

Lessons from the Use of Extraordinary Central Bank Liquidity Facilities

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- *During the financial crisis, central banks took extraordinary measures to inject liquidity into the global financial system in response to widespread deterioration in funding conditions.*
- *The traditional liquidity facilities available to central banks prior to the crisis were not designed to deal with severe disruptions in funding markets.*
- *Central banks adapted their facilities and introduced new ones. Overall, the evidence suggests that the policy response helped to reduce funding pressures.*
- *Important lessons can be drawn from this experience: extraordinary actions should be anchored by clear principles; a flexible operating framework facilitates an appropriate policy response; central bank co-operation maximizes effectiveness; and financial institutions and core funding markets are interdependent.*

Financial institutions rely to varying degrees on capital markets, including short-term funding markets, for their financing needs. In normal times, central banks provide routine short-term financing (hereafter referred to as liquidity) to financial institutions to support the smooth operation of the payments system, promote well-functioning funding markets and support the monetary policy stance. During the recent crisis, however, widespread deterioration in funding conditions for financial institutions led them to stop redistributing liquidity to the broader financial system, as they normally do, causing a seizing-up of important funding markets and requiring unprecedented measures from central banks. They responded by expanding their traditional provision of liquidity along the following dimensions: volume, term, eligible counterparties and acceptable collateral.¹ These extraordinary actions helped funding markets to gradually return to more proper functioning.

In this article, we examine the provision of central bank liquidity during the crisis and its contribution to alleviating pressures in short-term funding markets.² Central banks were flexible in providing extraordinary liquidity, and their actions were also designed to encourage a return to financing in private funding markets and to limit moral hazard.³ A review of this experience illustrates the importance of well-articulated intervention principles, a flexible operating framework, and clear communication by—and coordination among—central banks, regarding their

¹ See Zorn, Wilkins and Engert (2009) for more on the Bank of Canada's liquidity actions during the crisis and Zorn and García in this issue for more on collateral policies.

² Although we focus on measures taken by the Bank of Canada, the Bank of England, the European Central Bank and the U.S. Federal Reserve, other central banks took similar measures.

³ Moral hazard arises when central bank actions reduce the incentive for financial entities to protect themselves against risky outcomes. The concern with providing extraordinary central bank liquidity is that banks would improperly manage their funding risk, assuming that the central bank would provide liquidity support in times of stress.

liquidity policies. It also exposes the degree of interdependence of financial institutions and markets, making it essential to adopt reforms aimed at improving the infrastructure supporting core funding markets and the liquidity positions of individual institutions.

Liquidity Facilities: From Traditional to Extraordinary

Most central banks play the role of lender-of-last resort to the financial system of their respective countries.⁴ This involves providing routine liquidity to support the payments systems and the monetary policy stance, as well as providing emergency liquidity to eligible financial institutions affected by idiosyncratic liquidity shocks.⁵

Traditional liquidity facilities

To manage the aggregate level of liquidity available in the financial system, central banks typically use open market operations and/or a standing liquidity facility, whereby the central bank provides routine short-term liquidity to individual financial institutions. Liquidity is then efficiently allocated by these institutions to the financial system more generally. The Bank of Canada's framework for implementing monetary policy comprises the following key features: the target for the overnight rate, the operating band, the ability to conduct buyback operations at the target rate, and the management of settlement balances.⁶ Although deficit and excess settlement positions are typically resolved in the market, the Bank—through its Standing Liquidity Facility—provides collateralized routine overnight loans at the Bank Rate (the upper limit of the 50-basis-point operating band) to direct participants in the Large Value and Transfer System (LVTS), Canada's main payments system, if they are in a deficit settlement position. Conversely, the Bank of Canada pays interest (at the lower limit of the operating band) on deposits from institutions that are in a surplus position. The target overnight rate is the

midpoint of the operating band, and the Bank can adjust the level of settlement balances and undertake overnight special purchase and resale agreements (SPRAs) or sale and repurchase agreements (SRAs) to reinforce its target for the overnight rate if required.⁷

To manage the aggregate level of liquidity available in the financial system, central banks typically use open market operations and/or a standing liquidity facility. Liquidity is then efficiently allocated to the financial system generally

