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Market Liquidity Programs: GFC and Before¹

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Abstract

The virulence of the Global Financial Crisis of 2007–09 (GFC) was explained in large part by the increased reliance of the global financial system on market-based funding and the lack of preexisting tools to address a disruption in that type of system. This paper surveys market liquidity programs (MLPs), which we define as government interventions in which the key motivation is to stabilize liquidity in a specific wholesale funding market that is under stress. Most of the MLPs surveyed in this paper were launched during and after the GFC, but two pre-GFC MLPs are included. A subsequent survey on MLPs in response to the COVID-19 crisis is forthcoming. MLPs focus on markets that a central bank believes are critical to financial stability. Stress in these markets could be interfering with monetary policy transmission or disrupting the smooth flow of credit to the real economy. MLPs depart from traditional central bank responses to a systemwide liquidity crisis. MLPs have used a variety of techniques that central bankers would typically consider nonstandard for the purpose of promoting liquidity in wholesale funding markets. These include (1) targeted lender-of-last resort activities, (2) lending securities for securities, (3) lending cash for securities, (4) large-scale asset purchases, (5) targeted asset purchases, and (6) indirect asset purchases.

Keywords: market liquidity, wholesale funding, market-based funding, financial stability

¹ This survey explores part of the Yale Program on Financial Stability (YPFS) selection of New Bagehot Project modules considering the responses to the global financial crisis that pertain to market liquidity programs.

Cases are available from the *Journal of Financial Crises* at <https://elischolar.library.yale.edu/journal-of-financial-crises/>.

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Introductory note: In analyzing the programs that are the focus of this survey, a color-coded system is used to highlight particularly noteworthy design features. This system is as follows:

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 way of addressing a challenge common to this type of program. Less commonly, there will be empirical evidence or a widely held consensus that the design feature was effective in this context, in which case we 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 to the feature with the intention of improving the functioning of the program. Less commonly, there will be empirical evidence or a widely held consensus that the design feature was ineffective in this context, in which case we describe that evidence or consensus.

I. Overview

This paper surveys market liquidity programs (MLPs), which we define as *government interventions for which the key motivation is to stabilize liquidity in a specific wholesale funding market that is under stress*. MLPs focus on markets that a central bank believes are critical to financial stability. Stress in these markets could be interfering with monetary policy transmission or disrupting the smooth flow of credit to the real economy. This paper focuses mainly on MLPs used during the Global Financial Crisis of 2007–09 (GFC). A subsequent survey of MLPs in response to the COVID-19 crisis is forthcoming in 2021.

MLPs depart from traditional central bank responses to a systemwide liquidity crisis. In traditional interventions, central banks seek to fortify the balance sheets of financial institutions so that those institutions can allocate liquidity where it is needed. In contrast, in MLPs, the government has some idea where it would like the liquidity to be allocated. In common with traditional interventions, MLPs may rely on individual institutions as intermediaries or market-makers to pass on liquidity.

MLPs have used a variety of techniques that central bankers would typically consider nonstandard for the purpose of promoting liquidity in wholesale funding markets. These include (Table 1):

- (1) *Targeted lender-of-last resort (LOLR) activities*: lending to financial institutions with the expectation that they will use the funds to promote liquidity in a specific market;
- (2) *Lending securities for securities*: lending securities to financial institutions, taking as collateral assets from distressed markets;
- (3) *Lending cash for securities*: lending cash to a new class of financial institutions, taking as collateral assets from distressed markets;
- (4) *Large-scale asset purchases*: buying assets outright in large quantities, to stimulate trading in stressed markets;
- (5) *Targeted asset purchases*: buying assets in limited amounts to promote price discovery; and,
- (6) *Indirect asset purchases*: lending funds to private market participants to enable them to purchase assets.

This survey includes only two cases prior to the GFC. Both were targeted lender-of-last resort activities. In 1970, in order to restore liquidity to the commercial paper (CP) market following the bankruptcy of the Penn Central Transportation Company (Penn Central) railroad, the Federal Reserve channeled funds to banks via the discount window and eased restrictions on the interest rates banks could pay wholesale depositors. In 1987, following a historic stock market decline, the Federal Reserve took a number of measures to maintain liquidity in the payments and settlements system.⁶

⁶ Earlier examples of large-scale asset purchases include the purchases of equities by the Hong Kong Monetary Authority in 1997 and the Bank of Japan in 2002; these may be covered in future YPFS cases.

Table 1: List of Market Liquidity Programs by Type and Targeted Market

Type of Program	Market				
	Commercial Paper	Interbank	MBS/ABS	Bonds	Stocks
Targeted LOLR Activities	1970 CP Crisis (US, 1970)	Loan Bill Scheme, Excess-Capital Temporary Credit Facility (Denmark, 2008)	Single-Tranche Repo (US, 2008)		Market Crash (US, 1987)
Lending Securities for Securities			TSLF (US, 2008); SLS (UK, 2008)	TSLF (US, 2008); SLS (UK, 2008)	
Lending Cash for Securities	Special Funds-Supplying Operations (Japan, 2008)	Three-Year LTRO (EU, 2011)	PDCF (US, 2008)	PDCF (US, 2008)	
Large-Scale Asset Purchases	CPF, SCPF (UK, 2009)		CBPP (EU, 2009&11)	APP (UK, 2009) SMP (EU, 2010)	
Targeted Asset Purchases	Outright Purchases of CP (Japan, 2008)			CBSMS (UK, 2009)	
Indirect Asset Purchases	AMLF, CPFF, MMIFF (US, 2008)		TALF (US, 2008); PPIP (US, 2009)		

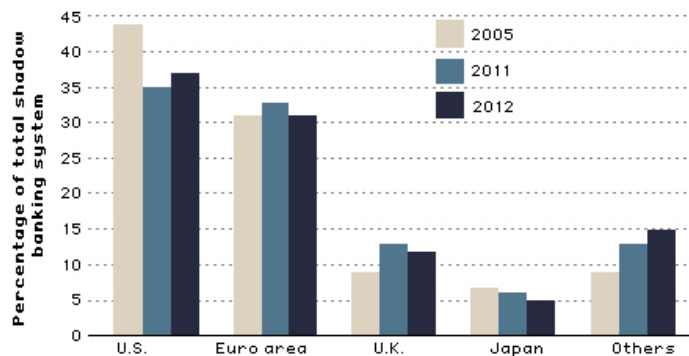
Acronym note: *AMLF*– Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; *APP*–UK Asset Purchase Program; *CBPP*–EU Covered Bond Purchase Program; *CBSMS*–UK Corporate Bond Secondary Market Scheme; *CPF*–UK Commercial Paper Facility; *CPFF*–Commercial Paper Funding Facility; *MMIFF*–Money Market Investor Funding Facility; *PDCF*–Primary Dealer Credit Facility; *PPIP*–Public-Private Investment Program; *SCPF*–UK Secured Commercial Paper Facility; *SLS*–UK Special Liquidity Scheme; *SMP*–EU Securities Market Program; *TALF*–Term Asset-Backed Securities Loan Facility; *Three-Year LTRO*–ECB Three-Year Long-Term Refinancing Operations; *TSLF*–Term Securities Lending Facility
Source: Author analysis.

The virulence of the GFC was explained in large part by the increased reliance of the global financial system on market-based funding and the lack of preexisting tools to address a disruption in that type of system.

