GETTING GLOBAL MONETARY POLICY ON TRACK

EDITED BY

Michael D. Bordo, John H. Cochrane, and John B. Taylor

FINANCIAL REGULATION AND MONETARY POLICY

INTRODUCTORY REMARKS

Stephen Haber

So during the last panel, we started to have a discussion about the connections among financial regulation, bank supervision, and monetary policy. And so it seems only appropriate that now we're going to dig a bit more deeply on the connection between financial regulation and monetary policy. I'm Stephen Haber, and I'm chairing this panel. I'm delighted to be moderating the panel composed of my colleagues Amit Seru from Stanford University, Darrell Duffie from Stanford University, Christina Parajon Skinner from the University of Pennsylvania, and Carolyn Wilkins from the Bank of England. We're going to start with Amit. Each presenter will make some brief remarks and then we will throw discussion open to the floor.

10

Too Many Rules and Too Much Discretion? Simplifying Financial Regulation

Amit Seru

In this chapter, I present what I think is the issue that financial regulation is trying to resolve and why it is difficult to achieve with complex rules. I hope to end the talk with a plea for simplifying financial regulation. Monetary policy, which is in the title of the session, obviously affects financial stability through many channels—for example, by impacting the value of the long-duration assets held by financial institutions or by impacting the credit risk held by various intermediaries.

The fundamental threat to financial stability, of course, comes from the fact that our banking system is highly leveraged. It is useful to calibrate what we mean by highly leveraged.

Figure 10.1 shows the distribution of leverage, measured by debt/assets (on the *y*-axis) across banks of different size (on the *x*-axis) in the financial system in the United States. As can be seen, a bank of pretty much any size has 90% debt in its capital structure. This figure implies that a small decline in asset values due, say, to higher rates in 2023 or credit risk in 2007 can make many institutions insolvent and threaten their financial stability. In turn, this creates an important constraint on monetary policy, as seen during the recent tightening and, similarly, by the need to keep the interest rates low during the Great Recession. Not surprisingly, policymakers have therefore tried to regulate and create many complex rules aimed toward getting financial stability, most aggressively since the

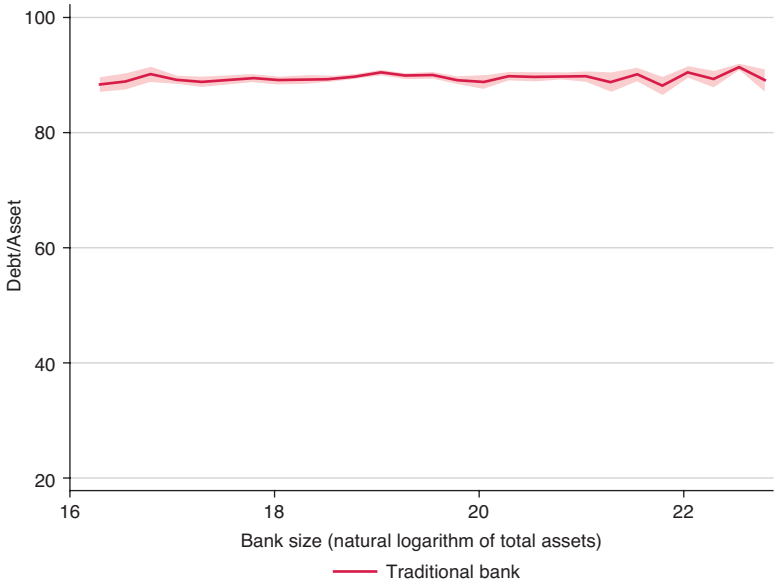

FIGURE 10.1. Debt-to-assets ratio (%) of US banks of different sizes.
Source: Jiang et al. (2024a).

Great Recession. The question we can ask is whether we have been successful. To get some answers, let us revisit what happened over the last year in the banking sector.

The aggregate balance sheet of the banking system is shown in figure 10.2 as of 2022 Q1, just before the monetary tightening we saw. On the asset side, we have $24 trillion in the banking system, spread across securities, loans, and so on. On the liability side, we have of course insured deposits of $9 trillion, but then we have $9 trillion of uninsured deposits and also $2 trillion of equity capital.

As monetary tightening occurred over the remaining part of 2022 and early part of 2023, it is instructive to ask what might have happened to the banking system. As interest rates rose, the market value of long-duration assets fell. One can ask what the "mark-to-market" losses amounted to in the banking system. In work with my collaborators (Jiang et al. 2024b), we did this exercise

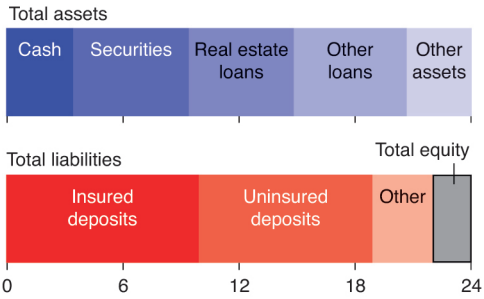

FIGURE 10.2. Aggregate balance sheet of US banks as of 2022 Q1 (in trillions of dollars).
Source: Jiang et al. (2024a).

using microdata across all the banks while considering the duration of different assets on the balance sheets of the banks. We called these mark-to-market losses "turbulence" in the banking system. It accounted for about $2 trillion of unrealized losses in the banking system. Notably, $2 trillion is an interesting number, because it effectively wipes out the equity in the system. In addition, what we found was that, unlike the stress in the banking system in 2007, which was about losses on illiquid assets (e.g., subprime mortgages), these losses were primarily about liquid securities. In fact, more than 60% of the turbulence was due to losses in liquid securities.

One might ask whether these losses are concentrated in only a few banks on the West Coast, such as Silicon Valley Bank (SVB) and First Republic. Figure 10.3 plots the distribution of mark-to-market losses in the system. As can be seen, the average of the distribution suggests that the losses experienced by an average bank in the system were large. The vertical line is where the unrealized losses of SVB were during the monetary tightening. SVB's losses were large, but there are several banks that had higher losses. The bottom line here is that the mark-to-market losses were large and spread across many banks.

If we focus on the liability side, uninsured leverage (defined as the ratio of uninsured debt to total assets for a financial institution)—an

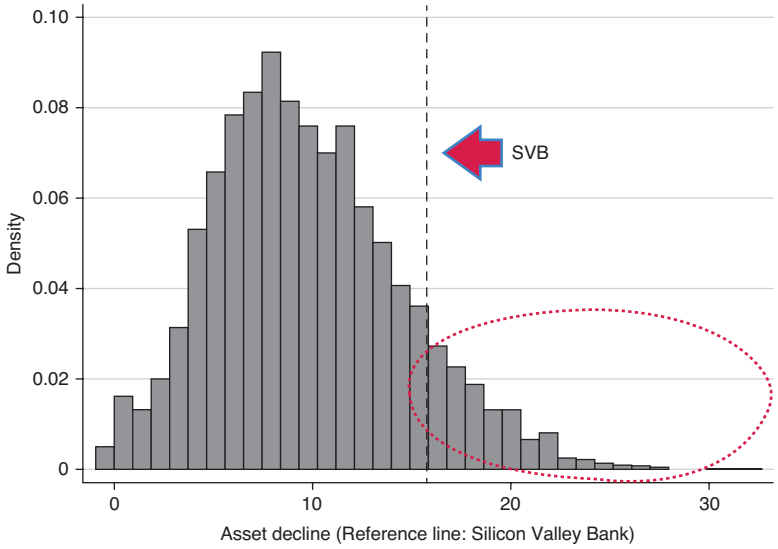

FIGURE 10.3. Distribution of unrealized losses in the banking system. Based on our analysis (as of the end of 2023 Q1), substantial unrealized mark-to-market losses may exist throughout the banking system.
Source: Jiang et al. (2024b).

aspect that my collaborators and I were studying for some time (Jiang et al. 2024a)—is economically meaningful for understanding fragility in the banking system. Uninsured debt, as it is uninsured, gives the maximum incentive to run if there are losses or spookiness about a bank's health. We called the extent of uninsured leverage of a bank its flight risk. Recall from figure 10.2 that there were $9 trillion of uninsured deposits in the system at the start of monetary tightening. It is unlikely that these deposits were sitting in one or two banks, as some commentators might have led one to believe.

Figure 10.4 illustrates the distribution of uninsured leverage across banks in the system. The vertical line here, again, is SVB. This figure shows that SVB was an outlier on this margin, but there were many other banks in the system in close proximity with pretty

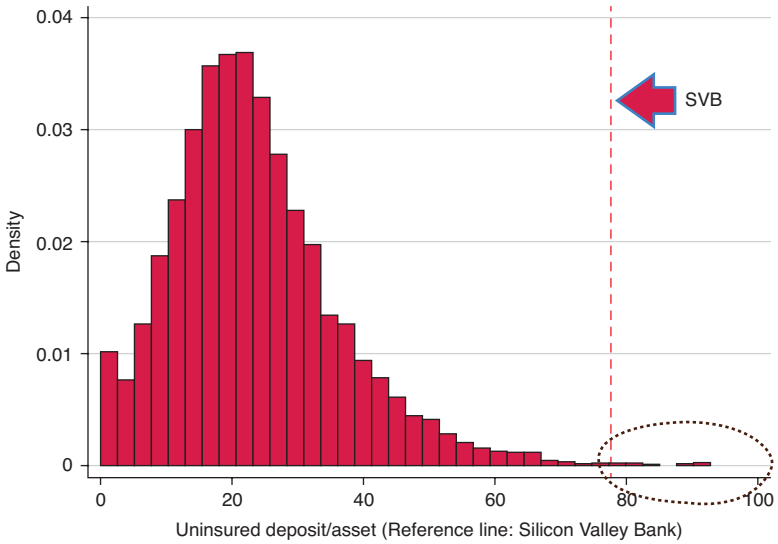

FIGURE 10.4. Distribution of uninsured leverage across US banks. Based on our analysis, SVB was an outlier in terms of its uninsured leverage, but quite a few other banks have uninsured leverage similar to SVB's.
Source: Jiang et al. (2024b).

high uninsured leverage. In other words, there were many banks with high flight risk in the system.

In Jiang et al. (2024b), we combined turbulence with flight risk in the banking system and asked which banks might be susceptible to what we called a "solvency run." Unlike runs based on illiquid assets, such as in the Diamond-Dybvig model, these runs would be caused by loss of value of liquid assets. Which banks would be susceptible to such runs? We found that when (1) interest rates go up and, as a result, the market value of long-duration assets goes down (i.e., turbulence is high), (2) uninsured leverage is high (i.e., flight risk is high), and (3) there is not enough equity capital in the bank to absorb the losses, a bank would be susceptible to solvency runs. This equilibrium could emerge because enough uninsured depositors get spooked and run to the bank, forcing the bank to realize their unrealized losses by selling their assets to satisfy depositors.

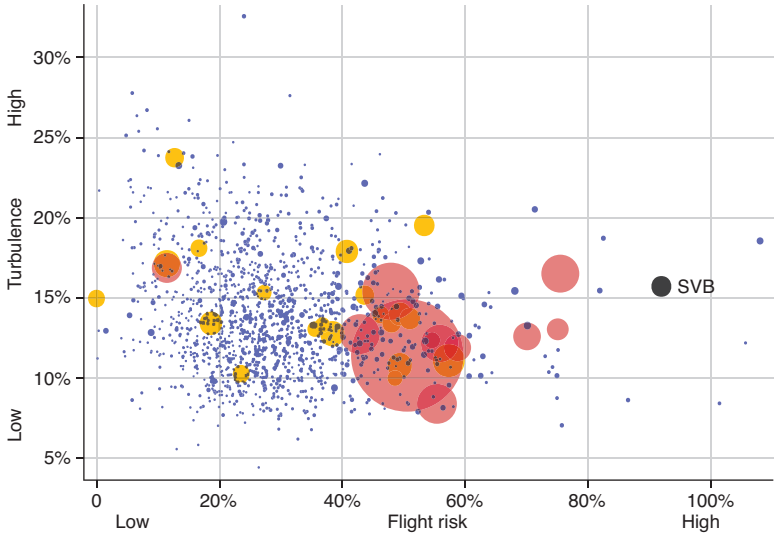

FIGURE 10.5. Turbulence (mark-to-market asset losses) versus flight risk (uninsured leverage): a plot of the full set of potentially insolvent banks. A bank is considered insolvent if the mark-to-market value of its assets—after paying all uninsured depositors—is insufficient to repay all insured deposits. The size of the dot represents the assets of the bank.
Source: Jiang et al. (2024b).

The natural question is how many banks in the banking system were facing risk of solvency runs. Figure 10.5 presents the evidence. The figure puts turbulence (i.e., mark-to-market losses) on the *y*-axis (low to high) and flight risk (i.e., uninsured leverage) on the *x*-axis (low to high). It then plots the set of banks that might be potentially insolvent due to a solvency run. Each dot in the figure is a potentially insolvent bank, with the larger dots representing bigger banks. Insolvency is defined based on whether a bank can pay off insured deposits, given a certain proportion of uninsured run first. The largest insolvent dot plotted in the picture is a global systemically important bank (G-SIB) with more than a trillion dollars of assets. As can be seen, as with SVB, that bank is potentially insolvent when turbulence is high and flight risk is high. But it is not alone. There are

many other potentially insolvent banks that face similar characteristics, that is, high turbulence and high flight risk.

Where was financial regulation in all this? Many rules and regulations were passed starting in 2007 in the hope of increasing financial stability. Have these rules worked in addressing the precarious situation we have found ourselves in? There have been two issues with the regulatory approach we have followed since 2007. First, many of the rules and regulations in the aftermath of the Great Recession were directed toward liquidity problems faced by intermediaries. And certainly, if one has a hammer in the toolkit, everything looks like a nail. Thus, even though the problem with the current situation in the banking system is about insolvent banks, policymakers diagnosed them as facing liquidity problems. Misdiagnosis of the problem has meant that policy responses have been misdirected. There have been several liquidity injections to banks, but banks have kept failing, and there is continued stress in the system. This is despite the government having effectively backstopped all uninsured depositors.

The second issue is that when responsibilities are fragmented across many regulators—as in the United States and everywhere in the world—regulatory discretion can interact with incentives of different regulators to create sluggishness in regulatory responses.

So the first question is whether there is a lot of discretion in the system when it comes to supervision and regulation.

Financial stability in the banking system is regulated through CAMELS ratings that are given to banks. The components, *C* (for capital adequacy), *A* (for asset quality), *M* (for management quality), *E* (for earnings quality), *L* (for liquidity quality), and *S* (for sensitivity toward risk), are each measured between 1 and 5, with a higher score indicating worse bank health on that margin. Clearly, some components (like *M*) have a lot more discretion in terms of measurement by regulators. The composite CAMELS ratings—also between 1 and 5—drive regulatory policy decisions from the deposit insurance a bank has to pay to whether banks are allowed to expand.

