BANK OF CANADA
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Financial System Review

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THE MACROFINANCIAL ENVIRONMENT (cont'd)

Preface

The financial system makes an important contribution to the welfare of all Canadians, since the ability of households and firms to hold and transfer financial assets with confidence is one of the fundamental building blocks of our economy. A stable financial system contributes to broader economic growth and rising living standards. In this context, financial stability is defined as the resiliency of the financial system to unanticipated adverse shocks, thereby enabling the continued smooth functioning of the financial intermediation process.

As part of its commitment to promoting the economic and financial welfare of Canada, the Bank of Canada actively fosters a stable and efficient financial system. The Bank promotes this objective by providing central banking services, including various liquidity and lender-of-last-resort facilities; overseeing key domestic clearing and settlement systems; conducting and publishing analyses and research; and collaborating with various domestic and international policy-making bodies to develop policy. 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 mandate.

The *Financial System Review* (FSR) is one avenue through which the Bank of Canada seeks to contribute to the longer-term resiliency of the Canadian financial system. It brings together the Bank's ongoing work in monitoring developments in the system with a view to identifying potential risks to its overall soundness, as well as highlighting the efforts of the Bank, and other domestic and international regulatory authorities, to mitigate those risks. The focus of this report, therefore, is on providing an assessment of the downside risks rather than on the most likely future path for the financial system. The FSR also summarizes recent work by Bank of Canada staff on specific financial sector policies and on aspects of the financial system's structure and functioning. More generally, the FSR aims to promote informed public discussion on all aspects of the financial system.

The Risk Assessment section is a product of the Governing Council of the Bank of Canada: Mark Carney, Paul Jenkins, Pierre Duguay, David Longworth, John Murray, and Timothy Lane.

The material in this document is based on information available to 23 November 2009 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.

Risk Assessment

This section of the *Review* presents the collective judgment of the Bank of Canada's Governing Council on the key risks and vulnerabilities arising from both international and domestic sources bearing on the stability of the Canadian financial system. The objective is to raise awareness of these risks and describe actions taken to address them.

Introduction

Conditions in the international financial system and in the global economy have improved considerably since the June 2009 *Financial System Review* (FSR). Underpinned by forceful policy actions around the world, investor confidence has begun to build, and there are early signs of a global economic recovery. While dislocations in financial markets persist, they are more isolated. Evidence of a more stable financial system includes improved access to private capital markets by financial institutions and a recovery in the market value of risky assets. However, in deciding when and how to disengage from the various policy measures put in place to stabilize the financial system, great care will be required by authorities to avoid either undermining the recovery or imparting excessive momentum to markets.

Conditions in the international financial system and in the global economy have improved considerably since the June 2009 Financial System Review*.*

This improvement in financial conditions is an essential precondition for the return of sustainable global economic growth. The feedback loop between financial markets and the real economy that deepened the recession has now reversed direction, adding impetus to the recovery. Stress on the financial system will likely decline further as the global economy continues to recover.

Confidence in the stability of the global banking system has improved, with profitability returning, concerns about counterparty risk abating, and risk appetite increasing. Impaired assets, however, remain an important source of vulnerability for international banks in the event of another negative shock.

Financial conditions in Canada have continued to improve and remain more favourable than in most other advanced countries. For example, pressures in funding markets have continued to ease since June, with short-term spreads returning to levels comparable to those before conditions deteriorated sharply in September 2008, and the availability and cost of funding at longer maturities improving as well. In addition, Canada's financial institutions

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remain sound—capital ratios are improving further, their loan losses are lower than expected, and their leverage remains low relative to that of their international peers—and they have also taken additional actions to strengthen their liquidity positions. Canadian households have been able to access credit, adding to their debt load. At the same time, bank lending to businesses has declined. This mainly reflects the weak outlook for business investment, although further tightening in the availability of credit has likely also played a role, particularly for small and medium-sized enterprises.

The purpose of this report is not to discuss the most likely outcomes of current trends, but rather to provide an assessment of downside risks that could potentially generate stress in the Canadian financial system. In the December 2008 and June 2009 issues of the FSR, five key sources of risk to the stability of the financial system were identified. They remain the key short-term risks facing the Canadian financial system. The following analysis explores how those risks have evolved over the second half of 2009, as well as additional risks that could materialize over the medium term as financial activity recovers.