Particularly in the US, funding for residential housing had largely moved off banks' balance sheets into the so-called shadow banking system. Many home mortgages were packaged into mortgage-backed securities (MBS), and some of these securities were sold to asset-backed commercial paper (ABCP) conduits and/or repackaged into collateralized debt obligations (CDOs); the securitization process itself was funded on a short-term basis through warehouse loans, CP, and repurchase agreements (repos); and this funding was provided by money market mutual funds (MMFs) and other institutional cash pools. Taken together, this system took on all the functions of traditional banks: with long-term loans at one end funded by short-term liabilities at the other. And this system was global: non-US banks, particularly

European, were deeply involved in the US shadow banking system and relied on short-term dollar-based wholesale markets to fund these activities. As of 2005, more than 40% of global shadow banking assets were in the US and 30% were in the euro area (Figure 1).

Figure 1: Share of Assets from Nonbank Financial Intermediaries



Source: Estenssoro 2013.

The market-liquidity crisis focused initially in mid-2007 on the MBS market and its related products and institutions: CDOs, ABCP, MMFs, and repos. The first attempt to address these market disruptions was through the standard central bank toolbox of traditional monetary policy and direct provision of liquidity to depository institutions. The European Central Bank (ECB) injected \$130 billion into banks, for example. While fear of stigma prevented US banks from significantly using the Federal Reserve's discount window, they drew more than \$100 billion in advances in August 2007 alone on mortgage-related assets from the Federal Home Loan Banks (FHLBs), quasi-lenders-of-last-resort available for some institutions in the US. The Federal Reserve also eased restrictions to encourage banks to help their securities affiliates fund mortgage-related assets. In late 2007, the Federal Reserve introduced the Term Auction Facility (TAF) and currency-swap arrangements to increase the use of its discount window by banks and to channel dollars to foreign banks affected by the growing crisis.

By early 2008, the Federal Reserve had become concerned about how the brewing financial crisis was affecting the primary dealers through which it conducts monetary policy. These included the five large independent US investment banks as well as the US securities arms of European and other foreign banks active in US securitization markets. These firms were dependent on overnight funding of hundreds of billions of dollars in CP, repos, and securities lending to conduct their business. If these wholesale funding markets froze, there was the risk that one of these firms might fail and not only disturb a key monetary policy transmission channel but also have additional significant negative impacts on the financial system as a whole.

These concerns led the Federal Reserve to launch the first MLP of the crisis: targeted LOLR activities (the Single-Tranche Repo) and innovative securities-for-securities and securities-for-cash swaps that built on preexisting tools but focused on restarting liquidity in specific wholesale funding markets. As the disruption deepened, other central banks took similar measures.

The bankruptcy of Lehman Brothers in September 2008 was followed by a sudden and prolonged liquidity freeze. The shadow banking system was experiencing a run, analogous to a traditional bank run, that quickly threatened to block the flow of funds to the real

economy. Among other measures, central banks across the world took the extraordinary step of attempting to stimulate market trading by buying assets outright or (in the US) lending to financial organizations to do so. It was hoped that MLPs could act as a temporary bridge to promote the long-term stabilization of important wholesale funding markets.

In retrospect, MLPs have been described as representing a new role for central banks in financial systems dominated by wholesale funding: that of a *market-maker of last resort* (Tucker 2009). Whereas the traditional role of a central bank as LOLR is to stabilize the balance sheet of banks, the role of a market-maker of last resort is to stabilize the limit-order book in critical funding markets (Cecchetti and Disyatat 2010).

Table 2 below shows the peak usage of each MLP. Where the numbers were unavailable, we included an aggregate amount of the program used throughout its life. Two US programs, the Money Market Investor Funding Facility (MMIFF) and Public-Private Investment Program-Legacy Loans (PPIP (Legacy Loans)), were unused, and the Term Asset-Backed Securities Loan Facility (TALF) and PPIP (Legacy Securities) were generally considered underused. Similarly, Denmark's central bank has noted the underuse of its two programs, the Loan Bill Scheme and Excess-Capital Temporary Credit Facility. We note here, however, that "underused" does not necessarily mean "ineffective," because it is possible for just the availability of programs to stabilize markets.

Table 2: Program Usage

Program	Peak Usage (in billions)	% of Market **	Program	Peak Usage (in billions)	% of Market **
1970 CP Crisis	\$1.7		CPF	£2.4	One-Third of Sterling CP
Single-Tranche Repo	\$80		APP	NA***	
TSLF	\$236		SCPF	NA***	
PDCF	\$147		CBSMS	£1.6	
AMLF	\$152	22% of ABCP	Denmark Loan Bill Scheme	DKK 6*	
CPFF	\$350	20% of CP	Denmark Excess-Capital Temporary Credit Facility	DKK 14*	
MMIFF	0		CBPP1	€60*	
TALF	\$48		CBPP2	€16*	
PPIP (Legacy Loans)	0		SMP	€218*	
PPIP (Legacy Securities)	\$24.9*		Three-Year LTRO	€1,000*	
			Japan Outright Purchases of CP	¥2,680*	
			Japan Special Funds-Supplying Operations	¥38,000*	

*peak usage data unavailable

**outstanding at the time of peak

***general usage data unavailable

Acronym note: **AMLF**-The Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; **APP**-UK Asset Purchase Program; **CBPP**-ECB Covered Bond Purchase Program; **CBSMS**-UK Corporate Bond Secondary Market Scheme; **CPF**-UK Commercial Paper Facility; **CPFF**-Commercial Paper Funding Facility; **MMIFF**-Money Market Investor Funding Facility; **PDCF**-Primary Dealer Credit Facility; **PPIP**-Public-Private Investment Program; **SCPF**-UK Secured Commercial Paper Facility; **SLS**-UK Special Liquidity Scheme; **SMP**-ECB Securities Market Program; **TALF**-Term Asset-Backed Securities Loan Facility; **TSLF**-Term Securities Lending Facility; **Three-year LTRO**-ECB Three-year Long Term Refinancing Operations

Source: Author analysis.

All acronyms used throughout our paper are defined in the paper and the Glossary.

II. General Themes for Key Design Features in MLPs

1. An overly restrictive program may create a stigma problem because financial institutions will hesitate if they believe participation could signal weakness.

MLPs can work only if financial institutions participate. During a crisis, financial institutions may be reluctant to draw on emergency lines of credit from the central bank if doing so could signal weakness to others. This concern intensified in 2008 as investors began to doubt the creditworthiness of major market participants. But the perception of weakness does not need to be based on reality to keep eligible institutions from participating in emergency lending programs (Domanski, Moessler, and Nelson 2014).

One way central banks addressed stigma during the GFC was through auctions (for example, the Federal Reserve's Term Securities Lending Facility [TSLF] and the Bank of England's Asset Purchase Program [APP] and Corporate Bond Secondary Market Scheme [CBSMS]). Auctions provided safety in numbers. Because many would borrow at once, there was less risk the market could identify a major borrower. Because the price was determined by auction, there was no direct connection to the stigma of paying a preset "penalty" rate. And because auctions occurred regularly but no more than once per week, there was less of a direct link to an immediate need for funding (English and Mosser 2018).

Second, limited or lagging disclosure can prevent stigma: if the market doesn't know a bank has received official liquidity, the bank won't suffer from stigma (Winters 2012). For example, in the crisis-era collateral swap programs (the Federal Reserve's TSLF and the Bank of England's Special Liquidity Scheme [SLS]), there was no reported change in total assets for the borrowing institutions or the central bank's reserves.

Third, many MLPs offered uniform access for all financial institutions, irrespective of their condition and systemic importance. Central banks sometimes encouraged healthy institutions to participate, as the Bank of England did to limit stigma in the SLS (Winters 2012).

The stigma problem is mainly relevant for government programs that financial institutions don't use in normal times. The ECB was able to lend billions of euros in the early days of the crisis through open market operations in part because its facility was already available to hundreds of financial institutions and used regularly (Domanski, Moessner, and Nelson 2014).

