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Liquidity, Liquidity Everywhere, not a Drop to Use: Why Flooding Banks with Central Bank Reserves May Not Expand Liquidity

Based on BFI Working Paper No. 2022-19, "Liquidity, Liquidity Everywhere, not a Drop to Use: Why Flooding Banks with Central Bank Reserves May Not Expand Liquidity," by Viral V. Acharya, NYU Stern School of Business; and Raghuram Rajan, Chicago Booth. This Brief was written by Acharya and Rajan for publication at VoxEU.

KEY TAKEAWAYS

- ✓ Greater liquid holdings do not seem to make markets for liquidity more immune to liquidity shocks.
- ✓ In times of stress, the demand for liquidity can significantly rise and liquid commercial banks, desiring to maintain unimpeachable balance sheets, may provide only limited re-intermediation of liquidity and contribute significantly to liquidity shortages.
- ✓ Commercial banks do not fully internalize prospective stress before it occurs or take sufficient steps to avoid it. Consequently, central bank balance sheet expansion may even actually exacerbate the problem.
- ✓ Further, the broader economy can be negatively impacted as this stress may attenuate any positive effects of central bank balance sheet expansion on economic activity.

Despite a significant expansion in central bank balance sheets, some markets like the US money market have experienced increasing interest rate volatility, including significant spikes in the repo rate, notably in September 2019 (see Copeland, Duffie and Yang (2021), Correa, Du, and Liao (2021), D'Avernas and Vanderweyer (2021), and Yang (2021)). This apparent disruption in money markets that depend intimately on the availability of liquidity seems puzzling when the cash and central bank reserves held by the US private sector at the end of 2019 were around 4 times their holdings before the Global Financial Crisis in 2007. Greater liquid holdings do not seem to have made markets for liquidity more immune to liquidity shocks. Indeed, markets were disrupted yet again in March 2020 at the onset of the COVID-19 pandemic and the banking system was found short in its ability to accommodate the demand for liquidity. In response, the Federal Reserve expanded its balance sheet yet more (see, for example, Kovner and Martin (2020)), buying financial assets from the private sector and placing large quantities of liquid reserves with it (or promising to do so). Where had all the prior liquidity gone?

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Our recent paper "Liquidity, Liquidity Everywhere, Not a Drop to Use: Why Flooding Banks with Central Bank Reserves May Not Expand Liquidity" (Acharya and Rajan, 2021) focuses on this question, not so much to explain the microstructure of interest rate spikes, but to analyze more general theoretical underpinnings of the consequences of central bank balance sheet expansion. It seems natural that the liquid central bank reserves issued to finance central bank balance sheet expansion should enhance the supply of liquidity, bringing down illiquidity premia in the market, and reducing the cost to firms of financing. Yet this view neglects three key private sector responses.

First, central banks effectively issue these reserves to commercial banks (henceforth "banks"), which have to finance them. For a variety of reasons, the best way for a bank to finance short-term assets is with short-term liabilities such as deposits. Such financing could initially happen near-automatically – the central banks buy financial assets from non-banks, who deposit the proceeds in their banks, giving the commercial banks both reserves and offsetting deposits. In times of liquidity stress, this offsetting liability could claim some of the liquidity created by the central bank.

Indeed, the evidence suggests this is the case (see Exhibit 1). The Federal Reserve bought financial assets between November 2010 and June 2011 ("QE II"), between September 2012 and October 2014 ("QE III"), and between March 2020 to the end of 2020 (the Pandemic Intervention which is still continuing). Exhibit 1, put together from the Flow of Funds data, suggests that commercial banks increased their assets considerably over the same period – so central bank reserves did not simply substitute for existing bank assets. Furthermore, bank deposit issuance was a multiple of the increase in commercial bank holdings of reserve balances and repos in each case. Of course, banks may also have expanded their holdings of other liquid assets such as vault cash and securities over these periods, but the increase in deposits exceeds even these. Indeed, in both QEII and the Pandemic purchases, the increase in bank deposits exceeds the overall increase in bank assets, while in QE III, it is 80 percent of the increase (the period of QE III was also one when bank loans went up considerably, along with bank liquid assets). In both QE III and the Pandemic Intervention, uninsured deposits account for the majority of the deposit financing. In Exhibit 2, we plot the cumulative increase in outstanding reserves against the rise in uninsured deposits over the last two decades, which confirms this financing pattern cumulates across programs. These data inform our modeling choices.