As the ultimate source of liquid funds to the financial system, central banks can also extend emergency liquidity to solvent individual financial institutions that face liquidity difficulties. Thornton (1802) and Bagehot (1873) established the principles that govern the extension of central bank liquidity: central banks should lend early and freely to solvent institutions against good collateral at a penalty rate.⁸ Since idiosyncratic liquidity shocks can lead to contagion and affect the financial system as a whole, the provision of emergency liquidity to individual banks contributes to financial stability. But central banks will lend only to solvent institutions; the solvency assessment is made by the bank regulator, which can be the central bank itself or, as is the case in Canada, a separate entity (with whom the central bank is typically in close collaboration).⁹

Extraordinary liquidity support

When the crisis began in the summer of 2007, central banks initially relied on their traditional tools, with marginal modifications in some cases, to support the orderly functioning of short-term funding markets and to support liquidity in the system through their traditional counterparties. In the summer and autumn of 2007, the European Central Bank (ECB) conducted a

⁴ For a review of the theory governing this role, see Freixas, Giannini, Hoggarth and Soussa (1999) and Cecchetti and Disyatat (2010).

⁵ Idiosyncratic liquidity shocks affect the liquidity position of individual financial institutions but not the overall financial system.

⁶ The framework for implementing monetary policy and the LVTS are closely linked because the final positions of LVTS participants settle on the books of the Bank. The penalty rate for participants that are short of settlement balances (i.e., require advances) provides them with incentives to obtain the liquidity they need from the market rather than from the Bank. Thus, end-of-day advances from the Bank are relatively small. For details, see Engert, Gravelle and Howard (2008) and <<http://www.bankofcanada.ca/monetary-policy-introduction/framework>>.

⁷ For more details on SRAs and SPRAs see Bank of Canada (2010).

⁸ For example, the Bank of Canada has an Emergency Liquidity Assistance facility whereby it can provide funds to a member of the Canadian Payments Association for a maximum of 6 months (renewable) at a minimum lending rate of Bank Rate (Bank of Canada 2004).

⁹ In Canada, the Office of the Superintendent of Financial Institutions has primary responsibility for regulating and supervising federally regulated deposit-taking institutions, and the Bank of Canada is a member of the Financial Institutions Supervisory Committee, which facilitates the exchange of information among federal entities.

number of supplementary long-term refinancing operations (LTROs) in addition to its regular monthly LTROs to help restore the normal functioning of the euro money market. The Bank of Canada conducted several overnight SPRA operations and increased the level of settlement balances in the system. In the United States, the stigma associated with the Federal Reserve's Discount Window Facility (DWF) led deposit-taking institutions to refrain from using this facility in the early phase of the crisis, despite increasing funding pressures (Bernanke 2009).¹⁰ To promote DWF borrowing, the Federal Reserve modified its terms in August 2007, lowering the penalty interest rate charged, extending the terms of the loans, and communicating that using the DWF was appropriate.

Going into year-end, pressures in global funding markets increased, leading to a significant shortening of the terms (i.e., not beyond year-end) at which funding was available. Central banks responded by adopting additional measures for injecting longer-term liquidity into the system through their traditional counterparties. Specific measures depended on the features of existing facilities: some central banks modified their existing open market operations (the Bank of England and the ECB),¹¹ while others introduced term liquidity facilities. For example, the Federal Reserve introduced the Term Auction Facility (TAF), and the Bank of Canada introduced the Term Purchase and Resale Agreement (PRA) Facility.¹² Central banks also adjusted the amounts offered, the term and frequency of the operations, and the eligible collateral, as required.

It became increasingly evident that the usual mechanism for redistributing liquidity within the financial system was impaired

As the crisis unfolded, it became increasingly evident that the usual mechanism for redistributing liquidity

¹⁰ Armandier, Ghysels, Sarkar and Shrader (2011) provide empirical evidence of the stigma associated with the DWF. They show that banks were willing to pay a premium to borrow from the Term Auction Facility (TAF), a new facility created during the crisis, rather than from the DWF.

