



Policy and
Infrastructure
Developments

Introduction

The financial system and all of its various components (institutions, markets, and clearing and settlement systems) are supported by a set of arrangements, including government policies, that influence its structure and facilitate its operation. Taken together, these arrangements form the financial system's infrastructure. Experience has demonstrated that a key determinant of a robust financial system is the extent to which it is underpinned by a solid, well-developed infrastructure. This section of the Review highlights work in this area, including that related to relevant policy developments.

Recent disruptions in financial markets have led central banks around the world to re-examine their roles in providing liquidity to the financial system, and the Bank of Canada has been no exception. In the article, **Financial Market Turmoil and Central Bank Intervention**, Walter Engert, Jack Selody, and Carolyn Wilkins consider the questions why, when, and how a central bank might intervene when confronted by financial market turmoil. They set out a policy framework and identify appropriate central bank instruments, consistent with central bank policy goals and functions.

Financial Market Turmoil and Central Bank Intervention

Walter Engert, Jack Selody, and Carolyn Wilkins¹

Recent disruptions in financial markets have led central banks around the world to re-examine their roles in providing “liquidity” to the financial system. Analysts often refer to different types of liquidity, that is, market liquidity, funding liquidity, and central bank liquidity. Market liquidity is an asset- or market-specific concept that refers to the ability to trade asset positions of reasonable size with little price impact. Funding liquidity is an institution-specific concept that refers to the ability of solvent counterparties to obtain immediate means of payment to meet liabilities coming due. Central bank liquidity refers to access to money from the central bank.

At some risk of oversimplification, one might consider that liquidity generally refers to the availability of assets that have predictable value over time, and that can be transferred, bought, and sold with low transactions costs and without affecting the market value of the asset.

The fundamental concerns of a central bank relate to two aspects of financial system liquidity. First, a central bank cares about aggregate system liquidity because of its connection to future inflation. Second, a central bank is concerned that the financial system effectively distributes liquidity, because the system can become inefficient and possibly unstable when liquidity is not available where it is most needed.

In this article, we consider central bank intervention to address financial market turmoil with a focus on the questions of why, when, and how a central bank might intervene. We set out a policy framework and identify appropriate central bank instruments to respond to extraordinary financial market turmoil, consistent with central bank policy goals and functions.²

Why Intervene?

Endogenous liquidity creation

Central bank open market operations and lending provide liquidity to the financial system. The central bank is not the only source of liquidity in the financial system, however, nor is it the main source. In modern financial systems, liquidity is generated endogenously, that is, within the system through the normal interaction of private participants pursuing their own interests. Central bank lending can be seen as an exogenous source of liquidity, determined by the central bank to meet its policy objectives. This makes central bank lending especially important when the endogenous generation of liquidity is impaired.

Considered in a highly stylized (or theoretical) framework, two functions are central to the process of endogenous liquidity creation: banking and market making. Banks provide liquidity by taking deposits that have a fixed value (at par) and that can be withdrawn on demand by their owners. Banks expand liquidity by leveraging existing deposits to issue new loans, which, in turn, can lead to new deposits. When a bank finds itself short of liquidity, it can borrow from other banks, sell assets in money markets, or go to the central bank for a loan. Markets provide liquidity by allowing assets to be readily sold at prices that correspond to the discounted stream of returns expected from the assets. Institutions that provide market-making services expand liquidity by leveraging their capital to buy and sell assets more frequently at such prices, which reflect fundamental value. When a market-maker finds itself short of liquidity, it can borrow from banks and other market-makers, or sell assets in money markets.³

1. This work has benefited from comments provided by numerous colleagues, for which we are grateful.
2. For a related perspective, see Carney (2008).

3. Of course, banking and market-making services can be provided by the same institution, and often are in Canada.

In a modern financial system, liquidity tends to be generated from hubs (or tiers).⁴ A banking hub is a group of major banks that are especially active in providing loans to each other, to financial institutions outside the hub, and to market-makers. A market-making hub is a group of institutions that are especially active in making markets and in buying or lending against the illiquid assets of other market-makers. Seen in this way, the institutions active in these hubs, pursuing their own interests, create liquidity that benefits other financial system participants. As a result, these banks and market-makers are collectively important to the stability and efficiency of the financial system.

