Liquidity Regulations and the Discount Window: Restoring a Balance Between Stored and Purchased Liquidity

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Acknowledging that current liquidity regulations make liquidity largely unusable, policymakers are considering revisions to the rules.[1] This note argues for the recognition of central bank liquidity that can be tapped during a stress event. Allowing such recognition significantly attenuates well-known distortions associated with the current liquidity regulations, thus improving both financial stability and credit provision to the real economy.

The analysis also shows that imposing a cap on discount window borrowing capacity, while an improvement over the status quo, is still significantly inferior to a "no cap" option. Moreover, recognition of borrowing capacity from the Federal Reserve's discount window could diminish the regulatory-driven demand for reserves that has prevented the central bank from significantly shrinking its balance sheet and trapped it in a permanent state of quantitative easing.

Stored and Purchased Liquidity

There are two types of liquidity that a bank can tap to meet deposit withdrawals. The first is *stored liquidity*, as reflected by central bank reserves and government securities held as assets by the bank. For example, a bank can meet a $100 withdrawal by using $100 of its reserve balances or selling $100 worth of Treasury securities. The second approach is to rely on *purchased liquidity*, borrowing funds to pay back the redeeming depositors. While some private lenders may not be willing to lend to a solvent but illiquid bank facing deposit outflows, it is the role of the central bank to act as the lender of last resort. Indeed, in the 1913 Federal Reserve Act, Congress designed the discount window to provide emergency liquidity to banks during times of stress.

[1] See Anderson et al. (2026), Bowman (2026), Darst et al. (2026), Logan (2026) and Bank of England (2023).

Solely relying on stored liquidity is an inefficient approach, as it involves hoarding large amounts of idle liquidity on bank balance sheets at the expense of credit provision to the real economy.[2] Nevertheless, that is the approach taken by global financial regulators with the Basel liquidity coverage ratio.

The Basel LCR requires banks to hold enough high-quality liquid assets to meet a hypothetical 30-day run. Specifically, banks must maintain their LCR above 100 percent:[3]

$$LCR = \frac{HQLA}{30 - Day\ Net\ Cash\ Outflow} \geq 100\%.$$

To meet redemptions, the LCR solely relies on stored liquidity as HQLA and does not recognize purchased liquidity. Indeed, the ability of a bank to purchase liquidity from the discount window is currently not considered as part of the HQLA calculation, despite the window's ability to provide immediate access to liquidity if the bank has sufficient pre-positioned collateral at the facility.

An additional fundamental problem with the LCR is that stored liquidity is largely unusable, the so-called "last taxi problem."[4] Suppose that a bank has $100 in deposits that are assigned a 25 percent outflow rate, which gives rise to $25 in 30-day net cash outflows. To maintain an LCR of 100 percent, the bank keeps $25 in HQLA. If a run occurs of the same intensity as predicted by the LCR, one would think that the bank should be able to use its $25 in stored liquidity to meet the $25 withdrawals. However, it cannot do so as it must hold HQLA for 25 percent of the remaining $75 in deposits. As a result, the bank has to maintain $18.75 in HQLA and thus can only use $6.25 in HQLA to meet the $25 run. Hence, most of the HQLA being held as stored liquidity to meet a run turns out to be unusable when the run occurs (the last taxi problem). If the only recognized liquidity is stored liquidity, a liquidity buffer above the LCR minimum requirement must be maintained at all times, further limiting the ability of the bank to supply credit to the real economy.

How Can We Alleviate the LCR Distortions and Recognize Purchased Liquidity in the LCR?

The last taxi problem, coupled with the sole reliance on stored liquidity, requires banks to hoard liquidity at the expense of credit supply. One option to alleviate these LCR-induced distortions is to recognize the ability of the bank to borrow from the discount window against pre-positioned collateral. Indeed, this is the most reliable source of liquidity in a stress event, which is why central banks are referred to as lenders of last resort. Borrowing from the discount window is as good a source of liquidity as holding central bank reserves and additionally allows the bank to provide more credit to the real economy at the same time.

Next, we show what happens when discount window capacity is counted as HQLA without caps and with caps. We find that incorporating discount window capacity in the HQLA without caps achieves both goals of fending off the run with ease and maintaining robust credit supply to the real economy both before and after the deposit run.