¹¹ In addition to raising the amount of liquidity offered through its longer-term open market operations, the Bank of England expanded the range of collateral eligible for these operations, notably to include asset-backed securities and residential mortgage-backed securities.

¹² Eligible counterparties in the TAF were deposit-taking institutions, the Fed's traditional counterparties in the DWF, while eligible counterparties in the Bank of Canada's Term PRA Facility were primary dealers, the Bank's traditional counterparties in repo operations.

within the financial system via markets and financial intermediaries was impaired and that the injection of liquidity through traditional counterparties was insufficient. Institutions that were eligible to participate in the central banks' facilities did not always redistribute liquidity across funding markets because of concerns about their counterparties and/or the preservation of precautionary liquidity for their own needs. This prompted central banks to take new measures along four broad lines.

First, some central banks introduced mechanisms that allowed firms to exchange less-liquid assets for very liquid assets. This was done to increase the volume of high-quality collateral available for funding in private markets, since liquidity in funding markets for other forms of collateral was seriously curtailed. The Federal Reserve created the Term Securities Lending Facility (TSLF) through which it lent Treasury securities to primary dealers for 28 days against less-liquid securities. Similarly, the Bank of England's Special Liquidity Scheme allowed banks and building societies to swap high-quality but relatively illiquid mortgage-backed securities for U.K. Treasury Bills. In Canada, the Government of Canada's Insured Mortgage Purchase Program (IMPP), through which the government purchased insured residential mortgage pools from regulated financial institutions, performed a similar function.¹³ Moreover, the Bank of Canada temporarily allowed LVTS participants to substitute their non-mortgage loan portfolio (NMLP) for marketable securities pledged as collateral in the LVTS, thus permitting participants to use these marketable securities elsewhere, notably in private funding markets.¹⁴

Second, since some key providers of liquidity in funding markets experienced serious liquidity shortages and did not always have access to the central banks' traditional liquidity facilities, some central banks created new facilities to provide liquidity to targeted groups of institutions. This was the case in the United States, where the Federal Reserve created two liquidity facilities for primary dealers.¹⁵ In addition to the TSLF mentioned above, the Primary Dealer Credit Facility (PDCF) provided primary dealers with

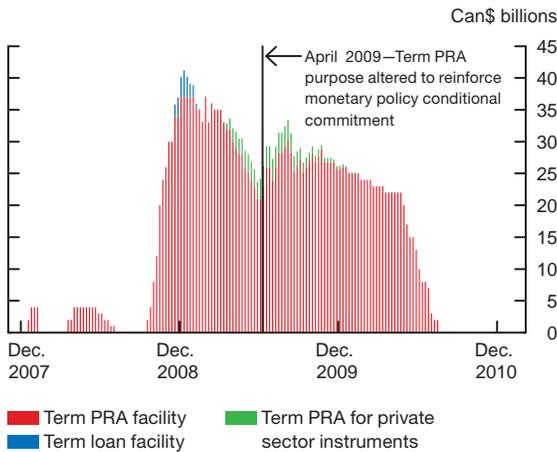
¹³ For details about the IMPP see Government of Canada (2008). While the mortgages were purchased for cash, the purchases were financed via the issuance of additional government debt securities. So for the financial system as a whole, these operations essentially represented a swap of more-liquid for less-liquid assets.

¹⁴ The Bank of Canada also created the Term Loan Facility (TLF) whereby direct participants in the LVTS could secure term loans against their NMLP.

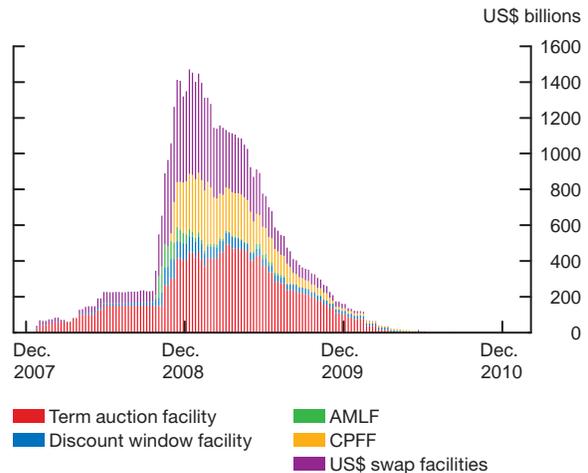
¹⁵ Although primary dealers are counterparties in the Federal Reserve's open market operations, they are not eligible for the DWF and the TAF.