This process of endogenous liquidity generation and distribution will almost always create sufficient liquidity in the right places in the financial system. It is also generally accepted that the market frictions and incentive misalignments that exist in normal financial system conditions are not sufficient to impair effective endogenous liquidity generation and distribution. It is also apparent, however, that in extraordinary circumstances, the process of endogenous liquidity creation can become impaired.

Endogenous liquidity creation can break down

When the endogenous generation of liquidity breaks down, the central bank can improve the stability of the financial system by providing liquidity. For example, a small shock to the demand for liquidity can ultimately lead to a disproportionate effect on a bank, given that deposits are redeemable at face value on demand. A resulting bank run can be associated with uncertainty about the solvency of the bank. And, as its creditworthiness becomes uncertain, the bank might not be able to obtain liquidity from other banks or from markets. If the central bank has access to information that indicates that the troubled bank is solvent (through the supervisory authority, for example), the central bank can improve the situation by lending to the affected bank.⁵

4. For an analysis of tiering in the context of the payments system, see Chapman, Chiu, and Molico (2008). See summary article, p. 83.

5. For discussion of the Bank of Canada's lender-of-last resort policies, see Bank of Canada (2004) or Daniel, Engert, and Maclean (2004–05).

The stability and efficiency of a modern financial system rely on market participants generally being able to buy and sell assets at prices that correspond to their fundamental values, especially in money markets. Financial markets are "incomplete," however, in the sense that all participants do not operate in all markets. This can inhibit the flow of information and funding in markets, which, in turn, can lead to pricing inefficiencies, including distorted liquidity premiums in important markets. Such pricing inefficiencies, which normally are minor transitory frictions, can become significant under certain conditions, such as a sudden widespread increase in uncertainty about counterparty solvency. This can discourage market participants from funding one another, and can cause important participants to withdraw from the market, worsening market incompleteness. Pricing inefficiencies can also be exacerbated by herding behaviour, where market participants follow the lead of others instead of relying on their own analysis.

In extreme circumstances, a lack of reliable information in incomplete markets can lead to significant pricing inefficiencies and to a breakdown of endogenous liquidity creation, further exacerbating pricing inefficiencies and declining liquidity. Under such circumstances, banks may not be in a position to respond by expanding their credit-intermediation services, either because they face an increased need for liquidity themselves or because they also lack reliable information about the creditworthiness of institutions acting as market-makers and about other market participants.

For example, an anticipated rise in defaults for a particular asset class could create uncertainty about the solvency of a market-maker for that asset class, limiting its ability to obtain the funding necessary (including through sales of the asset) to continue making the market, thus worsening pricing inefficiencies. Banks, having also been hit by the shock, might conserve liquidity for their own needs, limiting their ability to fund participants in such markets. As well, banks might not go to the central bank for additional liquidity because they might lack the collateral needed to obtain a central bank loan, or, more likely, they might be reluctant to borrow from the central bank because of the potential stigma (and possible supervisory intervention) associated with such borrowing. In addition,

banks might not have sufficient free capital (or be able to raise sufficient capital) to replace the financing previously available through the issue of securities in the now dysfunctional market. As a result, banks could be ineffective in re-establishing credit intermediation at any reasonable level for the participants in the market suffering the shock. This could also lead to adverse effects in other asset markets.⁶

A central bank could help stabilize the system by providing liquidity directly to the market. It could do so in this case by accepting as collateral for central bank liquidity the securities that traded in the now illiquid market, appropriately discounted, which could also help re-establish efficient pricing.

Another example is analyzed by Allen and Gale (2007) who consider the collapse of an asset-price bubble. A bank with significant holdings of this asset would become stressed because the value of many of its liabilities would be fixed while the asset would fall in value. This would force the bank to conserve liquidity for its own needs, thus reducing the amount of liquidity available to others. The bank would also liquidate assets, which would result in falling asset prices in illiquid markets, potentially undershooting fundamental values, leading to an inefficient allocation of resources.