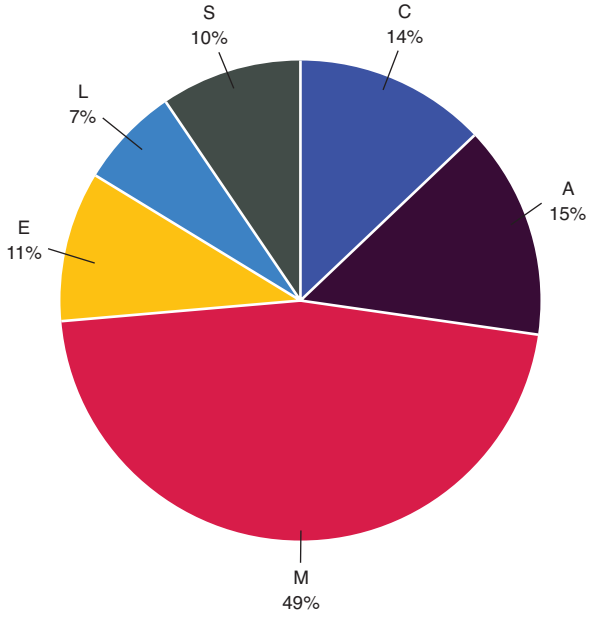

FIGURE 10.6. Discretion in CAMELS ratings: weight on each subcomponent in the composite CAMELS rating.
Source: Agarwal et al. (2024).

And so how do we know there is a lot of discretion? Figure 10.6 shows results from a recent study (Agarwal et al. 2024) where we identify how much each component contributes to the overall CAMELS score. As can be seen, half of the variation in the overall score is driven by the management quality component. This implies that there is a lot of discretion in how supervisory ratings are measured—and therefore how regulatory responses are devised.

So, one could ask: but does this discretion, which is quite a bit, really matter? There are many ways to look at it, but I'll give two. One is that lots of banks in the US system are regulated in tandem by state and federal regulators. This dual regulatory system exists for various reasons we can get into, but for the purpose of the analysis I will show you, the advantage one has is that for a given bank, at virtually the

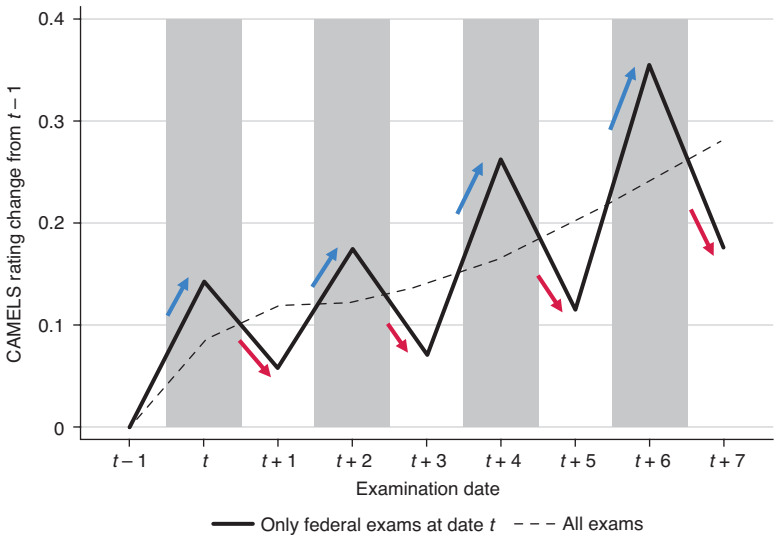

FIGURE 10.7. Does discretion matter? The figure plots CAMELS rating changes between consecutive exams that a state-chartered bank faces as it is supervised by a state regulator (white vertical bars) or a federal regulator (gray vertical bars).

Notes: A lower CAMELS score reflects a more lax score. Based on our analysis, banks such as SVB (and First Republic), which are supervised under dual regulators in rotation, face potentially inconsistent enforcement of regulation.

Source: Agarwal et al. (2014).

same time you can get a rating from both the state and the Federal Reserve, which you can then compare. And what do we find?

Figure 10.7 shows the findings most simply. What I will show is CAMELS ratings for a vast majority of banks that are state chartered—that is, they are regulated by state and federal regulators supervising them in rotation. One can then evaluate CAMELS given to the same bank at virtually the same time by state versus federal regulators. This figure plots CAMELS on the *y*-axis and regulatory spells on the *x*-axis. The state spells are represented by white vertical bars and federal spells for the same bank by gray vertical bars. As can be seen, state spells see CAMELS being lowered, while federal spells see CAMELS being increased. In other words, state regulators are more lax than federal ones. Moreover, we find

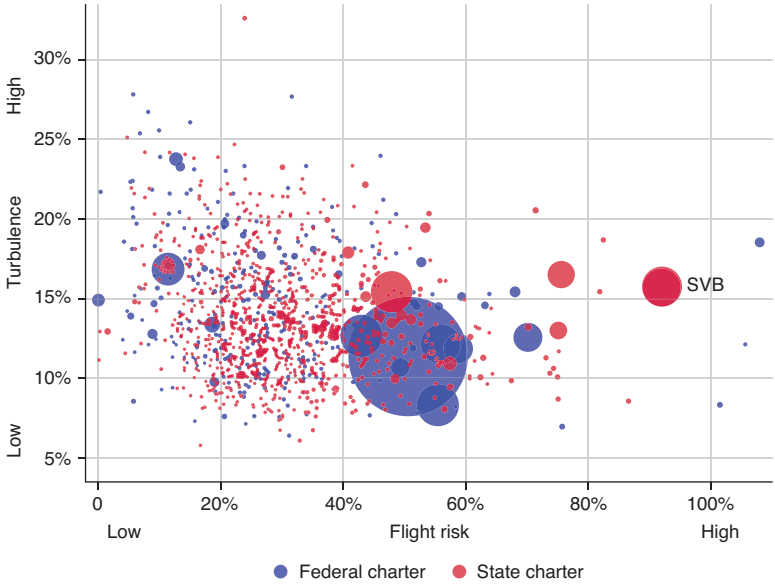

FIGURE 10.8. Turbulence (unrealized losses) versus flight risk (uninsured leverage) with fragmented regulators.

Notes: This figure reproduces figure 10.5, adding whether insolvent banks are state or federally chartered. State-chartered banks are supervised by state and federal regulators in rotation.

Source: Jiang et al. (2024b).

that state regulators are more lax and exercise more forbearance when a local economy is weak. And the seesaw pattern ends up creating sluggishness in the overall regulatory response.

There is another way to see that this regulatory discretion matters. Figure 10.8 reproduces figure 10.5 where we plotted insolvency in the system. What is being shown in this plot is whether the banks were supervised under the rotation system described in figure 10.7. The red dots here, including SVB, are all banks that are state chartered. You can see that most of the insolvent banks in the system faced a state and a federal regulator supervising them in rotation. As I noted before, this system is prone to sluggishness,

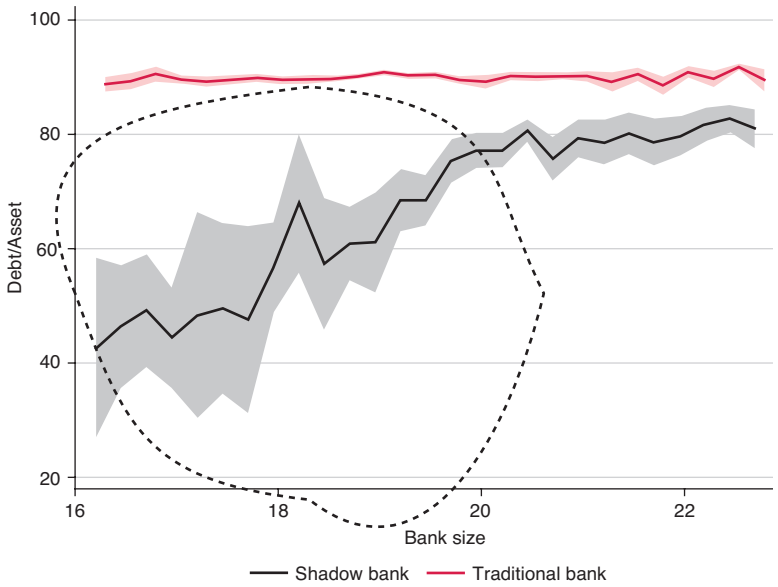

FIGURE 10.9. Debt-to-assets ratio of US banks and shadow banks (nondepository institutions) of different sizes (in natural logarithm of total assets).
Note: Shadow banks uniformly, but especially for small and midsize banks, have a much lower debt-to-assets ratio while originating similar risk as traditional banks.
Source: Jiang et al. (2024a).

and it is not surprising that we ended up with so many banks in the system being insolvent and yet regulators did not act.

So, can one simplify regulation instead of having too many rules and all this discretion? Recall that the issue of financial stability arises because banks are very highly leveraged. One way to address this simply is to ask how the market funds risk of the type that banks originate.

A natural laboratory in which to see this is to focus on shadow banks—non-deposit-taking institutions—and ask how they finance themselves. These institutions are now a large player in many markets where they perform activities similar to those of a bank. To illustrate this, figure 10.9 plots all the banks and shadow banks operating in the mortgage market.

What kind of capital structure do they have when performing these activities? As one can see, these institutions have substantially lower leverage than banks. In other words, these institutions finance risk they originate (like banks) with more equity. The gap between the equity of banks and that of shadow banks is largest when one focuses on small-to-midsize banks. Interestingly, this size distribution of banks is also a major part of the regional banking crisis.

As noted before, more equity would prevent solvency runs in a bank. It would also prevent other types of runs. A natural question, then, is that if that's the case, why haven't we yet asked banks to raise more equity?

One common narrative against such a policy is the rhetoric that it would lead to a decline in bank lending. This same narrative that is making the rounds as the Basel III Endgame is being debated in the US. The question then is whether this narrative holds any water. To answer this, note that the intermediation sector has changed dramatically over the last decade and a half in two important ways. First, banks now not only do balance sheets, but they also originate and distribute (OTD), especially if their balance sheet is constrained (Buchak et al. 2024a). So that means banks' overall lending activities cannot be captured by just focusing on bank balance sheets. Second, shadow banks or private credit can increasingly serve as substitutes if banks cannot provide credit (Buchak et al. 2024a). As we already know, these entities perform the same lending activities as banks but operate with much higher equity in their capital structure.

We put banks and shadow banks together, modeled the competition between them, and asked what the equilibrium mortgage lending might look like if capital requirements went up. Figure 10.10 illustrates the results of the counterfactual experiment, with the *x*-axis plotting capital requirements and the *y*-axis plotting change in overall lending. Thus, if one starts with the baseline capital requirement in the banking sector and then raises capital requirements, a few things happen.

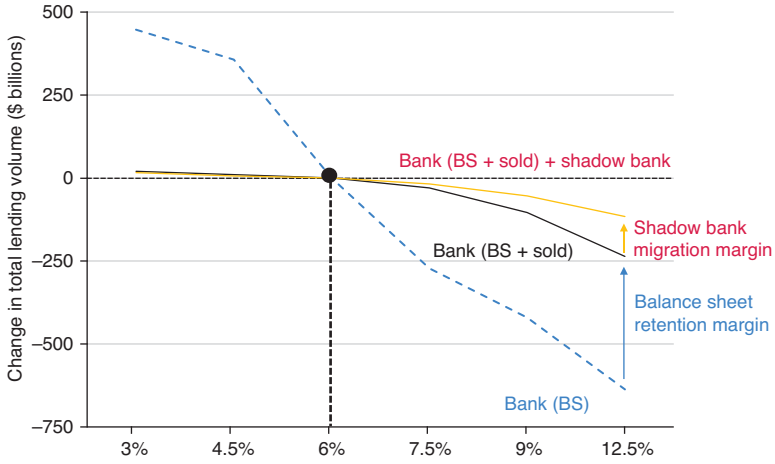

FIGURE 10.10. Impact on total mortgage lending in response to changing capital requirements: change in total lending volume in billions of dollars (*y*-axis) relative to a baseline scenario plotted against capital ratio requirements (*x*-axis). The baseline scenario starts at the capital ratio of 6%. Bank (BS) indicates balance sheet lending by traditional banks. Bank (BS + sold) indicates total lending done by traditional banks that includes both their balance sheet lending and the loans they sell. Bank (BS + sold) + shadow bank indicates total lending by traditional banks and shadow banks.

Source: Buchak et al. (2024a).

First, as you would expect, the balance sheet does get constrained. Since we make lending on a balance sheet expensive, the lending on a bank balance sheet falls. That's not all banks do when it comes to lending. When you add on top of that what banks do in terms of OTD, the total lending done by banks does not fall by as much. In other words, the ability of banks to do OTD dampens the drop in the lending they do. But that's not all. We also have shadow banks, and some of the lending activity migrates to shadow banks. Together, one can see that raising capital requirements by a lot barely changes overall lending activity.

What I have showed is in the mortgage sector, and one can ask: what about other sectors? It turns out that the trend that

bank balance sheet lending is becoming less important, and OTD by banks as well as shadow bank/private credit is becoming more important, exists beyond just the mortgage market. Buchak et al. (2024b) show that when one models these changes, the equilibrium changes in aggregate lending in response to an increase in capital requirements look similar to what we saw earlier in the mortgage market.

To conclude, we have a way to keep regulation geared toward financial stability simple. Banks need to have substantially higher equity. We know they can provide banking services with this change. A substantial private market/shadow banking sector already does so.

References

Agarwal, Sumit, David Lucca, Amit Seru, and Francesco Trebbi. 2014. "Inconsistent Regulators: Evidence from Banking." *Quarterly Journal of Economics* 129, no. 2 (May): 889–938.

Agarwal, Sumit, Bernardo C. Morais, Amit Seru, and Kelly Shue. 2024. "Noisy Experts? Discretion in Regulation." National Bureau of Economic Research Working Paper No. 32344, April.

Buchak, Greg, Gregor Matvos, Tomasz Piskorski, and Amit Seru. 2024a. "Beyond the Balance Sheet Model of Banking: Implications for Bank Regulation and Monetary Policy." *Journal of Political Economy* 132, no. 2 (February): 337–421.

———. 2024b. "The Secular Decline of Bank Balance Sheet Lending." National Bureau of Economic Research Working Paper No. 32176, February.

Jiang, Erica Xuewei, Gregor Matvos, Tomasz Piskorski, and Amit Seru. 2024a. "Which Banks Are (Over) Levered? Insights from Shadow Banks and Uninsured Leverage." National Bureau of Economic Research Working Paper No. 26903, March.

———. 2024b. "Monetary Tightening and US Bank Fragility in 2023: Mark-to-Market Losses and Uninsured Depositor Runs?" *Journal of Financial Economics* (forthcoming).

11

Liquidity Rules Have Increased the Minimum Size of the Fed's Balance Sheet

Darrell Duffie

I want to talk about some new research with Adam Copeland at the Federal Reserve Bank of New York and Yilin Yang, who was in our doctoral program and is now in Hong Kong. This is about how postcrisis financial regulations have increased the minimum size of the Federal Reserve balance sheet, which is clearly an issue related to monetary policy and financial regulation, our topic for today.

I'm sure that almost everyone in the room has noticed that this week the Federal Open Market Committee [FOMC] decided to slow down the reduction of its balance sheet. That might seem a little surprising, right? You thought the job of controlling inflation was not finished yet. Maybe we shouldn't be providing that kind of accommodation—having a large Fed balance sheet. But this is not about monetary policy accommodation, based on assets owned by the Fed. It's rather that the Federal Reserve learned back in 2019 that banks need a certain amount of cash held at the Fed to run their part of the financial system. And if they don't have that cash, bad things can happen in terms of funding markets. Let me explain more carefully what I just said.

