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Abstract

In this paper, we analyze broad-based emergency liquidity (BBEL) programs. Our main purpose is to assist policymakers who are considering establishing a BBEL program in designing the most effective program possible as efficiently as possible. Our insights are derived from 33 case studies the Yale Program on Financial Stability produced and existing literature on the topic.

Liquidity provision is a long-established mandate of central banks and was a function that private entities performed even before the establishment of central banks. We survey a sampling of cases from the 19th through 21st centuries, drawn from 10 countries and regions, to distill what elements make for effective BBEL programs and which factors can jeopardize a program's effectiveness.

In our review of these cases, we identified five major themes: (1) early deployment of credible BBEL assistance in the acute phase of a crisis can serve to arrest or moderate the crisis and stop it from evolving into an extended chronic phase; (2) relying on existing authorities, programs, or administrative frameworks enables the efficient design and deployment of BBEL programs; (3) if the liquidity constraint persists, we often see the use of multiple BBEL programs to provide wide access to a broad range of participants; (4) other interventions also commonly employed alongside BBEL programs include credit and account guarantees in the acute phase and asset purchases, recapitalizations, and loan guarantees in the chronic phase; and (5) in all phases, clear communication is a valuable policy tool to drive utilization, and positive announcement effects are possible.

Keywords: emergency liquidity, lender of last resort, liquidity support, moral hazard, penalty rate, solvency, stigma

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[1] This survey explores part of the Yale Program on Financial Stability (YPFS) selection of New Bagehot Project case studies considering broad-based emergency liquidity programs from various time periods and jurisdictions. Cases are available from the *Journal of Financial Crises* at https://elischolar.library.yale.edu/journal-offinancial-crises/.

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Introductory Note: This survey is an analysis of important considerations for policymakers seeking to establish a broad-based emergency liquidity (BBEL) program. It is based on insights derived from case studies of 33 specific BBEL programs the Yale Program on Financial Stability (YPFS) has completed and from the existing literature on the topic. While this survey can help inform a decision about whether to establish a BBEL program, our main purpose is to assist policymakers who have already made that decision in designing the most effective program possible. In analyzing the programs that are the focus of this survey, we use a color-coded system to highlight certain particularly noteworthy design features.

Color	Meaning
BLUE – INTERESTING	A design feature that is interesting and that policymakers may want to consider. Typically, this determination is based on the observation that the design feature involves a unique and potentially promising way of addressing a challenge common to this type of program that may not be obvious. Less commonly, empirical evidence or a consensus will indicate that the design feature was effective in this context, in which case we will describe that evidence or consensus.
YELLOW – CAUTION INDICATED	A design feature that policymakers should exercise caution in considering. Typically, this determination is based on the observation that the designers of the feature later made significant changes with the intention of improving the program. Less commonly, empirical evidence or a consensus will indicate that the design feature was ineffective in this context, in which case we will describe that evidence or consensus.
FOOTNOTE IN ITALICS	Where the reason that a given design feature has been highlighted is not apparent from the text, it is accompanied by an italicized footnote that explains why we chose to highlight it. Where necessary, these footnotes will be used to identify any considerations that should be kept in mind when thinking about the feature.

This highlighting is not intended to be dispositive. The fact that a design feature is not highlighted or is highlighted yellow does not mean that it should not be considered or that it will never be effective under any circumstances. Similarly, the fact that a design feature is

not highlighted or is highlighted blue does not mean that it should always be considered or will be effective under all circumstances. The highlighting is our subjective attempt to guide readers toward certain design features that (1) may not be obvious but are worth considering or (2) require caution.

Introduction

A primary role for central banks is to act as a "lender of last resort" (LOLR). This role is almost as old as central banking itself. In the 19th century, the Bank of England (BoE) was the most important LOLR in the world, and leading economic thinkers of the time debated its policies for emergency lending. Advice for the BoE as a LOLR was first accorded canonical status in Thornton (1802) and given its most popular formulation by Bagehot (1873), whose dictum instructs central bankers facing a financial panic to lend freely, upon good collateral, at a penalty rate. While debates as to some nuances are still active, Bagehot's dictum has largely survived intact into the 21st century and served as a guiding principle for the policy response to the Global Financial Crisis of 2007–2009 (GFC). In the wake of that crisis, Tucker (2014) provides a modern summary of the dictum as "lend freely and early to sound firms against good collateral at a premium to the risk-free rate of interest." Although much has changed in 150 years, aspects of Bagehot's guidance are now legally enshrined in the governing laws of many central banks.

The importance of the LOLR function has spurred a large literature by scholars and practitioners. Bignon, Flandreau, and Ugolini (2012) examines the development of the LOLR function and its original principles in the 19th century. Calomiris, Flandreau, and Laeven (2016) expands this history geographically and into the 20th century, surveying a number of central banks. Carlson, Duygan-Bump, and Nelson (2015) surveys in detail the Federal Reserve System's operations as LOLR during the Global Financial Crisis and the lessons to be learned; Plenderleith (2012) does the same for the Bank of England's performance, and Praet (2016) provides a similar examination of the European Central Bank (ECB) actions. Tucker (2014) more generally addresses a number of technical and governance challenges central banks faced during the GFC and reconsiders how Bagehot applies to the modern LOLR.

In this paper, we are not trying to duplicate these efforts. Instead, we are focused on the "key design decisions" (KDDs) necessary for broad-based LOLR programs during financial crises. Based on the close study of 33 specific programs, we identify specific design features that appear interesting or cautionary, and we attempt to add some detail and nuance to the Bagehot principles.

First, some definitions. We restrict our study to broad-based emergency liquidity (BBEL) programs: "broad-based" because such interventions are targeted to a wide range of financial institutions, and "emergency" because they are introduced during periods of systemwide stress. To the extent that lending is narrowly targeted toward one (or a few) institutions, we define such programs as "ad hoc emergency liquidity" and will survey them in a different series of case studies. To the extent that the lending is targeted to markets rather than institutions, we define those programs as "market liquidity" or "market support," surveyed in Rhee et al. (2020) and Rhee et al. (2022), respectively. To the extent that the lending targets a liquidity shortage in a foreign currency, we will consider those programs in a future "foreign currency swaps" survey.

The restriction to "emergency" programs is also important. Most central banks have standing nonemergency mechanisms to lend to their member institutions, generally banks, often

through a formal discount window (DW). Early in a crisis, the expanded usage of these windows may first bring attention to liquidity concerns. For the purposes of this survey, however, we focus on cases where either a program is entirely new, or policymakers have at least introduced an explicit change in such standing programs along with (internal or external) recognition of systemwide stress.

We do not consider our analysis bound by Bagehot's dictum, or by its modern nuances. It seems high time to take a fresh look at all aspects of emergency lending. But one Bagehot debate we find worthy of discussion right at the beginning: the issue of whether lending should be extended only to "solvent" firms. Some of the modern restatements of Bagehot's dictum have added this solvency (or "soundness") requirement, and some countries have even enshrined it in law. Yet Bagehot himself never mentions it in *Lombard Street*; his focus is entirely on the collateral that the Bank of England should lend against. In most financial crises, some firms are so far gone that the authorities face an immediate decision—rescue or let fail—a question that we save for our later ad hoc liquidity survey. But for the broader population of firms whose asset values are impaired by temporarily depressed prices, defining what solvency means in the midst of the panic would be difficult and even counterproductive for authorities to attempt.

To illustrate the challenge, it is helpful to think of financial crises and policy responses as having two different phases, "acute" and "chronic." In the initial acute phase, the financial system has an obvious liquidity problem—runs on banks or breakdowns in interbank markets are easy to spot—but the underlying solvency of banks is difficult to judge in the heat of that moment. The asset side of financial institutions' balance sheets may be impossible to value, and the collapse on the liability side can lead them to sell these assets at temporarily depressed prices. During this acute phase, policy responses need to be fast and emphasize protection of the fragile liabilities. That protection can be in the form of emergency lending, liability guarantees, or some combination of the two. To achieve these goals, policy should be targeted to reassure depositors and other short-term bank creditors that bank liabilities are safe. The goal in this phase is to arrest runs and prevent fire sales. Any strict solvency condition is doomed to failure—there is simply no time to make such judgments.

In the later chronic phase, the immediate liquidity pressures have eased, often because of effective BBEL programs, but any underlying solvency problems remain. In the traditional banking sector, a chronic phase is characterized by low capital levels that hold back long-term lending. As such, policies during the chronic phase should be targeted to influence the behavior of the banks themselves. Effective policies need to fix the solvency problem directly. Solvency is ultimately an equity problem and *cannot be solved* simply by lending. To fix solvency problems, policymakers typically need to deploy fiscal tools, either directly through capital injections or indirectly through the purchase and sale of bank assets. We survey these types of interventions in Rhee et al. (2022) and McNamara et al. (2022), respectively.

All the BBEL programs in this survey were created or activated during an acute phase: indeed, introduction during the acute phase is a defining feature of an "emergency" program. BBEL programs are often the first response to a crisis because they can be straightforward

adjustments to standing facilities and implemented under already existing authority. As a crisis evolves into an extended chronic phase, the authorities may adjust or augment their BBEL programs, for example, by broadening collateral eligibility, expanding the class of eligible participants, or increasing the size of auctions.

Figure 1 lists these 33 cases, which cover 10 countries and regions and are drawn from crises in the 19th, 20th, and 21st centuries. In some of the earlier crises, the LOLR was a private institution or consortium, and not a government entity. We will generally refer to "LOLR" unless the context calls for using a specific identifier such as "central bank" or "private LOLR."

Figure 1: Case Studies, Abbreviated Names, and Type of Lender of Last Resort (LOLR)

Case name	Short-form case name	Type of LOLR [a]	Reference
Canada: Contingent Term Repo Facility	Canada CT Repo	CB	(Nunn 2022)
Canada: Private-Sector Term Purchase and Resale Agreements	Canada Term PRA-PS	CB	(Sankar 2022a)
Canada: Term Loan Facility	Canada TLF	CB	(Sankar 2022b)
Canada: Term Purchase and Resale Agreement Facility	Canada Term PRA	CB	(Sankar 2022c)
European Central Bank: Fine-Tuning Operations	ECB FTOs	CB	(Runkel 2022a)
European Central Bank: Term Refinancing Operations	ECB TROs	CB	(Runkel 2022b)
Greece: Emergency Liquidity Assistance	Greece ELA	CB	(Runkel 2022c)
Hong Kong: Private Emergency Loans, 1965	Hong Kong 1965	P LOLR/FA [b]	(Hoffner 2022a)
Hong Kong: Temporary Liquidity Measures, 2008	Hong Kong 2008	CB	(Hoffner 2022b)
Hungary: Liquidity Scheme, 2009–2013	Hungary Liquidity	FA/CB [c]	(Mott and Buchholtz 2022)
Norway: Covered Bond Swap Program	Norway Covered Bond	FA/CB [d]	(Fulmer 2022b)
Russia: Central Bank Bonds, 1998	Russia OBR	CB	(Hoffner 2022c)
Russia: Lombard and Overnight Loans, 1998	Russia LO	CB	(Hoffner 2022d)
Thailand: Financial Institutions Development Fund Liquidity Support	Thailand FIDF	CB/OGA [e]	(Runkel 2022d)
United Kingdom: Bank of England Lending during the Panic of 1825	UK BoE 1825	P LOLR [f]	(Fulmer 2022c)
United Kingdom: Bank of England Lending during the Panic of 1866	UK BoE 1866	P LOLR [f]	(Fulmer 2022d)
United Kingdom: Discount Window Facility	UK DWF	CB	(Fulmer 2022e)
United Kingdom: Extended-Collateral Long-Term Repo	UK ELTR	CB	(Fulmer 2022g)
United Kingdom: Extended Collateral Term Repo Facility	UK ECTR/CTRF	CB	(Fulmer 2022f)
United Kingdom: Indexed Long-Term Repo	UK ILTR	CB	(Fulmer 2022h)
United States: Aldrich-Vreeland Emergency Currency during the Crisis of 1914	US Aldrich-Vreeland	FA	(Fulmer 2022i)
United States: Federal Home Loan Bank Advances, 1932–1941	US FHLB 1932–1941	OGA	(Leonard 2022a)
United States: Federal Home Loan Bank Advances, 2007–2009	US FHLB GFC	OGA	(Leonard 2022b)
United States: New York Clearing House, the Crisis of 1893	US NYCH 1893	P LOLR	(Leonard 2022c)
United States: New York Clearing House, the Crisis of 1914	US NYCH 1914	P LOLR	(Fulmer 2022j)
United States: New York Clearing House, the Panic of 1873	US NYCH 1873	P LOLR	(Fulmer 2022k)
United States: New York Clearing House, the Panic of 1884	US NYCH 1884	P LOLR	(Hoffner 2022e)
United States: New York Clearing House, the Panic of 1890	US NYCH 1890	P LOLR	(Hoffner 2022f)
United States: New York Clearing House, the Panic of 1907	US NYCH 1907	P LOLR	(Runkel 2022e)
United States: Reconstruction Finance Corporation Emergency Lending to Financial Institutions, 1932–1933	US RFC 1932–1933	OGA	(Leonard 2022d)
United States: Term Auction Facility	US TAF	CB	(Runkel 2022f)
United States: Y2K Special Liquidity Facility	US Y2K SLF	CB	(Leonard 2022e)
United States: Y2K Standby Financing Facility	US Y2K SFF	CB	(Leonard 2022f)

(a) CB = central bank. P LOLR= private LOLR, refers to a nongovernmental entity that functions as a lender of last resort. FA = fiscal authority; refers to a government fiscal authority such as a Ministry of Finance or Treasury. OGA = other governmental agency; refers to a government agency other than the central bank or fiscal authority.
(b) Two large private banks acted as private LOLRs and as a conduit for funding from the Hong Kong government.
(c) For the Hungarian Liquidity Scheme, the managing authority was the Ministry of Finance, which looked to the central bank and the Hungarian Financial Supervisory Authority to perform many of the administrative duties and make recommendations.
(d) The central bank recommended the Covered Bond Swap Program to the Ministry of Finance and managed the program on behalf of the ministry.
(e) A royal decree in 1985 created the Financial Institutions Development Fund (FIDF) as a legally distinct entity within the Bank of Thailand (BOT) to support troubled institutions. Regardless of its distinct legal status, the FIDF was controlled by the BOT.
(f) In 1825 and 1866, the Bank of England operated as a private LOLR, as it was not yet a central bank. In 1866, as in 1847 and 1857, the government authorized the BoE to exceed its legal limit on unbacked note issuance to alleviate liquidity strains.

Source: Authors' analysis.

The main body of this paper discusses the key design decisions necessary to implement these programs. Broadly speaking, designers must choose all the lending terms: rates (and how to set them), maturities, eligible counterparties, limits on lending to any specific counterparty, collateral rules, and everything else necessary for originating a loan. In making each of these design decisions, policymakers must face the key trade-off for all BBEL programs: **moral hazard versus stigma**. On one side, moral hazard concerns push designers to charge penalty rates,[7] restrict collateral types and counterparties, and in general place limits on the program. Their reasoning is that restrictive terms both prevent excessive use or abuse of the program during the crisis itself and provide fair warning to banks to keep risk in check to avoid a future crisis. This side of the trade-off is dominant in some policy discussions.

But on the other side, penalty rates and other punitive terms create stigma for any disclosed users of the program. Depositors and other market participants infer that any financial institution willing to pay punitive terms must be in some trouble. That belief can stigmatize users and depress participation in the program. If financial institutions are unwilling to participate, then of course the program will be less effective at stopping a panic.

The need to balance moral hazard and stigma impacts many design decisions and is to some extent unavoidable. When the pendulum swings too hard toward the prevention of moral hazard, we see examples of programs that go unused, and sometimes cause stigma that can persist even beyond the original crisis. Our penultimate Key Design Decision, No. 19, Stigma Strategy, discusses methods used to minimize this outcome, and in the "Conclusion" section, we provide a restatement of Bagehot's dictum informed by these methods.

[7] One paper notes that "even though Bagehot did not explicitly raise this issue, his insistence on high rates is typically seen [by scholars] as an important measure to alleviate such moral hazard. Indeed, the argument that penalty rates curb moral hazard is a widespread one" (Castiglionesi and Wagner 2012).

Discussion of Key Design Decisions

1. Purpose: Why was the program implemented? What problem was it addressing? What was its mandate?

BBEL programs are a central bank's traditional response to liquidity pressures. However, such stresses present themselves in varying ways. Among our cases, two circumstances appear most commonly as the problems the BBEL programs are designed to address. The first, cited by 31 of 33 cases, as shown on Figure 2, is that general liquidity stresses are occurring in the funding markets, constraining financial institutions from lending among themselves and onward to the real economy. Events that can trigger these situations include a run on a major bank (as occurred in Hong Kong 1965), tensions in the payment system (as occurred in the several US NYCH cases and the two Russia cases), actual or anticipated spikes in interest rates and tightening of the funding markets precipitated by other developments (such as the liquidity crisis sparked in 1914 by the start of World War I, which prompted the use of the US Aldrich-Vreeland emergency currency), and the anticipated tightening of credit (as in 2000, when the end of century date approached, discussed in the US Y2K cases).

Figure 2: Primary Purpose

Primary purpose articulated/identified	Cases	Total
Address conditions in credit and money markets/enhance flow of credit/provide liquidity insurance	Canada CT Repo, Canada Term PRA-PS, Canada Term PRA, ECB FTOs, ECB TROs, Hong Kong 2008, Hungary Liquidity,(a) Russia LO, Thailand FIDF,(b) UK BoE 1825, UK BoE 1866, UK DWF, UK ECTR/CTRF, UK ILTR, US Aldrich-Vreeland, US NYCH 1893, US NYCH 1914, US NYCH 1873, US NYCH 1884, US NYCH 1890, US NYCH 1907, US RFC 1932–1933, US TAF, US Y2K SLF, US Y2K SFF	25
Facilitate counterparties' management of balance sheets/finance illiquid assets	Hong Kong 1965, Russia OBR	2
A combination of the above	Canada TLF, Greece ELA,(c) Norway Covered Bond, UK ELTR, US FHLB GFC, US FHLB 1932–1941	6

(a) The Hungary scheme occurred in an environment where the Hungarian forint (HUF) was experiencing rapid devaluation. The Hungarian central bank (MNB) extended liquidity through foreign exchange (FX) loans to address the risk that banks would sell HUF to meet their FX needs, which would have placed even more pressure on the depreciating exchange rate.

(b) The Thailand scheme, which provided liquidity to troubled nonbank financial institutions, articulated no clear purpose, consistent with its nonpublic nature. Based on information available later, at least two conflicting priorities appear to have been in play—to save the financial system and protect the central bank's balance sheet.

(c) The Bank of Greece (BoG) cited bank runs and collateral issues in describing the purpose of the program. These events were occurring at a time when Greece sovereign bonds, a significant bank asset and collateral, were no longer eligible for ECB funding. The banks had also lost access to such funding because of concerns regarding their solvency.

Source: Authors' analysis.

Although not dispositive, the purpose is a main driver of program design. In addressing generalized liquidity situations, central banks most often lead by extending liquidity to longer maturities than they offer under their existing standing facilities (Sankar 2022c), increasing the amount of liquidity that is available (Runkel 2022a), and providing liquidity

at rates that are favorable to the then market rates and not so high as to stigmatize borrowers. For example, the ECB FTO imposed a "penalty" rate but only a slight one, and many of its auctions were oversubscribed (Runkel 2022a). The LOLR may also seek to widen the group of eligible participants, as occurred in the US during the Great Depression. The US RFC 1932–1933 and US FHLB 1932–1941 were created to provide liquidity to entities that had no LOLR. The US RFC 1932–1933 supported both banks and a broad set of nonbank financial institutions (NBFIs), with a focus on those that lent to small businesses, especially farmers. The US FHLB 1932–1941 supported nonbank mortgage lenders "including savings and loan associations (S&Ls), mutual savings banks, and life insurance companies" (Leonard 2022a; Leonard 2022d; Wheelock 2008). If the panic persists into the chronic phase, we observe that the LOLR may adjust several of these factors to make liquidity generally more available and responsive to the developing situation. The European Central Bank expanded the frequency, maturities, size, and set of eligible collateral for several of its standing term refinancing operations during the GFC (Trichet 2009).

A second purpose, cited in eight of 33 cases, was a focus on assisting counterparties with managing their balance sheets by funding collateral that had become illiquid. This circumstance applied in the Greece ELA and the Russia OBR cases, which were addressing in part sovereign debt that had become illiquid as collateral, and several cases targeted to rehabilitating mortgage-related collateral: Norway Covered Bond, Canada TLF, and US FHLB 1932–1941. LOLRs interested in addressing banking crises spurred by collateral-based concerns will want to review our Key Design Decision No. 11, Collateral, for common issues and practices utilized in this environment.

We also observe that six of 33 cases cited both primary reasons as bases for the programs. For example, as stated in the announcement relating to the Canada TLF: "By providing greater flexibility for liquidity provision with respect to eligible collateral, the TLF will facilitate further improvement in money and credit markets" (BoC 2008b).

In addition, three LOLRs pursued their BBEL programs during unique broad-based systemic disruptions. First, in the Hungary Liquidity Scheme during the GFC, a sudden devaluation of the local currency accompanied the tightening of the credit markets. As a result, the Ministry of Finance coordinated with the central bank and financial supervisory agency to provide liquidity in foreign currency. Second, the Thai Financial Institutions Development Fund (FIDF) addressed failed liquidity (and possibly solvency) not for banks, but for "troubled financial institutions" (BOT n.d.). Third, in the Greece ELA, the Bank of Greece (BoG) stepped in to provide liquidity to the entire banking system, intermediating between the banks and the ECB because Greek banks could no longer access ECB lending (Runkel 2022c).

We include one program because of its unusually high usage during the GFC, even though it was not designed to address crisis situations. The Federal Home Loan Bank (FHLBank) System is a government-sponsored enterprise (GSE)[8] created to support housing finance.

[8] In the US, government-sponsored enterprises are quasi–public private entities, such as the FHLBanks, Fannie Mae, and Freddie Mac, that operate with both public and private attributes. For example, GSEs enjoy an implied government guarantee, which has been shown to effectively lower their borrowing costs (Leonard 2022b).

The 11 FHLBanks operate a standing facility that provides funding, called "advances"—collateralized by mortgages and mortgage-related assets—to banks, thrifts, insurance companies, and credit unions (Narajabad and Gissler 2017a). FHLBank advances increased by 50% between the summer of 2007 and the fall of 2008, as members faced considerable stress and contraction in the wholesale funding markets (Narajabad and Gissler 2017b). Much of this increase was from large commercial banks, which previously made up only a very small portion of the FHLBanks' lending.[9] From the summer of 2007 to March 2008, the FHLB was the primary source of lending for depository institutions that also were eligible to borrow from the Federal Reserve's discount window (Ashcraft, Bech, and Frame 2008). Even as use of the DW bore acknowledged stigma issues, during this period, the FHLB advances were the low-cost choice, despite the Fed's having lowered the primary credit rate (Ashcraft, Bech, and Frame 2008). FHLBank borrowing lessened after March 2008 as the discount window became the cheaper option and the Federal Reserve introduced a series of new funding programs (Ashcraft, Bech, and Frame 2008; Narajabad and Gissler 2017b). Although the Fed eclipsed the FHLBanks in terms of total lending during the GFC, the FHLBank System was the largest lender to US depository institutions; much of the Fed's liquidity operations was for the benefit of nondepository or foreign financial institutions (Ashcraft, Bech, and Frame 2008).