A central bank can address this inefficiency by providing liquidity to the illiquid market so that asset prices can find their fundamental values, or it can lend to the affected banks so that they can increase liquidity as needed.

The growing importance of market liquidity

Since the events of August 2007, market conditions have solidified a growing realization that an adequate supply and distribution of market liquidity have become important to the stable and efficient functioning of the financial system.

Although economic theory suggests that the distribution of liquidity matters for the sound functioning of the financial system, few practitioners have seen a need for the central bank to provide direct liquidity support to individual

markets until recently. (See, for example, Banque de France 2008.) Altering liquidity through monetary policy, or in the core payment systems, or through a reallocation of liquidity to banks was seen as sufficient action by a central bank to maintain market and financial system liquidity.

This view changed with the events of August 2007 and the subprime-credit crisis. It is now more broadly accepted that the financial system will be more stable, and the effects of monetary policy actions more predictable, if the central bank directly supports market liquidity in some extraordinary circumstances.

Behind this change in view is a realization that the financial system has become more dependent on market liquidity. One reason for this increased dependence is the greater use of securitization to convert non-traded receivables (such as mortgages) into tradable securities (such as mortgage-backed securities), making financial institutions increasingly reliant on market liquidity for funding their operations.

Another reason for the increased prominence of market liquidity is the growing use of “mark-to-market” accounting that rapidly converts asset-price shocks into balance sheet shocks. This makes it more important that markets have sufficient liquidity to price assets efficiently so that market prices adequately reflect economic value. Where securities are not sufficiently standardized to be traded in a market, “mark-to-market” becomes “mark-to-model,” which creates additional valuation uncertainty in times of financial stress. These phenomena also cause financial institutions to hoard liquidity in case they have to restructure their balance sheets after a sudden change in valuations. Liquidity is preserved, in turn, by cutting back on lending and trading activities.

Intervening in markets is consistent with central bank policy objectives

Central bank provision of liquidity is governed by policies with a common objective. Such policies mitigate potential financial system instabilities that can be addressed only by the exogenous provision of liquidity by the central bank.

Monetary policy stabilizes the inflation rate. In a modern financial economy, the rate of inflation

6. This scenario can be seen as a type of “market failure,” where decisions resulting from individual pursuit of self-interest can lead to relatively poor collective or overall results.

is determined by the central bank setting a path for the riskless interest rate (i.e., the policy rate). This involves the central bank standing ready to lend to clearing banks in the payments system and to conduct limited open market operations to achieve the policy rate.⁷ The path for the policy rate determines aggregate liquidity in the financial system. Central bank intervention dealing with the distribution of liquidity (discussed below) may require an offsetting central bank action to leave the policy rate at its target, thus keeping the setting of monetary policy unaffected.

Payment, clearing, and settlement policy protects the payments system against the destabilizing effects of “gridlock,” which can occur if a participating bank does not have sufficient liquidity to meet its payment obligations. In a monetary economy, banks are linked by a system that uses central bank money to settle accounts, where the clearing banks (in the central hub) have access to standing overdraft facilities from the central bank to facilitate settlement of payments.

Lender-of-last-resort policy (or, more specifically, emergency lending assistance) stabilizes banks in the face of a liquidity shock that could cause a bank run because fixed-value deposits are redeemable on demand. Such lending is provided only when endogenous liquidity generation does not provide liquidity to a solvent bank, leaving the central bank as the only means of obtaining liquidity.

Exceptional market intervention policy addresses potential instabilities arising from liquidity distortions in money markets. These policies determine the extent to which central banks lend to markets, as well as the means of such liquidity provision, including choice of term to maturity, collateral, and counterparties.⁸

7. For more on how the Bank of Canada implements monetary policy, see Bank of Canada (2007) and Engert, Gravelle, and Howard (2008).

8. *Fiscal agency policy* complements these various central bank lending policies. It contributes to financial system stability and efficiency by providing for the efficient pricing of government bonds, which are the benchmark for many other securities prices in the financial system.

When to Intervene

In deciding whether to intervene in an episode of financial market turbulence, a central bank should address three basic questions, which are considered here.

Will central bank instruments be effective?