Second, the liquid reserves themselves get further encumbered. While a number of papers have focused on regulatory encumbrances such as capital requirements that inhibit banks' use of reserves, encumbrances may also be endogenous. For example, banks with liquid assets sitting on their balance sheets want to earn returns to that liquidity. So they sell it – by offering contingent lines of credit or guaranteeing margin calls on speculation (see, for example, Anderson, Du, and Schlusche (2021)), so long as liquidity will be available when they need it. Unfortunately, they typically oversell liquidity relative to what is societally optimal.

Third, and perhaps most novel, in times of liquidity stress healthy banks may see a valuable *convenience yield* to liquid reserves – for instance, because it is dry powder in case conditions worsen. Consequently, healthy banks may hoard liquidity rather than lending it out to stressed banks. A collateral benefit is that they avoid tainting their balance sheets by lending to stressed banks and may thereby also attract flight-to-safety deposits that leave these banks looking for a safe home.

Put differently, new sources of demand as well as constraints on supply may offset the new supply of liquidity. Consequently, it is possible that central bank balance sheet expansion under some circumstances does not reduce illiquidity premia, but may even enhance them. Instead of enhancing financial stability, it makes the financial system more fragile. Rather than expanding real activity, it dis-incentivizes it. While these are extreme possibilities, the norm may be that central bank balance sheet expansion contributes much less to liquidity, financial stability, and real activity than suggested by an analysis that abstracts from these three considerations.[1]

In our theoretical model (Acharya and Rajan, 2021), we assume the central bank wants to expand its balance sheet, buying financial assets from the public markets with newly issued reserves. We take any direct effect of the asset purchases

[1] Indeed, it has been hard to discern unambiguously the net macroeconomic effects of these interventions; see, for instance, Fabo, Jancokova, Kempf, and Pastor (2021).

Exhibit 1 · Incremental Depository Institution Balance Sheets

QE II (Between November 2010 and June 2011)

ASSETS		LIABILITIES	
Cash	60	Bonds	-62,773
Debt			
Securities	94,351	Holding Company Investment	42,870
Loans	-103,791	Commercial Paper	-46,539
Miscellaneous	18,748	Loans	-80,632
Repos	-11,639	Miscellaneous	-315,306
Reserves	194,070	Insured Deposits	1,264,014
		Uninsured Deposits	-534,919
	191,799		**266,715**
		Deposits/Total Liabilities	2.73361
		Deposits/(Cash+Securities+Repos+Reserves	2.63361
		Deposits/(Repos+Reserves)	3.99655
		Uninsured Deposits/(Repos+Reserves)	-2.93217
		Uninsured Deposits/(Uninsured+Insured Deposits	-0.73368

QE III (Between September 2012 and October 2014)

ASSETS		LIABILITIES	
Cash	11,191	Bonds	-112,030
Debt			
Securities	504,642	Holding Company Investment	332,381
Loans	804,170	Commercial Paper	-86,743
Miscellaneous	-64,076	Loans	108,019
Repos	-29,398	Miscellaneous	184,540
Reserves	713,351	Insured Deposits	-810,496
		Uninsured Deposits	2,528,429
	191,799		**2,144,100**
		Deposits/Total Liabilities	0.80124
		Deposits/(Cash+Securities+Repos+Reserves	1.43187
		Deposits/(Repos+Reserves)	2.51177
		Uninsured Deposits/(Repos+Reserves)	3.69679
		Uninsured Deposits/(Uninsured+Insured Deposits	1.47179

Pandemic (Between March 2020 to end 2020)

ASSETS		LIABILITIES	
Cash	15,843	Bonds	26,083
Debt			
Securities	1,041,056	Holding Company Investment	202,606
Loans	289,404	Commercial Paper	26,651
Miscellaneous	272,661	Loans	-227,272
Repos	179,821	Miscellaneous	-125,790
Reserves	1,282,417	Insured Deposits	1,317,938
		Uninsured Deposits	1,719,650
	3,081,202		**2,939,866**
		Deposits/Total Liabilities	1.03324
		Deposits/(Cash+Securities+Repos+Reserves	1.20581
		Deposits/(Repos+Reserves)	2.07736
		Uninsured Deposits/(Repos+Reserves)	1.17604
		Uninsured Deposits/(Uninsured+Insured Deposits	0.56612

Note: Sheets were obtained from Flow of Funds data Z1.111 – Level Data: U.S.-Chartered Depository Institutions.

