

## Special Feature C

# Liquidity Dependence

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At the Federal Reserve Bank of Kansas City's Jackson Hole Economic Symposium in late August 2022, the theme of the second day was "Reassessing Constraints on Policy". Viral Acharya presented his perspective on quantitative easing and tightening, based on joint work with Rahul Chauhan and Raghuram Rajan of the University of Chicago Booth School of Business, and Sascha Steffen of the Frankfurt School of Management and Finance, titled "Liquidity Dependence—Why Shrinking Central Bank Balance Sheets is an Uphill Task". This Special Feature summarises the main points of Acharya's Jackson Hole remarks.

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## 1 Introduction

Central bank reserves are among the most liquid assets but are also low-yielding. Consequently, it makes sense for the financial sector—typically commercial banks that hold the reserves—to make money selling claims on liquidity. Viral Acharya and Raghuram Rajan wrote a theory paper around this intuition, titled "Liquidity, Liquidity Everywhere, Not a Drop to Use—Why Flooding Banks with Central Bank Reserves May Not Expand Liquidity" (2021), explaining this process and clarifying how it can lead to liquidity stress. Specifically, when the demandable claims on central bank reserves come due, there can be liquidity stress, and vulnerability to such stress can be identified empirically by looking at the evolution of claims during quantitative easing (QE) and quantitative tightening (QT) episodes of the past. Focusing on these claims is different from the standard analysis of the transmission of QE, which has focused on how changes in bank assets lead to changes in real activity. This ignores, however, the effects on the liability side of the banking sector; from a financial stability standpoint, this is where the key action lies.

To understand this better, consider the process via which a central bank such as the Federal Reserve expands its balance sheet. The Federal Reserve swaps assets such as Treasury or Agency-backed securities for reserves. Typically, the reserves end up on commercial bank balance sheets. The asset swap, however, may happen in two ways:

- (i) The asset swap can happen directly with banks. In this case, banks swap eligible securities for reserves, and the process of the Federal Reserve injecting reserves directly does not lead to a growth of bank deposits. **Table 1** depicts an example of such swaps.

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**Table 1** QE I: Expansion of the Federal Reserve Balance Sheet

Initial Balance Sheet Conditions		Federal Reserve Purchases Assets from the Banks—Balance Sheet Effects	
Federal Reserve		Federal Reserve	
Assets	Liabilities	Assets	Liabilities
Treasury Securities	Reserves held by banks	Treasury Securities (+\$1)	Reserve held by banks (+\$1)
	Cash held by the Treasury		Cash held by the Treasury
Banking Sector		Banking Sector	
Assets	Liabilities	Assets	Liabilities
Treasury Securities	Deposits	Treasury Securities (-\$1)	Deposits
Reserves at the Fed		Reserves at the Fed (+\$1)	

Asset Swap with Banks

Note: Taken from Leonard, D, Martin, A, and Potter, S (2017), "How the Fed Changes the Size of its Balance Sheet", *Liberty Street Economics (blog)*, Federal Reserve Bank of New York.

- (ii) The non-bank sector can also sell eligible assets to the Federal Reserve. The payment is deposited in commercial banks; banks add reserves to their assets and these are effectively "financed" by the deposits of the non-bank sector that sold the asset. **Table 2** exemplifies this. Without any indirect or multiplier effects via the banks' balance sheets, there is a one for one expansion of the banking sector's balance sheet with reserves. Importantly, its deposits, which are typically wholesale demandable deposits, expand with reserves.

Given these different ways that the Federal Reserve's expansion of its balance sheet affects the banking sector, the following questions arise: How does this balance sheet expansion affect the size and demandable deposit base of the banking sector? Do other demandable liabilities issued by banks, such as credit lines to corporations, also grow with reserves? If banking sector liabilities grow, do they reverse via the same mechanism when the Federal Reserve shrinks its balance sheet?