Chart 1: Use of central bank liquidity facilities

a. Bank of Canada



b. U.S. Federal Reserve



Sources: Bank of Canada and U.S. Federal Reserve

overnight liquidity, thereby easing liquidity pressures in the repo market and helping to stop the liquidity-price spiral (Adrian, Burke and McAndrews 2009).

Third, as liquidity deteriorated in markets that play a crucial role in the provision of credit in some countries, some central banks provided liquidity directly to participants in these markets. To help restore liquidity in the markets for commercial paper and asset-backed commercial paper, the Federal Reserve introduced three complementary facilities: the Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), the Commercial Paper Funding Facility (CPFF) and the Money Market Investor Funding Facility (MMIFF).¹⁶ Similarly, the Bank of Canada's Term PRA Facility for private sector money market instruments was intended to enhance the functioning of money markets by providing the major participants in these markets with a liquidity backstop.¹⁷ Likewise, the Bank of England introduced an Asset Purchase Facility (APF) through which it purchased eligible commercial paper and corporate bonds to improve liquidity in these markets. The APF

was later turned into a tool for easing monetary policy (Kozicki, Santor and Suchanek 2011).¹⁸

Finally, pressures on U.S.-dollar funding were experienced across jurisdictions. European financial institutions had difficulty securing sufficient U.S.-dollar funding early in the crisis, leading the ECB and the Swiss National Bank to establish reciprocal U.S.-dollar swap facilities with the Federal Reserve that permitted them to provide their counterparties with significant term funding in U.S. dollars. In the autumn of 2008, U.S.-dollar funding pressures became more acute, prompting coordinated measures, and many central banks entered into similar reciprocal swap agreements with the Federal Reserve to provide U.S.-dollar funding to financial institutions in their respective jurisdictions.¹⁹

As illustrated in **Chart 1**, the liquidity facilities of central banks were used intensively during the crisis, although to a different extent across facilities.

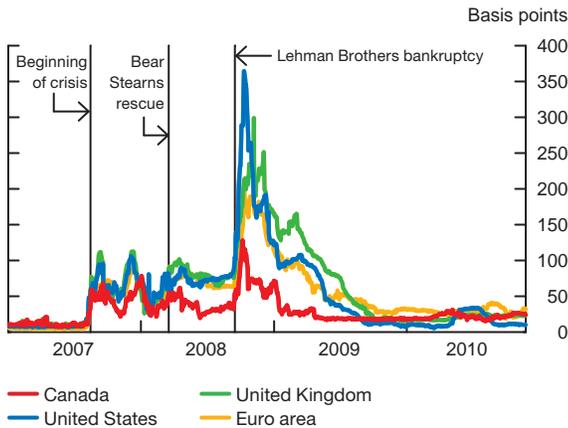
¹⁶ The AMLF assisted money market mutual funds facing redemptions; the CPFF offered term funding for commercial paper, providing greater assurance to issuers and investors that firms could roll over maturing debt; and the MMIFF facilitated the sales of money market instruments in the secondary market.

¹⁷ In February 2009, the Bank of Canada replaced this facility with a broader Term PRA Facility for private sector instruments designed to support the functioning of the money market and the corporate bond market.

¹⁸ When the APF served as a liquidity facility, asset purchases were financed by the issuance of Treasury Bills, whereas when the decision was made to use the APF for monetary policy purposes (i.e., to boost the supply of money and credit to meet the Bank of England's inflation target), asset purchases were financed by the creation of money.

¹⁹ The Federal Reserve entered into reciprocal swap agreements with 14 central banks, including the Bank of Canada (<http://www.federalreserve.gov/newsevents/press/monetary/20081029b.htm>). The Bank of Canada did not draw on this facility but judged that it was prudent to have the agreement in place. Swap lines have the advantage of respecting the principle that the home central bank should be the provider of funds to institutions in its jurisdiction, because it has better information about the borrower's needs and financial conditions (CGFS 2008).