2. An overly generous program may create moral hazard.

Moral hazard is a perennial concern of central bankers. In the context of MLPs, the concern is that providing emergency liquidity in a systemic crisis will encourage institutions to neglect the task of building liquidity buffers once the crisis has passed (Cecchetti and Disyatat 2010). Of course, there is an interaction between moral hazard and stigma: to the extent market participants are worried about stigma, there is less reason to worry that they will become complacent next time.

One way that central banks addressed moral hazard concerns during the GFC was by charging fees. It is a balancing act: the fee needs to be high enough to minimize moral hazard, cover the central bank's costs, and potentially limit its risks, but not so high as to deter participation (Plenderleith 2012). In the US, TSLF, the Primary Dealer Credit Facility (PDCF), the Commercial Paper Funding Facility (CPFF), and TALF imposed fees on participants. For example, the PDCF imposed a frequency-based fee—additional fees were charged dealers that accessed the facility on more than 45 business days. In some cases, as in the TSLF, fees reflected the riskiness of certain collateral; in other cases, other measures were used to limit the central bank's credit risk, such as collateral or haircuts.

Before the GFC, central banks sought to limit moral hazard through "constructive ambiguity." In other words, uncertainty about whether and how a central bank would provide liquidity was seen as a deterrent to private sector risk-taking. But at the depth of the crisis, the threat of possible inaction was no longer seen as credible. In a post-crisis paper, a group of central bankers noted: "Against this backdrop, it is questionable whether constructive ambiguity is a viable policy option in the future" (Domanski, Moessner, and Nelson 2014).

3. Legal constraints can affect the structure and timing of an MLP.

The Federal Reserve faced statutory limitations that other central banks didn't face during the GFC.

First, under a 1932 law, the Federal Reserve was allowed to lend to nonbanks through its discount window only in "unusual and exigent" circumstances. However, it hadn't used that authority in 70 years and was reluctant to do so. Meanwhile, US financial markets relied heavily on market-making by five large independent investment banks and many foreign bank-owned securities firms that did not have discount window access at the Federal Reserve. In contrast, most financial activities in Europe, the United Kingdom, and Japan were conducted by "universal banks" that did have such access. Their central banks could make do with traditional tools early in the crisis. As the crisis deepened, the Federal Reserve would on many occasions make the required "unusual and exigent" determination to provide liquidity to nonbanks and to support distressed funding markets. "In effect, the Federal Reserve has had to innovate in large part to achieve what other central banks have been able to effect through existing tools," Federal Reserve Chairman Ben Bernanke said in May 2008 (Bernanke 2008).

Second, the Federal Reserve may lend to financial institutions, but it can't purchase non-government assets. This difference in central bank powers was a key factor shaping the design of MLPs, as shown below.

4. MLPs may interfere with monetary policy goals.

Central banks conduct monetary policy (that is, they set policy interest rates) through open market operations that expand or contract their balance sheets. During the GFC, central banks sought to prevent MLPs from interfering with monetary policy by sterilizing the impact on the central banks' balance sheets—in other words, by preventing the programs from expanding the money supply (Borio and Disyatat 2009).

They could sterilize the impact of MLPs by lending securities rather than cash, selling Treasury debt to finance the activity, and paying interest on reserves. Similarly, Federal Home Loan Bank advances to US banks to finance mortgage assets during the second half of 2007 had no impact on the money supply, as the FHLBs finance their activities through the sale of debt to private investors. This activity could be compared to a central bank's standing facility, although the automatic sterilization through independent financing makes it unusual.

During the GFC, central banks could arrest the sterilization activity when monetary policy goals turned increasingly expansionary. For example, the Bank of England sterilized its purchase of CP only briefly before it launched its first quantitative easing program; after that, it funded the purchase of CP through central bank reserves, supporting the goals of quantitative easing.

5. MLPs may introduce new credit and counterparty risks that have to be managed.

MLPs introduce potential risks because the government is injecting liquidity into a market it may not traditionally deal with. Mechanisms to limit the government's credit exposure include measures to ensure accurate pricing of risks, collateral requirements, or facility fees and interest incomes charged. Central banks may hire temporary staff or recruit third-party firms to assist in risk assessment.

Also, traditional programs were typically on a recourse basis, meaning the central bank's counterparties were on the hook if collateral was insufficient. However, in cases where a central bank decided for policy reasons to lift the recourse requirement (for example, the Federal Reserve's Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility [AMLF] and TALF programs), private investors were sometimes brought in to share the risk of loss, while also sharing in potential upside.

As MLPs cannot be entirely risk-free, a central bank may consider the amount of residual credit risk it is comfortable accepting. The Treasury may get involved as a backstop. For example, the US Treasury shared risks with the Federal Reserve in the PPIP. The Bank of England conducted its MLPs with an indemnity from the government (Tucker 2009).

The progression of programs during the GFC illustrated a growing willingness by the Federal Reserve and other central banks to take more risks. In the TSLF and PDCF, two early programs, the Federal Reserve sought to vary the composition of its balance sheet and keep the overall size largely unchanged. However, as the crisis intensified following the collapse of Lehman Brothers, the Federal Reserve entered a second phase that involved a rapid expansion of its balance sheet. The Federal Reserve increased its risk tolerance in two ways: in the collateral it accepted and in the counterparties it was willing to deal with directly. In particular, the Federal Reserve had to consider whether and when to lend to nonbanks.

III. Specific Key Design Decisions in MLPs

Purpose of MLPs

MLPs have a key motivation to stabilize liquidity in a specific wholesale funding market that is under stress. The wholesale funding markets include CP, repos, asset-backed securities (ABS), MBS, certain bond markets, and (under some conditions) stock markets. MLPs have used a variety of techniques that central bankers would typically consider nonstandard and often relied on individual institutions as intermediaries or market-makers to pass on liquidity. MLPs can promote price discovery in frozen markets, provide temporary funding to tide markets over until buyers regain confidence, and head off cascading asset fire sales and liquidity runs.

Legal Authority

Differences in legal authority can affect the methods through which central banks reach illiquid markets. At the time of the GFC, the ECB, Bank of Japan, and Bank of England faced few constraints limiting their MLPs. They lent to a broad range of private actors and made outright purchases on the open market.⁷

In contrast, the Federal Reserve is not allowed to extend loans to nonbanks in normal times, and its power to purchase market instruments is limited. Therefore, for many MLPs during the GFC, the Federal Reserve relied on its emergency lending power to lend to nonbanks, in

⁷ After the crisis, the Financial Services Act 2012 clarified the Bank of England's responsibility for crisis management but required the Bank to seek cooperation from Her Majesty's Treasury if a liquidity program could put public funds at risk.

some cases enabling those organizations to purchase assets on the open market.⁸ For example, in the AMLF, the Federal Reserve lent cash to primary dealers so that they could purchase ABCP from MMFs, and in the CPFF, it lent cash to primary dealers to purchase CP directly.

These legal limitations may have affected the Federal Reserve's ability to reach illiquid markets quickly. In part because the Federal Reserve's indirect asset purchase programs were more complex than the direct asset-purchase programs implemented by other central banks, in some cases (for example, the MMIFF, TALF, PPIP), they took more than one month to get off the ground. Certainly, response time is an element of effectiveness. Ultimately, however, the methods themselves do not seem to not have had much influence on the effectiveness of each MLP.

Auction or Standing Facility

As discussed above, central banks sometimes dealt with stigma by using auctions instead of standing facilities. TAF first succeeded in utilizing the auction format (Armantier and Sporn 2013). TSLF was an extension of the System Open Market Account Securities Lending Program, and thus it seemed natural to be in the auction format. Other Federal Reserve and Bank of England programs, such as PPIP, APP, and CBSMS, were also conducted as auctions (Cecchetti and Disyatat 2010). Still, some MLPs were run as standing facilities and used other features to deal with stigma.

