



BANK OF CANADA
BANQUE DU CANADA

Financial System Review

June 2008

The *Financial System Review* and Financial Stability

The financial system makes an important contribution to the welfare of all Canadians. The ability of households and firms to confidently hold and transfer financial assets is one of the fundamental building blocks of the Canadian economy. As part of its commitment to promoting the economic and financial welfare of Canada, the Bank of Canada actively fosters a safe and efficient financial system. The Bank's contribution complements the efforts of other federal and provincial agencies, each of which brings unique expertise to this challenging area in the context of its own institutional responsibilities.

The financial system is large and increasingly complex. It includes financial institutions (e.g., banks, insurance companies, and securities dealers); financial markets in which financial assets are priced and traded; and the clearing and settlement systems that underpin the flow of assets between firms and individuals. Past episodes around the world have shown that serious disruptions to one or more of these three components (whether they originate from domestic or international sources) can create substantial problems for the entire financial system and, ultimately, for the economy as a whole. As well, inefficiencies in the financial system may lead to significant economic costs over time and contribute to a system that is less able to successfully cope with periods of financial stress. It is therefore important that Canada's public and private sector entities foster a financial system with solid underpinnings, thereby promoting its smooth and efficient functioning.

The *Financial System Review* (FSR) is one avenue through which the Bank of Canada seeks to contribute to the longer-term robustness of the Canadian financial system. It brings together the Bank's ongoing work in monitoring developments in the system and analyzing policy directions in the financial sector, as well as research designed to increase our knowledge. The strong linkages among the various components of the financial system are emphasized by taking a broad, systemwide perspective that includes markets, institutions, and clearing and settlement systems. It is in this context that the FSR aims to

- improve the understanding of current developments and trends in the Canadian and international financial systems and of the factors affecting them;
- summarize recent work by Bank of Canada staff on specific financial sector policies and on aspects of the financial system's structure and functioning;
- promote informed public discussion on all aspects of the financial system, together with increased interaction on these issues between public and private sector entities.

The FSR contributes to a safe and efficient financial system by highlighting relevant information that improves awareness and encourages discussion of issues concerning the financial system. The Bank of Canada welcomes comments on the material contained in the FSR.

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Developments and Trends

Notes

The material in this document is based on information available to **22 May 2008** unless otherwise indicated.

The phrase “major banks” in Canada refers to the six largest Canadian commercial banks by asset size: the Bank of Montreal, CIBC, National Bank, RBC Financial Group, Scotiabank, and TD Bank Financial Group.

Assessing Risks to the Stability of the Canadian Financial System

The *Financial System Review* (FSR) is one vehicle that the Bank of Canada uses to contribute to the strength of the Canadian financial system. The Developments and Trends section of the *Review* aims to provide analysis and discussion of current developments and trends in the Canadian financial sector.

The first part of this section presents an assessment of the risks, originating from both international and domestic sources, that could affect the stability of the Canadian financial system. Key risk factors and vulnerabilities are discussed in terms of potential implications for the system's overall soundness. The second part of the Developments and Trends section examines structural developments affecting the Canadian financial system and its safety and efficiency; for example, developments in legislation, regulation, or practices affecting the financial system.

The current infrastructure, which includes financial legislation, the legal system, financial practices, the framework of regulation and supervision, and the macroeconomic policy framework, significantly influences the way in which shocks are transmitted in the financial system and in the macroeconomy, and thus affects our assessment of risks.

Our risk assessment is focused on the vulnerabilities of the overall financial system, and not on those of individual institutions, firms, or households. We therefore concentrate on risk factors and vulnerabilities that could have systemic repercussions—those that may lead to substantial problems for the entire financial system and, ultimately, for the economy. In examining these risk factors and vulnerabilities, we consider both the likelihood that they will occur and their potential impact.

Particular attention is paid to the deposit-taking institutions sector because of its key role in facilitating financial transactions, including payments, and its interaction with so many other participants in the financial system. For instance, these institutions assume credit risks with respect to borrowers such as households and non-financial firms. Thus, from time to time, we assess the potential impact that changes to the macrofinancial environment may have on the ability of households and non-financial firms to service their debts.

Risk factors and vulnerabilities related to market risks are also examined. We assess the potential for developments in financial markets to seriously affect the financial position of various sectors of the economy and, ultimately, to disrupt the stability of the Canadian financial system.

Financial System Risk Assessment

This section of the Review presents an assessment of the risks arising from both international and domestic sources bearing on the stability of the Canadian financial system. The objective is to highlight key risk factors and vulnerabilities in the financial system and to discuss any potential implications for the system's overall soundness.

Key Points

- Although there has been some improvement in conditions over the past several weeks, strains in global credit markets have broadened since December.
- The process of financial system deleveraging appears to have led to wider spreads on fixed-income assets than would be justified by underlying credit risk.
- Enhanced disclosure of potential losses by several large global banks and efforts to strengthen their balance sheets are beginning to reduce counterparty concerns.
- Tensions in Canadian credit markets have been somewhat less severe than those in the United States.
- The strong balance sheet positions of the Canadian financial, non-financial, and household sectors have helped them to weather the turbulence.
- Weaknesses in the global financial system are now better understood, and improvements are being developed.
- The key risk to the financial system is that the downturn in the U.S. economy may be deeper than currently anticipated, increasing losses and forcing additional deleveraging.

Overview

Since the publication of the December *Financial System Review* (FSR), strains in credit markets have broadened and deepened. Estimates of potential financial sector losses from the deterioration in credit markets have increased, and uncertainty about the distribution of those losses has fuelled counterparty concerns. This exacerbated tensions in money markets and increased funding liquidity risks for financial institutions. Constraints on bank balance sheets and heightened risk aversion have been the catalysts for a deleveraging process that has affected even some of the more traditional segments of financial markets. The deterioration in financial conditions has also started to filter through to the real economy. The underlying dynamics of the financial market turmoil are now better understood, however, and work is under way in both the public and private sectors to address the structural weaknesses that have been exposed in the global financial system. More recently, there have also been some tentative signs that investors' appetite for risk may be starting to recover: yield spreads on fixed-income assets have retreated from their highs, demand has started to return to some of the worst-affected areas of the credit markets, and pressures in interbank funding markets have eased somewhat.

The U.S. economy remains at the epicentre of the turmoil. The Federal Reserve has responded to the recent deterioration in the macroeconomic outlook with aggressive interest rate cuts. Several other major central banks have also reduced their key policy rates as their economies have slowed.

Central banks have also employed less-conventional policy measures to address the supply and distribution of liquidity in the financial system. When tensions in the interbank lending markets intensified in December, both in Canada and abroad, the Bank of Canada joined with

other major central banks in a coordinated initiative aimed at improving market functioning through the provision of additional liquidity at maturities longer than overnight. These actions alleviated funding pressures at year-end, but spreads in term money markets remained above their pre-August levels. Interbank markets have been particularly volatile in the United States and Europe this year, reflecting the acuteness of counterparty concerns in these regions. Renewed pressures from financial market dislocations led to a further round of coordinated market intervention by the world's major central banks in March. Soon after these policy announcements, the Federal Reserve extended emergency funding to Bear Stearns, a large U.S. investment bank, facilitating its acquisition by another firm. Against this background, global counterparty concerns have remained high, and money market stresses were only partially eased by policy actions.

The balance sheets of the major global banks have come under increasing strain from the combined impact of writedowns, the downgrading of monoline insurers, the diversion of capital to rescue off-balance-sheet vehicles, and the reintermediation of loans into the banking system. Being increasingly short of balance sheet capacity, global banks have reduced their credit market exposures while also raising margin requirements and cutting back on lines of credit to hedge funds and other geared investment vehicles. The leverage that has supported credit market prices in recent years thus started to unwind, as the forced sale of assets into an illiquid market by investors seeking to reduce risk resulted in price declines that prompted further rounds of margin calls and fire sales of assets. This process has been complicated by valuation difficulties stemming from the opaque nature of many structured products and the lack of active trading in secondary markets.

Against a background of weakness in the U.S. economy and deleveraging by financial institutions, market contagion cascaded from asset classes with weaker fundamentals to those with stronger fundamentals. What started as a problem with assets related to U.S. subprime mortgages undermined the strength of the global banking sector, thus spilling over into the broader financial markets and resulting in liquidity-driven price declines that pushed up the yield spreads on a wide range of credit assets. Many valuation models based on underlying

economic fundamentals broke down as the market continued to weaken; stabilization will require reaching a price that will rekindle investor demand for these securities. The widening of spreads contributed to a virtual shutdown of new issuance in several key areas of credit markets, including residential mortgage-backed securities (RMBS), commercial mortgage-backed securities (CMBS), collateralized loan obligations (CLOs), and high-yield bonds. Equity markets have also been affected, as investors have begun to mark down their earnings expectations.

These broad trends have characterized the asset markets of industrialized nations around the globe, including those in Canada. For example, spreads in Canadian corporate debt markets rose to near all-time highs, despite the relatively favourable outlook for the domestic economy. As discussed in the Highlighted Issue on p. 15, these wide spreads are more likely a reflection of the illiquidity of corporate debt markets than a measure of perceived underlying credit risk. Access to primary markets also remains limited in Canada; financial firms are still raising funds in the primary debt markets, but often at larger concessions relative to secondary-market pricing. While most markets for asset-backed securities have also shut down, mortgage securitization is still possible under the government-insured National Housing Act Mortgage-Backed Securities (NHA MBS) Program, and these securities can be sold through the Canada Mortgage Bonds (CMB) Program, albeit at a wide spread over Government of Canada bonds.

More recently, there have been tentative signs that the turbulence in global financial markets may be starting to subside. Several large global banks have enhanced the disclosure of potential losses and have succeeded in raising capital to strengthen their balance sheets; this appears to be helping to lower counterparty concerns, as reflected in the yield spreads on the banks' credit default swaps (CDS), which have fallen back from their peaks. Demand for corporate bonds has also picked up moderately, and activity has started to resume in some of the worst-affected areas of the debt markets, such as the market for leveraged loans. Still, as detailed in the April 2008 *Monetary Policy Report*, the Bank currently expects global credit spreads to remain elevated until the end of 2008 and to recede only gradually over 2009. Furthermore, spreads are not expected to return to the unusually low levels that prevailed before August 2007.

Canadian financial situation

Tensions in Canadian credit markets have been somewhat less severe than those in the United States. The Canadian economy and financial system appear to be well placed to absorb the effects of the recent turbulence.

On balance, Canadian banks remain healthy. Although earnings of the major Canadian banks have been adversely affected by capital market writedowns, these writedowns have been relatively moderate compared with those of the large Wall Street banks. The Canadian banking system remains well capitalized: core earnings have, so far, remained relatively intact, and banks have been able to raise additional capital. Thus far, the degree of reintermediation of lending into the banking system has not created significant difficulties for Canadian banks, which have generally been able to access sufficient wholesale and retail financing (albeit at higher spreads) to support their own lending activities. Persistence of current unfavourable financial conditions would, however, dampen loan growth going forward. Bank profits will also likely come under further pressure. Revenues from investment banking activities will fall as securitization markets, a source of fee income, remain closed. Loan-loss provisions are beginning to rise from a low base, but the strong financial positions of the Canadian household and non-financial corporate sectors should limit the deterioration in the credit quality of loans. Although the major Canadian banks have some significant exposures to various markets in the United States, these appear to be manageable (see Box 3).

The non-financial corporate sector remains in good financial shape on the whole, reflecting strong profit growth, solid margins, and large holdings of liquid assets. This resilience in the face of a U.S. slowdown has been supported by strong global demand for commodities. Non-energy sectors with high exposure to international trade, however, have generally seen profits decline over the past year, reflecting the fallout from the U.S. slowdown and the stronger Canadian dollar. With limited access to capital markets, firms are increasingly drawing on their existing credit facilities with banks. Overall, growth in business credit has remained above its long-term average, despite some tightening

of bank lending conditions.¹ This tightening is likely to translate into some modest slowing of business credit growth. Strong balance sheets should still allow firms room to continue to expand their capital spending, but weaker demand conditions and increased material and fuel costs are likely to prove challenging for some sectors, particularly forest products and non-commodity, export-oriented industries.

The overall financial situation of the household sector also appears sound, as evidenced by aggregate indicators such as mortgage loan arrears and personal bankruptcies, which remain at low levels. With the cost of borrowing for households having declined in spite of rising spreads, and with little evidence of any tightening in the terms and conditions of household credit, borrowing has continued to grow at a strong pace. This has contributed to an increase in the debt-service ratio, which nonetheless remains relatively low by historical standards. Some modest deterioration in household balance sheets may be expected, owing to declines in financial-asset prices and slower economic growth. Household credit growth should also decelerate. The pace of increase in house prices is likely to continue to moderate. While a widespread decline in house prices does not currently appear likely in Canada, a weaker housing market represents the main risk to household net worth.

Risks

Global credit markets remain very fragile, although there has been some general improvement in market conditions over the past month or so. Investors remain wary of re-entering illiquid markets where further downside potential exists, even though market participants largely agree that credit assets have already undershot any conventional measure of fair value. Forced selling by leveraged investors may again push asset prices lower. Against this background, the situation remains highly uncertain.

Further shocks could expose a number of vulnerabilities in the financial system. Such a shock could emanate either from within the financial

1. See the Bank of Canada's *Business Outlook Survey*, Spring 2008, for indicators of credit conditions for businesses. The Highlighted Issue on p. 24 discusses broader trends in credit growth within the economy.

system itself, such as the collapse of a hedge fund resulting in the sudden forced liquidation of a large portfolio of assets, or from a much deeper and more protracted downturn in the U.S. economy.

The key risk would appear to be the economic situation in the United States. If the U.S. economic recovery proved slow to gain traction amid low levels of business and consumer confidence, the “adverse feedback loop” between the real economy and financial markets could intensify. This would likely result in tighter lending criteria, leading to a more widespread deterioration in the underlying credit quality of consumer and corporate loan portfolios. This, in turn, could trigger additional liquidity problems in financial markets. Associated losses would further erode bank capital, leading to renewed concerns over counterparty risks and higher funding costs in interbank markets. Further rounds of forced deleveraging by financial institutions and by leveraged investors could deepen the liquidity and credit crunch. Equity markets could also experience sharp falls in response to the deteriorating economic outlook, and the U.S. dollar could experience sharp downward pressure.

A deeper-than-expected downturn in the U.S. economy would be transmitted to the rest of the world through trade channels, as well as through financial markets, particularly via the negative impact on credit conditions. Emerging-market economies would be vulnerable to a sudden reversal of capital inflows, with potential adverse consequences for foreign investors. Commodity prices would also be vulnerable to a softening of global demand.

Such an outcome (weaker U.S. and global demand and a decline in commodity prices) would depress the profits of Canadian exporters, with knock-on effects for the broader economy. Canadian banks would likely experience further significant writedowns, the profits of their core business lines could contract, and loan-loss provisions could rise sharply. This could have a significant negative impact on the capital ratios of the major Canadian banks.

Balance sheet constraints and higher funding costs for banks could translate into a reduction in aggregate lending to the economy. Credit conditions for businesses and consumers would tighten significantly, and default losses on

corporate and household lending would rise. Consumer wealth would also decrease as the value of their financial investments declined and house prices weakened in some areas; housing markets in Western Canada would be particularly vulnerable to a sharp fall in commodity prices.

While the probability of such outcomes materializing is relatively low, they nonetheless warrant careful consideration by financial institutions because of the potentially large negative repercussions. On the whole, major Canadian financial institutions appear to have the margins for coping with such outcomes, and the Canadian financial system’s ability to weather these potential adverse developments remains sound.

Mitigating risks to the financial system

Recent events highlight the need for decisive action by both policy-makers and market participants to address the shortcomings that have been exposed in the global financial system. In the public sector, the Financial Stability Forum (FSF) is playing an important international coordinating role; its report outlining wide-ranging recommendations for strengthening the global financial system was endorsed by the G-7 finance ministers and central bank governors on 11 April.²

Immediate actions to ease the strains in financial markets need to focus on restoring the confidence of investors. Central bank market interventions aimed at addressing elevated pressures in the short-term funding markets have helped in this regard. The Federal Reserve’s aggressive reduction of its key policy interest rate has also reduced the risk of a sharp downturn in the U.S. economy. Many central banks have been working to strengthen their ability to respond to financial risks. In this respect, the Federal Reserve has introduced new credit facilities, and the Government of Canada has proposed

2. The full report is available at <http://www.fsforum.org/publications/FSF_Report_to_G7_11_April.pdf> and the accompanying statement of the G-7 finance ministers and central bank governors at <<http://www.fin.gc.ca/activty/g7/g7110408e.html>>; see the Highlighted Issue on p. 17 for a summary of the recommendations.

amendments to the Bank of Canada Act to modernize the Bank's powers, to allow it to support the stability of the financial system.³

The FSF report also identifies priority actions to be undertaken in the private sector to facilitate the adjustment of financial markets. It calls on financial institutions to enhance the disclosure of their risk exposures, writedowns, and fair-value estimates for complex and illiquid instruments; to strengthen risk-management practices; and to recapitalize bank balance sheets. It also calls for greater transparency regarding the composition of structured products to improve the pricing of risk.

Policy-makers are also considering potential actions aimed at enhancing the resilience of markets and financial institutions over the medium term. The FSF report highlights several key areas for reform, including strengthened supervisory oversight of banks' capital, liquidity, and risk-management practices, as well as measures aimed at addressing shortfalls in the credit-rating process for structured products.⁴ It indicates that, going forward, the FSF also intends to examine more closely the forces that contribute to procyclicality in the financial system and possible options for mitigating them. The report notes that it is important that any policy response avoid exacerbating financial stress in the short term. Overall, the report provides a useful template for reform, but national policy-makers must still be careful to ensure that any changes to the regulatory framework governing financial markets will promote an appropriate balance between the stability of the financial system and its efficiency.

3. See "Financial Market Turmoil and Central Bank Intervention" on p. 71 for a discussion of the economic rationale for these powers.

4. For a discussion of proposals for enhancing the credit-rating process, see "Reforming the Credit-Rating Process," *Financial System Review*, December 2007.

The Financial System

Financial markets

Since the publication of the December FSR, conditions in global credit markets have deteriorated, with strains spreading further beyond mortgage-related debt to the broader credit markets. The broadening of the turbulence in financial markets has developed against a backdrop of mounting concerns over liquidity constraints and systemic risk at financial institutions, and a deterioration in global (especially U.S.) economic prospects. Pressures on bank balance sheets related to subprime-related writedowns, higher funding costs, and the recapitalization of monoline insurers (Box 1) have contributed to a rapid deleveraging across financial market participants. This process has become self-reinforcing, as fire sales of credit instruments by leveraged investors into illiquid markets (to meet higher margin calls, for example) have put further pressure on asset prices, leading to further rounds of deleveraging. Contagion has thus extended throughout the credit markets, resulting in a significant widening of spreads on a broad range of credit assets and a virtual shutdown of new issuance in several major segments of the global fixed-income market (see Box 2 for details on the importance of the affected markets in Canada).

Recently, however, there has been some encouraging evidence that credit market tensions may be starting to abate, as CDS spreads, including those for the major global banks, have started to narrow (Chart 1). Demand for corporate bonds is also returning, and activity has resumed in some of the worst-affected areas of the credit markets.

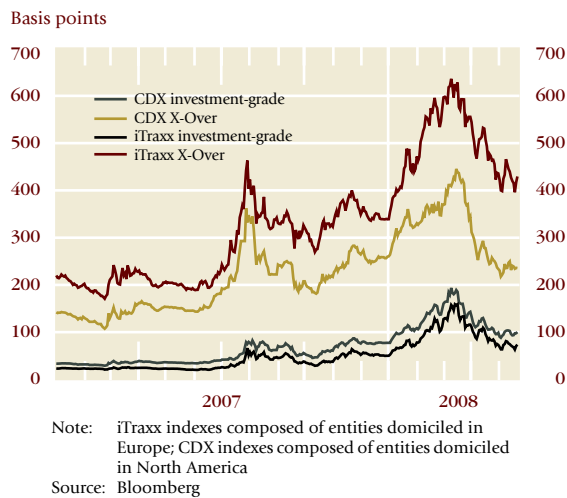
While volatility in equity and foreign exchange markets has been high compared with recent history, these markets have not experienced the dislocations occurring in the credit universe, and they continue to function in an orderly manner.

With the process of deleveraging and recapitalization across global financial intermediaries continuing, some time will be required before regular liquidity conditions are restored to affected markets and normal functioning resumes.

Money markets

The elevation of spreads in funding markets for financial institutions reflects a sharp increase in the size of their balance sheets and a corresponding increase in their demand for funds. This

**Chart 1 iTraxx and CDX Spreads
(Credit Default Swap Index Spreads)**



Box 1**Why Monolines Matter**

Traditionally, monoline insurance companies (monolines) have provided the issuers of U.S. municipal bonds with credit-default insurance by guaranteeing the timely payment of the interest and principal, thus allowing these issuers to obtain a AAA rating, which they otherwise would not have received.¹ This innovation increased the marketability of municipal debt and, thus, reduced the interest rates that municipal issuers had to offer. By 2007, the six largest monolines insured approximately half of the US\$2.6 trillion U.S. municipal debt market. Over the past decade, however, as structured debt markets became increasingly important, monolines began to change their business model. They started to guarantee the timely repayment of the principal and interest on the underlying assets of structured debt instruments such as CDOs. For this service, they received insurance premiums, either from issuers of structured products or from institutional investors who held specific products and wanted to hedge their exposure to credit risk.² Monolines devoted a growing share of their overall business to this area, and by late 2007, approximately 40 per cent of the US\$3.3 trillion in total outstanding debt insured by the monoline industry was based on structured credit products.

Insuring structured credit instruments implied higher levels of risk. Although monolines used underwriting criteria that were conservative by historical standards, the very high level of leverage they typically employed³ left very little margin for error. Given the significant losses in the market for structured products, many financial market participants began to question whether the monolines had adequate capital to honour their obligations and, correspondingly, whether these insurers still warranted the credit ratings that allowed them to offer AAA guarantees on insured products.

The removal of the AAA credit rating from monolines would affect two groups of market participants in particular: the U.S. municipal issuers and large global investment banks. Without the monolines' guarantee, most U. S. municipal issuers would likely face significantly higher costs of debt

financing. The failure of the municipal "auction-rate securities" market in early 2008 clearly showed the effects of the loss of investor confidence in monolines: during this episode, even well-known issuers of high-quality municipal debt saw their financing costs briefly spike to interest rates over 20 per cent.⁴

Large global investment banks, the primary counterparties to the monolines' structured products, are exposed to monoline-related losses in two areas. First, if monolines lose their AAA status, the marked-to-market value of their insurance is diminished, and the underlying insured asset would have to be marked down accordingly. Second, the market value of any credit default swaps sold to the banks by monolines would also decline. The inability of monolines to honour these insurance contracts would cause any hedged credit exposures to revert to unhedged status, against which the banks would have to allocate capital reserves.

It is difficult to estimate the total exposure of investment banks to the downgrades of monoline credit ratings. Accordingly, estimates of aggregate investment bank exposure to monoline credit downgrades vary and tend to be scenario-specific. Most estimates are large, however, with "worst-case" scenarios of approximately US\$125 billion.⁵ These losses—should they occur—would be in addition to all other losses suffered by investment banks on their subprime-mortgage and other credit-product investments, and would likely further constrain the ability of banks to extend credit to the economy.

One Canadian bank has had widely publicized problems with insurance purchased from ACA Financial Guaranty. Standard & Poor's lowered the credit rating on this monoline to CCC (the lowest junk rating above default) late in 2007. This caused the bank to write down the value of the contracts it held with ACA Guaranty by \$2.2 billion. This was just a partial writedown; the bank indicated that full writeoff would lead to further substantial losses. Other Canadian banks have also reported some monoline exposure.

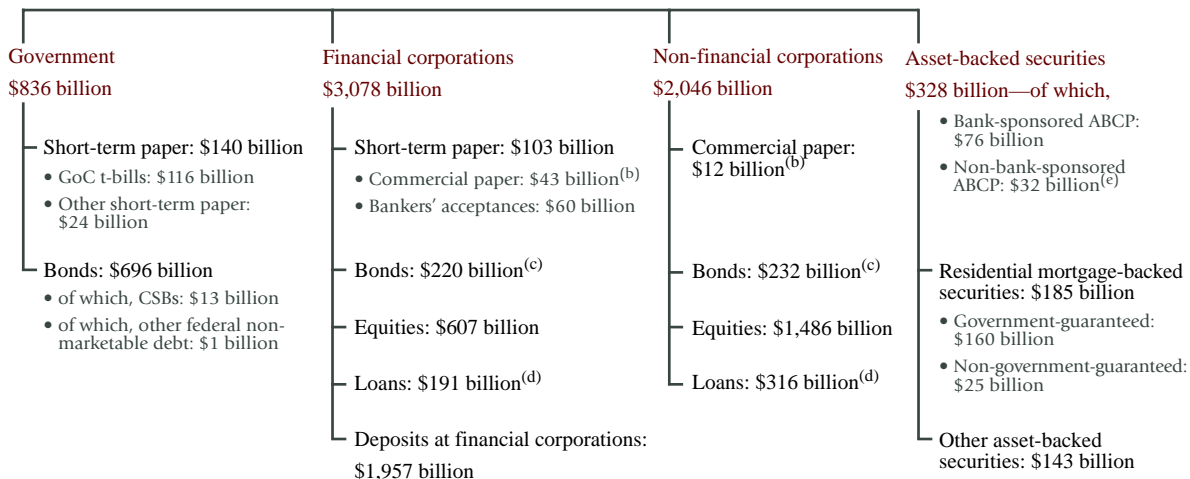
1. "Monoline" insurance companies are so-called because they focus on a single product line: insuring financial debt. Federally regulated Canadian insurance companies are prohibited from offering such insurance, and so monoline companies are non-Canadian firms.
2. Typically, monolines did this by writing credit default swaps with bank counterparties.
3. Their ratios of assets to equity ranged from the low 90s to well over 200 at the end of 2006.

4. Auction-rate securities are a form of floating-rate, long-term municipal debt in which the coupon level resets at regular dates according to an auction process. As the monoline guarantee for these securities came into question, investor willingness to bid for them at the auctions declined, causing yields to increase.
5. S. Glasser, "Monoline Downgrades: Understanding the Impact," *Barclays Capital* (January 2008): 1–19.

Box 2

Structure of Canadian Capital Markets

Figure A Size of Canadian Capital Markets—2007^(a)



(a) All data are December 2007 at book value, except equities at market value. Sources: *Bank of Canada Banking and Financial Statistics*, National Balance Sheet Accounts (Statistics Canada), OSFI, and the TSX.
 (b) Issued in Canada by Canadian and foreign corporations
 (c) Issued in Canada and abroad by Canadian corporations
 (d) Loans by Canadian financial institutions to Canadian and foreign borrowers for business purposes
 (e) These trusts were frozen under the Montreal Accord in August 2007.

This box outlines the size and structure of the capital markets in Canada. In light of the ongoing financial market dislocations, this puts into perspective the importance of the affected markets in Canada.

