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Central Bank Liquidity Policy in Modern Times

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Abstract

Central banks play a crucial role in promoting financial stability. They act as financial system stabilizers through their capacity to create liquidity and channel it to financial institutions and markets in times of stress—a role that has evolved and expanded substantially over the past 15 years. This paper provides a stylized discussion of recent policy developments in this area and what they mean for debates and decisions about the design of central bank liquidity policy. Across several policy dimensions, the paper outlines broad changes since the 2008–09 global financial crisis and highlights some of the key challenges, choices and considerations facing the designers of central bank liquidity tools today.

Topics: Lender of last resort; Financial stability; Central bank research; Financial institutions; Financial markets

JEL codes: D53, E58, E61, G01, G2, G21, G23, H12

Résumé

Les banques centrales jouent un rôle crucial dans la promotion de la stabilité financière. Elles agissent comme agents stabilisateurs grâce à leur capacité à créer des liquidités et à les diriger vers les institutions financières et les marchés en périodes de tensions, un rôle qui a évolué et pris beaucoup d'ampleur au cours des 15 dernières années. Ce document offre une analyse stylisée des faits récents touchant les politiques dans ce domaine et de leurs implications pour les débats et les décisions quant à l'élaboration des politiques relatives aux liquidités de banque centrale. À travers différentes dimensions de ces politiques, le document aborde les grands changements depuis la crise financière mondiale de 2008-2009 et fait ressortir des défis, choix et considérations clés pour les concepteurs d'outils de liquidités de banque centrale de nos jours.

Sujets : Fonction de prêteur de dernier ressort; Stabilité financière; Recherches menées par les banques centrales; Institutions financières; Marchés financières

Codes JEL : D53, E58, E61, G01, G2, G21, G23, H12

1. Introduction

Central banks play a crucial role in promoting financial stability. They act as financial system stabilizers through their capacity to instantly create central bank money and channel it to financial institutions and markets in times of stress.[1] Traditionally understood through the concept of lender of last resort (LLR), this role has evolved and expanded substantially over the past 15 years. Many of the key changes in this period stemmed from the creation of new types of tools for providing market-wide liquidity in response to systemic shocks, notably the 2008–09 global financial crisis (GFC) and COVID-19. These innovations led many commentators to conclude that central banks were not just LLRs but now also market makers of last resort (MMLRs) (Buiter et al. 2023; Hauser 2021; Mehrling 2010; Sibert and Buiter 2007). At the same time, the classic LLR approach of providing bilateral loans to individual banks has also been modified in important ways since the GFC and is currently receiving renewed attention as policy-makers draw lessons from the bank failures of 2023. In short, in a brief period, we have seen extensive changes to the ways in which central banks provide liquidity for financial stability purposes.

These developments raise key questions about central bank liquidity policy in the current era:

- To what extent do recent changes diverge from previous LLR policies and principles?
- What are the main issues and debates surrounding the design of liquidity tools today?
- Where is more research needed to further assess key policy challenges and options?

These questions have not yet received sufficient attention in contemporary discussions of central bank policy. This may be due, in part, to the pace of recent developments. As Buiter et al. (2023, 2) note, central banks are now extensively using LLR and MMLR facilities, "often putting them in place quickly and in a manner that leaves little time to reflect on their structure." But even when researchers have taken the time to study recent liquidity operations, their main focus has been on how central bank interventions affect market variables such as bank credit supply (Alves, Bonfim and Soares 2021; Carpinelli and Crosignani 2021), interbank lending rates (Christensen, Lopez and Rudebusch 2014), overnight unsecured lending markets (Garcia-de-

[1] Central bank money consists of bank reserves, or settlement balances as they are known in Canada, plus physical bank notes.

Andoain et al. 2016) and fire-sale risk (Acharya, Pierret and Steffen 2021). Broader conceptual discussions about the design and purpose of central bank liquidity policy have been less common, apart from a few papers published before the bank failures of 2023 (Buiter et al. 2023) and, in most cases, before COVID-19 (Cecchetti and Disyatat 2010; Dobler et al. 2016; Tucker 2014).[2]

By addressing the questions posed above, this paper provides an updated conceptual overview of contemporary developments and issues in the policy design of LLR-style tools. It does not cover every aspect of liquidity policy, but rather focuses on a limited number of crucial design features that have been debated continuously since Bagehot (1873).

The paper proceeds as follows. Section 2 outlines Bagehot's classic LLR principles, traces the modern evolution of central bank liquidity tools, and introduces foundational literature and concepts. Section 3 discusses key issues and debates regarding the design of liquidity tools today, using Bagehot's principles to organize the discussion into four areas of policy design: counterparties, pricing, collateral and solvency. For each area, the discussion highlights broad changes since the GFC and shows how these changes depart from—or align with—pre-GFC policy designs and classic LLR principles. Section 4 concludes with areas for future research.

2. Stylized overview of central bank liquidity tools

The classical doctrine of last-resort lending was most famously articulated by Walter Bagehot in his 1873 book *Lombard Street: A Description of the Money Market*.[3] Although Bagehot was writing specifically about the Bank of England in the 19th century, the basic principles he outlined had far-reaching influence on the global development of central banking and became the conceptual baseline for thinking about the LLR function (Laidler 2004). Over time, these principles have been distilled down to a single statement about what LLRs should do to arrest financial panics: lend freely, at a high interest rate, to solvent borrowers that offer good collateral. Bagehot also believed that central banks should make clear, in advance, their

[2] Several papers and reports have recently emerged on the lessons of the 2023 bank failures (e.g., Board of Governors of the Federal Reserve System 2023a; G30 2024; Schlegel 2023). However, these tend to be focused on a particular jurisdiction, liquidity facility, or policy challenge, rather than on a broad review of central bank liquidity policy today.

[3] Bagehot was not the first to provide an intellectual framework for thinking about the LLR function. This was done much earlier by Henry Thornton, notably in his 1802 book *An Inquiry into the Nature and Effects of the Paper Credit of Great Britain*. Bagehot built upon Thornton's work but also added his own distinctive perspective and points of emphasis.

intention to act as LLRs. This, he thought, would help avert future panics by generating stabilizing expectations about the central bank's commitment to backstop the system (Humphrey 1975).

The type of crisis Bagehot described as requiring an LLR was a generalized banking panic—a system-wide event characterized by a spike in the demand for money (gold in Bagehot's time, hard currency and bank reserves today). In this sense, the provision of broad liquidity to allay banking panics was a form of expansionary monetary policy, though monetary policy as a distinct concept did not yet exist in Bagehot's time (Goodfriend and King 1988; Humphrey 1975). Nor did the idea of specialized central bank tools or facilities for providing different kinds of liquidity. The only "facility" was the Bank of England's physical discount window, described by Capie (2002) as a frosted glass window where borrowers could exchange good collateral for cash at the prevailing interest rate in a simple, no-questions-asked transaction (see also Bordo 2014).

Over time, a distinction between LLR policy and monetary policy emerged, along with distinctive tools for each. Before the GFC, central bank liquidity operations in many jurisdictions could be divided into two main categories:

- Open market operations (OMOs) were the standard monetary policy instrument for adjusting the money supply to achieve broad price stability.
- Bilateral lending facilities were the standard LLR tool for providing loans to individual banks to prevent isolated liquidity issues from becoming widespread banking crises.

Unlike OMOs, bilateral lending in the modern era was not intended to influence the overall money supply and could be "sterilized" to offset any impact it might have in this regard.[4] Bilateral lending also differed from OMOs in terms of who initiated the operation. While OMOs were initiated by central banks as monetary conditions warranted, bilateral loans were initiated at the request of eligible commercial banks, subject to central bank approval.

For many scholars and policy-makers, bilateral lending became synonymous with the LLR function (see Goodhart 1999). From this vantage point, LLR policy was all about the design and operation of bilateral lending tools such as the Federal Reserve's discount window or what

[4] To sterilize lending, central banks sell assets in equal proportion to the loans they provide, neutralizing the net effect on the money supply.

many other central banks call emergency liquidity assistance. Not everyone shared this view, however. Goodfriend and King (1988) argued that bilateral lending was neither necessary nor desirable for performing the quintessential LLR function of quelling banking panics. In their view, such crises were best remedied with monetary policy tools, namely OMOs, which allowed central banks to quickly increase the amount of liquidity in the system in response to temporary spikes in the demand for bank reserves and hard currency. Because they believed that financial markets could efficiently distribute this liquidity to the individual institutions that needed it, Goodfriend and King (1988) saw no reason for central banks to provide bilateral loans (for similar arguments, see Kaufman 1991; Schwartz 1992).

The Goodfriend and King thesis provoked responses from theorists who rejected the assumption that markets could be trusted to efficiently distribute liquidity in times of stress. These theorists argued that market failures—coordination failures and information asymmetries in particular—could prevent solvent banks from being able to obtain market liquidity at reasonable cost (Freixas, Rochet and Parigi 2004; Rochet and Vives 2004). Thus, to prevent sound banks from failing and causing contagion, bilateral lending remained a critical tool.