You can think, as a metaphor for reducing its balance sheet, of the Fed landing a big airplane onto a runway. But it's foggy and the Fed is not exactly sure how far down it is to the runway. It wants to

This chapter is taken from the transcript of spoken remarks at the conference and retains the character of live speech.

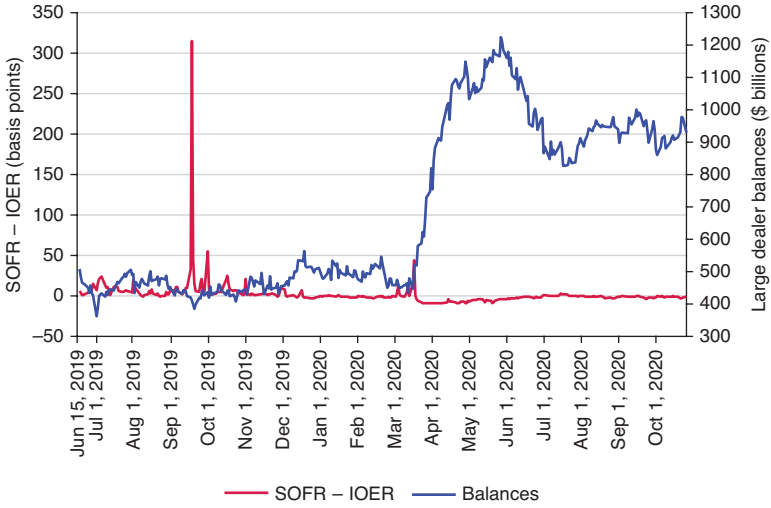

FIGURE 11.1. The risk of a liquidity crunch is higher when the reserve balances of the largest dealers are lower.

Source: Adam Copeland, Darrell Duffie, and Yilin Yang, "Reserves Were Not So Ample After All," Federal Reserve Bank of New York Staff Report Number 974, revised, June 2024, forthcoming, *Quarterly Journal of Economics*. © 2024 Federal Reserve Bank of New York. Content from the New York Fed subject to the Terms of Use at newyorkfed.org.

land very carefully. When it last landed, in September 2019, there was a big bump because the Fed landed very quickly. Funding markets were not able to cope with having such a low amount of cash held by banks at the Fed. So, this time around, as part of its FOMC announcement this week, they want to start earlier and go slower with their landing. They are going to land on a longer runway—and more slowly—so that they don't bounce on the runway. I'll take a minute to explain the chart (figure 11.1) showing the bounce that happened last time. On the left-hand vertical axis is the spread between the most important interest rate negotiated in funding markets, called SOFR—the Secured Overnight Financing Rate—and the interest rate paid by the Fed on bank balances. That spread is used as a gauge of the tightness of reserve balances. On the right-hand vertical axis, you're seeing the total reserve balances of the ten most active dealer banks that are providing funding in wholesale markets.

The FOMC also mentioned this week that it wants to reduce its balance sheet more slowly because it wants to make sure that reserve balances are being held in the right places in the financial system. Funding markets are basically intermediated by these ten largest dealer banks. Now let's take a look at what happened as the Fed's balance sheet declined beginning around 2018. Eventually, balances held at these ten largest banks reached a low point in September 2019, at which time we can see the big spike in funding market spreads. Basically, funding markets could not deal with that low a level of balances. In fact, intraday spreads jumped to one thousand basis points in the interdealer market. This was quite a disruption! Actually, there are a lot of other little bumps in the red line that don't seem very noticeable in this chart, but are considered very large disruptions in funding markets. Those bumps continued until the COVID-19 shock of March 2020. As a by-product of the COVID shock, the Fed had to buy an enormous number of Treasuries, which pumped up reserve balances at the dealer banks, at which point these bumps in funding spreads stopped. There have been no serious disruptions in funding markets ever since, because there have been abundant reserves.

Now, as the Fed is again bringing down its balance sheet and reducing the amount of reserves in the system, it wants to do that very carefully. Please now focus on figure 11.2, which illustrates the major part of the story. How those funds are distributed in the banking system matters, as the Fed has said. On the horizontal axis are the opening-of-day balances of the next ninety largest banks in the system. Remember, the top ten are the largest ten banks intermediating wholesale funding markets. The vertical axis shows how late in the day those ten critical dealer banks have received the first half of their daily incoming payments. You can see a clear relationship. When the other ninety banks have low balances, the critical ten dealer banks are getting paid later in the day. The R^2 for this relationship is about 69%. And if you have good color

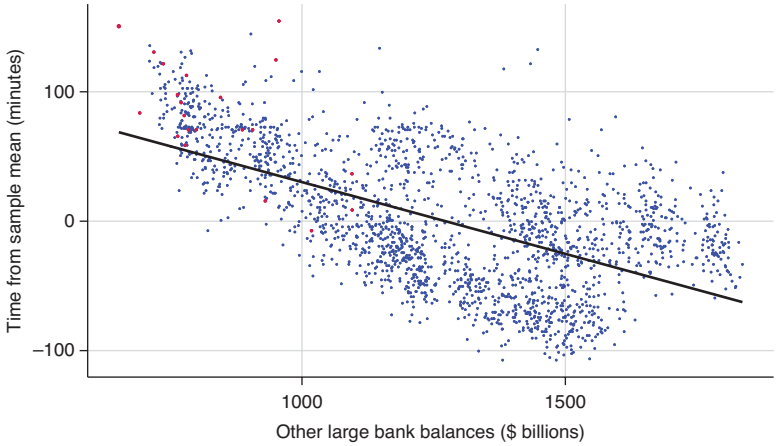

FIGURE 11.2. When reserves are lower, the largest dealer banks receive payments later in the day.

Source: Copeland, Duffie, and Yang, "Reserves." © 2024 Federal Reserve Bank of New York. Content from the New York Fed subject to the Terms of Use at newyorkfed.org.

sight, you'll see red dots up in the left corner of this scatterplot. Those are the days on which Treasury repo market disruptions were greatest. Treasury repos make up a $4 trillion-a-day market. The spread between repos and the interest rate paid by the Fed on balances skyrocketed on the red-dotted days. Notice they're clustered up on the top left, and the top leftmost red dot is that day in September 2019 when funding rates skyrocketed. To further establish the relationships among funding spreads, opening-of-day reserve balances, and the lateness of payments to our ten big dealer banks, our paper uses quantile regressions and probit analysis to analyze when the system had insufficient balances—that is, when these ten dealer banks are getting paid too late in the day. In reaction, they provide funding to others at excessively high rates.

To illustrate this, let me run a little experiment. Suppose you all have ten plastic poker chips and I give you each a list of ten other people in the room to whom you must pay fifty poker chips today. So, you must pay out five times as much as your initial stash of poker chips. You might ask, "How would I do that?" Well, others

are paying you poker chips during the day, so if you wait long enough, you'll eventually have enough poker chips to pay the other folks all fifty chips. But if everybody waits, that's a problem, because nobody would then get their chips until everybody else pays their chips. I think you all have the correct mental image. Now in the middle of this, Steve Davis—over here—calls John Cochrane—over there—in the morning, and says, "John, I want to borrow some money in the repo market. I'm really in need of funding." Today, however, John, you actually start the day with only five chips. So, John thinks, "Whoa, normally I have ten. Today my balances are only five. Steve's calling me for funding. I'm probably not going to get very many chips until later in the day because everybody else may also have fewer-than-normal chips and may be paying me late. So, I'm going to give Steve a very high quote for the interest rate on his funding. Steve's going to be very disappointed. He might not even like the idea of borrowing money at this high rate."

With this, I think you may all have a mental image of why having enough chips spread around the room—a metaphor for banks having enough cash held at the Fed—is critical for running the financial system. Not only do you all need to make payments to each other, but a critical ten of you, like John, are being asked to provide wholesale funding to markets.

Okay, so why don't we just find out what's the minimum level of chips in the system to make this work? That's basically where the Fed is now—finding its way down as it lands this plane. The Fed wants to feel its way down to the minimum level of reserve balances that does not lead to big bumps in funding markets, but this is an instrument-landing situation, where it would be nice to have an additional instrument. That's what I'm going to be showing you next. The elevation of the runway in this metaphor is uncertain because the structure of the financial system is changing all the time. Financial regulations are changing. For example, the Basel III Endgame is going to change the minimum capital requirements

of big banks. Last year at this Hoover conference we discussed the fact that the Fed may need to increase the amount of liquidity that banks are required to have in order to meet the demands of uninsured depositors in a bank run. And I suggested how this can be mitigated by prepositioning collateral at the Fed's discount window so that banks won't have to rely so much on reserves.

There are other changes in the financial system over time. It's difficult to know the minimum level of reserves. Again, that's why the Fed is now slowing down the pace of reductions in its balance sheet. There are some costs associated with a large balance sheet. These have been pointed out to me many times, for example by Bill Nelson and Charlie Plosser, who are here today and have written effectively on the costs of a large Fed balance sheet, which raises the volatility of the Fed's income and causes the Fed to have a larger footprint in money markets. On the other hand, if there are not enough balances in the system, we can get the funding market disruptions that I have described. The Fed's reputation for being in control of the situation can be reduced. There are also financial stability concerns: maybe Steve Davis really needed that funding from John Cochrane to roll over his obligations today—he might go belly-up. These stresses can be serious. The Fed can't really afford to take big chances. I think that explains why the FOMC made the decision that it made this week.

So, what about an extra early-warning sign? If you don't know exactly how far down it is to the runway and you are in the fog, maybe you need another instrument. In our latest results, we show that you could look back over the last ten days and monitor how late in the day these dealer banks—like John Cochrane in my experiment today—are getting their funding. If they are getting paid later and later in the day, you can guess that they're going to be reluctant to lend money at normal, competitive rates and that there is going to be some market disruption.

On the horizontal axis of figure 11.3 is the calendar date. On the vertical axis is the time of day by which those ten big active dealer

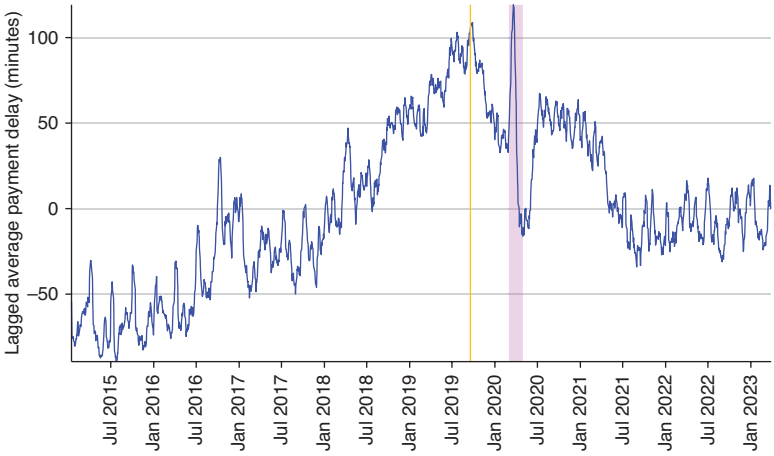

FIGURE 11.3. Later payments to the dealer banks signaled a likelihood of a liquidity crunch in September 2019.

Source: Copeland, Duffie, and Yang, "Reserves." © 2024 Federal Reserve Bank of New York. Content from the New York Fed subject to the Terms of Use at newyorkfed.org.

banks have received half of their incoming payments, relative to normal. So, one hundred on this scale means one hundred minutes later than normal. Getting paid one hundred minutes late is a warning sign that the Fed should stop reducing its balance sheet. The first vertical line on the chart is that day in September 2019 on which funding rates skyrocketed by hundreds of basis points. You can see from the trend in the lateness of payments to the dealer banks that this situation was building. Maybe if we had done our research earlier the Fed might have seen this as an early warning sign. Our paper provides quantile regressions showing that the lagged ten-day payment delay, that time of day by which John and the other nine dealer banks are getting paid half of their incoming balances, is useful information. When that time of day is late, say, more than fifty minutes later than normal, one would want to stop reducing the amount of cash balances that are available to the banks—or suffer some of the costs I have mentioned.

12

Can Fed Supervision Be "Independent" under US Law?

Christina Parajon Skinner

It is no exaggeration to say that all central banking policymakers and academic experts are well versed in the tenets of central bank independence.[1] Economists long ago discerned that politicians, acting in their near-term interests for popularity and reelection, have strong incentives to pressure central bank decision makers to assert accommodative monetary policy (formerly, low interest rates; in the future, this could include quantitative easing programs). Equally, it could be observed that running accommodative monetary policy for political reasons, and in the absence of economic data indicating for it, generally leads to inflation. Accordingly, the short-term interests of politicians (usually in the executive branch) are not aligned with the medium- and longer-term interests of society more broadly.[2]

Widespread acknowledgment of this incentive mismatch led to the global embrace of "central bank independence." Throughout the 1990s and early 2000s, the canon of central bank independence (CBI) developed into a norm against executive branch meddling in central bank policymaking, either formally (as in the UK, where the law changed to establish the Bank of England's operational independence for monetary policy) or informally, by reducing incidence of Treasury or presidential pressure on the central bank (as had previously been the case in the United States).[3]

Although central bank independence thus became a norm that was globally shared, technically speaking, whether a given central bank is,

in fact, "independent" from its government still has a distinct legal meaning.[4] In some jurisdictions, central bank independence in law simply refers to the fact that the central bank has been given a statutory mandate for price stability, implying that the central bank should have operational freedom to make the requisite policy choices. But CBI does not necessarily preclude the government from having a say in the overall trajectory or goals of monetary policy. This is the setup in the UK.[5]

In other jurisdictions, such as the European Union (EU), central bank independence has constitutional status; the Treaty on the Functioning of the European Union is explicit that neither the EU institutions (i.e., the European Commission, the European Parliament) nor member states' governments should "seek to influence" or give directions to the European Central Bank (ECB).[6]

In the United States, the Federal Reserve's independence has never been expressly established in the Federal Reserve Act, but Congress did offer the members of the Fed Board protections that are typically conferred on other non–executive branch agencies performing "quasi-legislative tasks."[7] In particular, members of the Board of Governors are given long fourteen-year terms, and they are also protected from removal from office. The Federal Reserve Act provides that the governors shall be entitled to serve out their term in office "unless sooner removed for cause by the President."[8] Although Congress never defined what constitutes a valid "cause" for removal, over the years legal experts have tended to assume a meaning roughly equivalent to the one afforded many other independent agencies—that is, "inefficiency," "neglect," or "malfeasance" in office. In turn, a consensus developed that none of these terms encompasses policy disagreements with the president.[9]

Reflecting on the rationale for central bank independence, and on the national differences in legal structures that have conferred on central banks their formal independence, raises important but unanswered questions about the universality of the version of CBI

that has heretofore been assumed. First, as a matter of policy optimality, should central bank independence extend to all of the functions a central bank performs—and specifically, does central bank independence extend to central bank *supervision of the banking sector*? Second, does US law support independent Fed supervision?