As in other mature capital markets, corporate equities represent the largest source of corporate financing in Canada, accounting for about one-third of the overall securities market.¹ The relative importance of corporate securities is somewhat higher in Canada and the United States than in the United Kingdom and the euro area, where firms have traditionally relied more heavily on bank loans.² This suggests that Canadian and U.S. corporations may be somewhat more directly affected by a deterioration in financial market conditions than firms in the United Kingdom or the euro area. The balance sheet leverage of Canadian firms has improved

significantly in recent years relative to those in the United States and the United Kingdom, however, which would suggest that Canadian firms are better positioned to confront economic and financial shocks.

In the United States and Europe, the issuance of structured financial products increased exponentially between 2000 and July 2007, when the financial crisis began.³ Over the same period, the asset-backed security (ABS) segment in Canada nearly tripled in size; ABS represents a slightly smaller share of the Canadian securities market (5 per cent) than of global markets (7 per cent). As it has elsewhere, the erosion of investor confidence in structured products has seriously impaired the functioning of the Canadian ABS market since July 2007. Mortgage securitization in Canada is still possible, however, under the NHA MBS Program, which benefits from an explicit government guarantee. This program accounts for close to 90 per cent of total outstanding residential mortgage-backed securities in Canada, and recent growth has been strong (see Highlighted Issue on p. 24). It should also be noted, however,

1. Global comparisons as of 2006. See McKinsey *Global Institute, Mapping Global Capital Markets: Fourth Annual Report* (2008) and the Bank of England's *Financial Stability Report* (October 2007). In Canada, the relative shares of the major components changed very little from 2006 to 2007.
 2. For further details, see D. Côté and C. Graham, "Corporate Balance Sheets in Developed Economies: Implications for Investment," (Working Paper No. 2007-24, Bank of Canada, 2007).

3. The IMF 2008 *Global Financial Stability Report* (April) p. 56, notes that issuance of CDOs, ABS, and MBS in the United States and Europe grew from US\$500 billion in 2000 to US\$2.6 trillion in 2007.

Box 2**Structure of Canadian Capital Markets (continued)**

that less than a quarter of total outstanding residential mortgages in Canada are securitized, compared with almost 60 per cent in the United States.

Nonetheless, exposure to U.S. subprime mortgages and CDOs has led to a crisis of investor confidence in Canada's ABCP market, particularly in non-bank-sponsored ABCP, the segment of Canada's securities market that has been most affected by the market turmoil. Since last August, non-bank-sponsored ABCP has been frozen under the terms of the Montreal Accord, as interested parties work to reach an agreement for restructuring the ABCP into longer-term instruments. ABCP has been an important source of short-term financing for Canadian firms over the past several years. Including non-bank-sponsored ABCP, it represents about 33 per cent of the Canadian ABS market and nearly 50 per cent of privately issued short-term paper.

increase is the result of the reintermediation of off-balance-sheet assets, constraints in accessing securitized funding markets, and the increased reliance of corporations on bank lending (see Highlighted Issue on p. 24).

The lack of transparency and secondary-market pricing in many structured products has made it difficult to gauge the potential loss exposure of financial institutions with any accuracy. This has increased counterparty concerns, which has also contributed to significantly higher spreads in inter-bank funding markets (Chart 2) and raised funding liquidity risk for financial institutions.

Strains also continue to be evident in the market for asset-backed commercial paper (ABCP). However, liquidity conditions have recently improved for bank-sponsored programs,⁵ and borrowing costs have decreased. Nevertheless, costs remain elevated relative to short-term risk-free rates, and secondary-market liquidity remains very limited.

Overall, credit spreads in money markets have increased significantly since the beginning of the turmoil and remain elevated. Liquidity remains inversely related to the borrowing term, with lenders reluctant to provide funds for terms greater than one month without significant compensation. Given the strong interlinkages between global financial markets, the persistence of these pressures prompted a coordinated response from the Bank of Canada and other major central banks to provide markets with additional liquidity on two separate occasions.⁶ Although market liquidity has improved somewhat, with term funding more readily available, and despite the improvement in credit spreads since year-end, signs of funding pressures remain.

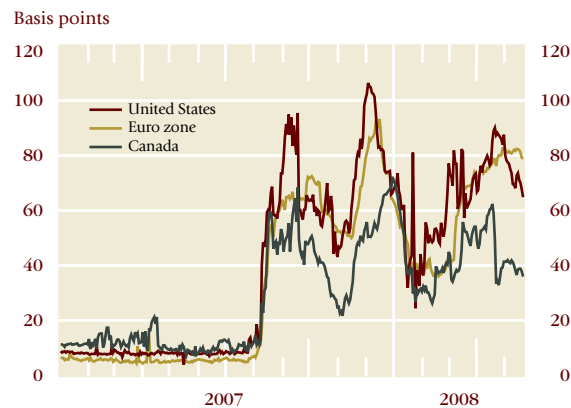
5. As indicated in the December FSR, the market for non-bank-sponsored ABCP is no longer active, with roughly \$32 billion undergoing a restructuring under the Montreal Accord, which is targeted to take effect this month. The last hurdle was crossed when the proposed restructuring was approved by a majority of creditors.
6. Coordinated policy initiatives were announced on 12 December 2007 and 11 March 2008. A third coordinated policy response was announced on 2 May, but the Bank of Canada did not participate. From 20 March 2008 to 15 May, the Bank of Canada auctioned \$2 billion of 28-day term purchase and resale agreements every two weeks. (Later operations were rollovers of previous operations.) On 29 May 2008, the Bank reduced by \$1 billion the outstanding amount of term financing.

Given persistent funding pressures in money markets, the U.S. Federal Reserve has introduced additional measures to address the need for liquidity in term money markets. These include the introduction of a Primary Dealer Credit Facility,⁷ a Term Securities Lending Facility,⁸ and modifications to the Term Auction Facility⁹ that were introduced in December 2007. Evidence to date suggests that while these measures have been useful in containing concerns about constraints on financial institution liquidity, they have not resulted in a material decline in funding pressures. In Canada, increased yield spreads in term money markets have generally been less severe than in the United States and elsewhere (Chart 2). Since the end of April, there has been a general improvement in Canadian money market conditions: bank funding costs have fallen markedly and are well below those in a number of other currencies.

Mortgage debt markets

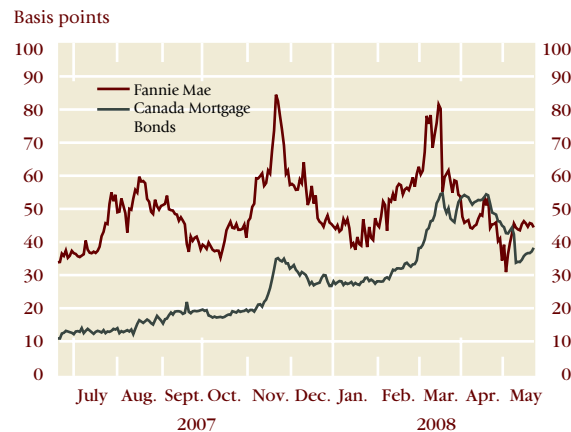
While the problems in the subprime sector of the market for residential mortgage debt are now well known, concerns have spread to the broader market for mortgage-backed debt. For example, the market for conforming mortgages, specifically those repackaged and sold by U.S. Government Sponsored Entities (GSEs), such as the Federal Home Loan Mortgage Corporation (Freddie Mac) and the Federal National Mortgage Association (Fannie Mae), experienced a disproportionately sharp rise in yield spreads relative to the expected modest deterioration in the underlying assets (high-quality mortgage loans) (Chart 3). Although partly related to financial concerns about the GSEs themselves,¹⁰ this widening bears witness to a strong investor

Chart 2 Spreads between 3-Month LIBOR and Overnight Index Swaps*



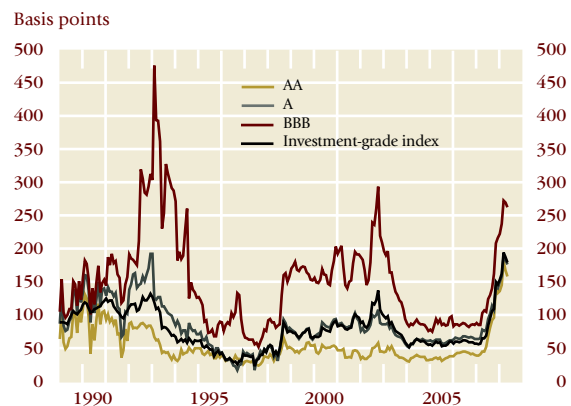
* U.S. LIBOR, EU EURIBOR, and Canadian CDOR
Source: Bloomberg

Chart 3 Spreads on 5-Year Mortgage Bonds



Source: Bloomberg

Chart 4 Yield Spreads on Canadian Corporate Bonds



1989–96: Scotia Capital corporate bond yields minus mid-term GoC yields
1997–2008: Merrill Lynch option-adjusted spreads
1989–91: monthly averages; 1992–2008: end-of-month values
Sources: Scotia Capital, Bloomberg, Merrill Lynch

7. The Primary Dealer Credit Facility is an overnight facility for primary dealers available on an ad hoc basis at the initiative of the borrower. Credit is rationed through prices, with loans granted at a rate equal to that for primary credit at the Federal Reserve Bank of New York under the discount window.
8. The Term Securities Lending Facility provides primary dealers with the opportunity to borrow Treasuries for a term of 28 days in exchange for a broader list of securities than the traditional securities-lending program.
9. The Term Auction Facility provides the depository institutions eligible for primary credit under the discount window with access to collateralized loans for a term of 28 days.
10. Both Fannie Mae and Freddie Mac have had to raise capital on two separate occasions, as well as cut their dividends, in order to repair their balance sheets in conjunction with reported mortgage-related losses.

aversion to any mortgage-related products, as well as the deleveraging of market participants invested in these high-quality mortgage products.

Strains have also appeared in the U.S. market for commercial real estate debt. For instance, the AAA tranche of the CMBX index, a synthetic proxy for the value of commercial mortgage-backed securities, has fallen dramatically. The price declines in this market, while partly reflecting the overall weakness in the U.S. economy, have also likely been driven by contagion from the residential mortgage market.

While the Canadian subprime market is not currently a source of concern (refer to p. 30), the Canadian mortgage-debt market has been affected by recent developments. Specifically, issues of the Canada Mortgage Bond (CMB) Program, whose underlying assets are composed of mortgage-backed securities insured under the NHA, have experienced a widening of their yield spread relative to Government of Canada bonds (Chart 3). It is difficult to gauge the extent to which this widening reflects investor aversion to mortgage-related products, rather than the sharp increase in supply: Canadian financial institutions have increasingly turned to CMBs as a source of wholesale funding since the turmoil began (see Highlighted Issue, on p. 24 for more detail).

As an alternative source of funding, Canadian banks have recently begun to issue covered bonds in the European market (Highlighted Issue on p. 33). Covered bonds are secured debt instruments issued by financial institutions and are traditionally seen by investors as a safe, liquid alternative to government bonds. The European covered bond market has not been immune to the recent market disruptions, however, since many of the assets underpinning covered bonds are tied to residential mortgages. Investors have increasingly begun to differentiate among covered bonds on the basis of issuer, country of origin, legal structure, and quality of underlying assets, despite very few rating downgrades. Demand for covered bonds has fallen, particularly for bonds issued by banks in those countries where housing markets have declined, such as Spain.¹¹

11. As such, recent new issuance has been weighted more heavily towards the private placement market, where dealers can be more assured of demand conditions before the actual sale of these bonds occurs.

Structured markets

Dislocations have been particularly severe in the market for structured products, such as collateralized debt obligations (CDOs), where price declines have been dramatic. Since December, as credit spreads continued to widen, many of the triggers embedded in structured products have been activated, resulting in forced selling or rehedging of credit exposure. This has served to reinforce and extend the repricing.

With secondary markets inactive, the valuation of many structured products remains difficult. When pricing is available, CDO tranches now trade at a significant discount relative to corporate debt. This partly reflects the belated acknowledgement that the credit ratings of structured products do not accurately reflect the probability or severity of downgrades. Overall, participants in structured debt markets increasingly differentiate on the basis of superior transparency and simplicity of structure. Nevertheless, the form that structured markets will take going forward remains unclear.

Corporate debt markets

Globally, yield spreads on investment-grade corporate bonds have increased. In Canada and the United States, for example, spreads reached, or approached, all-time highs (Charts 4 and 5) before easing back in recent weeks.¹² While at least part of the increase in credit spreads last summer reflected a healthy correction of excessively low spreads, the recent widening has, in many cases, gone beyond what current fundamentals might dictate. For example, at its peak in April, the cost of default protection in many markets implied default rates significantly greater than those experienced during the last two recessions.

It appears that the process of financial system deleveraging has exaggerated the movement in corporate debt spreads relative to underlying credit risk. Indeed, as discussed in the Highlighted Issue on p. 15, the lack of market liquidity appears to be a significant factor behind the widening of spreads on corporate credit in Canada,

12. The pronounced movement in investment-grade credit spreads also reflects the high concentration of financial sector issuers in the index. The credit spreads of these companies have been more affected by rising systemic concerns.

particularly for debt issued by investment-grade financial institutions.

Despite the increase in credit spreads, the overall impact on the cost of corporate borrowing has been mitigated by the decreased yields on sovereign bonds, both in Canada and abroad (Chart 6). A significant tiering of credit has also occurred, however, with lower-rated borrowers experiencing both higher costs and reduced access to markets.

In Canada, as elsewhere, access to primary markets for corporate debt has been a concern. Canadian firms, particularly those in the financial sector, were still actively raising funds in the primary debt market, but often at larger concessions relative to pricing in secondary markets. In recent weeks, however, access to markets has increased considerably, banks have funded more than they initially expected, and concessions to the secondary market have decreased. The strong balance sheet positions of non-financial firms, as well as the economic outlook and volatile market conditions, have likely caused many of these firms to delay market issues and/or increase their reliance on bank financing.

While credit spreads in the U.S. market for high-yield bonds have also increased significantly since July 2007, these spreads, unlike those for investment-grade bonds, remain well below the highs witnessed earlier in the decade related to the bursting of the technology sector bubble. Issuance in the high-yield market has been minimal, however, since access to this market has essentially been closed to many issuers (although activity has started to pick up again in recent weeks). The lack of access to primary markets by non-investment-grade firms is an important credit constraint, not only for U.S. firms but also for similarly rated Canadian firms that rely on the U.S. market for funding (Chart 7).¹³

13. See S. Anderson, R. Parker, and A. Spence, "Development of the Canadian Corporate Debt Market: Some Stylized Facts and Issues," *Financial System Review* (Ottawa: Bank of Canada, December 2003): 35–41.

Chart 5 Yield Spreads on U.S. Corporate Bonds

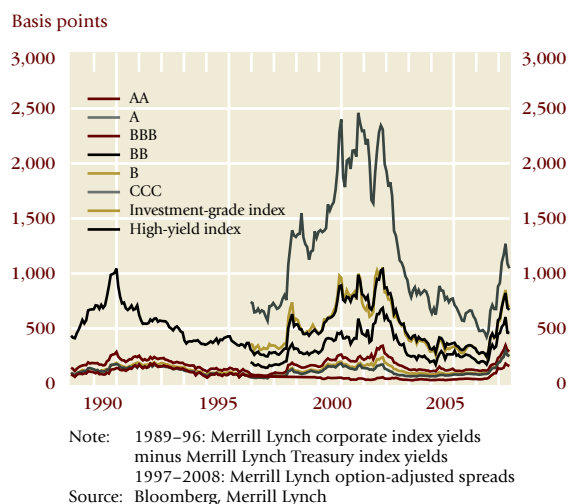


Chart 6 Yields on Canadian Corporate Bonds and 10-Year Government Bond

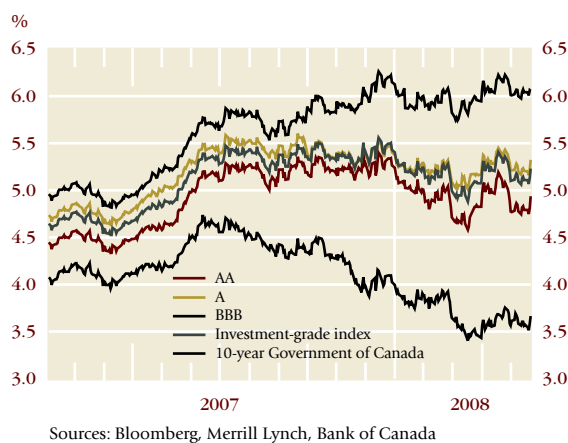


Chart 7 Issuance of U.S. and Canadian High-Yield Bonds

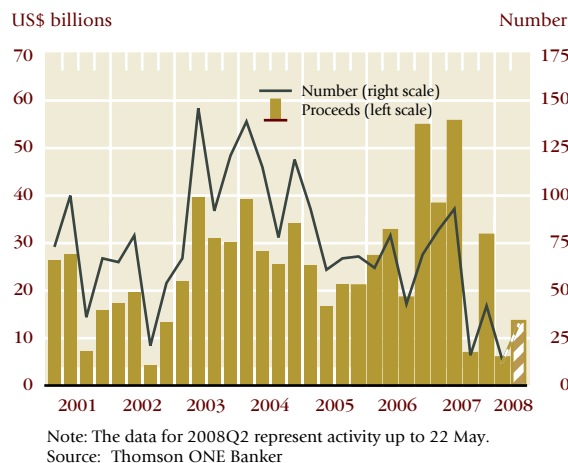
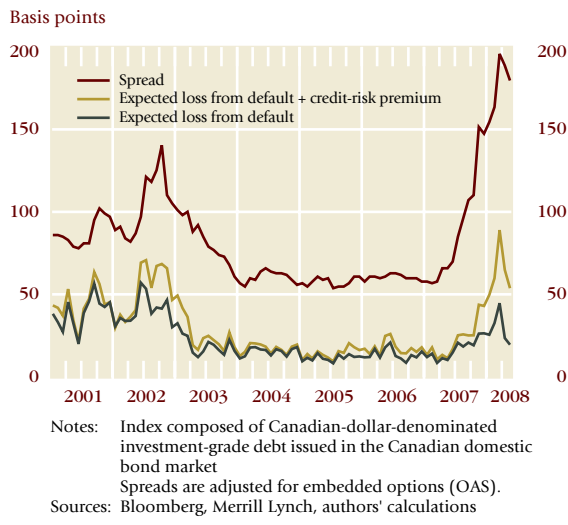


Chart 8 Decomposition of Credit Spread for Canadian Investment-Grade Bonds

Highlighted Issue

Decomposing Canadian corporate investment-grade spreads: What are the drivers of the current widening?

Prepared by Alejandro Garcia and Toni Gravelle

Yield spreads on Canadian corporate bonds began to widen last summer as the crisis in the subprime-mortgage market started to take hold (see top line in Chart 8). Spreads for investment-grade debt are now far wider than one would expect based on past experience with economic downturns and given that Canada's economy is in a healthier position than the U.S. economy. This Highlighted Issue examines the extent to which recent movements in the credit spread for investment-grade corporate debt have been driven by factors not related to credit risk, such as a drying up of market liquidity for debt issued by corporations.

In general, two important components drive variations in corporate yield spreads. One is the *expected loss from default*, the other relates to risk premiums. This latter component can be further decomposed into two types: a *credit-risk premium* and an *illiquidity premium*. The expected loss from default generally reflects the fundamentals of the firm, such as the degree of leverage and its ability to generate a stable stream of profits. The credit-risk premium is related to the variability of, or uncertainty about, potential loss from default. Both the credit-risk premium and the expected loss from default are affected by changes in macroeconomic activity.¹⁴ When combined, these two components comprise the part of the yield spread attributed to default-related credit risks.

The illiquidity premium, a non-credit-risk factor, relates to a lack of general market liquidity. Moreover, the credit-risk and illiquidity premiums, like other risk premiums, can vary with any change in the risk appetite of investors and are therefore likely to be positively correlated over time.

To identify the first two components, the expected loss from default and the credit-risk premium, we use a structural credit-risk model. These models treat the firm's equity and debt as

14. Credit-risk premiums rise during economic slowdowns, given the concurrent rise in macroeconomic (and, in turn, firm-level) uncertainty.

contingent claims on the firm's assets, with debt having a priority claim.¹⁵ In particular, the total value of the firm's assets is modelled as a time-series variable. Default occurs when asset values fall below the value of the firm's debt. The lower the value of assets relative to debt and the greater the variability of asset values over time, the more likely a firm is to default and, as such, the greater should be the two components related to credit: the expected loss from default and the credit-risk premium.

Using a structural model based on Churm and Panigirtzoglou (2005), we obtain the implied expected loss from default and credit-risk premium from the level and variability of the asset values of the firms included in the credit-spread index.¹⁶ We derive the illiquidity premium from the difference between the observed spread and the sum of the expected loss from default and the credit-risk premium (i.e., the credit-risk component).¹⁷

Decomposition of spreads into risk factors

The results from our model estimation, using monthly data, indicate that since July 2007, investment-grade firms have experienced an increase in both the credit-risk component (second from the top line in Chart 8) and the illiquidity premium (Chart 9).

As of 21 May 2008, while the actual spread was 179 basis points, the expected loss, credit-risk premium, and illiquidity premium were 20, 34, and 125 basis points, respectively. Comparable figures for end-July 2007 were 85, 21, 5, and 59 basis points, respectively. The increase in the investment-grade credit spread can thus be attributed to an increase in the credit-risk and illiquidity premiums above their recent historical norms.¹⁸

Chart 9 Risk Premiums on Canadian Investment-Grade Bonds

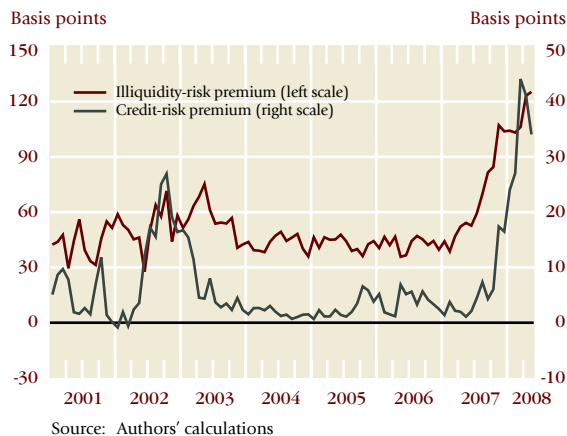
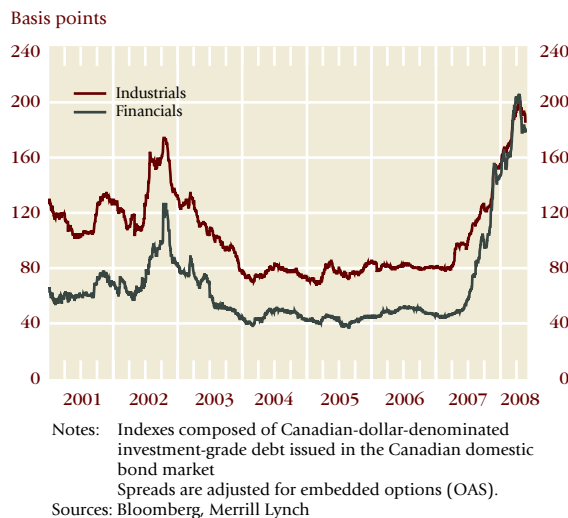


Chart 10 Yield Spreads on Canadian Corporate Bonds



15. See Huang and Huang (2003) for a comprehensive review of structural credit-risk models.
16. We thank the Bank of England for providing us with the Matlab code for the model's implementation.
17. Technically, this residual measures all non-credit-risk factors that can affect the credit spread. However, several empirical studies have documented that non-credit-risk factors tend to proxy the market illiquidity of corporate bonds. See Longstaff, Mithal, and Neis (2004) and Ericsson and Renault (2006).
18. The credit-risk component reached its peak level of 89 basis points in March 2008, and the illiquidity premium reached its peak level of 125 basis points in May 2008.

The rise in the credit-risk premium and the sharper rise in the illiquidity premium of the investment-grade index can be partly explained by the composition of the index. The Canadian index for yield spreads on investment-grade bonds contains a high proportion of financial firms (approximately 55 per cent of the index in 2007). Globally, financial firms are at the epicentre of the ongoing credit turmoil, and the rise in the credit-risk and illiquidity premiums for these firms, including those in Canada, is consistent with the rise in their funding liquidity risks, as assets are brought back onto their balance sheets and as access to certain segments of the securitized and/or structured markets is more constrained for these firms than in the past. This funding risk interacts with, and drives, the rise in credit-risk factors for banks and the illiquidity premium for their debt instruments.¹⁹ We observe the rise in the latter when investors indiscriminately reduce their demand for bank debt, securities become less liquid, and yield spreads widen further than bank fundamentals would indicate. Recent research on the components of corporate spreads for the United States and the United Kingdom also shows that the illiquidity premium for investment-grade firms increased during the last quarter of 2007 (Webber and Churm 2007).

As illustrated in Chart 9, the rise in the illiquidity premium for investment-grade firms is markedly higher than recent historical norms. The behaviour of the illiquidity premium is consistent with the nature of the crisis, because the repricing of credit risk is centred in financial institutions. Currently, as mentioned, financials are perceived to be strained and dominate the Canadian investment-grade index. The strain in financial institutions can be seen in Chart 10, which shows the yield spread for the two components making up the index: industrials and financial institutions. Chart 10 shows how the difference between the yield spread on industrials and that on financial institutions narrowed (and at times turned negative) since July 2007, indicating a rise in the perceived riskiness of Canadian financial firms relative to industrial

firms. This, in turn, was a reflection of global concerns regarding financial systemic risk.²⁰

Caveat

Recent research that expands structural models by including them in a broader macroeconomic setting has shown that credit-risk premiums may, in fact, account for a larger portion of the overall spread than indicated by the “traditional” structural model (Chen 2008). This suggests that the results of “traditional” structural models such as that used in this study should be interpreted with caution, and should focus on the direction in which risk factors evolve, rather than on the specific values of the relative contributions of the factors.

Highlighted Issue

Broad recommendations for reform in light of the recent market turmoil

Prepared by Jim Armstrong

Committees of central banks, regulators, and international institutions have analyzed the origins of the recent turmoil in financial markets and have proposed measures to strengthen the resilience of the financial system.²¹ There is a broad convergence of views among these proposals. Particular prominence has been given to recently published reports by the Financial Stability Forum (FSF) and the Senior Supervisors Group (SSG). This Highlighted Issue reviews these reports, focusing on their main observations and recommendations.

19. See IMF (2008) for more on the interaction between market liquidity risk and the funding liquidity risk faced by banks during the credit turmoil.

20. There is a rating differential between the industrials and financials components. The mode rating for industrials is generally lower than the corresponding rating for the financials. For example, in 2007 the mode for industrials was A2, and for financials it was AA3. In normal times, the ratings differentials are accompanied by a spread differential.

21. For example, the President’s Working Group on Financial Markets has issued a Policy Statement on Financial Market Developments available at <http://www.treas.gov/press/releases/reports/pwgpolicystatemktturmoil_03122008.pdf>.