Scholars and Federal Reserve officials have expressed concern over the FHLBank System's expanded lending and its perceived role as "lender of next-to-last-resort" (Narajabad and Gissler 2017a). Although the FHLBanks provided a significant amount of liquidity, especially during the early stages of the GFC, the FHLB System does not have a mandate as a LOLR or as a financial regulator. In making loans, it may not have considered issues of systemic risk.

2. Legal Authority: What legal basis did authorities rely on? Was a new law needed, or did they rely on existing authority?

Most often, the first action a central bank[10] pursues to address a liquidity constraint is to utilize its traditional or standing lending tools established under its basic authority to lend to banks: its discount window or open market (repurchase agreement, or repo) operations (Cheun, von Köppen-Mertes, and Weller 2009). Early steps a central bank takes include announcing a willingness to lend and promoting the availability of existing facilities. It may also make initial changes to standing facilities so they are more attractive sources of funding: lowering the borrowing rate, lengthening the maturity of loans, expanding the eligible

9 During the second half of 2007, FHLBank advances increased by USD 235 billion to USD 875 billion (a 36.7% increase). Ten FHLBank members accounted for almost USD 150 billion of this new advance lending. The largest borrowers were Washington Mutual, Bank of America, and Countrywide, whose borrowings increased between Q2 and Q4 2007 by USD 42.4 billion, USD 25.5 billion, and USD 18.9 billion, respectively. In total, FHLBank advances continued to grow into 2008, albeit at a slower rate, and stood at USD 914 billion as of June 30, 2008 (Ashcraft, Bech, and Frame 2008).

10 In a few historical cases discussed herein (see Figure 1), a private entity is acting as LOLR, but most of these experiences provide evidence as to why countries migrate to a government-sanctioned LOLR, usually a central bank. Some of the drawbacks to a private LOLR can include bias, limited jurisdiction, and the inability to print currency without further authorization from the government.

collateral, enlarging lending capacity, and increasing the frequency with which loans are available.

Consistent with this theory, in August 2007, in response to sudden stresses in the interbank funding markets, the Federal Reserve Board "lowered the primary credit rate to 5.75 percent—50 basis points above the funds rate—and provided for 30-day term lending through the discount window" (Champ and Wakefield 2007); unfortunately, borrowing remained limited because of significant stigma attached to DW borrowing (Cheun, von Köppen-Mertes, and Weller 2009; Runkel 2022f). However, such "first movement" actions can be very effective in addressing early signs of liquidity constraints. For example, when the European interbank market tightened in August 2007, the ECB used four large fine-tuning operations (FTOs) through its open market desk—which were announced and settled within the day—to support eurozone banks through the week (Runkel 2022a; Trichet 2010). These operations succeeded in calming the tensions in the short-term segment of the euro area money market, which, if left unaddressed, might have "caused a systemic liquidity threat to the financial system as a whole" (Trichet 2010).

A few of our cases address these types of "first movement" instances, but most do not; such occurrences are not easily identified, especially if they are successful. Because they involve the central bank's standing facilities, such actions usually are not separately administered or publicized and might be discussed only in periodic administrative reports. For these reasons, the BBEL programs discussed in this survey are, in most cases, specific actions that a central bank publicly announced as dedicated measures to address a liquidity constraint. The authorities supporting such BBEL programs can be divided into four groups, as shown on Figure 3:

- Applications of regular preexisting authorities,
- Applications of preexisting emergency authorities,
- Programs that required the granting of new authorities, and
- Programs that were deployed under opaque legal authority.

Figure 3: Legal Authority

Short-form case name	Origins in a pre-existing facility	Used existing regular authority	Used existing regular authority in a novel manner (a)	Used existing emergency authority (b)	New authority granted	Authority was opaque (c)
Canada CT Repo	Yes	X				
Canada Term PRA-PS	Yes			X		
Canada TLF	No	X				
Canada Term PRA	Yes			X		
ECB FTOs	Yes	X				
ECB TROs	Yes	X				
Greece ELA	Yes		X	X		
Hong Kong 1965 (d)	No	X				
Hong Kong 2008	Yes			X		
Hungary Liquidity	No				X	
Norway Covered Bond	No				X	
Russia OBR	No					X
Russia LO	Yes		X			
Thailand FIDF	No	X			X	
UK BoE 1825	No					X
UK BoE 1866 (e)	Yes	X		X		
UK DWF	Yes	X				
UK ELTR	Yes	X				
UK ECTR/CTRF	No			X		
UK ILTR	Yes	X		X		
US Aldrich-Vreeland (f)	No	X			X	
US FHLB 1932–1941	No				X	
US FHLB GFC	Yes	X				
US NYCH 1893	Yes					X
US NYCH 1914	Yes					X
US NYCH 1873	Yes					X
US NYCH 1884	Yes					X
US NYCH 1890	Yes					X
US NYCH 1907	Yes					X
US RFC 1932–1933	No				X	
US TAF	No		X			
US Y2K SLF	No		X			
US Y2K SFF	No		X			
Totals	**19/Yes**	**12**	**5**	**7**	**6**	**8**

(a) The LOLR utilized its authority in a new manner as to form of design, participants, or breadth. For example, the Fed amended its Regulation A to authorize the issuance of options in connection with the US Y2K SLF, and Greece's use of the ELA was the first broad-based application to an entire banking system (Leonard 2022e; Runkel 2022c).

(b) For these facilities, the LOLR used an authority that was delineated as being available when some heightened level of distress existed.

(c) These programs were implemented in circumstances where their legality was not evident or was questionable. In most circumstances, the government authorities recognized the opaque legality but chose not to prosecute the LOLR, likely because few, if any, government tools were available to address the crisis. However, the Russian securities' regulator brought action against the Central Bank of Russia (CBR) with respect to the OBRs (bonds the CBR issued for use as collateral in its lending facilities), which were held to be illegal (Hoffner 2022c).

(d) In 1965, Hong Kong had a largely laissez-faire financial system without a legal LOLR. Two private British note-issuing banks, HSBC and Chartered Bank, intervened during the crisis by lending to distressed local banks. Although these private, emergency interbank loans did not call upon any emergency legal authorities, the government partially funded the relief operations by injecting liquidity into several banks through HSBC and Chartered Bank as conduits. These government liquidity injections were rare and exceptional measures (Goodstadt 2005; Jao 1974).

(e) The BoE, acting as private LOLR, almost exhausted its reserves. However, it was restricted from issuing notes not backed by gold. Therefore, it requested a suspension of this requirement as provided for in the Charter Act of 1844, which the Exchequer granted, allowing the BoE to provide sufficient liquidity to calm money markets (Fulmer 2022d).
(f) In 1914, the US for the first time deployed the national emergency currency authorized by the Aldrich-Vreeland Act of 1908. Treasury Secretary William McAdoo asked Congress to amend the Federal Reserve Act of 1913 to provide eligibility for large banks to participate in the emergency currency and to suspend the USD 500 million limit on total issuance, broadening the reach of the currency (Fulmer 2022i).

Source: Authors' analysis.

Applications of Regular Preexisting Authorities

Slightly more than half of our cases, 19 of 33, involved BBEL programs that a LOLR implemented using its existing regular (12) and emergency-level (7) authorities. These programs generally increased funding opportunities, extended maturities, or accepted a broader range of collateral. Many such programs reference or modify a standing facility as these types of adjustments are often the quickest steps to implement in response to a liquidity crisis.

For example, before the GFC, the BoE regularly used monthly long-term repo (LTR) operations at a range of maturities to manage its balance sheet (Fulmer 2022h). As market liquidity tightened in late 2007, the BoE introduced Extended-Collateral Long-Term Repos (ELTRs), which offered longer maturities and accepted a broader set of collateral than its existing LTRs. In June 2010, the BoE replaced the ELTRs with the Indexed Long-Term Repo (ILTR) program to make the wider set of collateral a permanent part of its tool kit. Since the creation of the ELTRs was only an adjustment to the regularly scheduled open market operations (OMOs), they did not require additional legislation or external approval (Fulmer 2022g). During the GFC, the BoE accomplished most of its liquidity support measures using its existing authorities.

Also, during the GFC, the Hong Kong Monetary Authority (HKMA) implemented multiple enhancements to its discount window using its existing authority: (i) expanded the eligible collateral to include high-quality US dollar assets, (ii) extended the maximum maturity from overnight to as long as three months, and (iii) reduced the cost of borrowing by waiving the 5% penalty imposed on banks that borrowed against more than 50% of their holdings of Exchange Fund paper at the discount window (HKMA 2008a). The Bank of Canada (BoC) also modified or referenced standing programs when implementing several of its GFC programs, such as its repo facilities, Term Purchase and Resale Agreement Facility (Term PRA), and Private-Sector Term Repurchase and Resale Agreements (Term PRA-PS).

Because BBEL programs are usually the "first line of defense" in a liquidity constraint, they may be implemented when only limited information is known about the ensuing panic. Thus, the BBEL program may need to be adjusted or augmented as additional information becomes known to the LOLR or as circumstances change. As the constraint develops from the acute to the chronic phase, flexibility and continued monitoring are advised.

When use of existing authorities in a traditional manner did not succeed, central banks in five of our cases devised novel programs to address their liquidity constraints. For example, in anticipation of the Y2K century date change, the Fed introduced the Standby Financing Facility (US Y2K SFF), which auctioned three sets (or "strips") of options to primary dealers that could be exercised for overnight repos on specific dates around the year-end (FRBNY 1999). Approximately USD 481 billion of options were sold; however, because the Y2K event did not cause excessive strain in the credit markets, no options were exercised (Drossos and Hilton 2000). Drossos and Hilton (2000) conclude that the program calmed markets primarily through the "announcement effect"—"implied year-end funding premiums declined substantially when the details of the options auction were unveiled, after the early auction results were announced, and later on when the [Open Market Trading] Desk [at the Federal Reserve Bank of New York] extended the number of auctions." In addition, the authors report that personnel at the Desk reported that "many dealers indicated that the options program helped ease their anxieties about prospective market conditions around the year-end" (Drossos and Hilton 2000).

During the GFC, the Fed again designed a novel program to address stigma at the discount window, which was experiencing only limited use even though the Fed had lowered rates. Despite these changes, usage waned in part because of greater usage of advances from the FHLBank System. Rather than continue to adjust the terms of the DW significantly, the Fed chose to implement the Term Auction Facility (TAF), which was designed to provide DW funding without stigmatizing borrowers (FOMC 2007a). The Fed staff was of the opinion that the TAF "arguably had a better chance of avoiding stigma, partly because the auction format implies that no institution was being forced to borrow" (FOMC 2007b). It also increased the number of borrowers, delayed settlement, and limited the amount of funding (FOMC 2007a). These factors are further discussed at Key Design Decision No. 19, Stigma Strategy.

Applications of Preexisting Emergency Authorities

In addition to a LOLR's regular authorities, some LOLRs also have authorities that are reserved for emergencies or situations of heightened distress. Often, the enabling statute requires that some specified standard be met to activate the authority, and a formal finding or certain process may be required. As our examples evidence, these emergency authorities are designed to address systemic concerns.

In what was an unprecedented move, during the GFC, Greece provided Emergency Liquidity Assistance (ELA) for its banks on a systemwide basis. ELA was an extraordinary relief the national central bank provided. The risk of ELA liquidity was not shared with other eurozone members and was originally designed to address the special needs of a failing "systemically relevant financial institution" (ECB 2008c). Bank of Greece Deputy Governor John (Iannis) Mourmouras describes ELA as follows:

> Domestic ELA procedures are used by central banks to address the liquidity problems of banks that are essentially solvent. ELA is an emergency liquidity line provided by national central banks (NCBs) to solvent banks that exceptionally and temporarily no longer have collateral of sufficiently high quality to obtain funding via conventional Eurosystem operations. These lines are set up at the discretion and under the responsibility of the NCBs . . . ELA should be seen as a means of handling acute problems, to give the authorities time to decide whether other crisis management measures are needed, such as restructuring of troubled institutions. (Mourmouras 2017)

ELA is provided by the national central bank at its discretion. The national central bank must inform the Governing Council of the ECB of its intent to provide ELA and adhere to specific criteria. Although technically the Governing Council does not approve ELA but can only disapprove its issuance once notified by the national central bank, in practical terms, its administration of the Greece ELA operated as an approval.[11] Previous uses of ELA by eurozone member states had provided ELA assistance typically to only one or two banks (Praet 2016).[12] However, by the time the ECB published its ELA Procedures, in 2013, in light of the ongoing impacts of the European sovereign debt crisis, the wording reflected assistance to "a solvent financial institution, or group of solvent financial institutions, that is facing temporary liquidity problems" (ECB 2013). Peter Praet, member of the executive board of the ECB, comments that the crisis had two major impacts on ELA:

> This situation led to two types of innovation in the governance of ELA interventions: first, the duration of assistance lengthened; second, the scope of assistance broadened from individual institutions to entire banking systems. For example, in Greece last year the combined lending of the ECB and the Bank of Greece to Greek banks reached 71% of the country's GDP. Most of this liquidity was provided via banks' recourse to ELA. (Praet 2016, 5-6)

Under Section 18(g) of the Bank of Canada Act (Legislative Services Branch 1985), the bank has a two-part emergency authority that it may utilize in situations that challenge the stability of the Canadian financial system. Subparagraph 18(g)(ii) provides practically unlimited authority to the bank to purchase any security, including equities, if the Governor determines that "there is a severe and unusual stress on a financial market or the financial system."[13] To date, the bank has never taken action under the crisis authority in Subparagraph 18(g)(ii).

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[11] For a detailed discussion of the legal underpinnings of ELA and its application to Greece, see Lee (2016). Also see Key Design No. 4, Management.

[12] Generally, ECB ELA was initially intended for individual banks, and prior and contemporary applications in Belgium, Ireland, and Cyprus largely funneled liquidity to one or more large banks, whereas, in Greece, the entire banking system was compromised. See Lee (2016) for a discussion of the ECB ELA interventions. Also, ELA interventions evolved in two significant ways: "first, the duration of assistance lengthened; second, the scope of assistance broadened from individual institutions to entire banking systems" (Praet 2016, 6).

[13] Subparagraph 18(g)(ii) of the act reads: "[I]f the Governor is of the opinion that there is a severe and unusual stress on a financial market or the financial system, [the BoC may] buy and sell from or to any person any securities and any other financial instruments, to the extent determined necessary by the Governor" (Legislative Services Branch 1985).

Short of such situations, the partner Subparagraph 18(g)(i) permits the bank to expand the range of securities and financial instruments that it may purchase in the normal course "for purposes of addressing a situation of financial system stress that could have material macroeconomic consequences" (BoC 2008c; Legislative Services Branch 1985). In such a circumstance, the BoC may "buy and sell from or to any person securities and any other financial instruments — other than instruments that evidence an ownership interest or right in or to an entity" (BoC 2008c; Legislative Services Branch 1985).

The expanded range of securities and financial instruments that the BoC may purchase pursuant to Subparagraph 18(g)(i) is broad and includes: securities guaranteed by the Canadian, provincial, or US government; and Canadian dollar (CAD)–denominated bonds, commercial paper (CP), and asset-backed securities. Such "exceptional transactions" cannot extend beyond a term of 180-days, and the bank must publish its intent to engage in such transactions, including targeted securities, counterparties, and other relevant information prior to conducting such transactions (BoC 2008c; Legislative Services Branch 1985).

During the GFC, two Canadian programs were the subject of a Subparagraph 18(g)(i) notice. The BoC had the authority to perform repo transactions and had done so before launching the Canada Term PRA facility in 2007, but it had to amend the policy statement that implements the Bank of Canada Act to allow it to lend longer than 180 days under the program (Sankar 2022c). The second program, the Canada Term PRA-PS, was designed to provide liquidity to large money market participants, also through repos, and accepted commercial paper, asset-backed commercial paper (ABCP), bankers' acceptances, and corporate bonds as collateral (Sankar 2022a).

The UK ECTR/CTRF presents a slightly different scenario using an emergency authority. In light of continuing exceptional stresses in financial markets, the BoE announced the program in December 2011, describing it as "a new contingency liquidity facility . . . designed to mitigate risks to financial stability arising from a market-wide shortage of short-term sterling liquidity" (BoE 2011). The program allowed swapping of sterling cash for eligible collateral on a short-term basis and could be implemented by the BoE's governor if liquidity pressures emerged, which they did six months later. The facility was activated in June 2012 with an announcement stating that it was "designed to respond to actual or prospective market-wide stress of an exceptional nature" (BoE 2012).

The BoE's liquidity framework makes clear that the ECTR inhabits the position reserved for crises situations of "actual or prospective market-wide stress meaning banks need cheap, plentiful cash at term" rather than predictable regular liquidity needs or firm-specific liquidity needs resulting from specific shocks (BoE 2013). The structure of the BoE law permitted the preemptory adoption of this "exceptional" facility as a precautionary measure, which provided an opportunity to ready the facility before actual need. The BoE determined use of the facility to be a success in helping to bring down short-term sterling funding costs in 2012. It retained the program as a standing facility in its framework and reactivated the ECTR in June 2020 (BoE 2013).

The Hong Kong 2008 case is another that relied on a heightened level of authority. The HKMA's LOLR policy sets out a three-tier framework for liquidity support that is similar to that of the UK framework. The authority of the HKMA is intricately linked to the Exchange Fund, whose primary purpose is to maintain the value of the Hong Kong currency. Provided that the HKMA honors the currency board rules, the HKMA has legal authority to administer emergency liquidity support to an individual institution or the banking system utilizing the Exchange Fund when circumstances threaten the stability of the monetary or financial systems (HKMA 1999; Legislative Council 1997). One relevant policy statement stresses that such LOLR assistance must be for systemic purposes.[14] In September 2008, impacts from the Lehman Brothers bankruptcy and stresses in the US were resulting in tightening in interbank lending in Hong Kong (Hoffner 2022b). Although the HKMA considered its normal system for providing liquidity at the systemic and institutional levels to have prepared the banking system for turbulent times, in light of the market developments, the HKMA announced five temporary measures "intended to reinforce this framework at a time of instability and stress in the world financial system" (HKMA 2008b).

What these cases demonstrate is that some central banks see value in differentiating the provision of liquidity support, and specifically in anticipating situations of heightened stress that might require BBEL programs to arrest tension in the system. They also demonstrate that this preplanning and prepositioning of authority can have value and lead to heightened awareness and rapid response when needed. To this end, the procedures for utilizing such authorities should be clearly stated and set out ahead of time so necessary steps can be taken expeditiously during a crisis. Lastly, it is also worth noting that the standing emergency authorities may indicate recognition by the legislature that their exercise and the tools they represent are worthy of additional scrutiny by a designated authority (the governor of the central bank in the case of the UK and Canada, and the financial secretary in Hong Kong) to be triggered.

Such is also the case with one of the most powerful tools the Fed utilized during the GFC, Section 13(3) of the Federal Reserve Act of 1913 (FRA), which provides broad lending authority once the Fed Board finds that "exigent and unusual" circumstances exist and other specified provisions are met.[15] Section 13(3) was the basis for such broad-based programs as the Primary Dealer Credit Facility (which also may be categorized as a BBEL program)

[14] And although this policy statement is primarily concerned with LOLR assistance to individual institutions, its requirements also seem to apply to broad-based liquidity such as the five measures introduced in September 2008 (Hoffner 2022b). The policy statement includes the following paragraph:

> This means that in considering whether to provide LOLR support to an individual authorized institution, the guiding principle must be whether the failure of that institution would, either by itself or through spreading contagion to other institutions, damage the stability of the exchange rate or the monetary and financial systems. Such a contagion effect could arise, for example, where other institutions are heavily exposed to the troubled institution or share similar characteristics which could be interpreted as the origin of its problems. The vulnerability of other institutions to the contagion effect will also depend on the general tone of sentiment at the time, e.g. whether there is heightened nervousness about the stability of the banking or the monetary systems. (HKMA 1999, 77–78)

[15] Section 13(3) was also the basis for lending to address the failure of significant nonbank institutions such as Bear Stearns and American International Group (Alvarez, Baxter, and Hoyt 2020; Wiggins et al. 2021). The Fed could have used the section's authority to implement additional BBEL programs (Federal Reserve Act 2017).

and market-focused programs such as the Term Securities Lending Facility and Commercial Paper Funding Facility, which are considered in Rhee et al. (2020). In the aftermath of the GFC, Section 13(3) was narrowed to require that programs meet a specific definition of broad-based, among other things, and to require that the Fed seek the prior approval of the Treasury secretary before implementation (Federal Reserve Act 2017).

Programs That Required the Granting of New Authorities

Sometimes, during a panic, the LOLR exhausts its authorities and needs additional tools to continue to address the developing situation. Among our cases, six represent instances where countries adopted new laws or amended existing laws to facilitate BBEL programs. In each case, the BBEL authority was tailored to the unique situation presented.

In 1914, the US for the first time deployed the national emergency currency adopted pursuant to the Aldrich-Vreeland Act in 1908. However, Treasury Secretary McAdoo requested that Congress amend the FRA to provide eligibility for large banks to participate in the emergency currency and to suspend the USD 500 million limit on total issuance, broadening the reach of the currency (Silber 2008). Commentators have generally viewed the use of emergency currency as successful and as having helped to prevent a protracted panic (Sprague 1915).

In 1997, at the onset of the Asian Financial Crisis, the Thai FIDF was authorized to lend to distressed finance companies, and during the early part of that year it began secretly to make loans to the country's 91 nonbank finance companies. Lending proved significant and reached a peak outstanding of more than 430 billion Thai baht (THB; USD 17 billion[16]) in August (Haksar and Giorgianni 2000; Lindgren et al. 2000; see BOT 2009 for size of support). As liquidity problems deepened to threaten finance company creditors, the government considered how to free up collateral to be recovered by private creditors. In October, the Thai Parliament passed an emergency decree allowing the FIDF to relinquish collateral already held, make new unsecured loans, and raise member fees if the FIDF's board of directors "deem[ed] it necessary to restore the fairness and soundness of [sic] financial system" (Emergency Decree B.E. 2540 1997, 3). Ultimately, because of an inability to judge the health of the finance companies, accepting collateral of dubious value, and making uncollateralized loans, the FIDF lost more than THB 400 billion when a significant number of the finance companies failed (BOT 2002).

Additionally, during the Great Depression in the US, Congress created two new federal agencies to provide liquidity to segments of the financial system that had no LOLR. The Reconstruction Finance Corporation (RFC) provided funding to banks and other corporations that could not borrow from the Fed and the Federal Home Loan Bank System made loans to private institutions that specialized in "home mortgage loans, including savings and loan associations (S&Ls), mutual savings banks, and life insurance companies" (Wheelock 2008). Decades later, at the start of the GFC, the FHLBank System again played a

[16] The baht was fixed at THB 25=USD 1 until July 2, 1997. It peaked above THB 50 per dollar before settling around THB 40=USD 1 (Nabi and Shivakumar 2001).

role as "lender of next to last resort" as discussed in Key Design Decision No. 1, Purpose. (Narajabad and Gissler 2017a).

