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Bank of Canada Review

Autumn 2009

Special Issue

The Financial Turmoil
of 2007-2009:
Selected Essays



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Subscriptions for print are available, as follows:

Delivery in Canada:	Can\$25
Delivery to the United States:	Can\$25
Delivery to all other countries, regular mail:	Can\$50

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Remittances in Canadian dollars should be made payable to the Bank of Canada. Canadian orders must include 5 per cent GST, as well as PST, where applicable.

ISSN 0045-1460 (Print)
ISSN 1483-8303 (Online)
Printed in Canada on recycled paper

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Bank of Canada Review

Autumn 2009

The Home Bank of Canada

Paul Berry, Chief Curator, Currency Museum

Historically, Canada's financial institutions have enjoyed a reputation for safe, sound, and prudent management. On rare occasions, however, spectacular failures have occurred, resulting in substantial losses for Canadians. The failure of the Home Bank of Canada in 1923 was one such case.

Originally established in Toronto, Ontario, as a building and loan society, the Home Bank of Canada was chartered in 1903 during a period of heightened economic activity that saw the establishment of several chartered banks in Canada. Yet, on 17 August 1923, the bank closed all of its 71 offices in Ontario, Quebec, and the western provinces. It subsequently became clear that the bank had made sizable bad loans to companies in which several of the Bank's senior managers had an interest, and the president, vice-president, and several directors were arrested and eventually convicted of fraud for falsifying the bank's true position. The directors' convictions were later overturned because they had been unaware of the Bank's real state, having been misled by the president, H. J. Daly, who died before his trial started, and the former general manager, James Cooper-Mason, who died a few days before the bank suspended operations.

In the end, the bank's assets were insufficient to cover its more than \$4 million in losses, which wiped out its capital and reserve fund and left it with a deficit of \$1.8 million. Although shareholders had been required to pay double liability for their investment, depositors received only 25 cents on the dollar from the liquidator

against sales of the Home Bank's assets. An additional 35 cents was paid to those having deposits of \$500 or less from a special relief fund approved by Parliament in 1925.

The failure of the Home Bank shook public confidence, causing several runs on other banks. To shore up public faith, the Ontario government announced that it had made a sizable deposit in the Dominion Bank in Toronto, a move that was recognized as successfully combining prudence and enterprise. The long-term result, however, was improved government regulation of banks. In 1923, during the debate over the revision of the Bank Act, there had been calls for greater public scrutiny of bank activities, but no action was taken then, since it was believed that the controls in place were adequate and that such oversight could not be executed efficiently.

In response to the failure of the Home Bank, as well as to public concern over several other banking matters, the federal government established the Office of the Inspector General of Banks, a forerunner of the present Office of the Superintendent of Financial Institutions, with powers to investigate the financial affairs of each bank in Canada at least once a year and to report its findings to the Minister of Finance.

The artifacts pictured on the cover are part of the National Currency Collection, Bank of Canada.

Photography by Gord Carter, Ottawa.

Contents

SPECIAL ISSUE

THE FINANCIAL TURMOIL OF 2007–2009: SELECTED ESSAYS

Introduction

- 1 The Financial Turmoil of 2007–2009: Selected Essays**
-

Articles

- 3 Bank of Canada Liquidity Actions in Response to the
Financial Market Turmoil**
- 23 Understanding Corporate Bond Spreads Using Credit
Default Swaps**
- 33 Agency Conflicts in the Process of Securitization**
-

- 48 Bank of Canada Publications**
-

The Financial Turmoil of 2007–2009: Selected Essays

Scott Hendry, Guest Editor

Starting in August 2007, the worst financial crisis since the Great Depression began to significantly affect financial markets and real production worldwide. What began in the U.S. subprime mortgage market soon propagated to virtually every market and economy in the world. The effects of this crisis are still being felt today as economies work to regain lost ground. Central banks everywhere, including the Bank of Canada, were at the forefront of the policy response to contain, and eventually reduce, the effects of the crisis and continue to refine policies designed to promote financial stability.

This issue of the *Bank of Canada Review* highlights just a small sample of the work done within the Bank to help monitor, understand, and respond to the crisis.

In their article “Bank of Canada Liquidity Actions in Response to the Financial Market Turmoil,” Lorie Zorn, Carolyn Wilkins, and Walter Engert discuss the repeated interventions by the Bank of Canada to stabilize the domestic financial system and limit the repercussions of the crisis on the Canadian economy. They review the extraordinary liquidity measures taken by the Bank during this period and the principles that guided the Bank’s interventions. A preliminary assessment of the term liquidity facilities provided by the Bank suggests that they were a key source of funding liquidity support for important financial institutions and, on a broader basis, served to reduce uncertainty among market participants about the availability of funding liquidity, as well as helping to promote a return to well-functioning money markets.

Alejandro Garcia and Jun Yang examine the significant widening of corporate bond spreads worldwide since the beginning of the credit crisis in “Understanding Corporate Bond Spreads Using Credit Default Swaps.” They study default and liquidity risk—the main components of the corporate bond spread—for Canadian firms that issue bonds in the U.S. market, focusing in particular on their evolution during the credit crisis. During this period, the liquidity component is found to have increased more for speculative-grade bonds than it did for investment-grade bonds, consistent with a “flight-to-quality” phenomenon. For policy-makers seeking to address problems in credit markets, an important implication of these results is that liquidity risk in corporate spreads for investment and speculative bonds behaves differently than default risk, especially during crisis episodes.

In the final article, “Agency Conflicts in the Process of Securitization,” Teodora Paligorova reviews the agency conflicts, or conflicts of interest, between participants in the securitization process that contributed to the ongoing financial turmoil. Recent evidence finds a positive association between the prevalence of inferior-quality loans and the growth in securitized products. There are conflicting views as to the causes of this, but agency conflicts and the lack of incentives for originators to screen and monitor the ongoing performance of securitized loans were important contributors to the problem. The article highlights as well the most recent policy measures and potential solutions for ameliorating these agency issues.

Bank of Canada Liquidity Actions in Response to the Financial Market Turmoil

Lorie Zorn, Carolyn Wilkins, Financial Markets Department, and Walter Engert, Financial Stability Department*

- *The Bank of Canada intervened repeatedly during the recent financial crisis to provide extraordinary liquidity directly to financial market participants in order to stabilize the financial system.*
- *Over this period, the Bank's traditional liquidity framework was expanded in four key areas: terms to maturity, amounts, counterparties, and eligible securities.*
- *New liquidity tools were developed in accordance with a set of guiding principles.*
- *Although the regular term PRA facility was the most heavily used, the availability of all of the Bank's extraordinary liquidity facilities may have mitigated market stress and helped to restore well-functioning markets.*

The Bank of Canada fosters the safety and efficiency of the financial system, both in Canada and internationally. One of the means used by the Bank to achieve this goal is to provide liquidity to the financial institutions, financial markets, and payment, clearing, and settlement systems that form Canada's financial system. During the recent financial crisis, the Bank of Canada developed a series of new liquidity tools, and used its traditional tools as well, to stabilize the financial system and limit the repercussions to the Canadian economy.

At the onset of the crisis, which began in August 2007 and continued into 2009, global credit markets experienced sharp reductions in market liquidity, which caused some financial institutions to experience considerable trading losses.¹ Financial institutions around the world generally became more cautious about lending to each other and began to hoard liquidity for precautionary purposes. The resulting increase in interbank borrowing costs spread to other markets. As funding costs increased and funding liquidity declined, the capacity and willingness of financial institutions to make markets was reduced. This contributed to further declines in market liquidity. At several points during the period, interbank lending and other short-term funding markets ceased to exist for terms greater than overnight. As risk aversion increased, institutions became reluctant to extend credit more broadly, with serious economic implications worldwide.

Given this backdrop, central banks and governments around the world undertook a number of unprecedented actions to stabilize the financial system and

¹ There are three types of liquidity relevant to financial markets. Market liquidity refers to the ease with which financial asset positions of reasonable size can be traded with little price impact. Funding liquidity refers to the ability of solvent institutions to obtain immediate means of payment to meet liabilities coming due. Central bank liquidity refers to access to money from the central bank.

* Walter Engert is now with the Office of the Superintendent of Financial Institutions.

reduce the severity of the ensuing global recession.² The Bank of Canada, along with other central banks, intervened repeatedly to provide liquidity to financial market participants to mitigate the risks of serious financial disturbances and improve credit conditions. This article is focused on the liquidity actions taken by the Bank during this period to ensure that adequate liquidity was available to key financial institutions in Canada.

The Bank's decisions to intervene in markets were based on judgments that its actions could reduce the liquidity distortions, and that the benefits of alleviating financial system dysfunction would outweigh the potential costs of taking on additional financial risk and creating incentives for moral hazard (Engert, Selody, and Wilkins 2008). The Bank's provision of extraordinary liquidity has been guided by the following five principles.

- (i) Intervention should target distortions of system-wide importance.
- (ii) Intervention should be graduated, commensurate with the severity of the problem.
- (iii) The means of intervention should be well designed, using tools appropriate for the problem being addressed.
- (iv) Intervention should be efficient and non-distortionary.
- (v) Measures should be taken to mitigate moral hazard.

The following section reviews the extraordinary liquidity measures taken by the Bank to stabilize the financial system.³ This is followed by a discussion of how the Bank applied the guiding principles set out above. An overview is then provided of how the various liquidity facilities implemented by the Bank in the past two years were used, including an assessment of their performance. The final section outlines outstanding issues for future consideration.

2 See **Appendixes 1 and 2** for summaries of the initiatives undertaken over the 2007–09 period by the Bank of Canada and the federal government, respectively, in support of the financial system. A summary of the international initiatives, beginning in September 2008, is available at: <http://www.newyorkfed.org/research/global_economy/policyresponses.html>.

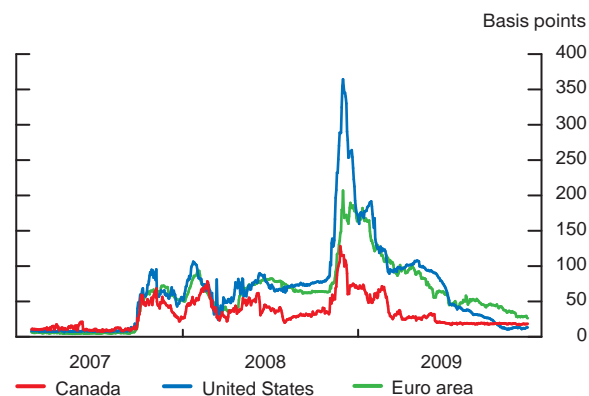
3 All data presented in this article are updated to 30 October 2009.

Liquidity Measures to Address the Financial Market Turmoil

During the summer and fall of 2007, the worsening performance of subprime mortgages in the United States led to investor concerns about asset-backed securities (ABS) backed in whole or in part by these mortgages. These concerns motivated a broad repricing of risk, first in the market for structured products, but then more broadly in global credit markets. Market participants became concerned about the financial health of counterparties, particularly of banks whose capital was perceived to be eroding, as trading losses mounted and reintermediation from securitized products occurred. This led to a significant increase in interest rate spreads and a reduction in liquidity in short-term bank-funding markets in many countries⁴ (**Chart 1** shows spreads between the London Interbank Offered Rate (LIBOR), the European Interbank Offered Rate (EURIBOR), and the Canadian Dealer Offered Rate (CDOR) and the rates for overnight index swaps (OIS) in their respective regions). There is evidence that this increase in spreads, at least in Canada, reflected increases in both credit and liquidity risks. (See Garcia and Yang, this issue, for evidence using spreads on credit default swaps.)

In Canada, the immediate effects were most acute in the market for the short-term debt of banks and corporations. The market for asset-backed commercial paper (ABCP) froze, and Canadian-bank issuers

Chart 1: Spreads between 3-month interbank offered rates^a and overnight index swap rates



a. For the United States, LIBOR; for the euro area, EURIBOR; and for Canada, CDOR. Source: Bloomberg

4 For a more detailed review of the circumstances that led to the financial crisis, see Carney (2008a) and International Monetary Fund (2007).

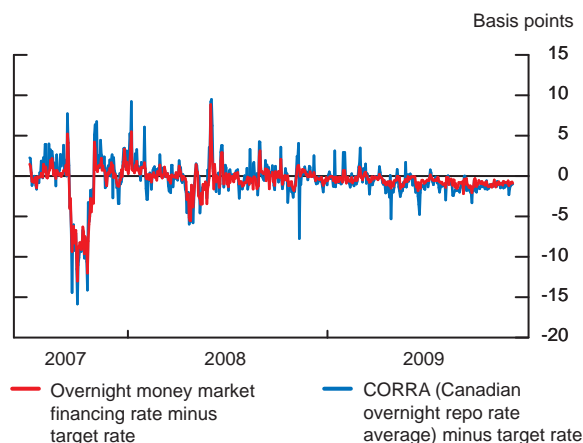
of ABCP were forced to take these securities back onto their balance sheets.⁵ In an environment of increasing risk aversion, this restricted the ability of these institutions to meet their funding needs and made them more cautious with respect to liquidity management. Short-term credit markets—specifically ABCP, commercial paper (CP), bankers' acceptances (BAs), and interbank lending—as well as repo markets experienced sharp declines in market liquidity and large increases in spreads relative to expected overnight interest rates. For a short time in Canada, there was a reluctance to lend in the money market for terms longer than a few days, and for several months, activity in some short-term markets (e.g., CP) was reduced for terms greater than one week.

The Bank of Canada responded rapidly at the onset of the crisis, using its traditional liquidity tools.

The Bank of Canada responded rapidly at the onset of the crisis, using its traditional liquidity tools. At the time, the focus of the Bank's liquidity framework was to reinforce the target for the overnight rate (the key means for achieving the Bank's monetary policy objectives and the anchor of the yield curve) by adjusting overnight liquidity through transactions with a limited set of counterparties on the basis of the most liquid, high-quality securities. As pressures in short-term funding markets emerged, the Bank intervened by conducting overnight buyback operations of Government of Canada (GoC) securities with primary dealers and by increasing daily excess settlement balances in the financial system.⁶

⁵ See Kamhi and Tuer (2007) for a review of the developments regarding ABCP in Canada.
⁶ The target for the overnight interest rate can be reinforced through transactions using overnight special purchase and resale agreements (SPRAs) or sale and repurchase agreements (SRAs) at the target overnight rate. SPRAs are used to inject intraday liquidity if the collateralized overnight rate is trading above the target, and SRAs are used to withdraw intraday liquidity if the collateralized overnight rate is trading below the target. Typically, these transactions are sterilized at the end of the day (i.e., the cash impact of these transactions on the level of settlement balances in the financial system is offset), leaving daily aggregate liquidity unchanged. The Bank can also adjust target end-of-day settlement balances in the financial system to relieve pressures on the overnight interest rate. For more information on these and related considerations, see Engert, Gravelle, and Howard (2008).

Chart 2: Spreads between overnight rates in Canada and the target for the overnight rate



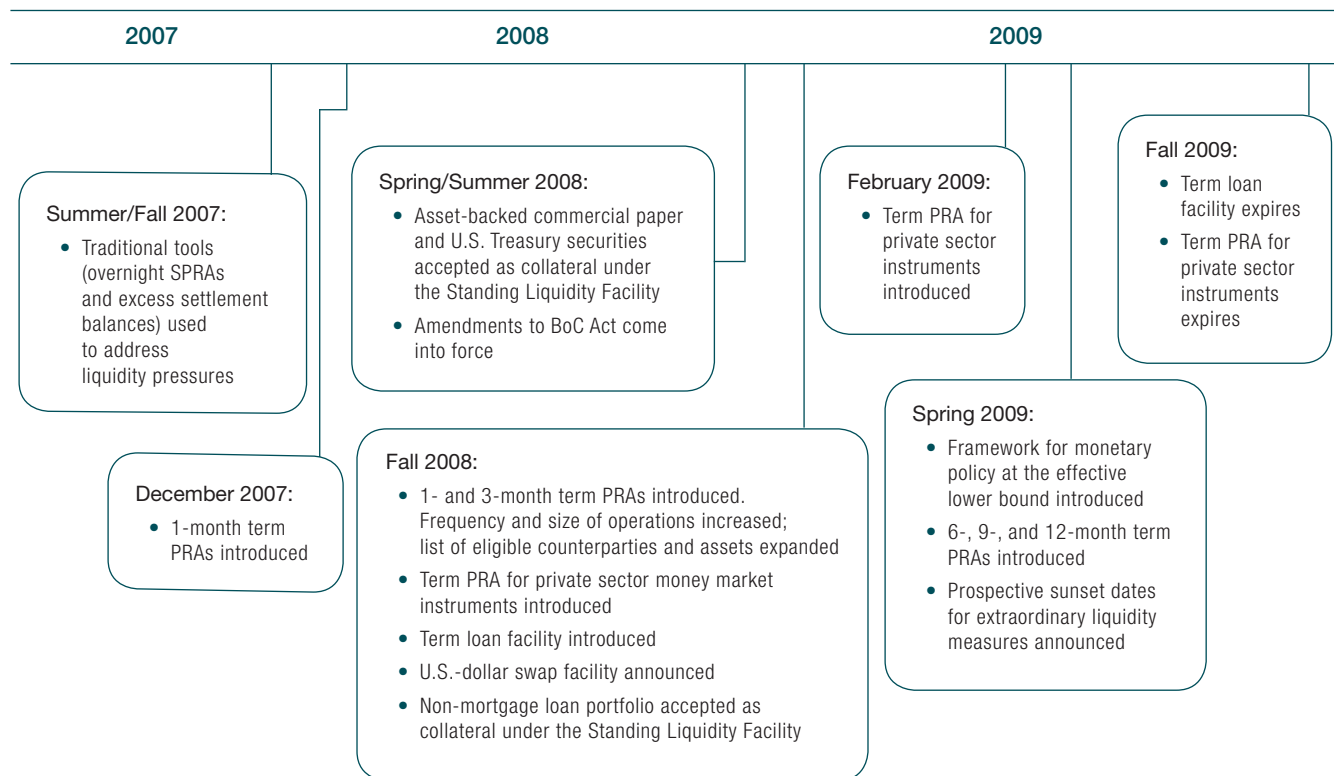
Source: Bank of Canada

These actions, which continued through the fall of 2007, supplied major financial institutions with liquidity at the shortest term and helped to contain overnight financing rates close to the Bank's target (**Chart 2**).⁷ (These traditional liquidity tools were effective throughout the period of financial market turmoil and continue to be an important component of the implementation of monetary policy in Canada.) In addition, the Bank's Standing Liquidity Facility continued to be available to address any temporary shortfalls of settlement balances in Canada's large-value payment system.⁸ As well, the Bank stood ready to provide emergency lending assistance to solvent financial institutions facing serious and persistent liquidity problems.⁹

As the situation deteriorated, the Bank gradually expanded its liquidity framework in four areas: terms

⁷ The unusually large negative gap in August and September 2007 between collateralized overnight financing rates (the Canadian overnight repo rate average [CORRA] and the money market financing rate) and the Bank's target rate did not reflect broader overnight funding conditions. Indicators of *uncollateralized* overnight rates, such as overnight Northbound (U.S.-dollar/Canadian-dollar) swap rates and overnight Canadian-dollar LIBOR rates, were significantly higher than the target rate; this was corroborated by anecdotal evidence from market participants. This suggests that, at the time, some segmentation between domestic and foreign financial institutions was likely occurring in overnight funding markets.
⁸ The Standing Liquidity Facility supports settlement in the Large Value Transfer System (LVTS) by providing collateralized overnight loans to direct participants in the system that are experiencing temporary shortfalls in their settlement balances. For more information, see Engert, Gravelle, and Howard (2008).
⁹ See Bank of Canada (2004) for the Bank's lender-of-last-resort policies.