Program Size

Sometimes, the size of the program was large or even unlimited relative to the size of the market where liquidity was under pressure. Several specified no size limits, including the Bank of Japan's Special Funds-Supplying Operations, the ECB's Three-Year Long-Term Refinancing Operations (Three-Year LTRO), and the Bank of England's Commercial Paper Facility (CPF) and Secured Commercial Paper Facility (SCPF). The Bank of England stated that the lack of limits was meant to ensure that the program would remain active as long as necessary until normal market conditions returned.

Targeted programs could be smaller and still achieve their purpose. For example, two programs—the Bank of Japan's Outright Purchases of CP and the Bank of England's CBSMS—sought to support price discovery by making sure that transactions took place. The frequency of the purchases was more important than the size. The Bank of England noted in a market notice that CBSMS was intended “to provide a back-stop offer to purchase modest amounts of a wide range of investment-grade sterling UK corporate bonds ..., initially by facilitating market-making by banks and dealers.” (Bank of England 2009)

Program Duration

Programs sometimes had specified end dates, but those were often extended. In extending the durations of programs, central banks typically noted that market conditions had yet to normalize or that other conditions still existed that continued to destabilize the market. Denmark extended its Loan Bill Scheme to align its expiry date with those of other temporary credit facilities.

⁸ After postcrisis reforms, the Federal Reserve retains the ability to conduct market-wide liquidity programs, but it now must obtain the Treasury secretary's approval before establishing such a program and is required to report to Congress on usage.

On the other hand, the Bank of England launched the CPF and SCPF with unspecified end dates. The Bank designed the facilities to last as long as abnormal conditions in corporate credit markets continued to impair the financing of real economic activity.

Prelaunch Public Consultation

The private sector was sometimes consulted on the details of a program in advance.

The Bank of England, before launching CPF and CBSMS, invited detailed comments on various components of the programs from all interested parties, including eligible institutions, intermediaries, and infrastructure providers. Before launching SCPF, it published a consultative paper on the proposal, which was an extension to its Asset Purchase Facility (APF). Determining the appropriate extent of such consultation is a delicate balancing act: too little consultation carries the risk that a program will not meet any actual market needs; too much consultation can allow front-running, market manipulation, and other subverting of social goals for private ones.

Private Sector Involvement

Participation of private institutions ensured accuracy and effectiveness of certain MLPs and resulted in interesting structures of those MLPs.

The Federal Reserve's MLPs made extensive use of private partners. For example, the TALF program used agents—primary dealers or other designated agents that handled certain administrative activities between the Federal Reserve Bank of New York (FRBNY) and borrowers. Bank of New York Mellon Corporation, the program custodian, was responsible for holding collateral, collecting and distributing payments and administrative fees, verifying the data provided by the TALF agents, and validating the pricing and ratings submitted for pledged securities. Collateral monitors, selected by the FRBNY, provided data and modeling services used in risk assessments and validated collateral pricing and ratings.

PPIP set up funds that were managed with full autonomy by prescreened private sector fund managers, which would buy legacy securities put up for sale by participating financial institutions.

For the MMIFF program, industry representatives were involved in several decisions made in the program design, including: (1) choosing JPMorgan Chase & Company to be the sponsor of the conduit special purpose vehicles (SPVs), (2) deciding to establish five SPVs, and (3) choosing the 50 institutional issuers whose debt would be eligible for purchase. The issuers were chosen primarily because they were among the largest issuers of highly rated short-term liabilities held by MMFs. The Federal Reserve also sought to achieve geographical diversification in each SPV.

Loss- and Profit-Sharing Arrangements

Some US facilities implemented a loss- and profit-sharing arrangement with the private investors participating in the program. For example, in TALF, private investors shared returns on the purchased ABCP pro rata with the Federal Reserve. In view of the long term-to-maturity of the loans, and wide variety of spreads for newly issued ABS and credit quality across the ABS market, it was desirable to have private investors' scrutiny. This involvement also avoided undercutting market mechanisms for allocating credit to borrowers by relying on private structuring and pricing of new securitizations (Ashcraft, Malz, and Pozsar 2012).

Moreover, relying on private investors in newly issued ABS and commercial mortgage-backed securities (CMBS) also provided benchmark pricing to the market. Even a small number of transactions informed market participants about where securitization liabilities would tend to price. This reduced market and funding liquidity risk by diminishing uncertainty about the funding cost of the underlying loans and the feasibility of a securitization exit, easing a key constraint on willingness to lend to creditworthy borrowers. Additionally, with a first-loss position, investors had skin in the game, incentivizing them to screen collateral for credit quality (Ashcraft, Malz, and Pozsar 2012).

A similar arrangement was available in AMLF.

In MMIFF, issuers selling assets to an SPV shared the risk of those assets. When issuers sold assets to the SPV, they received 90% of the purchase price in cash and the rest in ABCP issued by the SPV. And since the ABCP was subordinated to the FRBNY's recourse loan, the issuers were the first to absorb losses to the SPV. In addition, the yield on ABCP was at least 25 basis points less than the yield on the eligible asset sold, providing additional spread to the SPV. **These complexities in the loss-sharing arrangement, however, may have contributed to delay in operation of the program and lack of usage.**

In the PPIP Legacy Securities program, fund managers (private investors) were required to invest at least \$20 million of their firms' funds in their own Public-Private Investment Funds. This was done to ensure that they had "skin in the game" (SIGTARP 2009). These fund managers were also prepared to forfeit this equity should their investment decisions yield results that wiped it out (US Treasury 2009).

Further loss-sharing was also achieved through haircuts discussed below (SIGTARP 2009).

Loan or Purchase

Liquidity was provided to a troubled funding market either through loans and purchases, including indirect purchases, of assets. Central banks either participated directly in the market or indirectly supplied liquidity to the key market participants against a pledge of collateral (WGLA 2017).

The US Single-Tranche Repo, TSLF, and PDCF; the two Denmark facilities; the ECB's Three-Year LTRO; and Japan's Special Funds-Supplying Operations were all conducted as loans. Most of these were extensions of existing discount window or open market operations, so it was natural that they took the form of loans.

Other US facilities took the form of loans to purchase eligible assets due to the Federal Reserve's limited authority to directly purchase assets. For example, TALF provided term credit against newly issued ABS rather than outright purchases. This created an incentive for participants to establish sound collateral for the securities, since they took the first risk of loss (Cecchetti and Disyatat 2010).

Under AMLF, the Federal Reserve loaned funds to an intermediary such as a depository institution or a broker-dealer so that entity could purchase eligible ABCP from eligible MMFs. PPIP also did not initiate outright government asset purchases but made nonrecourse loans.

In contrast, the Bank of England, ECB, and Bank of Japan either did not have any legal restrictions on their direct participation in the funding markets and, in some cases, were explicitly authorized to make outright purchases of market products and had a history of doing so. Therefore, they were able to directly purchase key financial products from the market.

Domanski, Moessner, and Nelson (2014) observe that the different ways to promote liquidity seem to have been influenced by the legal authority and framework of each central bank. They also observe that there does not appear to be any reason apart from legal restrictions why the extension of credit was in the form of a loan. The loan versus purchase decision does not seem to have made a noticeable difference on the effectiveness of MLPs. Moreover, from the perspective of risk, the loans were virtually the same as if the Federal Reserve had bought the paper directly (Domanski, Moessner, and Nelson 2014).

Eligible Institutions

Some MLPs were limited to institutions the government was already familiar with. This was especially true for US MLPs during the GFC. As the Federal Reserve was less experienced with the markets, participating private institutions' expertise assisted the Federal Reserve to launch more effective and efficient MLPs. Moreover, allowing the private investors to share the returns and loss from the program incentivized the investors to be diligent in their investments.