In 2008, the Norwegian Parliament authorized the Ministry of Finance to implement a swap program in which eligible banks and mortgage companies exchanged covered bonds for Treasury bills to increase banking sector liquidity (Norges Bank 2010).

During the GFC, international investors fled Hungarian government bonds and other assets, causing a strain on liquidity for Hungarian banks because of a prevalence of short-term, foreign currency–denominated liabilities (IMF 2011). To improve the overall liquidity position of the banking system and maintain lending to the real economy, in March 2009, the Hungarian Parliament amended the Act on Public Finances to authorize the Ministry of Finance to extend uncollateralized medium-term foreign-currency loans under commercial terms to credit institutions in Hungary, including subsidiaries of foreign banks (EC 2010; IMF 2011). Because Hungary was part of the European Union (EU)—although not part of the eurozone—the program was subject to EU review as State Aid. The program was found to be "non notified aid," and a breach of EU regulations, but the European Commission (EC) ultimately authorized its use. See Mott and Buchholtz (2022) for a detailed discussion of this program.

One important fact to note with respect to changes in legal authority or new laws that implement BBEL programs is that, given the position of BBEL programs as a first response in the initial acute phase of a crisis, time is of the essence. Lengthy, drawn-out debates are unlikely to provide a sense of confidence to financial institutions and markets struggling to manage liquidity constraints. In this regard, central banks and governments may be well advised to review their arsenals of standing authorities and crisis-fighting tools in quiet times and pursue any adjustments before the next crisis. Secondly, authorities may also want to consider adopting some crisis-era BBEL programs as standing facilities to ensure that they are ready and available when the next panic occurs. The UK did just this, incorporating two of its temporary emergency programs, the UK ECTR/CTRF and the UK ILTR, into its standing framework (BoE 2013; Fulmer 2022f; Fulmer 2022g). Similarly, Hong Kong retained two of its five temporary measures, incorporating the discretionary lending and swap facilities into its standing toolbox (Hoffner 2022b).

Programs That Were Deployed under Opaque Legal Authority

In a developing financial crisis, the LOLR may take actions even where its legal authority is not totally clear. This circumstance appears in eight of our cases, six of which involve the New York Clearing House Association (NYCH) issuance of clearinghouse loan certificates (CLCs)[17] during several panics in the 19th and 20th centuries. According to the National Bank

[17] The New York Clearing House Association (NYCH) developed a mechanism, the clearinghouse loan certificate (CLC), to address recurring liquidity strains resulting from a variety of causes, such as stress of a systemically important bank or the illiquidity of a significant collateral class. The CLCs were collateralized bills that the NYCH membership jointly guaranteed and accepted for settling clearing balances among member banks. The issuance of CLCs freed up cash that members could use for depositor withdrawals, which helped address runs on members and somewhat mitigated the need to sell assets at fire-sale prices. The CLCs were used in several

Act of 1865, any currency not issued by a nationally chartered bank was subject to a 10% tax, priced extremely high to end the issuance of notes by state-chartered banks and private banks (US Congress 1865). Regulators did not weigh in on the legality of CLCs, although they also saw CLC issuance as essential to ending banking panics. In fact, the Comptroller of the Currency included an entire section on the usage of CLCs by the NYCH and other clearinghouses in a number of its annual reports without questioning their legality (OCC 1908; OCC 1914). Additionally, the CLCs were a model for the Aldrich-Vreeland emergency currency enacted by the government in 1908 and used once, during the Panic of 1914, alongside CLCs; as in other cases, the government did not object to the use of CLCs in that case (Fulmer 2022j).

However, we located one contemporary court case from 1895, Philler et al. v. Patterson, from the Pennsylvania Supreme Court, that discusses the legitimacy of the Philadelphia Clearing House Association and loan certificates it issued that were similar to the CLCs issued by the NYCH. The case seems to support the legality of CLCs generally (Philler et al. v. Patterson 1895).[18]

On less than firm legal ground were the small-denomination CLCs issued in some cities outside New York in the panics of 1893, 1907, and 1914, which circulated as money, and the certified checks that the NYCH and other clearinghouses issued in lieu of currency in the panics of 1873, 1893, and 1907 (see Key Design Decision No. 3, Part of a Package). Several authors in later decades argue that small-denomination CLCs issued outside New York were clearly illegal because of their broad circulation (Timberlake 1984). Gorton and Tallman (2016, 27) say that certified checks were not considered "money," but that this view was "essentially a fiction."

Another example of a BBEL program operated with legal opacity occurred during the Russian ruble crisis. In August 1998, a liquidity crisis ensued in Russia after the government and Central Bank of Russia (CBR) jointly announced a ruble devaluation and the suspension of payment on certain ruble-denominated government bonds, domestic banks' main collateral, which in turn effectively froze interbank lending. In September, without a functioning government-bond market and with many domestic banks unable to make payments, the CBR began issuing short-term, zero-coupon bonds (OBRs), which it exchanged for restructured, illiquid ruble Treasuries held by banks with outstanding debts to the CBR. The banks could then use the OBRs as collateral for the CBR's lending facilities and to obtain overnight loans from the CBR. Banks could also use the relatively liquid OBRs to regulate their own liquidity through interbank markets (Hoffner 2022c).

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major crises during the National Banking Era (1863–1913) and were also the model for the national emergency currency implemented by the Aldrich-Vreeland Act. (See Fulmer (2022b) for a discussion of the CLCs and Fulmer (2022i) for a discussion of the Aldrich-Vreeland emergency currency.

[18] According to the opinion by Justice Henry W. Williams in considering certificates issued by the Philadelphia Clearing House Association: "We are unable therefore to see in what respect these banks have violated the statutes of the United States relating to national banks or have transcended the limits which these statutes have drawn about the business of banking. . . This same method or one identical in general outline has been adopted by the banks in every great city in the United States and by many in other lands; and as far as I am aware, it has nowhere been held that the method is illegal" (Philler et al. v. Patterson 1895, 482).

Although the CBR was authorized to act as a "creditor of last resort," it did not have explicit legal approval to issue debt instruments. Its doing so was subject to public critique (on both sides) from industry professionals and legal challenge (Hoffner 2022c). The chair of the Federal Commission on the Securities Market, Russia's securities regulator, led a campaign against the CBR's use of OBRs. The campaign was successful, and in January 1999 the prosecutor general ruled OBRs illegal (Hoffner 2022c). The CBR noted in its 1999 annual report that "placement of new issues [of OBRs] was suspended [at the beginning of the year] as the legal basis of the Bank of Russia issuing its own bonds was questioned" (CBR 2000, 56). Only after the passage of an amendment to the Central Bank Law, effective July 8, 1999, did the CBR receive legal approval for issuing OBRs. However murky their legal status, with the introduction of OBRs, the CBR did succeed in creating a more liquid collateral instrument for use in its lending facilities, which enabled banks to resume payments (Hoffner 2022c).

Although encountered in only a handful of cases, these situations seem to illustrate that, in a crisis, LOLRs will stretch to find solutions to liquidity constraints, sometimes very creative ones. Additionally, given the circumstances, they may be granted some latitude in deploying such creativity, especially when there are few alternatives and when the situation being addressed is particularly urgent.

3. Part of a Package: What other measures did the authorities take? What additional measures did private LOLRs take, reflecting in part their lack of statutory powers?

BBEL programs are often the first response in an acute phase, in part because they can seamlessly be rolled out as extensions of standing facilities. Thus, to the extent that a BBEL program is part of a package, the central bank usually includes other BBEL programs. Among our cases, we identify five groupings where more than one BBEL program was deployed in close proximity to another: Canada (GFC, three programs), ECB (two programs), Russia (two programs), UK (four programs), and US Y2K (two programs). These packages are only illustrative; as discussed in the individual cases and below, and as shown in Figure 4, additional BBEL programs or other types of support programs may have existed at the same time. Central banks adopted related programs for a few reasons: (i) to provide liquidity at different maturities, such as overnight and long term, (ii) to provide liquidity that accommodated different collateral classes, and (iii) to differentiate among classes of eligible participants.

Figure 4: Part of a Package

Short-form case name	Part of a package [a]	Additional liquidity facility	Origins in a preexisting standing facility	Selected other contemporaneous actions [b]
Canada CT Repo	Yes	Yes	Yes	
Canada Term PRA-PS	Yes	Yes	Yes	
Canada TLF	Yes	Yes	No	
Canada Term PRA[c]	Yes	Yes	Yes	
ECB FTOs	No	N/A	Yes	
ECB TROs	Yes	Yes	Yes	
Greece ELA	No	N/A	Yes	
Hong Kong 1965	Yes	No	No	Government emergency currency controls and liquidity injections
Hong Kong 2008	Yes	Yes	Yes	
Hungary Liquidity	Yes	No	No	
Norway Covered Bond	Yes	Yes	No	
Russia OBR	Yes	Yes	No	
Russia LO	Yes	Yes	Yes	
Thailand FIDF	No	N/A	Yes	
UK BoE 1825	No	N/A	No	
UK BoE 1866	No	N/A	Yes	Government supports lifting restrictions on note issuance
UK DWF	Yes	Yes	Yes	
UK ELTR	No	N/A	Yes	
UK ECTR/CTRF	No	N/A	No	
UK ILTR	No	N/A	Yes	
US Aldrich-Vreeland	Yes	Yes	No	NYCH loan certificates
US FHLB 1932–1941	No	N/A	No	US RFC 1932–1933
US FHLB GFC	No	N/A	Yes	US TAF
US NYCH 1893 [d]	Yes	No	Yes	SC, SE, SI, TS
US NYCH 1914 [d]	Yes	Yes	Yes	SI, Aldrich-Vreeland currency
US NYCH 1873 [d]	Yes	No	Yes	RP, SC, SE, SI, TS
US NYCH 1884 [d]	Yes	No	Yes	SE, SI
US NYCH 1890 [d]	Yes	No	Yes	PLS, SE, SI, TS
US NYCH 1907 [d]	Yes	No	Yes	PLS, SC, SE, SI, TS
US RFC 1932–1933	No	N/A	No	US FHLB 1932–1941
US TAF	Yes	Yes	Yes	US FHLB GFC
US Y2K SLF	Yes	Yes	No	
US Y2K SFF	Yes	Yes	No	
Total yes	**22 of 33**	**15 of 33**	**21 of 33**	

(a) Except for the NYCH cases, this column indicates that the LOLR of the program featured in the case implemented other programs in close proximity to the launch of the featured case.
(b) Except as noted, this column indicates other contemporaneous actions an authority other than the LOLR of the program featured in the case undertook.
(c) The Term PRA was the first of several GFC-era Bank of Canada programs to launch, so at the time it was announced, it was not part of a package, but the "package" ultimately included the Term PRA-PS and TLF, as well as an (unused) USD swap facility.

(d) The following acronyms apply for NYCH cases: PLS: private bank loan syndicates; RP: reserve pooling; SC: suspension of cash convertibility; SE: special examinations of member banks; SI: suppression of member banks' balance sheet information; and TS: Treasury support through bond redemptions or deposits at NYCH banks.

Source: Authors' analysis.

As an example, the BoC implemented its Term PRA facility in December 2007 to complement its Standing Liquidity Facility (SLF). After the failure of Lehman Brothers in September 2008, the BoC quickly expanded eligible collateral for its SLF to include Canadian dollar non-mortgage loans and conducted Term PRAs more frequently against a broader range of collateral. Over the next two months, it also announced the Term Loan Facility and the Term PRA facility for private-sector money market instruments (Term PRA-PS) (Zorn, Wilkins, and Engert 2009). The combined effect was to fill in gaps in its liquidity programs to include additional collateral and participants and provide loans at a range of extended maturities (Longworth 2010). The relationships among these programs are shown in Figure 5.

Figure 5: Selected Canadian Liquidity Programs during the GFC

Canadian GFC-era BBEL programs				Existing Facility
	Term PRA facility	***Term PRA for private-sector instruments***	***Term Loan Facility***	**Standing Liquidity Facility**
First announced	December 12, 2007	October 14, 2008	November 12, 2008	Standing facility established in 2003; collateral expanded in fall 2008
Maturities	Term liquidity for up to one year	Term liquidity for up to three months	Auction facility for term liquidity up to one month	Overnight facility for temporary settlement imbalances
Participants	Primary dealers and, starting in October 2008, major banks that were direct participants in the Canadian payments system	Money market and bond market participants through primary dealers; initially, primary dealers could participate in their own right	Banks that were direct participants in the Canadian payments system	Banks that were direct participants in the Canadian payments system
Eligible collateral	Securities eligible for the BoC's Standing Liquidity Facility, a permanent overnight facility for temporary settlement imbalances	Initially, investment-grade private-sector money market instruments; later, included bonds issued by Canadian or foreign entities	Non-mortgage loans	Expanded in October 2008 to include Canadian dollar non-mortgage loans
Frequency	Varied from weekly to monthly	Weekly	Weekly	On demand
Peak outstanding (CAD)	37 billion	3 billion	4 billion	N/A
Final expiration	July 21, 2010	October 27, 2009	October 28, 2009	N/A

Source: Authors' analysis (BoC 2013).

Central banks have extended many other types of support alongside BBEL programs, such as credit and account guarantees in the acute, panic phase of crises, when the focus is on reassuring depositors and other bank creditors that bank liabilities are safe; asset purchases, recapitalizations, and loan guarantees in the chronic, extended phase of crises, when the focus is on addressing any underlying solvency problems that remain.

Major central banks implemented all these types of programs in the Global Financial Crisis. In the fall of 2008, the Fed, ECB, BoE, and BoC expanded their liquidity programs in response to the shock of the collapse of Lehman Brothers and other unprecedented events; in October, most developed countries implemented new credit and account guarantees, or supplemented existing ones. As the crisis persisted into its chronic phase, these central banks contributed to government responses, often with the assistance and cooperation of the fiscal authorities, that also included: ad hoc emergency liquidity to failing banks and nonbank financial institutions, asset purchase programs, capital investment programs, stress tests (US), and loan guarantees (ECB 2010; Trichet 2010; YPFS n.d.2).

Again, during the COVID-19 pandemic of 2020, which led to widespread and prolonged closures of public and commercial spaces, central banks rolled out a great number of crisis-fighting programs within a very short period. For example, the BoC activated the CT Repo facility along with 11 additional financial stabilization and liquidity provision measures (BoC 2020a; BoC 2020b; BoC 2020c). The Fed augmented a group of previously announced supports, including three liquidity facilities, by announcing on March 23, 2020, an additional set of interventions that included an asset purchase program, three new liquidity programs with financial support from the Treasury, and expansions to two previously implemented liquidity programs (Fed 2020).

Additional Measures Taken by Private LOLRs

The private LOLRs in our case series lacked the powers of the central banks in more recent cases, but they typically received support from the government in some form. The US Treasury injected substantial liquidity into the banking system in five of the six NYCH cases; the British government supported the Bank of England in 1847, 1857, and 1866 by suspending the statutory limit on its issuance of fiat currency; and, as described in Key Design Decision No. 7, Funding Source, the Hong Kong government backed two large private banks' LOLR measures in 1965.

During financial crises of the National Banking Era (1863–1913), the NYCH provided anonymous temporary lending through CLCs, often alongside the use of other emergency tools. These complementary programs most commonly included the suspension of cash convertibility of deposits, special bank examinations (often used as a form of stress test), and the suppression of member banks' balance sheet information (Gorton and Tallman 2016). Figure 4 shows the distribution of these additional tools across the six NYCH cases.

The suspension of cash convertibility was illegal, though rarely penalized, and the NYCH never officially announced the action (Gorton and Tallman 2018). These suspensions were enforced unilaterally across the NYCH membership and occurred in three of the six surveyed crises—in 1873, 1893, and 1907 (Gorton and Tallman 2016; Jacobson and Tallman 2015). In each of those panics, banks did not deny depositors access to their funds; rather, they issued certified checks to depositors in lieu of legal tender. In September 1873, the NYCH announced that all such checks, issued by any member bank, would be certified as "payable through the Clearing House" (Gorton and Tallman 2016, 28). Member banks were jointly liable for repayment. This action implicitly recognized that banks had partially suspended cash payments to depositors and were satisfying large withdrawals with certified checks instead. Banks accepted certified checks by common consent through the clearinghouse. They typically traded at a discount to legal tender (Timberlake 1984).

In every crisis that we examined, the NYCH also announced a temporary suppression of weekly reporting of members' balance sheet information (Gorton and Tallman 2016; Jacobson and Tallman 2015). Lastly, in five of the six crises, the NYCH organized special examinations of member banks (Gorton and Tallman 2016). In 1873 and earlier crises, the NYCH also utilized reserve pooling as a complementary program to CLC issuance; however, it did not do so again in the National Banking Era. The action bound the reserves of NYCH

members into one common pool wherein the NYCH could freely shift reserves between banks depending on an individual bank's liquidity needs (Anderson, Hachem, and Zhang 2021).

The NYCH's interventions in crises also coexisted with separate actions of private banks and the US Treasury designed to address the liquidity constraints. In at least two of the six crises, private bankers joined together to form loan syndicates, which lent to distressed NYCH member banks (Wicker 2000). Additionally, the Treasury took significant actions to provide liquidity to the banks in five of the six crises. In four crises (1873, 1890, 1893, and 1907), the Treasury provided liquidity through large bond redemptions and deposit placements at member banks (Cannon 1910; Sprague 1910; Wicker 2000). In the Crisis of 1914, the passage of the Aldrich-Vreeland Act six years earlier gave the Treasury the right to issue up to USD 500 million of emergency currency as a lender of last resort. However, as noted, early in the 1914 crisis, Congress lifted the USD 500 million cap in response to a request from the Treasury (Sablik 2013). The Treasury used its new powers for the first time and issued USD 386 million of emergency currency, of which USD 145 million went to New York City (Jacobson and Tallman 2015).

Similar to actions of the US Treasury during the crises of the National Banking Era, we also observe that during several bank panics of the 19th century in the UK, the Exchequer stepped in to support the Bank of England's efforts as a private LOLR. The Bank Charter Act of 1844 effectively provided the BoE with a monopoly over note issuance and the nation's gold. The Charter Act restricted the issuance of notes not backed by gold to 14 million British pounds sterling (GBP; later raised to GBP 17 million). In 1847, 1857, and 1866, HM Treasury authorized the BoE to exceed that limit if necessary. In 1847, the announcement of that suspension, combined with the BoE's increase in its interest rate to 8% at HM Treasury's request, brought foreign investors into the market and "rapidly restored financial stability" (Dornbusch and Frenkel 1984). In 1857, the BoE did exceed the limit following HM Treasury's authorization (Bagehot 1873, 88). In 1866, the announcement alone was again sufficient to calm money markets (Fulmer 2022d). These cases demonstrate that a private LOLR can have limitations that can critically hinder its success and may require the backing of a government authority to ensure success.

4. Management: Who managed this facility? What oversight was conducted?

A high-level board or committee at the LOLR, such as the Fed's Board of Governors (Fed 2008b) and the ECB's Governing Council (Trichet 2010), make the key implementing decisions—whether to initiate a program; framing decisions about a program's general form; the timing of the program; and basic design decisions such as program size, eligibility, rates, and acceptable collateral. In the cases involving a private LOLR, the entity's top management also make the implementing decisions regarding BBEL programs. For example, in the NYCH cases, once the association made the decision to issue CLCs, it then appointed an ad hoc Loan Committee to manage the issuance (Fulmer 2022a).

Central banks ran 20 of the 33 programs in our survey as shown on Figure 1. The LOLR function has "traditionally been considered the bedrock function of central banks" (Baker

2012, 84–85). Central banks have a unique viewpoint from which to observe market developments, such as an increase in interbank interest rates or the shortening of maturities. They can add to these observations information gleaned from their supervisory role, in many cases, and usage of their standing facilities. The central bank can thus "read" the liquidity constraint, analyzing whether there is a panic around one bank, the possibility of contagion, or the potential for a systemic event; consider whether existing programs are adequate to address the tensions; and if not, act accordingly. (See, for example, the discussion at the Federal Open Market Committee [FOMC] meeting on August 16, 2007 [FOMC 2008b].) If the central bank determines that the market needs assistance, it has the authority to provide meaningful support.

Nongovernment LOLRs, though rare, share some of the observing characteristics of central banks. For example, in 19th century London and New York, the BoE—then a strictly private institution—and the NYCH, respectively, stood at the center of these significant financial centers and were key to their payment systems. This position, and their interconnections with many of the banks as counterparties, and, in the case of the NYCH, as members, added credibility to their LOLR role when no public alternative existed.

However, as those cases also demonstrate, we observe certain drawbacks with private LOLRs. They did not have an unlimited ability to fund liquidity. The absence of a statutory mandate as "keeper of the system" at times impaired their capabilities and overall effectiveness. Bias or self-interest may intrude on their decisions. For example, during the Panic of 1825, the BoE originally set high standards for the collateral that it would accept for loans since it would be bearing the risk. Although the records are not complete, anecdotal evidence suggests that little lending was initially done. As the panic persisted, the bank expanded the scope of acceptable collateral (though still requiring that it be of a "highly conservative character") and dramatically increased its lending, eventually quelling the panic (Fulmer 2022c).

The fiscal authority worked with the central bank to establish two of the BBEL programs we examined. In Norway in 2008, the central bank (Norges Bank) proposed the Covered Bond Swap Program to the Ministry of Finance and then managed the program on the ministry's behalf (Fulmer 2022b). The government authorized the swap program, set the size of the program, and specified which bonds could be swapped for Treasuries and which entities could participate (Norges Bank 2008). The Norges Bank made other administrative decisions, such as changes and assessments, under a power of attorney from the ministry (Norges Bank 2008). We found no mention of oversight or reporting responsibilities in public documents. However, the program was well used and has been reviewed positively. This collaborative model seems to have permitted the fiscal authority to act as the senior partner while relying on the administrative expertise of the Norges Bank to fulfill its stated purpose.

In Hong Kong in 1965, at the request of the government, two large commercial banks, HSBC and Chartered Bank, acted as LOLRs to quell runs on local Chinese banks. Both HSBC and Chartered Bank offered unlimited support for the affected banks, but deposit withdrawals persisted (Jao 1974). As a result, the government introduced several emergency protocols to support the currency and to bolster the two banks' liquidity relief efforts (Jao 1974). The

government later characterized some of the liquidity support as its own, saying that following the emergency supports, it "provided considerable financial support, through the media of [HSBC and Chartered Bank] which acted as its bankers, to those adversely affected by the run" (Government of Hong Kong 1966, 37). The runs calmed following the emergency measures. In this case, the close collaboration between the private LOLR and the government in its willingness to take supplemental efforts appears to have proved reassuring to the markets. Relying on this collaboration for all LOLR needs would be dangerous, however; in a systemic crisis, large banks may also be in trouble.