Chart 2: Funding pressures in local funding markets^a
3-month LIBOR-OIS Spread



a. The spread between the London interbank offered rate (LIBOR) and the overnight indexed swap (OIS) rate is used to capture funding liquidity risk and credit risk for banks (or a combination of the two). The Canadian Dealer Offered Rate (CDOR) is the Canadian equivalent of the LIBOR.
Source: Bloomberg Last observation: 31 December 2010

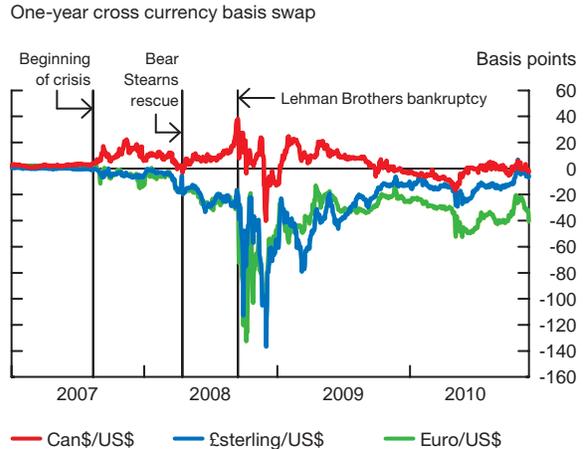
How Effective Were Liquidity Facilities?

To date, the evidence suggests that the provision of liquidity by central banks during the crisis helped to reduce funding pressures. The provision of extraordinary central bank liquidity directly improved the funding position of participating institutions (usually key financial intermediaries) by providing funding for a range of assets (or exchanging them for more liquid ones) that had become more difficult to finance in private markets in times of stress. It contributed indirectly to improving the liquidity position of the institutions with which these firms interact. Overall, this supported the private provision of liquidity in markets more broadly. As illustrated in **Charts 2 and 3**, funding conditions deteriorated markedly during the crisis, leading to the extraordinary measures described previously. The subsequent narrowing of funding spreads suggests that these facilities have had the intended effect. However, the possibility that other factors contributed to this improvement motivated a number of empirical studies that attempt to isolate the effect of central bank liquidity facilities.²⁰

Several studies of the Federal Reserve's TAF suggest that it was effective in reducing funding pressures for banks. McAndrews, Sarkar and Wang (2008) use an

²⁰ Although the impact of other facilities has been studied, we focus on the assessment of term liquidity and swap facilities.

Chart 3: Funding pressures in U.S.-dollar funding markets
One-year cross currency basis swap



Source: Bloomberg Last observation: 31 December 2010

event-study approach and show that TAF announcements contributed to a reduction in the liquidity component of the LIBOR-OIS spread.²¹ Sarkar and Shrader (2010) also conclude that the TAF operations were associated with a reduction in that spread at the beginning of the crisis, when funding pressures were driven mainly by liquidity concerns, but that the impact moderated over time as the widening spread reflected rising credit risk.²² Christensen, Lopez and Rudebusch (2009) generate the path that the 3-month LIBOR-Treasury spread would likely have followed without the TAF and conclude that interbank-market spreads would have been even higher than those observed during the crisis. Enenajor, Sebastian and Witmer (2010) also use an event-study approach to assess the impact of the Bank of Canada's Term PRA facility on CDOR-OIS spreads. After controlling for other factors, notably changes in the U.S. LIBOR-OIS spread, they show that the Term PRA announcements did have a statistically and economically significant impact.²³ Overall, these findings tend to suggest that the announcement of liquidity provision by the central

²¹ An OIS is a short-term swap in which two parties agree to exchange, for an agreed period, a fixed interest rate determined at the time of the trade for a floating rate that will vary over time.

²² The increase in market indicators of funding costs, such as the LIBOR-OIS spread, conceals significant disparities in the experiences of individual banks. For example, using a model of bidding with data from the ECB's one-week auctions, Cassola, Hortacsu and Kastl (2009) find considerable heterogeneity across banks. While two-thirds of participating banks suffered a dramatic increase in the cost of obtaining funds in the interbank market, the remaining third did not.