The TSLF, PDCF, and CPFF utilized primary dealers to reach the markets. Primary dealers had established relationships with the FRBNY and were active in the markets so were well suited to intermediate between the target markets and the Federal Reserve. In the AMLF, to facilitate quick implementation of the program, the Federal Reserve relied on institutions with which it had existing relationships (depository institutions and broker-dealers) to act as intermediaries and be the actual borrowers under the program.

Haircuts

The loan amount or the purchase price in MLPs generally incorporated a haircut on the value of underlying collateral or purchased assets. Haircuts helped mitigate the risks the central bank was taking on illiquid assets. Haircuts also helped address moral-hazard concerns: they were seen as important to encourage private-sector actors to monitor their own risks.

Unlike most of the Federal Reserve's financial crisis programs, the AMLF program applied no haircuts to purchased ABCP. The Federal Reserve required AMLF participants to purchase ABCP from MMFs at the MMF's amortized cost. This was done to prevent ABCP from transacting at depressed values. The Federal Reserve feared further market instability if another fund had to "break the buck". Without a haircut, to minimize the risk that it undertook, the Federal Reserve limited collateral to high-quality ABCP and tightened the requirements as the program progressed.

CPFF also did not impose any haircuts. The Federal Reserve instead lent against highly rated CP at a rate lower than the market rate at the time but higher than the rate at normal times. Further detail on interest rates for CPFF is discussed below.

Loans

Recourse or Nonrecourse

Loans were either recourse or nonrecourse, and nonrecourse loans generally were accompanied by a private loss-sharing arrangement. The advantage of recourse loans is that repayment is backed by the financial resources of the borrower. Recourse loans are typically further backed by collateral, which offers a secondary source of repayment (Domanski, Moessner, and Nelson 2014).

The Federal Reserve's earlier two MLPs—the TSLF and PDCF—were designed as recourse loans. Subsequent Federal Reserve programs—the AMLF, CPFF, MMIFF, TALF, and PPIP—used nonrecourse loans. Various programs in the United Kingdom, euro area, Denmark, and Japan also used nonrecourse. The Federal Reserve chose nonrecourse loans in some cases because it was lending to new counterparties whose financial condition could not be readily assessed. In other cases, the Federal Reserve found it would be counterproductive to expose counterparties to the risk of a decline in the collateral's value. In this case, from the Federal Reserve's point of view, providing a nonrecourse loan was economically the same as purchasing the underlying collateral (Domanski, Moessner, and Nelson 2014).

In some cases, the Federal Reserve used private loss-sharing arrangements to mitigate the risk it took in collateralized nonrecourse loans. For example, in the AMLF, TALF, and PPIP, borrowers and investors shared returns and losses on the collateral purchased with the borrowed funds and posted as collateral with the Federal Reserve. In the MMIFF, the FRBNY funded 90% of the cost of collateral through loans; eligible money market investors funded the rest by purchasing subordinated ABCP issued by SPVs.

The Federal Reserve didn't implement any private loss-sharing arrangement in the CPFF. Under that program, the FRBNY lent cash to a new private company, the CPFF LLC, that would then purchase CP. As noted, Section 13(3) of the Federal Reserve Act allows the Federal Reserve to lend to nonbanks in "unusual and exigent circumstances." The Federal Reserve also must determine that such loans have been "secured to [its] satisfaction." The Federal Reserve's legal advisors made that determination, noting several risk mitigants, including: (1) it would purchase only highly rated CP; (2) the loans to the LLC would be secured by the purchased CP, plus any accumulated fees and earnings; and (3) the purchases were at a discount to face value.

Terms

The terms of loans under certain MLPs matched the terms of underlying collateral. AMLF and CPFF provided loans that mirrored the maturity and term of ABCP or CP collateral that was purchased with and secured the loans. On the other hand, MMIFF provided overnight loans, although the FRBNY was committed to continuing to fund the purchased collateral assets until their maturity.

For TALF, the term of loans provided under the program was originally one year. However, it was extended to three to five years as an industry group pointed out that there was at least two years of mismatch between the terms of TALF loans and the underlying assets backing the loans. The mismatch meant that the nonrecourse financing would expire before the underlying debt securities were paid back, leaving the investors to assume the full risk for the last two years of the investment. For that reason, the Federal Reserve extended the terms of TALF loans.

Interest Rates

Liquidity facilities, in general, were designed so that accessing them would be optimal for some institutions when markets were dysfunctional but would become suboptimal when normal functioning of the markets returned (Cecchetti and Disyatat 2010). This balancing act was critical in setting the interest rate of an MLP loan. For example, the CPFF program charged a fixed spread over the three-month market rate, which was expected to become unattractive in normal times.

Additionally, interest rates in MLPs were a security feature: the accumulation of interest was expected to absorb losses and provide additional protection for central banks (GAO 2011).

In launching Outright Purchases of CP, Bank of Japan Governor Masaaki Shirakawa stated that the bid rate would be “more favorable than the market interest rates when the market is malfunctioning”; since losses on any purchased CP come at a cost to the taxpayers, a penalty rate would ensure that taxpayers were compensated for taking on the credit risk (Shirakawa 2009).

High rates also ensured that MLPs were functional only during stress times. For example, for the Bank of England’s CPF, the Asset Purchase Facility offered to buy up to three-month CP at spreads that were significantly below market rates at the time but that were significantly above those expected to prevail in normal conditions. Initially, this would help to drive market spreads down and provide a backstop. This was set up to be self-liquidating as normal market conditions returned (Fisher 2010).

Fees

As with interest rates, setting fees is a balancing act. For a program to be effective and ensure widespread use, the fee should be high enough to minimize moral hazard but not too high as to deter participation. The fees also should be sufficient to cover central banks’ costs of managing each MLP (Plenderleith 2012).

In the US, TSLF, PDCF, CPFF, and TALF imposed fees on participating institutions. For example, PDCF imposed a frequency-based fee: additional fees were charged dealers who accessed the facility on more than 45 business days.

Fees also may reflect the riskiness of the collateral. In TSLF auctions, the Federal Reserve charged a minimum fee of 10 basis points for Schedule 1 collateral (Treasuries and other relatively safe assets traditionally accepted in open market operations) and 25 basis points for Schedule 2 collateral (which encompassed riskier collateral, ultimately any investment-grade security). CPFF charged an additional credit enhancement fee for unsecured CP. TALF charged a higher administrative fee for loans secured by CMBS (20 basis points) compared to nonmortgage asset-backed securities (10 basis points). However, Plenderleith’s report on the Bank of England’s emergency liquidity assistance states that fees were not designed to manage the risks to the central bank or to the public—those risks should have been adequately covered by collateral and haircuts (Plenderleith 2012).

Eligible Collateral or Assets

Eligible collateral or assets were defined depending on the problems in the target market an MLP was attempting to address and often included unconventional assets that the central bank would not take in normal times. As the AMLF program was intended to assist MMFs in the CP market, the ABCP it accepted for collateral had to be purchased from an MMF, among other restrictions. TALF aimed to renew issuance of consumer and small-business ABS and thus included only newly issued non-mortgage-backed ABS, newly issued CMBS, and legacy CMBS.

In Denmark, to facilitate the interbank lending market, the central bank launched two facilities: the Loan Bill Scheme and the Excess-Capital Temporary Credit Facility. The loan bill program allowed the Danmarks Nationalbank to lend to a banking institution in exchange for loan bills issued by another banking institution. A 2009 report from Danmarks Nationalbank stated its disappointment in the efficacy of the loan bill program in supporting the interbank lending market. The report noted that the program underestimated the degree of loss of confidence among financial institutions and assumed that the banking institutions wanted to lend to each other (Danmarks Nationalbank 2009). Hence, the central bank

introduced the excess-capital facility, extending unsecured credit lines to banks on the basis of the institutions' excess capital adequacy. This facility was also underutilized.