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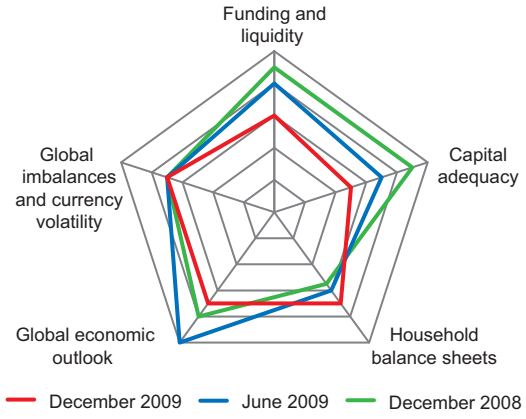
The Governing Council judges that the overall level of vulnerability of the Canadian financial system to an adverse shock occurring in the near term has declined modestly since the June 2009 FSR (**Table 1** and **Figure 1**). Should the recovery in the financial system and in the global economy proceed largely as expected, the Governing Council anticipates that, over the medium term, vulnerabilities associated with global financial and economic imbalances and household indebtedness will emerge as the most prominent risks to the Canadian financial system. While the measures taken by authorities around the world to stabilize the global financial system and the world economy have been broadly effective, they have also amplified the medium-term risks to the financial system—those arising, for example, from fiscal challenges—and have heightened moral hazard[1] in many countries. Maintaining momentum on appropriate regulatory reform will thus be critical in addressing the many unresolved structural issues exposed by the financial crisis.

Table 1: Changes in the key risks to the Canadian financial system

Risk	Direction over the past six months
1. Funding and liquidity	decreased
2. Capital adequacy	decreased
3. Household balance sheets	increased
4. Global economic outlook	decreased
5. Global imbalances and currency volatility	unchanged
Overall risk	**modestly lower**

1 Moral hazard refers to the possibility that expectations of policy support in the event of systemic stress would cause financial institutions and market participants to take on more risk than they would if they were fully exposed to the risk arising from their actions.

Figure 1: Risk assessment



Note: Each rung indicates a certain perceived risk level: the further away from the centre, the more elevated the perceived risk.

Key Risks

Funding and liquidity

The crisis of confidence that disrupted global financial markets in late 2008, resulting in heightened counterparty risk and intense funding pressures, has largely abated. Short- and long-term funding costs for Canadian and international banks have declined significantly since the height of the crisis, and access to market-based financing has continued to recover. As well, Canada's major banks have built up their stock of highly liquid assets and have increased their reliance on more stable sources of funding, thus reducing their exposure to liquidity shocks and bolstering their ability to perform their intermediation role between savers and borrowers.

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Much of the buildup in liquid assets on the balance sheets of Canadian banks is the result of liquidity support from the Bank of Canada and the Government of Canada. Use of these facilities has waned in recent months, largely because of the improvement in market conditions, but also because some pre-funding has already been secured by Canadian banks through the Insured Mortgage Purchase Program (IMPP).[2] Since some funding gaps could re-emerge as existing bank debt matures, it is important that these policy measures be withdrawn in a gradual and transparent manner. Consequently, the Government of Canada announced in September 2009 that the IMPP, even if it has not been fully subscribed recently, would be extended to the end of March 2010. The Bank of Canada terminated two of its less-used liquidity facilities in October 2009, and has kept in place its Term Purchase and Resale Facility. The Bank continues to closely monitor global market developments and remains committed to providing liquidity, as required, to support the stability of the Canadian financial system and the functioning of financial markets.

2 In addition, the pool of mortgages on banks' balance sheets that qualify for the IMPP program has diminished.

Despite notable improvement in funding markets, funding and liquidity constraints remain an important area of vulnerability. Should a negative shock occur, such as a renewed downturn in the global economy or a loss of investor confidence, funding and liquidity pressures would likely reappear relatively quickly. Improvements in central bank liquidity facilities since the onset of the crisis and ongoing initiatives to support the resilience of core funding markets should help to limit the impact on the overall financial system. "Improving the Resilience of Core Funding Markets" (p. 41) discusses such issues.

Forthcoming regulatory changes aimed at tightening global standards for liquidity may also initially increase funding and liquidity risk, since they will raise funding requirements and costs. A number of issues related to raising standards for the management of funding liquidity are discussed in the report, "Liquidity Standards in a Macroprudential Context" on p. 35.

Overall, the vulnerabilities in the Canadian financial system to further adverse shocks to funding and liquidity conditions are judged to have declined since the June 2009 FSR.