All entries under Assets and Liabilities are increments, i.e., changes, for that entry in Millions of Dollars; all ratios are increment or change in the numerator divided by that for the denominator.

on economic activity as given, so as to focus on what happens to liquidity after that. We assume the reserves eventually find their way back to commercial bank balance sheets (so cash holdings with the public do not go up), and the banks optimally issue liabilities to finance them. Key to the analysis is the mix of how banks finance these reserves. In keeping with the evidence in Exhibits 1 and 2, we assume that banks finance a large portion of the reserve expansion by issuing short-term liabilities. We are agnostic as to why longer-term financing (that is, capital) is costlier for banks, but assume functional forms that make it so.

We also assume that after commercial banks get reserves, make loans, and set their capital structure to accord with these assets, there is a probability that the demand for liquidity in the real economy will increase significantly, and will be concentrated on some banks. Call these the *stressed* banks. We assume that their wholesale depositors, fearful of any loss, withdraw their cash in such states, increasing the stressed banks' need for funds. A fraction of healthy banks will choose to become *tainted* by lending their reserves to stressed banks, making money on the lending. The remaining fraction of healthy banks will abstain from lending so as to be seen as *safe*, thereby attracting the flight-to-safety deposits fleeing stressed banks. To start with, we take the fraction of safe and tainted banks among healthy banks as given and endogenize it later. Finally, we assume that not all the central bank reserves held on commercial bank balance sheets can be used to pay withdrawers – some reserves are encumbered because regulators demand set-asides or the banks create further contingent claims on reserves.

The financing of partially encumbered reserves with short-term deposits, coupled with reserve hoarding by some of the healthy banks that are recipients of flight-to-safety deposits, sets up an interesting dynamic when liquidity is stressed: loan rates in the interbank market can shoot up as stressed banks try and attract liquidity from healthy banks. Importantly, the extent of illiquidity, and therefore the premium paid on borrowing in this situation (which will also affect the fire-sale prices of illiquid financial assets), need not fall in the reserves the central bank issues ex ante. Indeed, under plausible circumstances, every additional dollar of reserves the central bank issues up front can increase the net demand for liquidity in situations of liquidity stress, and can increase the interbank borrowing premium.

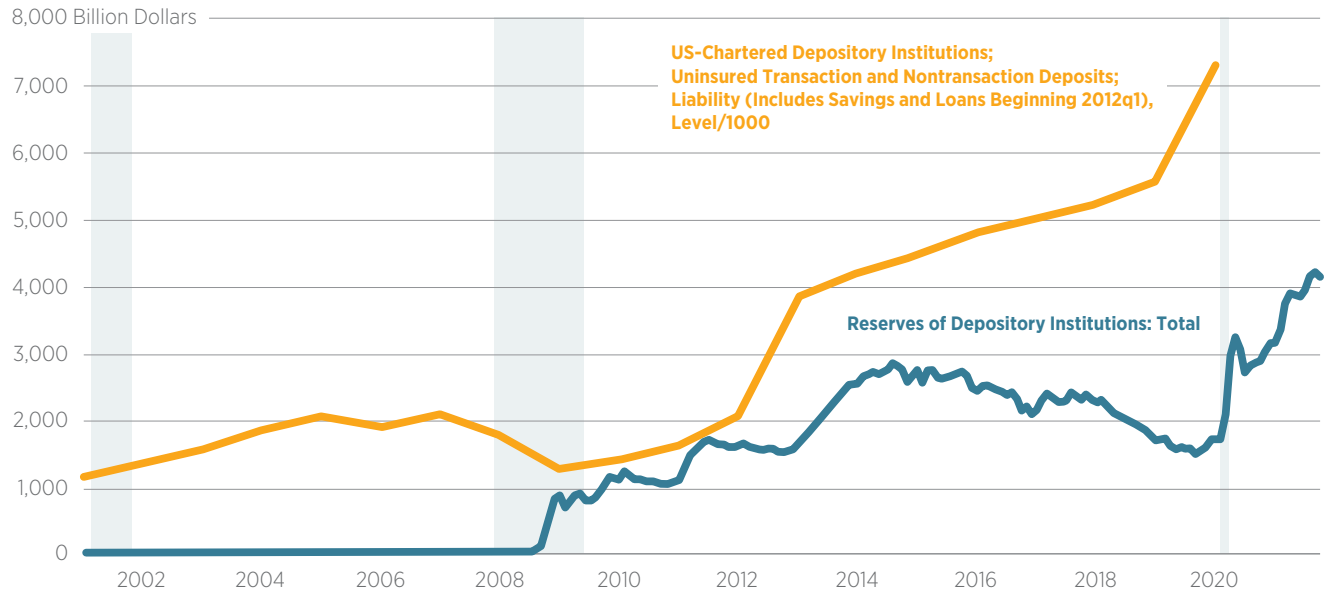
> In times of liquidity stress healthy banks may see a valuable convenience yield to liquid reserves—for instance, because it is dry powder in case conditions worsen. Consequently, healthy banks may hoard liquidity rather than lending it out to stressed banks.