**Table 2** QE II: Expansion of the Federal Reserve Balance Sheet

Initial Balance Sheet Conditions				Federal Reserve Purchases Assets from the Public— Balance Sheet Effects			
Federal Reserve				Federal Reserve			
Assets	Liabilities			Assets	Liabilities		
Treasury Securities	Reserves held by banks Cash held by the Treasury			Treasury Securities (+\$1)	Reserves held by banks (+\$1) Cash held by the Treasury		
						Expansion Financed with Bank Deposits	
Banking Sector		Public		Banking Sector		Public	
Assets	Liabilities	Assets	Liabilities	Assets	Liabilities	Assets	Liabilities
Treasury Securities	Deposits	Deposits	Wealth	Treasury Securities	Deposits (+\$1)	Deposits (+\$1)	Wealth
Reserves at the Fed		Treasury Securities		Reserves at the Fed (+\$1)		Treasury Securities (-\$1)	

Note: Taken from Leonard, D, Martin, A, and Potter, S (2017) "How the Fed Changes the Size of its Balance Sheet", *Liberty Street Economics (blog)*, Federal Reserve Bank of New York.

## 2 The Evidence

Our empirical evidence (Acharya, Chauhan, Rajan and Steffen, 2022) suggests that QE, which is an increase in aggregate reserves, is certainly associated with a growth of bank deposits. This is consistent with asset purchases by the Federal Reserve being in large part from non-banks. The rise in bank deposits is primarily in demandable deposits; time deposits in fact shrink during QE. In addition, banks originate more credit lines for corporations as the reserve holdings become a backstop for commercial banks to issue claims on liquidity that may not all materialise at the same time in the normal course, allowing commercial banks to generate higher fees (see Kashyap, Rajan, and Stein (2002)). The financing with demand deposits, the reduction in time deposits, and the writing of off-balance-sheet claims suggest an active response by banks to write demandable claims when aggregate reserves increase. Our most important result is that QT—when the Federal Reserve shrinks aggregate reserves—is not simply a reversal of QE. Demand deposits and credit lines continue to grow even after QE is over; they stabilise eventually, but do not shrink much—if at all—even during QT.

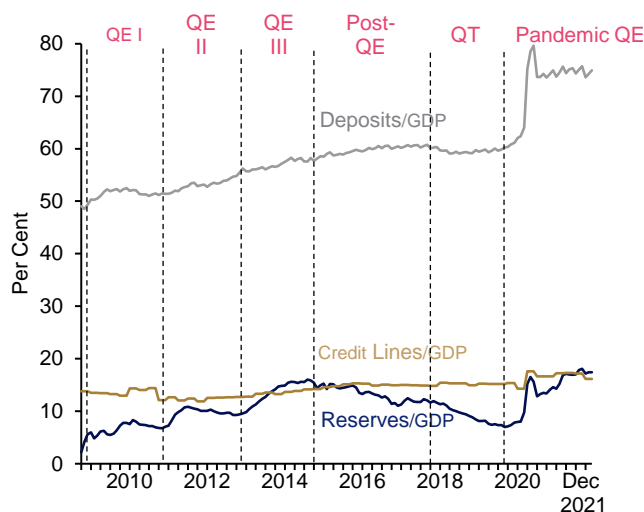
We refer to this phenomenon—whereby QE leaves the banking system with more on- and off-balance-sheet demandable claims that are not simply reversed with QT—as “liquidity dependence”, since it necessitates an even greater central bank balance sheet support in the future.

Liquidity dependence can also explain why the financial system suffered from liquidity stress in the form of the repo (repurchase agreement) spike of September 2019 (see Copeland, Duffie and Yang (2021) or D’Avernas and Vandeweyer (2021), for instance) and the

“dash for cash” during the COVID-19 outbreak of March 2020 (see Kashyap (2020) and Acharya, Engle and Steffen (2021), for instance)—in spite of reserves being in excess of \$1 trillion.