Financial Stability Forum—April 2008

In October 2007, the G-7 finance ministers and central bank governors asked the FSF to analyze the causes and weaknesses that produced the turmoil, and to make recommendations for increasing the resilience of markets and institutions. The FSF submitted its final report on 11 April. Its findings and recommendations are the product of a collaborative effort between the main international bodies and national authorities in key financial centres.²² The G-7 ministers and governors strongly endorsed the report, and committed to implementing its recommendations. They asked the FSF to actively monitor the implementation of their recommendations.

The FSF proposes actions in five broad areas. What follows is a high-level summary of the extensive list of recommendations (67 in all) and some comments from a Canadian perspective. While the FSF regards it as essential that steps to enhance the resilience of the global financial system be taken promptly to restore confidence in the soundness of markets and institutions, it also recognizes the need to proceed in a way that avoids exacerbating stress. Going forward, the FSF intends to examine the forces that contribute to procyclicality in the financial system.

a. Strengthened oversight of capital, liquidity, and risk management

The report concludes that Basel II provides the appropriate framework for addressing the weaknesses that the turmoil has exposed, and that its implementation should proceed with priority. However, it also points to elements of Basel II that need to be strengthened to improve resilience. In particular, it proposes to enhance the capital treatment of structured credit and off-balance-sheet activities, and recommends that

supervisors assess the cyclicity of the Basel II framework and take additional measures as appropriate. It also calls on the Basel Committee to issue for consultation a guide for the sound management and supervision of liquidity, and to strengthen its guidance for risk management and stress testing for capital-planning purposes.

In view of these recommendations, the Basel Committee on Banking Supervision announced a series of steps on 16 April to help make the banking system more resilient to financial shocks.²³

b. Enhancing transparency and valuation

To restore market confidence, the FSF strongly encourages financial institutions to use the leading disclosure practices summarized in its report to provide meaningful and consistent quantitative and qualitative information about their risk exposures, valuations, and off-balance-sheet entities. It expects further guidance in this area from the Basel Committee on Banking Supervision and calls upon the International Accounting Standards Board to accelerate its work on accounting and disclosure standards for off-balance-sheet vehicles and to enhance its guidance on valuing financial instruments when markets are no longer active.

c. Changes in the role and use of credit ratings

Credit-rating agencies play an important role in evaluating and disseminating information on structured credit products. The FSF calls on them to enhance their review of the information provided by originators, arrangers, and issuers of securitized products and to ensure that it is of sufficient quality to support a credible rating. It also asks agencies to differentiate the ratings used for structured products from those used for

22. The FSF drew on a large body of coordinated work, comprising that of the Basel Committee on Banking Supervision (BCBS), the International Organization of Securities Commissions (IOSCO), the International Association of Insurance Supervisors (IAIS), the Joint Forum, the International Accounting Standards Board (IASB), the Committee on Payment and Settlement Systems (CPSS), the Committee on the Global Financial System (CGFS), the International Monetary Fund (IMF), the Bank for International Settlements (BIS), and national authorities in key financial centres (these include Canadian representatives from Finance Canada, OSFI, and the Bank of Canada). The report is available at < <http://www.fsf.org> >.

23. These steps include:

- (i) Enhancing various aspects of the Basel II framework, including the capital treatment of complex structured credit products, liquidity facilities to support asset-backed commercial paper (ABCP) conduits, and credit exposures held in the trading book.
- (ii) Issuing a proposal for sound-practice standards for the management and supervision of liquidity risk.
- (iii) Initiating efforts to strengthen banks' risk-management practices and supervision related to stress testing, off-balance-sheet management, and valuation practices, among others.
- (iv) Enhancing market discipline through better disclosure and valuation practices.

corporate bonds. It warns investors that ratings should not replace their own risk analysis and advises authorities to check that the role that they have assigned to ratings in regulations does not induce uncritical reliance on credit ratings.

d. Strengthening authorities' responsiveness to risk

In its report, the FSF noted that some of the weaknesses that have come to light were known or suspected within the community of financial authorities before the turmoil began. Much work was under way at international levels that, if implemented, might have tempered the scale of the problems that were experienced. However, international processes for agreeing upon and implementing regulatory and supervisory responses have, in some cases, been too slow, given the pace of innovation in financial markets. Thus, the FSF recommends that supervisors, regulators, and central banks, individually and collectively, take additional steps to more effectively translate their risk analysis into actions that mitigate those risks. This includes improving information exchange and co-operation among authorities. Of note is a recommendation that large financial institutions share their contingency liquidity plans with their central bank.

e. Robust arrangements for dealing with stress in the financial system

The FSF report recommends that central bank operational frameworks be sufficiently flexible in terms of potential frequency and maturity of operations, available instruments, and the range of counterparties and collateral, to deal with extraordinary situations. Amendments to the Bank of Canada Act proposed in the federal government's budget bill would increase the flexibility of the Bank's operating framework by allowing the Bank to conduct open market operations with a wide range of assets as necessary.

The FSF report also proposes that authorities at the national level need to review and, where needed, strengthen legal powers and clarify the division of responsibilities of different national authorities for dealing with weak and failing banks. In Canada, a structured intervention framework exists that enables federal agencies to identify areas of concern at an early stage and intervene effectively, so as to minimize losses to depositors and the exposure of the Canada Deposit Insurance Corporation (CDIC) to loss

(Engert 2005). *A Guide to Intervention* (OSFI 2002) sets out the intervention measures that an institution can normally expect from OSFI and the CDIC, summarizes the circumstances under which intervention measures may be expected, and describes the coordination mechanisms in place between OSFI and the CDIC.

The G-7 ministers identified the following recommendations among the immediate priorities for implementation within the first 100 days:

- Financial institutions were strongly encouraged to make robust risk disclosures in their upcoming mid-year reporting, consistent with leading disclosure practices as set out in the SSG report and summarized in the FSF report.
- The International Accounting Standards Board and other relevant standard setters were urged to initiate action to improve the accounting and disclosure standards for off-balance-sheet entities and enhance its guidance on fair-value accounting, particularly on valuing financial instruments in periods of stress.
- Firms were also urged to strengthen their risk-management practices, supported by supervisors' oversight, including rigorous stress testing, and to strengthen their capital positions as needed.
- The Basel Committee was asked to issue revised guidelines for the management of liquidity risk by July 2008, and IOSCO to revise its code of conduct fundamentals for credit-rating agencies by the same date.

Senior Supervisors Group

Early in this period of market turbulence, the Senior Supervisors Group—supervisors of major financial services firms from France, Germany, Switzerland, the United Kingdom, and the United States—convened to assess whether shortcomings in risk management may have contributed to the credit losses being registered by major financial institutions.²⁴

24. Seven supervisory agencies participated in this project: the French Banking Commission, the German Federal Financial Supervisory Authority, the Swiss Federal Banking Commission, the U.K. Financial Services Authority, the U.S. Office of the Comptroller of the Currency, the U.S. Securities and Exchange Commission, and the U.S. Federal Reserve.

More specifically, the group sought to identify risk-management practices that have tended to work well, and those that have not. They developed an extensive questionnaire covering senior management oversight and risk-management performance across key dimensions. The group shared the questionnaire with 11 global banking and securities firms that were major players in key markets and had experienced a range of outcomes during this period. Its final report, "Observations on Risk Management Practices during the Recent Market Turbulence," was published in March 2008.²⁵

Importantly, the group found that firms that dealt more successfully with the ongoing market turmoil through year-end 2007 had adopted a comprehensive view of their exposures. They used information developed across the firm to adjust their business strategy, risk-management practices, and exposures promptly and proactively in response to changing market conditions. This information was also centralized into one risk-management unit reporting to the CEO. The group noted that differences in risk appetite, business strategy, and risk-management approaches in three particular business lines had led to considerable variability in firms' performance. The three business lines include: CDO structuring, warehousing, and trading; syndication of leveraged financing loans; and the conduit/structured investment vehicle (SIV) business.

The group's report discusses in detail key features of the broad functions of risk management—senior management oversight, the management of liquidity risk, and the management of credit and market risk—needed to ensure the success of global financial institutions through such challenging times.

Prior to the market turbulence, a series of interviews conducted by the Bank of Canada in January 2007 with the major Canadian banks on their risk-management practices found that they had improved over time and were broadly in line with their global banking peers (see Aaron, Armstrong, and Zelmer 2007). At that time, Canadian banks were striving, to varying degrees, to achieve a comprehensive and integrated view of their exposures, but they generally admitted that this was a "work in progress."

25. The full report can be found at <http://www.fsa.gov.uk/pubs/other/SSG_risk_management.pdf>.

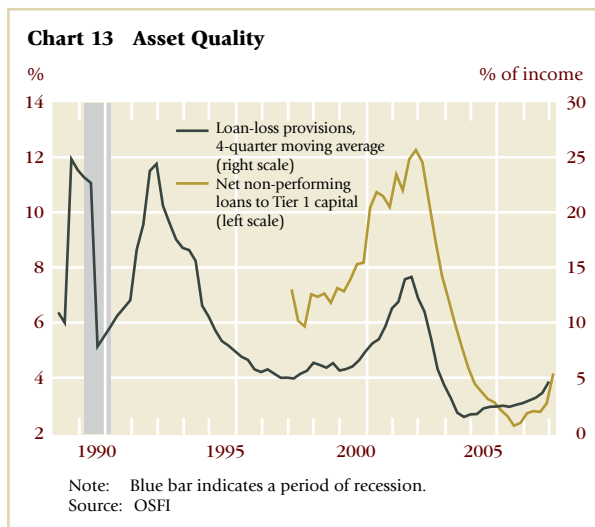
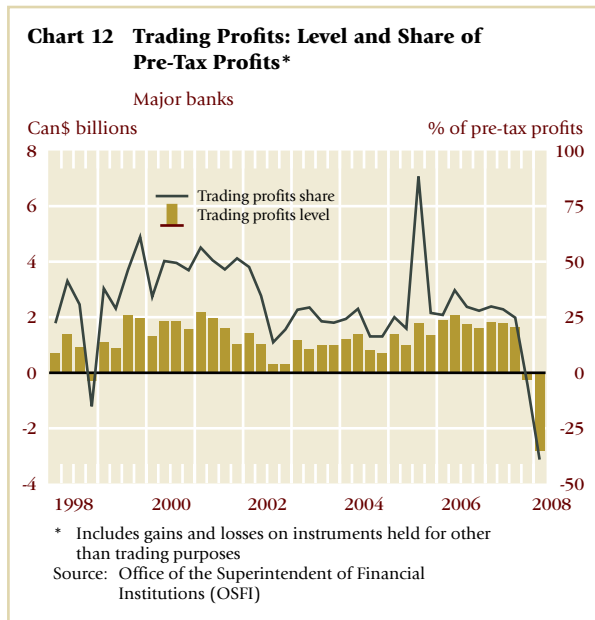
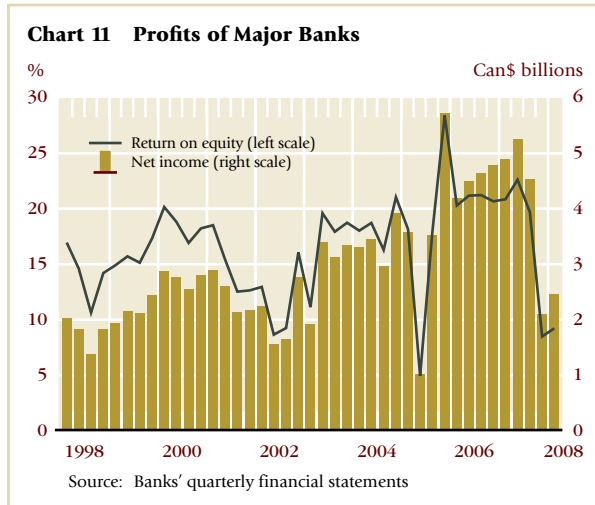
Financial institutions

Major Canadian banks reported weaker after-tax profits of \$4.6 billion through the first half of fiscal 2008 (ending 30 April). Earnings were lower by 53 per cent, compared with the same period in 2007. The weaker performance can be largely explained by \$8.1 billion of writedowns related to securities linked to U.S. subprime mortgages, and other credit market exposures experienced over the period (in addition to the \$2.1 billion in writedowns reported in 2007), and to a lesser extent, by rising loan-loss provisions. Average return on equity in the first half of 2008 was 8.9 per cent, compared with 21.0 per cent in 2007 (Chart 11). It should be noted that these writedowns reduce "trading profits" (Chart 12), which, on average, have comprised about 25 per cent of bank pre-tax income in recent years. While, to date, the writedowns for the major Canadian banks have been rather moderate compared with those for U.S. banks, the ongoing volatility in credit and structured instrument markets is expected to continue to hamper profit performance through 2008.²⁶

Core earnings derived from banks' lending and wealth-management operations have, to date, remained reasonably firm. But, given the unsettled global economic and financial environment, there is likely to be some deterioration in the credit quality of loans. Recently, loan-loss provisions have started to rise from a historically low base (Chart 13) and have been occurring both in the household sector and the manufacturing sector.

In the current volatile environment, Canadian banks have provided enhanced disclosure of their exposures to key problem areas, including subprime mortgages, structured investment vehicles, ABCP conduits, monoline insurers, hedge funds, and leveraged buyouts. While, on balance, these exposures appear to be manageable, some banks have announced certain concentrated exposures that they are trying to reduce or unwind. Furthermore, Canadian banks have significant exposures to various markets in the United States (Box 3).

26. The Bank estimates that the writedowns realized by Canadian banks in 2007 and in the first quarter of 2008 amounted to about 20 per cent of 2007 annual profits (excluding writedowns). This compares with about 42 per cent for U.S. banks and investment dealers as a group.



In general, major Canadian banks, like their global peers, are trying to cope with the following developments, which have put pressure on their capital ratios:

- Marked-to-market writedowns on securities related to U.S. subprime mortgages, as well as other credit markets exposures which, through the rules of fair-value accounting, have an immediate impact on retained earnings and Tier 1 capital. As mentioned earlier, Canadian banks have recorded cumulative writedowns of \$10.2 billion to date.
- A trend towards reintermediation as banks are pressed to bring assets from various off-balance-sheet structures onto their balance sheets, and to provide balance sheet financing to borrowers who are no longer able to access capital markets. This has tended to put upward pressure on risk-weighted assets (RWA). The Highlighted Issue on page 24 provides background on recent developments in securitization in Canada and the impact of the recent market turmoil on total credit growth and bank lending.
- The recent high-profile difficulties of U.S. monoline insurers (Box 1), which, in some cases, may call into question the reliability of the credit protection they have purchased, leading to the possibility of further increases in RWA or reductions in capital.

Reflecting the pressures on their balance sheets—as well as high debt maturities in 2008—the major banks have been active in raising funds in a range of capital markets. While all of these instruments boost liquidity, for example, deposit notes (senior debt), NHA MBS, and covered bonds (see Highlighted Issue on p. 33), other instruments also boost regulatory capital, for example, common shares (counts as Tier 1 capital), subordinated debt (Tier 2), non-cumulative permanent preferred shares (Tier 1), and innovative instruments (Tier 1). In addition, growth in wholesale deposits has been strong, from both financial and non-financial sources. To help maintain capital ratios, some banks have also suspended ongoing repurchase programs for common shares and have postponed further dividend increases.

It is important to note that even though banks have largely been successful in issuing debt at various terms, these instruments have been priced

Box 3

Exposure of Canadian Banks to the United States: An Aggregate View

Detailed public data on the U.S. exposures of Canadian banks are limited and often difficult to compare across banks. However, useful information can be obtained from the aggregate data collected by the Bank of Canada. Overall, the direct exposure of Canadian banks to the United States represents about 16 per cent of total bank assets, more than the combined exposure to any other group of foreign countries.¹ Although exposure to the United States as a proportion of total claims has remained roughly stable since the early 1990s, its composition has shifted as the activity of Canadian banks in capital markets has increased.

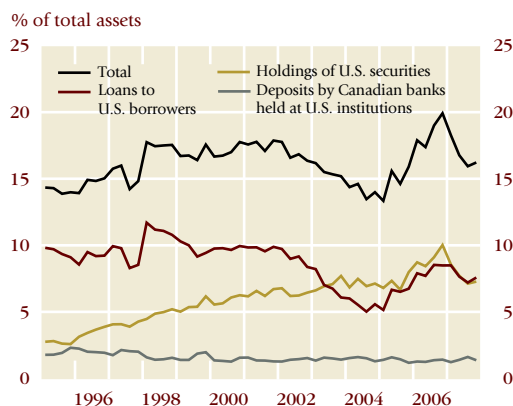
As seen in Chart A, exposure to the United States has increased mainly as a result of increased securities holdings. In the mid-1990s, exposure to U.S. securities and loans represented roughly 3 per cent and 10 per cent of total Canadian bank assets, respectively. In 2007, these figures had converged, each representing just under 8 per cent of total Canadian bank assets.² This shift, all else being equal, implies that the return on U.S. exposures has become more dependent on the performance of financial markets.³ This, in turn, may increase the volatility of bank earnings, and add downward pressure to profitability during periods of poor financial market performance.

Detail on the composition of Canadian bank holdings of foreign securities is limited. However, data show that securities issued by U.S. non-bank private institutions make up the majority (about 55 per cent) of U.S. securities exposure, having overtaken government-issued securities (about 35 per cent) in recent years. Securities issued by U.S. banks make up the remaining 10 per cent.

In terms of profitability, available data from Canada's five largest banks suggest that, on average, U.S. operations have underperformed relative to domestic operations. Although some improvement has taken place in recent years, the prospective profitability of U.S. operations remains uncertain, given the ongoing slowdown in the U.S. economy. Overall, exposure to the United States constitutes a significant portion of the total assets of Canadian banks, and given the expected future volatility in both the U.S. real economy and financial markets, Canadian banks' balance sheets may experience further pressure.

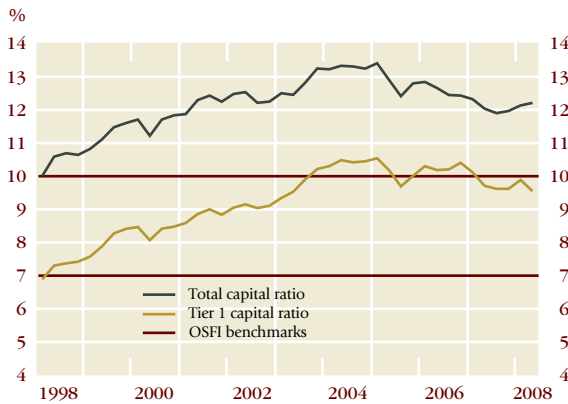
1. Data do not capture off-balance-sheet exposures (e.g., credit commitments) or indirect exposures (e.g., loans to a Canadian firm with extensive operations in the United States). Data are expressed on an immediate borrower basis (i.e., claims are recorded under the country where the immediate borrower is located). A short dataset is also available on an ultimate-risk basis since 2005 (i.e., claims are recorded in the country of residence of the entity that will repay the claim if the original borrower does not). The value of U.S. exposures differs only slightly between the two measures (the ultimate-risk measure is about 2 per cent smaller), and the choice of measure does not materially affect the figures used here.
2. Data do not account for TD Bank's recent acquisition of Commerce Bancorp in the United States. Data are unavailable regarding Commerce Bank's U.S. versus non-U.S. exposure; however, as of December 2007, the bank held roughly \$18 billion in loans and \$26 billion in securities. Combined, these figures represent just under 9 per cent of TD Bank's overall assets and less than 2 per cent of the overall assets of the Canadian banking sector.
3. This fact is consistent with C. Calmès and Y. Liu, "Financial structure change and banking income: A Canada - U.S. comparison," *Journal of International Financial Markets, Institutions & Money* (2007). Available at < <http://www.sciencedirect.com> >.

Chart A Canadian Bank Exposure to the United States, by Type of Claim*



* Immediate borrower basis
Source: Bank of Canada

Chart 14 Total and Tier 1 BIS Capital Ratios

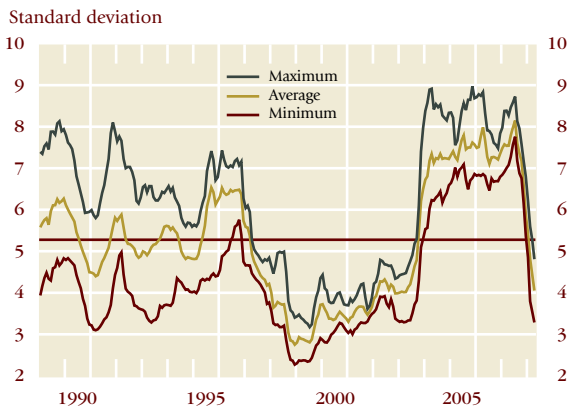


Note: Data reflect Basel II framework from 2008Q1 on.
Source: OSFI

at yield spreads over government bonds that are significantly higher than prior to the turmoil, and sometimes at significant concessions to the market on the day of issue. Nonetheless, their overall success at funding in sizable amounts has permitted banks to maintain satisfactory levels of liquidity through this difficult period, although liquidity-risk management continues to be given enhanced attention as events unfold.²⁷

Thus, the Canadian banking system remains well capitalized, with an average Tier 1 capital ratio of 10 per cent (well above OSFI's threshold of 7 per cent) and a total capital ratio of 12.7 per cent (compared with the threshold of 10 per cent) in the first quarter of 2008 (Chart 14).

Chart 15 Distance to Default for Major Banks



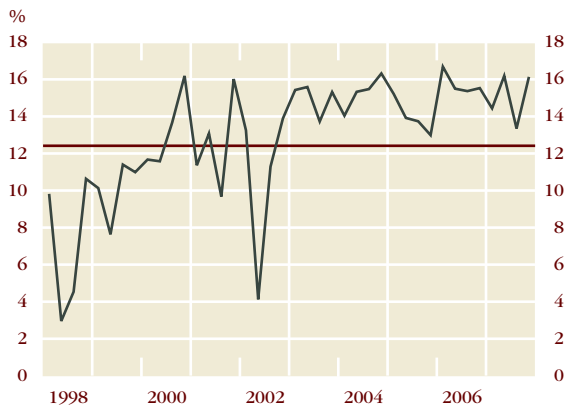
Note: Horizontal line is the average distance to default from December 1982 to present.
Sources: Bank of Canada calculations based on data from OSFI and Thomson Financial Datastream

The Basel II capital-adequacy framework for banks came into effect in Canada in November 2007. The initial effect for the first quarter ending 31 January 2008 was to raise the average reported Tier 1 capital ratio for the group by about 0.4 percentage points and the overall total capital ratio by about 0.3 percentage points over what it would have been under Basel I. On balance, a new capital charge for operational risk was more than offset by a lower charge for credit risk.

Market-based metrics suggest that banks are still in a sound financial position, although there has been a noticeable weakening since August 2007. For example, the distance to default for major banks has declined sharply, reflecting the increased volatility of bank share prices (Chart 15). While the impact has been greater on some banks than on others, the distance to default of the six largest banks, on average, has fallen moderately below its long-run mean, but remains above the lows reached during the technology-sector adjustment earlier this decade.²⁸ These developments are similar to the scenario presented in the December 2007 *Financial System Review* in which heightened equity volatility was assumed to continue one year into the future.

As noted earlier, provisions for loan losses at Canadian banks are also starting to rise, although

Chart 16 Return on Equity of Life and Health Insurance Companies



Note: Horizontal line is the average of return on equity from 1996Q1 to present.
Source: OSFI

27. As of mid-May, the major banks had issued approximately \$45 billion of debt and equity in 2008.

28. This remains true when a 6-month, rather than the standard 12-month, measure of volatility is used in the calculation of distance to default.

they remain below their historical average. Evidence thus far suggests that the credit quality of major Canadian banks remains relatively strong by historical standards, despite the negative impact of the U.S. subprime-mortgage crisis.

The three major Canadian life and health insurance companies reported generally strong earnings in the first quarter of 2008, with returns on equity in the range of 15 to 20 per cent, as both the insurance and wealth-management operations continue to do well (Chart 16). Recent favourable results occurred despite ongoing headwinds from a strong Canadian dollar, which reduces returns from their extensive foreign operations. The life and health companies continue to enjoy high credit quality in their fixed-income portfolios. They have reported minimal exposure to subprime instruments and some of the other problem areas of the capital markets. Furthermore, they have no significant involvement in the troubled bond insurance business. Continued volatile markets would tend to have an unfavourable impact on the profitability of their wealth-management business, although the insurance business should not be affected.

Highlighted Issue

The impact of the recent market turbulence on credit growth in Canada

Prepared by Jim Armstrong

Since the start of the financial market turbulence in August 2007, there has been a major loss of confidence in structured finance instruments, which has seriously impeded the financing technique of *securitization*, both globally and in Canada. Many securitization vehicles (often referred to as conduits) have had difficulty funding themselves in the ABCP market, and there has been pressure for the banks sponsoring them to assume the securitized assets on their balance sheets. In addition, banks have had to cope with increased demand for credit from borrowers with reduced access to the capital markets. Here, we briefly review how important securitization has been as a source of credit in Canada, as well as the impact of recent events on growth in total and bank-originated credit in Canada.

The importance of securitization in Canada

Chart 17 presents the trend in the share of securitized credit (securitized loans residing in conduits) as a percentage of the major categories of credit: residential, consumer, and business. The chart shows that securitization has been highest in the residential mortgage market (particularly NHA-insured mortgages) but has also been fairly significant for consumer credit. It still accounts for a relatively minor portion of business credit.²⁹

Impact of the recent developments on overall credit growth

The financial market turmoil—with its associated weakening effect on securitization activity and market-based finance—has not yet had a noticeable adverse impact on the overall growth of credit in Canada. Table 1 presents quarterly growth rates for total, securitized, and bank credit for each major credit category since the beginning of the turmoil in the middle of the third quarter of 2007.

Growth in residential mortgage credit has been sustained at a very strong pace (about 13 per cent). The NHA MBS Program has played a crucial role, exhibiting much higher growth (Table 1) than prior to the market turbulence. In contrast, securitization in non-NHA conduits declined. The major banks' success in securitizing mortgages through the NHA MBS Program has allowed them to reduce the rate of expansion of residential mortgages held on their balance sheets; growth was only 3.8 per cent in 2008Q1. It is important to note that much of this expanded use of NHA MBS was used to support issuance of CMBs.

Table 1 also indicates that consumer credit has remained firm, growing by about 10 per cent. While consumer loans held in securitization conduits have contracted sharply, banks have stepped in to fund a large amount of consumer credit directly on their balance sheets, registering very strong growth of 16.5 per cent in 2007Q4 and 13.5 per cent in 2008Q1.

29. This excludes "third-party" conduits sponsored by specialty firms, which invested in non-traditional structured assets, such as CDOs (largely originating from outside of Canada), and which are now the subject of restructuring following successful negotiations by major participants in the Montreal Accord.