In evaluating the potential effectiveness of its instruments, a central bank should focus on identifying the nature of the market failure causing the problem, and then judge whether its instruments are well suited to addressing the problem. Alternatively, a legislative, regulatory, supervisory, or market-practice change might, in some circumstances, be better suited to providing the incentives needed to correct the pricing inefficiency.

Central bank instruments are likely to be effective only when such intervention increases the willingness to participate in markets, either by increasing confidence that future prices will be more predictable and will reflect reduced liquidity premiums, or by reducing the stock of an illiquid asset held by the private sector.

What are the potential benefits of intervention?

The central bank is a public institution that helps manage the macroeconomy and should therefore consider only benefits that are evident at a macroeconomic level. In assessing the possible benefits of intervention, the following elements should be considered.

- The value of avoiding increasing financial system dysfunction that could occur from inaction.
- The avoided loss of selling assets at fire-sale prices, which could lead to insolvency and implies dead-weight losses to the economy.
- The avoided cost of loss of confidence in the financial system. For example, a major banking crisis specific to a country could cause international investors to demand a risk premium, which would constrain national growth.
- Benefits will be greater the more strongly economic activity is linked to the market under stress.

What are the potential costs of intervention?

In evaluating the possible costs of intervention, a central bank should assiduously guard against losing focus on its primary responsibility of low and stable inflation. A central bank should also mitigate financial risks to itself that may arise from intervention. Another cost of intervention relates to creating a sense of crisis when there is none (a false negative signal), by intervening when there is no need.

Finally, “moral hazard” is a major consideration. Moral hazard is the prospect that a party protected from risk will behave differently from the way it would behave if it were fully exposed to the risk, and, in particular, with less regard for the consequences of its actions, expecting another party to bear the consequences of those actions.

If the central bank intervenes only in true liquidity crises, then moral hazard would be limited to a distortion of the incentives to manage liquidity efficiently. Liquidity risk and solvency risk are often confounded, however, making it difficult in practice to determine when to intervene. This also raises the prospect that central bank intervention could discourage financial market participants from managing counterparty (credit) risk appropriately, with attendant adverse effects on the functioning of the financial system. As well, central bank intervention can create incentives for institutions to generate the conditions that would trigger such intervention, so that they can benefit.⁹

In sum, whenever a central bank intervenes, there are costs, and intervention creates the potential for moral hazard. To the extent that private agents expect a central bank to provide liquidity whenever financial markets encounter difficulties, private agents will take less care in managing their liquidity and counterparty risks, which could make markets work less well in the future.

9. Explanations of financial crises often involve elements of moral hazard, usually excessive risk-taking behaviour encouraged by poorly designed safety nets. Similarly, the economic literature suggests that financial systems with more conservative regulatory environments are better able to withstand crises (Benston and Kaufman 1997; Caprio 1998; Dziobek and Pazarbasioglu 1997; and Furlong and Kwan 2006).

Mitigating moral hazard

One way of limiting the effects of moral hazard is to intervene only under very adverse circumstances. The central bank could apply its tools selectively so that private agents are unlikely to perceive such actions as a reason to change their ongoing behaviour.

In this regard, the application of a test would be useful to determine when intervention would be appropriate. The following test, consistent with the questions posed in the preceding section, as well as the tests proposed by Summers (2007) and Buiter (2007), could be used to inform a decision on whether to intervene.

- Is there a significant common shock, substantial contagion, or negative spillover effects, with the prospect of significant real consequences?
- Is the problem primarily a liquidity problem, where a contribution to stability can be provided with high probability? (In contrast, if the problem is mainly one of solvency, central bank intervention is unlikely to be successful.)
- Is it reasonable to expect that intervention will not impose costs on taxpayers?
- Is the intervention unlikely to have a material impact on the likelihood and severity of future financial crises? (This would encompass, among other things, consideration of the nature of the intervention mechanism.)
- Will this action produce a net social benefit?

If the answers to these questions are “yes,” then there is likely a good case for the central bank to intervene. Importantly, this test suggests that intervention would be infrequent and would be associated with financial losses for market participants, which would provide an element of coinsurance to also help mitigate moral hazard.

