated that it intends to apply the Basel III liquidity rules to large U.S. operations of FBOs. These requirements are comparable to local liquidity requirements imposed by the United Kingdom Prudential Regulation Authority, although the authority's branch-level liquidity requirements are somewhat more flexible.

¹⁶ Similarly, the effective liquidity of short-term loans that a bank may count as an inflow under the LCR is in part dependent on the nature of the bank's relationship with the borrower. A bank's liquidity risk-management framework should recognize that, even under stress, it may be reluctant to refuse to roll over short-term credit to customers that it would like to retain in the longer run.

To complement the LCR and NSFR, in 2012 the Federal Reserve launched the Comprehensive Liquidity Assessment and Review (CLAR) for firms in the Large Institution Supervision Coordinating Committee (LISCC) portfolio.¹⁷ Like the Comprehensive Capital Analysis and Review (CCAR), CLAR is an annual horizontal assessment, with quantitative and qualitative elements, overseen by a multidisciplinary committee of liquidity experts from across the Federal Reserve. In CLAR, supervisors assess the adequacy of LISCC portfolio firms' liquidity positions relative to their unique risks and test the reliability of these firms' approaches to managing liquidity risk. CLAR provides a regular opportunity for supervisors to respond to evolving liquidity risks and firm practices over time.

CLAR involves evaluations of firms' liquidity positions both through a range of supervisory liquidity metrics and through analysis of firms' internal stress tests. A variety of liquidity indicators, such as funding concentrations, measure vulnerabilities beyond those captured in the LCR; the measurements are made over a number of time horizons. In parallel to this quantitative assessment, supervisors also examine the stress tests that each firm uses to make funding decisions and to determine its liquidity needs. Recent CLAR work on the firms' own stress testing practices has focused, among other issues, on assumptions regarding liquidity needs for capital markets activity, such as prime brokerage services and derivatives trading. As with CCAR, this analysis helps inform supervisors of the reliability of firms' own risk measurement and management.

Though similar to CCAR in some respects, CLAR does not include a specific quantitative post-stress minimum. Of course, LISCC firms will be required to meet the LCR, which is itself a

¹⁷ See www.federalreserve.gov/bankinfo/large-institution-supervision.htm for a current list of firms in the LISCC portfolio.

forward-looking requirement for a buffer against a potential stress on liquidity. In addition, firms with weak liquidity positions under CLAR's liquidity metrics are directed to improve their practices and, as warranted, their liquidity positions, through supervisory direction, ratings downgrades, or enforcement actions. Because CLAR assesses all LISCC firms simultaneously, the Federal Reserve is also able to compare the range of practices in liquidity risk management across the portfolio. Qualitative deficiencies identified in CLAR, such as questionable internal stress testing regimes, are addressed through the same set of supervisory tools. Knowledge gained through CLAR assessments also provides a macroprudential perspective on liquidity vulnerabilities and funding concentrations in the system as a whole.

An Interim Appraisal of Liquidity Regulation

The financial crisis revealed the need for prudential regulation to consider systemic vulnerabilities, as well as weaknesses in traditional regulation aimed at assuring the financial condition of individual firms. Both microprudential and macroprudential shortcomings were never as apparent as in the series of runs and general funding stress that defined much of the crisis. Today, as I hope I have adequately explained, we have a better appreciation for the role liquidity regulation should play in tandem with capital regulation and resolution mechanisms, and as a means for both complementing and limiting the LOLR function of central banks. We are well along the road of implementing regulatory and supervisory policies to play that role. Even though these measures are in some cases still under development and in others still being phased in, the liquidity positions and management practices of LISCC firms have improved considerably over the past few years. Since 2012, the LISCC firms' combined buffer of high-quality liquid assets has increased by about a third, and their reliance on short-term wholesale funding has dropped considerably.

Despite this progress, and perhaps to some degree because of it, important issues remain. Liquidity regulation is still a relatively new undertaking, certainly in its present form that includes quantitative requirements.¹⁸ There is still need for conceptual work on such questions as how to specify the extent to which banks should be required to self-insure against liquidity risk by maintaining larger liquidity buffers and more closely matching assets with liabilities, and how to define the circumstances in which central banks should provide liquidity.

It is also clear that liquidity regulation has the potential to generate unintended effects. For example, in periods of stress firms are likely to have multiple incentives to hoard accumulated liquidity, rather than to use it to relieve the funding needs of households and other firms. The upshot would be to exacerbate systemic strains and cause a reduction in economic activity. This tendency toward liquidity hoarding may be amplified by the very fact of quantitative liquidity requirements, since firms may fear that dipping below those levels even in a period of stress would project weakness to counterparties, investors, and market analysts. That is, we may be more successful in enforcing the maintenance of liquid asset buffers in normal times for use in stress periods than we will be in encouraging their use when such a stress period arrives.

For this reason we are working on a supervisory approach in which the remedy for falling below regulatory thresholds is context dependent. That is, a firm that falls out of compliance with the LCR or NSFR during a period of generalized stress should not be subject to automatic

¹⁸ Although, in recent decades, reserve requirements have been used to establish a stable demand for reserves for monetary policy implementation purposes, they were a form of liquidity requirement historically. As originally constructed, they were a substantial percentage of a bank's liability base and were intended (at least in part) to ensure that banks could meet their obligations in a timely fashion. (Some variations even distinguished between stable and volatile deposits, looking at turnover of different types of deposits to calibrate the appropriate reserve ratio.)

sanctions, but instead given an opportunity to come back into compliance in a way that does not expose either the firm or the system to greater stress.

Finally, the very progress made in regulating liquidity at large firms may raise a new set of regulatory arbitrage problems. Short-term wholesale funding markets are generally smaller today than before the crisis, the average maturity of short-term funding arrangements is moderately greater, and collateral haircuts are more conservative. Yet volumes are still large relative to the size of the financial system. Furthermore, some of the factors that account for the reduction in short-term wholesale funding volumes, such as the unusually flat yield curve environment and lingering risk aversion from the crisis, are likely to prove transitory. And, while prudentially regulated dealers will continue to play a central role as intermediaries in short-term funding markets, post-crisis reforms directed at the regulated sector could lead to the disintermediation of regulated entities over time. Financial, technological, and regulatory barriers to disintermediation of regulated financial firms could likely be overcome with time and sufficient economic incentive.

During normal times, short-term wholesale funding can help to satisfy investor demand for safe and liquid investments, lower funding costs for borrowers, and support the functioning of important markets, including those in which monetary policy is executed. But during periods of stress, runs by providers of short-term wholesale funding and associated asset liquidations can result in large fire-sale externalities and otherwise undermine financial stability. To the extent that disintermediation of prudentially regulated firms occurs, there will be a need to supplement prudential bank regulation with policy options that can be applied on a market-wide basis, such as a framework of minimum margin requirements for securities financing transactions. Last month, the Financial Stability Board finalized minimum margin requirements for non-centrally-

cleared securities financing transactions in which a bank or broker-dealer extends credit to an unregulated entity against non-sovereign collateral. The Financial Stability Board has also proposed to extend the framework to cover transactions among unregulated entities.¹⁹

Implementation of this initiative will be a first, important step to ensuring that better regulation of the liquidity positions of regulated firms does not result in the migration of run risks to the shadow banking system. We will need to monitor developments in order to assess whether further action is needed to consolidate the progress we have made in promoting financial stability.

¹⁹ Financial Stability Board (2014), *Strengthening Oversight and Regulation of Shadow Banking* (Basel, Switzerland: Financial Stability Board, October 11), www.financialstabilityboard.org/wp-content/uploads/r_141013a.pdf?page_moved=1.