Special situations may require unusual structures to govern the program management. For example, the ECB's ELA uses a two-tier structure, as shown in the Greece ELA case, the first use of ELA across an entire banking system. ELA allowed the BoG to act as LOLR—to temporarily lend to solvent but illiquid institutions headquartered in its jurisdiction at a penalty rate—so long as such lending did not conflict with the euro system's monetary policy (ECB 2013; Runkel 2022c). The ECB Governing Council initially approved EUR 50 billion for Greece ELA.[19] The BoG then administered the program, reviewing individual bank applications, although ECB rules dictated some details, such as haircuts. The ECB Governing Council also regularly reviewed the Greece ELA in detail to ensure ELA did not conflict with Eurosystem monetary policy (Andruszkiewicz et al. 2020; Lee 2016; Pantelias 2021a).

Determining program details beyond the key implementing level—direct lending or auction, acceptable collateral and haircuts, maturity of loans, and rates—is usually up to the program's administrators, often staff at the LOLR who have experience with such matters. See the discussion at Key Design Decision No. 5, Administration.

At first blush, governance procedures provide a control on the use of BBEL programs, a check that the program is being administered as intended and fulfilling its purpose. Very often, the implementing entity performs this function. For example, the BoE audited itself and issued periodic reports on the programs' operations. The ECB monitored the national central banks' compliance with the terms of ECB program parameters. If a fiscal authority has participated in establishing a program, it may also provide oversight, as when the Ministry of Finance reviewed Norway's covered-bond program.

Third-party oversight also provides a review on the program's operations. In the US, an oversight regime overlaid by the legislative body probes the Federal Reserve's actions and the use of its facilities. In the Russia OBR case, the Russian securities regulator challenged the legitimacy of the OBRs. The attorney general ultimately held OBRs to be illegal (Hoffner 2022c).

Funders may also be a source of oversight. In the Hungary Liquidity Scheme, the managing authority was the Ministry of Finance, which the government had granted the new power to

[19] Although technically the Governing Council does not approve ELA but can only disapprove its issuance once notified by the national central bank, in practical terms, its administration of the Greece ELA operated as an approval. For a detailed discussion of the legal underpinning of the ELA and its application to Greece, see Lee (2016). Also see "Applications of Preexisting Emergency Authorities" in Key Design Decision No. 2, Legal Authority.

make loans to credit institutions. The ministry looked to the central bank, the MNB, and to the Hungarian Financial Supervisory Authority (EC 2010) to perform many of the administrative duties and make recommendations to the ministry (EC 2010). The International Monetary Fund (IMF) and European Commission funded the loan program. Citing concerns over the program's terms, its risk to public finances, and uncertainty over whether banks would comply with the use-of-funds requirement, the IMF and the EC questioned the adequacy of the oversight that Hungary had incorporated into the scheme. They made many recommendations for increased oversight and on-sight exams, and then called for additional reviews, audits, and stress tests. However, these measures were not "required" as a condition of funding and were only partially implemented. Audits were requested but implemented only after loans were repaid (so it is possible that an audit was never conducted). Stress tests were required "upon request" from the ECB, but we found no evidence of a request having been made. Therefore, this case illustrates that oversight is only as good as the enforcement behind it (Mott and Buchholtz 2022).

Programs in some cases appear to have had very little oversight. We observe limited supervision in three types of situations: (i) the LOLR is a private entity; (ii) the LOLR is a new, decentralized entity; and (iii) the LOLR operates in an opaque legal regime. For example, in Thailand FIDF, liquidity was extended on a case-by-case basis. No criteria were published, the program was essentially secret, and the public responded critically when it was later revealed (Prateepchaikul 1997; Runkel 2022d).

In each of these types of situations, questions arose regarding the effectiveness of the LOLR's administration of the BBEL program. In situations where oversight was lacking, the BBEL programs suffered from a perception of bias (the NYCH cases), unclear standards (US RFC 1932–1933 and the Russia cases), and secrecy (Thailand FIDF). These issues are discussed further in Key Design Decision No. 5, Administration.

Note that despite these critiques, some programs with these characteristics were still perceived as being effective. So, the lack of oversight or weak oversight may not per se render a BBEL program ineffective—although questionable in many ways, the Hungary and Russia schemes kept those banking systems afloat until other measures could be employed to stabilize them. Nevertheless, scholars and practitioners often subscribe to the view that oversight and transparency generally improve a central bank's credibility and lend credence to its LOLR activities. "Policymakers should increase transparency about LOLR actions through ex ante public hearings and through independent external or internal audit checks for decisions on allocation and publication of losses" (Domanski and Sushko 2014, 7).

5. Administration: How was this facility administered? Did administration change over time?

Many BBEL programs were administered at a staff level. Administrative details set at this level include maturities of loans, collateral, frequency of loan offerings, total amount of each offering, terms of auction, and auction mechanism.

However, such details were not always left to the administrative body. The BoG jointly administered the Greece ELA with the ECB after the European Commission approved it. ECB rules determined certain lending criteria, including the requirement of an extensive and frequent review and approval procedure. For example, ECB guidelines required a penalty rate of 100 basis points (bps) to 150 bps above other Eurosystem refinancing facilities (Andruszkiewicz et al. 2020; Mourmouras 2017; Suoninen and Jones 2013). Individual Greek banks submitted applications for ELA to the BoG, which reviewed the applicant for solvency and evaluated collateral quality (Pantelias 2021b, 4:30-5:45), then batched the applications and submitted an ELA request to the ECB every two weeks (Runkel 2022c). To ensure compliance with EU parameters regarding monetary policy during the ELA provision, BoG officials required daily reports from banks to monitor their liquidity conditions. Cash made up a significant portion of the one-third decline in Greek bank deposits, so the BoG delivered ELA in the form of banknotes or as a revolving credit line (Pantelias 2021b, 29:23).

One of the benefits of the administrative details being managed at this secondary level is that the staff can quickly adjust them as needed without requiring a new formal determination. For these reasons, a LOLR might anticipate the need for flexibility and adopt regimes that support adaptability. Preparedness measures can include:

- Adopting broadly defined BBEL programs as a contingency to be activated under specified circumstances (accompanied by a well-defined process for doing so). In the UK, the governor of the BoE held the ultimate power to activate the ECTR facility in times of stress, although the Monetary Policy Committee and Financial Policy Committee provided feedback. Once activated, the BoE set the terms of the facility.

- Enacting statutes that provide broad guidelines for programs but leave the details to the agency's determination, either through issuing regulations or policy statements (as in the Canada cases, for example).

This type of preset authority has risks, but some of these risks can be neutralized by accompanying oversight and disclosure requirements.

Another significant benefit of BBEL programs is that they often utilize an existing lending infrastructure, which can expedite operationalization of the program and facilitate the LOLR's risk management. As shown on Figure 4, 21 of our 33 cases involved programs that were formed out of existing programs. In some of these cases, the LOLR limited eligible participants to the bank's existing counterparties, in essence designating a "prescreened group." Other programs adopted an existing collateral regime, with haircuts or utilized infrastructure that were already familiar to the eligible participants. For example, by adapting an existing process that generally lent for overnight maturities (and could be deployed the same day the scheme was disclosed) to also offer longer maturities, the ECB was able to announce and settle the first tenders of its FTO program the same day (Runkel 2022a).

Programs that adopt new administrative criteria or mechanisms generally take longer to operationalize. However, the possible downside to adopting existing administrative criteria and infrastructure is that doing so can limit access to the BBEL program to a certain known group of participants or limit the method of operating to one that is familiar, but which may not be the best approach in the given situation. When considering the adoption of existing criteria, policymakers should weigh the appropriateness of the administrative details of BBEL programs against the speed of operationalizing the BBEL program.

In the Hungary Liquidity Scheme, several agencies participated in administration, with each contributing its expertise. The MNB and the Hungarian Financial Supervisory Authority evaluated loan applications (EC 2010). The MNB assessed the institution's relative importance in the financial system and its impact on other institutions, markets, and the economy; its short-term liquidity position; and the overall availability of liquidity in the global credit market (EC 2010). The Supervisory Authority assessed the institution's assets and its medium- and long-term liquidity positions. Following evaluation, each authority recommended a level of assistance to the Ministry of Finance, which granted the institution such aid (EC 2010).

In several cases, we observe a decentralized administrative structure, which may have caused problems. For example, although the US RFC board set general criteria for collateral and haircuts, the decentralization of administrative decisions across many regional offices may have created inequities and limited confidence in the young agency (Leonard 2022d).

In modern times, administrative criteria of all types have become more standardized—originating from a central office—and are more likely to be published. Centralized decision-making based on publicized criteria promotes consistency. Even so, such decisions can also become subject to political pressures, especially in countries with less independent central banks (Russia LO) or little oversight (Thailand FIDF).

6. Eligible Participants: What types of financial institutions were eligible? What solvency or viability criteria did they have to meet, if any?

When acting as an LOLR, central banks must choose the set of eligible counterparties. They can maintain the narrow set of counterparties that already have regular nonemergency access, usually depository banks, which many authorities agree should have access to BBEL programs "so long as they were solvent and viable" (Domanski and Sushko 2014). Central banks can also include a broader set of nonbank financial institutions. If central banks stick with the former, they maintain extensive institutional knowledge from preexisting relationships and supervisory activities. On the other hand, expanding the eligibility increases the ability of the central bank to reach a wider swath of the financial system, which may also be experiencing distress. Central banks also must decide how much risk they're willing to take. Will they allow only healthy institutions to participate in the program? Figure 6 shows the different groups of participants LOLRs selected for their BBEL programs. The table also shows whether they conducted solvency or viability tests.

Nonbank Financial Institutions

Most of our cases do not involve direct participation in central bank facilities by nonbank financial institutions (NBFIs). When central banks provide a LOLR function to banks, the central banks typically themselves have the nonemergency responsibility to supervise and regulate the banks.[20] However, they do not regularly do this for NBFIs, which could lead to greater risk assumption by the central bank if it were to extend the LOLR function to NBFIs, owing to information asymmetries (Dobler, Murphy, and Radzewicz-Bak 2016). As discussed later in this survey, a central bank might need to perform solvency and viability tests to determine if NBFIs can access a BBEL facility, but that assessment is extremely time intensive.

During the GFC, the Bank of Canada found a solution for this dilemma. The BoC sought to alleviate pressure on money markets through the introduction of the Term PRA facility for private-sector instruments. However, the Bank of Canada allowed money market participants to access the facility only through primary dealers, with whom the central bank had long-standing relationships. This occasioned some concern that it possibly stigmatized the facility as money market participants had to provide sensitive financial information to their competitors, the primary dealers (Zorn, Wilkins, and Engert 2009).

Some practitioners argue that central bank BBEL regimes should be extended to systemically important NBFIs (Domanski and Sushko 2014). The BoC approach is consistent with a viewpoint generally held by many authorities: banks should have generous access to central bank lending, but NBFIs should "face constructive ambiguity" (Domanski and Sushko 2014; Tucker 2014). "Any decision to lend [should] be made in consultation with other government agencies and with ex-post consequences for the borrowing firms and the regulatory regime" (Domanski and Sushko 2014; Tucker 2014).

Solvency and Viability Tests

The central banks in most of our cases did not explicitly require solvency and viability (S&V) tests as a condition for BBEL lending. A LOLR can require such tests to minimize the assumed risk. However, implementing solvency and viability tests is time-consuming and can induce stigma. The question of solvency arose during crises when the NYCH authorized CLCs. Sometimes, the association reviewed the stability of members before or after granting them CLCs. However, to avoid stigma, these reviews were private and generally were not disclosed to the public. The association also suspended the publication of members' balance sheet information during crises (Fulmer 2022a).

Under the Hungary Liquidity Scheme, several government agencies cooperated to make a viability assessment of potential borrowers (Mott and Buchholtz 2022). The MNB assessed

[20] This is not always the case. One notable exception was that in 2008, the BoE was the LOLR, but the Financial Services Authority (FSA) was the bank supervisor. This division of authority led to some delay and missteps when Northern Rock needed ELA and experienced runs, despite the existence of a memorandum of understanding delineating the various authorities of the BoE, FSA, and HM Treasury in a financial crisis (House of Commons 2008). Northern Rock was later taken over by the government. See HMT/BoE/FSA 2006.

each institution's relative importance in the financial system and its impact on other institutions, markets, and the economy; its short-term liquidity position; and the overall availability of liquidity in the global credit market (EC 2010). The Financial Supervisory Authority assessed the institution's assets and its medium- and long-term liquidity positions. Following evaluation, each authority recommended a level of assistance to the Ministry of Finance, which granted the institution such aid (EC 2010).

During the GFC, the UK Discount Window Facility required on-the-day solvency and viability tests for loans to be offered to eligible counterparties (Winters 2012). This decision led to considerable stigma associated with the facility. To this date, no counterparties have drawn liquidity from the UK DWF.

Central bankers generally support access to LOLR lending for solvent banks. However, they recognize that distinguishing illiquid from insolvent institutions is not easy and may be impossible in times of crisis (Domanski and Sushko 2014; Hauser 2014). As one group of central bankers concluded—"First, illiquidity tended to develop into insolvency crises the longer a crisis lasted; second, illiquidity and insolvency were not independent from the judgment of the authorities; and, third, solvency assessments by supervisors or analysts might be biased" (Domanski and Sushko 2014). Further, a solvency decision depends on the value of assets. Assets are likely to be impaired in a crisis when valued at fire-sale prices but could regain their value if held and if a liquidity-related failure can be avoided (Domanski, Moessner, and Nelson 2014).

Foreign Banks

The majority of the BBEL cases did not provide access for foreign banks. For example, only banks majority-owned by Greek entities could access the Greece ELA program (Mourmouras 2017). This limitation caused a distressed Portuguese bank operating in Greece to approach the Portuguese central bank for help rather than the Bank of Greece. The Bank of Greece did not lend to the Greece-based branches of a Cypriot bank, which contributed to the liquidation of the Cypriot parent bank (Runkel 2022c). In contrast, the US TAF did permit US branches, agencies, and subsidiaries of foreign banks to borrow; these institutions were the largest borrower group in terms of amount of funding, accounting for approximately 65 percent of all TAF borrowing (Government Accountability Office 2011; Runkel 2022f).

Changing Eligibility

Most of the BBEL cases we analyzed do not feature a change in eligible counterparties during the facility's existence. In situations where the LOLR revised the qualifications, it was in the direction of widening eligibility, except for one case (Canada Term PRA-PS) in which the Bank of Canada removed primary dealers as they already had access to other funding sources (BoC 2009; Longworth 2009).

Figure 6: Eligible Participants

Short-form case name	Eligible institutions	Changed during intervention	Solvency test	Viability test	Foreign banks	Nonbanks
Canada CT Repo	FIs, NBFIs	No	No	No	No	Yes
Canada Term PRA-PS	PDs, money market and bond market participants	Yes, removed PDs	No	No	No	Yes (indirectly)
Canada TLF	Major FIs	No	No	No	No	No
Canada Term PRA	PDs, major FIs	Yes, added FIs	Yes	No	No	No
ECB FTOs	Banks	Yes (widened national flexibility)	No	No	No	No
ECB TROs	Banks	No	No	No	No	No
Greece ELA	Banks	No	Yes	Yes	No	No
Hong Kong 1965	Banks	No	Yes	Unknown	No	No
Hong Kong 2008	Banks	No	Yes	Unknown	Yes	No
Hungary Liquidity	Banks, FIs	No	Yes	Yes	Yes	Yes
Norway Covered Bond	Banks, bank-owned mortgage companies	Yes (added mortgage companies and savings banks)	No	No	Yes	Yes
Russia OBR	PDs, banks	Yes (post-default, added banks)	No	No	No	No
Russia LO	PDs, banks	No	No	No	No	No
Thailand FIDF	Banks, FIs	No	No	No	No	Yes
UK BoE 1825	Banks, FIs	No	No	No	No	Yes
UK BoE 1866	Banks, FIs	Yes	No	No	No	Yes
UK DWF	Banks	Yes	Yes (on the day)	Yes (on the day)	No	No
UK ELTR	Banks, BS, SD	No	No	No	No	Yes
UK ECTR/CTRF	Banks, BS	No	No	No	No	Yes
UK ILTR	Banks, BS, SD	No	No	No	No	Yes
US Aldrich-Vreeland	Banks, trust companies	Yes (expanded eligibility)	No	No	No	Yes
US FHLB 1932–1941	Banks, NBFIs	Yes (added nonmember financial institutions)	No	No	No	Yes
US FHLB GFC	Banks, NBFIs	No	No	No	No	Yes
US NYCH 1893	Banks	No	No	No	No	No
US NYCH 1914	Banks, trust companies	No	No	No	No	Yes
US NYCH 1873	Banks	No	No	No	No	No
US NYCH 1884	Banks	No	No	No	No	No
US NYCH 1890	Banks	No	No	No	No	No
US NYCH 1907	Banks	No	No	No	No	No
US RFC 1932–1933	Banks, NBFIs	No	Yes	Yes	No	Yes
US TAF	Banks	No	Yes	No	Yes	No
US Y2K SLF	Banks	No	Yes	Yes	Yes	No
US Y2K SFF	PDs	No	No	No	No	No

Acronyms: BS = building societies; FIs = financial institutions; NBFIs = nonbank financial institutions; PDs = primary dealers, SD = securities dealers.

Source: Authors' analysis.

7. Funding Source: How did the LOLR fund BBEL operations?

BBEL facilities have two main sources of funding: central bank balance sheet expansion or treasury debt issuance. Interestingly, the BoE's reserves in the 1800s, when it was still a private bank, effectively served as the cash reserves for the whole banking system because banks did not have to meet reserve requirements as in the US. One of the key distinctions between the two sources for external observers is that treasury debt issuance usually results in a public announcement of funding size. However, a LOLR may also announce the size of a program even when it is being funded from the balance sheet. Reasons to do this are to communicate a size to the problem rather than suggest that it is open-ended. The Fed managed this circumstance with the TAF by announcing a set amount for the four authorized auctions but also stating that it would consider additional auctions if circumstances warranted.

Several central banks funded their programs through treasury debt issuance:

- HM Treasury issued almost GBP 50 billion in gilts for use in the UK Discount Window Facility, which saw no usage. The Bank of England did not hold these gilts unless used in the facility, eliminating the need to pay interest on them to the government (Fulmer 2022e).

- The RFC funded its operations through the issuance of debt, which was guaranteed by the US federal government. Initially, this issuance could be up to only three times the RFC's subscribed capital, but later legislation raised this limit to almost seven times (Leonard 2022d).

- The FHLBank System funded its advances through the sale of consolidated obligations of the whole system. At the end of 2009, debt funded 96% of the FHLBanks' consolidated asset portfolio, with the remaining 4% coming from member bank stock subscriptions (Leonard 2022b).

We observe a few unique situations:

- Although the Bank of Greece funded Greece ELA on its balance sheet, the Greek government guaranteed the extended credits (Runkel 2022c).

- In Hong Kong 1965, a private bank, HSBC, funded some liquidity from its reserves but also acted as a conduit for funding that the government provided to certain banks (Hoffner 2022a).

- Across several panics, the NYCH also funded its issuances of CLCs from its reserves; members were jointly liable for all CLCs (Fulmer 2022a).

- In the Hungary Liquidity Scheme, the funding constraint was more obvious. The Ministry of Finance could lend up to 1.1 trillion Hungarian forints (HUF) through the liquidity scheme, which was funded with loans from the IMF and ECB (Mott and Buchholtz 2022).

Challenges for Private LOLRs

Private LOLRs generally fund their activities from their balance sheets. They are limited by their reserves, which they cannot voluntarily expand, unlike a central bank. In several cases, the private LOLR almost exhausted its reserves. In the 19th century, the BoE needed the Exchequer to suspend the statutory limits on its issuance of fiat currency to continue lending in 1847, 1857, and 1866 (Bordo 1998; Dornbusch and Frenkel 1984). The NYCH faced funding constraints that in several cases were alleviated by financial support from the Treasury (Fulmer 2022a). In the 1965 Hong Kong case, while the two private LOLRs funded loans out of their reserves and substantial additional deposits that they experienced, the government also transferred reserves from London into the Hong Kong banking system to provide additional liquidity support for various distressed local banks (FEER 1966; Jao 1974). In summary, private LOLRs do not have an unlimited ability to address systemic liquidity shortfalls without government support, and we have no way of knowing if these crises could have been calmed without it.

8. Program Size: Was the program size preannounced? Was it increased? How did central banks determine the size of auctions?

Central banks do not typically announce a predetermined aggregate size of BBEL facilities. However, the size of some programs may be limited by legislation, the amount of security issuance related to the facility, or the reserves available to the central bank. In only seven of our cases was an aggregate program size announced; in three of these cases, the limit was determined by statute (see Figure 7). For example, in approving the Norway Covered Bond scheme, the legislature approved a maximum amount for the program, NOK 350 billion, which was funded by the issuance of Treasury bills[21] (Fulmer 2022b).

Central banks that hold auctions or drawings routinely announce the amount of funds they will offer in each operation. In those cases, the size of the auction or drawing is an important decision. One consideration is the possible announcement effect of auction size. If a central bank makes the auction very large or even unlimited, it can have a strong announcement effect but may risk either sending the wrong message—that the situation is worse than it is—or creating moral hazard. (As discussed below, we have seen this full-allotment strategy employed only in the most critical situations).

On the other hand, announcing a program that is perceived as inadequately sized may also impinge on the bank's credibility and signal that the central bank is out of touch or not prepared to "do what it takes." In such circumstances, if the size is too small, many bidders will not be awarded funds. However, in this case, the central bank has the option to increase the size of individual auctions in response to high demand; increasing the size of auctions due to oversubscription or market developments can prove very effective. The BoE, the ECB, and the Fed followed this strategy in different ways during the GFC.

[21] As of December 31, 2008, NOK 7 equaled USD 1, pursuant to Yahoo Finance.

The BoE routinely changed the size of the ELTR auctions (UK ELTR), which varied from GBP 10 billion at announcement to GBP 40 billion at the program's peak in September 2008 but continued to tolerate some oversubscription in this program (Fulmer 2022g). It maintained a different strategy with respect to the ECTR facility, which offered GBP 5 billion in each of seven auctions but lent a total of only GBP 10 billion due to low demand. Notably, when the ECTR was reactivated in March 2020 in response to the COVID-19 pandemic lockdowns, the BoE preemptively restructured it to be "fixed price, full allotment, in unlimited size" (BoE 2020). In the first operation of this revived program, launched on March 26, 2020 (the day lockdown measures legally went into force), the BoE lent GBP 11.1 billion, or more than 96% of the facility's total usage during its second activation (BoE n.d.).

Beginning in September 2007, the ECB conducted refinancing operations under the ECB TROs program by variable-rate tenders offering between EUR 25 billion and EUR 75 billion every two weeks (ECB 2021). In October 2008, when the crisis had escalated significantly, the ECB switched to a "fixed-rate, full-allotment" methodology (ECB 2008a). Participants received whatever amounts they requested at a rate set by the ECB (at the policy rate) rather than by auction. During this period, the size of allotments varied greatly, driven entirely by participant demand. One-year operations commanded hundreds of billions of euros, while some one- and three-month LTROs (long-term refinancing operations) received less than EUR 10 billion in bids. After the introduction of fixed-rate tenders, the operations averaged EUR 40 billion (ECB 2021). This demand-driven, "full-allotment" policy combined with the longer maturities to ease interbank rates from their highs in the crisis (Runkel 2022b). The program provided significant liquidity to the system, with a peak outstanding of EUR 729 billion. Although the program has some critics, a member of the ECB's executive board terms the fixed-rate, full-allotment policy "the most significant non-standard measure" that the central bank implemented (González-Páramo 2011, 4). The Fed viewed the move favorably as well (see the discussion at Runkel 2022b).