Further, a penalty rate chosen at the discretion of the central bank could apply to the provision of central bank funds to individual institutions in this context.¹⁰ Finally, a central bank should promote the sound supervision of liquidity and

10. Penalty rate here means a premium above the central bank’s policy rate. (In Canada, the policy rate is the overnight interest rate, and the Bank of Canada’s minimum lending rate is the Bank Rate, that is, the overnight rate plus 25 basis points.)

related risks, and maintain some oversight of the management of liquidity risk by potential borrowers to help mitigate the costs and risks of intervention.

How to Intervene

Principles

A central bank should intervene only when there is a market failure and when significant financial instability can be avoided or mitigated without distorting the pricing of credit risk. The preceding discussion gives rise to five principles that should guide the use and design of central bank intervention facilities.¹¹

(i) *Targeted intervention*: Mitigate only those market failures (liquidity distortions) of system-wide importance with macroeconomic consequences and which can be rectified by a central bank. This principle acknowledges that the central bank cannot solve all problems, and indicates that the central bank should intervene only when the problem is one that is likely to materially affect the macroeconomy and one that could be reasonably addressed by central bank intervention.

(ii) *Graduated intervention*: Intervention should be commensurate with the severity of the problem. This principle recognizes that there is a cost associated with the central bank doing too much. It suggests an escalated response that depends on the severity of the problem to guard against central bank overreaction.

(iii) *Well-designed intervention*: Use the right tools for the job. Market-based transactions, provided through auction mechanisms, should be used to alleviate marketwide liquidity problems, while loans should be used to address liquidity shortages affecting specific institutions.

(iv) *Efficient, non-distortionary intervention*: Central bank transactions should be at market-determined prices to minimize distortions. In particular, central bank intervention should not distort credit-risk spreads, because this will create additional problems.

(v) *Mitigation of moral hazard*: The risk of creating adverse incentives that could impair the

functioning of the financial system over time should be considered carefully, and measures should be taken to mitigate such risks. Such measures include limited, selective intervention; an element of coinsurance; penalty rates as appropriate; and promoting the sound supervision of liquidity-risk management.

Auction mechanisms

Central bank intervention in markets (as opposed to loans to institutions under standing liquidity facilities) would likely be best achieved through auction mechanisms initiated at the discretion of the central bank. An auction format provides several benefits:

- Pricing is set competitively in an auction, and so generally should lead to the efficient pricing of the asset being auctioned.¹²
- The stigma that can be attached to central bank lending could be mitigated or avoided because an auction is a collective mechanism involving several borrowers simultaneously.
- An auction can reveal information about market conditions useful to the central bank in managing the situation.
- An auction provides flexibility to vary the key parameters of the transaction: that is, the term, eligible counterparties, and eligible securities, depending on the situation.
- Appropriately designed, an auction can help the market find more efficient pricing and encourage the recovery of a troubled market.

Different facilities for different circumstances

Along with traditional central bank tools, such as lender-of-last-resort arrangements, a range of facilities is likely necessary for the provision of liquidity to the financial system, each with distinct characteristics suitable for different circumstances.

11. Any intervention by the Bank of Canada would be in accordance with the terms of relevant statutes, most importantly, the Bank of Canada Act.

12. An auction might not reveal the correct price of the asset being sold (for allocative efficiency) when there is extreme uncertainty about the future market value of the asset. Nevertheless, compared with other mechanisms, auctions appear to be a fairly robust and efficient means of allocating resources (Chapman, McAdams, and Paarsch 2007).

Term purchase and resale agreements (or term repos) would be most useful for providing liquidity to money markets since they can be offered to any financial market participants with marketable securities as the basis for the transaction. Term repos would be most useful when liquidity premiums in money markets are distorted and are associated with widespread liquidity problems in an asset class or maturity.

Term securities lending would increase the supply of high-quality securities that could be used for collateral at times when there is a shortage of such collateral needed for funding. This mechanism can also provide for a direct exchange of less-liquid securities for more-liquid securities, thus reducing the incentive to hoard liquidity for precautionary purposes.