This evidence is presented succinctly in **Chart 1**, which shows the level of demandable claims of the banking system at these points of time. The blue line is reserves, the gold line is outstanding bank credit lines and the grey line is bank deposits, all relative to GDP. The vertical lines correspond to the beginnings of the different QE and QT programs of the Federal Reserve, as summarised in **Table 3**.

**Chart 1** Reserves and Claims as Percentage of GDP



Note: Plot taken from Acharya, Chauhan, Rajan and Steffen (2022).

**Table 3** QE and QT programs of the Federal Reserve

Start Date	Policy	Abbreviation in Chart 1
November 2008	QE I	QE I
November 2010	QE II	QE II
November 2012	QE III	QE III
October 2014	QE halted without actively reducing balance sheet size	Post-QE
October 2017	QT/Active balance sheet reduction	QT
September 2019	Repo market “spike” and liquidity infusion	Pandemic QE
March 2020	Pandemic-induced QE	

The key patterns that emerge are as follows:

- (i) Reserves expanded from the start of QE I to the end of QE III from 5% of GDP to 15% of GDP. There was some stabilisation, even decline, in reserves after the end of each phase of QE and before the start of the next. At the same time, as reserves expanded, bank deposits grew from 50% to 58% of GDP, again with some stabilisation when each phase of QE ended and before the next one began.

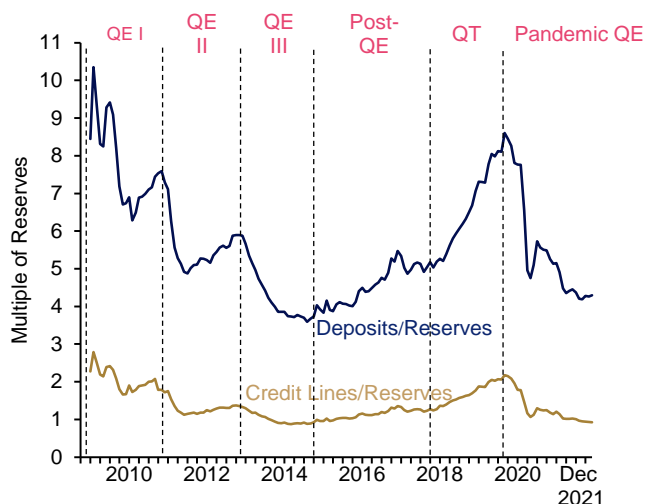
While the increase in credit lines was less pronounced at first, they too increased from the start of QE II from 12% to 14% of GDP by September 2014.

- (ii) Importantly, while reserves dropped by more than half between the halt of QE and September 2019 when QE resumed, both credit lines and deposits remained remarkably flat. Notably, their change during this period did not simply reverse their increase during QE I–III.
- (iii) However, when reserves increased from 7% to 17% of GDP during the Pandemic QE, bank deposits jumped again from 60% to 75% of GDP and credit lines increased to 16% of GDP.

This descriptive evidence already highlights the asymmetric effect of an expansion vis-à-vis shrinkage of the Federal Reserve's balance sheet on commercial bank demandable claims.

To see this point more sharply and to provide a financial stability perspective, consider **Chart 2**, which plots bank deposits and outstanding credit lines relative to aggregate reserves, i.e., the Federal Reserve's balance sheet size. The gold line represents outstanding bank credit lines, and the blue line is bank deposits, both relative to reserves. At the beginning of QE I–III as well as the Pandemic QE, credit lines and deposits drop as a multiple of reserves. In contrast, when the Federal Reserve started normalising and shrinking its balance sheet after October 2014, both credit lines and deposits more than doubled relative to reserves.