Although the Fed did not announce adoption of a fixed-rate, full-allotment policy, it eventually adjusted the TAF to that point in practice. First, it increased auction sizes and frequency in response to demand. The TAF operated with a set aggregate amount, which the Fed then apportioned between the different 28-day (and later 84-day) operations. For example, in December 2007, the TAF began with a total authorization of USD 40 billion split into two 28-day term auctions of USD 20 billion each. By May 2008, the total allotment had been increased to USD 150 billion in two 28-day operations of USD 75 billion each. In July, the Fed added a USD 25 billion 84-day term operation, which it alternated with the 28-day operations. It varied the amounts to stay within the total authorized amount (Runkel 2022f). Despite these increases, every TAF auction before October 2008 was oversubscribed, which left some bidders underfunded.[22]

After the collapse of Lehman Brothers and the aftershock, the Fed increased the size of auctions for both maturities beginning on October 6, to a point where it was providing full

[22] Oversubscribed auctions were part of the Fed's stigma strategy, since institutions could not ensure they would receive funds. The Lehman bankruptcy and the failure of several other major US institutions reprioritized the size of the TAF over its effects on stigma (Runkel 2022f).

coverage (it continued to set the rate via single-price auction) (Runkel 2022f). The Fed Board said it was taking these steps to "reassure financial market participants that financing will be available against good collateral, lessening concerns about funding and rollover risk" (Fed 2008c, 1). It maintained these increased sizes, providing full allotment to all bidders, effectively mirroring the strategy of the ECB's TROs (FOMC 2008b; Runkel 2022b) until July 2009 (Fed 2007–2010). The TAF was one of the most used of all the Fed's liquidity programs during the crisis, with a peak outstanding of USD 493 billion.

These cases demonstrate that central bank flexibility to increase program size in response to demand or market developments can be a very powerful tool, especially in the acute phase of a crisis.

Other Notable Cases

- The Winters report for the BoE, which reviewed the central bank's actions during the GFC, suggests that utilizing options for standing liquidity facilities could lessen stigma for discount windows and incentivize prudent liquidity-insurance behavior (Winters 2012).

- In the case of the UK's ILTRs, the BoE's predetermined auction mechanism automatically increased the available funding and allocated more liquidity to those collateral sets that the submitted bids indicated were experiencing a greater degree of stress in funding markets (Fulmer 2022h).

Figure 7: Program Size

Short-form case name	Aggregate limit	Individual auction limit	Peak outstanding (or total usage, if not available)
Canada CT Repo	No	No	CAD 292 million (USD 223 million)
Canada Term PRA-PS	No	Yes	CAD 3 billion (USD 2.4 billion)
Canada TLF	No	Yes	CAD 4 billion (USD 3.2 billion)
Canada Term PRA	No	Yes	CAD 37 billion (USD 30 billion)
ECB FTOs	No	Yes	EUR 95 billion (USD 131.1 billion)
ECB TROs	No	Became unlimited	EUR 729 billion (USD 1.02 trillion)
Greece ELA	Yes [(a)]	N/A	EUR 124 billion (USD 162 billion; first activation) EUR 87 billion (USD 95.7 billion; second activation)
Hong Kong 1965	No	Unlimited	HKD 163 million (USD 28.2 million; government injections)
Hong Kong 2008	No	Unlimited	HKD 11.4 billion (USD 1.5 billion)
Hungary Liquidity	No	N/A	HUF 690 billion (USD 3 billion)
Norway Covered Bond	Yes, determined by legislation	Yes	Total: NOK 230 billion (USD 32.9 billion)
Russia OBR	Yes	Unknown	RUR 2.3 billion[(b)] (USD 111 million)
Russia LO	No	N/A	Total: RUR 136 billion[(c)]
Thailand FIDF	No	N/A	THB 434 billion (USD 14 billion)
UK BoE 1825	No	Unlimited	Total: GBP 16 million
UK BoE 1866	No	Unlimited	Total: GBP 10 million
UK DWF	No	Unlimited	Never drawn
UK ELTR	No	Yes	GBP 180 billion (USD 261 billion)
UK ECTR/CTRF	No	Became unlimited	Total: GBP 10.8 billion (USD 16.9 billion; first activation)[(d)] Total: GBP 11.5 billion (USD 13.7 billion; second activation)[(d)]
UK ILTR	No	Unlimited	GBP 29 billion (USD 36.8 billion)
US Aldrich-Vreeland	Yes, determined by legislation → limit suspended	N/A	USD 364 million
US FHLB 1932–1941	No	N/A	USD 200 million
US FHLB GFC	No	N/A	USD 1 trillion
US NYCH 1893	No	N/A	USD 38 million
US NYCH 1914	No	N/A	USD 109 million
US NYCH 1873	Yes → No	Became unlimited	USD 22 million
US NYCH 1884	No	N/A	USD 22 million
US NYCH 1890	No	N/A	USD 15 million
US NYCH 1907	No	N/A	USD 88 million
US RFC 1932–1933	Yes, determined by legislation	N/A	First-year total: USD 1.6 billion
US TAF	Yes [(e)]	Yes	USD 493 billion
US Y2K SLF	No	N/A	USD 1 billion
US Y2K SFF	No	Yes	Options never exercised; USD 481 billion purchased

(a) Although technically the ECB Governing Council does not approve ELA but can only disapprove its issuance once notified by the national central bank, in practical terms, its administration of the Greece ELA case operated as an approval (Lee 2016).
(b) The only available data for this case provides an outstanding amount of OBRs for end of December 1998. The central bank capped the maximum outstanding issues at RUR 10 billion, but it is unclear how much of this was issued.
(c) The CBR presents this statistic as the total amount of liquidity provided under the Lombard and overnight facilities throughout 1998 (CBR 1999). Because of the ruble's extreme exchange rate volatility during 1998 (including an abandoning of the fixed-exchange-rate regime), an equivalent USD conversion is not useful.

(d) The UK ECTR/CTRF case encompassed two different activations: the BoE launched the first activation on June 15, 2012, and the second on March 26, 2020. Since the total usage during each activation period lasted several months, we approximate the USD equivalent using the launch dates as reference points for the GBP/USD conversion.
(e) The TAF operated with a program total allocated across two-week auction cycles. Initially, the TAF was authorized to auction USD 20 billion every two weeks, for a total of USD 40 billion. Between December 2007 and April 2008, the amount offered at each 28-day auction increased to USD 75 billion, bringing the program's total authorization for any cycle to USD 150 billion. When the facility added the 84-day loans in July and began alternating between auctions of 28- and 84-day loans, it modified the amount offered in 28-day auctions to maintain an authorized amount of USD 150 billion per auction cycle (Fed 2007–2010; Fed 2008b).

Source: Authors' analysis.

9. Individual Participation Limits: Did the authorities limit individual participation? If so, what was their motivation?

Central banks must decide if they will limit the amounts each participant borrows. Such limits are often driven by moral hazard concerns but can also be a mechanism to ensure anonymity and reduce stigma for borrowers. For example, no individual participant could take more than 10% of an auction in the US TAF. Because the Fed had set that limit, borrowers and other market participants knew that there was broad participation in any auction and would be less able to infer the identities of participants (Runkel 2022f).

If a central bank wants to further constrain participation, it can vary these limits based on the type of counterparty. For example, the Canadian Term Loan Facility lowers the maximum bid amount allowed as the counterparty's credit rating decreases below a threshold (Sankar 2022b). Central banks that conduct auctions in which successful counterparties pay what they bid can also implement individual participation limits by capping the number of bids allowed. For example, Norges Bank restricted counterparties to three competitive bids for the Covered Bond Swap Program during the GFC (Fulmer 2022b).

Participation limits may also be motivated by a simple need to preserve program funds. When the UK ECTR/CTRF had a fixed supply of liquidity on offer, the Bank of England implemented a maximum individual bid amount. However, the Bank of England removed this individual participation limit when the facility became unlimited in 2020 (Fulmer 2022f). The Bank of England did the same for the ILTR facility when it became unlimited (Fulmer 2022h).

10. Rates: How were they set? What was the minimum rate charged? Was the rate set by auction? If so, how did the auction work?

Bagehot's dictum can be summarized as "lend freely against good collateral at a high interest rate" (Bernanke et al. 2020, 57–58). In the introduction of this paper, we discussed the relevance of Bagehot's advice for modern crises and different crisis phases. In particular, we noted that the use of penalty rates can be a double-edged sword, particularly during the acute phase. Nevertheless, most LOLRs, historically and in modern times, did structure programs to lend at a penalty rate, either through a fixed rate or an auction (applying minimums). Some programs cut their rates over time because of poor uptake. For example, Canada's Private-Sector Term PRA received only nominal participation until the Bank of Canada sharply cut the fixed rate, at which point participation picked up (Sankar 2022a). This dynamic also occurred in the Hong Kong 2008 case (Hoffner 2022b).

Notably, a few programs with penalty rates experienced high usage in the absence of alternatives (Greece ELA, US RFC 1932–1933). In the Russia Overnight and Lombard facilities, the CBR fixed lending rates to interest rates that it gradually increased to maintain its fixed currency. But this process resulted in the lending facilities freezing up as Russia attempted to defend its peg in a volatile currency market. When the ruble floated, the CBR allowed rates to drop.

Pricing Structure: Competitive Auctions

As shown in Figure 8, pricing structures and rates strategies varied across BBEL programs. Many central banks choose to use auctions to administer their BBEL operations, as doing so allows market forces to determine rates and prevent moral hazard. Using an auction also helps to neutralize stigma associated with LOLR borrowing in that borrowing at an auction can be seen as simply borrowing at a market-determined rate, not at a penalty rate (Bernanke et al. 2020, 57–58). Further, in the event of a leak of borrowers' identities, many names would be divulged at the same time, providing some protection to individual borrowers (Hauser 2014).

For the US TAF, the Fed set a minimum bid that was below the market rate for interbank loans (the London Interbank Offered Rate, or Libor) but above the overnight indexed swap (OIS) rate (Runkel 2022f). In practice, bids consistently settled at the minimum bid rate. The low minimum created an arbitrage opportunity. By December 2008, the Fed had begun paying 0.25% interest on excess reserve balances (Fed 2008d). Banks could borrow from the TAF and then lend the Fed its own money at a profit. To avoid such arbitrage, in January 2009, the Fed switched the minimum bid rate from the OIS rate to the interest rate on reserve balances (Fed 2009).

If using a competitive auction, designers must decide which rates successful bidders will pay. Under discriminatory pricing, successful bidders pay what they submitted as their bid. Under uniform pricing, every successful bidder pays the same price, with a variety of mechanisms for setting this single price.

Central banks do not often discuss the reasoning behind their choice of auction methodology. Therefore, we cannot easily discern why one chooses discriminatory pricing while another chooses a uniform pricing mechanism. In general, discriminatory pricing and uniform pricing present different benefits in theory and practice:

> One argument for discriminatory pricing is that, if the goal of the auction is to get an honest valuation from bidders, discriminatory-price models are more likely to produce this result, since, in the uniform-price model, bidders tend to use steeper bid curves than their true valuations support. Furthermore, in both theory and practice, collusion tends to be reduced in discriminatory pricing . . . The argument for uniform pricing, however, is that, since discriminatory-pricing bidders know they will pay the full bid amount, they will bid less than their true valuations so as to be better off when they win. These lower bids imply that bidders are creating much flatter bid curves than their true valuations. Maximization of central banking revenue, therefore, will not be realized. (Kronick 2016)

Further, auction mechanisms have the added benefit of providing the central bank with pricing information from the market, which is not supplied in a fixed-rate regime.

One auction methodology about which we do have significant information is for is the UK ILTR program. The UK designed this program to be flexible and responsive to market conditions during stressed times. It utilized a product-mix auction—"a first in central bank auction design" (Fisher, Frost, and Weeken 2011). Participants could place any number of bids (spreads over the Bank Rate) on any of two, then three collateral sets (differentiated by quality from narrow to wider). The BoE determined a clearing spread for each collateral set, which then determined the rate for all borrowers. In utilizing this uniform-pricing structure for ILTR operations, which differed from the discriminatory-pricing mechanism used for ELTR operations, the BoE explained its decision as wanting to remove the incentive for counterparties to underbid relative to their actual financial situations (Fulmer 2022h).

In each ILTR operation, the Bank of England first allocated funds to the wider collateral and then to the narrower collateral set. It placed no restrictions on the aggregate value of bids or the total amount that could be allocated to a single participant (Fisher, Frost, and Weeken 2011). According to a BoE staff paper:

> Expressing the bids as spreads to Bank Rate eliminates the interest rate risk arising from unexpected movements in Bank Rate. Moreover, the spread the Bank charges to lend against wider collateral relative to narrow collateral and the proportion lent against each collateral set are determined within the auction (as the degree of market stress increases, the clearing spread on wider collateral relative to narrow collateral would be expected to rise . . .). Finally, from the pattern of the bids, the Bank obtains a signal about the need to expand the overall size or frequency of future operations. (Fisher, Frost, and Weeken 2011, 4)

Each ILTR operation had two built-in adjusters. First, the amount of liquidity available increased automatically if demand rose; and second, a greater proportion of funds was lent against a particular collateral set as the clearing spread for that collateral set increased relative to the other collateral sets (BoE 2014; Fulmer 2022h).

Figure 8: Auction Prevalence and Pricing Strategies

Short-form case name	Rate set by auction	Type of pricing [a]
Canada CT Repo	No	Fixed rate
Canada Term PRA-PS	Yes	Discriminatory
Canada TLF	Yes	Uniform
Canada Term PRA	Yes	Discriminatory
ECB FTOs	Yes (two exceptions)	Discriminatory auctions; fixed rate = ECB main refinancing rate
ECB TROs	Yes → No	Discriminatory auctions; fixed rate = ECB main refinancing rate
Greece ELA	No	Fixed rate = ECB main financing rate + 100 bps–150 bps premium
Hong Kong 1965	No	Overnight market rate
Hong Kong 2008	No	Fixed rate = base rate + premium
Hungary Liquidity	No	High premium on top of either IMF SDR rate[b] or interbank rate
Norway Covered Bond	Yes	Uniform
Russia OBR	Unknown	Unknown
Russia LO	No	Fixed rates tied to exchange rate of ruble (very high at the time)
Thailand FIDF	No	Fixed rate = repo funding plus a premium of 100 bps–250 bps
UK BoE 1825	No	Fixed at BoE base rate
UK BoE 1866	No	Fixed at BoE base rate
UK DWF	No	Fixed rate = BoE base rate + variable premium based on type of collateral and size of drawing
UK ELTR	Yes	Discriminatory (not indexed to Bank Rate)
UK ECTR/CTRF	Yes	Uniform in first iteration (minimum rate = Bank Rate + 25 bps); fixed rate (BoE base rate + 15 bps) in second iteration
UK ILTR	Yes	Uniform in first iteration (indexed to Bank Rate); fixed rate (BoE base rate + 0 bps – 15 bps) in second iteration
US Aldrich-Vreeland	No	Fixed rate; escalated the longer emergency currency was held
US FHLB 1932–1941	No	Variable rate, set in a decentralized manner
US FHLB GFC	No	Variable rate, set in a decentralized manner
US NYCH 1893	No	Fixed rate
US NYCH 1914	No	Fixed rate
US NYCH 1873	No	Fixed rate
US NYCH 1884	No	Fixed rate
US NYCH 1890	No	Fixed rate
US NYCH 1907	No	Fixed rate
US RFC 1932–1933	No	Fixed rate, set above the Fed's discount window rate
US TAF	Yes	Uniform
US Y2K SLF	No	Fixed rate = target federal funds rate + 150 bps
US Y2K SFF	Yes	Uniform for auction; strike price = either 150 bps or 250 bps above the target federal funds rate

[a]Definitions: Uniform: Every successful bidder pays the lowest accepted bid. Discriminatory: Every successful bidder pays their individual bid. Fixed rate: Every participant pays the same rate established by the administrator, fixed to either a stationary percentage or a fluctuating market rate.

[b] The Special Drawing Right (SDR) is an interest-bearing international reserve asset created by the IMF in 1969 to supplement other reserve assets of member countries (IMF 2021).

Source: Authors' analysis.

Pricing Structure: Fixed Rates

Many of the BBEL facilities in our survey utilized a fixed-rate pricing structure. While administratively simpler than an auction, a fixed-rate facility risks both overpricing—leading to stigma and little usage—or underpricing—leading to moral hazard and overuse. This challenge is unavoidable for bilateral facilities without auctions, such as on-demand facilities like the UK DWF facility. Although it was in part designed to address stigma in the UK's standing facility (the equivalent of the Fed's discount window), the UK DWF's high penalty rate contributed to its lack of usage throughout its existence, some observers argue, rendering it a "very extreme backstop for banks" (Winters 2012). The DWF facility also charged counterparties more for larger requests.

Another BoE program illustrates a similar situation with a different outcome. The Bank of England offered four term-repo auctions with expanded collateral sets in the autumn of 2007 at a penalty rate, with no takers. When the BoE later reformatted these operations as the ELTR facility, it removed the penalty rate and the facility saw plenty of usage (Cheun, von Köppen-Mertes, and Weller 2009; Fisher 2009). This outcome demonstrates the importance of rate-setting in BBEL facilities, especially when using a penalty rate. A central bank can price itself out of the market, temporarily impeding its lender-of-last-resort programs.

In the US during the GFC, use of FHLBank advances was elevated. FHLBank advances offered attractive rates at longer maturities than the Fed's discount window, which suffered from stigma (Ashcraft, Bech, and Frame 2008). The discount window was unused even after the Fed initially lowered its interest rates in hopes of mitigating the stigma (Ashcraft, Bech, and Frame 2008).

A fixed rate also can function as part of an exit strategy. When the market rates drop, banks are less likely to continue to seek out the central bank lending if the fixed rate becomes unattractive. See the discussion at Key Design Decision No. 20, Exit Strategy.

Unlimited Facilities

Sometimes, central banks switch to a fixed rate in connection with providing a full allotment to interested counterparties. For example, the ECB changed the pricing of TROs from discriminatory to fixed after the collapse of Lehman Brothers. Rather than deciding individual auction sizes, the ECB preferred to set a fixed rate and provide a full allotment (Runkel 2022b).

In another example, within weeks after the Lehman bankruptcy, the Fed doubled the authorized TAF amount to all bidders to USD 300 billion and increased auction sizes dramatically, to USD 150 billion each. This allowed all bidders to effectively receive the full allotment of all amounts bid for. Parties received funding at the minimum bid rate set by the Fed rather than at a rate determined by competitive auction (Runkel 2022f). We observed this shift away from a penalty rate to a lesser rate only in the most critical circumstances.

11. Collateral: What assets were eligible? Was this parameter changed? How were haircuts determined?

When extending liquidity to banks, LOLRs usually require each borrower to present collateral to secure the loan; indeed, many central banks are required by law to only lend on a secured basis. The LOLR has several decisions to make regarding collateral in designing a BBEL program. What is the group of eligible assets that may be presented as collateral? Will this be a narrowly defined or a broadly defined group? Collateral decisions can reflect the LOLR's intent behind the program, and they are likely to impact the program's accessibility and usage. If the program defines collateral too narrowly, usage may be limited, stifling the program's effectiveness. If the program defines eligible collateral too broadly, then, depending on market conditions and the other terms of the program, borrowers may use it opportunistically. Figure 9 describes the range of collateral used in our cases.

In 16 of our 33 cases, we classified the range of eligible collateral as narrow, although in some case this range was expanded. We see a LOLR choosing a narrow set of collateral when it is targeting assets that either are not eligible under existing programs or have become illiquid. The latter situation was the impetus for the Canada TLF, which accepted only CAD-denominated non-mortgage loan portfolios that had become relatively illiquid as collateral for loans of 26–30 days. Overall, across the four Canadian BBEL programs that we consider, the idea was to match the collateral eligibility of the central bank's Standing Liquidity Facility across two facilities (Term PRA + TLF), but lend at longer terms, and separately to support money and bond markets (Term PRA-PS). The regular Term PRA was the most used facility, and its collateral was the most aligned to the SLF (Sankar 2022b).

Similarly, "in order to facilitate banks' access to long-term funding," Norges Bank established the Norway Covered Bond scheme, which originally loaned government securities only in exchange for covered bonds backed by residential and commercial mortgages and municipal loans—in other words, assets that had become illiquid (Norges Bank 2010).

Some programs use narrow collateral requirements to focus on a particular participant group. The FHLBank System, established in the US in 1932, provides an example. The legislature established an entirely new agency to provide liquidity to banks and financial institutions that provided mortgages and limited the collateral that the FHLBanks would accept to mortgages and related securities (Leonard 2022a).

The Canada PRA-PS also was limited as to both collateral and participants. Originally, it permitted large participants in the money markets and primary dealers to secure loans with specified instruments common in that industry, commercial paper, and other investment-grade money market securities. In a second iteration of the Canada PRA-PS, money market participants and bond market participants were eligible, and had to bid through primary dealers, which could no longer bid on their own behalf. (The primary dealers remained eligible for the regular Term PRA [Zorn, Wilkins, and Engert 2009]). The collateral eligibility for the Term PRA-PS was widened to include investment-grade corporate bonds (Sankar 2022a). Overall usage of the PRA-PS (and TLF) was less compared to facilities that accepted broader collateral. However, establishment of the Term PRA for PS (and TLF) was consistent

with the BoC's intent to provide liquidity broadly. The low rate of participation may suggest that Canadian financial institutions were able to obtain short-term funding from other, more cost-effective sources (Zorn, Wilkins, and Engert 2009).

A LOLR will often follow the collateral polices of its conventional standing liquidity facilities (for example, the US discount window) when establishing new programs; doing so provides administrative ease as rules are already established. Fourteen of our 33 cases reference some existing standard schedule of collateral.

In August 2007, at the beginning of the GFC, the ECB implemented the ECB FTOs and ECB TROs, which expanded opportunities for overnight and term lending, respectively. Under these programs, the eligible collateral was originally limited to the types acceptable under the ECB OMO Unified Framework—euro-denominated marketable debt securities, nonmarketable bank loans, and retail mortgage-backed debt (Runkel 2022a; Runkel 2022b). However, in October 2008, the ECB significantly enhanced its liquidity provision by (i) swapping the auction feature of both facilities to fixed rate, full allotment; and (ii) expanding the eligible collateral widely to also accept debt instruments denominated in US dollars, pounds, and yen; certificates of deposit; subordinated marketable debt instruments; syndicated loans; and asset-backed securities (Runkel 2022a; Runkel 2022b).