Term loan facilities could be most useful when liquidity premiums in money markets are distorted because specific financial institutions had particular liquidity shortages. Such an operation could be conducted through an auction (subject to a minimum bid rate) when at least two eligible institutions are facing pronounced liquidity problems in this context, but do not yet need emergency lending assistance from the central bank.¹³

Concluding Remarks

Our conclusions can be summarized as follows.

First, central banks should provide liquidity to financial markets in extraordinary circumstances because: markets require liquidity for efficient pricing, illiquidity can contribute to financial system instability with real economic consequences, and a central bank's unique characteristics make it well suited to be the ultimate provider of liquidity to the financial system.

Second, a central bank should intervene to address financial market turbulence only when there is a significant market failure and significant financial instability and macroeconomic consequences could be avoided or mitigated.

Third, a central bank should price the provision of liquidity to financial markets competitively through auctions.

Fourth, a central bank should have a range of facilities with which to provide liquidity to financial markets, to better focus the provision of liquidity as needed. These include term repos, term securities lending, and term lending.

Fifth, the provision of liquidity to financial markets should be guided by the following principles.

- Targeted intervention
- Graduated intervention
- Well-designed intervention
- Efficient, non-distortionary intervention
- Mitigation of moral hazard

References

- Allen, F. and D. Gale. 2007. "An Introduction to Financial Crises." Wharton Financial Institutions Center Working Paper No. 07-20.
- Bank of Canada. 2004. "Bank of Canada Lender-of-Last-Resort Policies." Bank of Canada *Financial System Review* (December): 49–56.
- . 2007. "A Primer on the Implementation of Monetary Policy in the LVTS Environment." Available at <http://www.bankofcanada.ca/en/lvts/lvts_primer_2007.pdf>.
- Banque de France. 2008. *Financial Stability Review*. Special issue on liquidity (February) (11).
- Benston, G. and G. Kaufman. 1997. "FDICIA after Five Years." *Journal of Economic Perspectives* 11 (3): 139–58.
- Buiter, W. 2007. Comment on "Beware the Moral Hazard Fundamentalists," by L. Summers, *Financial Times Economists Forum*, 26 September. Available at <<http://blogs.ft.com/wolfforum/2007/09/beware-the-morahtml/#comments>>.
- Caprio, G. 1998. "Banking on Crises: Expensive Lessons from Recent Financial Crises." World Bank Policy Research Working Paper No. 1979.

13. According to the Bank of Canada Act, the Bank of Canada can lend only to members of the Canadian Payments Association.

- Carney, M. 2008. "Principles for Liquid Markets." Speech to the New York Association for Business Economics, New York, 22 May.
- Chapman, J, J. Chiu, and M. Molico. 2008. "A Model of Tiered Settlement Networks." Bank of Canada Working Paper No. 2008-12.
- Chapman, J., D. McAdams, and H. Paarsch. 2007. "Bounding Revenue Comparisons across Multi-Unit Auction Formats under ϵ -Best Response." *American Economic Review* 97 (2): 455–58.
- Daniel, F., W. Engert, and D. Maclean. 2004–05. "The Bank of Canada as Lender of Last Resort." *Bank of Canada Review* (Winter): 3–16.
- Dziobek, C. and C. Pazarbasioglu. 1997. "Lessons from Systemic Bank Restructuring: A Survey of 24 Countries." IMF Working Paper No. 97/161.
- Engert, W., T. Gravelle, and D. Howard. 2008. "The Implementation of Monetary Policy in Canada." Bank of Canada Discussion Paper No. 2008-9.
- Furlong, F. and S. Kwan. 2007. "Safe and Sound Banking, Twenty Years Later: What Was Proposed and What Has Been Adopted." Prepared for the Conference on Safe and Sound Banking: Past, Present, and Future, sponsored by the Federal Reserve Banks of Atlanta and San Francisco and *The Journal of Financial Services Research*, 17 August 2006, Federal Reserve Bank of Atlanta *Economic Review* 92 (1, 2).
- Summers, L. 2007. "Beware the Moral Hazard Fundamentalists." *Financial Times Economists Forum*, 24 September. Available at <http://blogs.ft.com/wolfforum/2007/09/beware-the-morahtml/#comments>.