Some commentators doubted that central banks—or anyone else—could accurately distinguish between solvent and insolvent banks, yet still thought that bilateral lending was justified to stem contagion (see Cecchetti and Disyatat 2010; Goodhart 1999; Goodhart and Huang 2005; Salter 2016) and prevent the failure of sound but illiquid banks (Freixas, Rochet and Parigi 2004).[5] Others, however, argued that central banks, with their access to supervisory information, were capable of making this distinction with reasonable accuracy and that they should always strive to lend only to the banks they deemed solvent (see Tucker 2014). Of these two positions, the latter is the one that best aligns with Bagehot and that central banks have generally taken in designing their lending policies. We can therefore summarize the main rationale for bilateral lending facilities as resting on the idea that sound banks can experience liquidity problems due to market failures, that these problems can cause contagion and

[5] Freixas, Parigi and Rochet (2004) propose a model in which it is impossible to distinguish between solvent and insolvent banks, leading to market inefficiencies (e.g., higher-than-optimal market spreads during crises) that warrant bilateral LLR support. In their view, it is better for the LLR to support all banks (sound and unsound alike) than no banks (leading to significant deadweight losses from the collapse of sound banks).

broader financial instability, and that central banks are well placed to address such challenges by advancing short-term loans to temporarily illiquid but otherwise solvent banks.

The GFC further weakened the view that standard monetary policy tools were sufficient for performing the LLR function. Initial monetary policy responses to the crisis failed to spread liquidity to those that needed it because financial markets, which were relied on to allocate liquidity, were malfunctioning. While bilateral lending remained a useful tool for providing liquidity directly to stressed banks, it too was insufficient to address the nature and scale of the problem. Bilateral tools could not be expected to restore the functioning of impaired asset markets that had become critical to the funding of financial institutions and to the flow of credit to the broader economy (Domanski, Moessner and Nelson 2014). The fact that the crisis embroiled not just banks but also non-bank financial institutions (NBFIs) further highlighted the limitations of existing central bank tools, which were designed to inject liquidity into banks.

In responding to the GFC, central banks were thus forced to deploy new tools and techniques for providing emergency liquidity. They did this largely through the creation of various "market-wide tools" that aimed to restore liquidity in core funding markets and ensure that the financial system as a whole—banks and NBFIs alike—had access to funding. These tools took many different forms but generally provided liquidity in one of three ways:

- by accepting securities as collateral in repurchase agreements (repos)
- by purchasing securities directly
- by auctioning term loans to eligible borrowers

Observers were quick to point out that through their repo facilities and asset purchases, central banks were acting as MMLRs (Mehrling 2010; Moe 2012; Sibert and Buiter 2007). The term itself drew obvious parallels with the LLR concept but also signalled something distinct. What made an MMLR similar to an LLR was that it served a financial stability function not unlike that prescribed by Bagehot. What made it different was its focus on stabilizing markets rather than institutions, as well as the fact that it was harder to distinguish from monetary policy, particularly in the case of outright asset purchases. While the term MMLR was increasingly used to describe market-wide operations designed to restore market functioning, the LLR concept

remained associated mainly with the more traditional bilateral lending facilities (see, for example, Hauser 2021).[6]

More than a decade after the GFC, when COVID-19 caused global funding markets to seize up in March 2020, central banks again relied on market-wide tools to restore market functioning and provide liquidity to the financial system as a whole, including the NBFI sector. This further solidified the transformation that had begun during the GFC. Central banks were clearly no longer just LLRs that used bilateral loans to backstop banks and quell depositor runs. They were also, and arguably to a larger extent, MMLRs that used asset purchases and repo facilities to backstop entire asset markets (Buiter et al. 2023; Hauser 2021).

At the same time, bilateral facilities remained relevant and have continued to evolve since 2008. While bilateral lending was often overshadowed by the scale of market-wide and monetary policy interventions during the GFC and COVID-19, the failure of Silicon Valley Bank (SVB), Credit Suisse, and other banks in 2023 has only reaffirmed its importance as an instrument for dealing with traditional-style banking crises. In the United States, the Federal Reserve introduced a new temporary bilateral facility—the Bank Term Funding Program (BTFP)—to backstop distressed banks in the wake of SVB's collapse, and US authorities have recently signalled plans to boost the effectiveness of the discount window (Abate et al. 2024; Board of Governors of the Federal Reserve System 2023b). More broadly, commentators and policy-makers continue to draw lessons from the events of 2023, opening the door for potential further reforms to LLR toolkits (Baer et al. 2023; Board of Governors of the Federal Reserve System 2023a; Expert Group on Banking Stability 2023; FSB 2023a; G30 2024; Jones 2023; Jordan 2023; McLaughlin 2023).

This paper treats bilateral and market-wide facilities, or the LLR and MMLR functions, as crucial but distinct parts of the broader liquidity toolkits that central banks can draw upon for financial stability purposes. The distinction matters because, as shown in subsequent sections, the design of central bank liquidity policy often depends on the type of facility in question (e.g., bilateral vs. market-wide) as well as the type of crisis (e.g., idiosyncratic vs. systemic) for

[6] In discussing the LLR and MMLR functions, this paper focuses on policies and facilities designed to provide liquidity support to financial institutions or markets that have become temporarily illiquid. The focus is not on bailout-style interventions whereby public authorities inject capital into failing banks or take bad assets off their balance sheets. For a discussion of bank bailouts and their welfare and distributional implications, see Schroth (2021).

which that facility was designed. Certainly, there are different ways to categorize central bank liquidity facilities, including ways that add further nuance to the binary distinction of bilateral versus market-wide (see, for example, Buiter et al. 2023; Sibert and Buiter 2007; Tucker and Cecchetti 2021). Nevertheless, we find this basic distinction to be useful for illustrating key differences between broad types of liquidity tools. The remainder of the paper considers the policy design of both types of facilities, though with a slightly greater focus on bilateral tools.

3. Designing liquidity tools: Key issues and debates

A century and a half after the release of *Lombard Street*, Bagehot's principles remain ubiquitous as a frame of reference and source of ongoing discussion in the LLR literature.[7] Using these principles as a starting point, this section highlights recent developments and unpacks key issues and debates surrounding the design of central bank liquidity tools today. It focuses on four areas of liquidity policy (counterparties, pricing, collateral and solvency) that correspond closely with the four main elements of Bagehot's dictum (lend freely, at a high rate, against good collateral, to solvent institutions).

3.1 Counterparties

For Bagehot, lending freely meant providing as much liquidity as the market requested without restriction on the types of eligible counterparties. We can thus think of the "lend freely" principle as having two elements: one concerning the quantity of funds made available; the other having to do with *who* has access to these funds. When panics occurred, lending freely in both senses would ensure that the system as a whole had sufficient liquidity to continue functioning. Today, it is generally accepted that the quantity of funds central banks provide should be determined by the liquidity needs of financial institutions or markets in times of stress and constrained primarily by the amount of eligible collateral borrowers are able to pledge. Less straightforward is the question of who should have access to central bank liquidity facilities.

Despite Bagehot's (1873, 51) insistence that emergency loans should be given "to merchants, to minor bankers, to this man and that man," central banks have traditionally made their bilateral lending facilities available only to deposit-taking institutions (i.e., banks). The

[7] As Choi, Santos and Yorulmazer (2021, 974) put it, "Despite having shaped central banks' policies for more than a century, these principles continue to be the subject of intense debate."

reasoning behind this is that banks play an indispensable role in the everyday operation of the monetary system, but one that is inherently risky (Dobler et al. 2016; Moe 2012; Tucker 2014). As Dobler et al. (2016, 11) put it, banks allow economic agents to make payments "from accounts where funds are immediately available and whose value is not subject to market price fluctuations," which "necessarily involves banks undertaking—and managing—credit risk and maturity mismatches." To safeguard this function, authorities provide a safety net composed of deposit insurance, regulatory requirements, supervision, and access to central bank lending facilities.[8] Making loans available only to the deposit-taking institutions subject to this safety net can also help central banks manage the risks of lending to institutions that are facing financial stress.[9]

While it remains the case today that access to bilateral lending facilities is generally limited to banks, it is no longer true that central banks rely on these facilities as the main instrument in their financial stability toolkits. As noted in section 2, central banks responded to the GFC and COVID-19 with a host of new market-wide facilities designed to, among other things, provide liquidity to a wider swath of financial market participants, including NBFIs (Pozsar et al. 2013).

In important ways, providing broad-based liquidity to a wider range of financial institutions brings central banks closer to the Bagehotian ideal of lending freely to the market as a whole. At the same time, we are far from a world in which all financial institutions have equal, or consistent, access to central bank liquidity. The Bank of England's original discount window as described by Capie (2002) was a single mechanism open to all borrowers with acceptable collateral. In contrast, the financial stability tools of most major central banks today resemble a patchwork of different facilities and programs, each with its own set of eligible counterparties and its own terms and conditions. Many of these—particularly the market-wide operations—are temporary tools established or activated only under conditions of systemic stress, with eligible counterparties that vary depending on the purpose of the facility or program in

[8] Importantly, the safety net is largely funded by the banks themselves (Dobler et al. 2016). Deposit insurance and supervision are funded by levies on institutions subject to these regimes; capital and liquidity requirements involve balance sheet costs; and last-resort loans are often made at an above-market interest rate.