The Rationale for CBI in Monetary Policy versus Fed Supervision

Since the Global Financial Crisis, major central banks around the world have acquired new—or at least supercharged—supervisory powers. In some cases, central banks acquired new supervisory units or mandates altogether. In the UK, banking supervision was transferred back to the Bank of England, with the creation of the Prudential Regulation Authority (PRA) in 2012 (which commenced operation in 2013).[10] In Europe, the ECB was given new pan-European supervisory tasks as the Single Supervisory Mechanism (SSM) was created in 2013.[11]

The Fed, for its part, had always been a microprudential supervisor (with the task primarily carried out by the regional reserve banks) and, since the 1990s, the Board had been acting as the "consolidated" supervisor (the banking agency with a bird's-eye view) for bank and financial holding companies.[12] But after the Financial Crisis, the Fed assumed newly expanded "macroprudential" responsibilities. These included, among others, designing heightened prudential and supervisory requirements for the largest, systemically important banks; conducting supervisory stress testing on the banking system as a whole; and assuming supervision over a new category of nonbank financial institutions that are designated as systemically important by the Financial Stability Oversight Council (FSOC).[13] And in general, the Fed widened its supervisory field of vision considerably by assuming a new mandate not only for bank "safety and soundness" but also for "financial stability" more generally.[14]

Inasmuch as central bankers have expanded their roles, so, too, have they extended their thinking about central bank independence. In particular, as central bankers began to use their new supervisory tools, they also asserted the need to operate them independently from political pressure. Global central banking authorities, such as the International Monetary Fund (IMF) and Bank for International Settlements (BIS), seem to suggest that independent central bank supervision should be the new norm in every jurisdiction. IMF research, for example, has suggested that "good" and "effective" supervision requires "operational independence to carry out their tasks free of outside pressures."[15] In a similar spirit, the general manager of the BIS, Agustín Carstens, claims that "banking supervision needs to up its game . . . [and to] do this supervisors will need to have operational independence."[16]

Recently, those views have been echoed by members of the Federal Reserve Board. The current chair of the Board, Jerome Powell, stated publicly in 2023 that "in the area of bank regulation, too, the Fed has a degree of independence, as do the other federal bank regulators. Independence in this area helps ensure that the public can be confident that our supervisory decisions are not influenced by political considerations."[17] Other members of the current Fed Board have expressed a similar view at various points in time.[18] But this notion that central bank independence has automatically extended to the Fed's banking supervisory role has not always been assumed. Fed Chair Ben Bernanke, for example, was explicit in his view that "independence afforded central banks for the making of monetary policy . . . should not be presumed to extend without qualification to its nonmonetary functions," such as "oversight of the banking system."[19] Most certainly, Milton Friedman's concerns about the democratic deficit inherent in CBI would have been exacerbated by the notion of independent central banking supervision.[20]

Indeed, these more recent assumptions about "CBI-S," as I have referred to it in another setting, may prove too much—at least in the

US case. As a matter of policy optimality and democratic legitimacy, should Fed supervision be "free from governmental tinkering," as Friedman once said?[21] There are at least three critical differences between monetary policy and supervision that bear on that key question.

For one, as will be elaborated on below, supervision is a coercive power of the state; monetary policy is not. Supervision entails mandatory information gathering and examination and comes with the threat of punishment. Importantly, the pace and rigor of supervision—and the regulations for which the supervisor examines banks' compliance—tend to reflect back on the flow and price of credit in a community and can affect market structure broadly. There are, as such, important implications for economic policy that follow from supervisory policy and practice, which arguably require political accountability.

And in point of fact, since the Fed acquired expanded supervisory authority in 2010, its supervisory policies have generally tracked the administration's goals—first, to ramp up heightened regulation for large financial institutions and risks outside of the banking sector; then, for tailoring that postcrisis regime; and most recently, during the Biden administration, for issues such as climate risks on bank balance sheets. This trend probably reflects the inherently political nature of supervision, but if that is to be the case, accountability to the political branches—including the president—should not be lacking. Monetary policy, in contrast, tends to be worse off with greater presidential involvement, as discussed above, and so the case that those decisions should be subject to the indirect input of the voters—or that greater presidential involvement is required as a matter of democratic legitimacy—is much weaker.[22]

Second, the Fed's mandates for "safety and soundness" and, even more so, its assumed responsibility to pursue "financial stability" confer a tremendous amount of discretion to engage in policy entrepreneurship. One recent example involves the creation of supervisory committees to scope climate risk in banks and the banking system

and the pilot of a new scenario analysis to probe climate risk in banks. The Fed, unlike the Bank of England or the ECB, does not have an explicit mandate to pursue climate- or sustainability-related goals. However, it has utilized the ambiguity within its supervisory mandates to creatively interpret certain provisions, thereby incorporating the mitigation of climate-related financial risk as an implicit supervisory objective.[23] It is much harder for the Fed to expand the ambit of its monetary policy mandate, because the pursuit of price stability has a concrete target, and the failure or success of a given sequence of decisions in pursuit of that target is clearly observable to the public. Perhaps for those reasons, the Fed Board seems far less willing to push the boundaries of its monetary policy mandate than those of its supervisory one.[24] Again, this difference suggests that whereas an independent monetary policy function does not—arguably could not—lead to *ultra vires* experimentation for "independent" supervision, this seems not to be nearly as taboo.

Third, supervisory and regulatory standards have been made to align with global standards set at Basel, but that global standard-setting process has no democratic accountability. The Basel Committee on Banking Supervision is a soft-law, informal international organization—meaning it is not a treaty-based institution and technically produces nonbinding supervisory and regulatory standards. Notwithstanding the fact that Basel is merely a group of central bankers and bank supervisors who have no formal authority to agree on law that binds their domestic jurisdictions, in practice the standards set at Basel almost always find their way into US supervisory law and lore.[25] And the US Congress has no input or involvement in the Basel process. The influence of Basel over US supervisory policy and practice thus arguably demands political accountability, not independence. There is nothing remotely equivalent to Basel in the realm of monetary policy.

This is not to say that independent central bank supervision is unsuitable for every jurisdiction. However, in the United States,

a policy case based on the fundamental rationale for central bank independence—the time-inconsistency problem—is not entirely clear. Even if it were, the requirements of democratic legitimacy make a fully independent Fed supervisory function difficult to achieve.

What US Law Says about Independent Fed Supervision

Setting the rationale for independent Fed supervision to one side, a separate—perhaps antecedent—question is whether US law would allow it. Certainly, in some jurisdictions, such as the ECB, the law is relatively clear that supervision should be independent from political direction.[26] Right now, however, in the United States there is a tension between statutory law on Fed supervision and the constitutional law surrounding agency independence.

As alluded to above, one of the ways that Congress has historically tried to insulate agencies from presidential interference—that is, make them "independent"—has been to give the leaders of the agency protection from removal. Congress has done just that for the members of the Board of Governors. But the Dodd-Frank Act introduced a conundrum when it comes to independence, removal, and the Fed's new supervisory role. That statute created a new position among the Board of Governors—that of the vice chair for supervision (VCS).[27] The job of the VCS is to set the overall supervisory agenda and ultimately recommend what policy course of action should be taken with regard to supervision and regulation.

If Fed supervision were to be treated as truly independent in the way that monetary policy is, then one would necessarily assume that removal from the role of VCS would be protected by the Federal Reserve Act's "for cause" language, just like removal from the Board is. But that conclusion seems constitutionally unsupported.

The president has the constitutional authority to "take care" that the law made by Congress is executed (i.e., implemented and enforced).[28]

He also has the constitutional responsibility to appoint those officers who will lead the administrative agencies that support him in this work.[29] In order to effectively supervise his agents, the president is likewise constitutionally permitted to remove those officers at will.

Indeed, as the Supreme Court clarified only recently, in the case of *Seila Law v. CFPB*, "the President's removal power is the rule, not the exception."[30] Renowned scholars of constitutional and administrative law recognize that "on both originalist and non-originalist grounds, there are reasonable arguments in favor of the view that, as a matter of constitutional right, the President must have substantial ability to remove and supervise all those who execute federal law."[31] In *Seila Law*, the court recognized only two exceptions to this rule: one, for groups of "principal officers," much like a commission; and two, for officers who have only "limited duties and no policymaking or administrative authority."[32] Neither of those exceptions applies in the case of Fed supervision as spearheaded by a VCS.

With regard to the first exception, so long as the VCS has agenda-setting power and the chair defers to the VCS's decisions (at least in the first instance), then this exception would seem not to apply at the Fed. A separate question, beyond the scope of this chapter, is whether the performance of significant supervisory duties across the Fed Board would be any better, as it might dilute the rationale for the Fed's independence overall.[33] With respect to the second exception, the VCS obviously does more than administrative work. As Peter Conti-Brown and Simon Johnson note, the VCS enjoys "the broadest grant of authority to an individual in the Federal Reserve Act—greater than even the explicit authority given to the Fed Chair" and can "set the tone for the Fed's entire regulatory apparatus."[34]

Two further constitutional precepts call into question the constitutional legitimacy of Dodd-Frank's seeming intention to establish the VCS as the head of an independent supervisory agency within the Fed. For one, the court in *Seila Law* also reminded us that no officer exercising executive power can be shielded from presidential

removal. The Supreme Court cited as hallmarks of executive power an agency's ability to create rules, otherwise restrict business activity, and impose monetary penalties. The VCS, when wielding the Fed's supervisory toolkit, has that same authority. On the front end, supervision involves the state's imposition of requirements for otherwise confidential and proprietary information on banks and asserts the state's entry, for examination, in the institution. On the back end, the output of supervision ranges from the moral suasion of the "Dear CEO" letter to informal agreements by which the bank consents to implementing the supervisors' required changes, to more formal consequences such as fines or consent decrees. Monetary policy, of course, is a completely different kind of policy action. The effects of interest rate policy are dispersed upon the economy as a whole; they are not targeted at any person or institution. They do not compel action, impose punishment, or prohibit activity. Accordingly, it is nearly impossible to argue that the Fed's supervisory function, as de facto led by the VCS, can be entitled to independence in the form of protection from removal.

The second point to bear in mind is that, for the Fed, the rationale for independence is equal parts law and economics. The discussion above set out the economic rationale, grounded in the time-inconsistency problem. But also, in the US case, independent monetary policymaking is constitutionally compelled. The power to "coin money" and "regulate" its value is assigned exclusively to Congress in Article I, Section 8 of the Constitution. Beyond peradventure, the framers and ratifiers of the Constitution were careful and intentional about vesting these monetary powers with Congress and keeping them isolated from the president's reach.[35] Accordingly, when Congress delegated this power to the Fed, the Fed become the paradigm of a "quasi-legislative" agency that merits its independence from the president.[36] Supervision, on the other hand, does not follow from a legislative power; again, it is precisely the opposite—a direct effort to implement and enforce the law.

Conclusion

In summary, the US Constitution is uncomfortable with an independent Fed supervision function. Are there possible structural solutions to the disconnect between Congress's vision in the Dodd-Frank Act for strong and independent supervision and the constitutional limits on Congress's ability to confer on an agency a wide berth from the president? One solution would be to eliminate the role of the vice chair for supervision. However, in order to preserve the Fed Board's independence for monetary policymaking, which could still be polluted by a muscular supervisory arm, some structural separation between Board members engaged in supervisory work and those involved in monetary policy work might be advisable—along the Bank of England model.

If, on the other hand, the VCS role has important policymaking and governance value and should therefore be preserved, future governments could simply observe that the "for cause" protection in the Federal Reserve Act does not apply to the VCS role—and the public should understand that adopting a convention of "at will" removal for the VCS would not affront the Fed's bona fide independence.

Notes

1. This chapter is adapted from a longer law journal article entitled "The Independence of Central Bank Supervision." That draft of the article, which was presented at the 2024 Hoover Monetary Policy Conference, is available at https://www.hoover.org/sites/default/files/2024-04/Parajon%20Skinner_Independence%20of%20Central%20Bank%20Supervision_Hoover.pdf.
2. This theory is generally known as the time-inconsistency problem and was first articulated by economists Finn Kydland and Edward Prescott. See Finn E. Kydland and Edward C. Prescott, "Rules Rather Than Discretion: The Inconsistency of Optimal Plans," *Journal of Political Economy* 85 (1977): 473–91. For an early discussion of time inconsistency, see "Time-

Inconsistency: A Potential Problem for Policymakers," *Federal Reserve Bank of Philadelphia Business Review*, March 1985. See also Thomas Drechsel, "Estimating the Effects of Political Pressure on the Fed: A Narrative Approach with New Data," National Bureau of Economic Research Working Paper No. 32461 (May 2024).

3. Michael Salib and Christina Parajon Skinner, "Executive Override of Central Banks: A Comparison of the Legal Frameworks in the United States and the United Kingdom," *Georgetown Law Journal* 108 (2020): 905–63.
4. Most democratic nations embraced central bank independence. There remain, of course, exceptions, and some countries continue to house their central banks within their governments. The People's Bank of China is one example.
5. Bank of England, "How Is the Bank of England Independent of the Government?," last updated May 18, 2020.
6. "Protocol (No. 4) on the Statute of the European System of Central Banks and of the European Central Bank," in *Consolidated Version of the Treaty on the Functioning of the European Union*, 2012 O.J. (C 326) 230, art. 130.
7. Humphrey's Executor v. United States, 295 U.S. 602 (1935).
8. Federal Reserve Act, § 10. This was added in the Banking Act of 1935, which amended the Federal Reserve Act in important ways.
9. See Cass R. Sunstein and Adrian Vermeule, "Presidential Review: The President's Statutory Authority over Independent Agencies," *Georgetown Law Journal* 109, no. 3 (February 2021): 637–64. Although not referencing the Federal Reserve Act specifically, these two legal scholars have concluded that "strictly as a matter of statutory interpretation, if the INM standard means anything, it means that the President cannot discharge a member of an independent agency simply because he disagrees with the agency's conclusions about policy or fact."
10. Financial Services Act 2012, c. 21, United Kingdom.
11. Council Regulation (EU) No. 1024/2013 of 15 October 2013 conferring specific tasks on the European Central Bank concerning policies relating to the prudential supervision of credit institutions, *Official Journal of the European Union* L 287 (2013): 63–89.
12. Gramm-Leach-Bliley Act, Public Law 106-102, 113 Stat. 1338 (1999).
13. "Dodd-Frank Wall Street Reform and Consumer Protection Act," Pub. L. No. 111-203, 124 Stat. 1376 (2010); Board of Governors of the Federal

Reserve System, "Supervising and Regulating Financial Institutions and Activities," in *The Federal Reserve System: Purposes & Functions*, 10th edition (2016), 98. For an overview of the FSOC and the designation process and its problems, see Christina Parajon Skinner, "Regulating Nonbanks," *Georgetown Law Journal* 105 (2017): 1529.

14. On the banking agencies' financial-stability mandates, see Christina Parajon Skinner, "Financial Stability and Bank Agency Discretion," *University of Chicago Law Review*, forthcoming (2024).
15. The IMF, for example, has published research indicating that "good" and "effective" supervision "require[s] operational independence to carry out their tasks free of outside pressures." "Financial Stability Needs Supervisors with the Ability and Will to Act," International Monetary Fund, September 18, 2023.
16. Agustín Carstens, "Investing in Banking Supervision," speech at the European Banking Federation's International Banking Summit, Brussels, June 1, 2023.
17. Jerome H. Powell, "Central Bank Independence and the Mandate—Evolving Views," speech, Chair of the Board of Governors of the Federal Reserve System, January 10, 2023.
18. See, for example, Michelle W. Bowman, "Independence, Predictability, and Tailoring in Banking Regulation and Supervision," remarks at the American Bankers Association Conference for Community Bankers, Orlando, FL, February 13, 2023; and Michael S. Barr, "Comment: Accountability and Independence in Financial Regulation: Checks and Balances, Public Engagement, and Other Innovations," *Law and Contemporary Problems* 83 (2020): 119.
19. Ben S. Bernanke, "Central Bank Independence, Transparency, and Accountability," Board of Governors of the Federal Reserve System, May 25, 2010.
20. Milton Friedman, "Should There Be an Independent Monetary Authority?," in *In Search of a Monetary Constitution*, ed. Leland B. Yeager (Cambridge, MA: Harvard University Press, 1962).
21. Friedman, "Should There Be an Independent Monetary Authority?"
22. In contrast, as I have written with Andrew Levin, monetary policy should be highly accountable to Congress. See Andrew Levin and Christina Parajon Skinner, "Central Bank Oversight," *Vanderbilt Law Review*, forthcoming (2024).