Figure 1: Evolution of the Bank of Canada's liquidity framework, 2007–09



Source: Bank of Canada

to maturity, amounts, counterparties, and eligible securities.¹⁰ **Figure 1** summarizes this evolution.¹¹

The trigger for the expansion of the Bank's liquidity framework came in the latter part of 2007. The financial reporting requirements of global banks (at fiscal year-ends) and related increases in funding needs had exacerbated the continuing desire to maintain a high level of balance-sheet liquidity. When combined with concerns about the soundness of some global financial institutions, credit market liquidity was further reduced around the world, including in Canada, and yield spreads rose on a broad range of credit assets. The spread between the rates in Canadian term money markets and the expected overnight rate increased markedly in late 2007.

(**Chart 3** provides an example, using CDOR as an approximation of bank funding costs, and OIS rates to estimate expected overnight rates.¹²) These pressures diminished somewhat in the new year, only to re-emerge in March 2008 when Bear Stearns, a major U.S. investment bank, began experiencing severe credit and liquidity problems.¹³

To address these heightened pressures in short-term funding markets, in December 2007, the Bank of Canada conducted term purchase and resale agreements (PRAs) with primary dealers against an expanded set of eligible securities, with maturities

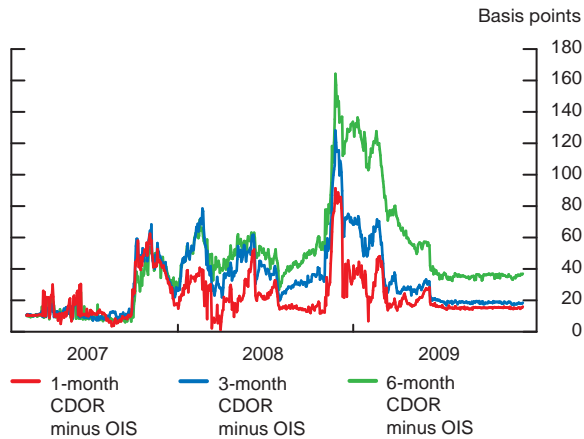
¹⁰ Other central banks took similar measures proportional to the severity of the financial market turmoil being experienced in their respective regions. See CGFS (2008) for a discussion of central bank actions up to the spring of 2008.

¹¹ Amendments to the Bank of Canada Act came into force on 5 August 2008, providing the Bank with greater flexibility to purchase and sell a wider range of securities for the purposes of conducting monetary policy and supporting financial system stability. See Bank of Canada (2008) for more on these provisions.

¹² CDOR is the average bid rate on Canadian BAs for specific terms to maturity, determined daily from a survey of principal market-makers, and provides the basis for a floating reference rate in Canadian-dollar wholesale and interest rate swap transactions. Since BA issuance and rates can vary widely across banks, CDOR is an imperfect measure of bank funding costs.

¹³ Bear Stearns experienced staggering losses on its securities portfolio and could not meet its obligations to creditors. The Federal Reserve averted the collapse of Bear Stearns by facilitating its purchase by JPMorgan Chase.

Chart 3: Spreads between Canadian bank funding costs and the expected overnight rate



Note: The Canadian Dealer Offered Rate (CDOR) is used to approximate bank funding costs, and overnight index swap (OIS) rates are used to approximate expected overnight rates. Source: Bloomberg

extending over the 2007 year-end.¹⁴ This marked the first time that liquidity operations extending beyond one business day were conducted to support funding liquidity; prior to December 2007, term PRAs had only been conducted on an occasional basis to address seasonal fluctuations in the demand for bank notes.¹⁵ Term PRAs were offered again beginning in March 2008 on a biweekly basis. The Bank also expanded the set of assets acceptable as collateral to secure intraday exposures in the LVTS and, correspondingly, for loans provided under the Standing Liquidity Facility, to include certain types of ABCP¹⁶ (in March 2008) and U.S. Treasury securities (in June 2008). These assets could replace other, more-liquid collateral pledged in the LVTS, which, in turn, could be used more easily by financial institutions to obtain market-based funding.

As pressures in global financial markets eased temporarily during the spring of 2008, the Bank wound down its term PRA operations. By June 2008, funding conditions in Canadian money markets for terms up to three months had improved relative to

those in other major currencies. On 10 July 2008, the Bank announced that it would not renew maturing term PRA.

Severe financial market pressures re-emerged in the fall of 2008, sparked by a series of failures and near-failures of financial institutions in the United States and Europe. The most significant was the bankruptcy, in September 2008, of Lehman Brothers, a major U.S. financial institution. Concerns intensified about financial institution losses and capital adequacy, and already tight liquidity conditions in short- and long-term funding markets around the world became even more restrictive. By early October 2008, the ability of both financial and non-financial borrowers to obtain market-based financing was seriously impaired in global markets. Credit spreads spiked to unprecedented levels, and interbank and wholesale funding markets ceased to exist in many countries for terms longer than overnight.

The deterioration in Canadian financial markets was much less severe than elsewhere (Chart 1), although liquidity was limited at all maturities, and trading volumes were thin. Demand for BAs and ABCP was limited to maturities of less than one month, and the spread between CDOR and the expected overnight rate hit record levels (Chart 3). Canadian financial institutions became increasingly more conservative in their management of liquidity and their balance sheets, which adversely affected funding and market liquidity more generally.

The Bank aggressively expanded its provision of liquidity by transacting more frequently with a broader range of counterparties, for longer terms, and against a wider range of eligible securities.

¹⁴ The primary dealers are BMO Nesbitt Burns Inc., Casgrain & Company Ltd., CIBC World Markets Inc., Desjardins Securities Inc., Deutsche Bank Securities Ltd., HSBC Securities (Canada) Inc., Merrill Lynch Canada Inc., Laurentian Bank Securities Inc., National Bank Financial, RBC Dominion Securities Inc., Scotia Capital Inc., and the Toronto-Dominion Bank.

¹⁵ The Bank of Canada can purchase GoC securities via term repo transactions to temporarily increase its assets to offset a temporary increase in its bank note liabilities.

¹⁶ There are strict eligibility requirements for ABCP securities, such that only those securities with minimal credit and liquidity risk are accepted. See: <http://www.bankofcanada.ca/en/notices_fmd/2009/securities_collateral060309.pdf>.

Canada, nor was it expected to.)¹⁷ This was part of various coordinated central bank actions designed to address elevated pressures in U.S.-dollar short-term funding markets.¹⁸

Shortly afterwards, the Bank aggressively expanded its provision of liquidity by transacting more frequently with a broader range of counterparties, for longer terms, and against a wider range of eligible securities. In particular, in response to increased pressures in term funding markets, the Bank again conducted term PRAs, but the frequency was increased to weekly (from the biweekly schedule followed earlier), eligible counterparties were expanded to include LVTS participants in addition to primary dealers, and a 3-month PRA maturity was added.¹⁹ The Bank also temporarily broadened the list of securities eligible as assets in term PRA transactions to include own-issued ABCP, much of which had been taken back onto the balance sheets of banks.

The Bank also took other measures to improve liquidity conditions. First, on 17 October 2008, the Bank decided to temporarily accept as collateral the Canadian-dollar non-mortgage loan portfolios of LVTS direct participants (at a collateral-to-portfolio value of 60 per cent). Initially, these assets were eligible to secure intraday exposures in the LVTS and, correspondingly, to secure loans under the Standing Liquidity Facility. Then, on 12 November, the Bank introduced a term loan facility for direct participants in the LVTS, also secured by Canadian-dollar non-mortgage loan portfolios. Through a weekly auction, the term loan facility provided a backstop source of collateralized funding at competitively determined

rates (with the Bank Rate as the minimum bid rate). These measures enabled direct participants in the LVTS to use their non-marketable, illiquid balance-sheet assets as collateral for these specific purposes, thus permitting them to use conventional, liquid collateral elsewhere.

Second, on 14 October, the Bank introduced a term PRA facility aimed at other non-traditional counterparties—participants in the money market (ABCP, BAs, CP). This facility was expanded in February 2009 to provide liquidity to participants in Canadian private sector bond markets as well, and the list of securities accepted as collateral under this facility was correspondingly broadened to include investment-grade corporate bonds.

These various measures increased the amount of term liquidity outstanding to a peak of over \$40 billion by December 2008, as shown in **Chart 4**.

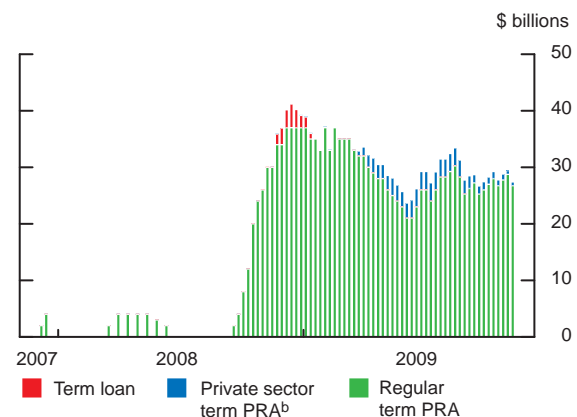
With the passing of year-end 2008, the initiatives taken by central banks and governments around the world began to have an impact, and the global financial turmoil dissipated. Funding conditions, particularly for terms of three months or less, and the liquidity of bank balance sheets improved. This was echoed in Canadian money markets more generally, as improvements in bank liquidity positions encouraged their intermediary and market-making activities. The Bank continued to offer extraordinary liquidity through its various facilities on a weekly basis, and the outstanding amounts remained at relatively elevated levels into the spring. (The Bank also eased liquidity conditions by further reducing its target overnight rate

17 Shortly afterward, the arrangement was expanded to provide up to \$30 billion in U.S.-dollar funding. This agreement between the Bank of Canada and the Federal Reserve has since been extended to 1 February 2010. The need to use this facility has not arisen because difficulties with U.S.-dollar funding mainly occurred in overseas markets, owing to time zone differentials and larger U.S.-dollar requirements. In addition, the major banks in Canada have U.S. operations and access to the Federal Reserve's discount window for U.S.-dollar funds.

18 In addition, in early October 2008, the Bank reduced its target overnight rate by 50 basis points in a move coordinated with other central banks to ease the pressure on global monetary conditions. This step was taken outside of the Bank's schedule for the setting of the target overnight rate. This was quickly followed by further rate cuts in Canada, for a cumulative reduction of 200 basis points between October 2008 and January 2009.

19 The LVTS participants are Alberta Treasury Branches, Bank of America National Assoc., Bank of Montreal, Bank of Nova Scotia, BNP Paribas (Canada), Caisse centrale Desjardins, Canadian Imperial Bank of Commerce, Credit Union Central of Canada, HSBC Bank Canada, Laurentian Bank of Canada, National Bank of Canada, Royal Bank of Canada, State Street Bank and Trust Company, and the Toronto-Dominion Bank. The securities dealer affiliates of eight of these participants are Bank of Canada primary dealers.

Chart 4: Amounts outstanding under the Bank's liquidity facilities^a



a. End-of-week par values

b. Term PRA for private sector money market instruments before 20 March 2009

Source: Bank of Canada

at its January, March, and April 2009 fixed announcement dates.) In April 2009, regular term PRA operations became part of the Bank's framework to implement monetary policy at the effective lower bound for overnight interest rates (see **Box**, p.10).

Into the summer and fall of 2009, financial market conditions continued to improve, and participation at central bank liquidity operations indicated a reduced need for the Bank's liquidity support. Prospective sunset dates for all of the Bank's extraordinary liquidity operations were announced at the end of June.²⁰ At the end of July, the Bank lowered its pre-announced minimum amounts for the regular term PRA auctions as well as that for the term PRA for private sector instruments and the term loan facility. The Bank subsequently announced on 22 September that, at the end of October, the term loan facility and the term PRA facility for private sector instruments would expire and the frequency of regular term PRA auctions would be reduced to biweekly from weekly. Despite a reduction in the amount offered at each PRA auction, the longer maturity profile of these operations (in support of the Bank's conditional commitment) maintained the amount of term liquidity outstanding at about \$27.5 billion by the end of October 2009. Finally, improved conditions in funding markets prompted the Bank to announce on 5 November that, beginning on 2 February 2010, it would gradually phase out its temporary measure allowing LVTS participants to assign their non-mortgage loan portfolios as eligible collateral for LVTS and Standing Liquidity Facility purposes.

Applying the Bank of Canada's Principles for Intervention

As noted above, in developing these additional liquidity tools during the financial crisis, the Bank was guided by a set of principles. This section considers how those principles were followed in practice.²¹

²⁰ On 25 June, the Bank announced that the regular term PRA would continue through to at least 31 January 2010; assignment of the non-mortgage loan portfolio as collateral for the Standing Liquidity Facility would continue until at least 1 February 2010; the term PRA for private sector instruments and the term loan facility would continue through to at least the end of October 2009; and that the reciprocal currency swap arrangement with the Federal Reserve was extended to 1 February 2010.

²¹ As explained in Longworth (2008), the Bank's actions, including the development of new liquidity policies and principles, were influenced by ongoing work in the BIS Committee on the Global Financial System and the Markets Committee that was aimed at strengthening central bank effectiveness in dealing with liquidity problems. See, for example, CGFS (2008).

Principle (i): Target distortions of systemwide importance

Application of the Bank of Canada's traditional liquidity tools was the appropriate response in the early stages of the financial market turmoil, given that problems were limited to a relatively small segment of financial markets. When it became clear that liquidity distortions were taking on systemwide importance, the Bank intervened. Particularly at the end of 2007 and during the fourth quarter of 2008, money markets were not functioning efficiently, and this had broader implications for the financial system as the normal generation of liquidity among system participants broke down. Increasing uncertainty related to credit and liquidity risk caused a reduction in money market activity, reduced the overall supply of liquidity, and inhibited its distribution among market participants. Investors grew increasingly cautious, and banks became more conservative in managing risk. As access to short-term funding decreased with respect to both amounts and maturities, market-making and lending activities were also sufficiently constrained so as to pose serious risks to the financial system. Consequently, the Bank of Canada expanded its role to provide funding liquidity directly to market participants to stabilize the financial system and to limit spillover effects to the broader economy.

When it became clear that liquidity distortions were taking on systemwide importance, the Bank intervened.

Principle (ii): Intervention should be graduated, commensurate with the severity of the problem

As the severity of the conditions changed, so too did the Bank's actions. Initially, funding difficulties at financial institutions were addressed by injecting liquidity through traditional channels; i.e., by offering overnight liquidity via open market operations with primary dealers, which could then be channelled through to other borrowers in need of liquidity. As market funding pressures persisted and extended into longer maturities in late 2007 and early 2008, the Bank correspondingly offered term liquidity, again through its traditional counterparties, as conditions warranted. As the credit and liquidity pressures intensified in the fall of 2008, the Bank's response

Term Liquidity Operations at the Effective Lower Bound for Overnight Rates

On 21 April 2009, the Bank of Canada announced that it would reduce its target for the overnight rate to 25 basis points, which it considers to be the effective lower bound (ELB) for that rate. It also committed to holding its policy rate at 25 basis points until the end of June 2010, conditional on the outlook for inflation. The Bank Rate, the rate at which LVTS participants access overdraft loans via the Standing Liquidity Facility, was correspondingly lowered to 50 basis points.¹

Several changes were made to the Bank's liquidity facilities to reinforce the Bank's conditional commitment, as well as to preserve the effective functioning of markets in a low interest rate environment.²

- First, minimum and maximum bid rates corresponding to the target overnight rate and the Bank Rate, respectively, were introduced for the regular term PRA facility. The minimum bid rate for the term PRA facility for private sector instruments was changed to the target overnight rate plus 25 basis points.
- Second, a portion of the Bank's existing stock of 1- and 3-month regular term PRAs were rolled over into 6- and 12-month terms. (In July 2009, the longest term for the regular term PRA was reduced from 12 months to 9 months and, in October, to 6 months; as of 31 October 2009, the longest maturity extends to 21 July 2010.)

- Third, a new standing overnight PRA facility was introduced for primary dealers, where funds could be accessed at the Bank Rate at their discretion rather than at the discretion of the Bank.
- The Bank also created excess settlement balances in the financial system; i.e., significantly more aggregate balances than required by direct participants in the LVTS. The Bank's target for daily settlement balances increased from \$25 million to \$3 billion.

With these changes, the Bank's term liquidity operations began to serve two objectives: financial system stability and monetary policy.

¹ The deposit rate, i.e., the interest rate paid on settlement balances (deposits) held at the Bank by direct participants in the LVTS, remained at 25 basis points. Because institutions would not have the incentive to lend at market rates below the deposit rate when they can earn that rate on balances held at the Bank, the deposit rate would provide a floor for the overnight rate.