A higher anticipated bank borrowing rate in the future then cascades up front into a higher rate for term loans made by banks, lower investment by firms, and lower aggregate activity. Somewhat perversely, therefore, higher central bank reserve issuance can create more headwinds even to current activity by increasing future, and thus current, borrowing premia. Put differently, the expansion in available reserve assets may be outweighed by claims created on them, or more succinctly, *the ex-ante supply of reserves affects the ex-post demand for them*.

Importantly, individual banks take the expected rates in the interbank market as given, and do not take account of the effects of their financing or activity choices on those rates. Ex ante, if they financed their own reserve holdings with more long-term capital (as the social planner would desire), there would be less call on liquidity when the economy is liquidity stressed. However, such financing is not privately optimal (as suggested by Caballero and Krishnamurthy (2003), Lorenzoni (2008) and Stein (2012)), and not observed in practice.

Consider the second contributor to liquidity stress, the extent of reserve encumbrance. Why might only a fraction of a dollar set aside as reserves be available to pay out on a future date? Two possibilities are speculation and regulation. A bank holding highly liquid reserves, with the reserves being required only in situations of liquidity stress, will want to try and "sell" liquidity in all the states it does not need it, for instance, by backstopping the liquidity needs of firms or speculators for a fee. To the extent that such backstopping cannot be fine-tuned, it will spill over into the states where the economy is liquidity-stressed and there is a high value for liquidity. The amount of free liquidity in such states will shrink relative to the ex-ante size of

Exhibit 2 · Reserves of Depository Institutions and Uninsured Deposit Liabilities



Notes: The data are from the Federal Reserve Bank of St Louis database (FRED). Shaded areas indicate US recessions. Source: Board of Governors of the Federal Reserve System (US)

the reserves. Indeed, defaults on such speculative trades (or even the price impact of unwinding trades because of increasing haircuts or margins, see Aramonte, Schrimpf, and Shin (2021)) may be a source of ex-post contagion in the financial sector.

To reduce such contagion, regulation of centralized clearing may require dealer banks to encumber a portion of the liquid assets as guarantee funds for the settlement of defaulted trades; similarly, regulation may require non-centrally cleared positions of dealer banks to also be backed by liquid assets for prudential management of the ex-post risks they pose. Such liquidity regulations, in response to speculation, are another source of encumbrance.

This raises an obvious question. Shouldn't the regulator suspend a liquidity requirement imposed ex ante when stress materializes ex post? If so, more reserves will be available to alleviate market illiquidity. Diamond and Kashyap (2016) explain why the regulator may not want to release banks from holding reserves for fear that localized stress morphs into a full-blown panic. Furthermore, ratchet effects whereby supervisors scrutinize reductions in reserves closely no matter what the prior level held (see Nelson (2019)) would also contribute to reserves being hard to deploy.

Consider now the third influence on ex-post liquidity – reserve hoarding by profit-maximizing banks. We assume banks see a convenience yield in directly holding reserves in times of stress. Given this benefit to holding liquidity, healthy banks can choose between two options: to either remain perceptibly safe and attract flight-to-safety deposits (with their associated convenience yield); or to lend in the interbank market and realize the associated rents but in the process become *tainted* and attract none of the flight-to-safety reserve flows. The interbank rate will have to move up to convince banks to lend and forego the convenience yield that comes from attracting flight-to-safety deposits. Clearly,

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the higher the perceived convenience yield, the higher the interbank rate will have to be. Indeed, the interbank market may remain shut altogether because it is cheaper for stressed banks to raise capital than to pay the exorbitant required rate. The bottom line though is liquidity hoarding by healthy banks can contribute to the ex-post shortage even if aggregate liquidity is plentiful.