23. See Christina Parajon Skinner, "Central Banks and Climate Change," *Vanderbilt Law Review* 74 (2021): 1301.
24. See Federal Reserve Board of Governors, "Press Conference, Jerome H. Powell, Chair," January 27, 2021, https://www.federalreserve.gov/mediacenter/files/FOMCpresconf20210127.pdf.
25. For an account of the legitimacy of the Basel regime, see David Murphy and Christina Parajon Skinner, *The Legitimacy of the Basel Regime for Bank Prudential Regulation* (draft on file with author).
26. See Jésus Fernández-Villaverde and Christina Parajon Skinner, *Central Banks within Democracy*, chapter 7 (manuscript on file with author).
27. 12 U.S.C. § 242 (2024).
28. US Constitution, Article II, Section 3.
29. US Constitution, Article II, Section 2, Clause 2.
30. Seila Law LLC v. Consumer Financial Protection Bureau, 140 S. Ct. 2183, 2206 (2020).
31. Cass R. Sunstein and Adrian Vermeule, "Presidential Review: The President's Statutory Authority over Independent Agencies," *Georgetown Law Journal* 109, no. 3 (2021): 637–64.
32. Seila Law, 140 S. Ct. 2183.
33. The Supreme Court has stated that the tenets of agency independence articulated in *Humphrey's Executor v. United States* apply to "a multimember body of experts, balanced along partisan lines, that performed legislative and judicial functions and was said not to exercise any executive power." Free Enterprise Fund v. Public Company Accounting Oversight Board, 561 U.S. 477, 505 (2010). For one thing, the Fed is not required to be balanced along party lines. Moreover, as has been discussed, engaging in supervisory policy of this magnitude constitutes executive power.
34. Peter Conti-Brown and Simon Johnson, "Governing the Federal Reserve System after the Dodd-Frank Act," Peterson Institute for International Economics, October 2013.
35. See Christina Parajon Skinner, "The Monetary Executive," *George Washington Law Review* 91 (2023): 164.
36. The canonical case articulating the rationale for agency independence, and distinguishing those agencies that are properly afforded it, is *Humphrey's Executor v. United States*. There, the court said, "The result of what we now have said is this: Whether the power of the President to remove an officer shall prevail over the authority of Congress to condition the power by fixing

a definite term and precluding a removal except for cause, will depend upon the character of the office." Humphrey's Executor v. United States, 295 U.S. 602, 631 (1935). And in particular, "The authority of Congress, in creating quasi-legislative or quasi-judicial agencies, to require them to act in discharge of their duties independently of executive control cannot well be doubted; and that authority includes, as an appropriate incident, power to fix the period during which they shall continue in office, and to forbid their removal except for cause in the meantime." *Humphrey's Executor v. United States*, 629.

13

Financial Stability and Monetary Policy: Lessons from the UK's LDI Crisis

Carolyn A. Wilkins

The study of links between monetary policy and financial sector policies is not new, with financial stability having long been part of many central bank mandates.[1] For instance, leading up to the Global Financial Crisis (GFC) there was a particular focus on whether low interest rates were fueling risk taking, and the merits of using monetary policy to "lean against" asset-price booms.[2] The GFC showed that monetary and microprudential policies were not sufficient for ensuring financial stability, paving the way for the development of macroprudential policies.[3]

By the late 2010s, compressed term and risk premia led to a very different concern: how rapid and sizable increases in interest rates could create financial stress. It was the subject of numerous risk assessments by many international bodies, including the Financial Stability Board (FSB), the International Monetary Fund (IMF), and the Bank for International Settlements (BIS) in the late 2010s.[4] This concern was also shared by the Bank of England (the Bank), and led the Bank's Financial Policy Committee (FPC) at that time to include an increase in interest rates as part of its stress-testing exercises on banks from 2017 onward.[5] In November 2018, the FPC also published an assessment of the risks from leverage in the nonbank financial system, which included the liability-driven investment

This chapter reflects my own views and not necessarily those of my Financial Policy Committee colleagues or Monetary Policy Committee members.

(LDI) sector.[6] Through 2021 and 2022, the FPC also warned that vulnerabilities in market-based financing could amplify shocks to market liquidity conditions.[7]

A version of this interest rate risk has indeed materialized in many jurisdictions over the last couple of years, although it was largely the result of a sharp and rapid rise in policy interest rates among many central banks to quell inflation, rather than a rise in risk premia. For its part, the Bank's Monetary Policy Committee (MPC) raised the policy rate by a cumulative 515 basis points between November 2021 and August 2023. While in the United Kingdom monetary policy actions have supported financial stability by returning inflation to target sustainably, the sharp transition to higher interest rates and greater market volatility could create stress in the financial system.[8] The FPC holds the view that UK households, businesses, and banks are resilient, but uncertainties remain given the risks and the fact that it takes time for the full impact of higher interest rates to come through.

These remarks will first address the dog that did not bark in the UK (but has in the United States)—interest rate risk on the banking book. I will then delve into the one that did—when fiscal policy announcements were followed by a significant rise in long-term gilt yields and then amplified by liquidity issues in highly leveraged LDI funds used by UK pension schemes. My remarks aim to draw out the following five lessons:

1. Market forces can be unpredictable and merciless, especially in the face of poorly managed risk.
2. Stress tests must be developed using better data and models to capture interconnections—including in nonbank financial intermediation (NBFI)—and to test operational resilience and scenarios that may have no historical precedent.
3. Financial stability interventions, if temporary and targeted, support monetary policy objectives without necessarily affecting the stance of monetary policy.

4. Central bank liquidity facilities need further development, particularly with regard to NBFI.
5. The Bank of England financial stability framework showed its worth, supported by a clear financial stability mandate, governance, and separation of responsibilities between the MPC and the FPC.

The Dog That Did Not Bark in the UK

The move toward tightening monetary policy to control inflation, which started in December 2021 in the UK and in March 2022 in the US, meant that banks operating in those jurisdictions were faced with sizable and rapid increases in interest rates. The speed of the monetary policy tightening made adjustments to higher rates particularly challenging.

This situation, combined with inadequate capital and liquidity, deficiencies in risk management, and highly mobile deposits, prompted the failure of Silicon Valley Bank (SVB), among others in the US, in March 2023 for reasons that are well known.[9] Aside from the spillover of SVB's trouble to its UK subsidiary, UK banks have been resilient in the face of monetary policy tightening.[10] There are a number of reasons for this positive outcome relative to SVB, the most important relating to these factors:

1. *Capital adequacy:* All UK banks hold capital against interest rate risk on the banking book, under Pillar 2A.[11]
2. *Liquidity management:* All UK banks are subject to liquidity requirements under Basel III (i.e., the liquidity coverage ratio [LCR] and the net stable funding ratio [NSFR]). In contrast, SVB was not subject to these requirements.[12]
3. *UK bank balance sheets:* These are less vulnerable than SVB's in that UK banks typically have much smaller "hold to maturity" portfolios, and do not have the extremely high reliance on uninsured deposits (e.g., 94% for SVB) coupled with heavy concentration in a particular sector.[13] This higher reliance on uninsured deposits means a greater

deposit flight potential when a risk crystallizes, including in a situation where rapidly rising interest rates expose risks to banks that have not been properly managed.

Together these factors have contributed to relative stability of deposits in UK banks, both in the face of the spike in gilt yields in 2022 and then in the wake of the US bank failures in 2023.

The Dog That Did Bark

Rising interest rates may not have triggered financial stress in the UK banking system, but stress in LDI funds used by pension schemes was triggered on September 23, 2022, when long-dated gilts spiked in response to the government's mini-budget announcement. This prompted the Bank of England to intervene with temporary and targeted gilt purchases to restore market functioning and, ultimately, protect financial stability in the UK.[14]

LDI Approach Aims to Lower Risk (But Can Do the Opposite)

LDI is an investment approach used by pension schemes to achieve a smoother, more certain path to fully funded status.[15] In particular, this approach seeks to match the sensitivities of scheme assets to liabilities, which are generally driven by (1) interest rates, and (2) inflation. For instance, an LDI strategy can be used to mitigate the risk of falling interest rates increasing pension-scheme liabilities, while still allowing some margin to invest in higher-yielding assets than gilts.

With the secular decline in government bond yields over several decades in the UK and other developed economies, LDI strategies became popular. At the end of 2021, there was an estimated £1.4 trillion of assets held in LDI strategies in the UK; around

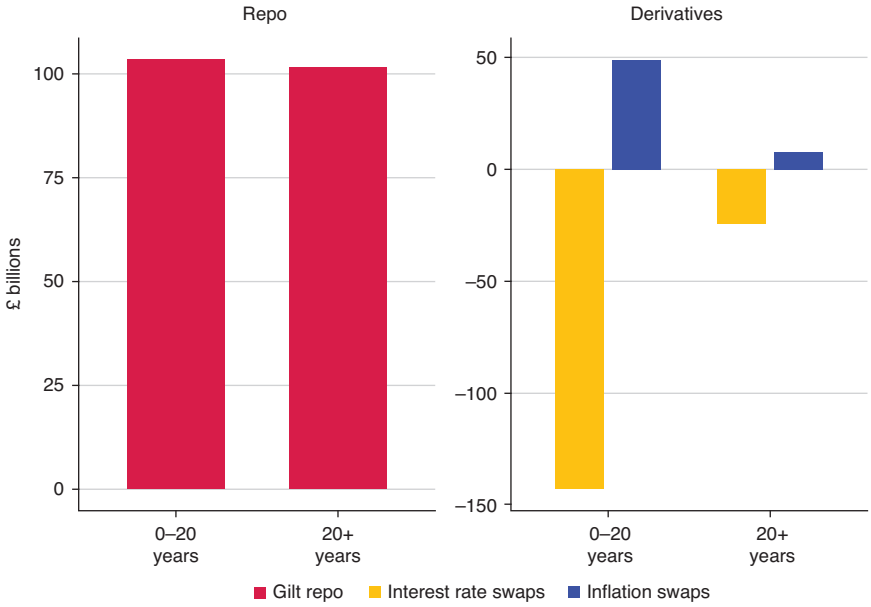

FIGURE 13.1. Net notional of outstanding swap positions (by contract maturity) and net repo borrowing (by collateral maturity) as of September 22, 2022.
Source: Lydia Henning, Simon Jurkatis, Manesh Powar, and Gian Valentini, "Lifting the Lid on a Liquidity Crisis," Bank of England, July 18, 2023.

85% of these assets were managed within segregated funds and the remainder were in multi-investor-pooled funds.[16] Typically, LDI funds in the UK used leverage through repo borrowing or interest rate derivatives (figure 13.1).[17] This allowed their pension-scheme clients to increase their hedges against falling interest rates with a lower up-front investment than if they had pursued an unleveraged LDI hedging strategy.

Any leveraged strategy comes with downside risks, for the individual firm and for the broader market, in the face of sharp declines in asset prices, as my colleague Jon Hall outlined very clearly.[18] If leveraged investors cannot raise capital or accept higher leverage, they are forced to sell assets in a declining market, amplifying the initial shock.

The risk to the LDI strategy materialized in September 2022 when interest rates rose sharply in response to the fiscal announcement. Although higher rates in general were positive for pension schemes overall, the LDI funds faced rapidly accelerating losses and large collateral calls such that they had an urgent need for capital. If the pension schemes were unable to provide capital in time, the LDI fund managers were forced to rebalance by selling gilts into an illiquid market. As discussed below, the prospect of forced selling at scale set in motion an amplificatory "doom loop" that put the long-term gilt market under extreme stress.

To some extent there was a similar set of challenges facing LDI funds in the Netherlands, but the key differences were that Dutch investors had more diversified bond and less-leveraged portfolios, which meant that the sell-off did not spark broader market stress, and they did not face the same magnitude of repricing.[19] LDI strategies are deployed in other countries but are much more significant in the UK, where they account for 80% of the overall defined-benefit market, compared to around 40% in the US and 35% in the European Union (EU).[20]

The Mini-Budget Announcement Awakened Market Forces

Yields on long-term government securities had been on an upward trend in peer jurisdictions in the months leading up to the September 2022 episode, commensurate with a monetary policy tightening cycle. For the Bank of England's part, the MPC began raising interest rates in December 2021, and quantitative tightening (QT) commenced two months later, initially through maturities. Following the MPC announcement on September 22, 2022, the Bank rate was raised 50 basis points to 2.25%, and a plan was announced to start the selling of gilts in QT in October. Markets adjusted to the news smoothly (i.e., a rise of 20 basis points on the

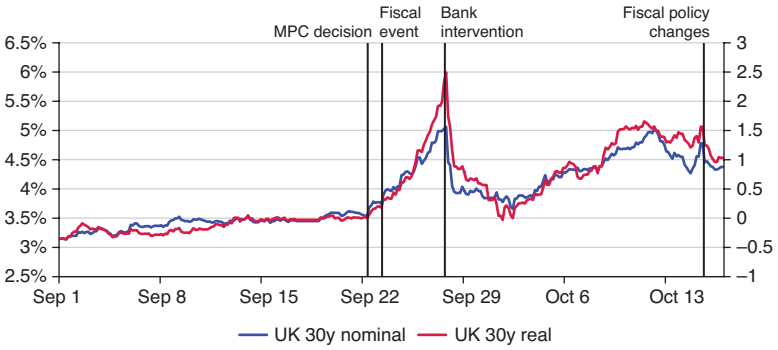

FIGURE 13.2. Blowout in yields on thirty-year UK gilts (basis point change since August 1, 2022), nominal (LHS) and real (RHS).
Source: Bank of England calculations.

day of the announcement commensurate with rises on other sovereign bond markets such as the US), as these moves were widely expected by markets and market liquidity remained good. There is therefore no indication that the rise in yields on subsequent days was induced by monetary policy.

There was, however, a clear break in gilt yields on the announcement of the new "Growth Plan" from the government on September 23 (figure 13.2).[21] Market reports indicated growing concerns among investors as to the government's commitment to fiscal responsibility, and doubts about whether the plan would indeed spur growth.[22] These concerns appear to have been the driving forces behind the spike in thirty-year nominal gilt yields, which started on the day the mini-budget was announced and totaled 130 basis points by September 28 (and thirty-year inflation-linked bonds were up by around 170 basis points). This represented a 24% and a 38% drop in the price of thirty-year nominal and real gilts, respectively. Long-maturity nominal gilt yields rose by 130 basis points in a matter of days—three times the size of any comparable historical move, and therefore exceeding the buffer held by LDI funds that would typically cover around 100 basis points.