[9] For example, key elements of the safety net (e.g., deposit insurance, regulatory requirements) reduce the likelihood that LLR assistance will be needed in the first place. And when central banks *are* called upon for LLR support, they can leverage supervisory information to inform their risk assessments and consequent lending decisions.

question.[10] Others are permanent standing facilities that can be accessed at any time, regardless of broader market conditions, but these tend to be bilateral LLR facilities available only to deposit-taking institutions.

The current patchwork of central bank tools has sparked calls for greater clarity and consistency regarding which entities have access to which facilities, when, and on what terms. One idea discussed by Hauser (2021) is for central banks to minimize their reliance on temporary, ad hoc tools by creating a wider set of permanent liquidity facilities, with terms that are known in advance. Having a clearer sense of when and to whom central bank support is available would allow market actors to better price risks in advance of stress episodes, while also reducing their uncertainty about the central bank's "reaction function" when such episodes do arise (Hauser 2021). To some extent, this requires a credible commitment from the central bank not to deviate from its permanent toolkit, which may be hard to establish given the appeal of policy flexibility in a world of ever-changing financial risks and vulnerabilities. But even if central banks retain a degree of ad hockery in their responses to unexpected shocks, creating new types of permanent liquidity facilities could still help fill existing gaps in their toolkits.

Lending to NBFIs is one such gap. Given the size and systemic importance of NBFIs, which hold roughly half the assets of the global financial system and perform many bank-like functions, central banks will inevitably feel strong pressure to backstop non-banks in moments of acute stress.[11] In response to the GFC and COVID-19, central banks used various ad hoc techniques to get market-wide liquidity to a range of NBFIs. But while similar techniques may work during future *systemic* events, central banks generally do not have dedicated tools for lending to NBFIs experiencing *idiosyncratic* liquidity stress or a shock that involves several firms *but is not (or not yet) systemic*.

Such tools may be desirable for two reasons. First, without an effective backstop, trouble at one NBFI could spread and cause system-wide problems, much like in the case of banks. The contagion risk for NBFIs has only grown over the past 15 years, given their larger and more interconnected role in the financial system, and is particularly acute for systemically important

[10] In some cases, eligibility is defined narrowly (e.g., many asset purchase programs are limited to primary dealers). In other cases, it is quite broad (e.g., the Bank of Canada's Contingent Term Repo Facility (CTRF) is open to any financial market participant that can demonstrate significant activity in the Canadian-dollar money markets and/or fixed-income markets and that is subject to federal or provincial financial sector or market regulation).

[11] For an overview of the current size and significance of the global NBFI sector, see FSB (2023b).

institutions (Buiter et al. 2023). Second, without ready-to-use tools built specifically for lending to NBFIs, central banks may be forced to provide this backstop function using whatever tools are available, which may not be fit for purpose. This was an issue, for example, during the United Kingdom's recent liability-driven investment (LDI) crisis. In the absence of an appropriate tool, the Bank of England had to rely on gilt purchases to support troubled pension funds, which delayed its plan to begin quantitative tightening and created challenges for the implementation and communication of monetary policy (Alexander et al. 2023; Chen and Kemp 2023). Tensions between price stability and financial stability could be avoided, conclude Chen and Kemp (2023, 18), by "allowing appropriately regulated and systemically interconnected NBFIs possible access to some liquidity support from the BoE [Bank of England] facilities."

One risk of creating NBFI-specific tools with terms that are known in advance is that doing so could produce moral hazard. This relates to the idea that central banks should practice "constructive ambiguity" to prevent financial institutions from expecting support and therefore taking excessive risks (Domanski, Moessner and Nelson 2014; Enoch, Stella and Khamis 1997; Freixas 1999; Goodhart and Huang 2005). While the constructive ambiguity approach has largely fallen out of favour since the GFC (Cecchetti and Disyatat 2010; Hauser 2014; Nakaso 2014), some observers argue that it should still apply for any lending to NBFIs (Domanski and Sushko 2014; Tucker 2014). That is because the potential for moral hazard is greater for NBFIs than for banks, since banks are subject to stricter regulatory requirements that enforce a considerable degree of self-insurance. In addition to keeping non-banks guessing about their access to central bank liquidity assistance, Tucker (2014) argues that central banks should only ever lend to systemically important NBFIs and impose *ex post* consequences on those that do require liquidity support.[12]

While it is far from the norm at this stage, some central banks have moved toward establishing permanent tools for providing liquidity to NBFIs in stress. In 2020, the Bank of Canada activated its Contingent Term Repo Facility (CTRF), which is open to all financial market participants that demonstrate significant activity in the Canadian-dollar money markets or fixed-income markets and that are subject to federal or provincial financial sector or market regulations. These eligibility criteria help address some of the concerns of lending to NBFIs. They require

[12] The types of consequences Tucker (2014, 28) has in mind include removing the firm's management and forcing it to change its business model.

prospective counterparties to be regulated (although not to the same extent as banks) and to demonstrate their significance in core markets. Moreover, the CTRF provides liquidity at a penalty rate and only against high-quality securities, which helps protect the Bank of Canada from financial risk while also ensuring that the facility is financially attractive only in times of stress. Finally, while it is a permanent tool, the CTRF is activated and deactivated at the Bank of Canada's discretion, rather than being available at all times. This should also curtail moral hazard by tempering NBFIs' expectations that the facility will necessarily be there for them when they want it.

Having taken seriously the lessons of the LDI episode, the Bank of England is also currently working on a new facility for lending specifically to pension funds and insurance companies, with plans to consider expanding access to other types of NBFIs over time (Alexander et al. 2023; Hauser 2023; Milliken 2023). At the time of writing, details of the facility's design were still under consideration, including whether it would be a standing facility or one that was activated at the Bank of England's discretion when stresses materialize. But early communications make clear that officials plan to mitigate moral hazard and other key risks through various design features, including penalty pricing and lending only to NBFIs that are judged *ex ante* to meet some threshold of resilience (Hauser 2023).

Central banks that move in the same direction as their Canadian and British counterparts will have to grapple with the question of which types of NBFIs to include in their facilities. The Bank of Canada's CTRF is open to all NBFIs that meet its eligibility criteria, whereas the Bank of England has prioritized pension funds and insurance companies. Hauser (2023, 9) notes that "insurance companies and pension funds were the biggest NBFI sellers [of gilts] in both the dash for cash and the LDI episodes." In fact, hedge funds and open-ended mutual funds each appear to have been bigger sellers than insurance companies—though not pension funds—in these episodes, suggesting that other considerations have shaped the decision to include insurance companies (e.g., their systemic importance, the fact that they are already prudentially regulated and exhibit greater resilience than other NBFIs).[13]

[13] For a breakdown of net gilt sales by NBFI type in the dash for cash and LDI stress episodes, see Hauser (2023, 10, Figure 4).

Dobler et al. (2016) consider the case for bilateral lending to three other types of NBFIs: financial market infrastructures (FMIs), securities dealers and mutual funds. They conclude that systemic importance provides an appropriate rationale for lending to FMIs.[14] For securities dealers, they argue that bilateral support, if ever needed, would be most justified for systemically important dealers trading predominantly in government securities.[15] In the case of mutual funds, the authors see LLR support as possible but not essential for addressing idiosyncratic concerns, emphasizing the role of better regulation instead. As they point out, while FMIs and securities dealers are often supervised or regulated entities (i.e., already subject to some aspect of the safety net) that provide critical services to financial markets, this is less likely to be the case for individual mutual funds.[16] Such considerations may help explain why the Bank of England has prioritized insurance companies (which are prudentially regulated) over mutual funds (which are not) for inclusion in its proposed NBFI lending facility, despite the latter having a bigger role than the former in recent stress events.

Going forward, there is a need to think beyond these more established NBFIs and consider also whether central banks should lend to newer entities such as stablecoin issuers or other fintech firms. Many of these businesses perform bank-like functions outside the regulatory perimeter, and there may at some point be a financial stability case for bringing them into the safety net. Before doing so, however, we must consider the potential ramifications of extending central bank support to a new sector for the first time, including the effect it would likely have on legitimizing and encouraging the further expansion of that sector.

3.2 Pricing

The second key element of Bagehot's (1873, 197) dictum is that, in his words, LLR loans "should be made only at a very high rate of interest." Most economists interpret this principle as meaning a high rate compared with normal market funding costs, not compared with the

[14] FMIs have become more systemically important through post-crisis reforms that concentrate risk on their balance sheets. Illiquidity of FMIs could have destabilizing knock-on effects throughout the financial system. In Canada, the Bank of Canada acts as the resolution authority for critical FMIs, which are currently the only type of NBFI eligible to borrow bilaterally from the central bank.

[15] Securities dealers provide a systemically important function, but Dobler et al. (2016) note that idiosyncratic support for such entities should be rare, given that government securities should be among the most liquid and creditworthy assets in the absence of a system-wide problem.