Table 1
Credit : Annualized Quarterly Growth

	Pre-crisis trend ^a	2007Q3	2007Q4	2008Q1
Residential	10.1	13.5	12.9	13.4
Securitized	20.3	9.6	-14.8	-5.8
NHA MBS	20.5	39.4	65.4	39.6
Bank	9.2	14.8	5.7	3.8
Consumer	10.0	10.7	10.2	10.0
Securitized	16.9	6.1	-9.9	-7.1
Bank	9.0	12.8	16.5	13.5
Business	7.0	8.1	7.4	5.8
Securitized	24.2	12.4	-10.3	-8.4
Bank	12.3	20.5	19.6	15.2

Source: Bank of Canada
a. Average of the annualized quarterly growth rates from 2006Q3 through 2007Q2

Total business credit (the sum of intermediated credit and market-based business credit) has remained reasonably firm since the beginning of the turmoil, with underlying growth of about 6 to 8 per cent.

As noted earlier, securitization accounts for a very low share of total business credit in Canada. However, more broadly, in the difficult credit environment, a contraction in traditional commercial paper (non-ABCP) for non-financial corporations, combined with a slowing in the issuance of bonds and debentures, equity, and trust units, resulted in banks assuming business credit onto their balance sheets at a very strong pace of about 20 per cent in the second half of 2007.

Chart 18 shows that, against this background, there has been a marked increase in the rate of growth in total domestic bank credit since August 2007.

Chart 17 Share of Securitized Credit in Major Credit Aggregates

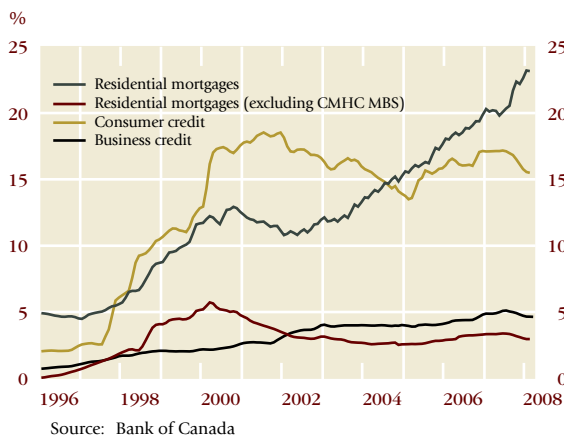


Chart 18 Domestic Bank Loans



Conclusion

In summary, the collapse of privately sponsored securitization and associated reintermediation trends has not seriously impeded the overall growth of credit in Canada. This outcome has been facilitated by the banks' willingness to assume more consumer credit and business credit on their balance sheets, while they themselves have been able to sell substantial amounts of residential mortgages through the NHA MBS program, which experienced very high growth in this period. Besides issuing NHA MBS, banks have also been successful in funding themselves in various other markets (see Financial Institutions section on page 20).

The Macrofinancial Environment

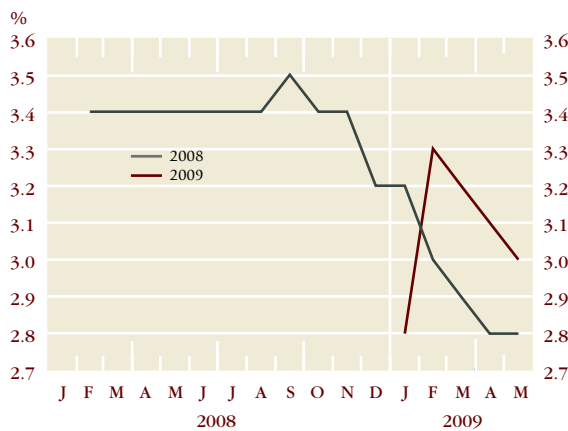
The international environment

The outlook for global economic growth in 2008 has been revised downwards since December 2007, led by a deceleration in growth in advanced economies that was more pronounced than expected and growth that was more moderate than expected in emerging-market economies, led by China and India (Chart 19).

In the United States, there are signs that the economy is likely to experience a deeper and more prolonged slowdown than had been projected. This slowdown stems from further weakening in the residential housing market that is adversely affecting other sectors of the U.S. economy and contributing to further tightening in credit conditions. The U.S. Federal Reserve's April 2008 *Senior Loan Officer Opinion Survey* showed a significant tightening of credit standards for business and consumer loans (Chart 20). Sales of new and existing homes, along with house prices, continue to decline, and the inventory of housing relative to demand remains elevated (Chart 21). The problems in the U.S. subprime-mortgage market appear to have spilled over into segments of the corporate and commercial credit markets, negatively affecting bank balance sheets and posing a further risk to the U.S. economy. The slowdown in consumer spending and tighter credit conditions have also led to lower business investment. U.S. GDP growth will be constrained by credit conditions that are unlikely to normalize until early 2010, but this should be somewhat mitigated by the aggressive easing of U.S. monetary policy and the fiscal-stimulus package announced by the U.S. government.

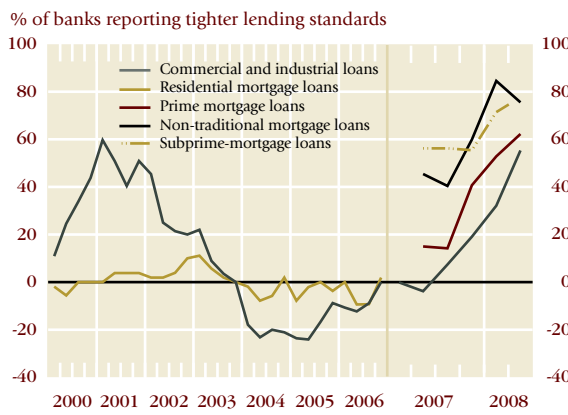
The deterioration in economic and financial conditions in the United States is expected to have significant spillover effects on the Canadian and global economies. For the advanced overseas economies, recent consensus forecasts predict a marked slowdown in growth in 2008 for the euro area and the United Kingdom. Expectations for growth in Japan have also been lowered slightly. Growth in Asia is expected to remain strong, although lower than previously expected. Inflation risk appears to be increasing in the global economy, driven mainly by food and energy prices, which have pushed headline inflation above targets in many countries. This may limit the ability of some central banks to use monetary

Chart 19 Evolution of Consensus Estimates for Annual World* Economic Growth in 2008 and 2009



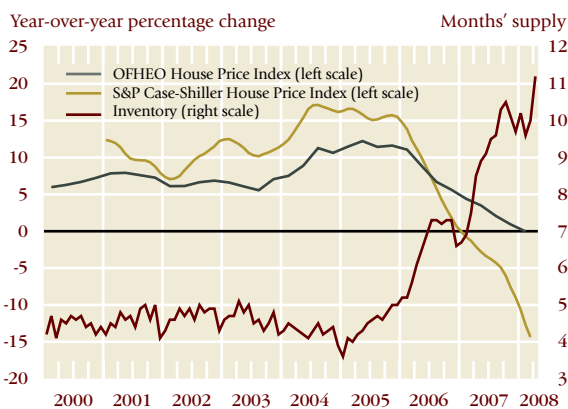
*46 of the world's economies accounting for over 90% of global GDP
Source: Consensus Economics Inc.

Chart 20 United States Senior Loan Officer Survey



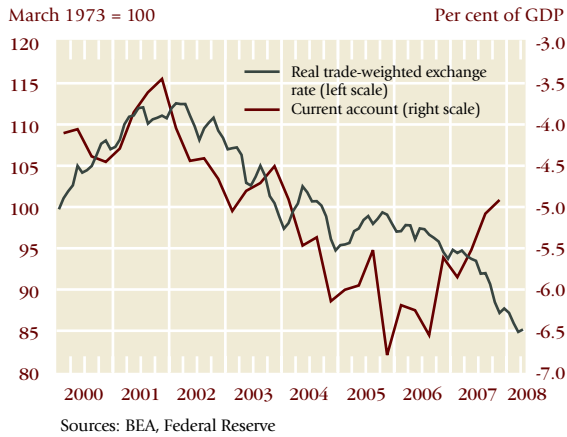
Source: Federal Reserve

Chart 21 U.S. House Prices and Inventory: Existing Homes



Sources: Office of Federal Housing Enterprise Oversight and National Association of Realtors, and S&P Case-Shiller

**Chart 22 United States
Exchange Rate and Current Account**



policy to counter the risks to economic growth from the ongoing financial turbulence.

The weakness in U.S. domestic demand and the associated depreciation of the U.S. dollar are contributing to an unwinding of global current account imbalances (Chart 22). Trade surpluses of the Asian and oil-exporting countries continue to expand, however, supported by official intervention to maintain fixed exchange regimes, as well as by high commodity prices.

As suggested by the modest rise in the spreads in the emerging-market bond index (EMBI), emerging markets continue to hold up well in comparison to previous episodes of financial turmoil (Chart 23). This resilience may be attributed to structural reforms, stronger macroeconomic fundamentals, and the accumulation of substantial foreign exchange reserves. There is, however, some underlying divergence between the continuing strong growth in commodity-exporting Latin America and Russia, and slower growth in emerging Europe and India, where inflationary pressures have required a tighter monetary policy response. As noted in the December 2007 FSR, the main risk for these economies remains the potential for a slowdown in the global economy with the associated reduced demand for exports and commodities.

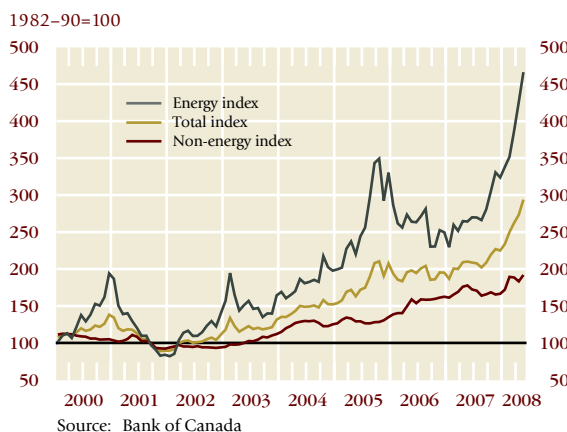
For 2008, the important risks to the global outlook are expected to come from disruptions in credit markets, continued deterioration in house prices in certain economies, the potential for a disorderly unwinding of global imbalances, and a sudden reversal of capital flows to emerging markets.

Chart 23 Emerging-Markets Sovereign Bond Spread (EMBI+)



While subject to some additional volatility, commodity prices have continued to strengthen so far this year, despite the ongoing financial turmoil and the slowdown in U.S. economic activity (Chart 24). In nominal terms, the prices of several commodities (such as crude oil and potash) have reached record highs. A number of factors may help to explain the strength of commodity price gains in recent years, including strong demand from emerging-market economies, supply constraints in the context of low stocks, and the depreciation of the U.S. dollar. Recently, speculative activity may also have played a role.³⁰

Chart 24 Bank of Canada Commodity Price Index



30. This reflects increased demand from institutional investors, hedge funds, and momentum traders, as well as the growing use of derivative products linked to commodities.

Canadian developments

Canadian economy

Canada's economic growth slowed considerably towards the end of 2007 and into early 2008, as manufacturers scaled back production (Chart 25). As detailed in the April 2008 *Monetary Policy Report*, Canada's economy is expected to be negatively affected by spillovers from the deterioration in economic and financial conditions in the United States, both through lower exports (in 2008) and through the dampening effect of tighter credit conditions and softening sentiment on domestic demand. Nevertheless, domestic demand is still expected to remain strong over the projection period. On the downside for Canada's economic outlook, greater-than-anticipated weakness in commodity prices (stemming from the projected slowdown in the United States and other industrialized economies) could mean slower gains in real incomes and domestic demand in Canada.

Corporate sector

The financial position of Canada's non-financial corporate sector as a whole continued to be quite robust in the first quarter of 2008, in spite of the slowdown in economic growth. The overall rate of return on equity, although easing somewhat, remained at a high level, and the ratio of debt to equity stayed relatively low (Chart 26). Profitability was relatively high in commodity-producing sectors and in most sectors with a low exposure to international trade but considerably weaker in a number of sectors with high exposure to international trade, including forest products industries.

Although it remains low, the share of non-financial corporations with weak financial ratios continued a modest upward trend in 2007 (Chart 27).³¹ Backward-looking measures, such as bankruptcies and bond defaults, indicate that corporate credit quality has declined slightly since the December FSR. More forward-looking market-based measures, such as the volatility of returns on the Canadian corporate portfolio (the Bank of

31. This microdata indicator represents the share of total assets attributable to companies with a comparatively high leverage ratio and weak current ratio and net profit margin. The indicator is based on data up to the end of 2007. Details on the indicator can be found in the December 2005 issue of the FSR, pp. 37–42.

Chart 25 Real GDP Growth: Canada

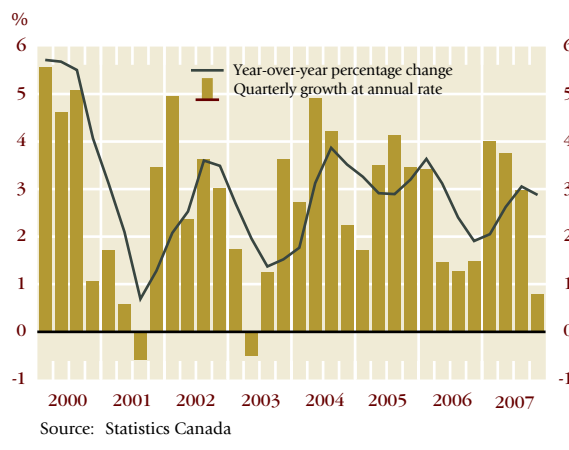


Chart 26 Financial Position of the Canadian Non-Financial Corporate Sector

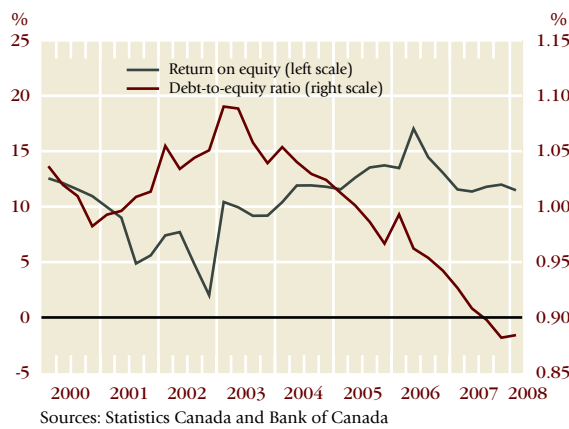
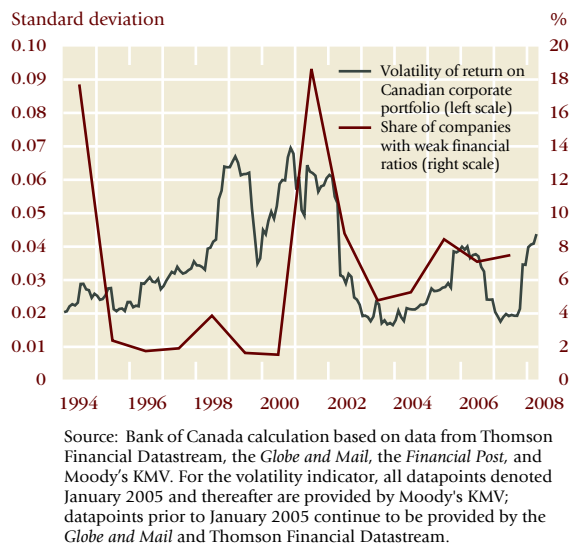


Chart 27 Indicators of Credit Quality



Canada's contingency claims approach (CCA indicator), also suggest that corporate credit quality has deteriorated somewhat in recent months (Chart 27).³² This shift is a reflection of the increased volatility of stock prices across the non-financial subindustries included in the calculation. Nevertheless, this indicator remains well below the peaks reached during the late 1990s and early 2000s, suggesting that, overall, the credit quality of non-financial corporations remains relatively strong.

Industry

Canada's forest products industry experienced losses in the fourth quarter of 2007 and the first quarter of 2008, reflecting the adverse effects of still more production curtailments, the strong Canadian dollar, U.S. housing market developments, and much higher fuel and wood fibre costs. With the liquidity of a number of companies under significant strain, and in the face of difficult credit conditions, restructuring of operations is continuing, and some firms have restructured their balance sheets.

Profitability in Canada's auto manufacturing industry was also quite weak during this period, with the softening of U.S. motor vehicle sales and the shift in the sales mix away from the more profitable larger vehicles. A prolonged drop in the sale of U.S. vehicles would have a severe impact on activity in Canada's auto manufacturing industry, including the auto parts industry, since around 90 per cent of vehicle production is exported to the United States.

Profitability in many other manufacturing industries has also eased, partly owing to the further appreciation of the Canadian dollar. With the slowdown in the U.S. economy spreading to sectors beyond residential housing and motor vehicles, further adverse effects on the financial positions of a broader range of Canadian manufacturers are likely over the near term. Indeed, some companies in the clothing and textile and printing industries are currently experiencing severe financial stress. The Canadian trucking industry is also beginning to experience financial difficulties as a result of the weakness in the manufacturing sector and sharply higher fuel costs.

32. The CCA indicator represents the volatility of market-valued assets in a portfolio consisting of nine broad non-financial industries. It is currently based on data up to the end of April 2008. Details of the CCA were outlined in the June 2006 issue of the FSR, pp. 43–51.

Although a number of manufacturing companies are experiencing serious financial difficulties, their problems are unlikely to have significant adverse effects on the Canadian financial system, since the direct exposure of Canadian banks to these industries remains limited.

House prices

In contrast to the United States, conditions in Canada's housing markets remain relatively favourable. Income growth, low unemployment rates, and relatively good financing conditions have continued to support rising house prices, although the pace of increase has slowed somewhat (Chart 28). This deceleration has been particularly marked in markets that have posted very steep price increases in the past two years, such as Alberta (Chart 29).³³ Lower price growth is the result of increased housing supply combined with some softening of demand, as illustrated by a decrease in home sales (Chart 30). At least part of this lowered demand for housing may be attributed to a deterioration in housing affordability.

Despite the increase in supply, the Canadian housing market does not seem to be characterized by excess supply at this time. The proportion of unoccupied newly built dwellings in most cities remains below historical averages (Chart 31), suggesting that a major widespread reversal in house prices is unlikely.³⁴ Moreover, the recent decrease in building permits suggests that housing supply is adjusting to the softening of demand.

The combination of an expected slowing in economic growth, more balanced housing supply and demand, deteriorating consumer confidence, and lower home-buying intentions³⁵ suggests that house prices should increase at a slower pace going forward. If a significant reversal in commodity prices were to occur, however, house prices could be severely affected, with

33. In contrast, there has been some pickup in house price increases outside of Alberta, reflecting recent migratory developments (with people leaving Alberta for other Western provinces) and the deterioration in housing affordability in the province.

34. This does not exclude the possibility of imbalances in certain segments of local markets.

35. CMHC's *Renovation and Home Purchase Report* (available at <http://www.cmhc-schl.gc.ca/odpub/esub/65459/65459_2008_AO1.pdf>) indicates that 6 per cent of households intend to buy a primary residence in 2008, down slightly from the 7 per cent that actually purchased in 2007.

price decreases in some local markets, where income and employment are particularly exposed to commodities. The direct impact on the banking sector would be somewhat limited, since all bank mortgage lending with a loan-to-value ratio greater than 80 per cent must be insured, and since mortgage insurers benefit from an explicit government guarantee. However, since lending to households—notably through home equity lines of credit—has been an important source of bank profits over the past few years, a slowdown in housing market activity would have a negative impact on the banking sector.

Mortgage market

A number of product innovations in the mortgage market and the mortgage-insurance market since 2006 (e.g., longer amortization periods, zero down payment options, subprime mortgages) have boosted housing demand in Canada and increased the vulnerability of the household sector to changing circumstances. But a housing market collapse, similar to that in the United States (i.e., largely driven by subprime-mortgage innovation) seems unlikely. The subprime-mortgage market remains small in Canada—accounting for less than 5 per cent of the residential mortgage market, compared with 14 per cent in the United States—and has not experienced the excesses of its U.S. counterpart.³⁶ The quality of the Canadian subprime-mortgage market remains good, as illustrated by still low (albeit rising) delinquency rates (Chart 32).³⁷

Still, the ongoing financial market turmoil has had some impact on the subprime-mortgage market in Canada. Subprime lenders that rely primarily on securitization to fund their mortgages have been significantly affected by the recent drying up of market liquidity: lending conditions have been tightened, and some mortgage products considered “riskier” have been withdrawn; some posted losses at the end of the year, and a number of small players exited the market altogether. Subprime lenders that rely on a deposit base to fund their mortgages were not affected as strongly by market-liquidity problems, although their funding costs have risen. Overall, this suggests that, going for-

36. For details, see Box 1 in the December 2007 FSR, p. 8.
 37. By comparison, 14.4 per cent of U.S. subprime mortgages were in arrears over 90 days or in foreclosure in 2007Q4 (up from 9.3 per cent in 2007Q2).

Chart 28 Real Prices for Housing in Canada*



Chart 29 Real Prices for Existing Houses by City*

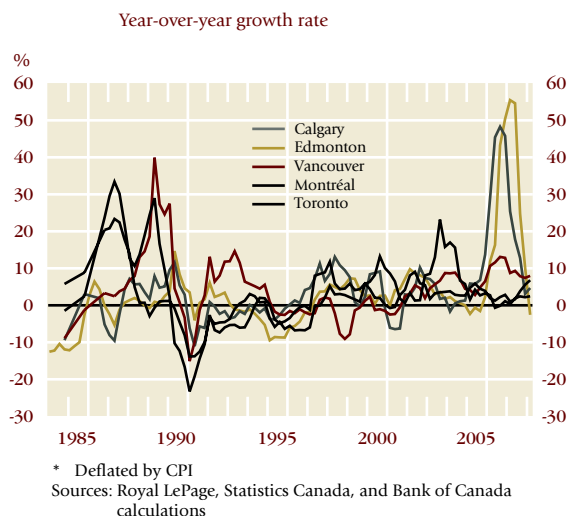


Chart 30 Indicators of Housing Supply and Demand

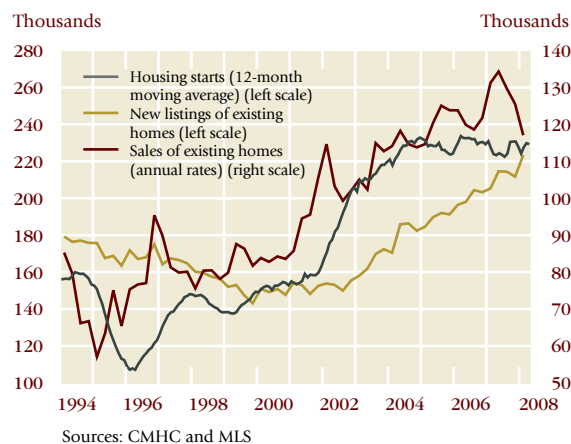
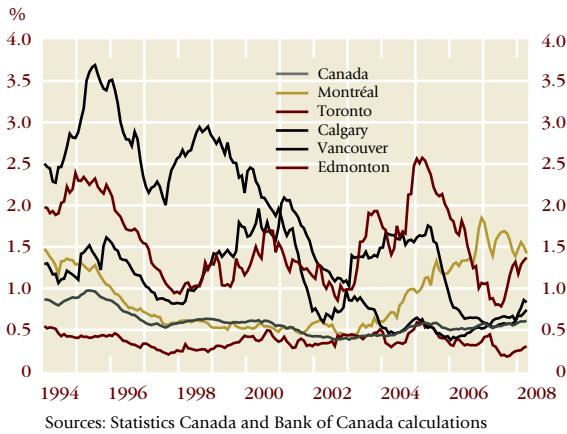


Chart 31 Recently Completed Unoccupied Dwellings, as a Percentage of Population



ward, the subprime-mortgage market should grow at a slower pace.

The recent popularity of product innovations in the mortgage market, such as low down payments and longer amortization periods, suggests that a certain proportion of homeowners have little home equity and would be more sensitive to adverse economic shocks. While the direct impact on the financial system would be limited to the extent that those mortgages are insured, there could be secondary effects on financial institutions.

Household sector

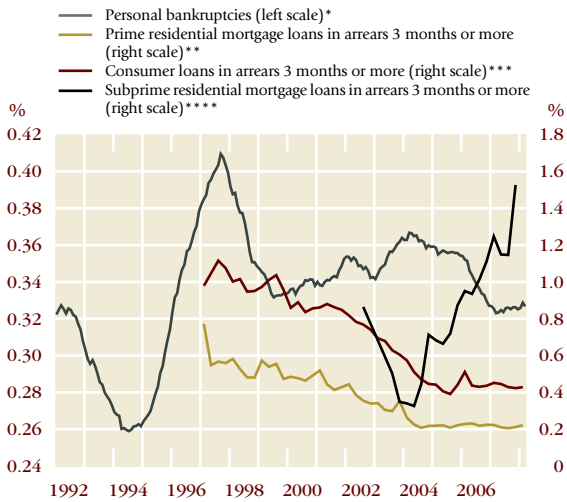
Disposable income continued to increase at a solid pace (2.8 per cent increase in the second half of 2007). The increase in household debt, however, outpaced that in income, leading to a further rise in the debt-to-income ratio, which stood at 131 per cent in 2007Q4 (Chart 33). Rising indebtedness was accompanied by higher mortgage rates, which pushed up the debt-service ratio (DSR) to 7.7 per cent in 2007Q4 from 7.3 per cent in 2007Q2.³⁸

Although household liabilities increased more rapidly than household assets (at market value), causing the debt-to-asset ratio to rise to 17 per cent in 2007Q4—up from 16.6 per cent in 2007Q2—household net worth still increased by 6.4 per cent in the second half of 2007.

Aggregate indicators of household financial stress continue to suggest that the Canadian household sector is in good financial health (Chart 32). Mortgage loans and consumer loans in arrears have remained at historically low levels, and the personal bankruptcy rate was unchanged at 0.33 per cent in February 2008.

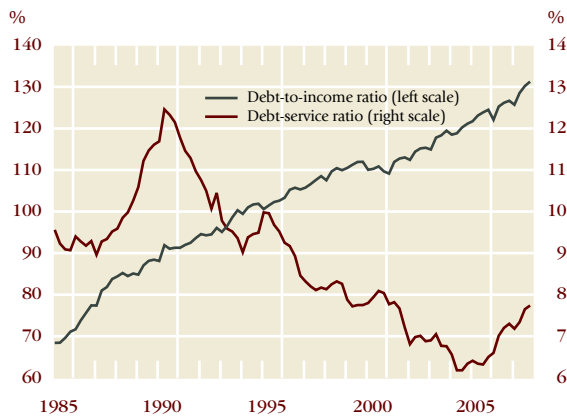
Notwithstanding the overall solid financial position of the Canadian household sector, the proportion of debt owed by vulnerable households (defined as households with a DSR above 40 per cent)³⁹ has increased slightly in the past year (Table 2). This suggests that some households could become more sensitive to negative economic shocks. Combined with possible ad-

Chart 32 Household Sector: Financial Stress Indicators



* As a percentage of population aged 20 and over
 ** As a percentage of prime mortgage loans outstanding
 *** As a percentage of consumer loans outstanding
 **** As a percentage of subprime mortgage loans outstanding, average of major subprime lenders
 Sources: Statistics Canada and Bank of Canada

Chart 33 Household Sector: Indebtedness Indicators



Sources: Statistics Canada, Ipsos Reid, and Bank of Canada calculations

38. It is estimated that the effective household borrowing rate increased by about 20 basis points over this period.

39. This threshold is a rule of thumb used by financial institutions in Canada to assess whether a loan should be granted. For more details about vulnerability thresholds, see the December 2007 FSR, p. 27.

ditional decreases in financial asset prices and the expected further slowdown in the growth of house prices, this suggests that the financial position of the Canadian household sector may deteriorate going forward. This deterioration would be more significant in the event of a sharp reversal in commodity prices, since such a reversal could lead to a decrease in house prices—at least in some local markets—and would likely be accompanied by a tightening in credit conditions. At present, however, the financial situation of households does not pose a threat to the stability of the Canadian financial system.