Lesson 1: Market forces can be unpredictable and merciless, especially in the face of poorly managed risk. Government bonds may be "free" from credit risk but are not free from interest rate risk. Clearly the LDI funds and strategies did not have adequate resilience to self-insure against this type of scenario.

The Ensuing Stress in LDI Funds Rapidly Generated a Risk to Financial Stability

In the absence of leverage, a rise in yields is generally positive for pension schemes because it reduces the present value of their liabilities more than the value of their assets. Given the leverage, however, a rise in yields created liquidity demands, particularly given that the adjustment happened quickly and over a short period. This created severe stress in gilt markets through several channels.

Forced Deleveraging and Liquidity Channel Propagated the Shock

The sharp rise in yields caused a sudden and significant rise in collateral calls on repo (biggest issue) and variation margin calls on derivative positions, amounting to an estimated £66 billion between the announcement on September 23 of the new Growth Plan and on September 28 when the Bank's financial stability operations commenced (figure 13.3). It is telling how little selling actually went through in the first few days of the stress, in which the rapid increase in gilt yields up to September 28 was driven by less than £5 billion of sales being successfully completed (a sign that liquidity was indeed very low; see figure 13.4).

The sharp rise in yields (drop in gilt prices) also caused a steep decline in the net asset value and an increase in leverage of these funds. It is not surprising that the firms in the LDI sector that

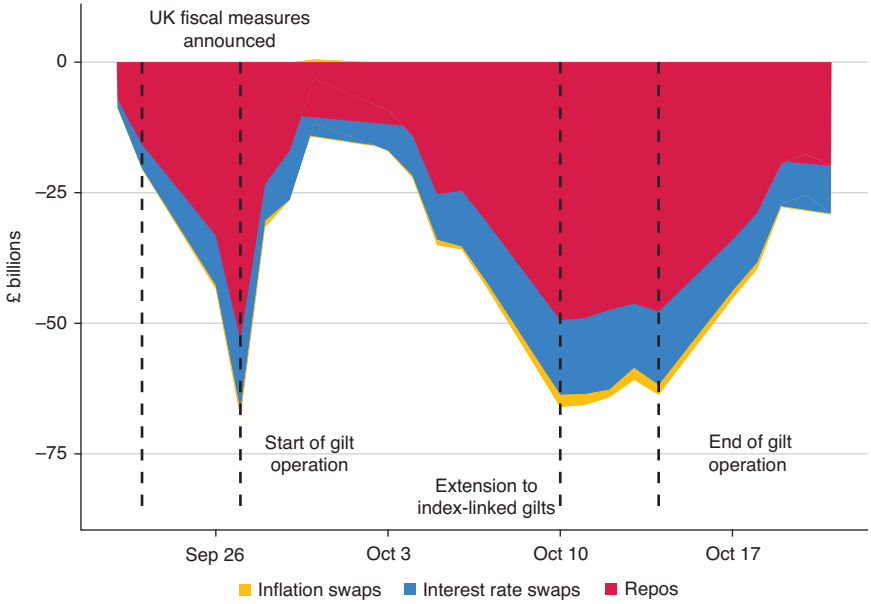

FIGURE 13.3. Cumulative variation margin on net repo borrowing and derivatives positions held by liability-driven investors (2022).
Source: Henning et al., "Lifting the Lid."

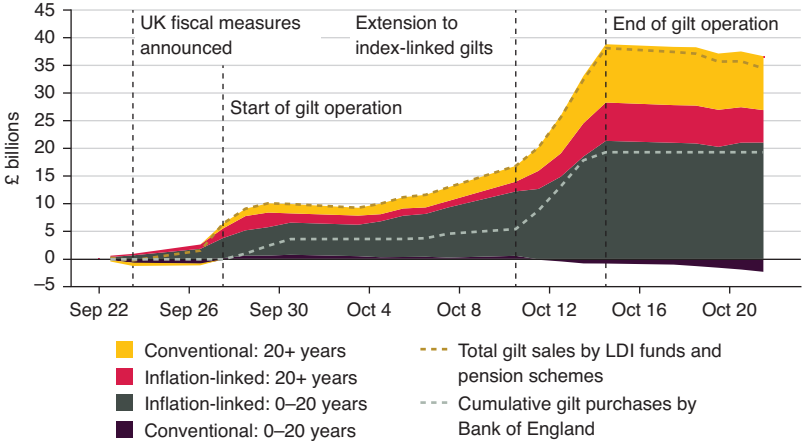

FIGURE 13.4. Cumulative net gilt sales by LDI funds and pension schemes with an open gilt repo or interest rate derivative position, between September 22 and October 21, 2022, and cumulative gilt purchases by the Bank of England.
Source: Paul Alexander, Rand Fakhoury, Tom Horn, Waris Panjwani, and Matt Roberts-Sklar, "Financial Stability Buy/Sell Tools: A Gilt Market Case Study," *Bank of England Quarterly Bulletin*, November 20, 2023.

had larger repo and swap exposure before the crisis sold more gilts during the crisis.[23]

While some pension funds were able to raise funds quickly (e.g., by selling nongilt assets such as corporate bonds, equities, and even collateralized loan obligations), many pooled funds experienced significant operational difficulties.[24]

Concentration Channel Amplified the Shock

Exposures in the pension and pooled LDI funds were highly concentrated and correlated, particularly in repo that was backed by index-linked and longer-term nominal bonds. Pension and LDI funds are the largest holders of the long-term index-linked gilt market. This concentration meant LDI funds were the natural buyers of linkers, so there were no other buyers to step in when selling pressures emerged.

Given the emergence of large and one-way selling pressures, market functioning broke down rapidly.[25] Market intelligence early in the week of September 26 suggested that additional long-term gilt sales of at least £50 billion were needed in short order. This was over four times greater than the recent average trading volumes of just £12 billion per day in these markets.[26]

Interconnections Channel Meant the Shock Spread to Other Markets

The gilt market is a core market, which means that it not only is critical to the transmission of monetary policy, but also is deeply interconnected with other parts of the financial system and the real economy. Because of this centrality, gilt market turmoil also spilled over to the real economy via other markets. For instance, interest rate swaps spiked dramatically, the two-year interest rate swap typically used to price mortgage products reaching 6% in the aftermath of the mini-budget. This prompted several mortgage providers to discon-

tinue their mortgage offerings temporarily as it became too difficult to price markets; it is estimated that around 40% of mortgage deals were pulled following the announcement.[27] While rates have stabilized since then, they remain at higher levels than prior to the crisis.

Lesson 2: Stress tests must be developed using better data and models to capture interconnections—including in nonbank financial intermediation—and to test operational resilience and scenarios that may have no historical precedent.

Work had been undertaken in 2018 to better understand liquidity risk from margin calls on interest rate swaps, using a rapid 100-basis-point shift up in the yield curve.[28] Although consistent with a "severe but plausible" framework based on historic data, this turned out to be smaller than the actual shock in September 2022. The exercise also assumed that those affected would have the operational capacity to make the necessary adjustments in a timely manner, given that pooled funds were not included. As discussed in the next section, expectations of resilience on both financial and operational fronts have been strengthened. Moreover, the Bank is undertaking a system-wide exploratory scenario (SWES) to better understand interconnections in the financial system.[29]

A Financial Stability Response Compatible with Monetary Policy

What was striking in this episode was the speed at which a "doom loop" emerged, leading to a breakdown in functioning of the gilt market within a matter of days.[30] The Bank took swift action to reduce the risk of a self-reinforcing cycle of collateral calls and forced gilt sales by giving pension funds time to meet their liquidity obligations. This forestalled an unwarranted tightening of financing conditions and an associated reduction in the flow of credit to households

and businesses. Our concern was that, without swift intervention, a large number of pooled LDI funds would have been left with negative net asset value and would have faced shortfalls in the collateral posted to banking counterparties. If the LDI funds had defaulted, the large quantity of gilts held as collateral by the banks that had lent to these funds could have been sold on the market, further impairing the gilt market. This would have accelerated self-reinforcing falls in asset prices, risking a sudden and excessive tightening of financing conditions for the real economy.[31]

On September 28, 2022, the FPC recommended that action be taken to address the risk to UK financial stability from dysfunction in the gilt market. It also welcomed the Bank's plans for temporary and targeted purchases in the long-dated gilt market on financial stability grounds at an urgent pace.[32] The MPC was informed of these temporary and targeted financial stability operations.[33]

The intervention followed five principles that were designed to maximize effectiveness while minimizing moral hazard and risks to monetary policy and to taxpayers:[34]

1. *Temporary:* The plan announced on September 28 stated that the program would run for thirteen trading days to allow pension and LDI funds the time to adjust their portfolios and build resilience. On October 3, the bank reconfirmed that it would carry out temporary purchases of long-dated UK government bonds until October 14, despite some pressure from market participants to extend the program.[35]
2. *Targeted:* The purchases were concentrated initially on longer-dated nominal bonds and, on October 11, the Bank added inflation-indexed bonds (greater than three years) to purchases given their importance in pension and LDI repo positions.[36]
3. *Backstop pricing:* The Bank set a reserve spread that was, broadly speaking, wider than "normal" market conditions and narrower than in stress. This meant that it only purchased at relatively distressed prices, which limited the take-up in the facility to those that

needed it. In the end, the Bank only bought £19.3 billion in gilts, of which around two-thirds were conventional bonds. This demand-led approach was in contrast to purchases for monetary purposes (QE), in which the Bank sets out to purchase a given quantity of gilts per auction. Moreover, when combined with the temporary and targeted approach to the intervention, backstop pricing limited moral hazard.

4. *Timely and orderly unwind:* The Bank began unwinding the portfolio on November 29, using a demand-led approach. This had the advantage of limiting impact on market pricing, allowing the portfolio to be fully dispensed of by January 12, 2023, without reigniting market dysfunction.
5. *Regulatory response to reduce underlying vulnerability:* During and after the intervention there was close interaction between the Bank and The Pensions Regulator (TPR), the Financial Conduct Authority (FCA), and overseas regulators of the LDI funds.[37] In March 2023, the FPC recommended that TPR act as soon as possible to mitigate the financial stability risks by specifying the minimum levels of resilience for the LDI funds and LDI mandates in which pension-scheme trustees may invest. The FPC also recommended that TPR should have the remit to consider financial stability issues on a continuing basis.

Ultimately, pension and LDI funds had time to rebuild their resilience to future market volatility (which is typically not an objective of monetary policy operations), and came out in a stronger position. This involved, among other actions, lowering leverage by selling £37 billion in gilts and raising an estimated £33 billion in funds from pension schemes (by selling other types of assets and using cash buffers).[38] Moreover, from the initial position where there were very few buyers before the Bank's financial stability intervention, the market ended up absorbing almost 50% of the total sales while yields stayed broadly in check (see table 13.1). With stable functioning of the gilt market restored, the first asset

TABLE 13.1. Comparing gilt purchases for financial and monetary stability purposes.

	Financial stability purchases (October 22 to January 23)	Monetary stability purchases (QE)
Purpose and governance	Aimed at reducing the risk of a self-reinforcing price spiral triggered by LDI vulnerabilities. FPC recommended action to tackle financial stability risk; MPC informed, in line with the Concordat regarding balance sheet operations; Bank executive implemented.	QE aimed at easing monetary conditions in pursuit of the inflation target. MPC voted on quantity targets; Bank executive implemented.
Duration of purchases and exit plan	Temporary: purchases undertaken for only as long as required by financial stability issue; and unwound through sales back to market in timely and orderly way once dysfunction resolved.	High-level targets for purchase, unwind and sales programs voted on by MPC as part of its monetary policy process.
Asset selection	Targeted: at assets most affected by financial stability issue.	Appropriately broad based to achieve monetary policy goals.
Pricing	Backstop pricing: to ensure the facility did not unduly interfere with price discovery or substitute for the need for market participants to manage their own risks over the medium term.	Priced to deliver MPC-determined quantity targets.

Source: Andrew Hauser, "Looking through a Glass Onion: Lessons from the 2022 LDI Intervention," speech given at the Initiative on Global Markets' Workshop on Market Dysfunction, the University of Chicago Booth School of Business, Bank of England, March 3, 2023.

sales as part of QT commenced on November 1, starting with shorter-dated bonds.[39]

Strict adherence to the design principles was critical to distinguishing asset purchases to support financial stability from purchases to support monetary policy objectives (table 13.1). Given the small size of the intervention relative to overall QE, it was not expected to have meaningful spillovers to monetary policy (figure 13.5). Early research indicates that, indeed, the intervention stabilized markets while having limited impact on monetary policy.[40]

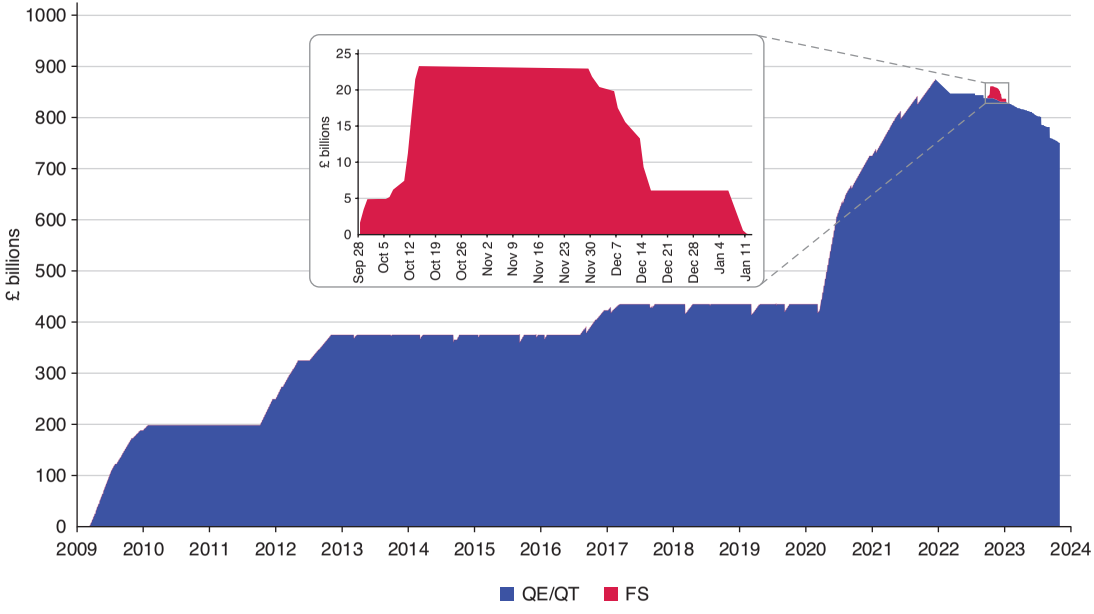

FIGURE 13.5. Gilt purchases for financial stability were small relative to QE.

Source: Adapted from Paul Alexander, Rand Fakhoury, Tom Horn, Waris Panjwani, and Matt Roberts-Sklar, "Financial Stability Buy/Sell Tools: A Gilt Market Case Study," Bank of England, November 20, 2023.

This highlights the third lesson: Financial stability interventions, if temporary and targeted, support monetary policy objectives without necessarily affecting the stance of monetary policy.