²³ Using individual bank data, Allen, Hortacsu and Kastl (forthcoming) show that banks' willingness to pay for central bank liquidity in Canada rose for only a limited time (the two months following Lehman's bankruptcy). This contrasts with the situation in Europe and the United States where funding pressures persisted for a longer period.

bank, together with other measures, contributed to alleviating funding pressures.²⁴

Studies also suggest that U.S.-dollar swap facilities were effective in reducing pressures in U.S.-dollar funding markets. Baba and Packer (2009) show that deviations from short-term covered interest parity for three currency pairs in the foreign exchange swap market were explained by different factors during the crisis. At first, counterparty risk seemed to be driving the dislocations, and U.S.-dollar auctions do not appear to have had an effect. Following the failure of Lehman Brothers, however, there was a global shortage of U.S.-dollar funding, and auctions of U.S.-dollar funds had a significant impact, suggesting that swap facilities were effective in reducing funding pressures when they became systemic. Similarly, Coffey, Hrungr, Nguyen and Sarkar (2009) and Fleming and Klagge (2010) find that the introduction of central bank swap lines contributed to easing the U.S.-dollar funding pressures experienced by overseas financial institutions.

Guiding Principles and Facility Design

By providing extraordinary liquidity in times of severe market dislocations, central banks were supplementing—and in some cases effectively replacing—private funding markets. Although this was necessary to secure financial stability, the provision of significant central bank liquidity for an extended period may discourage financial institutions from dealing with each other (Cecchetti and Disyatat 2010). Therefore, central banks had two objectives: (i) to provide sufficient funding liquidity to the targeted institutions and affected funding markets, while (ii) ultimately encouraging a return to functioning private funding markets as conditions improved. The design of central bank liquidity facilities played a central role in achieving these objectives.

Throughout the crisis, five principles guided the Bank of Canada's decisions with regard to the form and quantity of liquidity to provide (Engert, Selody and Wilkins 2008). Intervention should:

- (i) target market failures that are of system-wide importance;
- (ii) be well suited to the problem;
- (iii) be graduated, commensurate with the severity of the problem;
- (iv) be designed to be efficient and non-distortionary; and
- (v) mitigate moral hazard.

To maintain adequate liquidity throughout the system, central bank facilities targeted the institutions (and their funding markets) that experienced the most severe liquidity distortions. Differences in market structure and in the process of funding intermediation across jurisdictions meant that central banks adopted different approaches. In the United States, liquidity strains expanded beyond interbank markets into other markets that are key sources of funding for the economy (e.g., repo and commercial paper markets); therefore, the Federal Reserve expanded liquidity beyond banks. In Europe, since banks are the main providers of credit to the economy, they were the focus of the ECB's liquidity facilities throughout the crisis (Trichet 2009).

Pricing incentives

Underlying the pricing of many extraordinary liquidity facilities was the principle that the cost of central bank funding should be higher than the cost prevailing in private markets in normal times, but lower than the cost that existed during times of acute stress.²⁵ Such pricing mechanisms were designed to ensure that market participants accessed the facilities during periods of liquidity shortages, but had an incentive to return to private funding markets as conditions normalized. This pricing principle was implemented in two ways. For some facilities, such as the Federal Reserve's CPFF and the Bank of England's APF, the cost of funding was set as a fixed spread over the rates on overnight indexed swaps (OIS), whereas facilities that allocated funding via competitive auctions employed a minimum bid rate (which could be set as a spread over the OIS rate). Examples of facilities that used this latter structure include the Bank of Canada's Private Sector Term PRA and Term Loan Facilities, the Federal Reserve's TAF, and the ECB's LTROs before October 2008. Central banks also encouraged a return to private market financing by charging fees for the use of some facilities. For

²⁴ Government initiatives aimed at improving the solvency of financial institutions in a number of jurisdictions, e.g., capital injections and/or asset purchases, also likely contributed to the overall improvement in global funding conditions by alleviating counterparty concerns and thus restoring banks' willingness to transact with each other.

²⁵ Some market segments stopped functioning, so funding in those markets was effectively unavailable at any price.

example, the PDCF was subject to a fee dependent on usage over time, while the TSLF was subject to a fee that depended on the type of collateral posted.