Table 2
Vulnerable Households^a

	Proportion of households with DSR>40%^b	Share of total debt owed by households with DSR>40%
1999–2006 average	3.33	6.28
2001 ^c	4.04	7.83
2006	3.13	6.17
2007	3.16	6.51

a. Sources: Ipsos Reid and Bank of Canada calculations

b. As a percentage of total households with debt

c. We report data for 2001 because the share of debt owed by vulnerable households was at its maximum during the sample period (1999–2007) in that year.

Important Financial System Developments

This section of *Developments and Trends* examines the structural developments affecting the Canadian financial system and its safety and efficiency.

Highlighted Issue

An introduction to covered bond issuance

Prepared by Toni Gravelle and Karen McGuinness

The first covered bonds issued by a Canadian bank were offered in October 2007. This Highlighted Issue provides a review of the characteristics of and the market for these instruments. It also assesses the potential contribution of covered bonds to the efficiency of the Canadian financial system.

Covered bonds are marketable debt securities issued by banks and secured by dedicated collateral known as the “cover pool.” A large portion of the covered bonds issued, including those issued by Canadian banks, use mortgage loans as the underlying collateral.⁴⁰ Covered bonds have a long history in continental Europe, where a deep market has developed, reaching an outstanding amount of €1.7 trillion in mid-2007.⁴¹ It is only recently that Canadian and U.S. banks have started to issue covered bonds.

Characteristics

The defining feature of covered bonds is that, in the event of issuer insolvency, bondholders have both a claim on the issuing bank and a priority claim (over unsecured creditors) on the

bond’s dedicated collateral. That is, an investor in a covered bond is making a secured loan to the bank and, as such, covered bonds garner a higher credit rating (typically AAA) and require a lower yield than unsecured bonds issued by the same bank. Like asset-backed securities, such as mortgage-backed securities (MBS), a covered bond’s interest and principal payments are secured by bankruptcy-remote assets. But in contrast to MBS, the underlying assets for covered bonds remain on the issuing bank’s balance sheet.⁴² The bank must therefore continue to set aside capital (depending on the type and quality of the loans) for these assets, so the bank does not benefit from a reduction in capital charges related to the sale of loans off its balance sheet. See Table 3 for a summary of the differences between MBS and covered bonds.

A recent innovation in the covered bond market is the advent of so-called “structured” covered bonds. This innovation has enabled banks in countries that do not have specific financial legislation in place (typically those under common law, such as Canada and the United States) to enter the covered bond market. Banks in most European countries issue “traditional” covered bonds, which are regulated by country-specific legislation. Like traditional covered bonds, structured covered bonds provide for a claim on both the collateral and the issuer. The key difference is that the standards are defined in a contract, instead of in legislation.⁴³

In most EU countries, traditional covered bonds carry lower risk-capital charges than MBS. In

40. Although this Highlighted Issue focuses on covered bonds that use mortgages as collateral, a large segment of the covered bond market in Europe consists of bonds that use loans from local authorities as collateral.

41. Packer, Stever, and Upper (2007).

42. The creation and issuance of MBS require banks to sell the loans that they originated to a special-purpose vehicle (SPV) which, in turn, issues bonds collateralized by these loans. The sale of these mortgage loan assets takes them off the bank’s balance sheet. See Kiff (2003) for more on asset-backed securities.

43. Standards relate, for example, to the assets used, the quality of the assets, and the maintenance of asset quality.

Table 3
Traditional Covered Bonds versus Mortgage-Backed Securities

	Covered bonds	MBS
Balance sheet treatment of collateral	On the balance sheet of originating bank	Off the balance sheet, assets sold to special-purpose vehicle (SPV)
Legal treatment	Collateral is bankruptcy remote	Bankruptcy remote (given SPV structure)
Responsibility for principal and interest payments	Issuing bank (flows guaranteed by pledged collateral)	SPV's collateral cash flows
Bond structure	Semi-annual payment of interest and principal at maturity	Typically monthly payments, embeds prepayment risk
Rating	Depends on quality of underlying assets and on the rating of issuing bank (mainly AAA rated)	Depends on quality of underlying assets and credit enhancements to pool assets
Risk weighting ^a	10 per cent for most EU countries	20 per cent for Fannie Mae and Freddie Mac MBS and 50 per cent for non-agency MBS

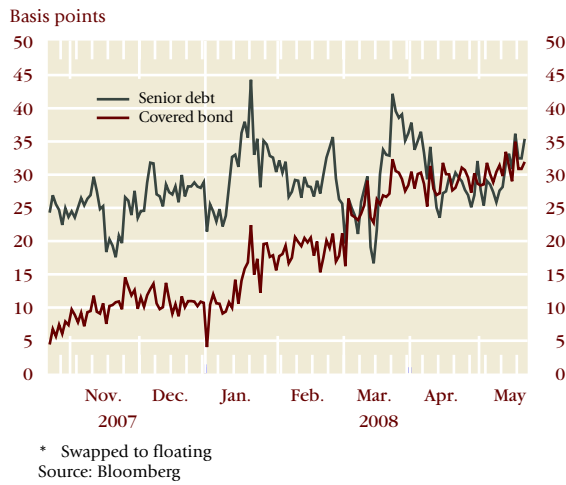
a. This treatment is covered under the Consolidated Banking Directive of the European Union.

addition, for many regulated investment funds in the European Union,⁴⁴ limits on asset concentration are less restrictive for covered bonds than for other corporate and securitized debt instruments. Covered bonds take on the traditional structure of “bullet” bonds, with semi-annual interest payments and principal payment at maturity. Holders of MBS, on the other hand, typically receive monthly interest payments and face prepayment risks, since the prepayment of any of the underlying mortgage loan is typically passed on to the MBS investor. These three factors, among others, increase the demand of institutional investors for covered bonds relative to similar debt instruments. Since most of the preferential treatment offered by traditional covered bonds does not apply to the structured variety, however, the latter are typically issued at higher yields than traditional covered bonds.

44. In Europe, regulated investment funds are subject to the requirements of the undertakings for collective investment in transferable securities (UCITS) directive. The directive lays down uniform requirements for the organization, management, and oversight of investment funds across the European Union. It imposes rules relating to fund diversification, liquidity, and the use of leverage, and defines eligible assets in which the fund can invest. Funds covered by the UCITS are similar to Canadian mutual funds.

The dual nature of covered bonds (i.e., being a senior or priority claim on both the issuing bank and the underlying collateral) is highlighted by the differences in the way two of the largest credit-rating agencies, Standard & Poor’s and Moody’s, assess the credit risk of the individual bond issues. In the case of Moody’s, it first establishes the senior unsecured credit rating of the issuing bank. Then, based on the legislative or contractual framework of the bond (which defines the quality of the collateral), as well as the degree of credit enhancement embedded in the bond’s collateral pool, Moody’s will award the covered bond a rating several notches above the rating of the bank’s unsecured debt. In contrast, Standard & Poor’s uses a structured-finance approach to assess the covered bond’s creditworthiness that is essentially the same as that used to assess asset-backed securities more generally. The only difference is that the issuing bank’s (unsecured) rating will affect the degree of credit enhancements required for the covered bond to be rated AAA. As such, the degree to which the downgrade of an issuing bank will affect the rating of the covered bond will vary across bonds and will generally depend on the legal or contractual structure of the bond, as well as on the overall quality of the cover pool, including the pool’s credit enhancements.

The existence of an active secondary market is a key factor in the attractiveness of covered bonds

Chart 34 Royal Bank: Spread on Covered Bond vs. Senior Debt*

for fixed-income investors, particularly for the benchmark segment of the market. The benchmark or “Jumbo” covered bond market consists of those issues with an outstanding size of at least €1 billion and represents approximately half of the total market. Although market liquidity has recently declined as a result of the market turmoil (see p. 13), the benchmark segment of the covered bond market is typically the second most liquid bond market in Europe, after sovereign government bonds.⁴⁵

Drivers of Canadian Bank Issuance of Covered Bonds

The interest of Canadian banks in issuing covered bonds is driven by several factors. One of the most important is that covered bonds provide for diversification of bank funding sources, as well as diversification of their investor base, since they tap into a largely European market. In particular, covered bonds help banks diversify their *secured* funding sources of mortgage lending, such as National Housing Act (NHA) MBS funding of the banks’ mortgage-loan portfolios (see the Highlighted Issue on p. 24 for more on the issuance of mortgage securities under the NHA MBS Program). The banks’ access to the NHA MBS Canada Mortgage Bond Program can occasionally be constrained, and covered bonds can provide Canadian banks with an alternative avenue of mortgage funding in these situations. Moreover, the issuance of covered bonds allows Canadian banks to use mortgages not eligible for NHA MBS issuance, thus better leveraging their broader pool of mortgage collateral to garner funding.

Covered bonds are particularly well suited to funding a bank’s fixed-rate mortgage loan portfolio. As Packer, Stever, and Upper (2007) note, the issuance of covered bonds, like that of other longer-term fixed-rate debt, enhances a bank’s ability to match the duration of its liabilities to that of its mortgage loan portfolio, enabling

45. The total outstanding value of benchmark covered bonds is approximately €700 billion as of 2006. See European Covered Bond Council (2007).

better management of its exposure to interest rate risk.^{46,47}

Another reason for Canadian banks to issue covered bonds is that they are a potentially cost-effective alternative to the issuance of unsecured senior debt. This was particularly the case before the recent credit market strains spread to the European covered bond market (Chart 34). By replacing the issuance of more expensive unsecured debt, covered bonds may help lower a bank's overall funding costs and, in turn, the cost of its capital. The lower overall cost of capital generates, all other things being equal, higher profits and/or lower mortgage loan rates for homeowners. However, since covered bonds represent a priority claim on a pool of bank assets, their issuance results in a smaller pool of assets available for the claims of depositors and other senior unsecured creditors in the case of a bank default. Covered bond issuance therefore poses additional risk to unsecured debt holders and depositors. Thus, the issuance of a large amount of covered bonds would affect a bank's creditworthiness and would likely lead to a downgrade of its unsecured debt and/or some form of remedial intervention by the banking supervisor.

Overall, the introduction of covered bonds in Canada should increase the effectiveness and robustness of the market-based funding programs of banks and lower the banks' overall cost of capital (if the amount of covered bond issuance is below some threshold). Covered bonds thus represent a potential enhancement to the efficiency of the Canadian financial system.

Policy Developments in Canada

In June 2007, OSFI completed an initial review of regulatory considerations regarding the issuance of covered bonds by Canadian banks and issued guidelines allowing for a limited issuance. In reaction to concerns that covered bonds create a preferred class of claimants, OSFI implemented a limit on the level of covered bond issuance of 4 per cent of a bank's total assets.⁴⁸ The 4 per cent limit would amount to a maximum issuance of roughly \$95 billion by the big six Canadian banks, based on the 2007 level of their total assets.

In imposing limits on covered bond issuance, banking supervisors tend to weigh the previously mentioned risks for depositors against the prudentially beneficial enhancements to a bank's creditworthiness offered by covered bonds in the form of lower overall wholesale funding costs and more robust access to liquidity. For example, the U.K. banking supervisor, the Financial Services Authority (FSA), envisages that an amount of covered bond issuance around 20 per cent of total assets would likely pose a high enough risk to require an increase in bank capital for most U.K. banks.⁴⁹ In other European jurisdictions, there is no limit on covered bond issuance (e.g., France).⁵⁰

So far, only a few Canadian banks have issued euro-denominated covered bonds in the European market. While the maximum potential issuance for major Canadian banks is roughly \$95 billion in aggregate, the actual issuance to date by Canadian institutions is approximately \$6.7 billion. Although the issuance of covered bonds by these Canadian banks is seen as cost-effective compared with some of their other market-based sources of funds, these issues were generally priced at concessions relative to covered bonds of similar size issued by

46. The U.K. Treasury notes that the absence of a U.K.-based market for covered bonds has impeded the development of longer-term fixed-rate mortgage lending. See <http://www.hm-treasury.gov.uk/media/F/D/consult_coveredbonds230707.pdf>.

47. An alternative source of secured funding for banks is repo funding, in that the bank pledges collateral to secure the loan (see Morrow 1994-95 for more on repo lending). As with covered bonds, the lender has a priority claim on the pledged collateral. Unlike covered bonds, however, repo funding is short term, typically one day. Moreover, the collateral consists largely of liquid government bonds, rather than (non-marketable) mortgage loans. As such, repo funding does not have the asset-liability matching attributes offered by covered bonds in funding mortgage loans.

48. See OSFI conditions at <http://www.osfi-bsif.gc.ca/app/DocRepository/1/eng/notices/osfi/cvbnds_e.pdf>.

49. See <http://www.fsa.gov.uk/pubs/international/cbsg_psletter.pdf> for more details on the FSA's approach to the supervision of banks in relation to their covered bond issuance.

50. The volume of covered bonds issued by Spanish banks is limited to 90 per cent of "eligible" assets. The eligible collateral pool is constrained to first-lien mortgages, with the loan-to-value ratio capped at 80 per cent for residential mortgages. An estimate based on a small sample of Spanish banks indicates that the eligible collateral pool typically makes up roughly 50 per cent of their total mortgage portfolio.

European banks. This partly reflects a lack of investor familiarity, given that Canadian banks are just entering this market, as well as the yield spread between “structured” and “traditional” covered bonds.

Compared with other forms of secured mortgage funding,⁵¹ anecdotal evidence indicates that, at the time of issuance, the yields on Canadian covered bonds were roughly in line with, or were slightly below, those on NHA MBS. Since late January 2008, however, the yield spreads on Canadian covered bonds have widened in relation to those for NHA MBS and senior

unsecured debt, implying that, at current yield levels, any new issuance of covered bonds by a Canadian bank would be a modestly more costly choice of secured mortgage funding than NHA MBS.

Conclusion

Covered bonds provide financial institutions with an additional funding vehicle and add to the geographic diversification of their funding sources. Since covered bonds also provide an alternative avenue of securitization, this should lead to the greater availability of lower-cost funding alternatives for financial institutions and, ultimately, should contribute to the overall efficiency of the market.

51. In most European jurisdictions, under typical market conditions, the yield on MBS issued by European banks is typically higher (i.e., higher cost) than that of covered bonds, owing to, among other things, their lower liquidity and lower investor appeal.

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Reports

Introduction

Reports address specific issues of relevance to the financial system (whether institutions, markets, or clearing and settlement systems) in greater depth.

The report on **Bank of Canada Oversight Activities during 2007 under the Payment Clearing and Settlement Act** discusses the Bank's activities in 2007 with respect to the three systems designated in accordance with the Act (the Large Value Transfer System, CDSX, and CLS Bank). This annual report by Walter Engert and Dinah Maclean also reviews other Bank activities related to that role.

In 2007, Canada's financial system was the subject of an FSAP (Financial Sector Assessment Program) update. This program is an International Monetary Fund and World Bank initiative aimed at helping countries to identify vulnerabilities in their financial systems and determine needed reforms. The report on **Bank of Canada Participation in the 2007 FSAP Macro Stress-Testing Exercise**, by Don Coletti, René Lalonde, Miroslav Misina, Dirk Muir, Pierre St-Amant, and David Tessier, contains a description of the Bank's role in the design and implementation of the macro scenario, as well as an independent assessment of the results provided by the participating financial institutions. The authors review the benefits of the exercise, as well as the challenges, and outline directions for future work.

The financial market turbulence experienced over the past year has led to concerns over the excessive reliance on credit ratings to assess the credit quality of financial instruments and their issuers. In the report, **The Role of Credit Ratings in Managing Credit Risk in Federal Treasury Activities**, Nancy Harvey and Mervin Merkowsky outline how ratings are used in the

Bank of Canada's own activities and in the activities that the Bank conducts for the Government of Canada as its fiscal agent. Their key message is that the Bank and the government adhere to common marketplace practices in their use of ratings, but are careful not to place excessive reliance on those ratings. Other mechanisms employed to mitigate credit risk include judgment and collateral requirements.

Bank of Canada Oversight Activities during 2007 under the Payment Clearing and Settlement Act

Walter Engert and Dinah Maclean

This report reviews the Bank of Canada's oversight activities during 2007 pursuant to the Payment Clearing and Settlement Act (PCSA). This is the third in an annual series of reports aimed at improving the transparency and accountability of the Bank's activities in this area.¹

The Bank of Canada has had formal responsibility for the oversight of clearing and settlement systems in Canada since 1996.² The PCSA gives the Bank of Canada this responsibility for the purpose of controlling systemic risk. In this context, systemic risk is defined as the risk that the default of one participant in a clearing and settlement system could lead, through the activities of the system, to the default of other institutions or systems.

A clearing and settlement system brings together various financial system participants in a common arrangement, such as a clearing house, where the participants are explicitly interlinked so that the behaviour of one participant can have implications for others. In such an arrangement, each participant could face potentially significant risks and liabilities, depending on the behaviour of other participants and on the design of the system. As a result, spillover or domino effects with broader economic consequences can occur if the system is not properly designed and operated.

Under the PCSA, the Bank identifies clearing and settlement systems in Canada that could be

operated in a manner that could pose systemic risk. Provided the Minister of Finance agrees that it is in the public interest to do so, these systems are designated for oversight by the Bank of Canada, and must satisfy the Bank that they have appropriate risk controls in place to deal with concerns related to systemic risk.³

Three systems have been designated by the Bank: the Large Value Transfer System (LVTS), which deals with large-value Canadian payments; CDSX, which clears and settles securities transactions; and CLS Bank, a global system for foreign-currency transactions.

In the following sections, we discuss various aspects of the Bank's oversight work during the past year. In 2007, the major payment, clearing, and settlement systems continued to evolve in a way that supports the stability and efficiency of the financial system.

The Large Value Transfer System

Owned and operated by the Canadian Payments Association (CPA), the Large Value Transfer System began operation in February 1999. During 2007, it processed, on average, 21,000 transactions per day worth approximately \$185 billion. In its nine years of operation, the LVTS has been a relatively stable system; that is, there have been few significant changes to its design and risk controls. In 2007, the Bank reviewed five rule changes concerning the LVTS, which were largely technical in nature, including further improvements to contingency arrangements and an adjustment to the operation of

1. The authors thank N. Arjani, M. Bonazza, N. Chande, P. Higgins, A. Lai, P. Miller, R. Murray, S. O'Connor, and R. Turnbull for their assistance.

2. A clearing and settlement system is the set of instruments, procedures, rules, and technical infrastructure for the transfer of funds or other assets among system participants.

3. For a discussion of the Bank's approach to the oversight of designated systems, see Engert and Maclean (2006).

the so-called central queue, to improve liquidity management.⁴

The past year, 2007, was the first full year in which the Bank of Canada and the CPA were operating under a Memorandum of Understanding (MOU), signed in November 2006. The MOU sets out the roles and responsibilities of both parties under the PCSA and how they intend to work together to meet these responsibilities. The MOU added clarity and structure to the relationship between the Bank and the CPA, and improved the oversight relationship between the two organizations.

The gains from a well-functioning relationship were illustrated in late October and early November 2007. The CPA discovered a coding error, which meant that, under certain circumstances, it was possible, in principle, for a queued payment in the LVTS to be processed through the system, even though it may not have passed the LVTS risk controls. Although the available data and anecdotal evidence suggest that the likelihood of such an event was remote, the LVTS was operating without the benefit of all the risk-control features working as intended. The implications of this could have been serious.

The CPA responded to the situation and worked with the Bank of Canada and LVTS participants to implement an interim solution acceptable to LVTS participants and the Bank, until a permanent solution that corrected the system error was put into place on 11 November.

Part of the oversight arrangement with regard to the LVTS, as set out in the Bank's MOU with the CPA, are regular meetings between the Bank and senior CPA officials. This allows the Bank and the CPA to discuss general payments system developments, as well as potential changes to the LVTS, early in the process of developing those changes. During 2007, the Bank held four such meetings with senior CPA officials. The Bank also met with the Board of Directors of the CPA.

CDSX

Owned and operated by CDS (Clearing and Depository Services Inc.), CDSX clears and settles

4. The central queue is an algorithm that offsets batches of queued (delayed) payments against each other (on a multilateral basis) at specified intervals throughout the day.

securities transactions in Canada. On average, in 2007, CDSX processed about 520,000 trades daily worth about \$250 billion.

In 2007, CDS established a new cross-border clearing and settlement link with a major securities settlement system in the United Kingdom operated by Euroclear UK and Ireland Limited (formerly known as CrestCo Ltd.). Through this link, called Euroclear UK Direct, CDS participants can directly settle U.K. securities transactions, facilitating their trading in these securities.

As part of its review of this initiative, the Bank conducted a comprehensive assessment of the link with the co-operation of CDS, to satisfy itself that the creation and operation of the link would neither pose unacceptable risks to CDS nor compromise the risk controls of CDSX. This link became operational on 27 August.

An important development in 2007 was the Bank of Canada's participation in the Financial Sector Assessment Program (FSAP) of the International Monetary Fund (IMF) and World Bank.⁵ The FSAP included a formal review of the compliance of CDSX with internationally accepted standards for the design, operation, and regulatory oversight of securities settlement systems.

Accordingly, the IMF conducted an extensive assessment of CDSX in collaboration with the Bank, provincial regulators, and CDS. The assessment concluded that CDSX is

sound, efficient and reliable. The legal basis for the system's operation is solid, its functionality is well developed, its risk management procedures to mitigate credit, liquidity, and operational risks are appropriate, and its governance structure is effective and transparent.

The IMF also made several recommendations to further enhance CDSX. Most important were those related to two standards that the IMF assessed CDSX as not observing.⁶ More specifically, the IMF advised that CDS diversify the settlement of U.S.-dollar positions arising from

5. For more on this FSAP review, see the IMF website at <<http://www.imf.org/external/pubs/ft/scr/2008/cr0859.pdf>>.

6. These were the only standards that CDSX was assessed by the IMF as not observing. The complete IMF assessment of CDSX is available at <<http://www.imf.org/external/pubs/cat/longres.cfm?sk=21712.0>>.

one of its services, currently concentrated on the books of a single, private bank. The Bank of Canada has accommodated this particular settlement arrangement because of the relatively small size of potential losses, and the complexity, operational risk, and significant cost of apparent solutions. The Bank will continue to monitor the situation, however, and will seek solutions with CDS if warranted.

The IMF also advised that CDS should not permit the transfer into Canada of securities obtained through its link with the Depository Trust Corporation (DTC) in the United States until after settlement finality is obtained in that system. DTC is a major securities settlement system in the United States and, under some circumstances, DTC has the ability to reverse a security transaction until the end of the day of the original transaction. This can raise risks for participants who have already disposed of the securities they are asked to return.

Rather than delay securities transfers from DTC to the day after the original transaction, thus importing inefficiencies into the Canadian marketplace, CDS has established means to mitigate the associated risks.⁷ The Bank's view is that even if such transaction reversals were to occur, any resulting risk is sufficiently mitigated by the risk controls that CDS has in place. Moreover, once a security is transferred into CDSX, the transaction is unlikely to be subject to such reversals.

The IMF assessment of CDSX provided a rigorous and useful complement to the Bank of Canada's oversight.⁸

7. This mechanism assigns the obligation to the CDS participant that had received the recalled security. If that participant does not comply, CDS has in place collateralized credit arrangements that would provide CDS with the funding needed to pay out the obligation or replace the security. Ultimately, any associated loss would be assigned to participants in a predetermined manner, protecting CDS.

8. In 2007, CDS was also assessed by a private custody and risk-management-rating firm, Thomas Murray, and received a rating of AA, which is deemed "very low risk overall." No depository clearing organization has received a higher rating from Thomas Murray. (Thomas Murray has rated over 140 securities depositories worldwide, including DTC, the U.S. Federal Reserve, and all of the Euroclear group.) The outlook for this rating is stable, suggesting that there are no forthcoming developments that would be expected to alter the assessment.

A valuable component of the Bank's oversight of CDSX is the bilateral meetings between the Bank and CDS that examine a range of topics related to the operation of CDSX. These meetings provide the Bank and CDS with an opportunity to explore any concerns or questions related to proposed changes to CDSX on a timely and efficient basis. In this way, the Bank is alerted to possible significant changes early in the process, and can raise any concerns that it may have, so that they can be dealt with efficiently by CDS in the process of developing system changes. During 2007, the Bank held two such meetings with senior CDS officials. Among the issues discussed, in addition to planned CDSX development, was the IMF assessment of CDSX.

The Bank of Canada approved 48 changes to rules and procedures concerning CDSX in 2007.

CLS Bank

CLS Bank clears and settles foreign exchange (FX) transactions in 15 currencies, including the Canadian dollar. In 2007, CLS Bank settled an average daily value of US\$3.6 trillion, which included Canadian-dollar transactions with an average daily value of US\$79 billion. Five of the six major Canadian banks now use CLS Bank as one means of settling their FX transactions.

CLS Bank is overseen collaboratively by the central banks whose currencies are included in the system, with the Federal Reserve Bank of New York acting as lead overseer. (CLS Bank is incorporated under U.S. laws, and the vast majority of FX trades involve the U.S. dollar.)

In 2007, CLS Bank proposed a number of new services and products that required regulatory approval. One of them is the provision of settlement services for over-the-counter (OTC) credit derivatives housed in the Depository Trust and Clearing Corporation (DTCC) Deriv/SERV trade information warehouse for which CLS won a tender offer in December 2006.⁹ This warehouse is a centralized database of records relating to OTC credit-derivative transactions in nine CLS-eligible currencies.

9. DTCC is a U.S. holding company that provides a range of clearing and settlement services through its six subsidiaries, including clearing and settlement of U.S. securities.

To this point, the focus of CLS Bank had been on virtually eliminating FX settlement risk by settling FX payments on a payment-versus-payment basis.¹⁰ The proposal to settle these OTC credit derivatives meant that CLS Bank would be settling non-FX-related payments. Since these are one-way payments from one participant to another (as opposed to two-way payments characteristic of FX transactions), they cannot be settled on a payment-versus-payment basis.