The intervention benefited from advance work by the Bank of England and others on how to develop central bank tools to deal with funding and market liquidity issues that threaten financial stability, some of which was motivated by the "dash-for-cash" episode at the onset of the COVID-19 pandemic.[41] This advance work, combined with staff with the right experience and access to market intelligence to execute, contributed to the success of the operation.

At the same time, activity in the nonbank financial sector continues to evolve, introducing new sources of systemic risk that need to be identified and mitigated.[42] As part of this effort, the Bank of England is continuing to develop its toolkit, with the gilt market as the initial areas of focus. The first phase will develop a tool that will act as a backstop in stress by providing liquidity to eligible pension funds, insurance companies, and LDI funds by lending cash against gilts in situations of system-wide stress that threaten financial stability.[43] Over time, the Bank intends to consider how this tool might be broadened to include a wider range of NBFIs as counterparties.

This highlights the fourth lesson: Central bank liquidity facilities need further development, particularly with regard to NBFI.

Given this, the Bank is working to develop its financial stability toolkit.[44] The FPC has stated a preference for backstopping market functioning by lending directly to NBFIs against high-quality collateral, when possible, rather than with asset purchases because it presents less risk to public funds and less moral hazard.[45] There may be circumstances in which lending may not be enough to alleviate the stress, as was the case with the LDI funds. In general, episodes

TABLE 13.2. Summary of the Financial Policy Committee's roles and responsibilities.

Objectives	To contribute to the Bank's financial stability objective to protect and enhance UK financial stability primarily by identifying, monitoring, and taking action to remove/reduce systemic risk with a view toward protecting and enhancing the resilience of the UK financial system. Subject to that, the FPC also has a secondary objective to support the economic policy of the government.
Main powers	May give directions to the Prudential Regulatory Authority (PRA) and FCA in relation to specified macroprudential measures. Powers to make recommendations to the Bank, FCA, PRA, and to His Majesty's Treasury (HMT) and other persons.
Membership	Thirteen members: six Bank of England staff, five external, FCA CEO, and one HMT member
Decisions taken by	Consensus wherever possible (otherwise by vote of those present, and the person chairing has a casting vote in the event of a tie)
Meeting frequency	Quarterly cycle of meetings
Treasury Ministry involvement	HMT member (nonvoting). HMT specifies what His Majesty's Government (HMG) economic policy is taken to be for purposes of secondary objective. HMG may make recommendations about FPC's responsibilities and functions in the annual remit letter.
Key publications	Summary and Record of all decisions published (four times a year). Twice-yearly Financial Stability Report Financial Stability in Focus (FSIF)—for more detail on certain topics.

of system-wide stress may differ in ways that require different remedies, so flexibility and nimbleness will be required.

Governance of Financial Stability Was a Strength

The clear and separate delegation of authorities for monetary and financial system policies in the UK is unique, and allowed the Bank's FPC to recommend that the Bank intervene to stabilize gilt markets and that the MPC be informed that action would be taken. This recommendation was consistent with the FPC's mandate to identify and monitor risks to the financial system, and to take appropriate action when necessary (see table 13.2 for FPC structure and mandate).[46]

While much of the time financial stability and monetary policy goals and actions are self-reinforcing, as experienced over the last couple of years, there can be real or perceived trade-offs. In the LDI episode, the monetary policy transmission mechanism was clearly at risk of impairment, which suggests compatible goals if executed following the principles outlined above. However, the concern over a potential trade-off arose because the MPC had announced just the day before (September 22) that it would reduce the stock of purchased UK government bonds held in the Asset Purchase Facility.

These trade-offs were very well managed through the governance arrangements in the UK:

1. The MPC has clear, measurable goals, authorities, and accountability to parliament. The inflation-targeting regime mitigates the concern that financial stability or prudential concerns will creep into decision making unless they directly influence inflation.
2. The FPC also has a clear mandate, authorities, and accountability to parliament.[47] This means that any actions taken must be targeted to the specific financial stability problem at hand, with design focused on stabilizing the situation while limiting moral hazard and other costs to the UK economy.
3. External members of each committee bring different outside sources of expertise that contribute to the policy discussions and decisions. These external members will have a particular focus on the objectives of the committee to which they belong, compared to the internal members, when faced with trade-offs between financial stability and monetary policy.[48]
4. Regularly scheduled communications between the committees means that each benefits from being better informed on areas of common interest, such as the economic outlook; how higher interest rates are affecting household and business finances; and what might be an appropriate bank stress-test scenario.

This highlights the fifth lesson: The Bank of England's financial stability framework showed its worth, supported by a clear financial stability mandate, governance, and separation of responsibilities between the MPC and the FPC.

A dedicated and empowered financial stability committee puts the focus on prevention through monitoring, stress testing, and follow-up actions to reduce vulnerabilities. It supports timely reaction to stress events that will minimize risks to public funds and market incentives, as well as the stance of monetary policy.

Conclusions

The Bank of England, along with many other central banks, tightened monetary policy as a necessary action to bring down inflation. While inflation control is foundational to economic and financial stability, market forces can be particularly merciless in the face of poorly managed risk. Both the SVB failure and LDI crisis are painful reminders that government bonds may be "free" from credit risk, but they are not free from interest rate risk. At a minimum, financial firms should build adequate resilience to self-insure against all but the most severe scenarios. Clearly, the capital liquidity requirements placed on all UK banks have contributed to their resilience to higher interest rates over the last couple of years.

Nonetheless, the LDI crisis underscores the need for better data and models to capture interconnections within the financial system, including NBFIs, and to test operational resilience and scenarios that have no historical precedent. The Bank's SWES exercise is an excellent step in this direction because it will help us understand the interconnections between different parts of the financial system. Given that risk cannot be driven to zero, the Bank continues to work on its liquidity toolkit with regard to NBFIs.

The Bank's intervention to purchase gilts over a thirteen-day period in 2022 successfully stabilized gilt markets and afforded pension schemes the time to meet their liquidity obligations. It supported monetary policy objectives by forestalling an unwarranted tightening of financing conditions and an associated reduction in the flow of credit to households and businesses. Because the intervention was temporary and targeted, it did not affect the stance of monetary policy in any meaningful way.

Finally, this episode highlighted the worth of the Bank's financial stability framework, which is based on a clear financial stability mandate, governance, and separation of responsibilities between MPC and FPC (see table 13.2). It allowed for preplanning for this type of intervention, rapid identification of the problem and decision to act, and clarity of communication to markets to distinguish between financial stability and monetary policy operations.

Notes

Thank you to Paul Alexander, David Baumslag, Rand Fakhoury, Simon Jurkatis, Clare Macallan, Ryan Murphy, Raakhi Odedra, Pierre Ortlieb, Waris Panjwani, Manish Powar, Alistair Ratcliffe, Matt Roberts-Sklar, and Giselle Samuel for helpful contributions to these remarks.

1. Viral Acharya, "Financial Stability in the Broader Mandate for Central Banks: A Political Economy Perspective," Hutchins Center Working Paper, April 14, 2015; and Renee Haltom and John A. Weinberg, "Does the Fed Have a Financial Stability Mandate?" Federal Reserve Bank of Richmond, June 2017.
2. Michael D. Bordo and David C. Wheelock, "Monetary Policy and Asset Prices: A Look Back at Past US Stock Market Booms," National Bureau of Economic Research Working Paper No. 10704 (August 2004); Charles Bean, "Asset Prices, Financial Imbalances and Monetary Policy: Are Inflation Targets Enough?" Bank for International Settlements Working Paper No. 140, September 2003; and David Gruen, Michael Plumb, and

Andrew Stone, "How Should Monetary Policy Respond to Asset-Price Bubbles?" *International Journal of Central Banking* 1, no. 3 (2005).

3. Isabel Schnabel, "Monetary Policy and Financial Stability," speech by Isabel Schnabel, Member of the Executive Board of the European Central Bank, at the Fifth Annual Conference of the European Systemic Risk Board, December 8, 2021.
4. Hyun Song Shin, "Is There a Risk of Snapback in Long-Dated Yields?" Panel remarks by Hyun Song Shin, Economic Adviser and Head of Research of the BIS, at the Second ECB Annual Research Conference, September 25, 2017; Financial Stability Board, "FSB Assesses Financial Vulnerabilities and Takes Stock of Actions under Its 2018 Workplan," June 25, 2018; and International Monetary Fund, "Global Financial Stability Report, April 2018: A Bumpy Road Ahead," April 2018.
5. An increase in Bank rate forms part of the Annual Cyclical Scenarios undertaken in 2017, 2018, 2019, and 2022–23.
6. Bank of England, "Financial Stability Report, November 2018." Liquidity risks from margin calls was also discussed in Matt Roberts-Sklar and Sheila Torrance, "Liquidity Risk: A Wake-Up Call," *The Actuary*, February 3, 2021.
7. For instance, see Bank of England, "Financial Policy Summary and Record of the Financial Policy Committee Meeting on 16 June 2022."
8. Bank of England, "Financial Stability in Focus: Interest Rate Risk in the Economy and Financial System," July 12, 2023.
9. Board of Governors of the Federal Reserve System, "Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank," April 28, 2023.
10. SVB had a subsidiary in the UK. The Bank of England took the decision to sell the UK bank on March 13. For an overview of events in 2023, see Sam Woods, "Bank Failures," speech given at Mansion House, Bank of England, October 16, 2023.
11. Prudential Regulation Authority, Bank of England, "The PRA's Methodologies for Setting Pillar 2 Capital," July 29, 2015.
12. Estimates show that SVB had an LCR of only 75% at the end of 2002, well below the 100% requirement. It would, however, have passed the NSFR test. See Greg Feldberg, "Lessons from Applying the Liquidity Coverage Ratio to Silicon Valley Bank," Yale School of Management, March 27, 2023; and Greg Feldberg, "Silicon Valley Bank's Liquidity,

Part Two: What About the Net Stable Funding Ratio?" Yale School of Management, April 4, 2023.

13. The depositors were concentrated in the tech sector. See Board of Governors of the Federal Reserve System, "Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank," April 28, 2023; and Basel Committee on Banking Supervision, "Report on the 2023 Banking Turmoil," Bank for International Settlements, October 5, 2023.
14. The full set of actions taken is set out in more detail in letters to Parliament. See Bank of England, "Letter from Jon Cunliffe to Mel Stride," October 5, 2022; and Bank of England, "Letter from Jon Cunliffe—LDI," October 18, 2022. The design of the operations is set out in Paul Alexander, Rand Fakhoury, Tom Horn, Waris Panjwani, and Matt Roberts-Sklar, "Financial Stability Buy/Sell Tools: A Gilt Market Case Study," *Bank of England Quarterly Bulletin*, November 20, 2023.
15. More than 20% of UK defined benefit (DB) pension funds were in deficit in August 2022, and more than 40% were in deficit a year earlier. See Bank of England, "Letter from Jon Cunliffe to Mel Stride."
16. Investor-pooled funds are structured so that a pot of assets is managed for a large number of pension fund clients who have limited liability in the face of losses. These funds are estimated to make up around 10–15% of the LDI market. See Sarah Breeden, "Risks from Leverage: How Did a Small Corner of the Pensions Industry Threaten Financial Stability?" Speech given at ISDA & AIMA, Bank of England, November 7, 2022.
17. Lydia Henning, Simon Jurkatis, Manesh Powar, and Gian Valentini, "Lifting the Lid on a Liquidity Crisis," Bank Underground, July 18, 2023.
18. Jonathan Hall, "With Leverage Comes Responsibility," speech given at National Institute of Economic and Social Research, published online by Bank of England, June 20, 2023.
19. Their holdings of the eurozone government bond market were also much smaller as a percentage of the market. For further detail, see Mona Dohle, "Dutch Derivatives: Insights from the LDI Crunch in the Netherlands," *Portfolio Institutional*, January 19, 2023; Sirio Aramonte and Phurichai Rungcharoenkitkul, "Leverage and Liquidity Backstops: Cues from Pension Funds and Gilt Market Disruptions," *BIS Quarterly Review*, December 2022; and House of Commons, "Oral Evidence to the Work and Pensions Committee (HC 826)," testimonies of Charles Counsell and Nikhil Rathi, December 14, 2022.

20. Financial Stability Board, "The Financial Stability Implications of Leverage in Non-Bank Financial Intermediation," September 6, 2023.
21. The plan focused on spurring growth through a number of measures, including reductions in taxes. For more information, see HM Treasury, "The Growth Plan 2022," presented by the Chancellor of the Exchequer to Parliament, September 23, 2022.
22. For example, see Paul Dales, "Kwarteng Causes Carnage," Capital Economics, September 23, 2022; and Jagjit S. Chadha, Max Mosley, Kemar Whyte, Hailey Low, Stephen Millard, and Adrian Pabst, "An Independent Assessment of the Mini-Budget," National Institute of Economic and Social Research, September 23, 2022.
23. See Peter Dunne, Angelica Ghiselli, Frederik Ledoux, and Barra McCarthy, "Irish-Resident LDI Funds and the 2022 Gilt Market Crisis," Central Bank of Ireland, Financial Stability Notes, vol. 2023, no. 7 (September 2023); and Gabor Pinter, "An Anatomy of the 2022 Gilt Market Crisis," Bank of England, Staff Working Paper No. 1,019, March 31, 2023.
24. Net sales of corporate bonds by pension and LDI funds totaled around £10 billion between the day of the mini-budget announcement (September 23) and the end of the Bank of England intervention (October 14). See Chart 5 from Henning et al., "Lifting the Lid."
25. Bank research shows that, during this period, forced sales by liability-driven investment funds (LDIs) led to discounts of roughly 10%, accounting for nearly half the overall decline in gilt prices. For more on the specific drivers of the selling dynamics in the gilt market, see Gabor Pinter, Emil Siriwardane, and Danny Walker, "Fire Sales of Safe Assets," Bank of England, Staff Working Paper No. 1,089, July 26, 2024.
26. See Bank of England, "Letter from Jon Cunliffe to Mel Stride."
27. Michael Brown, "Which Lenders Have Removed Their Mortgages Thus Far?" Moneyfacts, September 29, 2022.
28. While the report did flag broader issues with pension scheme and LDI fund liquidity management, it did not focus on interconnections between these and other participants (see Bank of England, "Financial Stability Report, November 2018").
29. The SWES aims to improve our understanding of the behaviors of banks and nonbank financial institutions during stressed financial market conditions and how those behaviors might interact to amplify shocks in UK

financial markets that are core to UK financial stability. See Bank of England, "System-Wide Exploratory Scenario" web page, last updated July 12, 2024.