² At very low interest rates, there is less incentive to participate in markets, owing to the compression of spreads and the corresponding reduction in potential trading profits.

escalated. Communications and actions were coordinated across central banks in recognition of the global nature of the problems and potential effects, and the Bank provided extraordinary term liquidity for larger amounts, for longer terms, to a broader set of counterparties, at more frequent intervals, and on the basis of a wider range of eligible securities. As general market conditions improved throughout the spring and into the early fall, the Bank gradually reduced the amounts of liquidity offered and discontinued facilities that were no longer required. The Bank's interventions thus evolved in accordance with the severity of the financial market dysfunction.

Principle (iii): Intervention must be well-designed; use the right tools for the job

As the market turbulence intensified in the fall of 2008, liquidity was not being reliably channelled beyond the Bank's traditional counterparties, nor was it accessible beyond the shortest terms or on the security of any but the most liquid and high-quality collateral. The Bank addressed this problem by providing liquidity to a wider range of financial institutions, at longer than usual terms, against a wider range of collateral. More specifically, money market liquidity problems were addressed by the Bank's term PRA facilities, while the term loan facility made liquidity available for financial institutions that may have had some difficulties in managing their balance sheets but whose difficulties were not serious enough to warrant emergency lending assistance. Further, adjustments in LVTS collateral enabled the release of conventional collateral for other uses (including term PRA with the Bank) and facilitated the subsequent establishment of the term loan facility, which is secured by the Canadian-dollar non-mortgage loan portfolios of LVTS direct participants. In these ways, the Bank implemented tools designed for particular market dislocations.

In providing liquidity during the crisis, the Bank relied heavily on buyback transactions (most notably, term PRA). From the Bank's perspective, these instruments are effective because they work through both demand and supply channels, but take on much less credit risk than an outright purchase. That is, counterparties that have access to central bank funding through PRAs should be more willing to extend term funding to other financial institutions and will have less precautionary demand for funding, since they have a

greater assurance of meeting their liquidity needs.²² Creditors, in turn, should be more willing to fund institutions that have access to term PRA because of the greater assurance of timely repayment (reduced counterparty risk). Moreover, PRAs that are offered through auction may also help price discovery at a time when price discovery is impaired. From the perspective of financial institutions, the term PRA facilities were effective because they provided a means of temporary funding and supported a return to more normal market conditions, at which point private sector sources of funding became more readily available.

Principle (iv): Minimize market distortions

The liquidity facilities introduced by the Bank were designed to minimize the risk of market distortion. The facilities use an auction mechanism to allocate liquidity so that the price of liquidity is determined competitively by the participants, rather than by the Bank of Canada. The simultaneous and anonymous participation of many financial institutions may also minimize the potential for stigma that might be attached to receiving funds from the central bank under conditions of heightened risk aversion in financial markets. Both the term PRA facility for private sector instruments and the term loan facility were designed as backstop facilities with appropriate minimum bid rates, which provided the Bank with a natural means to exit from these facilities when market sources of liquidity were a more cost-effective alternative for potential participants. In addition, the facilities were designed to preserve the existing market structures. For example, in the term PRA facility for private sector instruments, bidding by private sector market participants was done through primary dealers, which reduced the risk that the Bank of Canada would crowd out traditional market-makers. Primary dealers were not eligible counterparties for these term funds, because they have access to the regular term PRA. Primary dealers could only bid indirectly on behalf of those who were eligible. Finally, intervention is aimed at mitigating liquidity risk that, in the Bank's judgment, is not in line with fundamentals; it does not attempt to alter credit risk.

²² Chapman and Martin (2007) support the notion of providing central bank liquidity through a tiered structure, because the provision of liquidity by the central bank to all market participants more broadly can distort the price of credit risk in the market to which the liquidity is provided. When a central bank has relatively less information than market participants, it should delegate the monitoring of credit risk to a subset of the market.

Principle (v): Mitigate moral hazard²³

The Bank of Canada has taken several precautions to mitigate the creation of perverse incentives that could adversely influence market behaviour. As noted above, the Bank intervened only in response to specific, extraordinary episodes of heightened liquidity pressures. Moreover, the liquidity facilities were introduced as temporary measures to reduce the incentives for eligible participants to change their behaviour. The Bank has also worked closely with the Office of the Superintendent of Financial Institutions, as well as with the federal Department of Finance and other domestic bodies that share information and coordinate actions on financial sector policy, to monitor the liquidity conditions and risk management of major financial institutions. As well, the Bank has monitored the results of each liquidity operation. With this and other financial market information (for example, spreads between CDOR and OIS rates), the Bank determines the appropriate minimum and actual auction amounts so that the availability of liquidity varies according to market conditions; i.e., with amounts increasing/decreasing only when conditions warrant. Finally, where applicable, the pricing of new facilities was constructed to preserve incentives to transact in private sector markets. For example, the minimum bid rates on the PRA facility for money market participants and the term loan facility were set to ensure that these facilities were only used as a backstop.

The Bank has taken several precautions to mitigate the creation of perverse incentives that could adversely influence market behaviour.

Use of the Bank of Canada's Liquidity Facilities

This section considers use of the regular term PRA facility, the term PRA facility for money market instruments, the term PRA facility for private sector instruments, and the term loan facility, and discusses how

the liquidity facilities may have in turn affected broader financial market conditions. Because it has been the workhorse of the Bank's extraordinary liquidity facilities, most of the discussion is related to the regular term PRA facility.

Regular Term PRA

Participation: This facility has been used intensively by eligible participants, particularly during periods of stress in domestic short-term funding markets. Until the spring of 2009, the rate of participation at each operation was typically about 70 per cent of those eligible, indicating strong and widespread demand. From May 2009 onwards, however, the participation rate dropped steadily as other alternatives to central bank funding became more cost-effective.

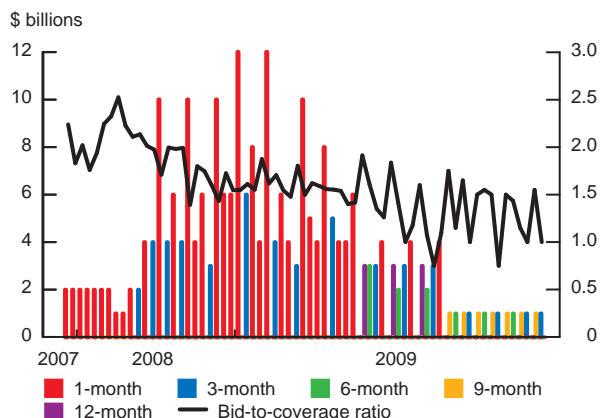
Bidding behaviour at the regular term PRA auctions has also reflected the demand for central bank funding, as measured by the bid-to-coverage ratio. As **Chart 5** illustrates, until the spring of 2009, the bid-to-coverage ratio ranged from about 1.5 to 2.5. The highest ratio was reached early in the crisis, but at that time the amount of funds offered by the Bank under the regular term PRA was relatively small, ranging from \$1 billion to \$2 billion. From October 2008 to July 2009, the auction sizes were greater, reaching as much as \$12 billion, and bids submitted at individual auctions peaked at \$19 billion. As the availability of shorter-term funds in the market improved in the spring of 2009, the bid-to-coverage ratio at the 1- and 3-month regular term PRA dropped. In contrast, bid-to-coverage ratios for the longer maturities recovered to levels seen earlier in the period, particularly once auction amounts were significantly reduced. Demand was higher for the newly introduced 6-, 9- and 12-month term funding, since auction participants wanted to lock in longer-term funding at attractive rates.

In sum, both participation rates and bidding behaviour reflected the changing demand for the regular term PRA facility as market conditions evolved over the period.

Securities used: A wide range of securities has been used in the regular term PRAs. As **Chart 6** shows, GoC securities typically made up less than 5 per cent of the securities used to acquire funds under the

²³ 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.

Chart 5: Term PRA: Auction size and bid-to-coverage ratios



Source: Bank of Canada

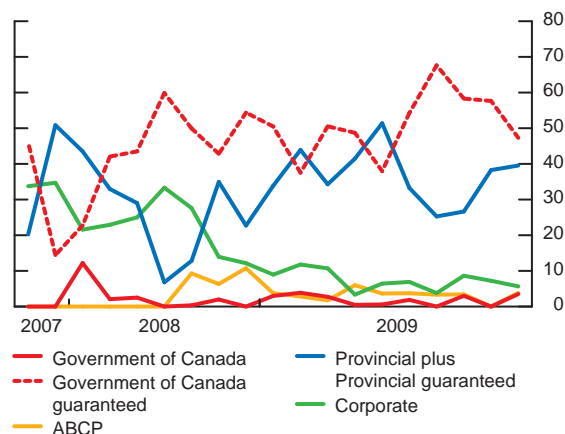
regular term PRA.²⁴ Increased aversion to liquidity risk meant that only the most liquid securities—GoC securities—could be funded in the market during the peak periods of financial market distress. As financial market conditions eased, participants continued to conserve their GoC securities for market funding rather than for central bank funding purposes. Consequently, less-liquid, but still high-quality securities issued by public sector entities have been heavily used in regular term PRA transactions with the Bank of Canada, including National Housing Act Mortgage-Backed Securities, Canada Mortgage Bonds issued by the Canada Housing Trust, and provincial government-issued and guaranteed bonds. Corporate bonds, corporate paper (including BAs), and ABCP have also been used to secure term PRA funding since they became eligible in the fall of 2008. These securities constitute about 30 per cent of those used during the most severe periods of market dislocation. ABCP represents a relatively small proportion of the securities used, indicating, in part, the significant decline in new issuance that occurred after July 2007. As this occurred, primary dealers reduced their market-making and, correspondingly, their holdings in these securities.²⁵ Overall, the types of securities

²⁴ From December 2007 to June 2008, eligible securities for the regular term PRA facility included GoC-issued and guaranteed securities, provincial government-issued and guaranteed securities, and financial corporate securities (BAs, bearer deposit notes). In the fall of 2008, this list was broadened to include non-financial corporate debt securities (commercial paper and investment-grade corporate bonds), own-issued ABCP of banks (subject to certain conditions, such as high credit quality), and U.S. Treasury securities.

²⁵ The market value of outstanding bank-issued ABCP declined from about \$85 billion in July 2007 to about \$36 billion by the end of August 2009.

Chart 6: Distribution of securities purchased under the regular term PRA facility

Average percentage over monthly operations



Source: Bank of Canada

used in the regular term PRA suggest that the Bank provided an important alternative source of funding for financial institutions, particularly when market-based funding for these assets was scarce.

Pricing: Other things being equal, the more aggressive the bidding for central bank funds (i.e., the higher the term PRA bid rates relative to the interest rate on market sources of funds), the greater the demand for the facility. In a PRA transaction, the Bank buys eligible securities from its counterparty and agrees to sell the securities back to the counterparty at the end of the term. As such, PRAs are a form of secured or collateralized lending. The difference between the average term PRA bid rate and the market rate on short-term, *unsecured* bank borrowing (represented by CDOR) is an indication of the degree to which participants needed or preferred to obtain liquidity from the central bank, particularly since central bank liquidity can only be obtained on a secured basis.²⁶ As well, the difference between the average term PRA bid rate, secured by a range of eligible securities, and the market rate on lending that is secured by GoC securities (represented by the OIS rate) provides a measure of the difficulty participants face obtaining funds secured by less-liquid securities.²⁷ In general,

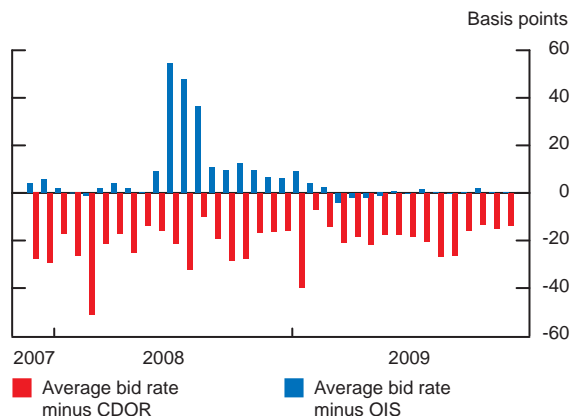
²⁶ One would expect secured lending rates to be lower than unsecured lending rates, because the collateral exchanged reduces the lender's risk of financial loss; i.e., the spread between the average term PRA bid rates and CDOR rates would be negative.

²⁷ OIS rates approximate the General Collateral repo rate over the term, where General Collateral in Canada is GoC securities. Therefore, the spread between the average term PRA bid rate and the OIS rate compares the cost of funding a range of (largely non-GoC) securities relative to the cost of funding GoC securities. One would expect this spread to be positive.

the greater these spreads, the greater the demand for funding via the Bank's regular term PRA facility.

As **Chart 7** illustrates, from December 2007 to early 2009, the average bid rate at the 1-month regular term PRA auction was about 20 to 25 basis points lower than 1-month CDOR rates, although this negative spread was 30 basis points or more at several points during periods of financial market stress. In comparison, bids at the 3-month regular term PRA auction were *higher* than CDOR rates at the peak of the turmoil in the fall of 2008 (**Chart 8**), resulting in a positive spread. Although this seems counterintuitive, this positive spread suggests that there was a significant demand for central bank funding during the market dysfunction. While 3-month BA rates (used to derive CDOR rates) were quoted over the fall of 2008, in fact, the ability of financial institutions to transact in these markets, particularly in October 2008, was very limited; i.e., market quotes were not reliable. At that time, interbank lending markets were dysfunctional in

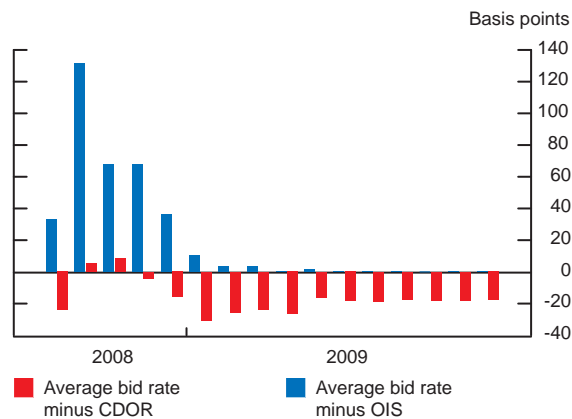
Chart 7: 1-month regular term PRA: Spreads between the average bid rate and the market rate



Source: Bank of Canada

most major countries. In Canada, activity was almost exclusively limited to terms of one month or less, and only against the most liquid collateral. Such market conditions were also evidenced by the spread between the average bid rate and the OIS rate. These spreads widened considerably during this period, peaking in early October at 55 basis points for the 1-month regular term PRA and at 132 basis points for the 3-month term. The bids received at the term PRA auctions indicate that auction participants were highly motivated to fund their less-liquid securities through the Bank of Canada.

Chart 8: 3-month regular term PRA: Spreads between the average bid rate and the market rate



Source: Bank of Canada

As these extreme market conditions settled down in early 2009, bidding at the regular term PRA auctions became much less aggressive, and spreads against market funding rates eventually stabilized within a relatively narrow range for both the 1- and 3-month terms. By the summer of 2009, average bids were 15 to 20 basis points lower than CDOR rates, and the spreads against OIS rates were well under 5 basis points. This continued into the fall of 2009. Overall, bidding at the Bank's term PRA auctions between 2007 and 2009 reflected the relative degree of stress experienced in term money markets over this period.

Market conditions: In examining the evolution of market rates for short-term funding in Canada over the 2007–09 period, it appears that the Bank's regular term PRA facility helped to improve the supply and distribution of term liquidity during periods of elevated financial market stress and, more generally, helped these markets to continue to function. At first, participation in the Bank's regular term PRA operations was a means for Canadian financial institutions to support their liquidity management at key points in the funding calendar in late 2007 and early 2008. Within a month of the introduction of the term PRA facility in December 2007, bank funding costs had stabilized, as demonstrated by spreads of CDOR over the expected overnight rate (Chart 3). Although the Bank of Canada's term PRA operations had been welcomed by the participants, at that time the operations may have had only a modest positive impact because the amounts were small (\$1 billion to \$2 billion) and were offered on a limited schedule, commensurate with the relatively strong liquidity position of eligible Canadian financial institutions. However, there was a commit-

ment by the Bank to adjust its term liquidity operations according to the Bank's assessment of financial conditions.

As discussed above, the Bank of Canada's actions intensified in late 2008 as term funding pressures became more acute, and this likely had a larger impact on funding markets. In September 2008, CDOR-OIS spreads spiked higher by 60 basis points for 1-month terms (80 basis points for 3-month terms). The Bank reintroduced term PRAs on 19 September 2008, for larger amounts and on a more frequent basis, and within four weeks had injected over \$20 billion of term liquidity into the financial system. The amount auctioned at the 15 October operation was substantial, \$10 billion, and within the week CDOR spreads had fallen significantly (by about 40 basis points for the 1- and 3-month terms). The pace of term liquidity operations was maintained, and 1- and 3-month CDOR spreads began to stabilize towards the end of 2008.²⁸ Notwithstanding usual year-end pressures,²⁹ by early 2009, CDOR spreads for 1- and 3-month terms had returned to a range of 20–40 basis points, and anecdotal evidence pointed to more normal conditions in short-term money markets.

Following the 21 April reduction in the Bank of Canada's target overnight rate to the effective lower bound and the corresponding changes in its operating framework for monetary policy, funding conditions in Canada continued to improve into the fall of 2009. Regular term PRA operations maintained the amount of outstanding term liquidity between \$25 and \$30 billion. One- and 3-month CDOR-OIS spreads fell further and quickly stabilized into a very tight range over the summer and fall of 2009. Similar effects were also evident for longer-term money market rates. With the provision of 6- and 12-month term liquidity (and later, 9-month terms) by the Bank, CDOR spreads at these terms moved closer to shorter-term spreads—a direct result of the Bank's conditional commitment to keep its target overnight rate at ¼ per cent until the end of June 2010. Overall, CDOR spreads since May 2009 have remained relatively close to pre-crisis levels and, more generally, financial institutions are facing more-normal funding conditions.