In assessing this proposal, the overseeing central banks considered whether this would compromise the ability of CLS to comply with the CPSS (Committee on Payment and Settlement Systems) core principles for systemically important payments systems, which underpin the oversight of CLS Bank.¹¹ As well, the central banks also considered broader risk issues associated with the future direction of CLS, and possible conflicts with the policies of some central banks if CLS were to evolve beyond its focus on reducing FX-settlement risk. For example, there was concern that CLS Bank could become a general-purpose payments system and reduce the role of major domestic systems, which could compromise the ability of some central banks to oversee systemically important payments systems involving their currencies.

The Bank of Canada continues to believe that the fundamental principle guiding the oversight group in considering such proposals should be the continued compliance with the CPSS core principles and, in particular, that any new service or product offered should not impair the controls put in place to manage FX-settlement risk. If these conditions are met, undue barriers should not be placed on the evolution of CLS Bank. It must also be recognized that, given the large fixed costs associated with CLS Bank's core FX-settlement business, complementary products may be useful to amortize these costs and may provide efficiencies.

With regard to the proposal to settle these specific OTC credit derivatives, approval was provided by the oversight group. Accordingly, CLS Bank began operation for transactions in five of the nine currencies in November 2007. Transactions in the other four currencies, including the Canadian dollar, will be phased in over time.

Approval was also given to CLS Bank to offer two other products: the settlement of payments related to non-deliverable forward contracts; and the settlement of FX option premiums.¹² Payments resulting from these instruments involve a single currency payment instead of a two-way currency payment as in a standard FX transaction.

The central bank oversight group also approved changes to the eligibility criteria for new currencies and settlement membership. The new criteria for currency eligibility will allow a currency whose sovereign credit rating is below investment grade to be settled in CLS Bank. However, such currencies cannot be used as collateral to support net debit positions within the system.

The minimum credit rating required for settlement membership was also lowered to below investment grade. Settlement members rated below investment grade cannot owe money within the system, however, but are required to fund settlement of their payment instructions on a cash basis.

These latter two changes have the potential to reduce settlement risk among a broader range of currencies and trading institutions than those previously eligible, without adversely affecting the safe and efficient functioning of the CLS settlement service.

Finally, an important outcome of the work among the overseeing central banks regarding CLS Bank's evolving business strategy has been

10. FX transactions involve the sale of one currency for another. In a payment-versus-payment arrangement, the currency payable is paid at the same time as funds due are received. In this way, risk arising from asynchronous exchange of payments (settlement risk) is eliminated.

11. These core principles are available at <<http://www.bis.org/publ/cpss43.pdf?noframes=1>>.

12. Non-deliverable forward contracts differ from normal forward FX contracts in that there are no transfers of the principal currency sums between counterparties. Rather, on the contracted settlement date, profit/loss is calculated based on the difference between the contracted exchange rate and the prevailing spot exchange rate, and a net cash payment is made by the party suffering the loss to its counterparty, often in U.S. dollars. Such contracts are commonly used to hedge against currency risks in emerging markets. An FX option premium is the price the buyer of an option contract pays for the right to buy or sell a certain currency for a specified price in the future.

a strengthening of the co-operative oversight arrangement that provides enhanced focus and resources with regard to CLS Bank developments.

August Financial Turbulence

The turbulence in financial markets that began in August 2007 led to increased volumes and activity for each of the designated systems. Although there were notable volume increases in the LVTS on some days in mid-August, there were no capacity problems, and the system functioned smoothly. Some system participants temporarily increased their collateral pledged in the system to support the higher value of LVTS transactions associated with intensified trading in markets and increased transactions in other clearing and settlement systems.¹³

The drying up of liquidity in the market for asset-backed commercial paper (ABCP) resulted in a number of defaults and extensions of entitlement payments related to securities held in CDSX.¹⁴ On 13 August 2007, approximately \$2 billion in maturities of ABCP held at CDS was not paid. Issuers of this ABCP had either to extend the maturities of this paper, where this right existed, or to leave the maturities unpaid.

In the event, about \$1.6 billion of ABCP was left unpaid, and another \$500 million was extended. CDS was not exposed to any financial risks arising from the unpaid maturities, because CDS does not execute an entitlement payment in CDSX unless it is prefunded by the issuers' paying agent. On 14 August, CDS took steps to assist issuers and participants holding the defaulted paper, including facilitating direct interaction between issuers and participants, to reach mutually agreeable solutions. It also enabled procedures to process partial payments on maturing ABCP. As well, CDS issued daily bulletins to system participants to provide information on unpaid and extended maturities, and on the evolving value of unpaid ABCP held at CDS.

Increased trading volumes in FX markets caused many market participants, including CLS Bank, to face internal capacity pressure. CLS Bank required two settlement extensions on 17 August, in the Australian dollar and Korean won. Peak-input volumes received on 16 and 17 August gave rise to peak-settlement days on 20 and 21 August, which were both record volume days for CLS Bank. Nevertheless, settlement and funding occurred within specified timelines on both of those days. CLS Bank had other peak-volume days after August, notably on 13 November, with over 1.4 million currency sides processed. Settlement proceeded smoothly on all of these peak-volume days.

In sum, the core payment, clearing, and settlement infrastructure functioned well during the period of market turbulence in 2007.

Other Oversight-Related Activities

CPA and other payments-system themes

In 2007, the CPA launched a strategic review of the LVTS and, more generally, is working to develop a long-term strategy for the evolution of the payments system in Canada, taking account of evolving needs and prospective developments. Such planning can provide helpful leadership in addressing important issues affecting the stability and efficiency of the Canadian financial system. Through the CPA's consultation with the Bank on these matters, the Bank undertook to enhance the ongoing exchange of research and analysis between the two organizations.

As part of the regulatory framework governing the Automated Clearing Settlement System (ACSS), the federal Department of Finance regularly consults the Bank with regard to proposed rule changes and other developments affecting the ACSS.¹⁵ In this regard, the Bank reviewed nine ACSS bylaw and rule changes during the year.

13. Collateral is pledged by LVTS participants to the Bank of Canada to help manage risk in the system.

14. Entitlements include dividends, interest, payment upon redemption or maturity, and other payments or distributions to holders of securities. Entitlements may be distributed in the form of a money payment or as a distribution of securities or other property.

15. The ACSS, which is owned and operated by the CPA, is used for payments not handled by the LVTS: generally, small-value items, such as paper cheques, automated bill payments, and debit card transactions. The ACSS is subject to oversight by the federal Department of Finance.

More generally, to facilitate the Bank's interaction with the Department of Finance on payments issues, including broader policy developments affecting payment, clearing, and settlement systems, senior and working-level officials meet on a quarterly basis to exchange information and analysis. Among the issues considered in 2007 were the CPA's medium-term strategic plan, effects of the financial market turbulence on core payments infrastructure, and work related to the IMF FSAP.

Central bank committees and working groups

The Bank is an active member of the Committee on Payment and Settlement Systems. The CPSS is a committee of central bankers that collaboratively sets standards that guide oversight policies around the world. The CPSS also conducts analysis and research on a range of issues relevant to clearing and settlement systems. (For more on the CPSS, see <<http://www.bis.org/cpss/index.htm>>.)

In 2007, Bank staff were also actively involved in two working groups established by the CPSS. One working group published a consultative report in July on a global survey conducted in 2006 on the management of FX-settlement risk at major international banks. The results show that CLS Bank was used to settle 55 per cent of the value of the settlement obligations in the survey, contributing significantly to a reduction in FX-settlement risk.¹⁶ The analysis also suggests that further reductions in FX-settlement risk can be made by making greater use of payment-versus-payment settlement methods (as provided by CLS Bank), increased reliance on bilateral netting arrangements, and, in some cases, simply through better measurement and control of settlement risk exposures. The CPSS is expected to publish the final report in mid-2008.

A second CPSS working group has been analyzing interdependencies that exist between payment and securities settlement systems in CPSS countries, as well as the potential role of these interdependencies in the transmission of risk across systems and across countries. The group's work highlights the fact that global payment and settlement infrastructure is becoming more interdependent. Tighter direct relationships

between systems, and more indirect relationships arising from the activities of large financial institutions and the use of common third-party service providers, have contributed to this trend.

These relationships have strengthened the global infrastructure by reducing costs and diversifying risks, yet they also pose challenges by increasing the potential for disruptions to spread widely and quickly. Therefore, the increasing interdependence of payment and settlement systems calls for broad risk-management perspectives and coordination among stakeholders. As well, risk-management controls should be commensurate with the roles of the system, institution, or service provider in the global infrastructure. The working group will be considering more specific policy implications in 2008.

SWIFT

The Bank also continues to participate in the co-operative oversight of the Society for Worldwide Interbank Financial Telecommunication (SWIFT). SWIFT is the principal payment-messaging service provider for financial institutions around the world and for critical systems, such as the LVTS and CLS Bank. This co-operative oversight group monitors and assesses the extent to which SWIFT maintains appropriate governance arrangements, operational processes, risk management, and controls to effectively address potential concerns that may arise for financial stability.

Business-continuity planning (BCP)

The Bank of Canada works with the operators and participants of systemically important Canadian clearing and settlement systems to enhance arrangements for continuity of operations. These systems are at the centre of Canada's financial system, and serious economy-wide repercussions could arise if their operations were not extremely reliable.

One of the key conclusions from the Joint BCP Working Group in 2006 was the importance of achieving a priority-recognition status for major clearing and settlement systems from federal and provincial organizations that have responsibilities for emergency management (Goodlet 2007). Recognition of priority access to essential inputs such as electricity, diesel fuel, or municipal

16. The results for the Canadian banks included in the survey are summarized in Arjani (2007).

services during a seriously disruptive event is an important component of these systems and of the Bank's BCP work.

In 2007, the Bank of Canada and other agencies continued to follow up on these recommendations. In particular, the Bank, Finance Canada, and the system operators have been working with the Province of Ontario to achieve priority status for critical clearing and settlement infrastructure.

The Bank was also active during the year to improve its own business-continuity arrangements. The Bank conducted two integrated IT disaster-recovery exercises under conditions that simulated a serious operational disruption at the Bank. The test results were satisfactory, with the Bank able to meet its recovery-time targets. In addition, a large-scale integrated business-recovery exercise was conducted at the Bank's recovery site, which provided useful lessons for the Bank's BCP planning.

High-availability banking system

As noted in last year's oversight review (Goodlet 2007), the Bank of Canada is committed to improving its ability to deliver its unique banking services to critical clearing and settlement systems and financial institutions on a high-availability basis.

In 2007, significant progress was made in the multi-year redevelopment of a high-availability delivery system for these banking services. Final preparation and testing are expected to continue in 2008, with implementation of the new system targeted for autumn 2008.

Publications in 2007

During 2007, the Bank published the following staff work related to clearing and settlement systems:

- Chapman, J. T. E. and A. Martin. 2007. "Rediscounting under Aggregate Risk with Moral Hazard." Bank of Canada Working Paper No. 2007-51. This work was summarized in the Bank of Canada *Financial System Review*, December 2007, under the title, "The Provision of Central Bank Liquidity under Asymmetric Information."
- Chiu, J. and A. Lai. 2007. "Modelling Payments Systems: A Review of the Literature." Bank of Canada Working Paper No. 2007-28. This work is summarized in the Bank of Canada *Financial System Review*, June 2007.
- Arjani, N. 2007. "Management of Foreign Exchange Settlement Risk at Canadian Banks." Bank of Canada *Financial System Review* (December): 71–78.
- Engert, W. and D. Maclean. 2006. "The Bank of Canada's Role in the Oversight of Clearing and Settlement Systems." Bank of Canada *Financial System Review* (June): 57–63.
- Goodlet, C. 2007. "Bank of Canada Oversight Activities during 2006 under the Payment Clearing and Settlement Act." Bank of Canada *Financial System Review* (June): 33–37.
- Arjani, N. and W. Engert. 2007. "The Large-Value Payments System: Insights from Selected Bank of Canada Research." *Bank of Canada Review* (Spring): 31–40.
- Ball, D. and W. Engert. 2007. "Unanticipated Defaults and Losses in Canada's Large-Value Payments System, Revisited." Bank of Canada Discussion Paper No. 2007-5.

Bank of Canada Participation in the 2007 FSAP Macro Stress-Testing Exercise

Don Coletti, René Lalonde, Miroslav Misina, Dirk Muir, Pierre St-Amant, and David Tessier

In 2007, Canada's financial system was the subject of an FSAP (Financial Sector Assessment Program) update (Box 1). A key component of this exercise was the stress testing of the Canadian financial system with a macroeconomic scenario. The Bank of Canada took the lead in developing, implementing, and assessing the results. This report describes the role played by the Bank and the main results of, and lessons derived from, this exercise.¹

General Framework

The purpose of stress testing is to assess the resilience of a segment of the financial system in the face of "rare but plausible" events that have either resulted in vulnerabilities in the past or could do so in the future. In macro stress testing, the events considered are macroeconomic shocks assembled (typically by means of a macroeconomic model) to form a macroeconomic scenario. The objective is to assess the impact of the scenario on a set of financial institutions.

There are two basic approaches to conducting macro stress-testing exercises:

- i) Bottom-up, in which the participating institutions assess the impact of a given scenario on their portfolio, and the authorities then aggregate and interpret the results.
- ii) Top-down, in which the authorities assess the impact of the scenario on financial institutions at a more aggregate level and use the results as a basis for discussion with individual participants.

In the Canadian FSAP update, it was agreed that macro stress testing would be conducted using the bottom-up approach, and that the subject of the stress test would be the loans portfolio of the participating Canadian banks. The Bank of Canada played several roles in the exercise:

- designing the macroeconomic scenario using an in-house model;
- modelling the relationship between macro variables and default rates in the business and household sectors (the individual institutions used these default rates to simulate the losses in their loans portfolio);
- conducting an independent assessment of losses that would arise under the scenario, to cross-check the results of individual banks.²

In the rest of this report, we elaborate on these points by describing the general features of the chosen scenario, the method used to relate default rates to macroeconomic variables, and the results that were obtained. The last section contains a summary of the results, some thoughts on the lessons learned, and an outline of the areas where further work is needed.

The Macroeconomic Scenario

In 2006, during the preparation stage of the exercise, it was agreed that the scenario to be considered would be based on a disorderly adjustment of global imbalances brought about by a downward revision to expectations for productivity growth in the United States. The impact of such a scenario would be traced over a 2-year horizon, starting in 2007Q1.

Our scenario has its origins in the historically high level of trend labour productivity growth experienced in the latter half of the 1990s and the early 2000s in the United States.³ As

1. For a more detailed analysis, see Coletti et al. (forthcoming).

2. The IMF has conducted its own independent assessment, the results of which are in their FSAP report at <<http://www.imf.org/external/pubs/cat/longres.cfm?sk=21710.0>>.

3. The macroeconomic scenario was developed using the Bank of Canada's version of the Global Economy Model (BoC-GEM) (Lalonde and Muir 2007). BoC-GEM is a variant of the GEM developed at the IMF (Faruqee et al. 2007).

Box 1**FSAP Update: Highlights of the IMF Conclusions**

The Financial Sector Assessment Program (FSAP), established by the International Monetary Fund (IMF) and the World Bank in 1999, provides countries with comprehensive assessments of the stability of their national financial systems. Canada undertook an FSAP assessment during the program's pilot phase in 1999–2000. In September 2006, Canadian authorities formally requested that the IMF undertake an FSAP update for Canada.

This update included an assessment of Canada's compliance with internationally accepted standards and codes for financial sector regulation, as well as a focused review of Canada's compliance with revised Basel Core Principles for Effective Banking Supervision. It also included a stress-testing exercise designed to assess the capacity of the Canadian financial system to absorb various adverse economic and financial shocks.

The full FSAP report can be found at <www.imf.org/external/pubs/ft/scr/2008/cr0860.pdf>. The IMF's overall conclusion is that Canada's financial system is mature, sophisticated, and well managed. The report states that financial stability is underpinned by sound macroeconomic policies and strong prudential regulation and supervision, while deposit insurance and arrangements for crisis management and failure resolution are well designed.

The IMF's conclusion concerning the stress-testing exercise is that Canada's major banks can withstand sizable shocks. Although capital drops below the regulatory minimum in the stress scenario, it remains adequate. The banking system thus appears sound, but it faces some challenges. In particular, the IMF notes that global financial turmoil since mid-2007 has highlighted the information and liquidity risks in the structured financial products that Canadian banks have embraced in recent years.

The report also concludes that CDSX, the securities-settlement system operated by Clearing and Depository Services Inc., is sound, efficient, and reliable and that it complies with almost all recommendations for securities-settlement systems. As well, Canada is found to be compliant with the four revised Basel Core Principles for Effective Banking Supervision. Finally, concerning securities regulation, the IMF concludes that the regulatory framework for the securities market in Canada implements the objectives and principles of the International Organization of Securities Commissions (IOSCO) in most respects, but that there would be advantages in moving towards a single securities regulator.

expectations of long-term growth in U.S. labour productivity were gradually revised upwards to 2 per cent and higher, perceived rates of return on U.S. investments were boosted, leading to increased investment demand, as well as increased capital inflows and a stronger U.S. dollar. In addition, expectations of higher permanent income led to an increase in consumption and a drop in the savings rate. In turn, these factors led to a rise in imports and an expansion of the U.S. current account deficit (Ferguson 2005).

In the scenario, it is assumed that expectations of a permanent rise in the growth of U.S. labour productivity are revised sharply downwards to 1.1 per cent per annum for the next 10 years from 2 per cent. The resulting downward revision to permanent income growth and to expected rates of return on investment lead to a retrenchment in demand that offsets the decline in the growth of the economy's productive capacity. It is also assumed that increased economic uncertainty causes declines in the confidence of consumers and firms, leading to a reduction in consumption and investment expenditures. Heightened uncertainty is also assumed to motivate foreigners to sell off U.S.-dollar assets, resulting in a rapid depreciation of the U.S. dollar. The resulting deterioration in the balance sheets of consumers and firms leads to a significant rise in financial risk premiums, further magnifying the economic slowdown.⁴

Furthermore, it is assumed that Canadian trend labour productivity growth slows to about 0.8 per cent per annum over the next 10 years from 1.5 per cent. As in the United States, we assume similar but smaller declines in consumer and business confidence. Premiums on Canadian commercial interest rates also rise as a result of the economic downturn, exacerbating the weakness in Canadian GDP growth.⁵

4. We assume that the risky spread (the difference between the rate on medium-term business loans and the rate on 5-year U.S. government bonds) widens to reach historic highs in early 2007 (the starting point of the shock scenario). Our analysis assumes similar increases in the spreads on consumer interest rates.
5. We assume that the risky spread between the rate on medium-term business loans and the rate on 5-year Government of Canada bonds widens to historically high levels. Risky spreads of this magnitude have occurred only about 2 per cent of the time in Canada over the period 1980 to 2006. The rate on medium-term Canadian business loans is based on the yield on bonds of A-rated firms, which represents the median rating of Canadian corporate bond issuers. We assume similar increases in spreads on consumer interest rates.

Table 1
Macro Stress-Testing Scenario (2007Q1–2009Q1)^a

	2007Q1	2008Q1	2009Q1
United States			
Trend labour productivity growth	1.9	0.9	1.1
GDP growth	2.2	-6.2	3.2
Unemployment rate (level)	4.5	7.7	8.0
Core CPI inflation	2.3	-2.0	-0.7
Real commodity price index (US\$, 1997=100)	194	180	177
Real effective exchange rate (+=depreciation)	1.06	1.19	1.18
Federal funds rate	5.3	0.7	2.1
Rate on 5-year government bonds	5.1	3.2	4.1
Rate on medium-term business loans	7.6	8.4	7.7
Canada			
Trend labour productivity growth	1.1	0.5	0.8
GDP growth	1.9	-4.3	2.0
Unemployment rate (level)	6.2	8.0	9.4
Core CPI inflation	2.2	-0.6	0.3
Real bilateral U.S. exchange rate (+=depreciation)	1.15	1.05	1.08
Target overnight rate	4.2	0.2	1.0
Rate on 5-year government bonds	4.4	1.9	2.6
Rate on medium-term business loans	5.0	4.0	3.8

a. The values are year-over-year (Q1 over Q1).

Taken together, the shocks in our scenario are extremely large by historical standards. As shown in Table 1, the scenario results in high real interest rates for consumer and business loans and an extremely severe economic contraction in the United States. The recession embodied in the scenario is even more severe than that experienced in 1981–82, with year-over-year real GDP growth in the United States troughing at -6.2 per cent in 2008Q1. As a result of the weakness in aggregate demand, U.S. labour market conditions deteriorate and the unemployment rate rises to a peak of about 8.5 per cent in mid-2008.

The recession in the United States, a higher Canada/U.S. real exchange rate, falling world commodity prices, the downward revision to expectations for the growth of domestic trend labour productivity, losses in domestic consumer and business confidence, and the rise in domestic financial risk premiums lead to a significant recession in Canada in 2007 (Table 1). In terms of cumulative output loss, the domestic recession embodied in the scenario is about one-third larger than that experienced in 1990–91, despite a significant easing in monetary policy.

As a result, core consumer prices fall throughout 2008. Inflation picks up gradually in 2009 and returns to the 2 per cent inflation target by the end of 2010. Canadian policy interest rates fall quickly to 0.25 per cent in early 2008 and remain very low for several years. The aggressive decline in policy rates, consistent with Canada's inflation-targeting framework, plays a very important role in mitigating the impact of the adverse shocks on the Canadian economy. Consequently, the rate on 5-year Canadian medium-term business loans actually declines in early 2007, despite the large rise in the financial risk premium. The relatively low level of domestic interest rates at a time when GDP growth is quite weak distinguishes the macroeconomic outlook from the events in the early 1990s.

Relating Default Rates to Macro Variables⁶

In modelling sectoral default rates, the objective was to identify systemic factors that affect default rates in all sectors. We assume that these factors are related to the overall performance of the economy. The initial set of explanatory variables includes the Canadian GDP growth rate, unemployment rate, interest rate (medium-term business loan rate), and the credit/GDP ratio. The paths of these variables under stress are obtained from the macro scenario.

The dependent variables are sectoral default rates. Because long time series of historical sectoral default rates with broad coverage are not available for Canada, proxies are constructed based on sectoral bankruptcy rates, supplemented by additional information. The adjusted data span the period from 1988Q1 to 2005Q4, at a quarterly frequency.

The specification of the sectoral regressions includes non-linear terms. We find that non-linearities are the key to capturing the behaviour of default rates around the historical extremes (Misina and Tessier 2007). Without non-linearities, even the extreme macroeconomic shocks have a very limited impact on default rates.

Simulation results are presented in Table 2, which contains information on historic peaks, as well as fitted values from the non-linear specification.⁷ Fitted values are, on average, close to historical peaks. The values used in the stress-testing exercise contain an ad hoc upward adjustment (equivalent to 0.25 standard deviation) reflecting the IMF's opinion that the magnitudes of responses should be larger than those generated by the default-rate models.⁸

Table 2

Peak Default Rates (Scenario and Historic Peaks)

	History (peak date)	BoC model (peak date)	Scenario	Scenario +0.25 standard deviation
Accommodation	7.58 (1992Q1)	6.26 (1992Q1)	12.3	13.75
Agriculture	0.83 (1992Q4)	0.78 (1992Q1)	1.37	1.61
Construction	3.27 (1992Q4)	3.61 (1991Q2)	5.63	6.38
Manufacturing	8.28 (1992Q1)	8.36 (1992Q2)	11.1	12.22
Retail	5.31 (1992Q1)	5.17 (1992Q2)	3.76	4.31
Wholesale	4.63 (1992Q1)	4.73 (1992Q2)	6.58	7.42
Mortgage	0.63 (1996Q4)	0.59 (1996Q3)	0.55	0.57

6. Technical details related to this section can be found in Misina and Tessier (2007).
7. The sectors included were accommodation, agriculture, construction, manufacturing, retail, wholesale, and default rates on mortgages in the household sector. Sectors for which default rates were not provided could either be merged with the above or classified in a separate category, and an average of defaults in the above sectors used. Both approaches were used by individual banks in implementing the scenario.
8. The performance of sectoral regressions under stress will depend on the precise configuration of the macroeconomic variables in a particular sectoral regression. During the recession in the early 1990s, interest rates were much higher than under the scenario. Thus, for interest-sensitive sectors, such as retail and mortgages, the situation under the stress scenario is more favourable than in the early 1990s, resulting in responses that are below historic peaks.

To compute losses under the stress scenario, we need information on exposures and on loss-given-default, in addition to default rates. Data on loan exposures are taken at 2006Q4, the last available point at the time of the exercise.

There is very little information on loss-given-default in Canada. A rough proxy can be obtained by looking at the ratio of estimated assets to estimated liabilities at the time of bankruptcy. This information is available from the Office of the Superintendent of Bankruptcy. For the corporate sector, the average for the period 1988–2006 is 0.35, which would suggest an expected recovery rate of 35 per cent, or losses given bankruptcy of 65 per cent. Since bankruptcy is the last stage of distress, and since most losses occur because of missed interest payments, we believe that this recovery rate might be somewhat low and, for the purpose of the FSAP exercise, have agreed with the IMF to set the recovery rate at 50 per cent.

Loss Assessment

Expected and unexpected losses

Each participating bank⁹ was asked to provide an estimate of expected and unexpected losses (the mean of the loss distribution, and the 99.9 per cent value-at-risk) arising from the macroeconomic scenario, for each quarter over a 2-year horizon. Individual results depend on how the banks used the inputs provided to them. While approaches vary across banks, some key commonalities had to be taken into account in arriving at the estimates of losses using our internal model. In particular:

- The banks' estimates of losses are based on their estimates of exposures at default (EAD), and these data were not publicly available at the time of the exercise.¹⁰ These estimates are larger than the publicly available balance sheet loan values, since the latter are based on the drawn amounts, whereas the former take into account undrawn commitments. Consequently, the

use of the balance sheet exposures will result in systematically lower estimates of losses.

- The banks' results indicate that the loss distribution has fat tails.

To deal with the first set of issues, the banks were asked to provide the values of EAD that they used in their stress tests. This information was used to adjust the results of the Bank of Canada's internal model by the difference between the exposures they used and those in their balance sheets. The difference between the two varied from bank to bank, with the lowest being 4 per cent, and the largest being 45 per cent.¹¹ To deal with the second set of issues, the simulations are performed using a *t*-distribution (with four degrees of freedom), rather than the normal distribution.

Chart 1 is a summary of the impact of the scenario on the participating banks. It contains estimates of expected and unexpected losses based on the individual results provided by the banks, Bank of Canada's estimates based on our internal stress-testing model (labelled BoC), and the IMF's estimates, which are based on the results contained in the IMF's FSAP report.¹²

The banks' estimates of their expected losses are higher than ours in the first year and lower in the second year. Estimates of the unexpected losses are similar in terms of overall magnitude.

An examination of the results reveals that increases in losses are driven largely by developments in the retail, manufacturing, and services sectors. (In this stress test, the retail sector includes consumer loans.)

The IMF's estimates are somewhat different, being either below (expected losses) or above (unexpected losses) the other two sets of estimates.