[2] See Federal Reserve (1971) and Nelson (2021).
[3] For more details about the types of HQLA and the calculation of the 30-day net cash outflow measure, see Macchiavelli (2026). Dropping the LCR below 100% triggers immediate and heightened supervisory scrutiny, which banks want to avoid at all costs (Macchiavelli, 2026).
[4] The "last taxi problem" was originally formulated in Roberston (1922) by pointing out that reserve requirements make the last reserves unusable, akin to requiring that there must always be one taxi waiting at the taxi stand. Goodhart in Banque de France (2008) adapted the last taxi problem to the lack of HQLA usability under the LCR. See also Nelson (2022) and Macchiavelli (2026).

Option 1: Recognizing discount window capacity with no cap.

Consider a bank with $10 in central bank reserves and $100 in loans that funds itself with $10 in equity capital and $100 in deposits with a 25 percent outflow rate. Under Option 1, we assume that 100 percent of discount window borrowing capacity counts as HQLA and that loans carry a 50 percent discount window haircut. Thus, $100 worth of loans would provide $50 in discount window borrowing capacity that counts towards HQLA. As the bank also has $10 in reserves, total HQLA equals $60. The $100 in deposits with a 25 percent runoff rate generate 30-day net cash outflows of $25. Thus, the bank has an LCR of 60/25 = 240 percent in normal times. In the Appendix, we show that this bank could easily weather a 25 percent deposit run and maintain a post-run LCR of 187 percent, well above the 100 percent minimum, without curtailing credit supply. Option 1 solves both problems highlighted above, namely fending off the run with plenty of liquidity remaining and maintaining credit supply to the real economy.[5]

Option 2: Recognizing discount window capacity as a Level 2B asset.

Next, we study the option of recognizing discount window borrowing capacity as a Level 2B asset, namely counting for 50 percent of its value and not representing more than 15 percent of total HQLA. This example is meant to parallel the Basel treatment of a central bank restricted committed liquidity facility (RCLF), although a RCLF is different from the discount window as it requires the bank to pay an up-front fee to secure a commitment to borrow from the central bank.[6] In the Basel III LCR framework, jurisdictions with insufficient domestic HQLA can incorporate committed central bank liquidity facilities as Level 1 HQLA, while jurisdictions with sufficient domestic HQLA can (in principle) recognize RCLFs as Level 2B HQLA. In particular, the undrawn amount of a RCLF could be included as a Level 2B asset and, as such, it would count for 50 percent of its value but may not represent more than 15 percent of total HQLA. Note that while Basel allows a RCLF to be included as Level 2B HQLA, U.S. regulators have not adopted this approach but have suggested that it may be a possibility in the future.[7] But even if allowed, the up-front fee envisioned by the Basel Committee for access to the RCLF is currently too prohibitive—at least 75 basis points annually.

Returning to our prior example and assuming that discount window borrowing capacity is counted as a Level 2B asset (with a 50 percent haircut and capped at 15 percent of total HQLA), the Appendix shows that imposing a cap is suboptimal. Indeed, compared to Option 1, the bank must hold more reserves. Thus, Option 2 is inferior to Option 1 in terms of lower credit supply to the real economy. Since the cap on discount window capacity is binding in Option 2, the bank holds just enough of an LCR buffer in normal times to be able to meet the run without dipping its LCR below 100 percent. The bank has an LCR of 175 percent in normal times and a post-run LCR of 100 percent. While the bank can still be LCR-compliant during the run with the 15 percent cap, it is barely so, whereas with no cap on discount window capacity it can withstand the run with still a large LCR buffer well above the 100 percent minimum. See the Appendix for more details.

[5] The last taxi problem is generated by the fact that banks must keep the LCR above 100% at all times to avoid supervisory scrutiny. Thus, Option 1 still has the last taxi problem lingering in the background, but the recognition of purchased liquidity from the central bank significantly mitigates the distortions associated with the last taxi problem.

[6] See https://www.bis.org/publ/bcbs238.pdf and https://www.bis.org/publ/bcbs274.pdf.