[16] This also implies that the heightened monitoring that accompanies LLR lending would generally be easier to impose on FMIs and securities dealers than on mutual funds.

temporarily elevated market rates that prevail during a panic (Buiter et al. 2023; Cecchetti and Disyatat 2010; Goodhart 1999; Salter 2016). Bagehot's rationale for charging a high rate was to discourage unnecessary requests for central bank liquidity, deter excessive hoarding of scarce cash, and mitigate moral hazard (Humphrey 1975, 2013). Penalty pricing would ensure that, under normal conditions, sound borrowers could always obtain cheaper funding from private markets and that central bank loans would become attractive only in times of stress when private funding became expensive and scarce. Paying a premium would also give borrowers an incentive to repay LLR loans promptly when a panic subsided, thus providing an exit strategy for ending central bank support when it was no longer necessary.[17]

Although central banks have historically charged a premium for LLR loans, to say they adhere to this part of Bagehot's thinking would be to gloss over the considerable variation that has existed across jurisdictions and over time. Since the GFC alone, central banks have implemented important changes to the way backstop liquidity is priced. One general development that has accompanied the recent rise of market-wide facilities is the increased use of auctions, where eligible counterparties bid on central bank funds through a competitive process that determines the costs of those funds. While quite different than the traditional approach of charging a fixed rate for bilateral loans, auction-based pricing can be (though is not always) designed in a way that adheres to the spirit of Bagehot's principle (see Buiter et al. 2023). Central banks can set the minimum bid rate above the cost of normal market funding to ensure the liquidity they provide is attractive only when markets are dysfunctional. As markets recover, well-designed auction facilities become progressively less attractive than market liquidity, making them self-extinguishing (Cecchetti and Disyatat 2010; Johnson 2023; Mehrling 2014; Tucker 2014).

In addition to the use of auctions for pricing many (though not all) market-wide facilities, there have also been several recent changes to the way that *bilateral liquidity* is priced at various central banks. Here, however, it is difficult to identify a consistent direction of change across jurisdictions. For example, the Bank of England opted for relatively high pricing in 2008 with the introduction of its Discount Window Facility (DWF), which charges 25–150 basis points (bps)

[17] An additional factor, important during Bagehot's time but less so today, was that a high interest rate would protect the country's gold reserves—the anchor of the monetary base under the gold standard—by encouraging the retention of gold at home and attracting gold from abroad (Humphrey 1975; Laidler 2004).

above the Bank Rate depending on the collateral pledged and the size of the loan compared with the borrower's liabilities.[18] Meanwhile, the Fed has moved in the opposite direction since March 2020, reducing the price of primary credit at the discount window so that it is equal to the upper end of the federal funds target range (a 50 bp reduction to a rate that was already relatively low).[19] At this new rate, borrowing from the Fed could actually be cheaper than normal market funding depending on the collateral against which a loan is made.[20] The Bank of Canada, for its part, introduced a new bilateral lending facility in March 2020 (the Standing Term Liquidity Facility (STLF)), which is priced somewhere between the Bank of England's and the Fed's facilities but is more expensive than the Bank of Canada's other bilateral facility, Emergency Lending Assistance (ELA).

The variation in these examples, while representing only a tiny sliver of global and historical cases, speaks to a broader truth about Bagehot's pricing principle and the way it is understood and applied: although few seem to disagree with the general notion of charging a premium for last-resort loans, Bagehot's advice is fundamentally indeterminant when it comes to *how high above which market rates* liquidity facilities should be priced. Ultimately, there is no consensus on the correct price. Interest rates differ from one facility and jurisdiction to the next, often reflecting different priorities and judgment calls about how to balance competing risks. On the one hand, there is a risk that central bank liquidity is priced too low to curb moral hazard or prevent financial institutions from using it as a replacement for normal market funding. On the other hand, there is a risk that liquidity is priced too high, making it unattractive to prospective borrowers, even in times of stress. The goal for central banks is to set a price that makes their liquidity facilities *usable but not abuseable*—that is, attractive when needed but not when viable market alternatives exist.

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[18] If a bank used mortgage or non-mortgage loan collateral (level C collateral in the Bank of England's three-tiered system) to borrow a sum equal to 5% or less of eligible liabilities, the spread would be 75 bps. Against the same collateral, the spread would be 100 bps for borrowing equal to 10% of eligible liabilities and 150 bps for borrowing equal to 15% of eligible liabilities.

[19] From March 2010 to March 2020, the Fed charged 50 bps above the upper limit of the federal funds target, but this previously higher rate was still relatively cheap compared with the Bank of Canada's STLF or the Bank of England's DWF. From 2003 to 2007, the Fed charged 100 bps above the top of the federal funds target range.

[20] The Fed charges an additional 50 bps above the top of the federal funds target range for secondary credit under the discount window. Depository institutions deemed too risky to qualify for primary credit "are eligible for secondary credit when use of such credit is consistent with a timely return to a reliance on market sources of funding or the orderly resolution of a troubled institution" (Federal Reserve 2023). While more expensive than primary credit, secondary credit is still likely cheaper than any market funding that banks in considerable distress could obtain.

Identifying the right price to achieve this fine balance is difficult for several reasons. One is that there is no single market rate for borrowing against the same range of collateral (let alone at the same term) that banks can use to draw on bilateral lending facilities.[21] Some central banks try to address this issue by using tiered pricing systems to lend at different rates against different types of collateral (e.g., the Bank of England's DWF, the Bank of Canada's STLF).[22] But others, such as the Fed, use a single rate. Thus, while borrowing primary credit from the Fed's discount window against high-quality liquid assets is likely to be more expensive than market funding using equivalent collateral, borrowing against less-liquid collateral (mortgages, non-mortgage loans) may be cheaper than market funding that could be obtained using the same assets.[23]

Finding the right price for last-resort liquidity is also complicated by the stigma associated with LLR facilities. Stigma refers to the fact that banks are generally hesitant to take central bank loans for fear that doing so, if revealed, will be interpreted by the market as a sign of weakness and that they will be singled out among their peers as a weak institution (Domanski and Sushko 2014; Fischer 2016; Freixas, Rochet and Parigi 2004; Winters 2012). Stigma and pricing interact in two ways. First, pricing is one of several factors that affects the degree to which liquidity facilities are stigmatized because financial institutions worry that borrowing at too high a rate will make them look desperate (Rochet and Vives 2004; Winters 2012). Second, stigma can cause the "true price" of central bank facilities to be underestimated. The true price can be seen as the nominal price *plus* the premium banks would be willing to pay to avoid a given facility. This means, for example, that facilities priced below market rates in nominal terms could *de facto* be priced above market rates, depending on how stigmatized they are.

[21] In addition to marketable securities, most bilateral LLR facilities (e.g., the Fed's discount window, the Bank of England's DWF, the Bank of Canada's STLF and ELA) will accept mortgages and non-mortgage loans as collateral.

[22] Under the STLF, the rate for borrowing against eligible marketable securities is the overnight index swap (OIS) plus 35 bps, while the rate for borrowing against eligible mortgages and non-mortgage loans is the OIS plus 75 bps.

[23] Unlike the Bank of Canada and Bank of England, the Fed does not charge a higher rate for lending against less-liquid collateral (e.g., mortgages, non-mortgage loans). This implies that smaller banks are more likely to find federal rates attractive, given their higher market funding costs. However, the availability of low-cost Federal Home Loan Bank (FHLB) funding has meant that, until recently, smaller banks could use mortgage collateral to obtain cheaper loans at their local FHLB. Under the Fed's current pricing structure, FHLB loans are no longer consistently cheaper than primary credit at the discount window, although they are less stigmatized.

Under the right conditions, the cost of stigma can be measured. Armantier et al. (2015) measure the stigma associated with the Fed's discount window by comparing its cost and usage with that of another Fed facility (the now-defunct Term Auction Facility (TAF) introduced in 2007) and to market funding. The TAF was structured like a market-wide auction facility but otherwise had the same collateral, haircut and counterparty requirements as the discount window. The authors found that banks were willing to pay an average premium of at least 35 bps before the Lehman Brothers collapse and 143 bps after it to borrow from the TAF instead of the discount window. Banks also paid similar premiums for market funding (specifically asset-backed commercial paper and repo funding).

In addition to showing that stigma can be quantified, these findings support the commonly held view that bilateral facilities are more stigmatized than market-wide facilities. The main reason for this greater stigmatization is simple: the risk of being singled out as a weak institution is much higher when an individual bank is drawing on a bilateral facility for idiosyncratic reasons than when many banks are simultaneously drawing on a market-wide facility due to a broader systemic shock (Winters 2012).