Criteria for eligible collateral evolved with changes in the need of the market as troubles deepened. The Federal Reserve expanded eligible collateral as market conditions worsened after Lehman Brothers failed. TSLF broadened the eligible set of collateral to all investment-grade debt securities, and PDCF included assets to closely match the types of instruments that could be pledged in the triparty repurchase agreement systems of the two major clearing banks. In the ECB, the first round of Securities Market Program (SMP) included government bonds from the secondary markets of Greece, Ireland, and Portugal, but the second round was expanded to Italy and Spain, responding to problems in those markets.

Safeguards against collateral risks also determined the eligibility of an asset. In most programs, assets had to satisfy certain credit-rating requirements. Also, programs often explicitly excluded certain assets. The ECB's Three-Year LTRO and the UK's SCPF excluded syndicated loans; Japan's Special Funds-Supplying Operations excluded CP issued by real estate investment corporations; and most UK programs excluded ABCP.

Other external limitations shaped the criteria for eligible collateral for MMIFF. Eligible participants for MMIFF were limited to 2a-7 funds.⁹ Because 2a-7 funds could only purchase and hold highly rated debt instruments, the Federal Reserve and FRBNY designed MMIFF terms and conditions to help ensure that the subordinated notes issued by each SPV would receive the highest rating from two or more major rating agencies (GAO 2011).

The Federal Reserve designed the eligible collateral structure for the Single-Tranche Repo program to alleviate strains in agency MBS by removing the stigma associated with MBS at the time. For conventional repo operations, the Federal Reserve accepts propositions from dealers in three collateral tranches. In the first tranche, dealers may pledge only Treasury securities. In the second tranche, dealers can also pledge federal agency debt. In the third tranche, they can also pledge MBS issued or fully guaranteed by federal agencies. With the Single-Tranche Repo program, dealers could combine MBS, federal agency debt, or Treasury securities in the single tranche. This feature would appear to be a fix for a stigma problem that carries no additional moral hazard risk: an unusual example of a free lunch in this policy space.

Downgrade of Collateral

Some MLPs included features to protect the central bank if a rating agency downgraded the collateral.

For example, under MMIFF, collateral downgrades would prevent the SPV from providing any further loans to the issuer of that collateral until all assets issued by that issuer and held by the SPV had matured. If there was a default, the SPV would not only stop providing further loans to the issuer but would also cease repayment on outstanding ABCP from the issuer. In TALF, if there was a collateral downgrade, TALF loans were not affected, but the downgraded collateral could no longer be used to back any new TALF loans.

⁹ Money market funds are a type of mutual fund registered under the Investment Company Act of 1940 and regulated under Rule 2a-7 of the Act. Money market funds pay dividends that reflect prevailing short-term interest rates, are redeemable on demand, and, unlike other investment companies, seek to maintain a stable net asset value, typically \$1.00.

In CPF, if purchased CP was downgraded below the minimum credit ratings set out by the Bank of England, the issuer of that CP would be unable to access the facility again until it again met the required minimum credit ratings.

SPV Involvement

The Federal Reserve and the Bank of England established special purpose vehicles separate from the central bank's balance sheet for some MLPs.

The Federal Reserve created SPVs to purchase specific instruments and lent money to them using its emergency authority. The SPVs in turn purchased assets from the troubled institutions. These assets served as collateral for the Federal Reserve's loans to the SPVs.

The CPFF established CPFF LLC to directly purchase newly issued ABCP and unsecured CP with the loans it received from FRBNY for that purpose. The FRBNY's loans were secured by CPFF LLC's assets including the CP that it purchased, fees that it collected and any uninvested fees, earnings, and proceeds from investments. This structure was chosen because the Federal Reserve would be dealing in a security that it did not normally handle and, with many types of entities, that it did not normally lend to. Similarly, for the operation of TALF, FRBNY created an SPV, TALF LLC, to manage any collateral surrendered by TALF borrowers to FRBNY.

The MMIFF similarly was created with SPVs. However, unlike other Federal Reserve programs with SPVs, these were set up to be managed by the private sector in collaboration with FRBNY. FRBNY worked with JPMorgan to set up the MMIFF SPVs. The deployment of multiple SPVs was intended, in part, to better ensure that MMIFF could continue to provide funding in the event that one of its SPVs was required to cease purchases. It was also thought that privately sponsored SPVs would appeal to the MMFs (GAO 2011).

Utilizing an SPV generally required additional structuring and administrative work. Therefore, the MMIFF needed a full month to become operational after it was announced. By comparison, the AMLF was announced on a Friday and was operating the next Monday. In the AMLF, the Federal Reserve Bank of Boston made loans to depository institutions to purchase certain ABCP from MMFs. It could be set up more quickly because it used existing discount window processes and documentation for its infrastructure.

The Bank of England also used an SPV for the CPF program but not due to any limits in its legal authority. CPF was launched under the APF, which was a £50 billion facility to purchase high-quality financial assets and ultimately to improve liquidity in credit markets. All transactions under APF were undertaken by a subsidiary company of the Bank of England, the Bank of England Asset Purchase Facility Fund Limited, that borrowed from the central bank to pay for its purchases.

Reserves Impact

In the US, UK, and ECB, central banks often prevented MLPs from interfering with the exercise of monetary policy by actively sterilizing their impact the money supply. In SMP, the ECB conducted special operations to reabsorb the liquidity injected through the SMP. The following four methods were used to sterilize the impact of MLPs on reserves during the GFC. The first was *lending high-quality securities*, typically Treasuries, to private financial institutions in return for distressed securities (e.g., the Bank of England's SLS and the Federal Reserve's TSLF). The second was *issuing Treasury debt* to finance the MLP activity (e.g., the Bank of England's early implementation of its Asset Purchase Facility and the Federal

Reserve's currency swap program in 2008¹⁰). The third was *selling a comparable amount of Treasuries* from the central bank's portfolio to offset the MLP's injection of dollars into the market (e.g., PDCF). The fourth was *paying interest on reserves*, so the central bank was able to offset expansionary effects of MLPs by paying banks to increase their reserves with the central bank (e.g., the Federal Reserve beginning in October 2008).

In the wake of Lehman's failure, central banks became less concerned about sterilizing MLPs, partly because these programs could complement their increasingly expansionary monetary policy stances. In the US, the startup of the CPFF and other MLPs led to a sharp growth in the Federal Reserve's balance sheet beginning in late September 2008 (Dudley 2009). The Bank of England briefly sterilized its purchases of CP before subsuming the program in the much larger asset purchase under its quantitative easing program.

Disclosure

Central banks did not disclose the lists of institutions participating in the MLPs but often disclosed aggregate transaction information with a lag.

To mitigate stigma, the Federal Reserve, like the Bank of England, had historically not released the names of borrowers from the window. The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 now requires the Federal Reserve to disclose details of discount window loans with a two-year lag; this is thought to be sufficient to limit the stigma associated with the use of the discount window.

More concerning, however, is the new reporting requirement to the US Congress for any future use of the Federal Reserve's emergency lending authority under Section 13(3) of the Federal Reserve Act. Within seven days of establishment of any 13(3) program, the Board must now report detailed transaction-level information to Congress on any lending activity conducted under those programs.

Aggregated transaction data were often disclosed weekly in the United States. Certain disclosures had the intention of improving information availability and supporting effective market functioning. For example, in the PPIP, after each legacy CMBS subscription, the FRBNY published the list of submitted legacy CMBS that had been accepted as collateral or rejected, either on the basis of the explicit terms and conditions for legacy CMBS or the FRBNY's risk assessment.