²⁸ Federal government initiatives also contributed significantly to the stabilization of Canadian financial markets (see **Appendix 2**). In addition, actions taken by other central banks and governments had a positive impact on global financial markets, from which Canada also benefited.

²⁹ Another factor that weighed on Canadian money markets towards the end of 2008 was concern related to the protracted restructuring of non-bank-sponsored ABCP trusts in Canada.

Term PRA for Money Market Instruments and Term PRA for Private Sector Instruments

The term PRA facility for money market instruments was implemented to support money market participants (other than primary dealers and LVTS participants) who were unable to obtain funding from typical market sources because ABCP, BA, and CP markets were not functioning normally. From its introduction, participation was modest, and a small amount of term liquidity was provided under this facility. Only \$25 million (the minimum allowable bid size) was outstanding on a fairly consistent basis until the end of January 2009 (Chart 4).

The term PRA facility for money market instruments was designed to be a backstop for private sector alternatives, and the minimum bid rate was set accordingly.

The likely reason for the modest use of this facility is that conditions in shorter-term money markets were not stressed enough to motivate a larger group of potential counterparties to participate; i.e., market funding could still be obtained. The facility was designed to be a backstop for private sector alternatives, and the minimum bid rate was set accordingly.³⁰ Another reason may be related to eligible participants: Only firms with significant activity in private sector money markets (and later, bond markets) could participate, and then only indirectly, by submitting bids through a primary dealer. The latter point may have deterred some potential counterparties from participating to avoid providing sensitive information to a primary dealer, which, in some cases, may have been a competitor. It may have also been the case that the initial list of eligible securities was not broad enough to encompass those sectors of the corporate market that were most in need of support.

With these factors in mind, the Bank announced in February 2009 that it would replace this facility with

³⁰ The minimum bid rate was originally set as a spread of 75 basis points above the OIS rate. When the facility was replaced in March 2009, the minimum bid rate was decreased to 25 basis points above the greater of the OIS rate and the OIS rate plus the difference between the average yield of the preceding regular term PRA auction and the OIS rate for that operation. As indicated in the Box, the minimum rate was amended in April.

the term PRA for private sector instruments, which added corporate bonds to short-term corporate securities. The minimum bid rate was also reduced. Bidding through primary dealers was preserved, as mentioned earlier, to uphold the traditional structure of market-making in Canada. Despite the changes, the number of participants and the value of transactions was still relatively small, although participating institutions did increase the value of their submitted bids up to the maximum allowable. The amount of term funding allocated under the facility did rise modestly, to a peak of about \$3 billion in the early summer of 2009 (Chart 4). Thereafter, participation waned, with several auctions receiving no bids at all. Because of the improvement in funding conditions for eligible participants, this facility was terminated at the end of October 2009.

Term Loan Facility

The term loan facility was designed to support LVTS direct participants in the management of their balance sheets in order to improve conditions in money and credit markets. For only a brief period at the end of 2008 was there any take-up of the Bank's regular weekly offering of 1-month term loans to LVTS direct participants. At its peak in early December 2008, funds outstanding from the term loan facility reached over \$4 billion, but gradually subsided to zero after the end of 2008 (Chart 4).

This facility was also designed to be a backstop, with pricing and terms and conditions set accordingly.³¹ In addition, all eligible participants had access to the Bank's regular term PRA facility.³² As a result, the low level of demand for the term loan facility can be interpreted as indicating that these financial institutions had no serious difficulties obtaining term funding from other sources. Despite the lack of take-up, the Bank honoured its commitment to conduct weekly auctions of term loans to eligible institutions until the end of October 2009.

Summing up

As the preceding review shows, the regular term PRA facility was heavily used and appears to have contributed to reduced market stress and a return to well-

functioning money markets. In contrast, there was relatively little demand or need for funding from the term PRA facility for money market instruments, the term PRA facility for private sector instruments, and the term loan facility, which were designed as backstops. Notwithstanding the general lack of use of the latter set of facilities, these arrangements provided liquidity support for some participants during the most difficult phases of the crisis, and thus may have mitigated subsequent disruptions specifically related to these institutions. As well, the presence of these facilities to the end of October 2009 helped to mitigate uncertainty among market participants about the availability of liquidity, if necessary.

Outstanding Issues

The global financial crisis has subsided, and financial conditions have improved significantly over the past six months, not just in Canada, but globally. Central banks and governments are now looking beyond the crisis, and are working to build a more resilient global financial system with the necessary market infrastructure, policies, and regulation. Canada is an active contributor to the G-20 agenda, working with its domestic and international partners in a wide range of areas.³³ With respect to the extraordinary actions discussed in this article, there are three topics on which the Bank of Canada is currently focused.

First, the Bank is interested in studying in more depth the effects of its extraordinary liquidity facilities on behaviour and, more generally, on the domestic financial system. A more rigorous empirical assessment should be made of the effects of the facilities during the financial crisis. In particular, it would be useful to determine the contribution of these facilities to mitigating the adverse effects of the crisis, compared with other potential contributing factors, such as actions taken by domestic financial institutions to improve their balance sheets, as well as actions taken by public authorities domestically and internationally to stabilize the global financial system. A comparison of Canada's experience with those of other countries that implemented extraordinary liquidity measures might also be useful. Further analysis could also assess the impact on the future behaviour of financial market participants, and, in particular, whether these actions generated moral hazard. Attention should also be devoted to whether the particular design of the

³¹ The minimum bid rate was set at the Bank Rate, which is the minimum rate against which the Bank can lend under the Bank of Canada Act.

³² Institutions eligible for the term loan facility were LVTS direct participants who had pledged their Canadian-dollar non-mortgage loan portfolios to the Bank as collateral for LVTS and Standing Liquidity Facility purposes.

³³ See Bank of Canada (2009) and Carney (2009) for an overview of the G-20 strategy.

auction mechanisms used in the facilities were the most useful to facilitate price discovery and competition in bidding.

Second, this research could be used to inform questions related to the design of liquidity policies. In particular, one could ask (with the benefit of hindsight) whether the range of liquidity facilities that were developed was necessary and efficient. In addition, while these various facilities were designed as temporary arrangements, would it be appropriate to make available some form of liquidity facility on an ongoing, permanent basis so as to facilitate continuous functioning of core markets? If so, what mechanisms might be required to reduce the risk that central bank facilities, if used for extended periods, adversely affect the behaviour of financial institutions? If not, how should the Bank maintain sufficient flexibility and readiness to respond to potential future liquidity challenges?

Work is continuing on an international basis to enhance market and institutional resiliency, and thereby reduce the magnitude of the effects of future financial disturbances.

Finally, the Bank is interested in promoting resilient financial markets, and, hence, a resilient financial system, to support endogenous liquidity creation and to reduce the probability of financial stress requiring central bank intervention. To this end, work is continuing on an international basis to enhance market and institutional resiliency, and thereby reduce the magnitude of the effects of future financial disturbances. For example, under the guiding principles of the Financial Stability Forum, market incentives, transparency, regulation, and oversight are being examined in relation to leverage and liquidity.³⁴ The Bank will also continue to work to identify and communicate key emerging structural vulnerabilities in the global and domestic financial markets that are relevant to Canadian financial stability, including via its twice yearly *Financial System Review*. Similarly, the Bank will also provide leadership in the development of relevant policies and core market infrastructures so that these core markets are continuously open and the liquidity of the financial system is not compromised by similar events.³⁵

³⁴ Duguay (2008), for example, discusses strengthening the resiliency of the financial system.

³⁵ Carney (2008b) discusses the importance of supporting continuously functioning core markets.

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Appendix 1: Bank of Canada Liquidity Facilities

	Term PRA	Term PRA for Private Sector Money Market Instruments	Term PRA for Private Sector Instruments	Term Loan Facility
Date announced	12 December 2007; modified most recently: 22 September 2009	14 October 2008; effective 27 October 2008. Discontinued 16 March 2009 ^b	23 February 2009; effective 16 March 2009. Discontinued after 27 October 2009	12 November 2008. Discontinued after 28 October 2009
Purpose	Temporary facility to provide liquidity in support of the efficient functioning of financial markets and modified on 21 April 2009 to also reinforce the BoC's conditional statement regarding the expected future path of the target overnight rate	Temporary facility to support liquidity in private sector money market instruments. This facility was replaced by the Term PRA for Private Sector Instruments.	Temporary facility to support liquidity in markets for private sector instruments	Temporary term loan facility to give LVTS participants increased flexibility in the management of their balance sheets and to improve conditions in money and credit markets
Eligible participants	Canadian PDs in GoC securities and direct participants in the LVTS	PDs on a direct basis and money market participants on an indirect basis who can demonstrate significant activity in the Canadian-dollar private sector money markets and who are subject to federal or provincial regulation	Institutions that can demonstrate significant activity in the Canadian private sector money and/or bond markets and that are subject to federal or provincial regulation	Direct participants in the LVTS
Eligible collateral/securities^a	Securities issued or guaranteed by the Government of Canada; securities issued or guaranteed by a provincial government; BAs and promissory notes; CP and short-term municipal paper; ABCP that meets the BoC's eligibility criteria; corporate and municipal bonds. On a temporary basis: affiliated ABCP that meets the BoC's criteria. Securities are subject to credit and other criteria.	BAs, CP, ABCP that meets the BoC's eligibility criteria, promissory notes. Securities are subject to credit and other criteria.	BAs, CP, and ABCP that meet the BoC's eligibility criteria, promissory notes, corporate bonds. Securities are subject to credit and other criteria.	Canadian-dollar non-mortgage loan portfolios, subject to credit and other criteria.
Haircuts	Margin requirements available at: http://www.bankofcanada.ca/en/financial/securities.pdf	See margin requirements (URL in Column 1)	See margin requirements (URL in Column 1)	See margin requirements (URL in Column 1)
Pricing and type of auction	Multiple-yield competitive auction for a fixed par Canadian-dollar amount. Introduced minimum and maximum bid rates on 21 April 2009. Minimum bid rate: lower end of the operating band (25 basis points). Maximum bid rate: Bank Rate (50 bps)	Multiple-yield competitive auction for a fixed par Canadian-dollar amount, subject to a minimum bid rate set at a spread of 75 bps over the average of the BoC's target overnight rate and the 1-month OIS rate as observed by the Bank	Multiple-yield competitive auction for a fixed par Canadian-dollar amount, subject to a minimum bid rate set at a spread of 25 bps over the target overnight rate	Single-price auction for a fixed par Canadian-dollar amount. Minimum bid rate: Bank Rate. All winning bids will pay the minimum accepted yield.
Term	1, 3, 6, 9, and 12 months	2 weeks	1 and 3 months	1 month
Frequency	Biweekly	Weekly	Weekly	Weekly

a. Full details regarding eligible securities are available at <http://www.bankofcanada.ca/en/financial/securities.pdf>.

b. As of 16 March 2009, this facility was replaced by the Term PRA for Private Sector Instruments.

Legend: ABCP = asset-backed commercial paper; BAs = bankers' acceptances; BoC = Bank of Canada; CP = commercial paper; CPA = Canadian Payments Association; ELB = effective lower bound; GoC = Government of Canada; LLR = Lender of Last Resort; LVTS = Large Value Transfer System; OIS = overnight index swap; PDs = primary dealers; SLF = Standing Liquidity Facility

Appendix 1: Bank of Canada Liquidity Facilities (cont'd)

	Sales and Repurchase Agreements (SRAs)/Special Purchase and Resale Agreements (SPRAs)	Overnight Standing Purchase and Resale Agreement (PRA) Facility	Standing Liquidity Facility (SLF)	Emergency Lending Assistance (ELA)
Date announced	Used since mid-1994	21 April 2009		
Purpose	Permanent tool of the BoC standard operating framework for the implementation of monetary policy. Used to reinforce the target overnight rate at the midpoint of the operating band. Under the ELB, SRAs would be used to reinforce the target overnight rate, which is the lower end of the operating band.	Temporary facility as part of the operating framework for the implementation of monetary policy at the ELB. This facility provides a funding backstop to PDs, similar to the overdraft facility for LVTS participants.	Permanent facility as part of the BoC's operating framework for the implementation of monetary policy and of the BoC's LLR framework. This facility aims to support settlement in the payments system by providing collateralized overnight loans to direct participants in the payments system who are experiencing temporary shortfalls in their settlement balances.	Permanent facility, part of the BoC's LLR framework. This facility provides extraordinary credit support to solvent institutions that are facing serious and persistent liquidity problems.
Eligible participants	PDs for GoC securities	PDs for GoC securities	Direct participants in the LVTS	Federally incorporated deposit-taking institutions that are CPA members that are solvent but face persistent liquidity problems and, in the case of an extraordinary and widespread event that would have significant adverse consequences for a provincial credit union or caisse populaire system, the Credit Union Central of Canada, a provincial credit union central, the Caisse centrale Desjardins, or the Federation des caisses Desjardins
Eligible collateral/securities^a	GoC securities	GoC securities	Securities issued or guaranteed by the Government of Canada, GoC stripped coupons and residuals, securities issued or guaranteed by a provincial government, BAs, and promissory notes, CP and short-term municipal paper, corporate, municipal and foreign-issuer bonds, marketable securities issued by the U.S. Treasury, ABCP that meets the BoC's eligibility criteria, and Special Deposit Accounts held at the Bank. Effective 20 October 2008 through to 1 February 2010, Canadian-dollar non-mortgage loan portfolios are also fully eligible. Securities are subject to credit and other criteria.	The BoC is willing to accept a broader range of collateral than for the SLF, including the Canadian-dollar non-mortgage loan portfolios, subject to credit and other criteria.
Haircuts	Margin requirements available at: < http://www.bankofcanada.ca/en/financial/securities.pdf >	See margin requirements (URL in Column 1)	See margin requirements (URL in Column 1)	See margin requirements (URL in Column 1)
Pricing	Overnight Target Rate	Bank Rate	Bank Rate	Minimum rate is the Bank Rate.
Term	Overnight	Overnight	Overnight	Maximum term to maturity: 6 months
Frequency	As required	Standing Facility	Standing Facility	As approved by BoC. Actual use is very rare.

a. Full details regarding eligible securities are available at <<http://www.bankofcanada.ca/en/financial/securities.pdf>> .

Legend: ABCP = asset-backed commercial paper; BAs = bankers' acceptances; BoC = Bank of Canada; CP = commercial paper; CPA = Canadian Payments Association; ELB = effective lower bound; GoC = Government of Canada; LLR = Lender of Last Resort; LVTS = Large Value Transfer System; OIS = overnight index swap; PDs = primary dealers; SLF = Standing Liquidity Facility

Appendix 2: Federal Government Initiatives in Response to the Financial Crisis

During the recent period of financial turmoil, the Government of Canada introduced a number of measures to respond to gaps in credit markets by providing up to \$200 billion to improve access to financing for Canadian households and businesses. One of the key measures is the Insured Mortgage Purchase Program (IMPP), under which the government purchases, through the Canada Mortgage and Housing Corporation, pools of insured residential mortgages from Canadian financial institutions. As uncertainty in global financial markets swelled, the ability of Canadian financial institutions to fund their lending activity became impaired. Through the IMPP, these institutions could mobilize assets on their balance sheet and obtain a significant and stable means of long-term financing. Thus, the IMPP enabled financial institutions to continue to provide credit to Canadian households, businesses, and the economy. The IMPP was complementary to the provision of extraordinary liquidity by the Bank of Canada, which, by virtue of the Bank of Canada Act, is legally restricted from acquiring an interest in mortgages.

A summary of the initiatives taken by the federal government in response to the financial crisis is presented in chronological order below.

- July 2008: CMHC's Canada Mortgage Bonds (CMB) Program was expanded to add a 10-year maturity.
- October 2008: The IMPP was introduced to purchase, through the Canada Mortgage and Housing Corporation (CMHC), up to \$25 billion in insured mortgage pools.
 - The maximum amount was subsequently raised to \$75 billion in November 2008 and to \$125 billion in January 2009.
 - About \$66 billion in mortgages had been purchased by the end of October.
- October 2008: The Canadian Lenders Assurance Facility (CLAF) was set up as a temporary facility to provide insurance on the wholesale borrowing of federally regulated (and eligible, provincially regulated) deposit-taking institutions. This was undertaken to ensure that Canadian institutions were not put at a competitive disadvantage relative to foreign competitors when raising funds in wholesale markets. It has not been used to date.
- November 2008: The Office of the Superintendent of Financial Institutions (OSFI) announced that the limit for preferred shares within the capital rules for OSFI-regulated institutions would increase to 40 per cent.
- December 2008: The Canadian and Ontario governments jointly announced financial assistance to the automotive sector via a \$4 billion loan facility to the Canadian subsidiaries of General Motors and Chrysler. Between 30 March and 15 July 2009, a total of USD \$12.4 million was disbursed.
- January 2009: The Canadian Secured Credit Facility (CSCF) was introduced in the 2009–2010 Federal Budget to purchase up to \$12 billion in newly securitized term asset-backed securities (ABS) backed by loans and leases on vehicles and equipment. The facility is managed by the Business Development Bank of Canada (BDC).
- January 2009: Changes were made to improve the capacity of the Canada Deposit Insurance Corporation (CDIC) to respond to troubled financial institutions:
 - CDIC's borrowing limit was increased from \$6 to \$15 billion;
 - CDIC was allowed the ability to establish a bridge institution as an additional resolution tool.
- January 2009: The Business Credit Availability Program (BCAP) was introduced to improve access to financing for Canadian businesses by providing new resources and flexibilities to Export Development Canada (EDC) and the Business Development Bank of Canada (BDC), combined with enhanced co-operation between private sector lenders and those Crown corporations.
 - The government injected an additional \$350 million in capital in both EDC and BDC.
 - EDC's and BDC's borrowing limits were increased.
 - EDC's mandate was temporarily expanded to enable it to support financing in the domestic market.
- May 2009: The Canadian Life Insurers Assurance Facility (CLIAF) was established as a temporary

Appendix 2: Federal Government Initiatives in Response to the Financial Crisis (cont'd)

facility to provide insurance on the wholesale borrowing of federally regulated life insurers. This was undertaken to ensure that Canadian institutions were not put at a competitive disadvantage relative to foreign competitors when raising funds in wholesale markets. It has not been used to date.