9. These are the "Big 5" banks: CIBC, RBC Financial Group, Bank of Montreal, TD Bank Financial Group, and ScotiaBank.

10. Under Basel II reporting rules, banks will be required to provide this information.

11. Scaling up the results by the difference between exposures is implicitly based on the assumption that the sectoral distribution of exposures used by the banks corresponds, in relative terms, to their balance sheet exposure. This assumption is difficult to verify, since the banks provided only total exposures.

12. The IMF reports losses as a percentage of risk-weighted assets. These were converted into dollar amounts by using publicly available information on the values of risk-weighted assets.

Impact on the capital-adequacy ratio

The ability of the banks to absorb the losses that arise under the scenario can be assessed based on the impact on their capital-adequacy ratio (CAR). That assessment is based on the fact that total capital (Tier 1 + Tier 2) should be sufficient to cover the unexpected losses (at the 99.9 per cent value-at-risk).

The results are presented in Chart 2, which shows the average of the results reported by banks, our estimates, and the IMF estimates. The horizontal line represents Basel II requirement for total capital (8 per cent). The results suggest that if the unexpected losses materialized at any point over the stress-testing horizon, the CAR would fall below the 10 per cent threshold for total CAR set by the Office of the Superintendent of Financial Institutions. If the unexpected losses materialized after the fourth quarter of the scenario, the results indicate that the CAR would fall below the Basel II requirements.¹³ The results do vary across banks, and in the best case the CAR remains above 8 per cent throughout the exercise.

The above analysis is based on the assumption of zero growth in regulatory capital over the stress-testing horizon (no mitigating action by the management to reduce the impact of the scenario). This assumption results in very conservative (worst-case) estimates. Some banks also assessed the impact of the shock on their CAR allowing for management action. These assessments were based on a variety of assumptions, but in all cases, the estimated CAR under stress remained above the regulatory requirements.

There is no doubt that the banks would use a variety of measures to maintain their CAR above the stipulated threshold (e.g., reduce/halt dividend payments or change lending practices to include fewer risky borrowers). Nonetheless, banks' estimates may be overly optimistic, since simultaneous actions by all banks to manage their capital (e.g., tightening credit) may have a negative impact on the real economy and exacerbate the problem.

Chart 1 Losses under the Scenario

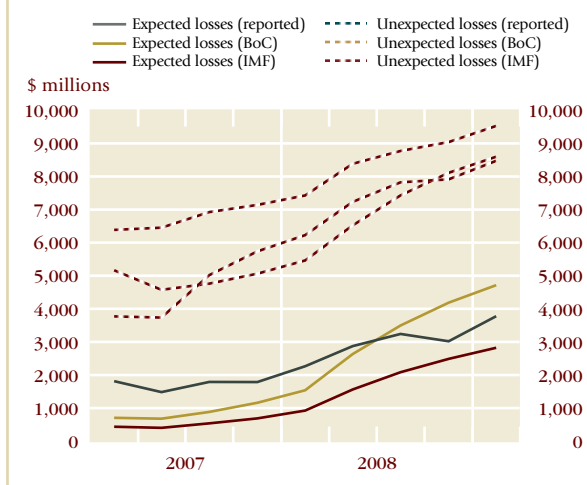
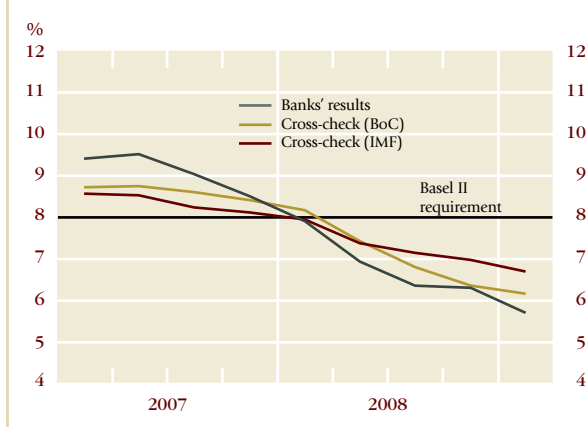


Chart 2 Impact of the Scenario on the Capital-Adequacy Ratio



13. Since the default rates reach their peaks around 2009Q1, we expect the biggest impact on the banks' CAR to occur around that time, with a possible improvement later on.

Conclusion

With a recession that is one-third larger than that experienced in the early 1990s, and increases in defaults exceeding predictions made by econometric models, the stress-test scenario analyzed in the FSAP update is extreme. Nonetheless, in terms of severity, the Canadian scenario is broadly in line with the scenarios used in other developed countries.

In the event of the materialization of the unexpected losses implied by the scenario, the banks' capital is, on average, sufficient to absorb these losses, although the average CAR falls below the regulatory requirements. In such circumstances, banks would need to take action either to raise new capital, which could be difficult given the high financial stress assumed in the scenario, or to cut risk-weighted assets, which could be costly for the economy. Authorities, particularly monetary policy authorities, would need to factor in these impacts on banks in determining the appropriate policy response.

While modelling and data differences make it difficult to compare the outcomes of stress tests across countries, generally speaking, the results indicate that the losses, while not negligible, did not pose a systemic threat to the financial systems of the countries tested. The results for Canada are in line with these general findings.

From the perspective of the Bank of Canada's ongoing work to develop tools to assess the resilience of the financial sector and its impact on financial stability, the exercise was valuable, leading to:

- a deeper understanding of the complexities of the relationship between the micro and macro aspects of the analysis of financial stability;
- improvements in the Bank's internal stress-testing models and methodologies;
- increased awareness of data limitations and data requirements;
- improved information sharing between the banks and Canadian government agencies; and
- increased knowledge of risk-management practices at individual financial institutions.

The exercise has also revealed the limitations of the existing stress-testing tools and methodologies, as well as the need for continued improvement, including:

- developing macro models that would be better suited to the analysis of extreme events;
- further work on models that relate default rates to macroeconomic variables (better integration with the main macro model and explicit modelling of economic behaviours); and
- gathering data on defaults beyond those of large publicly traded companies and getting more comprehensive data on the exposures of financial institutions.

Difficult issues at the frontier of current research efforts reflect broader problems: lack of the second-round/feedback effects that relate the actions of financial institutions back to financial markets and the real economy; the interlinkages among financial institutions; and channels of contagion. Nonetheless, we think that, even at the present stage, properly designed stress tests, based on scenarios that reflect rare but plausible sources of stress, can be useful in identifying vulnerabilities in the system. This information can help to guide official institutions in looking more deeply, in a risk-focused way, at possible channels through which vulnerabilities in one bank could be transmitted to others in the system. It can also form the basis for supervisory/macroprudential guidance to individual institutions or to the market as a whole.¹⁴

The FSAP has stimulated the Bank of Canada's stress-testing work. We are planning to maintain this accelerated momentum by investing in two priorities: (i) research efforts to address some of the shortcomings identified in the previous paragraph, and (ii) regular updating, using various scenarios of interest, of the top-down approach (Box 2). We are also considering, together with financial institutions and other government agencies, the possibility of

14. We thank Karl Habermeier and Mark Swinburne of the IMF for insightful comments and for providing a broader perspective regarding the nature of these exercises.

Box 2

Macro Stress Testing: An Update of the FSAP Results

The FSAP exercise discussed in this report was based on data for 2006Q4. Here we present an updated top-down assessment of credit losses in the loans portfolio based on data for 2008Q1.

Highlights of the changes in the data since 2006Q4

In the aggregate, there has been little change in the composition of banks' loans portfolios. Exposure to mortgage and retail sectors (the latter includes consumer loans) continues to account for approximately 75 per cent of total lending.

- The banks' loans portfolios have increased by 12 per cent on average.
- On average, the capital-adequacy ratio (CAR) of total (Tier 1 + Tier 2) capital to risk-weighted assets has declined slightly.
- New data on exposures at default (EAD), which the banks started reporting in 2008Q1, obviates the need to rely on adjustments to balance sheet exposures, as was done in the FSAP exercise.

Results

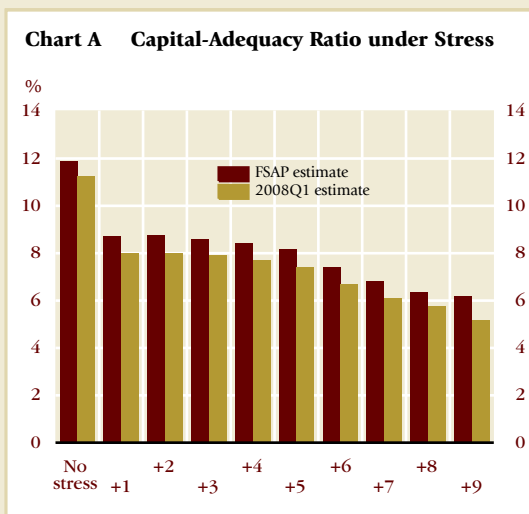
Chart A summarizes the results of the stress-testing exercise that takes the above points into account. Losses under the scenario are estimated using our internal model and are converted into an impact on the CAR using the same methodology as in the FSAP exercise. The first bar represents the median values of CAR for the five banks prior to stress. The subsequent bars represent the level of the CAR in each quarter if the unexpected losses (i.e., 99.9 per cent value at risk) associated with the scenario were to materialize.¹ For example, if the scenario-induced unexpected losses were to materialize in the fourth quarter after the initial shock, the median value of the CAR would change from

1. Recall that the actual CAR is determined on the basis of the estimates of the unexpected losses.

11.26 prior to stress to 7.69 in that quarter. If, instead, the unexpected losses materialized in the sixth quarter after the shock, the median value of the CAR would change from 11.26 prior to stress to 6.68 in that quarter.²

Higher exposures and a lower CAR starting point for values produce somewhat lower values for CAR under the scenario than in the 2006Q4 exercise. The levels of capital at these banks in 2008Q1 would still, in the aggregate, be sufficient to absorb the losses. Nonetheless, to continue to meet the regulatory requirements (total CAR of 8 per cent under Basel II; OSFI threshold of 10 per cent), the banks would have to take appropriate action: raising their levels of capital, reducing their risk-weighted assets, or a combination of the two. The feasibility and broader implications of these adjustments would depend on the nature and timing of these actions, as well as the horizon over which the banks' CAR values would return to their target levels.

2. The methodology used here does not allow us to infer the CAR values in the quarters following that in which the unexpected loss first materializes.



conducting periodic bottom-up exercises, as well as developing a more comprehensive approach to stress testing.

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The Role of Credit Ratings in Managing Credit Risk in Federal Treasury Activities

Nancy Harvey and Mervin Merkowsky

The ongoing turbulence in financial markets has been accompanied by growing concern that the use of credit ratings may have encouraged some investors to rely too heavily on ratings as a summary statistic of risk. The Bank of Canada has raised the issue of overreliance on credit ratings through public speeches and in an article in the previous issue of the *Financial System Review* (Zelmer 2007).

Like many other central banks and market participants, the Bank of Canada (the Bank) uses a variety of tools, including credit ratings, in the management of credit risk in its own activities and in those that it carries out for the federal government (the government) as its fiscal agent. This report provides a brief overview of the credit risk management frameworks used by the Bank and the government and how credit ratings are used in these frameworks. As is outlined below, the Bank and the government are careful to avoid placing too much reliance on ratings.

Credit Risk

Credit risk can be defined as the risk that a counterparty may fail to meet its obligations as they come due: that is, the risk of default. In its broadest sense, credit risk also includes the risk of a decline in the market value of investments that may arise from a deterioration in the credit quality of a counterparty. This is known as credit transition risk.

The Bank is exposed to credit risk through its routine advances to members of the Canadian Payments Association (CPA) and through market transactions conducted in the form of purchase and resale agreements (PRAs) and loans of securities. The amount of credit risk borne by the Bank is modest, however, because these transactions are fully collateralized with high-

quality securities denominated in Canadian dollars.¹ In the unlikely event of a counterparty default, collateral can be liquidated to offset the credit exposure. The credit quality of collateral is managed through a set of restrictions tied to asset type, credit ratings, and the term to maturity of the securities pledged as collateral.

Credit risk is also evident in activities that the Bank conducts for the government as its fiscal agent. Credit risk arises from the investment of Canada's foreign reserves, held in the Exchange Fund Account (EFA), in financial instruments issued by non-Canadian sovereign governments, their agencies, official international institutions, and major foreign financial institutions. Credit risk is also engendered in the funding of reserves when swap transactions are conducted with major Canadian and foreign banks to transform domestic-currency debt into foreign-currency obligations. And it is present in the government's Canadian-dollar cash balances, which are invested in short-term deposits issued by the major financial institutions operating in Canada.

Credit-risk policies have been established for all of these treasury activities to ensure that credit risk is kept to a minimum. These policies specify the types of transactions that can be conducted, the range of counterparties permitted, minimum credit-quality thresholds, and how credit ratings are used in the assessment of credit risk. More broadly, the policies seek to minimize credit risk by promoting the use of a diversified pool of highly rated counterparties and, where appropriate, collateral frameworks.

1. In December 2007, the Bank of Canada announced its intention to broaden eligible collateral for the Standard Liquidity Facility to include U.S. Treasuries by mid-2008. Details available at <http://www.bankofcanada.ca/en/notices_fmd/2007/not121207a.html>.

Why and How Credit Ratings Are Used

Credit ratings published by the major rating agencies offer important benefits to market participants and public institutions. They provide a commonly recognized source of independent opinions on creditworthiness, which can serve as a useful starting point for assessing the credit quality of counterparties and their financial instruments. The use of credit ratings is also cost-effective, because rating agencies benefit from economies of scale in assessing credit risk. Indeed, agencies rate almost all of the counterparties used in the treasury activities of the Bank and the government. But credit ratings are not flawless indicators of credit risk. Rating agencies have been periodically criticized for, among other things, overreliance on historical information and for being slow to react to new information.

Thus, the Bank and the government use credit ratings in a prudent fashion. For any given credit rating, exposure limits and collateral haircut margins vary across asset classes. For example, the investment limits and collateral haircuts for AAA-rated government securities are more generous than those applicable to similarly rated private sector instruments in recognition of the fact that the former are generally more liquid than the latter. By the same token, the Bank and the government have refrained from investing in, or accepting as collateral, some highly rated structured products, when the assets in question were judged to be incompatible with the objectives governing investment and collateral-management activities.

In selecting which rating agencies to use, the Bank and the government adhere to market practice by using agencies that are widely accepted by private investors in the relevant markets and that have been recognized by the regulators of those markets (e.g., the U.S. Securities and Exchange Commission for markets operating in the United States). Hence, the Bank and the government have chosen to rely on credit ratings published by four rating agencies: Dominion Bond Rating Service (DBRS), Fitch Rating Service, Moody's Investors Service, and Standard & Poor's.

Ratings from these four agencies are used to assign a credit-quality grade to each counterparty, security issuer, or security issue. Thus, the credit-quality grade essentially represents the consensus

of the agency ratings. The number of external credit ratings used depends on rating availability and on the type of activity. Most activities require a minimum of two ratings, and when the rating agencies post different credit ratings, the credit-quality grade is usually based on the second-highest rating in accordance with the standardized credit-risk methodology proposed by Basel II.² Moody's and DBRS recently introduced new methodologies for rating commercial banks. These procedures explicitly consider the likelihood of external support (e.g., government or central bank support) in the determination of their ratings for commercial banks. This has led the Bank and the government to review the appropriateness of the official credit ratings for commercial banks from these two agencies and to start using their "stand-alone" ratings for commercial banks instead. (See Box 1 for additional information on DBRS and Moody's new rating methodologies and their implications for the treasury activities of the Bank and the government.) The next three sections describe how ratings are used in treasury activities. Further details can be found on the Bank of Canada and Department of Finance websites.

Management of the Exchange Fund Account

The Exchange Fund Account is the main repository for Canada's foreign reserves. Assets held in the EFA are managed by the Bank on behalf of the government in accordance with investment policies approved by the Minister of Finance. Assets in the EFA are invested mainly in highly rated securities issued by sovereigns, their agencies, and official international institutions. Investments in short-term securities, deposits, commercial paper, and certificates of deposit issued by major foreign institutions are also permitted. Investments in more complex securities, such as those that have embedded options and prepayment risk, structured products, and other asset classes not listed above are prohibited.

The assets in the EFA are managed against a portfolio of dedicated liabilities that are matched in terms of duration and currency. Funding

2. See the treatment of multiple credit ratings in "Credit Risk—the Standardised Approach" in Part 2, Section II.C.2 of: *International Convergence of Capital Measurement and Capital Standards: A Revised Framework*, available at <<http://www.bis.org/publ/bcbs107.pdf>>.

Box 1**Stand-Alone Ratings**

In late 2006 and early 2007, DBRS and Moody's implemented new methodologies for rating commercial banks. The new procedures are based partly on their presumption that, in the event of default, governments (and central banks) would likely stand behind the liabilities of major systemically important commercial banks. As a result, when the new rating methods were unveiled, many commercial banks were given higher credit ratings by DBRS and Moody's.

The methodologies highlight a fundamental issue for governments and central banks. That is, should they rely on credit ratings that are based partly on the presumption that they would come to the aid of systemically important commercial banks? While other market participants may be willing to accept the new rating procedures, from a risk-management perspective, it is inconsistent for the Bank and the government to use ratings that are partly based on their own credit strength and on their presumed willingness to provide support to the banking sector.

As a result, the Bank and the government have decided to rely on the Bank Financial Strength Ratings published by Moody's and on the Intrinsic Assessment ratings published by DBRS when assessing the credit quality of commercial bank counterparties in EFA investment and funding activities.

Such stand-alone ratings are also used in the Standing Liquidity Facility to assess the sponsors of asset-backed commercial paper pledged as collateral. The latter must be sponsored by a deposit-taking institution that is federally or provincially regulated and that has a minimum stand-alone credit rating equivalent to a credit rating of at least A- from at least two rating agencies.

requirements are met primarily through an ongoing program of cross-currency swaps, whereby domestic-currency liabilities are transformed into foreign-currency liabilities in accordance with the swap-management policies approved by the Minister of Finance. The government is exposed to credit risk when swaps increase in market value, because it could experience a loss if swaps had to be replaced following the default of a counterparty.

Credit risk is mitigated in the foreign assets and liabilities by setting limits on credit exposure that foster an appropriate diversification of counterparties and investments. Exposure limits vary across asset classes and according to credit quality within each asset class. Credit ratings published by rating agencies are used to determine: (i) the eligibility of a counterparty and (ii) exposure limits for individual counterparties within each asset class. To be eligible for investment, a counterparty or security issuer must have a minimum credit rating of A- from at least two of the four rating agencies.³ In practice, however, almost all EFA investments are placed with sovereigns, sovereign agencies, and official international institutions that are rated AAA, while most private sector counterparties are rated at least AA-. Thus, the allowance of exposures rated below AA- is meant to facilitate an orderly reduction in exposures if a counterparty is downgraded below that category. Within each asset class, stronger-rated counterparties receive larger exposure limits than those that have lower ratings. Since credit ratings change periodically, they are continuously monitored, and exposure limits are updated accordingly.

While credit ratings are used to determine counterparty eligibility and to set exposure limits, exposures vary within those limits. Investment and swap transactions are executed based on their specific return and risk characteristics and on the credit outlook for the counterparties or the security issuers. Exposure limits are not often used to their fullest. Moreover, exposures have been kept well below limits when credit assessments by the Bank and the government suggested that uncertainty surrounding the credit quality of a counterparty was higher than normal and was not fully reflected in public credit ratings. Thus, while credit ratings help set the parameters

3. Rating references in this document use the Standard & Poor's ratings scale for illustrative purposes.

of the investment framework, they do not drive the day-to-day investment and funding of the foreign reserves within those parameters.

Management of Receiver General Cash Balances

The management of the government's Canadian-dollar cash balances differs from the investment of the foreign reserves in that the former are placed with counterparties on a short-term basis through a deposit-auction process rather than on the basis of transactions initiated by the Bank on behalf of the government. Consequently, exposure levels are determined by the counterparties themselves, subject to maximum bidding limits. Hence, the determination of the eligibility of participants and the setting of bidding limits must be thorough and transparent so that the rules are understood by all auction participants before the auctions take place. Thus, the option of using internal credit assessments to gauge the credit quality of counterparties and to set counterparty exposure limits is not practical. Instead, credit risk related to Receiver General deposit auctions is mitigated mainly by (i) promoting a diversified set of counterparties through the use of individual bidding limits that are partly linked to credit ratings; (ii) typically limiting the term of deposits to several business days; and (iii) where possible, taking collateral to limit the amount of uncollateralized exposures.

Receiver General cash balances are invested through twice-daily auctions (morning and afternoon). Most of the government's funds are usually auctioned in the morning, for terms that can range up to several business days, and are carried out on a collateralized and uncollateralized basis. Eligible participants include a broad range of counterparties whose bidding limits for uncollateralized funds are based in part on their credit ratings. For example, they are required to have minimum credit ratings of A- from at least two rating agencies, and those with higher ratings receive larger uncollateralized bidding limits. The rules of the auction process are clearly formulated and are publicly available.⁴

4. The rules of the auction process can be found in "Terms and Conditions Governing the Morning Auction of Receiver General Cash Balances" on the Bank of Canada's website at <http://www.bankofcanada.ca/en/auction/rec_general.pdf>.

In contrast, the afternoon auction takes place late in the day, after the government's financial flows for the day have been finalized. Since the auction takes place after the close of the delivery-versus-payment period of the automated securities settlement system (CDSX) operated by the Canadian Depository for Securities Ltd., it is not possible to conduct securities transfers at the same time as cash settlement. Instead, credit risk in this auction is mitigated by restricting access to direct participants in the Large Value Transfer System (LVTS) and by limiting the term of these deposits to overnight. Bidding limits for this auction are based on the size of the institution in the Canadian financial system based on Canadian Payments Association ratios, which represent an institution's share of total Canadian-dollar deposits.

Collateral Management

As mentioned, collateral is also used to protect the Bank and the government against loss from a credit event. In the case of a counterparty default, the proceeds from liquidating collateral can be used to offset exposure from the underlying transaction. The legal agreements in place, which must be signed by each counterparty (or participant) before any transaction occurs, are used to ensure that the Bank or the government obtains a valid, first-priority security interest in the pledged collateral under the applicable law, while establishing, when applicable, thresholds where the Bank or the government have rights to make margin calls for additional collateral as needed. The collateral frameworks of the Bank and the government have been enhanced from time to time, in keeping with good market practice and their own business requirements. With the broadening of eligible securities in recent years, credit ratings have been used to help determine which securities can be pledged under the various collateral frameworks. With the inclusion of securities other than government-guaranteed securities in the eligible collateral pools, the need arose for a transparent mechanism to establish the creditworthiness of collateral so that pledgers understand ahead of time which securities can be pledged as collateral in the Bank's treasury activities and how they will be valued and haircut.

In fiscal-agent activities, non-U.S. and non-Canadian government securities pledged as collateral for EFA securities lending or in support

of Receiver General deposits must adhere to minimum credit-rating thresholds of AA- and A-, respectively. In contrast, only U.S. Treasury, U.S. Agency, and Canadian government securities can be pledged as collateral in support of EFA tri-party repo and swap transactions. In the case of swaps, credit ratings are also used to set predetermined thresholds for margin calls of additional collateral. This mechanical approach is unavoidable since swaps are long-term contracts that must contain explicit contingency plans for credit migration.

For its own activities, the Bank can lend only on a secured basis and thus has collateral frameworks in place to support its operations under the Standing Liquidity Facility (SLF) and in its activities involving securities-lending and purchase and resale agreements.⁵ The Bank uses credit ratings, in combination with other mechanisms, to set eligibility requirements for securities and applicable collateral haircuts or margin requirements.

In its role as lender of last resort, the Bank routinely provides liquidity to facilitate settlement in the payments system through the SLF by providing collateralized overnight loans to participants in the LVTS. The Bank establishes the list of assets acceptable for pledging as collateral and provides valuations of pledged securities. The latter are valued on a daily basis at current market prices less an appropriate haircut to protect the Bank against unexpected fluctuations in their market value. The Bank determines the appropriate haircuts based on its own analysis of the market and the liquidity risks of the securities in question.⁶ In particular, the Bank has found it useful to establish haircuts that vary depending on asset class, tenor, and credit quality of the security.⁷ Credit ratings play a dual role in this process. First, they are used to help determine

the minimum acceptable credit quality of a security. Second, they are used, in combination with other indicators of market and liquidity risk, to determine haircut levels for acceptable securities. In practice, haircuts are larger for lower-rated assets and for those with longer maturities, since the prices of these securities tend to exhibit greater volatility, and their markets tend to be less liquid.⁸ There are, however, other safeguards in place to mitigate collateral risk: pledgers may not pledge their own securities; and, in the case of private sector securities pledged as collateral under the SLF, pledgers cannot pledge more than 20 per cent of the securities of related issuers to promote a diversified pool of private sector securities pledged as collateral.

The Bank also uses a collateral framework to mitigate credit risk in its own market operations. These are conducted in the form of PRAs and loans of its own holdings of Government of Canada securities. Through its PRAs, the Bank offers to temporarily purchase specific securities from designated counterparties with an agreement to sell them back at a predetermined price and date. Under its securities-lending program, the Bank makes its Government of Canada securities available through a tender process when there are indications that those securities are unavailable or trading at an unusually high premium in the market. Only primary dealers are eligible to participate in these activities, however, since they are the main market makers in the markets for Government of Canada securities, and thus have the strongest need for access to funding and securities from the Bank to help promote the liquidity of those markets. Thus, credit ratings are not used to determine who can access those facilities. Instead, they are used only to set eligibility and haircut requirements for securities pledged as collateral.

5. Terms and conditions of these programs are set out in the document “Securities Eligible as Collateral under the Bank of Canada Standing Liquidity Facility” <<http://www.bankofcanada.ca/en/financial/securities.pdf>> and “The Bank of Canada Securities-Lending Program: Terms and Conditions” <http://www.bankofcanada.ca/en/notices_fmd/2003/terms_en0403.pdf>.

6. A haircut is a percentage that is subtracted from the market value of the assets that are being pledged as collateral. The size of the haircut reflects the market and liquidity risks associated with the assets.

7. Securities acceptable as collateral for SLF loans are also eligible for intraday credit in the LVTS.

8. For example, a haircut of 1.5 per cent is applied to a security issued by the Government of Canada with a 5-year term, while a haircut of 7.5 per cent is applied to any asset-backed commercial paper (ABCP) pledged as collateral. In the case of ABCP pledged as collateral, the pledger cannot be the sponsor or financial services agent for the ABCP program, nor can the pledger be the provider of liquidity support to the program.

Conclusion


The need for a more sophisticated approach to managing credit risk in the treasury activities of the Bank and the government has grown over time. Credit risk in these activities was traditionally managed by restricting the list of eligible counterparties to a small set of institutions and by accepting only government-guaranteed securities as collateral. However, a more comprehensive and transparent framework for managing credit risk became necessary as the list of eligible counterparties and collateral expanded over time. This naturally led to the use of credit ratings published by external rating agencies to help assess the credit quality of counterparties and of the securities pledged as collateral.