[7] See https://www.occ.gov/news-issuances/federal-register/2014/79fr61440.pdf. In particular, regulators noted that "[t]he agencies are considering the merits of including central bank restricted committed facility capacity as HQLA for purposes of the U.S. LCR requirement and may propose at a future date to include such capacity as HQLA."

Conclusion

Currently, only stored liquidity is recognized in the LCR. This note shows that including liquidity available to be purchased from the central bank significantly attenuates well-known distortions embedded in the LCR. Relative to the status quo, including discount window borrowing capacity as HQLA provides the most benefits, allowing banks to extend the most credit to the real economy while also remaining liquid and compliant with the LCR during a run. Additionally, this option could eliminate the component of demand for central bank reserves that originates exclusively from liquidity regulations, thus potentially facilitating a more substantial shrinkage of the Federal Reserve balance sheet.

We also explored the option of including discount window borrowing capacity as Level 2B HQLA. Currently, Basel allows a similar option for jurisdictions with sufficient domestic HQLA, but U.S. regulators have not implemented it. This option, while representing an improvement over the status quo, is significantly inferior to counting discount window borrowing capacity without limit.

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Appendix

The Status Quo.

We start by describing the last taxi problem that arises under the current version of the LCR, following the numerical examples in Macchiavelli (2026). Suppose that a bank funds itself with $10 in equity and $100 in deposits that are assigned a 25% outflow rate under the LCR and that it holds $85 in loans and $25 in HQLA such that the bank has an LCR of 100%. Suppose that, in line with the LCR assumptions, exactly 25% of the deposits run and that HQLA is used to meet those redemptions. With no HQLA left after the run, the post-run LCR equals 0%. But the bank still needs to maintain 25% of the remaining deposits that did not run as HQLA.

With $75 in deposits after the run, the bank must hold 25% of them as HQLA, or $18.75. Thus, only $6.25 worth of initial HQLA can be used, and the remaining $18.75 must be raised by selling loans. Since loans may not be liquid in the short run, the bank may prefer to maintain additional HQLA in normal times to avoid fire-sales and possible insolvency in bad times.

To meet the $25 redemption and still be LCR-compliant after the run, the bank must hold $18.75 in HQLA to back the remaining $75 in deposits, plus the $25 of HQLA needed to meet the run. Hence, the initial HQLA must be the sum of the two, or $43.75, representing an LCR of 175% in normal times. Accordingly, loans must decline from $85 to $66.25 to provide room to accommodate the higher liquidity buffer. Hence, the last taxi problem coupled with sole reliance on stored liquidity generate less credit supply.

Option 1: No Cap, 100% of DW capacity counted as HQLA.

As before, suppose that a bank has $10 in equity capital and $100 in deposits that are assigned a 25% outflow rate by the LCR. Also assume that the bank faces a run of the expected magnitude, namely a $25 deposit withdrawal. However, this time assume that regulators fully recognize DW borrowing capacity as HQLA and apply a 50% DW haircut to loans. Not having to hoard reserves to meet the LCR, suppose that the bank only needs $10 in reserves for ease of payments, and the remaining $100 in assets can be allocated to loans to the real economy. With a 50% DW haircut and 100% of the DW borrowing capacity counting as HQLA, the $100 in loans generate $50 in HQLA. The bank also has $10 in reserves for a total of $60 in HQLA, and $100 in deposits with a 25% outflow rate. Thus, the bank has an LCR of 60/25 = 240% prior to the run.

Can the bank still satisfy the 100% minimum LCR after the run? If so, what would the final balance sheet look like? After the run, to be LCR complaint, the bank needs 25% of the remaining $75 of deposits as HQLA, namely $18.75 worth, and the bank wants to keep $10 in reserves. Hence, it needs at least $8.75 in available discount window capacity after the run. Since we assumed that the bank wants to maintain its level of reverses at $10 both before and after the run, the redemption has to be fully accommodated via a DW loan of $25, which must be backed by $50 worth of loans. As the bank had $100 worth of loans and it pledges half of them to meet the run, the bank is left with $50 worth of unencumbered loans after the run, which correspond to $25 in DW borrowing capacity that counts towards HQLA—more than the $8.75 needed. Thus, the bank is LCR complaint even after the run.