Understanding Corporate Bond Spreads Using Credit Default Swaps

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- *Since the beginning of the credit crisis, spreads on corporate bonds (the difference between the yields on a corporate bond and a government bond with identical cash flows) worldwide have widened markedly.*
- *This article decomposes Canadian corporate spreads into default and liquidity components for selected Canadian firms, using a model that extracts default information from credit default swaps.*
- *During the credit crisis in 2008, the liquidity component for speculative-grade bonds increased earlier than it did for investment-grade bonds, which is consistent with a “flight-to-quality” scenario.*
- *Although the results are based on a small sample of Canadian firms, they are consistent with recent research on how liquidity risk is priced in corporate bond markets.*

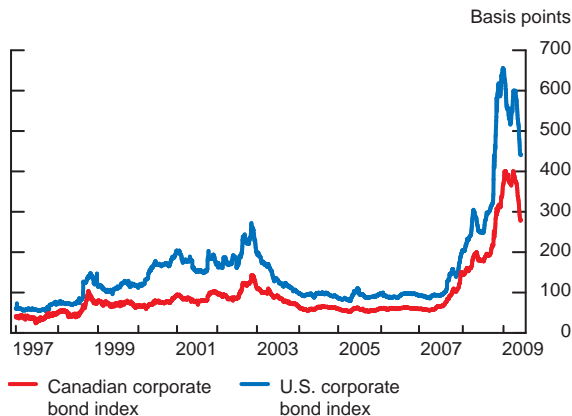
Since the beginning of the credit crisis in mid-2007, corporate spreads worldwide widened markedly. In Canada, the aggregate spread for investment-grade firms reached a maximum of 401 basis points (bps) in January and March of 2009, substantially more than the historical average of 92 bps; the spread on the equivalent index in the United States reached 656 bps in December 2008, also substantially more than its historical average of 153 bps (**Chart 1**).¹ Owing to the problems in funding markets, corporations and financial institutions began to replace “risky” assets with “safer” ones; this “flight-to-quality” effect resulted in large price declines in equity and corporate bond markets and increases in prices in the government market.

In this article, the corporate bond spread is defined as the difference between the yields on a corporate bond and a government bond with identical cash flows. Under this definition, the corporate spread reflects the additional compensation required by investors to hold the corporate bond compared with the return on the default-free asset (the government bond). This additional yield compensates investors for two types of risk: (i) the risk of default, i.e., that the firm may not be able to meet the promised cash flows; and (ii) the liquidity risk, i.e., the risk that the investor may not be able to sell the bond quickly, before it matures, without a significant discount to the existing market price.

Since promoting financial stability is part of the mandate of central banks, they have a natural interest in understanding what drives changes in corporate spreads—default risk, liquidity risk, or both—since

¹ The average spreads for Canada and the United States are calculated for the period from 31 December 1996 to 18 May 2009, using the Merrill Lynch corporate indexes for investment-grade firms. The new maximum spreads surpassed previous record highs for this period of 272 bps on 10 October 2002 for the United States and 143 bps on 24 October 2002 for Canada.

Chart 1: Corporate bond spreads in Canada and the United States



Note: Merrill Lynch spreads for broad corporate indexes. Corporate yield spreads are adjusted only for embedded options. Sample: 31 December 1996 to 18 May 2009. Sources: Bloomberg, Merrill Lynch

their policy response will be different, depending on which factor is responsible. If, for example, rising corporate spreads result mainly from an increase in liquidity risk, and the central bank judges that this warrants intervention, then it might address the situation, at least in part, by providing liquidity. In contrast, if rising spreads are the result of increased default risk, the appropriate policy response may be quite different.² Decomposing corporate spreads is not easy, because both components are unobservable and possibly correlated.

This article is part of a series of papers that studies the risks—mainly default and liquidity—that are priced into corporate bond spreads.³ Its contributions to this research agenda are as follows: (i) the use of information from the credit default swap and bond markets for Canadian firms; (ii) analysis that is performed at the firm level; and (iii) a focus on Canadian firms that access funding in the United States.⁴

Related Literature

For some time, researchers have been investigating how much of the corporate bond spread is attribut-

² One reason why the policy reaction may be different for liquidity risk than for default risk is that the former may be the result of a “friction” (i.e., information), whereas the latter may be the result of systematic factors.

³ Garcia and Gravelle (2008) use a structural model with equity data to decompose Canadian corporate spreads.

⁴ Other work decomposing spreads for Canada focuses on the aggregate index spread, using equity-based structural models instead of prices on credit default swaps (see Garcia and Gravelle 2008).

able to default risk and how much stems from liquidity risk. Corporate spreads seem to be too high for default risk to be the only contributing factor; in addition, they are inconsistent with historical default rates and recoveries (Elton et al. 2001). Observed corporate spreads are also inconsistent with traditional structural models based on Merton (1974) (Huang and Huang 2003). As well, changes in spreads on corporate bonds are not well explained by changes in the factors affecting default risk (Collin-Dufresne, Goldstein, and Martin 2001), and the unexplained portion appears to have a common factor. Liquidity risk may therefore be an important factor affecting corporate spreads, since corporate bond markets are much less liquid than government bond markets. Various approaches are used in the literature to measure the two components of corporate bond spreads. These approaches are detailed next.

Liquidity component

Researchers have used different methods to measure the liquidity of corporate bonds and to study the relationship between liquidity, liquidity risk, and corporate spreads. Chen, Lesmond, and Wei (2007) use implicit bid-ask spreads and the frequency of zero returns to measure the liquidity of corporate bonds. Chacko (2005) and Mahanti et al. (2008) use the turnover of portfolios holding the bond, and others (Edwards, Harris, and Piwowar 2007; Goldstein, Hotchkiss, and Sirri 2007; Bao, Pan, and Wang 2008) use measures of the impact on prices. In general, they find a positive relationship between the illiquidity of corporate bonds and their yield spreads. Several recent studies (de Jong and Driessen 2006; Downing, Underwood, and Xing 2007; Acharya, Amihud, and Bharath 2008) analyze how liquidity risk is priced in corporate bond returns. They find that, relative to investment-grade bonds, speculative-grade bonds carry a higher liquidity-risk premium. Most of these papers estimate models focusing on one aspect of illiquidity, such as transactions costs, inventory risk, asymmetric information, or search costs. In addition, most papers relate their illiquidity measures to corporate spreads in regressions, and are therefore not suitable to decompose corporate bonds into liquidity and default components.

Default component

In general, researchers use two methods to estimate the default risk of corporate spreads. One way is to use historical default rates and recoveries; this method ignores the risk premium associated with

default risk. Thus, in these models, no consideration is given to the extra premium that investors require to invest in risky securities whose returns are correlated with systematic factors. Another method is to determine default risk relative to other traded financial instruments, such as equity and credit derivatives. According to Merton (1974), equity can be treated as a call option on firm values. Corporate bonds can be treated as a portfolio holding an equivalent risk-free government bond and shorting a put option. Equity prices can be used to extract information about the firm's valuation process, which can then be used to price corporate bonds. The validity of this method requires that the structural models be correctly specified. Huang and Huang (2003) show, however, that since most structural models are misspecified, their results cast doubts on the value of using structural models to decompose corporate spreads.

With the growth of markets for credit derivatives in recent years, researchers have started to use credit derivatives, such as credit default swaps, to estimate the default component of corporate spreads (Longstaff, Mithal, and Neis 2005). We use credit default swaps to decompose the spreads on Canadian corporate bonds because, as discussed in the next section, their lower susceptibility to liquidity effects makes them a much purer measure of default risk. In addition, the reduced-form approach we use to evaluate credit default swaps is less prone to misspecification.

Credit Default Swaps

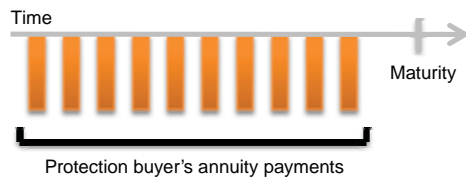
A credit default swap (CDS) is a contract that provides insurance against the default of a particular company. The company is known as the *reference entity*, and a specific bond of the company is known as the *reference obligation*. The quantity of the reference obligation to which the derivative contract applies is known as the *notional principal*.⁵ In a CDS, there are two parties to the contract: the *buyer* of credit protection makes periodic payments to the *seller* of the credit protection until either the contract matures or there is a default event by the company. In exchange for the periodic payments made by the buyer, the seller agrees to pay the buyer the difference between the face value and the market value of the reference obligation if a credit event occurs. If no default occurs, the protection buyer still makes all the agreed-upon

⁵ The total outstanding notional principal of CDS contracts for a given reference entity can exceed the total amount outstanding of the reference obligation.

payments. There is a payment to compensate for default losses only in the case of a default.

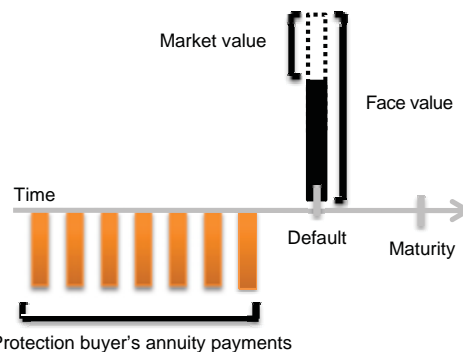
Figure 1 shows the cash flows for a typical CDS when no default occurs, while **Figure 2** shows cash flows in a default scenario. The orange boxes represent the annuity payments made by the protection buyer, while the black box in Figure 2 represents the payment that the protection seller makes to the protection buyer upon default.

Figure 1: Credit default swap: Cash flows when there is no default



Note: The orange boxes represent the payments made by the protection buyer to the protection seller.
Source: Bank of Canada

Figure 2: Credit default swap: Cash flows when default occurs



Note: The orange boxes represent the payments made by the protection buyer to the protection seller. The black box represents the payment made by the protection seller to the protection buyer at default.
Source: Bank of Canada

As in any swap, the premium (which determines the annuity payments) is the rate that equates the expected streams of cash flows that the buyer and the seller make. The CDS premium therefore contains information on the default probability associated with a reference entity, since this information is embedded in the expected payment made by the protection seller.

CDS contracts are commonly used to extract proxies for default risk for several reasons. As contracts, not securities, CDSs are far less sensitive to liquidity

effects, since securities are in fixed supply, while the supply of CDSs can be arbitrarily large. Because of this reduced sensitivity, CDSs provide a better measure of default risk. As well, it is less costly for investors to liquidate CDSs prior to maturity than to liquidate a corporate bond, since investors simply enter into a swap contract in the opposite direction. Further, CDSs are not likely to become “special” like treasury bills, or “squeezed” like corporate bonds.⁶ In principle, therefore, CDSs should contain mainly default information about the reference entity. However, they are not totally immune to liquidity effects, since search costs may be high for illiquid CDS contracts.⁷

In principle, CDSs should contain mainly default information about the reference entity. However, they are not totally immune to liquidity effects.

It is difficult to obtain data from the Canadian-dollar CDS market for Canadian reference entities, since this market is underdeveloped and illiquid compared with the U.S. market. Moreover, because of the illiquidity of the market, these data are likely to contain a non-negligible liquidity component, which violates our basic modelling assumption. An alternative is to use data from CDSs issued in U.S. dollars for Canadian entities. Although better than data from the Canadian-dollar CDS market, these data are available for a limited number of firms, only some of which may have liquid contracts. A caveat persists as well with respect to the degree of liquidity risk embedded in CDS prices—anecdotal evidence suggests that, during a crisis, CDS prices, like corporate bonds, might carry a liquidity-risk premium. In this study, we use the most liquid CDS contracts to decompose Canadian corporate spreads and make every effort to minimize any decomposition bias resulting from potential illiquidity in CDS contracts. In the next section, we present the

data used to conduct our analysis, as well as the controls that helped to focus on the most liquid CDS contracts in our sample.⁸

Data

In practice, the CDS quote can be different from the CDS transaction price. The CDS quote reflects the risk characteristics of the reference entity, whereas the transaction price can also reflect the differential in counterparty risk between the protection buyer and the seller. For this article, we use quote data obtained from Markit Inc., the leading provider of CDS data.

We obtained a dataset of Canadian firms for which there are CDS contracts and bonds with a maturity greater than one year. Because of the aforementioned data limitations on Canadian-dollar-denominated CDSs, we use U.S.-dollar-denominated securities (CDSs and bonds). We also need data for the yields on U.S. risk-free zero-coupon bonds, which are obtained from the study by Gürkaynak, Sack, and Wright (2006). Our initial dataset included 38 Canadian firms. Filtering out Canadian Crown corporations, firms with too few CDS or corporate bond quotes, firms without senior unsecured debt, and firms for which the number of common dates between the CDS data and the corresponding bonds are less than a year, we are left with a set of eight large Canadian firms from various sectors of the economy. Six of the firms are rated BBB, while the other two are rated CC (see **Table 1** for selected statistics on the firms' bond data). The bond and CDS data used in the article cover different samples for each firm, beginning as early as June 2006 and ending as late as November 2008.⁹

For the Canadian firms selected, we prepared the data by selecting bonds and CDS prices that had two or more quotes per week and interpolating them linearly, when necessary, to obtain a common day of the week used to change the frequency of the data from daily to weekly. We did this to obtain a dataset where, at each moment in time, there is an observation for the CDS and the bond prices, which allows

⁶ “Specials” are specific repo rates significantly below prevailing market interest rates for loans of similar maturity and credit risk. “Squeezed” refers to a shortage of supply relative to demand for a particular security, as evidenced by a movement in its price (or its repo rate) to a level that is not in line with the prices of comparable securities.

⁷ Longstaff, Mithal, and Neis (2005) use the most liquid CDS contracts in their study.

⁸ Note that default risk on Canadian-dollar and U.S.-dollar bonds issued by the same Canadian entity may differ, to the extent that they could be subject to different rules governing default or debt workouts in different jurisdictions.

⁹ The sample data available for the eight firms used here are for the following periods: Firm 1, 30 June 2006–14 November 2008; Firm 2, 23 June 2006–31 October 2008; Firm 3, 8 June 2007–24 October 2008; Firm 4, 22 June 2007–31 October 2008; Firm 5, 14 July 2006–7 November 2008; Firm 6, 30 June 2006–7 November 2008; Firm 7, 10 November 2006–14 November 2008; and Firm 8, 30 June 2006–31 October 2008.

Table 1: Firms' bond data

Rating	BBB	CC
Number of firms	6	2
Minimum number of bonds	2	3
Maximum number of bonds	3	4

Note: Data from Markit Inc. cover the period June 2006 to November 2008. The BBB rating includes all ranges within the BBB category. CC-rated firms were downgraded to D in April 2009.
Source: Markit Inc.

the model to extract information simultaneously from all prices and thus to decompose the spread.

Table 2 provides descriptive statistics for each CDS contract. The CDS premiums show that the eight firms in our sample can be separated into two groups: sub-investment (or speculative-) grade firms, which includes Firms 1 and 2; and investment-grade firms. Firms in the first group have higher and more volatile CDS premiums, while those in the second group have lower and more stable premiums.

Table 2: Contract data for credit default swaps

Premiums on credit default swaps (in basis points)				
	Mean	Standard deviation	Maximum	Rating
Firm 1	1,665	1,612	6,984	Speculative
Firm 2	1,082	967	5,995	Speculative
Firm 3	87	64	405	Investment
Firm 4	350	90	538	Investment
Firm 5	108	50	213	Investment
Firm 6	141	57	306	Investment
Firm 7	75	66	337	Investment
Firm 8	71	69	403	Investment

Note: All CDS contracts have a 5-year maturity.
Source: Bank of Canada

Methodology

We use a reduced-form model based on the framework of Jarrow and Turnbull (1995); Lando (1998); and Duffie and Singleton (1999). In this model, investors demand a return for holding corporate bonds that includes the risk-free rate, the default risk of the issuer, and the liquidity premium associated with the security. Similarly, investors demand compensation for selling the CDS that includes the risk-free rate and the default risk associated with the reference entity (bond issuer). Note that, in the model, we assume that

the bond yield includes compensation for liquidity and default risk, whereas the CDS includes compensation only for default risk.¹⁰

The methodology can be summarized as follows. We have two unobserved variables, liquidity and default, as well as time series for the CDSs and several bond prices for the same reference entity. From the CDSs, we obtain the default factor, which is used to obtain the liquidity factor from the bond prices. We are able to determine both factors by estimating the parameters of the model to minimize pricing errors.¹¹ We proceed to create a synthetic zero-coupon 5-year bond. For the synthetic bond, we find the corresponding yield to maturity and subtract the risk-free rate to obtain the corporate spread. The corporate spread thus obtained is then decomposed into its default component, such that the yield to maturity includes only the risk-free rate and the default compensation, and its liquidity component (the difference between the corporate spread and the default component).

Results

We first analyze the results around three key events: (i) the Bear Stearns liquidation of two hedge funds that invested in various types of mortgage-backed securities on 31 July 2007; (ii) the announcement by the Federal Reserve Bank of New York that it would provide term financing to facilitate the acquisition by JPMorgan Chase of The Bear Stearns Companies on 24 March 2008; and (iii) Lehman Brothers filing for Chapter 11 bankruptcy protection on 15 September 2008.¹² **Chart 2** shows the decomposition for the average firm from the investment-grade category, and **Chart 3** shows the results for the average firm from the speculative-grade category.

The liquidity component of both investment- and speculative-grade firms started to increase right after the liquidation of the Bear Stearns hedge funds, consistent with the overall market conditions. After the acquisition of Bear Stearns, the investment-grade firms' liquidity and default component decreased slightly, and the speculative-grade firms' components also decreased for a short period. Both of these effects possibly reflect the awareness of government support for troubled firms. After the filing by Lehman,

¹⁰ This assumes that the CDS liquidity compensation is negligible.

¹¹ See the **Box** on p. 28 and Longstaff, Mithal, and Neis (2005) for details on the model and the estimation.

¹² Another key event was the halt on redemptions on three investment funds on 9 August 2007 by BNP Paribas, France's largest bank. This, with the Bear Stearns acquisition, triggered subsequent events that led to the financial crisis.