While the financial system remains vulnerable to the risk of insufficient funding and liquidity, there is also a risk that easy access to cheap sources of short-term funding may have unintended consequences. For example, the potential for a maturity mismatch to develop between assets and liabilities at some global financial institutions is an emerging source of vulnerability. In addition, a sharp correction could occur in equity and corporate credit markets should the current momentum in markets outpace the improvement in underlying fundamentals.

Overall, the vulnerabilities in the Canadian financial system to further adverse shocks to funding and liquidity conditions are judged to have declined since the June 2009 FSR.

Capital adequacy

Canadian banks have remained broadly profitable and well capitalized throughout the recession.

Canadian banks have remained broadly profitable and well capitalized throughout the recession. They have increased their capital positions, including tangible common equity (TCE),[3] the type of capital providing the most effective protection against unexpected losses. The leverage of Canadian banks, already low relative to that of their international peers, has fallen further since June, owing largely to an increase in their capital base from retained earnings. Nonetheless, given their key role as intermediaries between savers and borrowers, Canadian banks remain exposed to the risk of a marked deterioration in economic conditions.

In the June FSR, concerns were expressed that market participants might exert pressure on banks to maintain capital ratios that are higher than necessary, thus constraining the ability of capital to perform its intended role as a buffer against an unexpected deterioration in the banks' loan portfolios and trading positions. These concerns persist and, in fact, have been reinforced by uncertainty regarding forthcoming changes to the global capital regulatory framework. While it is clear that overall capital requirements will increase, the exact specifications of the

3 Tangible common equity is calculated by removing from common shareholders' equity assets that are likely to have a negligible value in the event of liquidation–for example, goodwill and preferred shares.

future framework are largely a work in progress.[4] The preference of Canadian and international banks not to allow capital buffers to be drawn down, but to maintain them at historically high levels until the new regulatory landscape is clarified, could slow the improvement in credit conditions.

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Confidence in the global banking sector overall remains a key concern. While the position of global banks has improved since the June FSR, important underlying vulnerabilities persist. Several international banks have not been fully recapitalized, nor have they sufficiently reduced their leverage.

As the recent crisis has highlighted, despite their relative strength, Canadian financial institutions are exposed to conditions in the international financial system. For now, however, diminished uncertainty about the global recovery, together with the improvement in financial market conditions, has reduced the likelihood of further material stress in the global banking sector. Some further deterioration in the asset quality of Canadian banks can nonetheless be expected, particularly for those banks with a high exposure to U.S. commercial real estate (see June 2009 FSR, page 26). Canadian banks also face some uncertainty in the form of the upcoming convergence towards International Financial Reporting Standards (IFRS) in Canada (see **Box 3** on p. 31). The primary effect of this change on Canadian banks is a restriction on the off-balance-sheet treatment of asset securitizations, therefore requiring banks to hold capital against these assets.

While market pressures continue to constrain the use of capital buffers, and the uncertain global regulatory environment remains a concern, the factors outlined above suggest that there is a lower probability of an adverse reaction being triggered than at the time of the June FSR. The level of risk related to capital adequacy is thus deemed to have diminished.

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Household balance sheets

The vulnerability of Canadian households to adverse wealth and income shocks has risen in recent years as aggregate debt levels have increased in relation to income. The risk is that a shock to economic conditions could be transmitted to the broader financial system through a deterioration in the credit quality of loans to households. In such an event, the resulting increase in loan-loss provisions and the reduced quality of the remaining loans could lead to tighter credit conditions and, in turn, to mutually reinforcing declines in real activity and in the health of the financial sector. While the broader effects are difficult to anticipate with precision, some sectors, such as retail and housing, would likely be affected more than others. Such a shock would also affect certain segments of capital markets, particularly those that are exposed to the creditworthiness of households; for example, the market for securities backed by credit card receivables. Strains on the

The vulnerability of Canadian households to adverse wealth and income shocks has risen in recent years as aggregate debt levels have increased in relation to income.

4 The Basel Committee on Banking Supervision (BCBS) will issue proposals on these measures in the coming weeks. It will carry out an impact assessment in the first half of 2010 and calibrate the new requirements by the end of that year. Implementation will be timed to ensure that the phase-in of these new measures does not impede the recovery of the real economy. Ongoing work to strengthen capital-adequacy standards is discussed in Governor Carney's remarks of 26 October 2009, available at <http://www.bankofcanada.ca/en/speeches/2009/sp261009.html>.

household sector could also cause a more generalized rise in risk premiums, with attendant negative implications for a variety of asset prices.