Note that the current DW loans have 90-day maturity and are renewable and prepayable, thus never leading to an increase in the LCR denominator.[8] This structure is important, otherwise the use of the DW would lead to a need to accumulate more HQLA, in a vicious cycle that could undermine the usability of the DW. All in all, the bank

[8] DW loans backed by non-HQLA collateral with less than 30-day maturity are currently assigned a 25% outflow rate in the U.S. LCR.

weathers the run by tapping the DW and ends up with a post-run LCR of 35/18.75 = 187%, well above the 100% minimum.

Relative to the status quo described above that solely relies on stored liquidity, adding DW capacity leads to a 51% increase in loan supply, from $66.25 to $100. Importantly, these long-term gains come at no short-term cost to financial instability as the bank can weather the 25% deposit run and still maintain a large liquidity buffer (LCR=187%).

Option 2: DW borrowing capacity as Level 2B asset.

What could be the result of counting DW capacity as a Level 2B asset? Suppose that DW undrawn capacity is considered a Level 2B asset and as such it is applied a 50% haircut (on top of the 50% DW haircut placed by the central bank) and is capped at 15% of total HQLA. From our previous example, a bank with $100 in liabilities subject to a 25% runoff rate that wants to still be LCR compliant during a run (of the same magnitude expected under the LCR) must maintain a pre-crisis LCR of 175%, which requires 100 x 0.25 x 1.75 = $43.75 of HQLA in normal times. With $10 in desired reserves, the bank needs $33.75 in HQLA from DW capacity. However, only 15% of the required HQLA can consist of Level 2B assets, corresponding to a maximum of 43.75 x 0.15 = $6.56. Thus, under the 15% cap, the bank needs an additional 33.75 – 6.56 = $27.19 of HQLA.

In sum, the cap forces the bank to hold an additional $27.19 of central bank reserves, which mirrors a reduction in loan supply by the same amount. Thus, relative to Option 1, total reserves must rise from $10 to $37.19 and loans must decline from $100 to $72.81. Notice that the bank now has DW borrowing capacity of 72.81 x 0.5 = $36.41, which corresponds to 36.41 x 0.5 = $18.20 in potential HQLA after applying the 50% haircut for Level 2B assets, enough to make up for the necessary $6.56 in capped Level 2B HQLA coming from DW capacity.

After the $25 in deposit withdrawals, the bank is left with $75 in deposits, which are subject to a 25% runoff rate. Thus, the bank needs 0.25 x 75 = $18.75 in HQLA post run, of which Level 2B assets can be at most 18.75 x 0.15 = $2.81, while the remaining $15.94 must come from reserves. Thus, reserves are allowed to decline by $21.25 from $37.19 pre-run to $15.94 post-run. Reserves can accommodate $21.25 of the $25 in redemptions, with the remaining $3.75 having to come from DW loans. Lastly, we need to check that the bank still has enough DW capacity to generate the necessary $2.81 in HQLA post-run. To back a $3.75 DW loan, the bank must pledge $7.5 as collateral, thus leaving 72.81 – 7.5 = $65.31 available, which generates unused DW borrowing capacity of 65.31 x 0.5 = $32.66. After applying the 50% Level 2B haircut, it generates 32.66 x 0.5 = $16.33, more than the $2.81 needed to barely satisfy the minimum LCR of 100% during the run.[9]

In sum, considering DW borrowing capacity as a Level 2B asset (50% haircut and 15% cap) allows the bank to still weather the run without dipping the LCR below 100%, but requires a 27% reduction in loan supply from $100 to $72.81 in normal times. The option that allows for enough liquidity to weather the run without sacrificing loan supply is Option 1, namely fully counting DW capacity as Level 1 HQLA. Next, Option 2 (Level 2B) creates a 27% decline in loan supply relative to Option 1. The worst option in terms of loan supply is the current framework, which creates a 44% decline in loan supply relative to Option 1.

[9] Note that the binding constraint that makes Option 2 suboptimal relative to Option 1 is the 15% cap. The 50% haircut on Level 2B assets will not become the binding constraint until the cap is significantly increased.