Estimating the Model

Let r_t denote the risk-free rate, λ_t the intensity of the Poisson process governing default, γ_t a liquidity premium, and c the continuous coupon rate paid by the corporate bond. Each of the processes r_t , λ_t , and γ_t is stochastic. Following Lando (1998), we assume that a bondholder recovers a fraction $1-w$ (fixed at 50 per cent) of the par value of the bond in the event of default. Then a corporate bond that pays a continuous coupon rate c is priced as follows:

$$\begin{aligned}
 P_{bond} = & E^Q \left[c \int_0^T e^{-\int_0^t (r_s + \lambda_s + \gamma_s) ds} dt \right] \\
 & + E^Q \left[\int_0^T e^{-\int_0^t (r_s + \lambda_s + \gamma_s) ds} dt \right] \\
 & + (1-w) E^Q \left[\int_0^T \lambda_t e^{-\int_0^t (r_s + \lambda_s + \gamma_s) ds} dt \right],
 \end{aligned} \tag{1}$$

where T is the time to maturity. Let s denote the continuous premium paid by the CDS buyer. The present value of the premium leg of a credit default swap (Pre) can be expressed as,

$$Pre = E^Q \left[s \int_0^T e^{-\int_0^t (r_s + \lambda_s) ds} dt \right]. \tag{2}$$

The value of the protection leg of a CDS (Pro) can be expressed as:

$$Pro = E^Q \left[w \int_0^T \lambda_t e^{-\int_0^t (r_s + \lambda_s) ds} dt \right]. \tag{3}$$

From equating both payment legs, we obtain the expression for the CDS premium as:

$$s = \frac{E^Q \left[w \int_0^T \lambda_t e^{-\int_0^t (r_s + \lambda_s) ds} dt \right]}{E^Q \left[\int_0^T e^{-\int_0^t (r_s + \lambda_s) ds} dt \right]}. \tag{4}$$

To obtain closed-form evaluations for both corporate bonds and CDSs, we specify the risk-neutral dynamics for default-intensity process λ_t and liquidity process γ_t as follows:

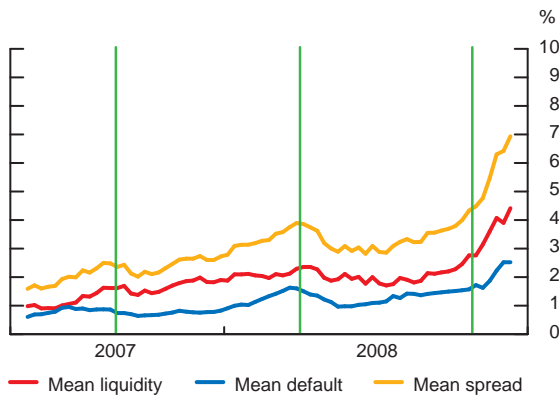
$$\begin{aligned}
 d\lambda_t &= (\alpha - \beta\lambda)dt + \sigma\sqrt{\lambda}dZ_t \\
 d\gamma &= \eta dZ_t.
 \end{aligned} \tag{5}$$

The closed-form formula for both corporate bonds and CDS premiums can be found in Longstaff, Mithal, and Neis (2005). To estimate the model, we minimize the pricing error for the CDS premiums and the bond prices associated with a given firm. We recover λ_t from time-series observations of CDS premiums;¹ then, at each time t , we recover γ_t by minimizing the percentage pricing errors from at least two corporate bonds at time t . We find maximum-likelihood estimates for those parameters by minimizing the sum of corporate bond pricing errors over the entire sample.

¹ The initial values used for the parameters are reasonable estimates, based on the literature and recent evidence.

Chart 2: Corporate bond spreads for an average investment-grade firm

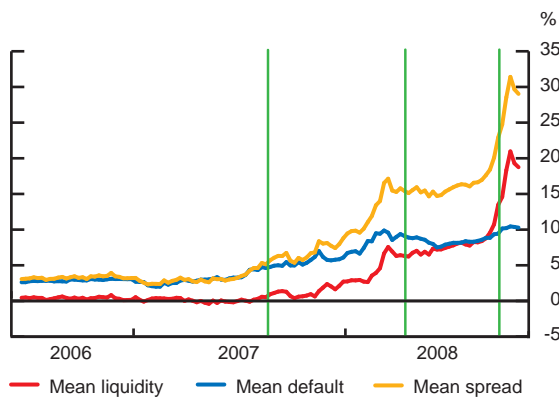
Synthetic zero-coupon 5-year bond



Note: The green lines represent the dates when Bear Stearns liquidated two hedge funds that had invested in mortgage-backed securities (31 July 2007), the Federal Reserve Bank of New York announced that it would provide term financing to facilitate JPMorgan Chase's acquisition of Bear Stearns (24 March 2008), and Lehman Brothers filed for Chapter 11 bankruptcy (15 September 2008).
Source: Bank of Canada estimates

Chart 3: Corporate bond spreads for an average speculative-grade firm

Synthetic zero-coupon 5-year bond



Note: The green lines represent the dates when Bear Stearns liquidated two hedge funds that had invested in mortgage-backed securities (31 July 2007), the Federal Reserve Bank of New York announced that it would provide term financing to facilitate JPMorgan Chase's acquisition of Bear Stearns (24 March 2008), and Lehman Brothers filed for Chapter 11 bankruptcy (15 September 2008).
Source: Bank of Canada estimates

the default component of the average investment- and speculative-grade firm started to increase, while the liquidity component for both increased substantially. It is difficult to determine the medium-term impact of the filing by Lehman, since there are only a limited number of days for which the CDS data for Canadian firms are still reliable. After September 2008, the CDS data quickly become unreliable as a pure source of default risk, owing to reduced trading—or no trading

at all—in the market. Right after the filing by Lehman, however, we notice that, for both types of firm, it is the increase in the liquidity component that dominates the change in the spread. This is in line with the drastic deterioration in North American credit markets.

In more general terms, our results show that, for investment-grade firms, the majority of the spread corresponds to liquidity; on average, the liquidity component accounts for 63 per cent of the spread. For speculative-grade firms, it is the reverse—the majority of the spread corresponds to default, with the default component accounting for 77 per cent of the spread, on average.¹³ In addition, our results provide evidence that the liquidity component increased earlier for the speculative-grade firms.

For investment-grade firms, the majority of the spread corresponds to liquidity. For speculative-grade firms, the majority of the spread corresponds to default.

These results are consistent with those of de Jong and Driessen (2006) and Acharya, Amihud, and Bharath (2008) in finding that the credit crisis has had a larger impact on speculative-grade than on investment-grade bonds. As shown in Charts 2 and 3, the overall spread is much higher and the liquidity component (red line) increased markedly and earlier for speculative-grade firms.¹⁴ For the average investment-grade firm, the increase in the liquidity component was less drastic than the corresponding increase for the average speculative-grade firm, at least prior to the Lehman filing, after which it dominates the change in the spread. At this point, however, the CDS data are a less-reliable source of default risk.

Similarly, a comparison of the volatility of the liquidity component across firms shows that spreads for (speculative-grade) firms 1 and 2 exhibited larger volatilities in their liquidity component than did (investment-grade) firms 3 to 8 (Table 3). Although firm 7 has a mean liquidity component higher than that of firm 2, the associated standard deviation is much smaller.

¹³ For speculative-grade bonds, the liquidity premium is a smaller share of a wider spread, and thus is larger in absolute terms.

¹⁴ Note that the vertical axis in Chart 3 is more than three times larger than the one in Chart 2.

Table 3: Volatility of the liquidity component (%)

	Mean	Standard deviation	Rating
Firm 1	4.13	5.74	Speculative
Firm 2	2.14	3.85	Speculative
Firm 3	1.58	0.37	Investment
Firm 4	1.57	1.04	Investment
Firm 5	1.39	0.74	Investment
Firm 6	1.98	1.12	Investment
Firm 7	3.00	0.63	Investment
Firm 8	0.93	0.98	Investment

Note: The level of the liquidity component is obtained from the total spread minus the spread with only default taken into account.

Source: Bank of Canada

Conclusion

In this article, we used a reduced-form credit-risk model to decompose the spread for Canadian firms that issue bonds in the U.S. market. Our main results suggest that the proportion of liquidity and default risk varies across firms and over time, and that the nature of the variation depends on the nature of the shock to the economy. More-specific results that apply to the credit crisis of 2007–08 are: (i) the relative size of the liquidity component in corporate bond spreads is larger for investment-grade bonds than for speculative-grade bonds; (ii) both the liquidity and default components of corporate spreads for speculative-grade bonds increased markedly after the beginning of

the crisis; and (iii) the liquidity component increased more for speculative-grade bonds during the credit crisis, which is typical of a “flight-to-quality” phenomenon. While these findings are consistent with intuition, they should be verified with a larger sample of firms once more data become available as the market for CDSs for Canadian firms develops further.

The proportion of liquidity and default risk varies across firms and over time, and the nature of the variation depends on the nature of the shock to the economy.

A key implication of these results is that, in designing policies to address problems in credit markets, it is important to consider that the liquidity component in corporate spreads for investment- and speculative-grade bonds behaves differently than the default risk, especially during crisis episodes.

Future work on the decomposition of corporate bond spreads should focus on: (i) the study of Canadian-dollar-denominated corporate bond markets, (ii) comparing different methods of decomposing Canadian corporate spreads, and (iii) incorporating time-varying default- and liquidity-risk premiums in the analysis. In addition, appropriate policy responses under different conditions should be investigated.

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Agency Conflicts in the Process of Securitization

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- *The misalignment of incentives among participants in the securitization process has been identified as contributing to the financial crisis.*
- *Recent evidence finds a positive association between the prevalence of loans of inferior quality and the growth in securitized products. Some argue that this is caused by the lack of incentives among lenders to screen borrowers, while others point to factors such as the specifics of balance-sheet management.*
- *Current initiatives to regulate securitization markets include greater transparency and standardization; requiring participants to hold an economic interest in the credit risk of securitized assets; linking the compensation of market participants to the long-term performance of the underlying loan; and regulation of credit-rating agencies.*

Securitization is the process of turning cash flows from a pool of non-tradable assets into tradable debt instruments. Major examples include the pooling of residential mortgage loans into residential mortgage-backed securities; consumer debt receivables such as leases and auto, equipment, and student loans into asset-backed securities; and bank loans, bonds, and mortgage- and asset-backed securities into collateralized debt obligations.¹ The misalignment of incentives among participants in the securitization process has played a major role in the ongoing turmoil in financial markets (Carney 2009). Many policy-makers have emphasized that the originators of loans lacked the incentive to act in the best interests of investors, the ultimate holders of loans, causing multiple agency conflicts.² Mishkin (2008), for example, argues that originators are motivated to maintain high volumes of loan issuance, but not to promote high-quality loans, since they no longer have any exposure to the pool of securitized assets.

Understanding conflicts of interest inherent in the securitization process is important for several reasons. First, levels of securitized debt grew tremendously in the past decade. In the United States, the share of outstanding asset-backed corporate debt increased from roughly 4 per cent of all corporate debt in 1985 to 40 per cent in 2007 (Federal Reserve Board Statistical Release, Flow of Funds Accounts). A similar, though less-pronounced, trend was observed

* The author would like to thank Greg Bauer, Ian Christensen, Chris D'Souza, Scott Hendry, Donna Howard, Grahame Johnson, Stéphane Lavoie, Jonathan Witmer, Elizabeth Woodman, and Mark Zelmer for their valuable comments.

1 Mortgage-backed securities include residential and commercial mortgage-backed securities. See Fabozzi, Davis, and Choudhry (2006) for details on securitized financial products.

2 An agency relationship is a contract under which a principal employs an agent to perform some service on their behalf, requiring the delegation of decision-making authority to the agent (Jensen and Meckling 1976). Principal-agent (agency) conflicts are prevalent; for example, managers may not always act in the best interests of shareholders, over whom they often have an informational advantage. Or, in financial contracts, lenders cannot directly observe the quality of borrowers and may lend to those who take risky actions, thus decreasing the probability of the loan being repaid.

in Canada, where outstanding asset-backed corporate debt was 6 per cent of all corporate debt in 1993 but 18 per cent in 2007.³ Second, this rise in the volume of securitized debt led to significant structural changes in capital markets.⁴ Specifically, traditional bank-based relationship lending was replaced by arm's-length contracting, with the owners of securitized products having little knowledge of the original loans or of the borrowers.⁵

The rise in the volume of securitized debt led to significant structural changes in capital markets.

Third, securitization may affect the monetary policy transmission mechanism. On the one hand, securitization may strengthen the effect of monetary policy through the liquidity channel because, in theory, it should improve liquidity in credit markets, which can potentially contribute to the efficient allocation of credit. In addition, securitization transforms the underlying pool of bank loans into contingent claims that depend on asset prices in capital markets. The more closely the cost of securitized assets is linked to market interest rates rather than to the capital cost of bank lending, the stronger might be the impact of securitization on the relationship between market and short-term policy interest rates, thus enhancing the transmission mechanism. On the other hand, securitization may weaken the effect of monetary policy by providing an alternative source of funding. Under tight monetary policy, according to the theory of the bank-lending channel, banks may experience funding problems (Bernanke and Gertler 1995). By providing an alternative source of funding, securitization may resolve these funding problems and thus dampen the

effect of monetary policy. Overall, the effect of securitization on monetary policy remains ambiguous.⁶

Finally, securitization can also reduce funding costs by allowing originators to remove the pool of loans from their balance sheets and thus avoid regulatory capital charges (Acharya, Philippon, and Richardson 2009; Acharya and Schnabl 2009). Once the assets are no longer on their balance sheets, originators can use the proceeds to originate new loans. Pooling and tranching also permit the conversion of illiquid assets into tradable and divisible debt securities that better correspond to the investors' risk-return profiles, which improves overall liquidity in capital markets (Coval, Jurek, and Stafford 2009; DeMarzo 2005).

When the credit crisis began, however, it was evident that conflicts of interest among participants can potentially reduce the benefits of securitization and increase the risk to the system as a whole. This article discusses agency conflicts that occurred at different stages of the securitization process before the outbreak of the credit crisis in 2007. It focuses on the latest theoretical and empirical work on conflicts of interest related to moral hazard and adverse selection.⁷ In particular, studies on securitization and loan quality, screening incentives, credit ratings, risk taking by originators, and the incentives of servicers are reviewed. Various regulatory proposals and potential solutions for ameliorating agency conflicts in the securitization process are discussed as well.⁸

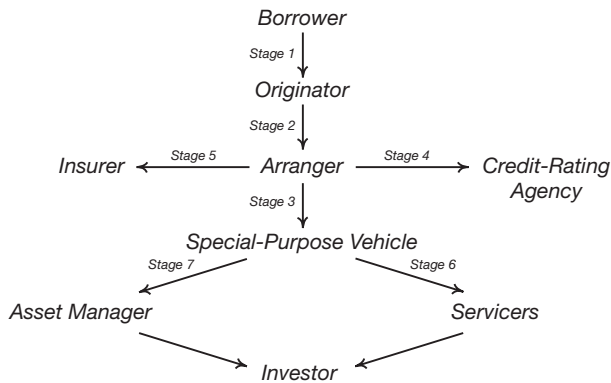
The Basics of Securitization

Securitization is a complex, multi-stage process involving various players. **Figure 1** shows a stylized representation of the various stages in the securitization process (the stages do not necessarily follow

3 Author's calculations, based on Bank of Canada data.
4 See Kiff et al. (2009) for an analysis of the issuance trends related to different securitization products. The overall trend is a large increase in volumes over the 2000–07 period followed by a sharp drop at the start of the crisis.
5 See Rajan (2005) for an overview of the changes in financial transactions over the past decade. In particular, the author notes that the typical financial transaction today is based on arm's-length contracting rather than on a long-term relationship between a client and financial institution. Financial transactions also depend on global liquidity, because the markets have become more integrated. Reintermediation has resulted in less direct investment by households and a rise in the number of institutional investors.

6 Estrella (2002) shows that, over the period 1966–2000, an increase in the federal funds rate led to a much stronger increase in mortgage rates under securitization than happened when there was no securitization.
7 Moral hazard occurs when an agreement creates an incentive for an agent to take more risks against the interests of the principal (or an issuer). For example, if policy-makers rescue some firms, other firms may take on more risk if this leads them to believe that the probability of being bailed out has increased. Similarly, a firm approaching insolvency with only a low probability of survival may take extremely large risks in an attempt to benefit from the situation. Adverse selection occurs when one of the parties to a transaction has more information than the other. For example, if there are two groups of assets, only one of which is defective, and the seller can identify their quality but the buyer cannot, then an adverse selection problem arises in which buyers suspect that all assets are defective and discount their value.
8 Table A1 in the Appendix provides a summary of recent regulatory recommendations, their purpose, and potential flaws. Some of them will be described in the text below.

Figure 1: Major players in the securitization process



sequentially, but may often take place simultaneously). The stages, along with the main responsibilities of the players, are discussed below.⁹

Stage 1: *Borrowers* apply for loans, which are initially funded by an originator, usually a bank or savings institution.

Stage 2: The *originator* identifies and pools assets into a portfolio, which may consist of any of the following assets: mortgage, bank, auto, home equity, student, or equipment loans; bonds; consumer debt; or trade or lease receivables. The pool of assets is sold to a *special-purpose vehicle* (SPV), a thinly capitalized entity whose ownership and management are independent of the originator (Gorton 2008). The SPV is usually established as a trust whose main purpose is to purchase the assets and realize their off-balance-sheet treatment for legal and accounting purposes. Originators receive an origination fee paid by the borrowers plus the difference between the values of originated and sold loans (Ashcraft and Schuermann 2008).

Stages 3–5: *Arrangers*, usually investment banks, are involved in all aspects of the deal structure and are compensated through fees paid by investors. Their responsibilities are to create the SPV, fund the assets until the securitization deal is closed, and underwrite the issuance of asset-backed securities. They consult *credit-rating agencies* (**Stage 4**), which assign ratings

⁹ See Ashcraft and Schuermann (2008) for a more detailed presentation of the players and the typical incentives in a securitization transaction involving residential mortgages. Note that securitization deals are typically not standardized, except for mortgage-backed securities, and the originators may play multiple roles (arranger, underwriter, and servicer), which further complicates the agency conflicts in the structure.

based on the credit risk of the asset-backed securities, measured in terms of the probability of default. Since the arrangers are responsible for the design of the security, they are key players in financial innovation.