In the June 2009 FSR, the Bank judged that, since the onset of the recession, the risk that substantial credit losses on Canadian household loan portfolios could be a source of stress for the broader financial system had increased, although it remained a low-probability risk. This was illustrated by a stress-testing exercise to assess the effect of a hypothetical increase in unemployment on the financial health of the household sector.

While arrears and bankruptcies have continued to rise since June, the start of the economic recovery has reduced the likelihood of this risk materializing in the near term. However, it remains a key source of vulnerability over time, given that the debt-to-income ratio is at historically high levels. While the growth rate of income should increase once a robust economic recovery takes hold, it could remain below that of credit for some time, causing further increases in the debt-to-income ratio. The Bank has conducted a stress-test simulation to gauge the financial vulnerability of Canadian households over the medium term in a scenario of sustained growth in the debt-to-income ratio and an environment of rising interest rates (see p. 23).

The stress-test simulation conducted by the Bank underlines important risk-management challenges for individual households and financial institutions alike.

This exercise underlines important risk-management challenges for individual households and financial institutions alike. When borrowing funds, especially in the form of mortgages, households need to assess their ability to service these debt obligations over their entire maturity, taking into account likely changes in both income and interest rates and the risks surrounding this outlook. Financial institutions need to carefully consider the aggregate risk to their entire portfolio of household exposures when evaluating even an insured mortgage, since a household defaulting on an insured mortgage would likely be unable to meet its other debt obligations. This implies that the overall quality of a bank's loan portfolio would deteriorate, even if no loss is incurred on the insured mortgage itself. In addition, claims to recover losses on insured mortgages are not themselves without cost.

The likelihood of system-wide stress arising from the household sector over the medium term is judged to have risen as a result of increased indebtedness.

The potential for system-wide stress arising from substantial credit losses on Canadian household loan portfolios remains a relatively low-probability risk at the moment, particularly given the near-term prospects for growth. However, the likelihood of this risk materializing in the medium term is judged to have risen as a result of increased indebtedness.

Global economic outlook

The outlook for the global economy has improved since the June FSR.

The outlook for the global economy has improved since the June FSR. The risk of a further material and protracted contraction in international economic activity, highlighted at the time, has not materialized. As outlined in the October 2009 *Monetary Policy Report* (MPR), recent indicators point instead to the start of a global recovery from a deep, synchronous recession.

While this suggests that positive momentum in the global economy is stronger than envisioned at the time of the last FSR, economic growth is nonetheless likely to remain subdued for some time as necessary structural adjustments take place.

Deleveraging of the balance sheets of both financial institutions and households, for example, remains incomplete.

Although the uncertainty surrounding the global economic outlook has diminished somewhat, it nevertheless remains elevated. As well, there is a risk that self-sustaining growth in private demand, a prerequisite for a solid recovery, may take longer than expected to materialize, given that the recovery currently relies on an unprecedented level of policy stimulus. Reflecting the high level of uncertainty worldwide, there is a wide divergence in forecasts for global economic growth.

Although the uncertainty surrounding the global economic outlook has diminished somewhat, it nevertheless remains elevated.

With the slow pace of the recovery, the global economy is vulnerable to additional negative shocks. While the probability of a renewed, synchronous decline in world output is fairly low, even a slower-than-expected recovery may have important implications for the international financial system. If the global recovery does not live up to market expectations, a market correction could ensue. A modest market correction can normally be considered a useful purging of excess risk taking and a re-evaluation of fundamental factors. In the current environment, however, an economic downturn or a significant market correction arising from renewed pessimism could, in a worst-case scenario, reactivate the adverse feedback loop between the real economy and financial markets (by which declines in overall economic growth and in markets reinforce each other).

Overall, the likelihood of a renewed downturn in the global economy and the magnitude of this risk for the Canadian financial system are judged to have diminished since the last FSR.

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Global imbalances and currency volatility

While there were many causes of the financial crisis, large and unsustainable current account imbalances across major economic areas were integral to the buildup of vulnerabilities in many asset markets. In the June 2009 FSR, the Bank identified the risk of a disorderly adjustment of exchange rates as a key area of vulnerability. This could occur if the international policy response to the crisis did not help to address these disequilibria by fostering a timely and sustained rotation of demand away from excess consumption in the United States and towards internally generated sources of demand in the developing countries of Asia. The G-20 commitment to promote strong, sustainable, and balanced growth in global demand is an important step in the right direction. The policy response should include a transition towards more flexibility in exchange rates, which would provide less costly and more symmetric adjustment to the current disequilibria and to future economic shocks.[5]

Large and unsustainable current account imbalances across major economic areas were integral to the buildup of vulnerabilities in many asset markets.