In addition, the UK's CBSMS regularly posted traded prices on its wire service and its website. CPF and SCPF published the weekly aggregate amount of CP and securities purchased. The Bank of England explained that such transparency was intended to reduce uncertainty in the market value of corporate bonds and to reduce the risk aversion that contributed to market illiquidity.

Relief from Regulatory Capital and Liquidity Requirements

In some cases, governments tweaked capital or liquidity requirements to encourage institutions to use MLPs.

In the AMLF program, because the Federal Reserve protected borrowers from credit or market risk in holding ABCP, the Federal Reserve assessed no regulatory capital charge with respect to those holdings. The CP received a 0% risk weight for calculating risk-based capital

¹⁰ The currency swap programs will be covered in a future survey.

and was excluded from average total consolidated assets for calculating regulatory leverage ratios. On the other hand, the regulatory capital requirements for securities financed by a TALF loan were the same as those for securities that were not financed by a TALF loan. We were unable to identify a clear reason behind these different treatments.

With regard to liquidity requirements, in the Danish Loan Bill Scheme and Excess-Capital Temporary Credit Facility, the buying institution could count the loan bill and credit lines toward its statutory liquidity until one month before the expiry of each respective facility.

Relief from Other Restrictions

To improve the ability of an MLP to reach the intended markets, central banks at times exempted or limited existing legal restrictions.

After the Penn Central bankruptcy in 1970, the Federal Reserve was concerned that the discount-window adjustment alone would provide insufficient incentive to banks to support the CP market. For that reason, the Federal Reserve suspended its interest-rate ceilings under Regulation Q. This allowed banks to pay more for large-denomination certificates of deposit and other time deposits.

In launching the AMLF program, the Federal Reserve exempted participating banks from Section 23A of the Federal Reserve Act. Section 23A limits a bank's "covered transactions" with any single affiliate of the bank to 10% of the bank's equity, and all such transactions to 20%. The exemption facilitated banks' purchase of ABCP from affiliated MMFs.

In announcing the TALF program, the government made it clear that the executive compensation restrictions that Congress had mandated for companies receiving taxpayer support under the Troubled Assets Relief Program (TARP) would not be applied to TALF sponsors, underwriters, and borrowers. This was to encourage participation in the program. In comparison, in the PPIP, it was not made clear whether PPIP participants would be exempt from the executive compensation restrictions.

International Cooperation

The GFC showed how a crisis in one country can easily spill over to another. Global financial institutions had increasingly invested and funded themselves in multiple currencies and national financial markets. International coordination was necessary to address liquidity strains that crossed international boundaries. Central banks found they needed to develop new ways to coordinate their liquidity assistance programs. Furthermore, responding to the crisis demanded an understanding of the differences in national legal and institutional frameworks (WGLA 2017).

Foreign, mostly European banks played a significant role in US shadow-banking markets prior to the crisis—borrowing short-term in US money markets and then investing in long-term US securitized assets. One estimate is that foreign banks sponsored about 60% of the \$1.2 trillion US ABCP market (Acharya, Afonso, and Kovner 2013); they had also issued half a trillion dollars in dollar-based unsecured financial CP (Adrian, Kimbrough, and Marchioni 2011). When commercial-paper markets froze in mid-2007, European banks faced a severe dollar shortage. The Federal Reserve coordinated with the European, Swiss, and other central banks to establish currency swap lines through which the Federal Reserve could provide dollars to central banks, which could then lend to their banks on dollar-based collateral.

US affiliates of foreign banks were also among the biggest direct users of US market liquidity programs throughout 2008. For example, they accounted for more than half of the usage of the TSLF and about three-quarters of the usage of the Single-Tranche Repo and the CPFF.

IV. Evaluation

Post-crisis evaluations of market liquidity programs, typically conducted by central bank staff, have measured success in various ways:

- 1) Was the program used sufficiently?
- 2) Was the program introduced expeditiously?
- 3) Was price discovery restored?
- 4) Did market volumes recover relatively quickly?
- 5) Was credit restored to the real economy?

To be sure, all of these criteria are not appropriate for all market liquidity programs. For example, total usage is not a fair measure of the success of the 1970 and 1987 targeted LOLR activities or of the crisis-era targeted asset-purchase programs, which sought to simply establish market prices. And the recovery of market volumes is not necessarily a fair measure of the success of a program like the AMLF, which successfully financed banks' purchases of CP but could not address the market's preference for overnight paper during the crisis; policymakers then introduced the CPFF to temporarily create a market for longer-term paper until market conditions recovered.

Moreover, post-crisis studies emphasize the difficulty in isolating the independent effects of MLPs. Market liquidity programs are often part of larger policy packages and, as their launches typically coincide with the worst of a crisis, the aftermath may coincide with a broader recovery. For example, studies suggest that it is hard to determine the role of PDCF in alleviating liquidity constraints for primary dealers as the Federal Reserve had TSLF running at the same time. In the UK, since the MLPs were launched under the larger Asset Purchase Facility, it is again difficult to isolate their individual effectiveness. In Europe, the ECB's MLPs were among many operating programs to solve the same problem at the same time.

For these reasons, some studies analyze the short-term effects that the announcements of these programs may have had on market pricing to gauge how they were received by market participants.

Usage

Usage is described above. Some programs were underutilized. In Denmark, massive underuse of the Loan Bill Scheme was a disappointment to the central bank. In implementing the Excess-Capital Temporary Credit Facility, it said that the facility was partly driven by the initial failure of the loan bills program to meet banking needs that were intensified after the fall of Lehman Brothers. It further elaborated that the scheme assumed that the banking institutions wanted to lend to each other while the confidence among the banking institutions continued to deteriorate. (Danmarks Nationalbank 2009)

Speed of Rollout

The ability to roll out a program quickly provided benefits in some cases, serving as a bridge as other programs were put together. The Federal Reserve's AMLF and the Treasury's money market fund guarantee were both announced on September 19, 2008. But the AMLF was rolled out the next business day because it used existing arrangements through the discount window. The following week, as some MMFs continued to experience significant redemptions, AMLF usage jumped to more than \$150 billion before the Treasury guarantee went into effect on September 29. Federal Reserve economists conclude that the program had "provided substantial liquidity to MMFs at a critical moment" (Logan, Nelson, and Parkinson 2018). Similarly, banks that borrowed from CPFF when it was launched on October 27—as much as \$15 billion by Bank of America Corporation alone—soon replaced those borrowings with longer-term debt, once the Federal Deposit Insurance Corporation's Temporary Liquidity Guarantee Program, which guaranteed newly issued debt at far longer maturities, was underway (Anderson and Gascon 2009).

On the other hand, a larger gap, one month or more, between the time when the program was first announced and when the program actually became operational may have affected the effectiveness of the program. Three examples of such programs are MMIFF, TALF, and PPIP (Legacy Securities). These delays were generally due to the operational novelty and complex structure of these programs.

Federal Reserve economists involved in constructing some of the Federal Reserve's market liquidity programs—including lending programs like TSLF and PDCF and the later indirect asset purchase programs—have said that, in hindsight, earlier rollout might would have made them more effective. "In retrospect ... we think that earlier introduction of broader programs and in some cases, in larger initial size could have been more effective. The programs were not approved and implemented until it was abundantly clear that runs were seriously impairing the ability of the financial institutions affected to meet the credit needs of the economy" (Logan, Nelson, and Parkinson 2018).

Impact on Market Volumes

Market liquidity programs ultimately must be judged on their success at catalyzing private sector transactions in targeted markets (Cecchetti and Disyatat 2010). The design of MLPs entails a delicate balancing act: central banks seek to intervene forcefully enough to reengage long-term market participants but not so forcefully as to crowd them out.