**Chart 2** Claims on Liquidity as Multiple of Reserves



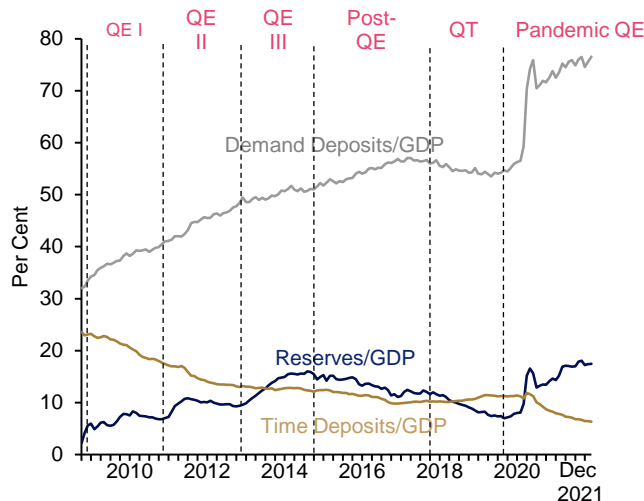
Note: Plot taken from Acharya, Chauhan, Rajan and Steffen (2022).

Even more interestingly, by September 2019, the ratios are almost at the same level for both deposits and credit lines as in 2008, before QE began. In other words, a shrinkage of the Federal Reserve's balance sheet during QT by a magnitude far smaller than the expansion undertaken during QE led to the claims on liquidity relative to available reserves reaching pre-QE levels. Put differently, far more reserves were now needed to back the liquidity claims that had been written.

It turns out that there is yet another dimension to liquidity dependence induced by QE, which is a shortening of the maturity of commercial bank liabilities. As shown in **Chart 3**, time

deposits shrink substantially during QE, stabilise somewhat post-QE and rise only slightly during QT, whereas demand deposits rise more than one for one during QE, keep growing post-QE, and come down only marginally during QT (with the effects driven almost entirely by the uninsured portion of deposits, which tends to be more demandable than insured deposits).

**Chart 3** Demand and Time Deposits as Percentage of GDP



Note: Plot taken from Acharya, Chauhan, Rajan and Steffen (2022).

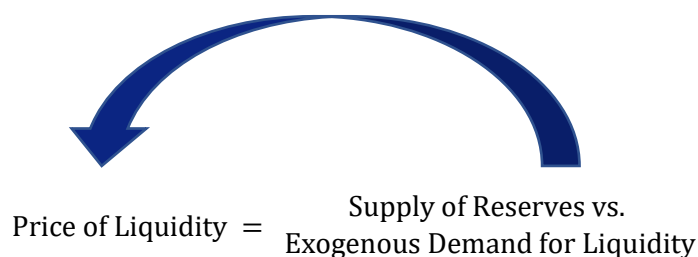
We verify these results econometrically by examining the cross-section of banks over time. This requires that we instrument reserves at the individual bank level, so as to provide for better causal inference; panel data also provides statistical power to verify patterns within individual QE/QT episodes. Focusing on quantity results, as to how reserves affect demandable claims, we confirm that an exogenous increase in a bank's reserves increases its deposits, specifically, its demandable deposits, while shrinking its time deposits; and also increases the origination of credit lines.

Both of these results hold for QE, but there is no reversal post-QE or in QT.

### 3 Implications for Policy

A key implication is that there is a "wrong" way to think about QE: taking the nature of claims on liquidity on the banking sector as given and unaffected by reserve expansion. Under this view, an increase in central bank balance sheet size always lowers the price of liquidity and improves financial stability, so that a solution to any liquidity stress is to inject even more reserves (**Chart 4**).