The security design involves the division of the pool of assets into several slices, called *tranches*, each of which has a different level of risk and is sold separately. The least risky tranche, for example, will be the first to receive proceeds from the income generated by the underlying assets, while the riskiest tranche has the last claim on that income. The conventional securitization structure assumes a three-tier security design: junior (equity, or first-loss), mezzanine, and senior tranches. This structure concentrates expected portfolio losses in the junior position, which is usually the smallest of the tranches but the one that bears most of the exposure to credit risk and is thus expected to receive the highest return.

The initial risk level of each tranche determines the amount of additional credit needed to reach a higher rating. Arrangers help to reduce the credit risk of the pool of securitized assets by requiring collateral, insurance, or other agreements to reassure the investors that they will be compensated if the borrower defaults. Arrangers devise ways to enhance credit (i.e., improve the credit rating) from either internal or external sources. Internal sources include the subordination of the tranches (imposing constraints on the payment of interest and principal for the various tranches) and/or overcollateralization of the asset pool (where the value of the issued securities is lower than the value of the underlying assets).¹⁰ Alternative internal sources of credit enhancement are a reserve fund (a separate fund created by the issuer that reimburses the trust for losses up to the amount of the reserve) and an excess spread (the difference between the proceeds from the underlying assets and the coupon on the issued security). Among a variety of possible external sources, the arrangers (on behalf of the issuers) can

¹⁰ In this type of structure, some tranches are subordinated to others with the goal of obtaining a high investment-grade rating for the other tranches in the deal. In theory, the subordinated structure must reflect the credit quality of the underlying pool of assets. There is a cascade payment if some of the underlying assets default, with losses allocated to subordinated tranches in a waterfall structure. The equity tranche investors will be paid only after all the other tranches have been paid off. For example, if a \$100 million asset-backed transaction is financed with a \$96 million senior tranche, \$3.38 million mezzanine, and \$0.62 million equity tranche, the subordination level of the senior tranche is 4 per cent, which suggests that if the default loss is less than 4 per cent, the senior tranche is shielded from it.

purchase letters of credit or a credit default swap (CDS) from a *monoline insurance company* (Stage 5), so that if the issuer fails to make a payment, the guarantee provided by the insurers comes into effect.¹¹

Stage 6: Arrangers delegate the portfolio management to *asset (collateral) managers*, who ultimately represent investors. By trading the assets in the portfolio and replacing non-performing assets, managers make decisions on the risk-return characteristics of the portfolio. A manager's compensation includes fees as well as incentive pay linked to the returns of the different tranches.

Stage 7: *Master servicers* are employed by the SPV to collect loan payments, make advances to the trust of unpaid interest by borrowers, and provide customer service to the borrowers (although the originator frequently performs some of these functions). Compensation for master servicers consists of a percentage of the outstanding balance of the loan, plus float.¹² In the event of delinquency, the master servicer may decide to transfer the underperforming loan to *special servicers*, who work out these loans by making decisions on whether to modify or foreclose the loan, and when to do so. Special servicers receive a fixed fee and a percentage of the outstanding loans. If a troubled loan is liquidated, they receive an additional fee.

Investors, at the end of the securitization process, are the ultimate holders of the loan. Households, pension funds, hedge funds, and various financial intermediaries hold the equity, mezzanine, or senior tranches.

Agency Problems

The rather complicated process just described involves many principal-agent relationships, which provide numerous opportunities for agency problems. Agency problems that can occur at each stage of the securitization process are described below, with a discussion of how they may have contributed to the recent financial crisis.

¹¹ A credit default swap is a type of insurance contract against credit risk. For a fee, the buyer secures a promise from the seller of the swap to pay the buyer a stated amount in the event of the borrower's default. See Kiff (2003) and Garcia and Yang (this issue) for a description of this derivative. The International Swaps and Derivatives Association reports that the international CDS market grew from \$631 billion in 2001 to \$54.6 trillion in 2008. Acharya, Brenner, and Engle (2009) provide a brief overview of the CDS market and the financial crisis.

¹² Float is the return that master servicers earn between the time when the borrower advances payment on its obligation and when the servicer passes the payment to investors.

Origination and structuring (Stages 1–3) Adverse selection

Asymmetric information (adverse selection) occurs when, *ex ante*, one of the participants in a financial transaction is better informed than the other about certain aspects of the product's quality.¹³ With traditional lending, banks have a comparative advantage in collecting proprietary information about borrowers (Diamond 1984), which reduces informational asymmetry about the probability of loan repayment. Under the originate-to-distribute model, however, where originator banks remove loans from their balance sheets by selling them to investors, there may be a reduced incentive for the banks to collect information, since they are partially separated from the consequences of the borrower's default and may therefore lack the incentive to develop a long-term relationship with potential borrowers. A major concern about securitization is that it has weakened banks' incentives to screen borrowers, which allowed a higher percentage of bad-quality loans to enter the credit market over the 2000–07 period (Mishkin 2008).¹⁴ The question of whether securitization has diluted screening incentives has been of great importance to policy-makers since the start of the credit crisis in 2007 (e.g., Shin 2009). The problem of asymmetric information may operate throughout the securitization process, in that the originator of loans may have more information about the quality of the assets than arrangers do; similarly, arrangers may be better informed than asset managers.

Assessing whether securitization has led to the lowering of lending standards or whether lax lending standards have contributed to the growth of securitization is a challenging task, the results of which

¹³ Akerlof (1970) refers to the market for used cars, which is characterized by substantial asymmetric information. Assuming that the market price of a used car is the price of a car in average condition, only sellers of cars in equal or worse condition will have an incentive to trade. Because the buyers do not have sufficient information to distinguish between cars with different qualities, the pricing policy deters good-quality buyers and attracts only bad-quality buyers. By lowering standards and prices, only poor-quality cars ("lemons") will be left. This situation is inefficient because, initially, there were buyers who wished to purchase cars at a higher price; however, due to the low quality of the cars, they left the market.

¹⁴ Originators of subprime mortgages face different levels of supervision in the United States. Deposit-taking institutions, such as banks, are supervised by the Federal Reserve Board and the Federal Deposit Insurance Corporation, among other bodies, while non-bank originators, such as mortgage brokers, undergo less supervision. An interesting question, which is beyond the scope of this article, is: To what extent does the regulatory environment affect the incentives of originators for screening and due diligence? See Keys et al. (2009), whose results on the effects of regulation on loan quality show that subprime mortgages originated by banks tend to default more than those originated by less-regulated institutions.

could imply different policy responses. In the former case, regulators and policy-makers should focus on fixing securitization per se, while, in the latter case, the need for screening incentives should be addressed. Ideally, to determine whether securitization has caused lax screening behaviour, securitized and unsecuritized loans with identical loan characteristics should be compared. If no dilution effect is observed, the reason for lax lending standards may be the prevalence of specific types of loans, rather than securitization. The significant differences between securitized loans and non-securitized loans in terms of a borrower's quality, as measured by loan-to-value ratios and FICO scores, implies that originators have securitized only a particular group of loans.¹⁵ Thus, the impact of securitization on screening behaviour may be the result of these differences in loan characteristics, rather than the securitization process itself.

Whether securitization has diluted screening incentives has been of great importance to policy-makers since the start of the credit crisis.

Keys et al. (2010) use data on more than two million subprime mortgages for the period 2001–06 to establish the effect of securitization on screening. They find that the number of loans that are easier to securitize and do not require the collection of costly (unobservable) information about borrowers is more than double (110 per cent) the number that are more difficult to securitize and require the collection of hard-to-verify borrower information. The probability of default within two years of origination is 20 per cent greater for the former than for the latter. The authors take this as evidence that securitization has led to laxer screening standards, which suggests the presence of an adverse selection problem. Demyanyk and Van Hemert (2009) find that the growth of the subprime mortgage market is associated with a decrease in loan quality adjusted for observed loan characteristics and macroeconomic circumstances from 2001 to 2007. The authors of this study conclude as well that issuers were aware of the decrease in loan quality, since mortgage rates continued to rise

while the loan-to-value ratio (which measures a borrower's riskiness) increased over the 2001–07 period.

Another way to determine whether securitization has led to the origination of bad loans is to analyze the trading activity in loans before and after the crisis. Using the sudden freeze in the secondary market in 2007 to identify the effect of securitized lending on mortgage quality from the third quarter of 2006 to the first quarter of 2008, Purnanandam (2009) finds that banks with a large quantity of loans originated before the first quarter of 2007 (before the onset of the credit crisis) could not sell them in the immediate post-crisis period. The author attributes this to the inferior quality of these loans, which is confirmed by observing that the loans had high mortgage charge-off and default rates. After ruling out the effect of different loan characteristics and the liability structure of banks, Purnanandam (2009) concludes that securitization contributed to the origination of inferior loans. This finding is observed to be stronger in banks with relatively low capital and weaker sensitivity to demand deposits.

The reverse causality may also be true, however: Lax lending standards may have contributed to the expansion of securitized credit. Mian and Sufi (2008) explore possible reasons for the recent increase in subprime mortgages. They show that neither the prospect of higher income for subprime borrowers in early 2000, nor the increased expectation of future growth in house prices can explain the rise in the supply of credit. The authors argue that the increase in the number of subprime loans is the result of a greater willingness among lenders to originate such loans. The study is inconclusive about the exact reason for the increased supply of credit, however, which may be better risk diversification, implicit government guarantees, or the lack of screening incentives. Similarly, McCoy, Pavlov, and Wachter (2009) posit that inflated fees at every stage of the securitization process have increased the competition for lending products. To acquire a larger market share, originators decreased their lending standards and extended mortgages to risky borrowers. Measuring lending standards by loan-denial rates and loan-to-income ratios, Dell'Ariccia, Igan, and Laeven (2008) find that the decrease in lending standards has led to an increase in the demand for, and supply of, subprime loans. In addition, the decrease in lending standards is more pronounced in regions where lenders securitized large portions of the originated loans.

Shin (2009) argues that the lack of screening incentives that is presumed to have led to low lending

¹⁵ FICO (Fair Isaac Corporation) scores measure the probability of a negative credit event in a 2-year period. More information can be found at <<http://www.myfico.com>>.

standards may not be the only reason for the growth of securitization. The supply of credit depends on balance-sheet attributes such as equity, leverage, and the funding source. Financial intermediaries must be funded either by equity or by borrowing from creditors outside the banking system. Securitization facilitates credit supply by attracting new creditors such as pension funds, mutual funds, and foreign investors. According to Shin's model, after the banks exhaust the pool of less-risky borrowers, intermediaries seek more-risky borrowers in order to invest the available funds from the new creditors. Thus, the increased supply of credit to more-risky borrowers results more from the availability of funds than from lax lending standards.

The importance of screening incentives is further highlighted by Rajan, Seru, and Vig (2008), who claim that the originators' lack of incentives to collect information about borrowers led to estimates of default probabilities that were biased downwards. In particular, originators of loans acquire two types of information: verifiable (loan-to-value ratios and FICO scores) and unverifiable (soft) information, which is not easily documented (e.g., possible termination of the borrower's job or expenses that are not included in the current credit report). As the distance between the borrower and the investor increases, originators do not have the incentive to collect soft information, which, since it is not verifiable, cannot be reflected in the price of the loans. Models using data from a low-securitization regime will systematically under-predict default probabilities in a high-securitization regime, when soft information is more important. Better statistical techniques may not reduce model risk, because the growth of securitization has changed incentives to determine the riskiness of loans. This suggests that regulators, credit-rating agencies, and investors may face challenges when they rely solely on historical data to estimate the riskiness of assets. One solution is for regulators to take into account the drop in originators' incentives and to mandate the collection of all the necessary information, regardless of the securitization regime.

A host of recent papers therefore suggest that securitization has weakened the incentives of originators to screen, resulting in a large increase in poor-quality securitized loans over the 2000–07 period. Alternatively, the growth in credit supply facilitated by securitization has forced an expansion of the pool of borrowers to include those who are more risky (Shin 2009).

Transparency and standardization

One way to reduce the problem of asymmetric information in securitization markets is greater transparency, which helps originators and arrangers to exercise due diligence and, consequently, to limit various types of risk, such as the risk of allowing bad loans to enter the asset pool.¹⁶ Yet, greater transparency may also reveal the investment strategies of loan originators, thereby affecting their willingness to buy and sell certain assets.

Securitization has weakened the incentives of originators to screen, resulting in a large increase in poor-quality loans over the 2000–07 period.

The proposals for regulatory reform require issuers of asset-backed securities to disclose more information, as well as to provide more standardized formats for reporting. For example, issuers will have to report the underlying structure of the securitization vehicle and will supply information about the transactions, the composition of the asset pools, and their outstanding balances. In addition, originators would have to disclose the structure of their compensation and their level of risk retention, as well as that of brokers and sponsors. To further improve investment decision making in securitization markets, there should be better standardization that will guarantee uniform rules for the various procedures.

Security design

The level of credit support provided to the senior tranches of asset-backed securities is determined by the subordination structure, whereby the first losses are covered by the equity tranche holders. In theory, the use of subordination as an internal source of credit enhancement signals the willingness of the issuer to weather significant credit risk. Low subordination implies that the share of the equity tranche in the deal is small, and may expose investors in the senior tranche to losses. Thus, if the subordination level is too low (the equity tranche is small relative to the senior tranche), originators and arrangers, as holders of the equity tranche, may not have enough incentive to screen borrowers and exert due diligence, and may

¹⁶ See Fender and Mitchell (2009a) for details on policy initiatives other than transparency and standardization. Some of these initiatives are discussed below.

find it more profitable to take large risky positions because the senior tranche investors will bear the greater share of potential losses. If the subordination level is too high (the equity tranche is large and covers potential losses), then originators and asset managers who hold the equity tranche may have strong incentives to screen and monitor. But, owing to the risky profile of the securitization deal, the investors in the equity tranche may not be able to cover the potential losses. Provided that the assets are diversified, with a low correlation of default, subordination offers a shield against losses on the pool of underlying assets and creates incentives for screening and due diligence.

Moral hazard

Shareholders employ managers to handle the day-to-day operations of the firm, yet conflicts of interest can arise between them because managers may not always act in the best interests of shareholders. For example, managers may have an incentive to herd (mimic the investment decisions of other managers) by ignoring private information (Rajan 2005). Herding can lead to suboptimal risk taking by not creating new value-enhancing projects and exposing the firm to the risk of using a single technology, rather than diversifying. Managers may also entrench themselves within the company by making manager-specific investments, such as taking projects whose completion depends on their specific skills, making it costly for shareholders to replace them (Shleifer and Vishny 1989). Entrenchment is also associated with suboptimal outcomes, since the firm relies on managers who invest only in projects that coincide with their own expertise, thereby increasing the firm's risk exposure.

Within financial markets, a moral hazard problem arises when the originator of a loan has no incentive to monitor the borrower's actions—again, because the originator will not retain the loan on its balance sheet and thus will not bear the costs of bankruptcy. Purchasing credit protection, such as credit default swaps, may also weaken originators' incentives to monitor borrowers (Kiff, Michaud, and Mitchell 2003). A consequence of this moral hazard problem is that borrowers may take risky actions that reduce the probability of loan repayment. Recent evidence suggests that the 3-year risk-adjusted underperformance of loans with an active secondary market is partially due to the lack of monitoring, which has allowed excessive risk taking by borrowers (Berndt and Gupta 2008).

Yet, the problems may be amplified throughout the securitization process. Excessive risk taking by bank managers, the main originators of securitized loans, is considered one of the major factors contributing to the credit crisis (Trichet 2008). Originators not only failed to monitor the actions of borrowers, they also appear to have taken risky actions that were not in the best interests of the ultimate holders of the loan (Mishkin 2008). Managers took risky positions mainly because their compensation did not reflect the level of risk of the investments. They had stronger incentives to take tail risks (those that generate a small probability of severe adverse consequences, but offer generous compensation the rest of the time) because their compensation was more sensitive to upside than to downside returns (Rajan 2005). Their compensation was also linked to short-term returns, assuming that negative outcomes would occur only in the distant future. These risks translated into positive returns most of the time, and only rarely into negative returns, until 2007. Because compensation was linked to instant profits without recognizing the source of the risk, banks had incentives to build their balance sheets by investing in securitized products.¹⁷

The policy debate on executive remuneration recognizes that compensation has to be adjusted for different risks.

The policy debate on executive remuneration recognizes that compensation has to be adjusted for different risks by ensuring that it is both symmetric and time consistent with those risks (Bordeleau and Engert 2009; U.S. Treasury 2009; Acharya, Carpenter, and Gabaix 2009). Edmans et al. (2009) propose a new scheme that would allow the firm to escrow compensation until retirement. To maintain sufficient equity in the firm, even if its stock falls, the authors suggest a rebalancing mechanism that maintains a constant ratio between cash and stock. Another way to avoid excessive risk taking in highly leveraged institutions is to decrease the sensitivity of compen-

¹⁷ Highly rated securities, regarded as less risky, required low capital reserves; as well, the originating banks did not account for the assets' level of liquidity risk. Clementi, Cooley, and Richardson (2009) note banks' practice of holding collateralized debt obligations (CDOs) rated Triple-A that they themselves had originated. CDOs are debt securities backed by a pool of heterogeneous debt instruments such as bonds and loans. See Gorton (2008) for a description of the design and issuance trends for CDOs in the 2000s.

sation to return as the value of debt increases (John, Mehran, and Qian 2007). This compensation structure would ensure that managers do not engage in behaviour that incurs higher risks for debt holders. Stated differently, the study implies that compensation in financial institutions has to be designed to encourage managers to serve not only the interests of shareholders, but those of debt holders as well.