After the failure of Lehman Brothers, the Federal Reserve and Treasury tried several methods to resuscitate market demand for CP. The AMLF, as noted, was successful in the short term in providing funding for banks to purchase CP from money market funds. But the volume of the CP market continued to shrink, outstanding CP was increasingly short-term, and spreads remained elevated. The Federal Reserve created the CPFF LLC, a special purpose vehicle, to directly purchase relatively long-term (three-month) CP at narrower spreads from issuers. It was immediately used heavily. The program peaked in January 2009 at \$350 billion of outstanding CP, 20% of total paper outstanding (Logan, Nelson, and Parkinson 2018). Over the course of 2009, CPFF usage declined as issuers increasingly sold their paper on the open market.

Similarly, TALF helped restart the ABS market. TALF-eligible ABS issuance accounted for about two-thirds of total ABS issuance in the second quarter of 2009. As the market recovered, that percentage fell to just more than one-third in the fourth quarter and a small fraction by early 2010 (Agarwal et al. 2010).

Price Discovery

Bank of England economists have said that its targeted purchase program helped reestablish pricing in the market for corporate bonds, despite its small size. “The presence of a market maker of last resort quickly restored market functioning and the price floor established by the purchase programs did not bind for long” (Fawley and Neely 2013).

Many papers conclude that the Federal Reserve’s indirect asset purchase programs helped improve pricing. Adrian, Kimbrough, and Marchioni (2011) find that usage of the CPFF was accompanied by a narrowing of the spread between CP rates and comparable OIS (overnight indexed swap) rates. Federal Reserve officials noted at an Federal Open Market Committee meeting in early 2009 that even spreads on CP that was *not* eligible for purchase under the CPFF had dropped as investors reentered the market.

Ashcraft, Malz, and Pozsar (2012) find that TALF contributed to a sharp decline in spreads in ABS markets by improving liquidity conditions and also had a longer-term impact by encouraging improvements in the design of CMBS. The authors also argue that TALF helped permanently shift the composition of the ABS investor base from short-term funds to hedge funds. Ashcraft, Malz, and Pozsar (2012) find evidence that TALF reduced the spreads on legacy CMBS that were accepted into the program. Similarly, the Treasury Office of Financial Stability (OFS) credits PPIP with having played some role in helping to “restart the market for [mortgage] securities, thereby allowing banks to begin reducing their holdings in such assets at more normalized prices” (OFS 2010).

Credit to the Economy

Market participants and government officials have claimed that various market liquidity programs were successful in channeling credit to frozen markets, although empirical evidence is limited. Some consider the TALF to be distinctive in offering a more direct impact to the consumer because nearly all of the auto lenders supported by the TALF reported that the facility enabled them to offer more credit to consumers at lower rates. Lenders attributed this impact to the program’s success in re-opening the securitization channel through which roughly half of consumer loans were financed (Sack 2010).

Announcement Effect

Some programs have been viewed as effective based on the market response to their announcements. At the time of its announcement, the CBPP was one of the first unconventional monetary policy actions taken within the Eurosystem and caught market participants by surprise. A study of TALF finds that nine major announcements over the course of the program had a substantial effect on market pricing of highly rated auto ABS and CMBS (Campbell et al. 2011). More specifically, after the announcement of TALF’s expansion to as much as \$1 trillion on February 10, 2009, spreads for the credit card, auto, and student loan sectors narrowed, according to another study (Agarwal et al. 2010).

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VI. Glossary

ABCP	Asset-backed commercial paper
ABS	Asset-backed securities
AMLF	Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility of the United States was established in September 2008 by the Federal Reserve under Section 13(3) of the Federal Reserve Act. AMLF lent money to US depository institutions and bank holding companies to purchase high-quality asset-backed commercial paper from money market mutual funds. It intended to foster liquidity in the ABCP market and money markets more generally.
APP	Asset Purchase Program of the United Kingdom was established by the Bank of England in March 2009. APP primarily purchased gilts and specifically targeted nonbank financial institutions to improve liquidity in credit markets that were not functioning normally.
CBPP	Covered Bond Purchase Programs were established by the European Central Bank in May 2009 and October 2011. CBPP purchased euro-denominated covered bonds issued in the euro area in both primary and secondary markets to promote the ongoing decline in money market term rates, to ease funding conditions for credit institutions and enterprises, to encourage credit institutions to maintain and expand their lending to clients, and to improve market liquidity in important segments of the private debt securities market.
CBSMS	Corporate Bond Secondary Market Scheme of the United Kingdom was established by the Bank of England in March 2009. CBSMS purchased modest amounts of a wide range of investment-grade sterling UK corporate bonds with the aim of improving secondary-market liquidity, initially by facilitating market-making by banks and dealers.
CP	Commercial paper
CPF	Commercial Paper Facility of the United Kingdom was established by the Bank of England in January 2009. CPF purchased commercial paper from both primary issuers and secondary holders to serve as a ready buyer for commercial paper, thereby restoring liquidity to corporate credit markets.
CPFF	Commercial Paper Funding Facility of the United States was established in October 2008 by the Federal Reserve under Section 13(3) of the Federal Reserve Act. CPFF purchased three-month unsecured and asset-backed commercial paper through an SPV and intended to enhance liquidity in the commercial paper markets.
MBS	Mortgage-backed securities
MMIFF	Money Market Investor Funding Facility of the United States was established in October 2008 by the Federal Reserve under section

13(3) of the Federal Reserve Act. MMIFF provided senior secured funding to a series of LLCs that were established with the private sector. It intended to provide liquidity to US money market mutual funds and certain other money market investors, thereby increasing their ability to meet redemption requests and hence their willingness to invest in money market instruments, particularly term money market instruments.

MMF	Money market mutual fund
PDCF	Primary Dealer Credit Facility of the United States was established in March 2008. PDCF was an overnight loan facility that provided funding to primary dealers and helped to improve conditions in financial markets more generally.
PPIP	Public-Private Investment Program of the United States was established in March 2009 by the Treasury, the Federal Deposit Insurance Corporation, and the Federal Reserve under the Troubled Assets Relief Program (TARP). Using TARP capital and capital from private investors, PPIP generated purchasing power to buy legacy assets. It was to support market functioning and facilitate price discovery in the markets for legacy commercial mortgage-backed securities and nonagency residential mortgage-backed securities.
SCPF	Secured Commercial Paper Facility of the United Kingdom was established in July 2009 by the Bank of England. SCPF purchased secured commercial paper from eligible parties in the primary and secondary markets to improve the function of markets for the raising of short-term working capital.
SMP	Securities Market Program was established by the European Central Bank in May 2010. SMP purchased government bonds of selected countries from the secondary market to aid malfunctioning securities markets, restore liquidity, and enable proper functioning of the monetary policy transmission mechanism.
TALF	Term Asset-Backed Securities Loan Facility of the United States was established in November 2008 by the Federal Reserve under Section 13(3) of the Federal Reserve Act. TALF issued loans with terms of up to five years to holders of eligible asset-backed securities and facilitated the issuance of ABS collateralized by a variety of consumer and business loans, intending to improve the market conditions for ABS more generally.
Three-Year LTRO	Three-Year Long-Term Refinancing Operations was established by the European Central Bank in December 2011. It used its regular LTRO format but extended the term to three years to provide liquidity to European financial institutions to lend on private wholesale funding markets during a period of persistent and growing market tension.
TSLF	Term Securities Lending Facility of the United States was established in March 2008 under Section 13(3) and 14 of the Federal Reserve Act.

TSLF loaned Treasury securities to primary dealers for one month against eligible collateral.

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