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**Chart 4 Traditional View—Exogenous Demand for Liquidity**


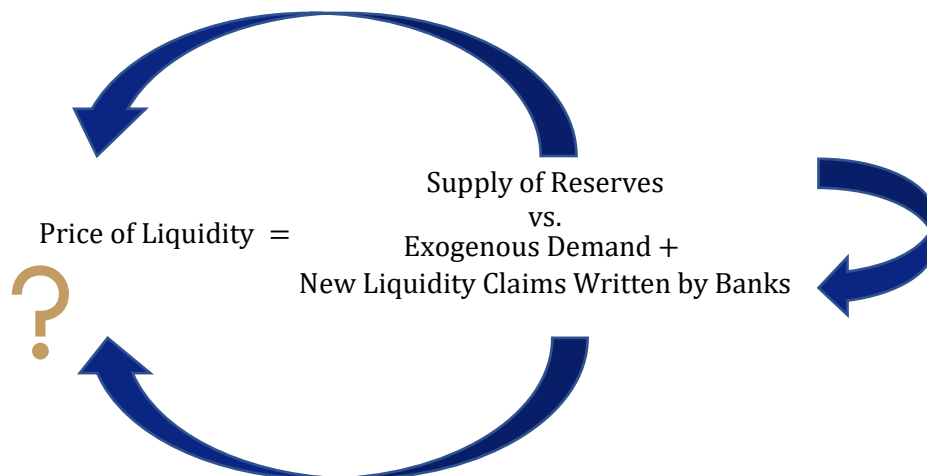
- As demand is exogenous, increasing supply of reserves is stabilising.

Note: Diagram taken from Viral Acharya's presentation at the Federal Reserve Bank of Kansas City's Jackson Hole Economic Symposium, August 2022.

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In contrast, our liquidity dependence view suggests that banks write new liquidity claims when exogenously pumped full of reserves, and do not shrink these claims easily. The supply of reserves creates its own additional demand for liquidity, via these new claims that can come due in times of aggregate stress. This implies reserve expansion may have muted, even adverse, effects on available liquidity and thence financial stability, with maximum danger when reserves are shrunk (**Chart 5**).

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**Chart 5 Dependence View—Liquidity Demand Affected by Reserves**


- Supply of Reserves creates its own additional demand, new claims written by banks.
- Liquidity conditions and the effect of QT depend on how these claims evolve.

Note: Diagram taken from Viral Acharya's presentation at the Federal Reserve Bank of Kansas City's Jackson Hole Economic Symposium, August 2022.

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Notably, QE during the pandemic had caused banking sector demandable liabilities to rise again, and the Federal Reserve has recently embarked on QT. The past suggests that there is no guarantee that these liabilities will shrink as the Federal Reserve shrinks its balance sheet. What then are some of the other policy implications? We emphasise the following points as the most important implications:

- (i) Liquidity dependence can create a potential conflict with the Federal Reserve's monetary policy objectives when QT is embarked upon. To shrink aggregate demand, the Federal Reserve may want to tighten monetary conditions; however, demandable liabilities in the banking system can create financial stability issues, preventing the Federal Reserve from unwinding stimulus at a pace commensurate with monetary objectives.
- (ii) As QT is embarked upon, careful attention will have to be paid to the system's demandable claims and to ensuring the mobility of reserves within the banking system. On the former, banks can be incentivised to hold more time deposits rather than demandable ones and capital charges for undrawn credit lines can be raised. On the latter, Liquidity Coverage Ratio and Resolution Planning liquidity requirements for banks can be required to be met on a fortnightly basis with some tolerance allowed on a daily basis; this can create incentives for banks to not hoard reserves by reducing the supervisory stigma of temporarily falling short.
- (iii) Next, the Federal Reserve can reduce the flow of reserves through commercial bank balance sheets by placing them directly with non-banks via reverse repo facilities; the eligible non-banks would however need to be supervised and subject to prudential qualifying requirements, as otherwise the creation of demandable claims on liquidity would simply shift from the banking sector to the shadow banking sector.

At any rate, since most of the reserves will be held by the banking sector, which will issue hard-to-reverse liquidity claims on them, the scale, scope and duration of QE may have to be rethought, especially when QE is simply "pushing along a string." Equally important, liquidity dependence warrants that the Federal Reserve proceed on QT carefully while closely monitoring outstanding liquidity claims on the commercial banking, and more generally, the financial sector.

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