When it comes to bilateral loan facilities, concerns about stigma have led some central banks to ignore, or at least de-emphasize, Bagehot's (1873) advice to lend only at a high rate. As noted above, the Fed's rate for primary credit hardly qualifies as a penalty rate, suggesting that reducing stigma and making the discount window more usable is a higher priority than ensuring, through a high price, that banks only have an incentive to use the facility as a last resort.[24] Susan McLaughlin (2023), former head of the New York Fed's discount window from 2018–2023, questions whether Bagehot's principle should apply at all to the Fed's short-term lending to sound banks, stressing the need for pricing to be set in a way that minimizes stigma. Before proceeding, we should note that pricing is not the only factor that affects stigma.[25] US authorities, for example, are currently considering non-price-related methods to further reduce

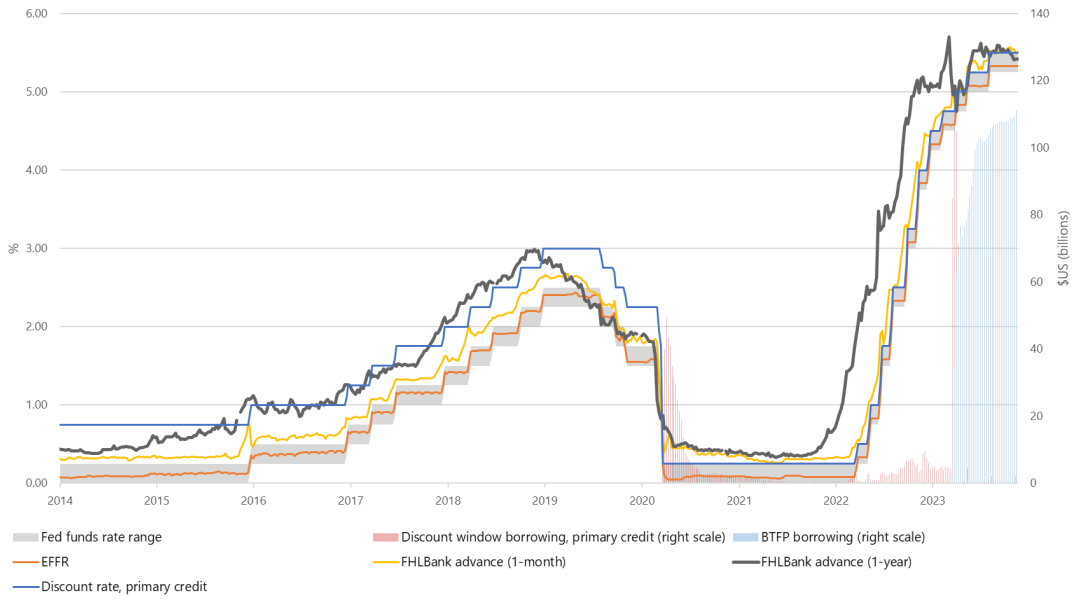
[24] There is no shortage of analysis or commentary from Fed officials suggesting that they view stigma as a persistent problem that interferes with the optimal functioning of the discount window. For example, see Armantier and Holt (2020), Bernanke (2008), Carlson and Rose (2017), Ennis and Price (2020), Madigan (2009) and Nelson (2021).

[25] Other factors that may affect the level of stigma include, but are not limited to: policies regarding public disclosure of LLR borrowing; whether a facility is bilateral or market-wide; whether a facility is available only to solvent or sound borrowers; the type of collateral a facility accepts; how routinely a facility is used; and the circumstances under which financial institutions may look to draw on a facility (e.g., stigma will be higher in idiosyncratic than systemic stress).

stigma, including mandatory testing where banks are required to periodically borrow from the discount window to make the process more routine and familiar (Johnson 2024).

While stigma persists and remains a concern for the Fed, its relatively relaxed pricing scheme has no doubt contributed to the fact that the discount window is used on a consistent basis. The facility sees a steady but low level of usage most of the time, punctuated by large spikes in moments of generalized banking stress (e.g., the GFC, the initial COVID-19 shock, the wake of SVB's collapse). This paper does not attempt to estimate the exact effect of reduced discount window pricing since March 2020 on the demand for loans. However, the Fed has clearly set a rate at which banks are willing to borrow (though we do not currently know whether they are borrowing more or less than needed). **Chart 1** shows the discount rate for primary credit next to the lowest rate for overnight market funding (the effective federal funds rate [EFFR], as well as the cost of one-month and one-year loans from a Federal Home Loan Bank. It also shows a steady uptick in discount window borrowing from mid-2022 to early 2023, followed by a huge spike in borrowing from the discount window and the Fed's BTFP facility after the fall of SVB in March 2023.

Chart 1: Select US rates and borrowing from the Federal Reserve



Note: EFFR is the effective federal funds rate; FHLBank is Federal Home Loan Bank; BTFP is the Bank Term Funding Program.
Sources: Federal Reserve, FHLB Des Moines and Federal Reserve Bank of New York
Last observation: November 15, 2023

At the other end of the spectrum, the Bank of England has adopted a relatively aggressive pricing structure for the DWF.[26] This facility is significantly more expensive than the Fed's lending, especially considering that the DWF provides not cash but gilts, which then have to be lent for cash in private markets or at the Bank of England's indexed long-term repo facility. It is perhaps not surprising, then, that the DWF is considered stigmatized, has never been used, and appears unattractive relative to market rates even in times of stress, particularly for banks that want to borrow against less-liquid eligible collateral (Winters 2012). It is important to note, however, that continually since 2012, the Bank of England has provided relatively inexpensive funding to the same banks eligible for the DWF through a series of term funding schemes.[27] Providing four-year funding at the Bank Rate against the same collateral eligible for the DWF, these schemes have made the DWF less needed and less attractive than it might otherwise have been. Whether the DWF is too expensive to be usable in the circumstances for which it was designed cannot be properly tested until the latest funding scheme expires.

The Bank of Canada's ELA facility is priced similarly to primary credit at the discount window, charging only the Bank rate for emergency loans. One important difference between the Canadian and American approaches, however, is that the Bank of Canada charges a *lower rate* for its more extraordinary facility (ELA) than it does for its more routine facility (STLF), whereas the Fed does the opposite (secondary credit costs 50 bps more than primary credit). While charging a higher rate for riskier loans is intuitive, the inverse approach may make sense if the stigma associated with these more exceptional facilities is strong enough on its own to deter unnecessary loan requests and curtail moral hazard. If so, the pricing mechanism is not needed for this purpose, and charging a higher rate would only increase the financial burden on already-troubled banks or, for banks in resolution, on public authorities (Cecchetti and Disyatat 2010; Crockett 1996; Freixas et al. 2000; Garcia and Plautz 1988).

For both bilateral and market-wide facilities, it is generally agreed that it remains desirable to price liquidity higher than market funding costs during normal times but lower than the temporarily elevated market rates seen during crises (Buiter et al. 2023; Cecchetti and Disyatat

[26] As noted above, the DWF charges a spread of 25–150 bps above the Bank Rate, depending on the collateral pledged and the size of the advance compared with the borrower's liabilities.

[27] The first of these programs was the Funding for Lending Scheme launched in 2012, followed by the Term Funding Scheme introduced in 2016, and then the Term Funding Scheme with additional incentives for small and medium-sized enterprises introduced in 2020.

2010; Goodhart 1999; Salter 2016). But there is no agreed-upon rate or method for determining the optimal rate. The choice of rate ultimately reflects judgment calls and risk priorities, which can differ considerably from one central bank to another. Nevertheless, central banks looking to set or evaluate their pricing of liquidity facilities should consider the following: how their pricing compares with market funding costs (specifically the costs of funding against the same collateral and over the same term, as permitted under the facility in question); the cost of stigma associated with the facility; and what the actual usage of the facility (or similar facilities) suggests about its attractiveness to eligible counterparties.

3.3 Collateral

In line with his view that last-resort loans should be widely available in times of need, Bagehot insisted that the LLR should lend against all "good collateral," by which he meant the types of assets that could ordinarily be used as collateral for securing loans but whose value may be temporarily depressed in a panic. Lending against good collateral protected the central bank against the risk of loss in the event of a counterparty default. It also, in Bagehot's view, served as a test of the borrower's solvency in the absence of better information. Having sufficient high-quality assets to pledge as collateral could be taken as an indication that, while illiquid, the borrower in question remained fundamentally solvent (Humphrey 1975, 2013).

Today, interpretations of what constitutes good collateral vary. Many commentators interpret it as meaning high-quality marketable securities and use this definition to suggest that modern central banks have deviated—or indeed must deviate—from Bagehot's guidance in carrying out their LLR duties (e.g., Cecchetti and Disyatat 2010; Choi, Santos and Yorulmazer 2021; Dobler et al. 2016; Hogan, Le and Salter 2015). Others point out, however, that the spirit of Bagehot's principle is not overly prescriptive in terms of the type of collateral central banks should accept and that Bagehot himself advocated for the Bank of England to accept some fairly unconventional assets (e.g., railway debenture stocks) (Bignon, Flandreau and Ugolini 2012; Humphrey 1975, 2013). In general, Bagehot was concerned with ensuring that borrowers could obtain sufficiently large loans and thus endorsed a wide conception of good collateral. At the same time, he clearly rejected the idea that the LLR should accept "bad bills or bad securities," which he thought would make a panic worse (Bagehot 1962, 97).

Bagehot's views on collateral all pertain to the question of which assets the LLR should lend against. Another crucial question is how central banks should value the collateral they accept. On both fronts, central banks have made significant policy changes since the start of the GFC.