In some cases, a central bank's standing facility accepts a wide range of collateral and using its schedule may indicate intent to provide broader access and flexibility. For example, the BoE introduced the ECTR in 2011 and activated it in 2012. This facility accepted the same collateral as its Discount Window Facility, providing additional options for the use of the widest set of collateral eligible in the Sterling Monetary Framework, for overnight and term lending (Fulmer 2022f). Together, the ECTR and DWF provided maximum flexibility for borrowers to use the widest set of collateral eligible for overnight and term loans. The Fed's Y2K programs, US Y2K SFF and Y2K SLF, also adopted a broad range of collateral from its standing facilities (Leonard 2022e; Leonard 2022f).

The benefit of a wider collateral set is that it provides more options to a borrower for how to deploy its assets. For example, in the GFC, although the US TAF accepted a broad range of collateral, studies show that borrowers pledged large amounts of relatively risky and illiquid assets: commercial loans, asset-backed securities (ABS), mortgage-backed securities (MBS), and residential mortgages. They pledged much smaller amounts of their safest assets, US Treasury bills and government bonds, presumably because they could use these elsewhere (Fed 2007–2010). This demonstrates that establishing a wide class of eligible collateral does not guarantee that borrowers will use the full range of assets for the program. Another similar example occurred at the NYCH during a number of panics. The NYCH accepted a range of collateral—"bills receivable, stocks, bonds, and other securities"—for CLCs (OCC 1907, 66). However, reports confirm that the majority of collateral delivered was much narrower: commercial paper, commercial loans, US Treasuries, and gold certificates (Fulmer 2022a).

In eight of our cases, the LOLR expanded the set of eligible collateral once the program was implemented. Norway's 2008 covered-bond program, which originally accepted only covered bonds secured by housing mortgages, expanded in January 2009 to accept covered

bonds secured by commercial loans or loans to the central government or a local government (Fulmer 2022b). Notably, the original authority and the circular explaining the swap program provided for the possibility that Norges Bank could expand the eligible set of collateral beyond covered bonds secured by Norwegian residential mortgages to include covered bonds secured by other types of assets, as well as any other bonds secured by Norwegian mortgages (Norges Bank 2008).

The BoC's Term PRA facility presents a particularly interesting case in which the Bank of Canada first expanded and then contracted eligible collateral. At its introduction, the Term PRA Facility accepted a narrower range of collateral than that of the Bank of Canada's Standing Liquidity Facility. In September 2008, the BoC then expanded the Term PRA to include all collateral eligible at the SLF at the time. In December 2009, as market conditions improved, the Term PRA eliminated eligibility of BBB corporate bonds and certain ABCP securities (Sankar 2022a).

The Depression-era RFC extended the types of collateral it accepted to boost demand from borrowers, without formally revising the stated list of eligible collateral). The RFC had discretion under the law to accept a broad range of collateral, but in practice, it chose at first to accept only a narrower range, similar to what was then eligible at the Fed's discount window[23] (Anbil and Vossmeyer 2017). This collateral policy was perceived as too restrictive and impeding the use of the facility. Once the agency broadened the collateral it accepted, the failure rates on RFC loans decreased. (They had been high because, having deposited their high-quality collateral with the RFC, some borrowing banks had difficulty raising additional funds to meet depositor withdrawals. The loosening of collateral requirements improved their overall borrowing capacity.) (Mason 2001a).

Given the incidence of central banks expanding collateral under BBEL programs, drafting programs that provide some flexibility at the administrative level to widen the eligible collateral may be useful.

Separate Lending Facilities Based on Collateral

LOLRs may separate lending into distinct facilities based on collateral type and apply haircuts according to those categories. However, we were unable to identify the motivations behind those decisions, and they may have been made simply for ease of administration.

However, in one program, the separation of collateral clearly served a direct policy purpose. In the UK Indexed Long-Term Repo operations, the Bank of England created two separate pools of collateral to employ discriminatory pricing for repo auction. Participants could bid against a narrow set of collateral (traditional government securities) or a wide set (less

[23] *The Fed's discount window accepted gold; Treasury securities; and commercial, industrial, and agricultural paper. The RFC's decision to base its collateral eligibility on the discount window reflected the influence of Eugene Meyer, the governor of the Federal Reserve Board and chairman of the board of the RFC. However, after slow utilization and Meyer's exit, the RFC "relaxed" and broadened the eligible collateral it accepted, although we were unable to determine the parameters of the wider practices (Leonard 2022d).*

liquid, high quality debt securities), or submit paired bids for both pools.[24] The Bank imposed the same haircuts used in its LTR operations for the narrow set, while imposing higher haircuts on the wide set that varied depending on type, rate, and maturity of collateral. By offering bidders these choices, the ILTRs allowed banks to submit more sophisticated bids that more closely resembled their funding needs. Since cutoff prices, especially for the wider set of collateral, rose during times of systemic stress, the auctions provided the BoE with an "early warning indicator" (Fisher, Frost, and Weeken 2011, 9). Haircuts varied depending on security type, maturity, and interest rate. Own-name covered bonds, introduced in the second iteration, received an additional haircut of 5% (Fulmer 2022h).

Special Situations

The Russia, Thailand, and Greece cases are unusual in that the LOLR accepted collateral of dubious credibility. The Central Bank of Russia issued and accepted its own legally questionable bonds (OBRs) as collateral to restart interbank lending, which had stopped because of the government's default on some of its bonds (Hoffner 2022c).

Greek bonds had also defaulted, and the ECB lending facilities no longer accepted them. The BoG accepted Greek sovereign bonds, regardless of credit rating or maturity, in addition to other collateral accepted under ECB open market operations, to prop up the value of eligible collateral held by domestic banks for typical monetary policy operations. The BoG also applied various haircuts to the collateral, some steep, and required that borrowers pay a fee for a government guarantee of all loans (Runkel 2022c).

The Thai FIDF loosened its collateral criteria and made some unsecured loans. These practices eventually led to the government's absorbing losses to save the financial institutions it sought to help (Runkel 2022d).

Under Hungary's Liquidity Scheme in the GFC, the central bank, MNB, also extended uncollateralized loans, but borrowing banks had to commit to secure external funding and maintain corporate lending exposures in Hungary. Participants that defaulted on loans needed to submit restructuring or liquidation plans to the European Commission within six months (Mott and Buchholtz 2022).

These unusual cases demonstrate the range of creativity that central banks are capable of in critical situations. But they also caution that in such dire situations, a central bank should take extra efforts to secure itself.

[24] *Later, in 2014, the BoE revised the program, creating three separate collateral pools for three separate auctions: Level A, a narrow set (high-quality, highly liquid government securities); Level B, a wider set (high-quality liquid collateral such as sovereign, supranational, mortgage, and corporate bonds); and Level C (less-liquid securities including own-name securities and portfolios of loans) (Fulmer 2022h).*

Figure 9: Eligible Collateral

Short-form case name	Scope [a]	Notes on eligible collateral [b]	Basis or range of haircuts [c]
Canada CT Repo	N	**A, B**–Securities issued or guaranteed by the Canadian government	Standing Liquidity Facility
Canada Term PRA-PS	N→M	Highly rated bankers' acceptances, CP with < 1 year to mature, and highly rated ABCP; later added corporate bonds	N/A
Canada TLF	N	Non-mortgage loans not already used as collateral in the domestic payments system	40%
Canada Term PRA[d]	M→W	**A, B**–Securities issued or guaranteed by Canadian government and certain bankers' notes, then all assets eligible under Standing Liquidity Facility: later removed eligibility of BBB corporate bonds and certain ABCP	Standing Liquidity Facility
ECB FTOs	N→W	ECB OMO Unified Framework, then added debt instruments denominated in USD, pounds, and yen; certificates of deposit; subordinated marketable debt instruments; syndicated loans; asset-backed securities	OMO Unified Framework + 8% on non-euro collateral + asset classes varying from 5%–15%
ECB TROs	N→W	ECB OMO Framework**,** then added debt instruments denominated in USD, pounds, and yen; certificates of deposit; subordinated marketable debt instruments; syndicated loans; asset-backed securities	OMO Unified Framework + 8% on non-euro collateral + asset classes varying from 5%–15%
Greece ELA [e]	W	ECB OMO Framework and any Greek sovereign debt regardless of credit rating. Greece moved through three separate haircut schedules from 2012–2015	OMO Unified Framework + 15%–71% for Greek sovereign debt + 23%–81% for private debt
Hong Kong 1965	W	Mortgageable assets, securities, foreign balances, and secured advances	Unclear if discounted
Hong Kong 2008	N	**A, B**–The enhanced discount window accepted Hong Kong government Treasuries and added US Treasuries. The discretionary term lending facility also accepted other investment-grade securities	DW
Hungary Liquidity[f]	U	Lending was uncollateralized	N/A
Norway Covered Bond	N→M	Covered bonds backed by residential mortgages; later expanded to include covered bonds backed by Norwegian loans to, or guaranteed by, central or local governments or commercial mortgage loans, and CB-backed commercial mortgages, including those denominated in six currencies	Varied by collateral type; + 10% added to foreign currency collateral
Russia OBR [g]	N	Bank of Russia Bonds (OBRs)	None
Russia LO [g]	N	Russian government securities; replaced by OBRs after default	Unclear
Thailand FIDF	N→U	Thai government bonds, then added promissory notes from finance company debtors and unsecured loans	Unclear
UK BoE 1825	N	Bills from commercial transactions in goods that were endorsed by two London bankers and no longer than 65 days; added bills up to 95 days and government securities	Unclear but discounted
UK BoE 1866	N	Bills of exchange (unsecured debt) endorsed by two "good British parties"	Unclear but discounted
UK DWF	W	**A, B, C, D**–The widest set of eligible collateral	DW margin ratios + 3% for non-sterling collateral and 5% for own-name securities
UK ELTR	M→W	**A, B, C** - Originally A and B; later added corporate and consumer loans, ABCP, and bank bonds. Securities could be denominated in sterling and seven other currencies	Established a margin schedule separate from other OMOs + 3% for non-sterling collateral
UK ECTR/CTRF	W	**A, B, C, D**–Same as UK DWF	Sterling Monetary Framework
UK ILTR	M→W	**A, B, C, D**–Originally A and B; later added C and D. Securities could be denominated in sterling and seven other currencies	Sterling Monetary Framework

Short-cut case name	Scope [a]	Notes on eligible collateral [b]	Basis or range of haircuts [c]
US Aldrich-Vreeland	W	Any security, including CP, held by a national currency association, but CP could be no more than 30% of borrower's capital and surplus	23% for state and municipal bonds to 44% for warehouse receipts
US FHLB 1932–1941	N/U	Initially only home mortgages; the FHLBanks also made some uncollateralized loans	Varied based on maturity and loan-to-value ratio
US FHLB GFC	N	MBS and related assets, US Treasuries (USTs), agency securities, and community development loans. Some uncollateralized loans supported by stock subscriptions	Varied based on maturity and loan-to-value ratio
US NYCH 1893 [h]	W	Bills receivable, stocks, bonds, and other securities	Minimum 25% haircut except for USTs, at par
US NYCH 1914 [h]	W	Bills receivable, stocks, bonds, and other securities	Minimum 25% haircut except for USTs, at par
US NYCH 1873 [h]	W	Bills receivable, stocks, bonds, and other securities	Minimum 25% haircut except for USTs, at par
US NYCH 1884 [h]	W	Bills receivable, stocks, bonds, and other securities	Minimum 25% haircut except for USTs, at par
US NYCH 1890 [h]	W	Bills receivable, stocks, bonds, and other securities	Minimum 25% haircut except for USTs, at par
US NYCH 1907 [h]	W	Bills receivable, stocks, bonds, and other securities	Minimum 25% haircut except for USTs, at par
US RFC 1932–1933	N	Despite broad discretion to accept various types of collateral, the RFC originally only accepted collateral similar to the Fed DW (gold; Treasury securities; and commercial, industrial, and agricultural paper). After slow utilization, it "relaxed" and broadened eligible collateral in unspecified ways	20%–50%, depending on quality
US TAF [i]	W	**A, B, C, D**–Same as discount window; significant use of commercial loans, ABS, MBS, and residential mortgages; fewer USTs	DW schedule + extra 100% cushion reduced to 33%
US Y2K SLF	W	**A, B, C**–Same as discount window	Standard DW schedule
US Y2K SFF	N	**A**–Options could be exercised for Federal Reserve Bank of New York (FRBNY) repos using typical collateral, but expanded to include agency securities, USTs, and "stripped" bonds of other government agencies	Standard FRBNY OMO repo schedule

(a) This column represents the authors' attempt to classify the range of collateral that was eligible as (N) narrow, (M) moderate, or (W) wide. (U) indicates programs that offered uncollateralized lending.

(b) We use the following categories to indicate the range of eligible collateral:
- Level A: High-quality sovereign debt.
- Level B: High-quality securities that normally trade in liquid markets, including: other sovereign and central bank debt; major international institutions' bonds; Group of Ten (G-10) government-guaranteed agency bonds; government-guaranteed bank debt; US agency debt; prime residential mortgage-backed securities; regulated covered bonds; asset-backed securities backed by credit cards, auto loans, student and consumer loans; and portfolios of senior corporate bonds and commercial paper issued by nonfinancial companies.
- Level C: Illiquid but transferable securities, including commercial mortgage-backed securities, asset-backed commercial paper, and securitized portfolios of corporate bonds.
- Level D: Own-name securities and loans, including residential mortgages; consumer, commercial real estate, and corporate loans; own-name securitizations; and covered bonds (Winters 2012).

(c) Where we identified that an existing schedule was used for the haircuts, we list it. "Unclear" indicates we were not able determine the basis for haircuts.

(d) The Canada Term PRA applied individual collateral concentration limits (based on collateral source) per participant.

(e) The Greece ELA was funded through the ECB, and it used the ECB OMO collateral and haircut schedule. It also accepted Greek sovereign debt, which at the time, ECB lending facilities did not accept. Originally, the BoG applied haircuts on Greek sovereign debt, which ranged from 15% to 71%, depending on the maturity and coupon of the bond. In December 2014, the BoG lowered haircuts to a range from 6.5% to 52.5%. After February 2015, the BoG applied a uniform haircut rate of 45% for all Greek debt regardless of the bond's maturity and coupon (Runkel 2022c).

(f) Given the unusual circumstances of the Hungarian crisis, the MNB extended credit on an uncollateralized basis against a commitment to procure external funding and maintain domestic lending exposures.

(g) In August 1998, the Russian government defaulted on its ruble-denominated Treasury bonds (GKO-OFZs) maturing before 2000. Before the default, these securities had been the primary collateral instrument banks used at the CBR's lending facilities.

Beginning in September 1998, the CBR issued zero-coupon Bank of Russia Bonds (OBRs) as eligible collateral instruments through which banks could secure CBR loans (Hoffner 2022c; Hoffner 2022d).

(h) The NYCH accepted a range of collateral, generally defined as "bills receivable, stocks, bonds, and other securities" (OCC 1907). However, banks primarily collateralized CLCs using commercial paper and commercial loans (Fulmer 2022a; OCC 1873).

(i) In addition to standard haircuts, the TAF initially required banks to provide a collateral cushion equal to 100% of the value of collateral for the duration of the bidding process; the Federal Reserve eventually reduced the collateral cushion to 33%, however, and required banks to keep the cushion on deposit for the duration of the loan (Fed 2008b; FOMC 2008a).

Source: Authors' analysis.

Haircuts

In 32 of our 33 cases the LOLR required that lending be secured; however, in two of these cases, the LOLRs also made some unsecured loans. Only the Hungary Liquidity Scheme made exclusively unsecured loans, which the government guaranteed under a previously announced program. In all but three of our cases, we found evidence that it applied a haircut.[25] A few themes emerge from our cases.

Standard Collateral Frameworks

When a LOLR borrows or references a standard collateral schedule for a program, it generally applies the haircuts listed in that schedule as well. This is an efficient way to work with information that is known to the LOLR and likely participants. Thirteen cases, from five central banks (BoC BoE, ECB, Federal Reserve, and HKMA), borrowed collateral and haircut schedules from their standard collateral frameworks or from a standing facility, such as a DW.

For example, the US TAF accepted collateral that could be used at the discount window and applied haircuts from that schedule. These collateral rules were regularly administered by the staff of the Federal Reserve Bank of New York, which managed the TAF so it could quickly and efficiently assess and value collateral deposited for TAF borrowings and implement TAF auctions (FOMC 2007a; Runkel 2022f).

Although, in some of these instances, the bank tweaked the haircuts that it applied, this frequency seems to imply that the banks valued their well-thought-out schedules and only in limited cases saw reason to "start from scratch." An example of the latter case was the Canada TLF, in which the Bank of Canada applied a uniform 40% haircut to the program's narrow set of eligible collateral, non-mortgage loans (BoC 2008a).

Despite the efficiencies of using an established collateral haircut schedule, the schedule might not be the most appropriate in some circumstances. After all, central banks set these schedules during normal market conditions, whereas a liquidity constraint can easily disrupt the underlying assumptions and cause collateral to quickly lose value and become illiquid. When an existing schedule is inappropriate, the LOLR can take steps to adjust haircuts for certain classes of collateral. This alteration can be done by adding premiums such as for

[25] In Hong Kong 1965, Russia OBR, and Thailand FIDF, we could not find evidence to show that a haircut was applied (Hoffner 2022a; Hoffner 2022c; Runkel 2022d). In the Russia OBR case, the central bank likely did not apply a haircut when accepting its own OBR bonds as an alternative collateral under its lending facilities when the Russian government bonds defaulted. With respect to Thailand, the absence of haircuts may have exacerbated the situation and contributed to losses the FIDF suffered.

collateral denominated in a foreign currency, as discussed below. The LOLR can also adjust how the collateral is valued while keeping the haircut the same; this too would provide additional security to the LOLR, but we did not observe this in any of our cases. Third, the LOLR can require an overcollateralization cushion, as the US did under the TAF.

Haircut Premiums

In six of our cases, the LOLR applied an additional haircut, above the schedule haircut, to certain classes of collateral. For example, the ECB applied its OMO Unified Framework of haircuts to collateral under the ECB FTOs and the ECB TROs facilities but applied an additional 8% haircut for non-euro-denominated collateral (USD, pound, or yen). Norway similarly applied an additional 10% haircut for collateral denominated in a foreign currency under the Norway Covered Bond facility. The BoE applied an additional 3% to its Discount Window Facility margin ratios for collateral not denominated in Sterling but in any of seven other currencies. Central banks apparently were comfortable with a fixed premium haircut across foreign currencies because they accepted only collateral denominated in a limited number of high-quality currencies.[26]

We identified several other situations in which haircut premiums were applied:

- Norges Bank also applied additional haircuts of 2%–5% for pools of floating-rate bonds in lieu of a "top-up" clause based on maturity. See Fulmer 2022b for a discussion of this feature.
- The UK DWF applied an additional 5% haircut on own-name securities (Fulmer 2022e).
- ECB FTOs and TROs required additional haircuts for certain types of expanded collateral when the central bank adopted a fixed-rate full-allotment regime in October 2008:
    - An additional 5% haircut on debt instruments issued by credit institutions traded on specific nonregulated markets;
    - An additional 10%–15% haircut on subordinated debt instruments guaranteed by financially sound guarantors; and
    - An additional 5% haircut on marketable securities rated lower than A- but at least BBB-, except for asset-backed securities (ECB 2008b; Runkel 2022a).

[26] For the Norway program, covered bonds backed by Norwegian residential and commercial mortgage loans could be denominated in Swedish kronor, Danish kroner, euros, US dollars, British pounds, or Swiss francs (Norges Bank 2009a).

- The US TAF required an overcollateralization cushion for its longer-term loans. This cushion was initially equal to 100% of the value of collateral after haircuts were applied, effectively doubling the amount of collateral borrowers needed. In July 2008, the Fed reduced the size of the collateral cushion to 33% but mandated that banks keep the cushion on deposit for the duration of the loan after discovering that many participants withdrew the cushion immediately after receiving TAF loans (FOMC 2008a; Fed 2008a).

Fairness and Uniform Application

One of the benefits of using a published schedule of collateral and haircuts is that it creates a sense of fairness and equity if uniformly applied. This has become a standard operating practice of many modern central banks, as noted earlier and as indicated in Figure 9. However, where the criteria are not clear or uniformly applied, the integrity of the facility and/or the LOLR can be impaired. Such was the case of the US RFC, established during the Great Depression to provide liquidity to banks that were not eligible to borrow from the Fed. The RFC home office prescribed stringent collateral policies and haircuts. However, the valuation of collateral was done at regional field offices, which led to subjective and varied results. The unaccommodating collateral practice undermined the effectiveness of the liquidity intervention and corresponded with increased rates of failures amongst borrowers before requirements were relaxed (Leonard 2022d).

12. Loan Duration: What were the maturities of the BBEL loans? Were maturities extended?

A frequent effect of a liquidity constraint is that maturities will shorten. For that reason, a common strategy that LOLRs employ is to provide funding for longer maturities. In some instances, this may be done by retaining a short loan term and rolling over the loan. This was a practice the central bank followed in Russia LO. Several market participants criticized the CBR's unconventional use of the overnight facility in the post-default period (Rao 1998).

A more frequent practice is for central banks to add specific maturities to their loan programs, whether offered as direct loans or auctions. In the case of direct loans, a program may offer one term or more than one term, which the participant may select. During the GFC, the HKMA enhanced its discount window by permitting banks to request loans with one- and three-month maturities, in addition to overnight (HKMA 2008b). Figure 10 shows the range of maturities offered under our cases.

In the case of auctions, loans of specific terms are delineated so participants can bid on the maturities they desire. For example, the ECB TROs auctioned loans with terms of one, three, six, and 12 months (Runkel 2022b).

Another interesting case is the US TAF, which initially auctioned only 28-day loans. This term brought the maturity of the new facility close to the maximum term on discount window loans, the facility for which it was designed to substitute (FOMC 2007a). In July 2008, the Fed began also offering extended term loans of 84 days (DW loans had been extended in March) (Fed 2008a; Fed 2008b; FOMC 2008a). FOMC officials expressed concerns about the

increased credit risk that the longer maturities posed to the reserve banks. For that reason, the program required overcollateralization of the loans, to be maintained throughout the term of the loans (Armantier, Krieger, and McAndrews 2008).

Risk is a common concern with respect to longer loans. The US RFC initially kept loans to less than six months, although it frequently rolled over loans, despite its legal authority to loan for periods of up to three years. The shorter terms enabled the RFC to have greater control over borrowers, a factor that bothered some banks (Mason 2001b). The Bank of England addressed risk a different way in its UK DWF program, which initially offered 30-day loans. It later introduced 364-day loans, with an additional fee of 25 bps (BoE 2009).

Throughout our cases, LOLRs show a commitment to be flexible about the maturities of loans offered and to make changes as market conditions evolve. LOLRs offered extended terms in other ways:

- The Norway Covered Bond program offered four maturity options between three months and three years, and later expanded the maximum term to five years. Norges Bank announced the size of the amount at each auction but reserved the right to distribute the total auction amount across the different swap periods within each auction, following an assessment of all the bids received (Norges Bank 2008; 2009b).

- With one exception, the NYCH issued its CLCs without a maturity date; the certificates were redeemable at the borrower's discretion. Arguably, as market interest rates returned to normal, the CLC rate would become unattractive, prompting redemptions (Fulmer 2022k).

In connection with the century date event, the Y2K SLF optioned repos that could be exercised for overnight, two-, three-, four-, or five-day loans during certain periods (FRBNY 1999).