Another factor related to securitization that exacerbated risk taking is that the fees paid to various parties were all transaction based—they were realized when the transaction was recorded. Brokers and traders were paid when the contract was signed; the mortgage lender earned a fee when the mortgage was sold; and the issuer was paid an issuance fee. Thus, no party was found to have any stake in the long-run performance of the underlying loan. To rectify this, regulators have moved to link the compensation for brokers, originators, sponsors, and underwriters to the long-term performance of the securitized assets. An important change will be the accounting recognition of income over time instead of the current practice of immediate recognition (U.S. Treasury 2009).

“Holding the equity tranche”

It is assumed that if originators hold the equity (junior) tranche, they will absorb the first losses and will bear most of the risk of default. Because they are in a position to know more about the quality of the loans they have securitized, requiring them to hold a portion of the equity tranche would give them a stronger incentive to screen and monitor borrowers. In the early days of securitization, originators usually kept the equity tranche; however, at some point during the 2005–07 period, these tranches began to be sold to investors such as pension funds, or hedged through credit derivatives.¹⁸ Banks undertook regulatory arbitrage by keeping the Triple-A tranches of securitized products, which allowed them to avoid capital charges. Under these conditions, the equity tranche did not play an incentive role, since they held the senior tranches instead of the equity tranche that could potentially curb risk taking (Clementi, Cooley, and Richardson 2009).

Even if it is held by the originators, the equity tranche may not be the most effective device for aligning incentives under all circumstances, since a systematic factor (an event beyond the control of the originators) might affect the performance of all of the tranches. In a theoretical model, Fender and Mitchell (2009b) argue that if the probability of an unfavourable systematic outcome is high, the equity tranche will absorb losses regardless of the efforts by originators, and thus may actually provide less incentive for originators holding those tranches to screen borrowers. In these circumstances, it is optimal to hold equal slices of both the mezzanine and equity tranches, or a slice of each tranche of the portfolio (a vertical slice). If the probability of a favourable outcome is high, however, then it is better to hold the equity tranche than the mezzanine or the vertical slice. Finally, the authors note that the equity tranche will not play an incentive role if it is hedged with credit derivatives or if the portfolio consists of loans with highly correlated default probabilities. In response, recent regulatory proposals prohibit any direct or indirect hedging of risks related to the equity tranche, which is meant to ensure the material interest of the originators and sponsors of the deal (U.S. Treasury 2009).

Requiring originators to hold a portion of the equity tranche would give them a stronger incentive to screen and monitor borrowers.

Credit rating (Stage 4)

At Stage 4 (Figure 1), arrangers contact credit-rating agencies to obtain a rating on each tranche. By assessing the creditworthiness of a corporation or security, credit-rating agencies act as “gatekeepers” that reduce the probability of asymmetric information about the default and recovery risk of securities and firms. As users of credit ratings, investors are interested in accurate ratings, while issuers, who are paying for the ratings, are interested in favourable ratings. Thus, there is a conflict of interest among issuers, rating agencies, and investors, for which rating agencies have been criticized.¹⁹ A frequently cited cause of the financial crisis is that credit-rating

¹⁸ Some of the U.S. pension funds that held CDO tranches in the pre-crisis period were Calpers (California Public Employees’ Retirement system), the General Retirement System of the City of Detroit, the Teacher Retirement System of Texas, and the Missouri State Employees’ Retirement System.

¹⁹ Of course, this agency problem is modified somewhat by reputational concerns: Issuers are interested in favourable ratings from reputable rating agencies that provide accurate ratings.

agencies may have delivered inaccurate ratings of structured products because the models and the underlying assumptions did not fully reflect the complexity and risk of these securities (Coval, Jurek, and Stafford 2009; Richardson and White 2009).²⁰ Rating original asset-backed securities depends on the default correlation among the underlying assets, while rating CDO tranches depends on the default probabilities of asset-backed securities. In other words, the ratings depend on the default probability of a product that itself depends on default probabilities. Coval, Jurek, and Stafford (2009) note that small errors in estimating the likelihood of default may not be enough to change the rating of structured products securitized once, but they may be crucial for the rating of products like CDOs that are securitized two or more times.

Another factor that might have exacerbated the agency problem between issuers and investors is “rating shopping,” which allows issuers to choose only the most favourable rating received from all of the credit-rating agencies. Agencies may have encouraged rating shopping by selling consulting, or advisory, services to attract issuers. The complexity of structured products may also increase the disparity in ratings across agencies, as argued by Skreta and Veldkamp (2009), which may be another reason for rating shopping. Regulators agree that the practice should be banned. Assuming that advisory services promote rating shopping, the European Union regulator has stipulated that “agencies may not provide advisory services” (European Commission 2008). A similar, though less-restrictive, proposal by the Securities Exchange Commission is to separate the roles of a rater and an adviser for the design of tranches in securitized products.

Theory suggests that reputational concerns may act as a disciplinary device among rating agencies. Klein and Leffler (1981) suggest that the agencies’ reputational concerns may maintain quality standards in markets where problems with asymmetric information preclude it. A recent theoretical study by Bolton, Freixas, and Shapiro (2009) shows that the issuance of inflated ratings is higher in situations where the costs of maintaining the agency’s reputation are low.

Since creating and maintaining a reputation is linked with competition, the market structure of the credit-rating agencies is expected to affect the quality of the service. Becker and Milbourn (2008) reason that competition reduces producer profits, which may result in weakened reputational concerns and, hence, ratings of a lower quality. On the other hand, competition among agencies may strengthen their reputational concerns because issuers can choose among many agencies. An empirical study by Becker and Milbourn (2008) on the effect of competition on ratings finds that the increase in the market share of Fitch in corporate bond rating since the mid-1990s has resulted in less-accurate corporate ratings. A potential policy implication is that weaker competition may strengthen reputational concerns and thus the quality of the ratings; however, careful examination of both the costs and the benefits of competition in the rating industry is needed.

Various regulatory proposals have been formulated to address conflicts of interest among credit-rating agencies. One of the methods used most frequently to realign incentives is the pay structure. Regulators are debating whether the fees collected by credit-rating agencies should be paid by investors rather than issuers (SEC 2009). If investors pay, however, they may not be willing to share rating assessments, which would reduce disclosure and increase the asymmetrical-information problem, likely to the detriment of smaller investors.²¹ Another proposal requires issuers to pay up front, which may introduce a new moral hazard problem: Rating agencies may not have the incentive to deliver high-quality service. An alternative mechanism for mitigating agency problems is strong oversight. The European Union regulator suggests that agencies appoint at least two directors on their boards whose salary does not depend on the performance of the rating agency (European Commission 2008).

Another proposal would require rating agencies to improve the disclosure of the models, methodologies, and assumptions on which the ratings are based (U.S. Treasury 2009). Too high a level of disclosure may deter innovation and reduce the diversity of models, thus increasing systemic risk, while too low a level hurts the interests of investors. A larger set of risk

²⁰ Although not necessarily proving the inaccuracy of the ratings of structured products, Fitch Ratings (2007) reports that 70 per cent of their structured products are rated Triple-A. Using a Standard & Poor’s database of 3,912 tranches of CLOs (securities backed by a pool of corporate loans), Benmelech and Dlugosz (2009) discover that 70.7 per cent of all tranches receive the highest grade.

²¹ See Zelmer (2007) for more details on this topic.

metrics can potentially inform investors of the multi-dimensional aspects of the risks they are taking.²²

Insurance (Stage 5)

Issuers and arrangers may choose to buy credit default swaps (CDSs) to insure against the possibility of default on the pool of underlying assets. In general, a CDS introduces counterparty risk—the risk that the insurer will fail to fulfill its obligation to pay the buyer of the swap (arrangers) if the borrower defaults (the pool of underlying assets). In the recent crisis, the counterparty risk in the CDS market turned into systemic risk because the standard bilateral arrangement of this contract did not take into account the exposure to other buyers of swaps. One way to mitigate this risk is to impose collateral and margin requirements. However, the lack of transparency in this market masked the exposure to expected credit defaults of counterparties, which may have made swap buyers reluctant to demand large margins and collateral.

The lack of transparency in the CDS market masked the exposure to expected credit defaults of counterparties.

In the wake of the market turmoil, it became apparent that high-rated swap sellers such as AIG had not posted sufficient collateral for their swap contracts. The swap counterparties were relying on AIG's own ratings to hedge counterparty risk.²³ However, this created a moral hazard problem because the expansion of insurers' balance sheets as a result of collateral avoidance allowed them to sell even more swaps. The question arises: Would the issuers have bought CDS contracts had they known, for example, that AIG had \$400 billion worth of exposure to credit defaults?

²² For example, the Dominion Bond Rating Service (DBRS) has introduced new reporting requirements for conduits of Canadian bank-sponsored asset-backed commercial paper. In particular, they are required to include details of the underlying structure of each conduit, the type of the transaction, and the composition of the asset pool. In addition, to increase the transparency of the rating process, DBRS releases surveillance reports on commercial mortgage-backed securities (CMBS) (DBRS 2009).

²³ AIG counterparties did not require collateral because of the insurer's Triple-A credit rating. Yet, they required collateral once the company was downgraded in September 2008 (Acharya, Brenner, and Engle 2009; McCoy, Pavlov, and Wachter 2009).

Since they are subject only to anti-fraud and anti-manipulation prohibitions, CDSs have been very lightly regulated (McCoy, Pavlov, and Wachter 2009). Regulatory proposals will require that if CDS markets continue to increase in size, they should trade through centralized clearinghouses or exchanges that play the role of counterparties (U.S. Treasury 2009; Acharya, Brenner, and Engle 2009).²⁴ An expected benefit from trading through these institutions is that the collateral and margin requirements will not be set bilaterally, ignoring the counterparty risk for each trade. In addition, exchanges guarantee that whenever the margin requirements are low, the trading positions will be liquidated immediately, unless the margins are restored. Thus, the collateral and margin arrangements would correspond to the credit and market risks, resulting in better aligned incentives for insurers.²⁵

Asset management (Stage 6)

At Stage 6, investors employ an asset manager to formulate a strategy and manage the pool of assets. Yet moral hazard arises because of investors' and managers' differing incentives. While the investors' objective is to achieve an optimal risk-return trade-off, the goal of asset managers is to maximize their fees, which may lead them to engage in various adverse strategies in regards to portfolio design and trading decisions. They may, for example, build high-risk undiversified portfolios that do not maximize risk-adjusted returns for investors; if they hold a portion of the equity tranche, they may purchase (sell) loans below (above) par value and distribute the gains to holders of the equity tranche. They may also buy low-rated assets to earn higher yields at the cost of increased credit risk or may not expend the effort to acquire private information about the loans, instead mimicking the investment decisions of other managers by "buying the market," thus ensuring that they will not underperform their peers (Rajan 2005). These

²⁴ If trading is organized through a clearinghouse, each trade is initially set bilaterally. The clearinghouse then steps in as a counterparty, thus permitting the netting of identical offsetting contracts. If the trading is organized in a formal exchange, licensed market-makers are counterparties that meet collateral and margin requirements. Exposure netting under both arrangements reduces counterparty risk. Duffie and Zhu (2009) examine whether the establishment of clearinghouses reduces counterparty exposure and collateral demand, arguing that this is efficient only if "the opportunity to get multilateral netting in that asset class dominates the resulting loss in bilateral netting opportunities across other asset classes" (p. 2).

²⁵ The regulatory proposals for over-the-counter (OTC) markets also include standardization of the CDS contracts; a centralized registry if the contracts are not large enough; (delayed) disclosure of the net positions of market participants; and transparency of information for regulators. See Acharya, Brenner, and Engle (2009) and U.S. Treasury (2009) for more details on these proposals.

risks can be alleviated by imposing constraints on managers' decisions and on the composition and risk profile of the portfolio (Keller 2008).

Servicing (Stage 7)

Once the loan is transferred to a trust and securitized, the master servicer is responsible for the allocation and distribution of the loan proceeds and losses to the tranche holders. The special servicer manages the work-out plan for delinquent loans. The presence of servicers alleviates potential coordination problems among heterogeneous classes of investors with different risk-return profiles. Ashcraft and Schuermann (2008) refer to Moody's estimates that the loss can vary within a 10 per cent range, depending on a servicer's quality.

Senior- and equity-class investors may have conflicting interests regarding the choice of extending the loan or foreclosing and selling the property. Loan extension may not be preferred by the senior-class investors, since the collateral may continue to deteriorate, thereby decreasing the proceeds. If interest rates are falling, however, senior tranche holders may be better off with an extension. The equity tranche holder may prefer an extension to prolong the period of fee proceeds if the value of the collateral is less than the loan balance.

Once they are handling the loan, special servicers may prefer to extend a loan work-out to obtain higher fees rather than assuming the cost of monitoring and creating the work-out. Gan and Mayer (2006) show that if a special servicer holds the equity tranche, the probability of transferring loans into special servicing is lower. Once the loan is transferred into special servicing, the size of the loss in the deal affects the liquidation period; i.e., loans with small losses are associated with faster liquidation than are loans with larger losses. Overall, holding a stake in the deal appears to be an important device to realign incentives between servicers and investors.

Conclusion

The rapid growth of securitization has modified the way credit markets function. Although securitization has many potential benefits, the agency problems inherent in the various stages of the process have made it difficult for investors to evaluate the underlying risks.

Thus, the main question is how to restore healthy and sustainable securitization markets by overcoming these agency problems. The regulatory proposals target reforms in several areas: improved transparency and disclosure, better use of credit ratings, effective alignment of incentives between originators and arrangers, and increased standardization. It is also debated that the regulators need to consider not only the separate effect of each policy, but their interactive impact as well.

The main question is how to restore healthy and sustainable securitization markets by overcoming these agency problems.

To ensure the availability and quality of information for the participants in the securitization deal, the proposals recommend better and timely disclosure of practices by originators, asset managers, and underwriters. For instance, regional industry bodies have prepared recommendations for disclosure at the pre-issuance stage of information on the cash flow of pools of assets (sensitivity to prepayments, default, and recovery scenarios, and a summary of loan characteristics), expected credit ratings, and a description of the hedging arrangements for the cash flow. At the post-issuance stage, investors will receive regular reports for the underlying structure of each deal, the nature of the transactions involving (asset-backed) securities, and the composition of the asset pool at the time of reporting. The regulators should ensure, however, that the information that is released has material content and does not burden investors and securitizers with irrelevant details. To further improve transparency and reduce valuation difficulties, the policy initiatives preview a reduction in the complexity of securitized products by imposing standardization.

To guarantee better use of credit ratings, the proposals require the disclosure of conflicts of interest among the participants, as well as more detailed information on the methods used to calculate the ratings. Credit-rating agencies should also release reports on, for example, specially serviced loans and collateral changes from previous reporting periods. It is also suggested that structured and unstructured products should be identified. To alleviate the conflicts

of interest, the practice of simultaneously obtaining a rating and advice on the deal structure will be banned.

Requiring issuers and/or originators to retain some exposure to the securitized asset is viewed as one means of achieving an alignment of their incentives with those of investors. While it is agreed that originators should maintain a material economic

interest in the deal by holding a portion of the loans they originate, the type and size of the tranche to be retained are still under debate. Retaining the equity tranche per se may not provide strong incentives to screen and monitor borrowers if it is too small to cover losses in a downturn.

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Appendix

Table A1: Summary of Regulatory Proposals Related to Securitization

Proposal	Purpose	Potential drawbacks
<p><i>Skin in the game</i></p> <ul style="list-style-type: none"> • Originators of securitized loans and sponsors have to hold 5 per cent of the credit risk of securitized exposures. 	<ul style="list-style-type: none"> • To ensure that participants have incentives to conduct due diligence regarding the performance of underlying assets 	<ul style="list-style-type: none"> • It remains unclear how regulators have defined the size of the material interest. Some consider that 5 per cent is not enough. The optimal size of the retention tranche is expected to depend on deal-specific characteristics and economic conditions.
<p><i>Focus on the long-term performance of loans</i></p> <ul style="list-style-type: none"> • Compensation of brokers, originators, sponsors, underwriters, and other participants should be linked to long-term performance of loans rather than being transaction based. • Eliminate the gain-on-sale accounting treatment 	<ul style="list-style-type: none"> • To redirect the focus from short-term fee-based performance onto long-term performance of assets corresponding more closely to their maturity. Ensure time consistency between incentives to monitor the actual maturity of the asset. • Eliminate the upfront profitability of securitization and thus induce better risk assessment 	<ul style="list-style-type: none"> • It may be difficult to measure long-term profit; need for design and implementation of new accounting rules • One-size-fits-all solutions. There may be other ways of linking pay to long term-performance: vesting periods, clawbacks, and target levels for incentives.
<p><i>Regulation of over-the-counter markets</i></p> <ul style="list-style-type: none"> • Clearing of all standardized OTC derivatives • Impose margin requirements and risk controls • Prudential supervision (capital requirements, reporting requirements, and rules for business conduct) 	<ul style="list-style-type: none"> • Prevent activities that increase systemic risk • Promote efficiency (through better price discovery) and transparency • Prevent manipulation, fraud, and other abuses. 	<ul style="list-style-type: none"> • Complexity in transforming the OTC market into exchanges. It may not occur immediately. • Clearing houses will clear only standardized trades. A large segment of the CDS market is not standardized • Need to coordinate oversight agencies
<p><i>Transparency and standardization</i></p> <ul style="list-style-type: none"> • Disclosure of practices by originators, asset managers, and underwriters • Disclosure of pay structure • Standardization of structured products 	<ul style="list-style-type: none"> • To reduce asymmetric information among the parties involved in the transaction 	<ul style="list-style-type: none"> • Standardization may impair innovation of structured products.
<p><i>Regulation of credit-rating agencies</i></p> <ul style="list-style-type: none"> • Disclosure of conflicts of interest; consistent policies for disclosure • Differentiate ratings of structured and unstructured products • More disclosure of methods for rating and of the risks involved 	<ul style="list-style-type: none"> • The pricing of structured products depends crucially on credit ratings. The rating agencies are considered to have provided too-optimistic assessments of credit risk. The ultimate purpose is to prevent such behaviour in the future. Less reliance on credit ratings in regulations 	<ul style="list-style-type: none"> • Optimal level of disclosure that is not accounted for in the current proposal. Too much disclosure may deter innovation in models that evaluate creditworthiness.

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