One general trend over the past 15 years has been a broadening of eligible collateral, as central banks have come to accept a wider variety of illiquid (or less-liquid) assets. Designed to expand the amount of liquidity available to distressed financial institutions, the policy moves that were behind this trend were a response to the exigencies of financial crises (BIS 2013; Buiter et al. 2023; Choi, Santos and Yorulmazer 2021). The Bank for International Settlements (2013) documents examples of this trend in the first five years after the GFC, while IMF researchers (Buessing-Loercks et al. 2020) highlight the further expansion of central bank collateral frameworks following the COVID-19 shock. A few examples from the Canadian case include the Bank of Canada's decision to:

- accept a wider range of assets (asset-backed commercial paper and US Treasury securities in 2008, non-mortgage loans [NMLs] in 2010) for its routine Standing Liquidity Facility (SLF)[28]
- accept NMLs (2010), as well as residential and commercial mortgages (2015), for its extraordinary bilateral liquidity tool, ELA
- establish a new bilateral facility, STLF (2020), which would accept NMLs and residential mortgages

The shift toward accepting a wider range of collateral has not applied equally to all liquidity facilities. While some central banks accept the same collateral across all standard facilities (e.g., European Central Bank, Bank of Japan, Swiss National Bank, Sveriges Riksbank, Reserve Bank of Australia), others take a differentiated approach, typically one in which less-liquid assets are eligible under bilateral loan facilities but not OMO-style interventions (e.g., Bank of Canada, Federal Reserve). The rationale for accepting a wider range of assets under bilateral facilities is discussed later.

As central banks have come to accept a wider range of assets as collateral, they have also developed more sophisticated models for valuing and haircutting the different forms of

[28] The Bank of Canada first decided to accept NMLs on a temporary basis around the Y2K transition and then accepted them on a temporary basis again starting in 2008. In February 2010, their acceptance became permanent.

collateral they accept. These models provide better tools for estimating the value for which collateral could likely be sold during severe stress and thus allow central banks to better calibrate haircuts. Nevertheless, the size of haircuts applied to different forms of collateral varies across central banks, reflecting differences in risk tolerances, modelling approaches and asset characteristics.

Central banks face clear trade-offs in deciding which collateral to accept for their liquidity facilities, as well as how to value and haircut that collateral. All else being equal, accepting only the safest, most liquid securities best protects central banks against financial losses, as such assets carry little credit risk and are easy to sell if counterparties default. But this approach limits the borrowing capacity of eligible financial institutions and can thus undermine the broader objectives of LLR policy. Haircuts are similar. Bigger haircuts give central banks more protection against the risk of having to liquidate collateral at a loss if counterparties default, but they also diminish borrowing capacity and raise all-in borrowing costs for these counterparties.

How central banks balance these trade-offs in practice partly depends on the type of financial stress scenario and, by extension, the type of liquidity facility in question.[29] Many of the market-wide operations used to stabilize core funding markets deal exclusively in high-quality securities whose price they seek to put a floor under.[30] In contrast, bilateral lending facilities tend to accept a wider range of collateral to meet the needs of individual banks that can no longer fund themselves in the market. By the time a bank turns to its central bank for bilateral assistance, it may have already exhausted its high-quality securities in an effort to raise liquidity (Dobler et al. 2016; Tucker 2014). Even if the bank has retained these assets (e.g., to avoid selling them at fire-sale prices), its pool of marketable securities is unlikely to provide sufficient collateral to secure a loan big enough to cover large-scale deposit outflows. Thus, to provide further liquidity, the central bank must stand ready to liquify less-liquid assets (e.g., mortgages, NMLs) by accepting them as collateral. Hence, Koulischer and Struyven (2014) suggest that central banks should lend against low-quality collateral when all high-quality collateral has been exhausted. Choi, Santos and Yorulmazer (2021, 976) go further to argue that "lending

[29] It also depends on central banks' capital frameworks and their relationships with fiscal authorities (e.g., whether they are indemnified against losses).

[30] Some asset purchase programs have targeted lower-quality securities, such as corporate bonds, which exposes the central bank to greater credit risk than do government bond purchase programs.

against low-quality collateral can improve welfare even when high-quality collateral is still available" by leaving more liquid assets in the market to circulate.[31]

Accepting a wide range of collateral—including illiquid loans—increases the borrowing capacity of eligible banks but does not guarantee their ability to access sufficient backstop liquidity. The case of Credit Suisse is extreme but instructive. In March 2023, the bank did not have sufficient collateral to meet its funding needs through the Swiss National Bank's (SNB) emergency liquidity assistance facility, despite the latter's broad acceptance of illiquid collateral (e.g., residential and commercial mortgages, corporate loans, foreign loans). Part of the problem was that Credit Suisse was not operationally ready to use all of its eligible collateral (Schlegel 2023). In the end, the Swiss government passed an emergency law that enabled the SNB to lend uncollateralized to Credit Suisse and thus provide enough liquidity (equivalent to 168 billion Swiss francs) "to cover virtually all possible short-term outflows from the bank" (Schlegel 2023, 7). While its uncollateralized lending was secured "solely by means of preferential rights in bankruptcy proceedings," the SNB did enjoy protection from losses on this lending through a federal government guarantee (Schlegel 2023, 8).

While unique in its own ways, the Credit Suisse example speaks to two broader points about collateral and its use in securing loans from central banks. The first is that banks need to be ready to use their eligible collateral when the need for such loans arises. A lack of operational readiness in this area was a problem not only for Credit Suisse but also for American banks (e.g., Signature Bank) that attempted to borrow from the Fed during the recent US banking stress (McLaughlin 2023). Recognition of this issue has led to calls for much greater pre-positioning of collateral at central banks (as well as mandatory testing where banks are required to go through the process of borrowing from certain liquidity facilities) (G30 2024; Johnson 2024). The second point is that even if banks are ready and able to use their collateral, there is no guarantee they will always be able to borrow as much as they need. One factor that can offset the extra borrowing capacity generated by central banks accepting a wider range of collateral is the fact that they apply larger haircuts to riskier, less-liquid assets.[32] The valuation

[31] During the GFC, borrowers pledged large amounts of relatively risky and illiquid assets (commercial loans, asset-backed securities, MBSs, residential mortgages) and much smaller amounts of safe assets (US Treasury bills and other government bonds), presumably because they could use the latter elsewhere in the market to generate liquidity (Wiggins et al. 2022).

[32] Central banks also mitigate the credit risk in general by lending bilaterally only to regulated banks that fall within the safety net regime, and often only to those that have been deemed solvent or otherwise financially sound.

of collateral is not set in stone, however. It can be adjusted as a means of altering the balance between protecting central bank balance sheets and promoting financial stability. This raises questions about the circumstances under which adjustments may be warranted.

For the Fed, the banking stress triggered by SVB's failure in March 2023 warranted the creation of a new temporary bilateral lending facility (the BTFP) that valued eligible collateral *at par*—at face value instead of current market value—and, additionally, did not apply a haircut to this collateral. While the BTFP was available to the same counterparties as the discount window, the collateral it accepted was limited to bonds issued or backed by the US government.[33] Valuing these assets at par, and with zero haircut, provided a generous backstop for banks that faced heightened interest rate risk as a result of the depressed market value of their hold-to-maturity bonds. Rather than having to sell bonds at a loss to cover depositor withdrawals, banks could bring them to the Fed and get a one-year term loan worth the face value of the bonds. Banks that did this would still realize losses on their bonds over time—as their funding costs under the BTFP (one-year OIS rate plus 10 bps) would exceed the yields on these bonds—but it would be a slow burn rather than a sudden shock (Kelly 2023). To insulate the Fed from any potential losses, the US Treasury Department agreed to provide $25 billion worth of credit protection. This, combined with the high-quality nature of the collateral itself, is likely what allowed the Fed to accept the risk of valuing collateral at par without haircuts.[34]

The BTFP's unique approach to collateral reflected the problem it was designed to address. That problem was both systemic (it grew out of a system-wide vulnerability in bank balance sheets) and idiosyncratic (it could materialize in the form of a run on one or many banks at any given time). Valuing collateral at par and with no haircuts dealt with both sides of the problem. It addressed the underlying vulnerability by protecting banks against a sharp and sudden realization of interest rate risk. This, in turn, reduced the risk of depositor runs and bond market fire sales (Kelly 2023). For banks that nevertheless found themselves in trouble, the BTFP boosted the amount of cash they could obtain for their bonds and provided one-year term funding, giving banks ample time to course-correct. Importantly, the valuation of collateral under the BTFP helped the Fed reconcile the tension between its monetary policy and financial

[33] Namely, US treasuries, US agency securities and US agency MBSs.

[34] The fact that this collateral carried virtually zero credit risk meant the Fed could hold it to maturity if counterparties defaulted on their loans and thus avoid any face-value losses.

stability responsibilities. The Fed was able to continue raising interest rates while at the same time providing refuge to banks (though not NBFIs) that were beginning to wobble under the weight of the unrealized losses on their treasury or agency bonds.