Figure 10: Maturities

Short-form case name	Maturities
Canada CT Repo	One month
Canada Term PRA-PS	Two weeks (first iteration); one to three months (second)
Canada TLF	One month
Canada Term PRA	Two weeks and one month (first iterations); one month (second); one and three months (third iteration); later added six and 12 months
ECB FTOs	No fixed maturity: in practice, all were overnight except one six-day maturity
ECB TROs	One, three, six, and 12 months
Greece ELA	Undisclosed: varied according to borrower's needs, generally short term
Hong Kong 1965	Undisclosed: varied according to borrower's needs
Hong Kong 2008	Overnight, one and three months (DW); up to one month; later revised to three months (discretionary term lending)
Hungary Liquidity	Maximum of three years; one-third of each loan eligible to receive a four-year maturity
Norway Covered Bond	Four maturity options between three months and three years; later expanded to a maximum of five years
Russia OBR	One month and three months
Russia LO	Maximum of one month, shortened to seven days or less; CBR often rolled over outstanding loans beyond maturities
Thailand FIDF	Undisclosed: funding structure tied to seven-day repos
UK BoE 1825	Maximum of 65 days; later allowed bills in excess of 95 days for discount
UK BoE 1866	Uncertain: typically bills of 65-day maturities
UK DWF	Maximum of 30 days; later added 364 days
UK ELTR	Three months
UK ECTR/CTRF	Six months (first activation); three months (second); later adding one month
UK ILTR	Three months and six months; later only six months
US Aldrich-Vreeland	None; issued without an expiration date
US FHLB 1932–1941	Short-term (a few days to a year) or long-term (one year to 10 years)
US FHLB GFC	One day to 30 years
US NYCH 1893	None; redeemable at the borrower's discretion
US NYCH 1914	None; redeemable at the borrower's discretion
US NYCH 1873	First issuance, two months; subsequent issuances, none; redeemable at borrower's discretion
US NYCH 1884	None; redeemable at the borrower's discretion
US NYCH 1890	None; redeemable at the borrower's discretion
US NYCH 1907	None; redeemable at the borrower's discretion
US RFC 1932–1933	Despite authorization to make loans of up to three years, the RFC initially restricted loans to less than six months, although it frequently rolled over loans
US TAF	28-days; later added 84-day loans
US Y2K SLF	Until program expired: up to four months
US Y2K SFF	Overnight, two-, three-, four-, five-day

Source: Authors' analysis.

13. Other Conditions: Did BBEL programs impose other conditions on borrowers?

Most of the cases in the BBEL case series did not contain significant other conditions attached to lending. BBEL programs need to be rapidly implemented and broad-based. They are typically conducted by central banks outside political influence.

Although many BBEL programs involved the transfer of cash liquidity to counterparties, the Discount Window Facility in the UK involved a securities swap. In return for eligible collateral, the Bank of England provided counterparties with gilts, a type of government security. One of the conditions attached to this lending was that counterparties could not simply turn around and use these gilts at other Bank of England facilities to gain access to cash liquidity (Fulmer 2022e). This additional condition related to concerns about monetary policy transmission. See Key Design Decision No. 14, Impact on Monetary Policy Transmission.

14. Impact on Monetary Policy Transmission: Did the BBEL programs affect monetary policy transmission, and did the central bank respond with sterilization measures?

In the majority of the BBEL programs studied in this series, central banks did not publicly detail the potential effects of the lending facilities on monetary policy. In general, BBEL programs are small relative to the scale of monetary policy operations. Furthermore, emergency-lending policies are conceptually distinct from monetary policy: in the former, the government is typically exchanging reserves for risky collateral (altering the total supply of safe assets); while in the latter, the government is typically exchanging reserves for safe government collateral (leaving the total safe-asset supply unchanged). This is why private LOLRs are at a disadvantage to government LOLRs, because they cannot unilaterally expand the money supply. Nevertheless, enough overlap exists between emergency lending and monetary policy to cause some concerns, especially if the BBEL programs are large.

The Bank of England noted that ELTR operations injected "extra liquidity" into the banking sector, which impacted the central bank's ability to determine monetary policy. To reduce its excess reserves, the BoE created a one-week Bank of England bill, remunerated at the Bank Rate (Fisher 2009). At its peak, the Bank sold GBP 100 billion in one week during January 2009 to drain excess reserves from the banking system and regain control of monetary policy (Cross, Fisher, and Weeken 2010).

Instead of sterilizing the Term PRA's effect on monetary policy, the Bank of Canada decided in April 2009 to shift the facility to also conduct monetary policy. It did so by setting the minimum and maximum bid rates to the target rate and the Bank Rate, respectively. Bank of Canada researchers specifically refer to this change occurring at the "effective lower bound," demonstrating the possible need for combining liquidity provision for financial stability and monetary policy when rates approach zero (Zorn, Wilkins, and Engert 2009, 9).

The European Central Bank followed a "separation principle" for many years, in which monetary policy and liquidity management were pursued separately, with different tools. The ECB maintained this stance through the early stage of the GFC. However, the ECB

abandoned the separation principle later in the GFC, as interest rates approached the zero lower bound. A counterfactual exercise in 2019 by the ECB showed that the separation principle weakened the effect of the ECB's supplementary longer-term refinancing operations (SLTROs). The exercise shows that liquidity management and monetary policy may have complementary, positive effects on each other when combined in the same tool (ECB 2019).

15. Other Options: Did the LOLR consider other options before implementing the BBEL program?

For many of the BBEL programs covered in this series, we find no public indication that the LOLR considered other options instead of the implemented facility. However, we do know that the Fed FOMC considered other options that might make the discount window more attractive to address the strain in bank funding markets before adopting the TAF in December 2007:

> These options might include (1) a temporary reduction in the spread between the primary credit rate and the target federal funds rate; (2) the adoption of a term credit program, under which term credit could be extended, potentially at a lower rate than the primary credit rate, at a borrower's initiative; and (3) the adoption of a term auction facility (TAF) at which term discount window funds would be auctioned at the System's initiative. (FOMC 2007b, 5)

Ultimately, the FOMC decided to adopt the TAF because it presented several advantages, even though the auction format did not guarantee that any firm would win funds in an operation:

> The TAF has several advantages relative to the other two options. First, it would allow the Federal Reserve to retain close control over the supply of reserves because we would determine the auction amounts—at least assuming that the minimum bid rate is not binding. Second, the facility arguably has a better chance of avoiding stigma . . . Third, each auction would reveal information about the strength of the demand for funds. Finally, a TAF could also have potential longer-run benefits for managing reserves and conducting monetary policy both in routine circumstances and in circumstances of financial stress. (FOMC 2007b, 6-7)

These similar options would be available to other central banks as possible options. (Also see Key Design Decision No. 3, Part of a Package, for a discussion of actions undertaken by the LOLRs contemporaneously with the BBEL programs.)

16. Similar Programs in Other Countries or Jurisdictions: Did multiple jurisdictions introduce similar BBEL programs at the same time?

Earlier BBEL cases focus on unique programs that did not involve international coordination, in part because financial systems were much less interconnected in prior centuries. However, in every case except 1884 (when the crisis and bank failures were largely confined

to New York City) (Hoffner 2022e), several clearinghouse associations in cities other than New York also issued CLCs (Bagehot 1873, 88).

Recent financial crises, such as the GFC, have highlighted the significant changes in the world's financial systems and how interconnected they have become. As a result, central bank responses, including BBEL programs, have been more coordinated than they had been in previous times. In the late 1990s, significant shared consultative efforts were undertaken in preparation for the century end date (Y2K) event, with several international groups of central banks meeting to share ideas (Leonard 2022e; Leonard 2022f). Governments and central banks also pushed out a large number of similar support programs across much of the globe in early 2020 in response to the impacts of the COVID-19 pandemic lockdowns (YPFS n.d.1).

In the GFC, however, we have recently witnessed the most extensive cooperation among central banks. Several major central banks announced programs at the same time during the GFC to address pressures in short-term funding markets, project confidence, and settle market stress. For example, on December 6, 2007, the following actions were announced in unison, with each central bank linking to the others' press releases:

- The Bank of Canada announced the temporarily expansion of the list of securities eligible for Term PRA transactions (BoC 2007);

- The Federal Reserve announced the creation of the TAF, which would auction term funds to depository institutions against the wide variety of collateral that could be used to secure loans at the discount window, and the creation of swap lines with the European Central Bank (up to USD 20 billion) and the Swiss National Bank, or SNB (up to USD 4 billion) (Fed 2007);

- The ECB announced two USD liquidity-providing operations, in connection with the US TAF, against ECB-eligible collateral for maturities of 28 and 35 days (Sveriges Riksbank 2007);

- The Swiss National Bank announced that it had entered into a currency swap agreement with the Fed and would offer a USD repo transaction of up to USD 4 billion against SNB-eligible collateral, in the form of a variable-rate tender auction that would provide funds for 28 days. The action was intended to facilitate the US dollar funding of SNB counterparties in the Swiss repo system (SNB 2007);

- The Bank of England increased the total amount of funding offered in upcoming long-term repo OMOs from GBP 2.85 billion to GBP 11.35 billion and widened the range of acceptable collateral (BoE 2007); and

- While not announcing new programs, the Bank of Japan and the Sveriges Riksbank (Sweden) also issued press releases endorsing the actions of the other banks and indicating that that they were closely monitoring the situation vis-à-vis their domestic banks and would be ready to provide liquidity if appropriate (Sveriges Riksbank 2007; Bank of Japan 2007).

The coordinated actions of seven major central banks evidenced a recognition by the banks of the interconnectedness of the financial systems and the need for a coordinated response and demonstrated the willingness of central banks to work together to address the burgeoning crisis. Although each central bank developed its respective actions, the ECB and SNB established their measures in cooperation with entering into US dollar swaps with the Fed—in a "package deal"—which allowed the ECB and SNB to provide US dollar lending downstream to their domestic banks (FOMC 2007b, 17). For a time, the ECB and SNB auctions were coordinated with the TAF auctions (Runkel 2022f). In September, the Fed also entered into swaps with the other four banks from the December 2007 announcements, and ultimately, the Fed was party to 14 swap agreements (Wiggins and Metrick 2020). In October, six major banks took the highly unusual step of jointly announcing a reduction in their policy rates by 50 bps (Kahn and Meade 2016).

As the crisis persisted into the chronic phase, the various central banks undertook differing strategies, rolling out a plethora of programs to address the various effects their systems were experiencing, notably in Europe, the sovereign debt crisis. In spite of this divergence, we find evidence that the major central banks continued to share information and meet with one another through mediums such as the BIS Basel Committee and Group of 20 conferences, and that overall, these efforts have been considered very successful (James 2013; Kahn and Meade 2016; Van Der Weide 2020).

17. Communication: How did the LOLR communicate its program? What does this tell us about its objectives for the program? Do the communications evidence a commitment to transparency?

In general, when introducing a BBEL program, a central bank is usually rather circumspect in characterizing the reasons behind the program or the precipitating circumstances; we highlight in Figure 11 those circumstances where communications were notable for one reason or another. Announcement of a BBEL program usually included a reference to the general problem the BBEL program was designed to address. The most common, cited by 31 of 33 cases, was that general liquidity stresses were occurring in the funding markets, constraining lending among the financial institutions and onward lending to the real economy. (See discussion at Key Design Decision No. 1, Purpose, and Figure 2.) Other reasons cited with some frequency were to relieve stress related to a particular collateral class or to respond to, or prevent, bank runs. However, particularly because BBEL programs are activated at the beginning of panics and are intended to calm them before they develop into full-blown crises, the concern about saying too much, and the constraining style of communication, seems appropriate. At the early stages of a panic, known facts are often limited and fast changing, and the risk of sparking additional panic is considerable.

Even given these concerns, communications should be clear and consistent and convey a sense of confidence from the LOLR, to promote confidence in the LOLR and in its ability to make good on its promises. When there is high confidence in a LOLR's credibility and capabilities, the announcement of a BBEL program itself can have a powerful signaling effect and calm a run, even if the program is not utilized. For example, Canada's Term Loan Facility and private-sector Term PRAs saw little usage, unlike the earlier Term PRA, but BoC officials believed the announcement and availability of the two programs "helped to mitigate uncertainty among market participants about the availability of liquidity" (Longworth 2010, 6). In 1866, the announcement that the government would allow the Bank of England to issue notes beyond the statutory limit, if necessary, immediately calmed bank runs, and the BoE did not have to follow through with the measure (Fulmer 2022d). However, see Key Design Decision No. 8, Program Size, for further discussion.

Figure 11: Notable Communications

Short-form case name	Notable communications
Canada CT Repo	N/A
Canada Term PRA-PS	Required publishing of Subparagraph 18(g)(1) notice of "extraordinary transactions"
Canada TLF	N/A
Canada Term PRA	Required publishing of Subparagraph 18(g)(1) notice of "extraordinary transactions"
ECB FTOs	N/A
ECB TROs	N/A
Greece ELA	The BoG and ECB slowly abandoned constructive ambiguity and became more transparent
Hong Kong 1965	The announcement that HSBC (the private LOLR) agreed to extend an emergency loan to a failing Chinese bank temporarily halted a deposit run. However, runs on the bank resumed after HSBC stated that its emergency lending would not be unlimited. Even though HSBC again renewed its pledge of unlimited support, inconsistent communication undermined the effectiveness of the LOLR efforts and government emergency protocols were required to calm the runs.
Hong Kong 2008	N/A
Hungary Liquidity	Announced with amendment of the Act on Public Finances, which adopted the authority for the program. Delayed communication to EU regarding State Aid review
Norway Covered Bond	Norges Bank published three circulars defining the swap program, as well as the auction schedules
Russia OBR	The CBR did not publicize a lot of the lending details and specifics. Did not allow the public to understand who was eligible for the lending, which led to speculation of political favoritism
Russia LO	Same as OBR
Thailand FIDF	The FIDF did not disclose the existence of the program or support until after 50+ finance companies were suspended
UK BoE 1825	N/A
UK BoE 1866	N/A
UK DWF	The Bank of England first announced the DWF in a consultative paper and officially established it with a market notice on October 20, 2008
UK ELTR	The Bank of England first announced the ELTRs on December 12, 2007, but did not initially refer to them as an established program.
UK ECTR/CTRF	The BoE announced the program in December 2011, and it was activated six months later with an announcement stating that it was "designed to respond to actual or prospective market-wide stress of an exceptional nature" (BoE 2012)
UK ILTR	The Bank of England released market notices announcing the auction schedule and changes to the program and communicated directly with counterparties to educate them on the innovative auction design
US Aldrich-Vreeland	The Treasury secretary conducted active communication to project confidence, since this was the first usage of the emergency currency
US FHLB 1932–1941	N/A
US FHLB GFC	The significant uptick in borrowing during 2007–2008 was not announced or publicly reported by the FHLBanks but was disclosed in regular reports filed with the Securities and Exchange Commission (because of debt raising) and in public annual reports filed by the FHLBanks Office of Finance.
US NYCH 1893	The NYCH reported on the program in the financial press. On October 31, 1893, the Loan Committee submitted an internal report to the association including "full and complete statistics of the transactions with each bank" (Sprague 1910, 412)
US NYCH 1914	The NYCH reported on the program in the financial press
US NYCH 1873	The NYCH publicized its decision to issue CLCs in the local financial newspapers and held a public meeting to discuss the plan
US NYCH 1884	The NYCH reported on CLC operations via articles in the *New York Times* and financial market magazines
US NYCH 1890	The NYCH publicized some CLC borrowers' identities in the financial press
US NYCH 1907	The NYCH does not appear to have made a concerted communications effort with respect to the issuance of the CLCs
US RFC 1932–1933	President Hoover stated that the purpose of the RFC was to increase broad employment, rather than to aid "big industries or big banks" (Leonard 2022d). The program was targeted to small banks and employers, which were not eligible to borrow from the Federal Reserve

US TAF	Fed communication increased after the FOMC decision to establish the TAF. In the early stages, communications and lending activity were coordinated with other major central banks, which were also providing liquidity in domestic currency as well as USD liquidity (through currency swaps)
US Y2K SLF	For primary dealers—part of a multiyear plan to avoid issues at the century date change. The program was announced in July 1999, prior to the SFF
US Y2K SFF	For banks—part of a multiyear plan to avoid issues at the century date change. The program was announced in August 1999

Source: Authors' analysis.

Successful communications are clear about the goals of the program, send consistent messages, and portray the authorities as competent and decisive. Where this has not occurred, for instance, where the communications have been confusing or uncertain, results have been negative. For example, in Hong Kong in 1965, HBSC, a private bank operating as LOLR at the behest of the government, announced that it would make an emergency temporary loan to a local Chinese bank that was suffering a run. The announcement halted the run. But the runs on the Chinese bank resumed after HSBC issued a clarifying statement that its emergency lending would not be unlimited. Following the controversy, HBSC and the other private LOLR bank (Chartered Bank) issued clear statements ensuring the availability of unlimited liquidity; however, runs on Chinese banks continued (Hoffner 2022a). The inconsistent communications undermined the effectiveness of the LOLR efforts, and government emergency protocols were required to calm the runs (Hoffner 2022a).

The few instances among our cases with significant communications announcing BBEL programs tended to be for novel programs, rather than merely a new iteration of an existing program. One example is the UK ILTR program, which encompassed an innovative auction methodology, launched as part of its revamp of liquidity programs following the GFC. In this circumstance, extra effort was undertaken by the BoE to facilitate greater understanding and acceptance of the program, which involved participants possibly submitting multiple bids against one or more of three collateral sets determined by quality and paying different rates for loans against each (BoE 2014). Bank staff also published a white paper on the program's first-year experience (Fisher, Frost, and Weeken 2011).

Ideally, high standards of communication should be maintained throughout the life of the program and across any amendments and extensions. BBEL programs are often initiated at the beginning of panics and amidst changing circumstances, so they are often modified and amended as circumstances change or to make the program more accessible. Such communication should be well thought out to avoid announcement clutter and minimize confusion. One way of doing this is for the LOLR to announce a range of modifications, or to preposition possible additional changes. For example, when broadening maturities, the LOLR could state that it may also add additional maturities as circumstances warrant. Then, if needed, the additional maturity can be offered through an administrative decision without the need for additional amendments to the program. This also gives the LOLR the ability to act in a prospective manner based on changing information and to not always be in reactive mode.

A Note about Constructive Ambiguity

A second option for a LOLR to consider is to define and publish a liquidity framework before it is needed. A theory among central bankers is that one way to address moral hazard is "constructive ambiguity" about the availability of emergency liquidity, the argument being that if the circumstances under which the central bank will provide liquidity are unclear, banks are unable to game around or rely on such support (Winters 2012). Constructive ambiguity is intended to also preserve the central bank's discretion to provide or withhold such support and on what terms (Lee 2016).

> In practice, central banks (and public authorities responsible for financial crisis management) were reluctant to set out their approaches to ELA because of concerns about serious moral hazard and adverse effects on market functioning. By end-2006, about half of the central banks of the G10 advanced economies had publicly released statements on their ELA policies. Generally, these statements set out broad guidelines or principles for ELA. Many central banks, particularly in the euro area, were deliberately vague about their ELA policies, emphasizing the importance of constructive ambiguity. (Domanski, Moessner, and Nelson 2014. 5)

However, the argument for this view seems to have waned in light of the experiences of many central banks during the GFC, with respect to banks at least. In the UK, ambiguity surrounding the circumstances and terms of emergency liquidity does not appear to have been effective in limiting moral hazard pre-crisis and led to excessive swings in market expectations about the BoE's willingness to lend (Hauser 2014). Post-crisis, the BoE, following recommendations from several official reviewers, "concluded that the LOLR regime should be richly specified, and embedded in a largely public framework" (Hauser 2014, 81). Officially, the BoE rejected constructive ambiguity: "The Bank will ensure that the Sterling Monetary Framework remains one of most transparent regimes globally" (BoE 2013, 9).

Tucker (2014) has also promoted this practice to increase certainty and address issues of time consistency that arise when the LOLR has to make decisions regarding the provision of liquidity as the crisis is developing. Hauser advocates for the same: "Published facilities send a clear signal to the markets, government and the public of what the bank will and will not do, channeling expectations and allowing banks to plan accordingly. Clearly, for this to be effective the commitments in the framework need to be credible" (Hauser 2014, 87). See the discussion of the UK ECTR at Key Design Decision No. 2, Legal Authority, on "Applications of Preexisting Emergency Authorities" for an example of an emergency facility adopted by the BoE as a contingency and activated six months later.

The central bank can avoid the negative signaling effect of activating a facility by having liquidity insurance facilities permanently available and setting out ex ante the terms under which the central bank would expect to lend. And greater knowledge of the terms of central bank liquidity insurance allows banks to factor this into their planning and take out what they see as an appropriate level of self-insurance, consistent with having the central bank insurance available to help manage the extreme "tail" risks that might arise.

A Note about Timing

As discussed, poor communications create a lack of credibility around the LOLR and its BBEL programs. This includes situations where a long delay persists between the announcement and implementation of a program. This timing can erode market confidence in the availability of the liquidity support and raise questions of bias. Thus, one important decision made at the management level is consideration of when to announce the program. In the best scenarios, the announcement of a liquidity program can have a positive "announcement effect," which itself serves to calm the panic, even before there is much use of the program. As noted above, this positive effect occurred with respect to Canadian programs during the GFC (Sankar 2022c). And in the UK in 1866, the announcement from the government that it had suspended the Bank Charter Act and would permit the BoE to issue notes above the legal limit (requiring that they be backed by gold) had a calming effect (Fulmer 2022d).

A similar result occurred with respect to the Fed's two liquidity programs introduced before the Y2K century date change event, the Y2K SLF and, in particular, the US Y2K SFF. See Leonard (2022e) and Leonard (2022f), respectively. In the August 24, 1999, FOMC meeting, committee members anticipated that "the greatest impact [the SFF] could have is the announcement effect . . . it would be a measure of success of the program if very few of these options were exercised" (FOMC 1999). In fact, none of the USD 490 billion of options were exercised, indicating that the program primarily functioned by easing anxieties around the century date change.

Credibility is not the only consideration regarding the timing of an announcement. Liquidity constraints ebb and flow. A central bank may decide that a program is necessary but then tensions may relax. Announcing the program after the tension has subsided can be interpreted as a sign that the tensions are expected to return. However, one option that the central bank has is to delay adopting and publicly announcing the program. It can be held in abeyance and deployed later if changed circumstances warrant. This is what occurred with the Fed's TAF, which was originally considered by the Fed Board in September 2007. Conditions improved, and the Fed decided to delay adoption and announcement of the program until December (Wiggins and Metrick 2020).

Central banks are also well advised to complete all the work to set up a program behind the scenes before announcing the initiative because, although the announcement of some programs has a positive lifting effect, this result is not guaranteed. History has shown that not delivering liquidity when expected can cause a negative reaction from the market. For example, in 1866, when the BoE refused assistance to Overend-Gurney, the largest discount house in London, Overend-Gurney suspended payments to its creditors, a major run ensued among London's banks, and use of the BoE's discount window surged[27] (Fulmer 2022d). The panic only subsided once the BoE swiftly changed course and began to lend freely.