Over the course of the crisis, variations of this pricing structure were used. When the pricing mechanism did not incorporate a penalty rate, the incentive to gradually return to private market funding sources was achieved in other ways. For example, prior to April 2009, the Bank of Canada's Term PRA facility employed a competitive auction without a minimum bid rate.²⁶ The Bank of Canada imposed counterparty limits and also used the bidding data at term PRA auctions as a measure to gauge the demand for funds and adjusted the size of the operations accordingly, scaling down the provision of liquidity as conditions improved. In the aftermath of October 2008, the ECB's liquidity facilities offered unlimited amounts at the ECB's policy rate to ensure that there would be enough liquidity to meet the high funding needs. As funding conditions for European institutions improved, the ECB began to gradually revert back to the facility design used in their standard operating framework, which includes multi-price competitive auctions with or without a minimum bid rate, depending on the type of operation. As funding conditions in Europe deteriorated again in mid-2010, however, the ECB reverted to providing unlimited amounts at a fixed rate.

Lessons Learned

During the financial crisis, not only did central banks inject an unprecedented volume of liquidity into the global financial system, but in some cases used measures that had never been employed before. A number of lessons can be drawn from this experience.

Extraordinary actions should be anchored by clear principles

The crisis demonstrated that idiosyncratic and systemic liquidity shocks require different policy responses. Traditional central bank liquidity facilities were designed to deal with liquidity problems faced by individual institutions and could not effectively respond to a system-wide liquidity shock that affected

funding markets. Central banks therefore modified some of their facilities and created new ones. The scale, scope and diversity of central banks' interventions suggest that establishing clear principles to guide such actions prior to, or early in, a crisis can help anchor decisions and guide central banks' operations in rapidly evolving circumstances. For instance, the Bank of Canada's principle that intervention should be commensurate with the severity of the problem guided its decisions on the appropriate size of the liquidity injections over time, while the principle that interventions should be non-distortionary argued for pricing at backstop rates relative to normal funding conditions and that auction-based mechanisms should be used in the allocation of these funds.

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Such principles also facilitate effective communication with financial markets and the general public, to explain why certain measures are taken and others are not (especially if those measures appear to pose increased credit or market risk to the central bank) and how those actions differ from regular operations. And because it is not possible to know ex-ante exactly what form of intervention might be required in a future crisis, guiding principles for intervention are preferable to precise rules. Although central banks' extraordinary liquidity facilities varied across countries and over time, the broad principles that underlined them were to maintain an appropriate level of liquidity in the financial system while minimizing distortions in the efficient allocation of credit and mitigating moral hazard.

A flexible operating framework facilitates an effective policy response

The rapid evolution of funding conditions during the crisis and the range of actions taken by central banks demonstrated the importance of having an operating framework that is flexible enough to accommodate the need to respond in an appropriate and timely

²⁶ The Bank of Canada used the Term PRA facility for monetary policy purposes starting in April 2009. In order to reinforce its conditional commitment to leave the target for the overnight rate unchanged until the end of the second quarter of 2010, conditional on the inflation outlook, the Bank lengthened the term of the PRA transactions to up to 12 months and introduced minimum and maximum bid rates that matched the upper and lower limits of the operating band for the overnight rate, respectively.

manner.²⁷ Facilities designed to deal only with a previous crisis may not allow an appropriate response to future events, so central banks must be able to adapt. This includes having the ability to target segments of the financial system where disruptions can have important negative implications for the broader financial system and the economy.

In addition, a flexible policy response can help mitigate moral hazard. To the extent that there is uncertainty with regard to the central banks' actions, including whether or not it will intervene and if so when, how, and at what price, the ability of market participants to anticipate those actions and adjust their behaviour in anticipation of the central bank's response is reduced (Selody and Wilkins 2010). There is thus a trade-off between preserving flexibility to facilitate an appropriate response and to mitigate moral hazard while, at the same time, establishing clear principles to guide and explain the central bank's actions.