While the BTFP is a unique facility designed to deal with a particular problem, there may be other cases where relaxing the valuation of collateral is justified on financial stability grounds. For example, Kelly (2023) advocates for a countercyclical haircut approach that follows the logic of pricing, where haircuts are kept relatively high during normal times but relaxed in moments of stress. This would work in tandem with pricing to make central bank loans less attractive when market funding is readily available—helping to mitigate moral hazard—and more attractive precisely when they are needed most—helping to reduce stigma and reinforce the effectiveness of central bank liquidity policy. It would also enable financial institutions to borrow relatively larger amounts from the central bank in times of stress, when extra borrowing capacity could prove crucial. Ultimately, these benefits must be weighed against the additional risks that a countercyclical approach might entail. One risk is that central banks become more exposed to financial losses during downturns by reducing haircuts at the same time collateral is becoming riskier. Some central banks were willing to accept this risk during the GFC, as they reduced haircuts on a temporary basis (BIS 2013). Since then, however, haircut models have generally become more sophisticated and precise in calibrating haircuts that align with central banks' risk tolerances. As such, there may be less room today to adjust haircuts downward unless central banks are also willing to adjust their underlying risk appetites.

To a large extent, the contemporary policy conversation has moved beyond debates about what constitutes good collateral and whether central banks should lend against only such collateral. There is a greater recognition today that the appropriate collateral policy may depend, as many elements of LLR and MMLR policy seemingly do, on the types of financial shocks and the corresponding liquidity facilities (e.g., bilateral or market-wide) in question. With this comes a greater focus on questions of when, why, and on what terms central banks should lend against different types of collateral—questions that naturally go beyond a simple application of Bagehot's formula. For each of these more specific questions, there are clear tensions (e.g., between the central bank's own risk appetite and its broader financial stability goals) that central banks must confront and resolve through the design of their liquidity tools.

3.4 Solvency

The final Bagehot principle holds that LLRs must lend only to banks that are financially sound (Humphrey 2013). Bagehot made no exception for systemically important banks. The LLR's job was not to save unsound banks but to prevent their failure from spreading to sound institutions (Humphrey 1975).[35] Writing before the advent of modern bank supervision, Bagehot viewed soundness not as something that authorities would determine based on formal assessments, but as something that could be assumed of entities that possessed good collateral. Over time, Bagehot's original points have been elaborated upon to form the more familiar statement that LLRs should lend only to solvent (but illiquid) financial institutions.

Lending to insolvent firms is problematic insofar as it generates moral hazard, puts taxpayer money at high risk and produces distributional inequities (Buiter et al. 2023; Meltzer 1986; Tucker 2014).[36] Lending to banks that later fail can also further stigmatize central bank facilities and negate their confidence-enhancing effects. If banks that are solvent but illiquid refuse to borrow from facilities that appear to put them in the same company as fatally flawed institutions, central banks will be unable to perform their basic LLR function (Tucker 2014). Likewise, if market actors do not see central bank support as a signal that the bank in question is sound and will survive in its current form, then central bank lending will have limited impact on restoring market confidence.

Before the GFC, central bank policy largely followed the principle of lending only to solvent banks. Authorities did not use collateral to gauge soundness, as Bagehot suggested; they leveraged supervisory data and rating methodologies to judge whether a potential borrower was solvent. Not all banks that received central bank assistance turned out to be solvent in the end, but being deemed solvent was, in many jurisdictions, an explicit *ex ante* requirement for gaining access to LLR facilities. While this remains a requirement of some facilities, central banks now have several financial stability tools for providing liquidity that are not contingent on the borrower's solvency. This is the result of two important changes to central bank toolkits over the past 15 years: one related to market-wide tools, the other to bilateral facilities.

[35] Many of these views on lending only to solvent institutions were espoused before Bagehot by Henry Thornton.

[36] One potential distributional effect of lending to banks that turn out to be insolvent is that short-term, unsecured creditors escape but longer-term, unsecured creditors end up as claimants in bankruptcy with a claim on a smaller pool of assets.

The first change came from the emergence of market-wide facilities, which generally do not require solvency checks. Most market-wide facilities are repo or asset purchase programs that focus, from a risk perspective, on the soundness of the assets rather than the counterparties. In an important sense, this brings central banks closer to what Bagehot (1962, 97) had in mind when he wrote that the LLR must provide liquidity only to "the 'sound' people, the people who have good security to offer."

The second change, however, was a sharp departure from Bagehot, as well as from past central bank practice. After the GFC, Group of Twenty (G20) jurisdictions set about creating resolution regimes to provide better options for dealing with failing banks, particularly systemically important ones. The crisis had forced financial authorities into an impossible dilemma: either bail out insolvent banks or let them collapse in a destabilizing manner. Resolution regimes gave authorities tools and legal powers to take over failing banks and restructure them in a way that distributed losses among shareholders and creditors (rather than taxpayers), all while maintaining the critical functions these banks performed in the financial system. Importantly, keeping a bank running while in resolution required access to funding (FSB 2014). Some central banks therefore reformed their bilateral toolkits to enable lending to banks in resolution. In 2015, for example, the Bank of Canada rewrote its ELA policy so that banks no longer had to be solvent to access emergency lending; instead, they had to have a credible recovery and resolution framework. Likewise, the Fed can provide secondary credit to banks deemed too risky to qualify for primary credit, but only when doing so "is consistent with a timely return to a reliance on market sources of funding or the orderly resolution of a troubled institution" (Federal Reserve 2023). In an important sense, then, the Bagehot principle of lending only to solvent banks was upended as a matter of policy with the advent of bank resolution regimes.

In another sense, however, resolution regimes may allow central banks to strengthen their commitment to withhold regular bilateral liquidity support from unsound banks. Central banks in the pre-GFC period generally agreed that loans should not be given to insolvent banks but sometimes found it difficult to stick to this position in moments of financial stress (Bordo 2014; Calomiris, Flandreau and Laeven 2016; Humphrey 2013; Schwartz 1992). When central banks did extend loans to institutions of questionable soundness, it was often done in the name of stemming contagion. While there was a distinct school of thought that endorsed lending to insolvent banks for precisely this reason (see Bordo 1990; Salter 2016), more important was the

fact that central banks faced a time consistency problem (Selgin 2012; Tucker 2014).[37] No matter what their policy position was in normal times, the pressure to lend became intense during moments of severe stress and uncertainty, as nobody wanted to be responsible for failing to stop the next financial crisis. Resolution regimes promised to change this. By providing the option of resolving banks that were "too big to fail," these regimes allowed authorities to prioritize financial stability without having to lend to unsound institutions (unless these institutions were going to be resolved and required resolution funding). It is for this reason that Tucker (2014) regards resolution regimes as critical to fixing the time consistency problem and making credible the central bank promise of lending only to solvent firms.

Resolution regimes thus present important opportunities for improving central bank liquidity policy. But they also raise new questions and challenges for the design of liquidity toolkits. For central banks that provide resolution funding, one challenge is mitigating the financial risk of lending to failing firms. This can be done, in principle, if central banks commit to lending only when there is a clear and credible pathway for rehabilitating the troubled institution.[38] This is what the Bank of Canada has tried to do through its eligibility criteria for ELA (recall that banks must have a credible recovery and resolution framework to be eligible for ELA).

Another challenge is stigma. Solvent banks that simply need short-term liquidity may be reluctant to use bilateral facilities that can also be used by, and may thus become associated with, banks in resolution. To address this issue, central banks may consider creating two separate lending facilities: one for solvent but illiquid institutions, the other for those with deeper problems. For example, the Bank of Canada has the STLF, which is available only to sound banks, and ELA, which can be used for recovery and resolution funding (Graham, Khan and Lai 2016). Having two separate facilities can enhance the effectiveness of each. As per Tucker's (2014) point, it should be easier to turn away insolvent banks from the pure liquidity facility if there is an alternative source of funding for those in recovery or resolution. Likewise, solvent banks may be more likely to view the pure liquidity facility as a confidence-enhancing

[37] The school of thought that endorses lending to insolvent banks is often associated with the New York Fed (Salter 2016; Tucker 2014). Salter (2016) notes that scholarly support for this view comes from Bernanke (1983), Goodhart (1985, 1987) and Solow (1982). Bordo (1990) attributes the view to Goodhart (1985) and Solow (1982).

[38] Central banks may, of course, face pressure to lend to systemically important institutions even if they do not have a clear and credible path to viability. One way to address this issue is through efforts to ensure, *ex ante*, that important financial institutions have credible resolution frameworks in place should they ever be needed.

signal—a stamp of approval from the central bank—if it is truly reserved for institutions that are fundamentally sound.

Shortly after the GFC, Cecchetti and Disyatat (2010, 31) noted that

> [t]he primary threat posed by an institution-specific acute liquidity shortage, and hence the main justification for any official assistance, is that failure may result in contagion and spillover effects that could put the entire financial system at risk. The key criterion in the consideration of liquidity support is then whether the institution in question is systemically important or not. The distinction between illiquidity and insolvency is not really relevant.