[27] Although a run was ignited, there is also some evidence that some industry leaders agreed with the BoE's decision not to lend to Overend-Gurney because they thought it was insolvent. This decision has also been analogized to the Fed's decision in 2008 not to lend to Lehman Brothers. (For further discussion of the role of solvency in BBEL programs, see Key Design Decision No. 6, Eligible Participants, Solvency and Viability Tests).

When confusion ensues, counterparties may pull back from lending and conserve cash, in essence, self-protecting. This activity may also be accompanied by a rush to the LOLR for liquidity. To avoid such negative reactions, announcements should be clear and detailed and should be made in close proximity to the operational availability of the program. This timing will also facilitate the greatest impact from the BBEL program, which is especially desirable since they are first responses with the ability to quell the liquidity constraint.

18. Disclosure: Did the program release data at the transaction level or only on an aggregate basis? Did the program release data on a delayed basis?

Disclosure policy requires balancing two important concerns: (i) providing information to the taxpayers and the public about the use of government funds, and (ii) protecting borrowers from possible negative stigma reactions. In this section, we discuss the ways LOLRs in our cases provided information to the public. We address the latter concern in Key Design Decision No. 19, Stigma Strategy.

As shown in Figure 12, with few exceptions, the LOLRs in our cases did *not* report data regarding individualized lending on either a contemporaneous or delayed basis. We identified three levels of disclosure in our cases: (i) only aggregate data disclosed (27 of 33 cases), (ii) borrowers identified but not amounts borrowed (six of 33 cases), and (iii) borrowers identified with the amounts borrowed (five of 33 cases). The overwhelming majority (27 of 33 cases) chose to report information on a delayed basis, whether in aggregate or more detail. This could be due to reporting occurring in periodic (weekly, monthly, etc.) reports.

Figure 12: Disclosure

Disclosure	**Type of disclosure**				
Short-form case name	**Blind auction results announced [a]**	**Delayed disclosure**	**Utilization reported in the aggregate [b]**	**Borrowers identified [c]**	**Amounts identified to borrower [d]**
Canada CT Repo	X		X		
Canada Term PRA-PS			X		
Canada TLF			X		
Canada Term PRA			X		
ECB FTOs			X		
ECB TROs	X		X		
Greece ELA			X		
Hong Kong 1965				X	
Hong Kong 2008			X		
Hungary Liquidity		X		X	X
Norway Covered Bond	X		X		
Russia OBR			X		
Russia LO [e]			X		
Thailand FIDF		X	X		
UK BoE 1825			X		
UK BoE 1866			X		
UK DWF		X	X		
UK ELTR	X		X		
UK ECTR/CTRF	X		X		
UK ILTR	X		X		

US Aldrich-Vreeland			X		
US FHLB 1932–1941		X	X		
US FHLB GFC [f]			X		
US NYCH 1893		X		X	X
US NYCH 1914		X	X		
US NYCH 1873		X			
US NYCH 1884		X	X		
US NYCH 1890		X		X	X
US NYCH 1907		X	X		
US RFC 1932–1933 [g]		X	X	X	X
US TAF [h]	X	X		X	X
US Y2K SLF [i]	X		X		
US Y2K SFF	X		X		
Totals	**9**	**12**	**27**	**6**	**5**

(a) Details of auction results such as amounts bid, stop-out rate, and number of bidders are announced in close proximity to the completion of the operation, but borrowers are not identified.
(b) Utilization of program is reported in aggregate, but borrowers are not identified.
(c) Individual borrowers are identified, but the amounts borrowed are not disclosed.
(d) In some instances, borrowers are named along with the amounts they borrowed.
(e) This case covers several lending facilities, which had differing disclosure policies. The Lombard facility had the most public disclosure of the facilities, while post-default interventions lacked public disclosure and communication.
(f) The agency reported aggregate lending data by region monthly. However, because of its need to raise additional funds, it filed securities offerings with the Securities and Exchange Commission (SEC), which required more detailed disclosure regarding the agency's lending, including identifying some borrowers by name and amount.
(g) Under the original RFC Act, the RFC was to publish aggregated loans by borrower class. Mid-1932 legislation required the RFC to report names of borrowers and amount and rate of interest monthly. After disclosure, stigma likely offset the effectiveness of RFC lending.
(h) The Fed publicized the auction parameters and disclosed auction results but did not disclose identifiable, loan-level data until after the TAF expired and it was required to do so in response to a Freedom of Information Act (FOIA) request (Runkel 2022f).
(i) Borrowing at the SLF was published through the Fed's weekly H.4.1 releases.

Source: Authors' analysis.

Disclosure is often made through periodic reporting mandated by regulation. Most LOLRs include some discussion of usage in their reports. But such disclosure almost always is in an aggregate form that does not identify individual borrowers. In some cases, the discussion combines information from different programs. This type of disclosure may be designed to remove any fear of exposure and stigma for the participants. Of note, although the EU's regulatory structure supports transparency and disclosure of harmonized information regarding banks' encumbered and unencumbered assets, the European Banking Authority was careful "to ensure that the level and evolution of assets encumbered to central banks and the amount of liquidity assistance given by central banks cannot be detected" from such disclosures (EBA 2014, 3).

The one area where disclosure does occur on a contemporaneous basis is for a program that employs an auction. The LOLR usually releases the results of auctions soon after the operation ends, providing information about volume, number of bidders, number of successful bidders, prices, and overage. These results provide valuable information to the auction process but do not identify individual participants. For example, the UK ILTR, ELTR and ECTR programs announced results on the day the auctions occurred (Fulmer 2022h). Similarly, for the US Y2K SFF program, the FRBNY published the volume of bids, the range of

prices submitted, and the lowest accepted bid for each auction operation; it did not publish the names of borrowers (Leonard 2022f).

One interesting situation we observe among our cases is the disclosure of lending information by the FHLB System during the early stages of the GFC, when it experienced a dramatic uptick in lending. The agency was required to disclose aggregate lending data by region on a monthly basis, which it did. However, because of its need to raise additional funds, it also had to file securities offerings with the Securities and Exchange Commission (SEC). These SEC reports required more detailed disclosure regarding the agency's lending and were a source for more current and detailed information about its developments, including the identification of certain borrowers (Leonard 2022b).

Given the original reasons stated at the beginning of this section, most LOLRs do make some type of disclosure. When no disclosure is made, or when disclosure is very limited, there is a risk that the credibility of the LOLR will be impugned, especially when there are concerns about political influences. This dynamic can be observed in Thailand with respect to its "secret" funding of financial institutions and in Russia and Hungary, where the rules concerning how government lending was distributed and the results were perceived as opaque (Hoffner 2022d; Mott and Buchholtz 2022; Runkel 2022d).

19. Stigma Strategy: How did the LOLR address stigma problems—through auctions, or through other methods?

Stigma is a primary concern for program design. Blind following of Bagehot's dictum to use a "very high rate" can lead to stigmatized programs that are unable to serve their main purpose. This is an old problem: Owen and Robinson (2003) and Gorton and Metrick (2013) discuss how discount window stigma prevented the Federal Reserve from responding to the runs of the Great Depression.

Discount window stigma has persisted through time and challenged the Fed during the early stages of the GFC. Fed Chairman Ben Bernanke described the situation in August 2007: "Banks were reluctant to rely on discount window credit to address their funding needs. The banks' concern was that their recourse to the discount window, if it became known, might lead market participants to infer weakness—the so-called stigma problem" (Armantier and Holt 2020, 5361).

Program design should aim to minimize stigma. Techniques we observe in our cases include:

- Providing for a large number of participants,
- Using auctions to set pricing,
- Allocating or limiting funds, and
- Delaying settlement.

The Fed's TAF utilized some of these features to provide discount window funding to banks without stigmatizing borrowers; overcoming stigma was the driving motivation of the program (FOMC 2007a). TAF mitigated stigma by increasing the number of borrowers and tweaking features of the discount window that facilitated adverse selection—chiefly, immediate availability of funding. Most importantly, TAF priced loans through auction, setting a minimum bid that was below the market rate for interbank loans (LIBOR) (Runkel 2022f). This feature countered the view that participating banks were distressed, since "banks would not necessarily signal an abnormally high demand by bidding" (Armantier, Krieger, and McAndrews 2008, 6). Moreover, distressed banks couldn't rely on the TAF since some bidders did not win funds. And because no bidder could borrow more than 10% of the allotment (because the Fed wanted to be sure the liquidity was not monopolized by a few big borrowers), the facility could hardly be viewed as a lifeline for banks in dire straits. Additionally, loans settled three days after the auction, inconsistent with the needs of a failing institution (Mishkin 2008).

The TAF was immediately successful in terms of amounts borrowed, and Armantier and Holt (2020) argue that its destigmatizing effect is evidenced by the fact that absent discount window stigma, no borrower should have bid above the DW rate, yet more than half the TAF participants did just that. Banks were willing to pay a premium (in excess of 44 bps, on average) to borrow from the TAF instead of the DW (Armantier et al. 2015).

Several cases also demonstrate the chilling effect of stigma after disclosure. Where identities of banks that borrowed are disclosed, there is almost always a pullback from those banks and from the facility. When a borrower is identified, the public repercussions can be negative, with counterparties pulling back and depositors running. This occurred in the Panic of 1890 when the NYCH published the names of CLC borrowers along with the amounts they borrowed and balance sheet information. Within a short time after the disclosure, one of the banks identified failed (Hoffner 2022f).

Another example is the newly created Reconstruction Finance Corporation during the Great Depression. The legislation that established the RFC required it to publish quarterly reports in the Federal Reserve bulletin providing aggregate information about loans to each class of borrower, including number of borrowers by state (Fed 1932). However, in 1932, concerns about corruption in lending prompted Congress to pass legislation requiring the RFC to report monthly on "its activities and expenditures . . . with a statement showing the names of the borrowers to whom loans and advances were made, and the amount and rate of interest involved in each case" (US Congress 1932a, 8). Even though the intent was to only circulate the reports to the Senate and not publish them to the public, the Clerk of the House of Representatives interpreted the law to require the public reading of borrowers, which he did on the floor of the House. This action created a clean, natural experiment, as the timing of loans resulted in some borrowers remaining secret while others were revealed. Anbil (2017) analyzes the outcome of this experiment, finding that "revealed banks" lost deposits faster and were more likely to be closed than "non-revealed" banks, and concluding that ". . . these results imply that keeping LOLR loans secret will lead to higher deposit funding at banks that borrow from their LOLR" (Anbil 2017, 5).

This theory seems to have been proven as recently as the GFC. Governor Mervyn King of the Bank of England observed: "[Banks] deliberately did not ask for the liquidity they needed for fear of damaging their reputation—the "stigma problem" (Armantier and Holt 2020, 5631). Some banks did borrow from the discount window, but information regarding a number of these participants (such as Barclays) were leaked, and in the case of Northern Rock, led to a depositor run and its eventual takeover by the government (Armantier et al. 2015; House of Commons 2009). The issue is discussed at length in the House of Commons' report on Northern Rock, but the report does not identify any specific actions taken by the BoE to mitigate stigma; the report does urge the BoE to "place particular emphasis" on the issue in its further reforms (House of Commons 2008, 50).

If the crisis of an individual bank or the system is severe enough, banks will borrow even at the risk of disclosure and stigma. This is what occurred in Greece in 2009. The situation for the Greek financial institutions was severe because of the double impact of the default on Greek sovereign bonds (that comprised an outsized amount of available collateral) and underlying concerns about bank solvency. As a result, most banks could not borrow from ECB liquidity facilities, so borrowing from the ELA, orchestrated by the BoG, was the only available funding. ELA participation was broad, and stigma was not reported as a concern because banks needed ELA regardless of the reputational risks (Runkel 2022c). According to Spiros Pantelias, then head of financial stability at BoG, "[ELA] may have been viewed negatively by market participants but banks had no other alternative at that time" (Pantelias 2021a).

In the Thailand case, borrowers apparently were successfully insulated from stigma by secrecy. The liquidity support the FIDF provided to finance institutions appeared on the BOT's balance sheet only in aggregate and was revealed only after 58 of the institutions were suspended from operations but before their failure (Runkel 2022d). So secret was the FIDF lending that the legislature publicly criticized the BOT about the lack of transparency (Prateepchaikul 1997). However, the decision not to disclose liquidity support prevented market observers from stigmatizing the borrowers.

20. Exit Strategy: How did the LOLR plan for the termination of the program?

LOLRs have several options when deciding on exit strategies:

- Use a pricing mechanism,
- Set an expiration date,
- Wind down by reducing the allotted amount and/or frequency of auctions, and
- Transition to a standing facility.

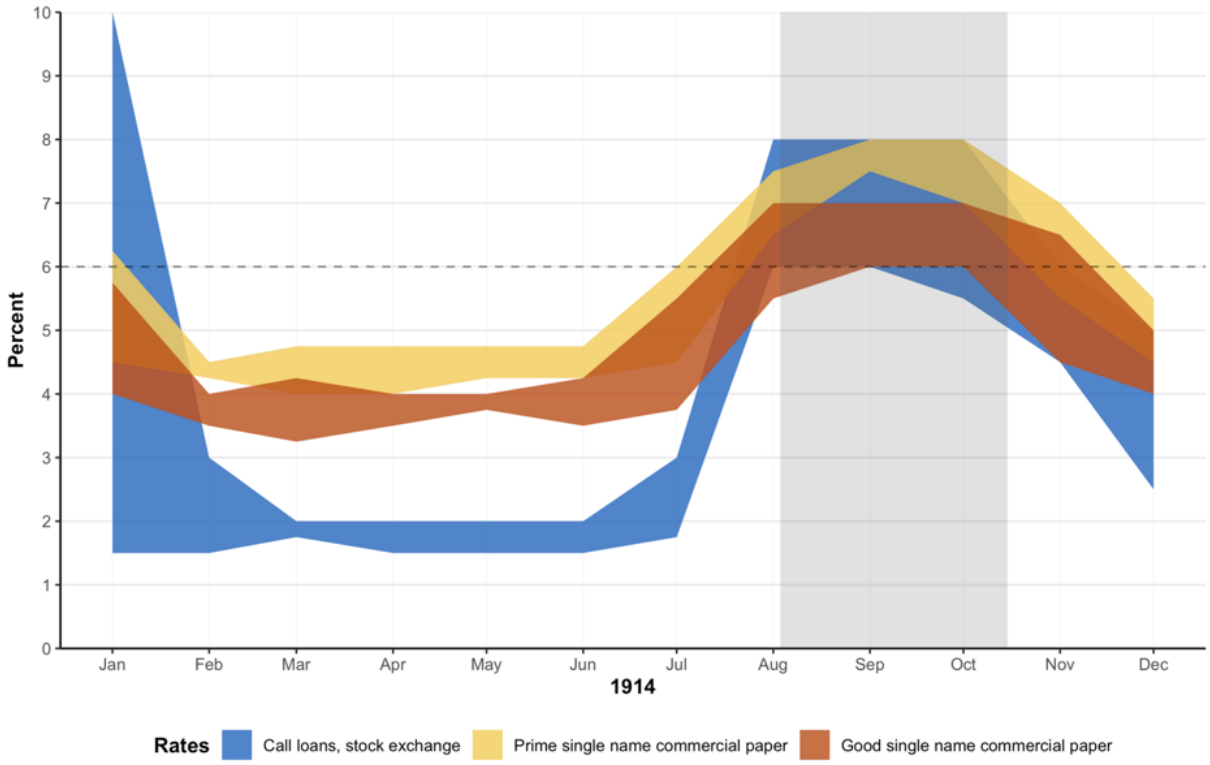
Some programs use more than one of these mechanisms. For example, a program may be announced with an end date to emphasize that it is intended as a temporary measure, but it may also have a pricing mechanism that becomes unattractive once the market stresses are relieved. In general, the first three options provide wide flexibility to resolve the program in

the most appropriate manner. The fourth represents a decision that regardless of whether the program is still being used, having it at the ready for future deployment is valuable. We further consider these choices below.

Using a Pricing Mechanism

One benefit of using pricing as an exit strategy is that it naturally depresses usage of the BBEL program as market prices recover, which then makes the shuttering of a program much simpler. Announcing the closure of a program that is no longer extending liquidity is easier than doing so for one that is still providing liquidity to institutions. Bagehot's basic theory to lend at a premium rate is consistent with this strategy. If the BBEL program is priced at a premium, then, when the market recovers, the price will be unattractive, and borrowers will naturally migrate back to the market funding. This is the theory supporting the NYCH premium pricing of its CLCs (Gorton and Tallman 2016). According to Gorton and Tallman (2016), the interest rate charged essentially matched the rates on commercial paper; however, the haircut applied to CLC collateral made CLCs more costly. As a result, CLCs were an attractive substitute for cash in a crisis, but normalizing market conditions quickly incentivized borrowing banks to retire their CLC holdings (Gorton and Tallman 2016). See Figure 13 for a visualization of CLCs serving as an attractive option during the crisis but quickly becoming costly compared to market rates.

Figure 13: Market Rates in New York City and CLC Interest, 1914



Note: The dotted line at 6% represents the interest rate charged by NYCH for utilizing CLCs. The gray shading in August–October represents the acute phase of the crisis, during which the New York Clearing House Association issued CLCs.

Source: Fulmer 2022j.

Two of the Bank of Canada's BBEL facilities during the GFC used pricing as a natural exit strategy. The Term Loan Facility and the Term PRA facility for private-sector instruments both contained a minimum bid rate that disincentivized usage during normalized conditions, as banks could more easily find liquidity on the market rather than from the central bank (Longworth 2010; Zorn, Wilkins, and Engert 2009). The Norway Covered Bond program also utilized a pricing mechanism as an exit strategy, implementing a premium to participate in the program before closing the facility. Initially the program set a minimum price of Norwegian Interbank Offered Rate (Nibor) minus 20 bps. As market conditions improved, Norges Bank gradually increased the minimum price, and the last auction where bids were submitted was in October 2009. The bank then set the minimum price at Nibor plus 70 bps. The last two auctions in November and December were canceled owing to a lack of participation, and the facility phased out in December (Norges Bank 2010).

Setting an Expiration Date

Another exit strategy is for the LOLR to set an expiration date for the program. Many BBEL programs are announced with an expiration date to emphasize that they are temporary. The

Fed, for example, announced that its Y2K SLF loans would expire on April 7, 2000, six months after it announced the program (Leonard 2022e). Expiration dates can always be extended if the LOLR chooses; and in a prolonged crisis, such as the GFC, these dates often are repeatedly extended.

Winding Down by Reducing the Allotted Amount and/or Frequency of Auctions

Pricing alone does not always work as an exit strategy, and a firm expiration date may not be the best choice. For example, the US TAF, announced on December 12, 2007, committed to four auctions to be held in December and January. The program was called "temporary," and no firm expiration date was published. However, the Fed also stated that it "may conduct additional auctions in subsequent months, depending in part on evolving market conditions" (Fed 2007, 1). The TAF eventually conducted 70 auctions and had a maximum outstanding amount of almost USD 500 billion. Fed staff expected the TAF to "downsize pretty automatically" as participants stopped seeking funds in favor of cheaper alternatives (FOMC 2008c, 218). But usage remained robust until the Fed moved to wind down the program by reducing individual auction sizes and maturities (Runkel 2022f).

> In its September 2009 meeting, Fed staff first proposed a gradual reduction in offering amounts. The Fed decided then to phase out 84-day auctions by shortening the maturities first to 70 days, and then removing credit longer than 28 days altogether. On January 27, 2010, the FOMC announced the wind-down of several GFC programs including the TAF, specifying the final two amounts offered (USD 50 billion and USD 25 billion) and dates (February 8 and March 8) when they also raised the minimum bid rate. (Runkel 2022f).

Other than pricing mechanisms or adopting temporary programs into standing facilities, some BBEL programs did not publicly state a specific exit strategy beyond a simple phaseout of the program. For example, the Bank of Canada did not utilize a pricing mechanism to wind down the Term PRA facility, as the pricing for that facility fulfilled a monetary policy purpose. Instead, the Bank of Canada gradually announced that it would not renew funding from the facility, and decreased the size and frequency of auctions, before finally shuttering the facility (Sankar 2022c). Likewise, the ECB did not provide specific details on the exit strategy for the TROs and the FTOs beyond that they would eventually end (Runkel 2022a; Runkel 2022b). Such phaseouts are gradual, to allow counterparties time to find alternative funding sources.

The Russian banking system improved relatively quickly after August 1998, and ruble deposits of commercial banks at the CBR saw marked increases beginning in September (Owen and Robinson 2003). Given these developments, the Central Bank of Russia also scaled down liquidity operations for the Lombard and overnight facilities and ended lending by November (Owen and Robinson 2003).

Transitioning to a Standing Facility

In certain cases, central banks adopt temporary BBEL facilities into their standing liquidity frameworks, as was the case with the Bank of England's Discount Window Facility and ELTR operations (made permanent with the ILTR facility) (Fulmer 2022e; Fulmer 2022g).

Hong Kong also adopted two of its five temporary emergency actions as standing facilities, the discretionary lending and swap facilities; these two received the most usage, whereas the enhanced discount window (longer terms, broader collateral options) was not used (Hoffner 2022b). Since these liquidity facilities are available during noncrisis periods, central banks must ensure that the pricing mechanism makes utilizing these facilities costly compared to funding in the market during normal times. Therefore, using pricing as a natural exit strategy can be very useful.

Conclusions

In our review of these cases, we identify several major themes:

(1) Early deployment of credible BBEL assistance in the acute phase of a crisis can serve to arrest or moderate the crisis and stop it from evolving into an extended chronic phase;

(2) Relying on existing authorities, programs, or administrative frameworks enables the efficient design and deployment of BBEL programs;

(3) If the liquidity constraint persists, we often see the use of multiple BBEL programs to provide wide access to a broad range of participants;

(4) We see other types of supports also being employed alongside BBEL programs, such as credit and account guarantees in the acute phase and asset purchases, recapitalizations, and loan guarantees in the chronic phase; and

(5) In all phases, clear communication is a valuable policy tool to drive utilization, and positive announcement effects are possible.

Based on the cases discussed in this paper and the related academic evidence, we propose a (less pithy) restatement of Bagehot's dictum:

> **In the acute (panic) phase of a crisis, a LOLR should lend freely and broadly against good collateral, at rates set by auction, taking care to avoid disclosing details about individual borrowers.**

Unpacking the reasoning behind this modernized dictum, we have:

- "lend freely and broadly"—we add an explicit mention of "broadly," consistent with practice both in Bagehot's time and today.

- "against good or sound collateral"—no change here. But it is important to note that "good" or "sound" collateral for Bagehot referred to the status of that collateral before the panic began.

- "at rates set by auction"—the auction mechanism was the most important innovation of the GFC-era programs. A well-designed auction mechanism will yield penalty rates with a minimum amount of stigma.

- "taking care to avoid disclosing details about individual borrowers"—efforts to minimize stigma must also include only minimal disclosure about individual borrowers during the acute phase of the crisis, or we have just wasted a nicely designed auction. However, providing such information once markets have calmed can provide an essential service to taxpayers and potentially help mitigate moral-hazard concerns.

Note that the restated dictum does not say anything about "solvent" institutions. Yes, we did that on purpose.

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