Effective central bank co-operation is important

The global scale of the recent crisis demonstrated the benefit of co-operation among central banks in times of acute stress. Throughout the crisis, central banks engaged in continuous close consultation and co-operated in unprecedented joint actions to reduce strains in financial markets. For example, in light of the global disruptions to funding markets, central banks entered into reciprocal swap agreements to facilitate the provision of U.S.-dollar funding to their respective banks.²⁸ This co-operation helped to reassure markets that policy-makers understood the severity and global nature of the crisis and were prepared to respond accordingly. This likely increased the overall effectiveness of the policy response.

Funding markets and financial institutions are interdependent

Finally, the crisis highlighted the important role that financial markets play in the provision of credit to the economy and exposed how interdependent financial institutions and financial markets have become; a fact

that many did not fully appreciate prior to the crisis. Financial institutions rely to varying degrees on capital markets, including short-term funding markets, for their financing needs. It is therefore essential that the funding markets at the core of the financial system be continuously open, even in times of crisis.²⁹ For example, Fontaine and Garcia (2009) show that funding liquidity predicts risk premiums across a range of markets. The effect is large and pervasive through crises and normal times. Their findings show that funding markets have a first-order impact on other capital markets and suggest that, as the recent crisis unfolded, funding conditions became the hub for the amplification and propagation of financial shocks throughout the financial system and to the real economy. At the same time, most financial markets are dependent on the ability and willingness of a core set of institutions to transact, which reinforces the interdependence of markets and financial institutions.

The crisis exposed how interdependent financial institutions and financial markets have become

Policy initiatives designed to improve the infrastructure supporting core markets and to reduce the potential disruptions that can be caused by the failure of a single institution are therefore of utmost importance. One example is the increased use of central counterparties in repo and over-the-counter derivatives markets (Chande, Labelle and Tuer 2010; Wilkins and Woodman 2010). The crisis also revealed the unrealistically high degree of confidence of many financial institutions in their ability to access short-term funding markets and their insufficient planning for the possibility that funding might not always be available at a reasonable cost. The revised regulatory regime for banks, including the introduction of new liquidity standards, appropriately aims to increase their resilience in such circumstances (BCBS 2010).³⁰

²⁷ Amendments to the Bank of Canada Act came into effect in August 2008 to provide the Bank with greater flexibility to purchase and sell a wider range of securities.

²⁸ Also, in an October 2008 press release, G-7 central banks announced coordinated interest rate reductions, recognizing that intensification of the financial crisis had increased the downside risks to economic growth and diminished the upside risks to inflation, warranting some easing of global monetary conditions. See <<http://www.bankofcanada.ca/publications-research/press-releases>>.

²⁹ A core funding market is one that: (i) is an important source of funding for the institutions, market-makers, and governments at the centre of the financial system; (ii) constitutes a funding source for which there is no immediate substitute; and (iii) could channel significant contagion should it cease to function properly. See Fontaine, Selody and Wilkins (2009) and Carney (2008).

³⁰ The Liquidity Coverage Ratio requires banks to hold enough unencumbered liquid assets to cover their cumulative net outflows for 30 days. The Net Stable Funding Ratio requires banks to maintain a certain level of stable funding dependent on the liquidity of their assets and the size of their exposures.

Conclusion

Two and a half years after the dramatic events of the autumn of 2008, central banks are taking stock of their experiences with extraordinary liquidity facilities during the crisis, and some central banks are adjusting their frameworks. For instance, the Bank of England has made permanent changes to its Sterling Monetary Framework, including the introduction of a DWF whereby banks can borrow U.K. Gilts for longer terms against a wide range of collateral (Fisher 2010). The Bank of Canada also decided to continue allowing the use of NMLP as collateral, but for only a portion of the collateral pledged by LVTS participants.

A lot has been learned from this difficult period. Clearly, idiosyncratic and systemic liquidity shocks require different policy responses, and the traditional facilities available to central banks prior to the crisis were not designed to deal with system-wide disruptions. Central banks adapted their facilities and introduced new ones. Overall, the evidence and research suggest that the response was effective. Still, events have shown that central banks need to be flexible enough to adapt their policy response. At the same time, extraordinary actions should be based on sound principles that can guide and help communicate policy-makers' decisions. Central banks will continue to review their experience during the worst crisis in decades, and to learn from this episode.

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