30. There have been other jumps to illiquidity in recent years, including during the "dash for cash" experienced by many countries when the actions of some NBFIs amplified the initial market reaction to the COVID-19 pandemic.
31. Bank of England, "Risks from Leverage."
32. Bank of England, "Bank of England Announces Gilt Market Operation," news release, September 28, 2022.
33. This was in line with the Concordat governing the MPC's engagement with the Bank's executive regarding balance sheet operations.
34. This borrows heavily from Paul Alexander et al., "Financial Stability Buy/Sell Tools." See also Andrew Hauser, "Looking through a Glass Onion: Lessons from the 2022 LDI Intervention," speech given at the Initiative on Global Markets' Workshop on Market Dysfunction, the University of Chicago Booth School of Business, Bank of England, March 3, 2023.
35. Bank of England, "Gilt Market Operations—Market Notice 3 October 2022."
36. Bank of England, "Temporary Purchases of Index-Linked Gilts—Market Notice 11 October 2022."
37. The LDI funds were domiciled and regulated outside the UK.
38. These gilt sales are smaller than the total margin and collateral calls faced by LDI funds and pension schemes over this period, which Bank staff estimate to be in excess of £70 billion. This reflects the fact that LDI funds and pension schemes were also able to sell assets other than gilts and use existing cash buffers in order to meet these obligations. For more information, see Bank of England, "Financial Stability Report, December 2022."
39. On October 18, 2022, the Bank announced that the first gilt sale operation would take place on November 1, 2022. Moreover, it announced that, for 2022 Q4, sales would be distributed evenly across short (three to seven years) and medium (seven to twenty years) maturity buckets, rather than also across long (twenty years–plus) maturity.
40. Nicolò Bandera and Jacob Stevens, "Monetary Policy Consequences of Financial Stability Interventions: Assessing the UK LDI Crisis and the Central Bank Policy Response," Bank of England, Staff Working Paper No. 1,070, April 2024.

41. See, for example, Darrell Duffie and Frank M. Keane, "Market-Function Asset Purchases," Federal Reserve Bank of New York, February 2023; Bank of International Settlements, "Market Dysfunction and Central Bank Tools," Markets Committee Papers, May 11, 2022; and Andrew Hauser, "Why Central Banks Need New Tools for Dealing with Market Dysfunction," speech given at Thomson Reuters Newsmaker, Bank of England, January 7, 2021.
42. Bank of England, "Financial Policy Summary and Record of the Financial Policy Committee Meeting on 13 March," March 27, 2024.
43. Nick Butt, "Market Resilience, Non-bank Financial Institutions and the Central Bank Toolkit—Practical Next Steps," speech given at ISDA virtual conference on Procyclicality and Margin Practices, March 12, 2024.
44. UK Parliament, "Quantitative Tightening: Government, Bank of England and Debt Management Office Responses to the Committee's Fifth Report," April 18, 2024.
45. Bank of England, "Financial Policy Summary and Record of the Financial Policy Committee Meeting on 13 March," March 27, 2024.
46. An interim Financial Policy Committee was created by the Court of the Bank in February 2011. It was then statutorily established by the Financial Services Act of 2012, which came into effect in 2013 pursuant to the Financial Services Act of 2012 (Commencement No. 1) Order 2013.
47. The same can be said of the Prudential Regulatory Authority.
48. For instance, governance issues can arise when a central bank is responsible for bank regulation because they may consider the profitability and stability of the banking sector in the setting of monetary policy, and not just inflation. See Mark Copelovitch, Jeffry Frieden, and Stefanie Walter, "The Political Economy of the Euro Crisis," *Comparative Political Studies* 49, no. 7 (March 14, 2016).

GENERAL DISCUSSION

STEPHEN HABER: Thank you. What I propose we do is we'll take three or four questions, give the opportunity for some responses, then take a few more questions. I'm mindful that our questions and answers are between us and lunch. So we'll ask that if you're making a comment, that this is like *Jeopardy!* It comes in the form of a question.

JOHN COCHRANE: John Cochrane, Hoover. For the first time in my life, I have a short question. It's for Darrell. You told the lovely story about poker chips, but we're talking about a trillion poker chips now. Back before 2008, we got along with about 10 billion poker chips. I'm curious, what happened? Why are a trillion not enough now, but 10 billion were plenty back then? I understood part of the problem from earlier work of yours: the Fed requires us to hold nine of the poker chips in our pockets. To what extent are those new liquidity requirements part of the problem? Also, we used to have intraday overdrafts. You can borrow chips during the day. I don't know if we still do, but they remove this whole business about what time of day you get or receive cash. Is that gone? Is that a good thing to bring back? What happened here?

HABER: Okay, I see another hand here in the back.

AXEL MERK: Thank you, I would love to. This is Axel Merk. I would love to have maybe Amit and Carolyn have a little argument here, because I somehow heard opposing views when I heard "targeted and temporary." In the US, we call it a "Fed put" to have a disincentive actually to get your house in order.

And I wonder, you pointed out, we need to do more financial modeling. Well, it will never be possible to model everything.

And I think one of the reasons, at least in the US, why the small banks have these issues is because there are so many regulations and they have limited resources, so they forget to look at the forest for all the trees because they try to cross all the t's. And there is the more simplified approach of having maybe less regulation to empower and hold management responsible, including allowing the potential failure of the businesses, whether that might not be a better approach than doubling down on the financial-stability operations, as you very nicely call it. I'm afraid such operations might just turn out to be a micromanagement of the economy.

HABER: Okay, Mickey Levy.

MICKEY LEVY: Amit, I have a question about your empirical work that finds that higher capital requirements for banks generate a lending response from nonbanks. What data source are you using for nonbank lending? I hear tons of anecdotal evidence about significant amounts of lending by nonbanks, but we really don't have a good grip on how much it is. So I'm interested in your database. I wouldn't be surprised if increased capital requirements for banks result in a rise in total lending after a short period.

BRIAN SACK: Hi, Brian Sack from Balyasny Asset Management. Question for Carolyn also. I do think the Bank of England did a remarkably good job separating out market-functioning purchases from QE [quantitative easing] purchases. And, you know, there had been work done at the BIS [Bank for International Settlements] by Andrew Hauser on that, and it was neat to see that done in practice. I wanted to ask something, though. This was a situation where the problem was pretty visible to you and pretty contained. It was a particular set of institutions. And it's great to say that we did it well in that instance, but I'm wondering, will that always be the case? I could imagine market-functioning problems where it's really not clear what the problem is and where it involves a bigger set of market participants. I think 2020 is a good example in the US Treasury

market. So I'm asking, in these more complicated situations, how confident are you that you can separate that out? Thank you.

HABER: I'm going to take two more questions and then we're going to allow panelists to respond. This gentleman here whose name I can't see, so if you could tell us who you are, and then Michael Boskin.

BILL NELSON: Hi, I'm Bill Nelson from the Bank Policy Institute, and these were all very interesting presentations and I'd be happy to ask all of you questions, but I know Darrell will be disappointed if I don't ask him a balance sheet question. So it was clear to financial market participants starting at the end of 2018 that conditions were beginning to get tight. It was well known in advance that this was a tax day when there were going to be big payments out of money-market funds into the TGA [Treasury General Account]. It was well known that there were coupons, security settling that were going to require more repo funding. And the Fed used to know how to handle that situation. When those situations were coming, they added a lot of reserves. So, I mean, isn't the solution not to stop with two or three hundred billion above where you think you might need to go, but rather as you get closer, just to control those swings? I mean, Lou Crandall wrote a month before it happened that there was going to be a train wreck, and I wrote two weeks before it was going to happen that there was going to be a train wreck. So wouldn't that, you know, given that there are costs to size, isn't it better to explore that lower limit by controlling volatility and reserve balances?

HABER: Michael Boskin.

MICHAEL BOSKIN: I just want to ask a general question that reflects almost everything that's been said all day today. We've been talking about central bank independence, separation or integration of supervision and regulation, and financial stability for monetary policy. We've had some discussion, especially in the Latin context, of the fiscal pressures, and with John Cochrane here,

we of course have to emphasize that. But we haven't heard a lot about the integration of the central bank balance sheet and the Treasury's balance sheet. And while we're forcing all these people to take mark-to-market or giving them a pass from it, the Fed used to be a very large supplier of tax revenue to the Treasury. And we haven't talked much about the risk to independence, if it ever becomes widely perceived, from the capital losses on the long-term bonds and mortgage-backed securities where we've sort of shifted the duration risk from private sector balance sheets to the Federal Reserve, which is dealing with it right now. Okay.

HABER: So let me give the panelists an opportunity to respond and do it in the order in which they presented and start with Amit Seru, and then Darrell Duffie, and then Christina Parajon Skinner, and then Carolyn Wilkins. Amit?

AMIT SERU: All right, thanks for great presentations and also questions from the floor. So there are many questions and everybody has a lot to say, so I'll just say a couple of things. Let me start with what was said about trying to model all kinds of scenarios being a futile exercise in the end. I'm an engineer myself, so my natural tendency is to believe in models. However, I also remember what the late Bob Lucas taught us in his famous "Lucas critique." Models with incorrectly specified interactions between various agents are bound to fail. And I think that applies very heavily in this setting. So we need to be humble and realize that models can only go that far and are bound to have errors. We have enough historical evidence. Thus, all one is saying is, let us create a buffer to account for such errors. If one looks at private credit, say, at private equity, there is skin in the game around risks they take. So all one wants is something similar for banks, some more skin in the game for all the risks they take. That's it. It's not very complicated.

How much skin in the game is one asking for? You saw that picture—all the 4,800 banks in the banking system have pretty much 90% debt. It is going to be very hard to write a model

that will say that across the size distribution this is "the" optimal leverage ratio. One can explain the behavior very simply without any model—they are all at the regulatory constraint since many of them take subsidized debt (deposits) in order to maximize subsidies they get. So how much skin in the game should one have for banks? That is where the nonbank analysis I showed you is useful. These institutions offer the same banking services as banks but are financed by nonsubsidized debt. And one finds that they are funded by a lot of equity that allows them to take the kind of risk they are taking. That is what the market outcome is.

There was a question on where one gets the data on nonbanks. There is some good nonbank data related to consumer credit and, in particular, to mortgages. That was the reason that we collected detailed data on banks and nonbanks in this sector. And the first set of counterfactuals I showed you were indeed in this sector. It is hard to do this for all sectors. One can try to infer it with flow-of-funds data, but getting very granular is hard. One can still run some counterfactuals at the aggregate level. Finally, let me briefly address the question of "mark-to-market" unrealized losses for the Fed. Absolutely, it is a pretty big number, given their high exposure to long-duration securities that they accumulated as a part of a series of QE they did. This may have bearing on future actions they take, but I am not sure I know exactly what, and I will let others chime in on this issue.

HABER: Darrell?

DARRELL DUFFIE: Okay, I'm going to start with John's question, because it goes to the heart of this panel's mandate, the connections between financial regulation and monetary policy. After the financial crisis, Congress really got religion about having banks relying only on themselves to meet their liquidity needs. And a raft of new regulations implementing Congress's wishes required banks to have enough liquidity for essentially any circumstances, even including the need for them to be wound down in a failure,

without reliance on a lender of last resort. So, forget discount window and overdrafts, they had to have enough liquidity on their own.

And so, as is implicit in your question, they stashed up a lot of liquidity for any circumstance and they never wanted to reduce below that required amount of liquidity because their supervisors would have otherwise written them a note that would've gone to their CEO and the Fed. The CEO would have been very disappointed at the people managing those balances. So we had what is sometimes called the last-taxi problem. Lots of liquidity was there, but the banks weren't willing to use that liquidity when the opportunity came about and they weren't willing to fund other banks that were in need of liquidity. That was the major change in regulation. We can cite all the specific regulations on resolution planning and liquidity stress testing, the whole nine yards. This is not the LCR [Liquidity Coverage Ratio], which is a thirty-day liquidity rule. Other regulations require that in any circumstance within a single day, a bank must meet all of its liquidity needs.

On Mickey's question, aren't higher regulatory capital buffers going to cause banks to provide more liquidity rather than less? Yes, higher-risk-based capital buffers generally imply greater liquidity. However, there's this wrinkle in capital regulations called the leverage rule. In the US, this is called the enhanced supplementary leverage ratio, which doesn't pay any attention to risk. Even something as safe as a deposit in the central bank requires the same amount of capital under this rule as a risky real estate loan. When those leverage rules are binding, banks can be averse to providing liquidity in funding markets, even in the form of essentially perfectly safe Treasury-backed overnight loans. That's an unfortunate part of regulation.

Where did we get the data? Thanks to John Williams's invitation, I visited the New York Fed last year, where we had access

to intraday Fedwire transactions and the repo transactions conducted by commercial banks.

On Bill Nelson's question, yes, and I was one of the people that was suggesting that the airplane was getting a bit low, and that we don't know where the runway is. Maybe we shouldn't try to get any lower. The Fed did put out a survey to all of the large banks saying, in the worst circumstances, how much reserves would you actually need to meet your needs? And they responded to the Fed, around 800 billion. There was about 1.5 trillion in the system at that time, and so the Fed assumed that it was fine. This was the first major reduction in its balance sheet post–financial crisis. So, you know, maybe the Fed might have been more risk-averse, as it is today, I believe, but at the time, it was relying on what it thought was reliable data and got it wrong despite some signals that were available.

HABER: Christina Parajon Skinner?

CHRISTINA SKINNER: I'll just briefly touch on the last question that was posed. I'll also take the opportunity to plug another paper that I wrote with Andy Levin, who is here today. In that paper, we argue that the fiscal consequences of the Fed's use of its balance sheet today, specifically in connection with QE and its limitless ability to issue short-term liabilities that are backed by the full faith and credit of the government—bank reserves and repos—has been, by default, systematically excluded from most forms of congressional oversight, which Congress ordinarily uses to monitor the performance and impact on the public fisc of the operations of all other major independent agencies. And so, we try to call attention to the need for greater public debate and more congressional scrutiny of the Fed's contemporary balance sheet use. I think the same point applies to the question of whether we've entered a world in which we have two parties in the US government acting as debt managers. And if we have,

how is that work being coordinated, if at all? Should the central bank have a role in debt management?

HABER: Carolyn Wilkins.

CAROLYN WILKINS: I think the comment was, why do we spend time thinking about tools instead of thinking about what's getting in the way of reducing the vulnerabilities in the first place, and how complexity in the regulatory system might be getting in the way? I would say that, yes, we need to look at those other issues too. And that's why we've done a few things at the Bank of England. The prudential side has got an exercise called "strong and simple," which is basically looking at the regulatory regime for smaller banks, thinking about what actually makes sense for them and what we can simplify in a way that supports safety but reduces the burden and may take us away from thinking about risk in a more fulsome way. The Financial Policy Committee has a dual mandate that says, well, financial stability first, but you need to take into account the net benefits, which means looking at the costs, especially related to broader objectives of innovation and growth in the UK economy.

And those aren't just words. Last year or the year before, we eliminated one of our requirements in the mortgage market. We have the LTI [loan-to-income] limit and the affordability test, which is basically a test of whether a borrower could sustain interest rate rises. We found in our research that in fact the latter one was superfluous, so we dropped it. So I think there are ways to support financial stability without overly hindering innovation and growth. Still, shocks are going to happen, and they're not in the control of the central bank or anyone, for that matter. And so we need to be prepared to respond to those. That takes planning, if you want to do it well, and it's best if you've thought of the principles to follow in advance.

Just quickly, on the balance sheet and the interaction with fiscal policy. I couldn't agree more that there are really important

questions to resolve there. In some countries like Canada and the UK, in any QE exercise or any purchase exercise that involves risk to the balance sheet, indemnities are sought. And it's not necessarily because one has to, it's just that it's recognized that QE has potential fiscal consequences. I think the bigger and more gnarly issue is related to thinking about the real net benefits of QE relative to some other kind of response. And that includes fiscal policy. The optimal fiscal-monetary policy mix is an interesting academic exercise, but it's a really, really tricky public policy exercise when what you'd like to have is independence of both fiscal policy and monetary policy.

HABER: Let me thank the organizers of this conference, John [Taylor], John [Cochrane], and Michael [Bordo], for putting together this fascinating panel. And to also let you all know that lunch is served.