Although the establishment of resolution regimes, which enable lending to insolvent banks, seems to reinforce their point, our discussion above leads us to the opposite conclusion. Rather than eroding the importance of distinguishing between solvent and insolvent banks, resolution regimes and the policy adjustments they enable only reaffirm the significance of this distinction. Central banks with separate facilities for sound and unsound banks need to know, with some confidence, which facilities to make available to which banks. The credibility and effectiveness of their lending frameworks depend on it. Relatedly, it is important that market participants be able to clearly tell the difference between these types of lending facilities and their purposes. For example, while the Fed also has two distinct tools (primary credit and secondary credit) that could complement each other in the manner described above, both exist under the broader heading of the discount window, which is often seen as a single facility. McLaughlin (2023) argues that the Fed must draw a clearer line between these two facilities to reduce the stigma associated with primary credit and generally strengthen the effectiveness of the Fed's lending tools.

Whether central banks—or anyone else for that matter—are even capable of distinguishing between solvent and insolvent banks has been debated in the LLR literature. Goodhart (1999) and Goodhart and Huang (2005), for example, doubt that central banks can make this distinction within the timeframe they have to approve or deny loan requests. Dobler et al. (2016) give three reasons why distinguishing between solvent and insolvent banks can be hard:

- the mark-to-market value of financial assets can become volatile in crises, and if firms liquidate assets at fire-sale prices, illiquidity can quickly turn into insolvency
- the valuation of non-tradable assets and collateral can be difficult to evaluate, especially if impacted by broader macroeconomic shocks

- solvency assessments may be biased if supervisors have an incentive to protect their reputations by preventing insolvencies from being identified on their watch

As Tucker (2014) points out, however, solvency judgments are challenging but not impossible, and they need not be perfect to be useful. Assessments of a firm's financial soundness are inherently probabilistic and forward-looking—they are a best guess based on available information. And central banks are well placed to make such assessments, given their expertise and access to confidential supervisory data (see also Dobler et al. 2016). Still, it is important to not underestimate the challenge of generating accurate assessments in a timely manner, especially considering recent concerns about the increased speed of bank runs (see, for example, G30 2024). Where possible, central banks should invest in further strengthening their capabilities in this regard. They need to be ready to make quick decisions not only about whether to lend but also about which type of facility is most appropriate given an institution's financial condition.

A final point worth highlighting is that resolution regimes are largely untested in practice. The nature of their interaction with central bank liquidity policy ultimately hinges on whether they work as intended. Credit Suisse's failure in March 2023 was something of a test case. In that instance, "authorities decided not to use statutory resolution powers to execute the resolution plan" (Carstens 2023). This decision was motivated by a concern that even resolution risked unleashing financial instability. As Thomas Jordan, chairman of the SNB, explained at the time: "Resolution in theory is possible under normal circumstances, but we are in an extremely fragile environment with enormous nervousness in financial markets. […] Resolution in those circumstances would have triggered a bigger financial crisis, not just in Switzerland but globally" (Jones and Ralph 2023). The problem with this statement is that resolution, especially of a global systemically important bank, is an exceptional event that will never take place under normal circumstances. Resolution plans need to be executable in the conditions of severe distress that are likely to accompany the failure of systemically important institutions.

The decision to not put Credit Suisse through resolution had implications for the SNB's role as an LLR. It meant a larger amount of financial support from the public sector was needed, as the resolution plan would have bailed-in a wider set of liabilities (Carstens 2023). The amount of liquidity that was ultimately needed—168 billion Swiss francs—far exceeded Credit Suisse's borrowing capacity under the SNB's emergency liquidity assistance facility, given collateral

constraints. As noted in the previous section, the SNB was ultimately able to fill the funding gap with uncollateralized lending sanctioned by emergency legislation. While any losses on this uncollateralized lending were covered by a government guarantee, the SNB still found itself exposed to significant financial and reputational risk by providing massive liquidity to a deeply unsound institution that was not being put through a formal resolution process.[39] Even if resolution had been pursued, the SNB did not have a dedicated facility for lending to banks in resolution. This carries broader lessons for authorities with similar gaps in their policy set-ups. Effective resolution regimes clearly require appropriate funding strategies and mechanisms (Carstens 2023; FSB 2023a). To the extent they are responsible for this funding, central banks should develop explicit mechanisms for resolution funding—ideally ones that are distinct from their classic Bagehot-style lending to solvent but illiquid banks.

4. Conclusion

Compared with the LLR function in Bagehot's time, the contemporary world of central bank liquidity tools is far more complex, with a wide range of tools that vary substantially in their design and, consequently, in their alignment with the core Bagehot principles. Using these principles as an organizing device, this paper has explored many of the key issues and debates that recent changes in central bank liquidity policy have generated. In some areas, existing literature provides useful guidance that can help policy-makers think through current challenges and options for addressing them. But in other areas, more research and analysis are needed. The remainder of this section outlines some productive areas for future analytical work.

4.1 Counterparties

As highlighted in section 3.1, the financial stability tools of most major central banks today resemble a patchwork of different facilities and programs—some permanent, many ad hoc and temporary, each with its own set of eligible counterparties and its own terms and conditions. More work is needed to better understand the implications of these institutional arrangements, not in terms of the effectiveness of individual tools but in terms of the effectiveness and overall coherence of a central bank's broad liquidity policy framework.

[39] The government guarantee also did not change the fact that a huge volume of taxpayer money (roughly double the annual expenditure of the Swiss government) was put at significant risk to fund a failing bank that should have gone through a more thorough bail-in process (Carstens 2023; Schlegel 2023).

- Do existing tools serve as complements or substitutes for one another?
- Is the overall framework clear and intelligible to key stakeholders?
- Does the framework benefit some institutions more than others, and, if so, why?
- Are there notable gaps or inconsistencies in the framework?

One potential gap discussed in this paper is the lack of permanent facilities available to NBFIs facing a liquidity stress that is not quite, or not yet, systemic. More analysis of whether and how to fill this gap—both in general and in specific jurisdictions—is needed and can draw on the Bank of Canada's and Bank of England's early experiences in creating NBFI-specific tools.

4.2 Pricing

A key theme or lesson from our discussion of pricing was that, although most agree with the idea of charging a premium for last-resort loans, Bagehot's principle provides little guidance on *how high above market rates* to price central bank liquidity facilities. One important challenge in setting and assessing the optimal price of a given facility is stigma. While stigma is often acknowledged and has received some analytical attention, more research is needed on theorizing the causes and consequences of stigma, as well as estimating its cost. A large portion of the literature on this topic comes from Fed researchers and focuses on the discount window specifically (Armantier and Holt 2020; Bernanke 2008; Carlson and Rose 2017; Ennis and Price 2020; Madigan 2009; Nelson 2021). But stigma is likely to differ, perhaps substantially, from one facility to another. Thus, there is much more room for understanding the level of stigma associated with different facilities at different central banks and for explaining variation across facilities and jurisdictions. Understanding stigma is important not just for pricing liquidity facilities but also for designing other aspects of a central bank's liquidity framework. For example, as discussed in section 3.4, central banks that provide resolution funding should consider doing so through a facility that is separate from the one they use for pure liquidity support, as this would arguably help manage stigma and bolster the effectiveness of their liquidity toolkits.

4.3 Collateral

Central bank collateral frameworks continue to evolve in both small and significant ways, with considerable variation in the details across jurisdictions. This variation raises questions about

the extent to which lessons emerging from one jurisdiction might apply to others. Further analysis is likely needed to assess how central banks can usefully adapt the policy lessons of 2023 to their specific institutional contexts. The following questions are a starting point:

- What, if any, are the jurisdiction-specific considerations for moving toward a system in which banks are forced to pre-position more collateral at the central bank?
- Both the US and Swiss cases saw a significant relaxation of collateral policies (par valuation and zero haircuts under the Fed's BTFP, uncollateralized lending by the SNB) to unlock more liquidity. How can other jurisdictions learn from these experiences to improve their own approaches to balancing the trade-offs inherent in collateral policy (e.g., protecting public finances versus promoting financial stability)?
- Should central banks consider countercyclical approaches to haircuts, where collateral is valued more generously during moments of stress? What are the pros and cons of this approach, and how does it interact with pricing considerations and the need to make liquidity facilities attractive in stress but more expensive in normal times?

4.4 Solvency

One important takeaway from our discussion of solvency is that post-GFC changes in financial governance force us to rethink the meaning and relevance of this classic Bagehot principle in the contemporary era. In some cases, central banks now explicitly lend to financial institutions that do not pass solvency or soundness tests. Yet most central banks continue to reserve certain liquidity facilities for sound banks, reaffirming the importance of the sound-unsound distinction as a basis for lending decisions. Going forward, some of the biggest questions for policy design in this area concern the ways in which central bank liquidity frameworks interact with resolution regimes. More analysis is needed to understand how different jurisdictions have institutionalized resolution funding arrangements, what roles central banks have been given in such arrangements and with what implications for the design of liquidity facilities. A specific configuration that deserves more attention is the creation of two separate bilateral facilities (one that can be used for resolution funding, the other reserved for sound institutions). How have these set-ups worked where they have been implemented, and what are the best ways of designing them to ensure that the facilities are both individually and mutually effective?

Addressing the topics outlined in this section will help further enrich our understanding of the liquidity tools and frameworks central banks have used, or might consider developing, to promote financial stability today and in the foreseeable future.

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