Credit-rating agencies provide a well-recognized opinion on creditworthiness for a wide range of counterparties and financial instruments. Many investors have found it cost-effective to rely on their opinions because rating agencies benefit from economies of scale in assessing credit risk. These benefits have led many central banks and market participants to use credit ratings to help determine counterparty eligibility requirements and to set credit-exposure limits.

The Bank and the government use a variety of techniques to assess and manage credit risk, including rating-based frameworks in which judgment is applied. For example, they seek to transact with a wide range of counterparties and to minimize uncollateralized credit exposures. Furthermore, in the case of the Exchange Fund Account, exposures have been kept well below limit when the Bank and the government believe that the uncertainty surrounding the credit opinion is higher than normal and not fully reflected in public credit ratings. Thus, while external credit ratings are embedded in many facets of the treasury activities of the Bank and the government, they are not accorded undue weight as a summary statistic of risk. Credit ratings are only one of many tools used to manage credit risk in these activities.

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Policy and
Infrastructure
Developments

Introduction

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

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

Financial Market Turmoil and Central Bank Intervention

Walter Engert, Jack Selody, and Carolyn Wilkins¹

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

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

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

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

Why Intervene?

Endogenous liquidity creation

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

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

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

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

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

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

Endogenous liquidity creation can break down

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

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

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

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

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

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

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

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

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

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

The growing importance of market liquidity

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

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

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

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

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

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

Intervening in markets is consistent with central bank policy objectives

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

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

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

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

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

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

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

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

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

When to Intervene

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

Will central bank instruments be effective?

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

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

What are the potential benefits of intervention?

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

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

What are the potential costs of intervention?

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

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

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

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

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

Mitigating moral hazard

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

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

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

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

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

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

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

How to Intervene

Principles

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

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

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

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

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

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

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

Auction mechanisms

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

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

Different facilities for different circumstances

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

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

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

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

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

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

Concluding Remarks

Our conclusions can be summarized as follows.

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

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

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

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

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

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

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Research

Summaries

Introduction

Bank of Canada staff undertake research designed to improve overall knowledge and understanding of the Canadian and international financial systems. This work is often pursued from a broad, systemwide perspective that emphasizes linkages across the different parts of the financial system (institutions, markets, and clearing and settlement systems), linkages between the Canadian financial system and the rest of the economy, and linkages to the international environment, including the international financial system. This section summarizes some of the Bank's recent work.

The first two research summaries describe recent work on payment and settlement systems. In the first summary, **A Model of Tiered Settlement Networks**, James Chapman, Jonathan Chiu, and Miguel Molico describe their development of a dynamic equilibrium model of settlement networks, in which the settlement structure is determined endogenously, to study the degree of tiering and the welfare effects of clearing-agent failure. They show that, in the presence of imperfect information and fixed costs of participation, a tiered structure can be an efficient arrangement that supports cost saving and inter-bank monitoring. However, because settlement failure may generate negative spillovers on other participants, the market-determined concentration and degree of tiering may not optimally diversify the risk of a clearing-agent failure.

The second summary, **The Effects of a Disruption in CDSX Settlement on Activity in the LVTS: A Simulation Study**, by Lana Embree and Kirby Millar, describes work that focuses on the interdependencies of two settlement systems: the Large Value Transfer System (LVTS), which settles payments, and CDSX, which settles debt and

equity trades. These are two of the main settlement systems in Canada, and they are closely linked. At the end of each day, the final CDSX positions must be settled through the LVTS, and, in planning their LVTS activity, participants take into consideration their expected CDSX settlement payment that day. Therefore, any event affecting CDSX settlement may have systemic implications for the LVTS. In this work, the authors quantitatively assess the impact on the LVTS of an operational event that would prevent the completion of CDSX settlement. The results indicate that this type of event could lead to a considerable amount of unsettled payments and payment delays. This study highlights the importance of the contingency measures and mitigating actions that are available to safeguard these payments systems.

The final article, **Family Values: Ownership Structure, Performance, and Capital Structure of Canadian Firms**, by Michael King and Eric Santor, examines how family ownership affects the performance and capital structure of 613 Canadian firms from 1998 to 2005. The authors find that family ownership per se is not negative for performance: it is the use of control-enhancing mechanisms that reduces a firm's valuation. Whereas free-standing family-owned firms with single-class shares have a market performance similar to that of other firms, family-owned firms that use dual-class shares have valuations that are lower by 17 per cent, on average, relative to widely held firms, despite having similar returns on assets and financial leverage.

A Model of Tiered Settlement Networks

James Chapman, Jonathan Chiu, and Miguel Molico

Settlement networks typically involve various tiers of intermediation. Some banks participate and clear directly in a “first-tier” network. A subset of these direct clearers then act as clearing agents by operating a “second-tier” network and providing settlement accounts to indirect clearers downstream. In Canada, both the Large Value Transfer System (LVTS) and the Automated Clearing Settlement System (ACSS) exhibit a high degree of tiering. The efficiency and risk associated with these tiered settlement networks are of particular interest to policy-makers. For example, what are the immediate impact and long-term effects of the failure of a clearing agent in a highly tiered settlement system? How do these effects differ from those caused by the failure of an ordinary direct clearer?

This article summarizes Chapman, Chiu, and Molico (2008), in which we develop a dynamic equilibrium model of settlement networks to study these questions. We demonstrate that, in the presence of imperfect information and fixed costs of settlement system participation, a tiered structure can improve efficiency by supporting interbank monitoring and cost saving.

Methodology

While policy-makers care about the efficiency and stability of settlement systems, guidance provided by economic theory has been limited. In particular, there is little theoretical work on the tiered structure in settlement systems. This is because standard economic models abstract from the mechanism through which payments and settlement take place and thus are not suitable tools for modelling settlement systems. Our study is the first to develop a dynamic equilibrium model for studying the degree of tiering and welfare effects of clearing-agent failure.¹ Economic

models of payments systems are developed to capture how the incentives and behaviour of participants will adjust in response to changes in policy or in the economic environment.² Moreover, since we have limited historical data on certain rare but highly significant events (e.g., failure of clearing agents), using an economic model to conduct hypothetical experiments can help us gain a better understanding of the potential causes and consequences of such extreme events.³

Model

Our analytically tractable model of the settlement system, in which the settlement structure is determined endogenously, is built on rational, strategic, and forward-looking agents. In the model, the economy consists of two sectors: a trading sector and a settlement sector. In the trading sector, agents meet bilaterally to trade consumption goods financed by private liabilities. In the settlement sector, agents interact to clear and settle these payment instruments. Underlying transactions in the trading sector generate the bilateral payment flows in a settlement network. In this environment, the mode of settlement (i.e., real-time vs. deferred) and the structure of settlement networks (i.e., direct or indirect participation) are endogenously determined by agents, subject to the fundamental cost structure and information structure.

The choice of settlement mode between real-time and deferred settlement involves the fundamental trade-off between liquidity costs and

1. Related literature includes Kahn and Roberds (2002), Lai, Chande, and O’Connor (2006), and Chapman and Martin (2007).

2. Much of the literature on payments system design is based on payments system simulators such as that developed by the Bank of Finland (BoF-PSS2). Because they do not model the behaviour of system participants, these tools are not appropriate for studying the endogenous formation of tiered networks.

3. See Chiu and Lai (2007) for a more detailed discussion of the microfoundations of payment economics.

default risk. On the one hand, since real-time settlement imposes a higher liquidity cost (for example, the need to hold low-return liquid assets as collateral), payment senders (debtors) may prefer deferred settlement. On the other hand, because of the settlement risk involved, payment recipients are willing to accept deferred settlement only from creditworthy payment senders. Therefore, the choice of settlement mode depends critically on whether creditors possess reliable information about debtors' credit history. This informational constraint is particularly binding for trades involving debtors whose creditworthiness is not well known to other agents and debtors who trade with other agents only infrequently. We label these "small" agents. As a result, some of these small but safe debtors with no public history will be forced to use real-time settlement. This is inefficient, because the unnecessary liquidity cost incurred by these safe debtors leads to a suboptimal allocation of resources.

This allocative inefficiency can be resolved by having some financial institutions act as clearing agents for these small agents. Typically, these clearing agents are "large" in the sense that they have frequent transactions with a significant set of debtors and creditors. These large agents can improve the efficiency of settlement by providing information and cost saving. Through their frequent dealings with creditors, they can establish a reputation and make their own creditworthiness public information. Through their frequent dealings with debtors, they can monitor debtors' credit history and choose the optimal settlement mode for each of them. This is their information role. When there are fixed costs associated with participation in the settlement system, clearing agents can also enjoy economies of scale and thus play a cost-saving role in a settlement network.

Main Findings

Our main findings can be summarized as follows. First, we demonstrate that a tiered structure can improve efficiency by supporting cost saving and interbank monitoring. In a tiered settlement system, large agents work as clearing agents who participate directly in a settlement system. Small agents become indirect clearers who settle their debt through their clearing agent's internal second-tier network.

This arrangement allows clearing agents to monitor the credit histories of the indirect clearers that they serve and to then use this private information to choose the best mode of settlement for their clients. Clearing agents have incentives to appropriately monitor their clients because they will be held responsible if their clients default. Furthermore, a tiered structure can improve efficiency by economizing on the fixed cost of settlement system participation.

Second, the degree of tiering is decreasing in the fixed cost of operating the second-tier network and the availability of public credit history. As the fixed cost of being a clearing agent increases, each clearing agent requires a larger number of the small agents as clients to be profitable. Therefore, there will be fewer larger clearing agents.

If a clearing agent's provision of information is its primary motivation, then more public information regarding the creditworthiness of indirect clearers will lead to fewer clearing agents. For example, an increase in the number of agents with credit ratings will reduce the equilibrium degree of tiering.⁴ In the extreme case, in a world where agents' credit histories are perfectly observable, clearing agents have no informational role.

Third, the failure of a clearing agent leads to social costs, which can be decomposed into: (i) default loss; (ii) participant loss; (iii) information loss; and (iv) operational inefficiency. The loss to default and the loss of participants are transitory in nature and represent straightforward losses as a result of the clearing agent's failure to perform its contracted role. The information loss and operational inefficiency are of interest, since they can have persistent welfare implications and are closely related to the clearing agent's unique role. The failure of a clearing agent leads to the loss of private information regarding the trading history of its indirect clearers, which took time to accumulate. In addition, if there are economies of scale in the operation of the clearing agent's second-tier network, then, unless that agent is immediately replaced, its failure will lead to operational inefficiency because the remaining clearing agents will need

4. In Canada, while all the direct clearers and clearing agents have credit ratings, many indirect clearers do not.

to serve too many indirect clearers and will be operating above their efficient capacity.

Conclusion

Our study highlights that, in the presence of imperfect information and fixed costs, the tiered structure can, indeed, improve efficiency by supporting interbank monitoring and cost saving.⁵ One policy implication of this finding is that restricting the degree of tiering in payments systems such as the LVTS or ACSS may distort the efficient monitoring structure of the system.⁶ Moreover, we identify the social costs resulting from the failure of a clearing agent. Since such a failure may generate negative spillovers on other participants, the market-determined concentration and degree of tiering may not optimally diversify the risk of such failure. In conclusion, this framework can be expanded for future analysis of specific payments system policies and their welfare implications.

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5. Potentially, a tiered structure may also help to mitigate the impact of systemic liquidity shocks (such as the recent market events) on the indirect participants.
 6. There is a volume restriction imposed on ACSS participation. There is no similar restriction to access in the LVTS.

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The Effects of a Disruption in CDSX Settlement on Activity in the LVTS: A Simulation Study

Lana Embree and Kirby Millar

A safe and efficient payments system is critical to the smooth functioning of the financial system. In Canada, the Large Value Transfer System (LVTS), for time-sensitive payments that are typically large-value payments, and CDSX, for the clearing and settlement of debt and equity securities, are two of the systems that have been designated as systemically important under the Payment Clearing and Settlement Act.¹ The operations of these systems are closely linked. For example, many LVTS participants are also CDSX participants, and end-of-day funds exchange relating to CDSX settlement occurs through the LVTS.

Given this link, a disruption to CDSX settlement could potentially have a significant impact on LVTS activity. By monitoring their CDSX activity, LVTS participants can anticipate what their CDSX settlement position will be and whether they will receive a CDSX pay-out. Therefore, the participants take into account their expected CDSX funds when planning their LVTS activity throughout the day. An unexpected event that disrupts CDSX settlement could affect end-of-day activity in the LVTS.

The importance of this link between the two settlement systems has long been recognized by system participants, system operators, and the Bank of Canada. In our study (Embree and Millar 2008), we try to quantify the potential impact of an operational event affecting CDSX settlement. Specifically, we simulate an event that prevents CDSX settlement pay-outs from being completed. Many possible events could disrupt CDSX settlement in this way: for example, events affecting the operator of CDSX, the system participants, or the Bank of Canada. We find that

such an event can have important potential impacts. There are, however, a number of mitigating actions and contingency measures to prevent such disruptions and reduce the impact should they occur.

CDSX and LVTS

Throughout the day, debt and equity trades and related entitlement payments (e.g., maturities and dividends) are settled in CDSX. At the end of the day, CDSX participants must settle their net funds position through the LVTS. The Bank of Canada is the settlement agent for the CDS Clearing and Depository Services Inc. (CDS), the owner and operator of CDSX. The Bank receives, through the LVTS, all the CDSX payments from those participants in negative CDSX funds positions. The Bank then makes the payouts to those in positive positions through the LVTS.² CDSX settlement is usually completed by 17:05.³ After CDSX settlement occurs, important LVTS payment activity continues, as LVTS participants make payments for about an hour on behalf of their clients or their own business. This is followed by a pre-settlement period, between 18:00 and 18:30. LVTS settlement begins at 18:30.

Data and Methodology

The LVTS has two payment streams, Tranche 1 (T1) and Tranche 2 (T2). Each tranche is characterized by its own risk controls. Since CDSX settlement takes place through T1, our study focuses on T1. The study makes use of payment-

1. For more information on CDSX, see McVanel (2003). For more information on the LVTS, see Arjani and McVanel (2006).

2. Participants can draw on liquidity in CDSX prior to CDSX settlement through a CDSX-LVTS funds transfer. Anecdotal evidence suggests that this transfer is not used frequently.
3. All times are in Eastern Standard Time.

by-payment transactions data and intraday credit-limit data obtained from the Canadian Payments Association, as well as payment instructions regarding the CDSX settlement account held at the Bank of Canada. Our simulation spans the 65 business days from 1 June 2006 to 31 August 2006.

Our data suggest that the value of the CDSX pay-outs and subsequent LVTS T1 activity is a significant portion of the total daily T1 activity. Over the sample period, there were, on average, seven CDSX pay-outs each day worth \$3.5 billion. This represents 2 per cent of the average daily T1 volume and 16 per cent of the average daily T1 value of \$21 billion. The largest settlement pay-out to a single CDSX participant was \$7 billion, while the daily maximum to all participants was over \$16 billion. In addition, after CDSX settles, there continues to be considerable LVTS activity, with a daily average of 17 payments of \$2.6 billion. This represents approximately 12 per cent of the daily average T1 value. During the sample period, up to 37 payments worth a total of \$10.8 billion were sent after CDSX settlement.

The main approach used is a simulation employing the payments system simulator (BoF-PSS2) developed by the Bank of Finland and adapted to replicate LVTS conditions.⁴ The simulator allows us to use LVTS and CDSX data to recreate actual LVTS activity and to use this as a benchmark. We then identify and remove the CDSX pay-outs, without removing the pay-ins, and simulate the LVTS with these payments removed. In effect, this simulates a situation where the CDSX pay-outs are not completed. For example, an event affecting the Bank of Canada between pay-ins and pay-outs could result in the type of event simulated. It is important to note that the simulation does not incorporate mitigating strategies, such as alternative payment methods, that can be used to circumvent, or at least reduce, the effect of such an event. The simulation presents a possible worst-case scenario.

Results

We find that the simulated outage results in some LVTS payments being unable to settle during the day, and some payments being temporarily

delayed. In addition, we find that pre-settlement activity in the LVTS may be disrupted.

Our results indicate that a disruption to CDSX can lead to payments that cannot settle. Unsettled payments occur on 32 of the 65 days simulated. We examine how important the CDSX funds are for end-of-day LVTS payment activity on the days with unsettled CDSX payments. First, we calculate the value of unsettled LVTS payments as a share of the CDSX pay-outs. We find that, on average, the value of payments that are unable to settle is equal to 27 per cent of the CDSX pay-outs. On some days, this value can be over 80 per cent. Second, we assess how much of the LVTS payments that are sent after CDSX settlement at 17:05 are affected by the simulated disruption. We find that, on average, 36 per cent of the T1 payments made after 17:05 are unable to settle.

The simulated outage also results in a substantial increase in the delay of LVTS payments. Payments that are unable to pass the risk controls when they are submitted may be entered into a queue.⁵ While some queued payments can subsequently be settled, they are delayed. We therefore examine queue usage to understand the delay caused by the outage. In the base case, where CDSX settlement occurs, the queue is used on 6 of the 65 days, and in the simulated CDSX outage, the queue is used on 39 days.

We also find that a disruption to CDSX settlement will likely affect LVTS pre-settlement activity. Pre-settlement transfers allow participants to bring their end-of-day LVTS position close to zero, by making interbank payments. Pre-settlement payments are made between 18:00 and 18:30. During the pre-settlement period, LVTS participants with a positive position lend to those in a negative position in order to bring their positions close to zero. Receipt of a CDSX pay-out may cause some participants to have a positive LVTS balance, allowing them to lend to participants in negative positions. Some interbank activity to bring positions close to zero can take place prior to the pre-settlement period. By examining pre-settlement payments, we find that institutions that did receive CDSX pay-outs are, in fact, making most of the payments during the pre-settlement period. For instance, on 35 of the 65 days, over 70 per cent of the pre-settlement

4. For more information, see the Bank of Finland's payment simulator website at <<http://www.bof.fi/en>>.

5. For more information on the LVTS payment queue, see Arjani and McVanel (2006).

payments were made by recipients of CDSX pay-outs.

Contingency Measures and Mitigating Actions

Contingency measures are in place that can be implemented to prevent CDSX settlement from being delayed. While events affecting CDSX settlement do happen, they are infrequent and of short duration. To ensure that important payments can be made during operational disruptions, CDS, the LVTS, system participants, and the Bank of Canada have contingency measures in place to safeguard their operations. These measures include making payments using alternative payment methods, such as the LVTS direct network, and moving operations to an alternate site.⁶ These measures help to ensure that any event that may prevent CDSX settlement from being completed is managed quickly, and that the CDSX settlement payments can be made with little or no delay.⁷

Furthermore, if an event does lead to a delay in CDSX settlement pay-outs, LVTS participants can take actions to mitigate the impact of the delay. Our analysis of past operational events suggests that LVTS participants apportion additional collateral to T1 and move payments to the T2 payment stream when CDSX settlement is delayed.⁸

Conclusions

The completion of CDSX settlement through the LVTS creates an important operational link between these two systemically important systems. Our analysis demonstrates that a disruption to CDSX settlement can potentially have important effects on end-of-day activity in the LVTS. In the unlikely scenario that the CDSX settlement funds are not available and mitigating action is not taken, a significant number of

payments would be unable to settle or would be delayed. In most cases, the participants would take action to mitigate these impacts; for example, they may move payments to T2 or apportion additional collateral. Moreover, CDS, LVTS system participants, and the Bank of Canada could employ contingency measures to ensure the completion of CDSX settlement. The results of this study highlight the importance of well-designed systems and procedures, including contingency measures and mitigating actions, to safeguard the payments system.

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6. For more information on the LVTS direct network and other contingency measures, see the LVTS Rules available on the Canadian Payments Association's website.
7. For more information on the Bank of Canada's contingency plans, see Allenby (2003).
8. Participants could implement other mitigating actions that are difficult to analyze, such as changing the order in which they submit payments so that liquidity can be used more efficiently.

Family Values: Ownership Structure, Performance, and Capital Structure of Canadian Firms

Michael R. King and Eric Santor

Theories of the relationship between concentrated ownership and firm performance predict positive, negative, or no statistically significant relationship, depending on the trade-offs between the alignment and entrenchment effects.¹ Likewise, empirical studies have produced mixed results, which may be due to two problems: one related to model specification, the other to model estimation. First, Demsetz and Villalonga (2001) and Claessens et al. (2002) argue that the relationship between family ownership and performance cannot be identified without disentangling ownership (claims against the cash flow of the firm) from control (the holding of voting rights at the Board level).² Studies that do not disentangle the alignment and entrenchment effects of ownership and control may conflate these effects, leading to inconclusive results.

A second explanation for the mixed results relates to unobserved firm heterogeneity: there may be systematic differences between firms with high and low ownership concentration. This generates an identification problem: while theory may suggest that causation runs from family ownership to performance, an alternative explanation is that causation is reversed.³

1. The alignment effect describes the positive incentive of ownership on corporate governance. As the ownership stake increases, there are greater incentives for controlling shareholders to monitor firm performance. The entrenchment effect describes the negative consequences of greater ownership by managers, since poorly performing firms are insulated from the possibility of a takeover. Managers may also pursue their private interests at the expense of other shareholders.
2. For the purpose of this study, we define control as holding 20 per cent or more of the firm's voting shares.
3. Demsetz and Lehn (1985) argue that efficient markets will lead to optimal ownership structures, since firms with inefficient ownership structures will fail to survive in the long run. Thus, the relationship between ownership and performance may be endogenous.

One limitation of existing international studies of ownership, performance, and capital structure is that most studies involve countries or regions with legal, regulatory, and market institutions that differ markedly from those of the United States, making it difficult to disentangle firm-level effects (such as the choice of capital structure, corporate governance, or management quality) from country-level effects. Canada provides an ideal setting for studying this question. Canada and the United States share a common legal ancestry, with Canadian corporate and securities laws adopted from American precedents (Buckley 1997). Both countries have the same English common-law legal system, require similar disclosure levels, and exhibit similar levels of shareholder protection (La Porta et al. 1998, 2000). At the same time, Canada features more concentrated corporate ownership than the United States and more prevalent use of dual-class shares and pyramidal structures that increase the risk of expropriation of minority shareholders (Attig 2005; Morck, Stangeland, and Yeung 2000).⁴ A study of Canadian firms therefore provides a useful counterfactual assessment, since it features ownership structures resembling those of European or Asian firms in an institutional setting similar to that of the United States.

Theory

Increased ownership by insiders or the presence of a large blockholder can sometimes lead to better performance. For example, greater equity ownership by insiders improves corporate

4. We use the term "dual-class shares" to refer to three categories of shares in Canada: non-voting shares, subordinate voting shares, and restricted voting shares. Pyramids occur when a blockholder controls an apex firm or holding company that has control stakes in a related group or chain of firms.

performance because the monetary incentives of the manager are better aligned with those of other shareholders, thereby mitigating the standard principal-agent problem. On the other hand, many studies that document the prevalence of family ownership around the world have expressed concerns that concentrated ownership, particularly in the presence of control-enhancing mechanisms, may have negative implications for firm performance: it may contribute to the entrenchment of poor managers, the expropriation of resources from minority shareholders, capital misallocation, and reduced or inefficient investment. A high prevalence of family ownership and control-enhancing mechanisms may also lead to financial inefficiency, since investors would be unable to invest in a properly diversified portfolio of widely held, and thus better-governed, firms (Morck, Stangeland, and Yeung 2000).⁵ Moreover, the Organisation for Economic Co-Operation and Development (OECD 2007) notes that concentrated ownership has led to cases of shareholder expropriation and, subsequently, to large negative externalities for financial markets. Taken together, these issues have led some researchers to argue that the prevalence of family ownership can ultimately result in lower economic growth (Morck, Wolfenzon, and Yeung 2005).

This statement implies that if family ownership does indeed have such negative effects, then policy-makers may wish to consider implementing policies that discourage family ownership or, at the very least, discourage the use of control-enhancing mechanisms. As noted above, however, empirical evidence regarding the effects of concentrated ownership on firm performance is mixed. It is therefore necessary to further examine the relationship between family ownership and performance to determine whether a policy response is warranted.

Methodology

Our study (King and Santor 2007) seeks to address these issues and makes four contributions to the literature. First, we collect annual data for

5. For instance, in many countries, a large proportion of firms may be closely held and/or have control-enhancing mechanisms. Investors who wish to (or may be required to) hold a market index must, de facto, invest in such firms despite the greater risk of expropriation of minority shareholders.

613 Canadian firms that were members of the TSX 300 and the S&P TSX Composite Index from 1998 to 2005 and identify the owner, the percentage control of votes, the percentage cash-flow stakes, and the use of dual-class shares or pyramidal structures in these firms. To our knowledge, this is the largest and most comprehensive database of Canadian ownership. Second, we distinguish between the effects of family ownership and control-enhancing mechanisms (specifically dual-class shares and pyramidal structures). Third, we examine the impact of ownership structure on both the market and accounting performance of our full sample, using as proxies Tobin's Q and return on assets (ROA), respectively.⁶ Fourth, we test different theories relating ownership to capital structure. We are not aware of any other Canadian study that examines this issue.

To address the issues of endogeneity described above, we follow Claessens et al. (2002) Specifically, we use a random-effects specification to examine the effect of ownership on firm performance and capital structure:

$$y_{it} = \alpha + \beta'x_{it} + \delta OWN_{it} + \varepsilon_{it}, \quad (1)$$

where y_{it} is either Tobin's Q, ROA, or (for financial structure) leverage (measured as the ratio of total debt to total assets); x is firm characteristics, namely firm size, sales growth, industry Tobin's Q, ROA, financial leverage, firm age, membership in the composite index, and ratio of capital expenditures to sales (ROA and leverage are excluded when they are the dependent variable); OWN is a measure of ownership, whether the size of the control stake, dummy variables identifying owner type, the use of control-enhancing mechanisms, or the size of wedge between control stakes from cash-flow stakes; ε_{it} is the mean-zero residual adjusted for firm-specific heterogeneity.

Results

The degree of family ownership and control-enhancing mechanisms exhibited by Canadian firms is high relative to that in the United States: over 32 per cent of the firms in the sample are family owned at the 20 per cent threshold, and 14 per cent have dual-class shares (compared

6. Tobin's Q is (total assets + market value of equity-book value of equity)/total assets.

with 20 per cent and 8 per cent, respectively, in the United States). We find that the market performance of free-standing, family-owned firms with a single-share class is similar to that of other firms (based on Tobin's Q ratios). We also find that these firms have superior accounting performance (based on ROA), and higher financial leverage (based on the ratio of debt to total assets). These results are consistent with the U.S. evidence in Anderson and Reeb (2003) and Villalonga and Amit (2006). In contrast, family-owned firms with dual-class shares have market valuations that are 17 per cent lower, on average, than those of other firms, despite having similar ROA and financial leverage. This valuation discount is consistent with evidence from U.S. and international studies that firms with a separation between cash-flow rights and control rights have lower valuations because they have a higher risk of expropriation of minority shareholders (Claessens et al. 2002; Villalonga and Amit 2006). This valuation discount is also robust when we control for Canadian firms that are cross-listed on U.S. exchanges. In summary, family ownership is not negative for performance per se: rather, it is the use of control-enhancing mechanisms that reduces a firm's valuation.

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