In sum, the key problem is that central bank reserves are placed with commercial banks. Commingled with those balance sheets, they influence other activities (lending, deposit financing, hoarding) that have the potential for significantly enhancing the net demand for liquidity. If, instead, central bank reserves were placed directly with households, or with financial intermediaries that did not issue claims on liquidity, the effects we hypothesize would be mitigated (as argued, for instance, by Greenwood, Hanson and Stein, 2016), but not entirely eliminated.

What, for instance, if the central bank issues reserves directly to the non-bank private financial sector? Here again, a desire to match the duration of liabilities with assets to reduce risk will result in non-banks financing with short-term liabilities. Many of the consequences we have documented and modeled for banks will follow. In April 2021, the Federal Reserve reinstated the supplementary leverage ratio (SLR) for commercial banks. This is a regulatory capital requirement that was suspended in April 2020 in the wake of the pandemic (see Covas, 2021). Given the increased cost to banks of funding reserves with long-term capital, they released reserves. Interestingly, money market funds, themselves funded with short term liabilities, took on the reserves and redeposited them at the central bank via overnight reverse-repo facilities. This suggests the natural form of reserve funding is short-term even in the non-bank financial sector.

Given current practice, our paper suggests that under certain circumstances, there is a threshold size of the central bank balance sheet beyond which further expansion will increase the severity of future liquidity problems. Consequently, the balance sheet size that is optimal from a purely monetary perspective may be excessive from a financial stability perspective. More generally, even though the central bank has no direct cost of creating additional fiat money (Friedman (1969)), our paper proposes a social cost stemming from the reactions of market participants with consequences for financial stability.

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Much of the related literature has focused on frictions such as market segmentation, capital regulation, and timing mismatches (from intraday payments and Treasury sales) to explain price spikes in usually liquid money markets. To alleviate these spikes, a number of commentators suggest that the central bank provide more liquidity in stressed times to a wider array of market participants (see the G30 Report on US Treasury Markets 2021), that it permanently expand the quantum of reserves (Copeland, Duffie, and Yang (2021)), or that it reduce or eliminate capital requirements against reserves (Liang and Parkinson (2020)). While these proposals will likely reduce stress ex post, we also need an ex-ante analysis of why the system is so fragile despite abundant reserves to understand the full consequences of the proposed policies.[2]

[2] Most closely related to our paper is Diamond, Jiang, and Ma (2021), who ask how the reserve build-up by the Federal Reserve could affect bank lending. Using structural estimation methods, they conclude the $2.7 trillion increase in Fed reserves from quantitative easing reduced bank lending by over $500 billion. Our focus instead is on the effects of reserves on ex-post liquidity, and how that would impact corporate lending. Even though our papers are complementary given their focus, the implications, for example on whether capital requirements should be relaxed ex ante for reserve holdings, are different.

For instance, reducing capital requirements on reserves could make them more available ex post, but it will increase the short-term financing of reserves, which contributes to the problem. Similarly, the central bank can certainly flood the market with reserves ex post. Such intervention is not without cost. Ex post, it crowds out lending by healthy banks, increasing the scale of the needed intervention. Ex ante, market participants are even more inclined to write future claims on liquidity and ever more reliant on the central bank backstop. Consequently, we should expect escalating and more frequent central bank interventions over time, with broader categories of assets accepted as collateral for the central bank intervention, and potential distortions creeping into asset prices as well as asset allocations. In our analysis, such growing liquidity dependency of the system on the central bank is a concerning possibility.

Put differently, the shrinking of central bank balance sheets that is currently being discussed by major central banks will have to be managed carefully so as to avoid market disruption. That the central bank's balance sheet is many times historical levels does not mean that the liquidity provided exceeds the private sector's needs – the latter have grown along with the growth of the central bank balance sheet. Indeed, the private sector will have to be weaned off dependence on the central bank's balance sheet. That is likely to be a delicate task requiring central bank skill, determination, and patience.

CLOSING TAKEAWAY

Given current practice, our paper suggests that under certain circumstances, there is a threshold size of the central bank balance sheet beyond which further expansion will increase the severity of future liquidity problems. Consequently, the balance sheet size that is optimal from a purely monetary perspective may be excessive from a financial stability perspective.

We have likely only scratched the surface in modeling and sketching out implications of the phenomenon that the ex-ante supply of reserves affects the ex-post demand for them. There is clearly more work to be done in understanding and mitigating liquidity stress implied by this phenomenon.

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