Recent events suggest that the necessary adjustment in the composition of global demand has begun. Since June, the U.S. current account deficit as a share of GDP has continued to decline and global trade activity has rebounded, owing in part to the depreciation of the U.S. dollar, which has largely been orderly. While the

5 Policy options for supporting the orderly adjustment of current account imbalances are discussed in "The Evolution of the International Monetary System," remarks by Governor Carney, 19 November 2009, which can be found at <http://bankofcanada.ca/en/speeches/2009/sp191109.html>.

decline in the U.S. current account deficit can be partly attributed to cyclical factors, there are also signs of necessary structural adjustments under way to broaden the sources of global demand away from reliance on U.S. consumption on a more consistent basis. These adjustments include investment in infrastructure projects and fiscal incentives for consumer spending in China, as well as increased savings by U.S. households. The latter is being partly offset, however, by increased fiscal deficits or, in other words, U.S. government dissaving.

The orderly resolution of global current account imbalances could be hindered by the sharp deterioration in the structural fiscal positions of a number of countries.

Deteriorating fiscal positions increase the vulnerability of countries to adverse macroeconomic developments and reduce their ability to effectively address them. The orderly resolution of global current account imbalances could thus be hindered by the sharp deterioration in the structural fiscal positions of a number of countries and by projections of a substantially worse fiscal path over the medium term.

Should concerns over fiscal sustainability mount, they could result in a renewed increase in risk premiums and volatility across a broad range of assets and currencies, and a higher cost of debt for both the public and private sectors. In the case of carry trades,[6] such rapid shifts in asset prices and associated revaluations of assets and liabilities could result in significant financial stress.

While Canada's fiscal position remains relatively strong, our financial system would be affected indirectly, since higher borrowing costs facing those countries with large financing needs would mute the global recovery. In addition, disorderly fluctuations in exchange rates could cause financial stress for Canadian businesses, financial institutions, and households.

On balance, the Bank judges that the risk to the Canadian financial system arising from global imbalances is roughly unchanged since the June FSR.

On balance, the Bank judges that the risk to the Canadian financial system arising from global imbalances is roughly unchanged since the June FSR. While the likelihood of insufficient improvement in the rotation of global demand is judged to have declined, growing concern over the medium-term sustainability of fiscal positions in the major industrialized countries has emerged as a new potential trigger for a disorderly adjustment of global imbalances.

Policy Actions and Assessment

Policy actions to stabilize the global financial system

Policy actions have helped to further mitigate systemic risks and to improve liquidity and funding conditions.

Authorities around the world responded to the financial crisis with unprecedented actions aimed at restoring confidence and, in turn, the flow of credit. At the time of the June FSR, these measures had begun to take hold. Evidence since then suggests that these policy actions have helped to further mitigate systemic risks and to improve liquidity and funding conditions.

Central banks have continued to provide liquidity support to their respective financial systems. The need for this support has

6 Carry trades generally involve borrowing in low-interest-rate currencies and investing the proceeds in higher-yielding currency assets, typically neglecting potential exchange rate movements, which should, if arbitrage were perfect, offset the interest rate differential.

declined in many countries as conditions in funding markets have improved, and several central banks have consequently begun gradually winding down a number of liquidity facilities. Outside of Canada, the immediate priority is to stabilize the banking system in countries where there have been failures. Although it is widely accepted that restoring stability also requires repairing the balance sheets of financial institutions that have significant exposures to impaired assets, this has yet to be definitively addressed. Recently, however, progress has been made in this regard in some jurisdictions. In the United States, for example, equity has been raised from private investors for the purchase of legacy securities. Ireland announced the creation of a government-supported agency that will purchase eligible bank assets to stabilize and strengthen the banking system. As well, the European Commission has approved measures to restructure the U.K. mortgage bank, Northern Rock, into an entity that will pursue lending activities (i.e., a "good" bank) and an asset-management company that will liquidate impaired assets (i.e., a "bad" bank).

Domestically, the Bank of Canada has continued to provide term liquidity to the financial system. Two of its less-used extraordinary liquidity facilities—the Term Loan Facility (TLF) and the Term PRA Facility for private sector instruments—were discontinued at the end of October. The Bank has also announced that, after 1 February 2010, it will gradually reduce the percentage of collateral for Large Value Transfer System (LVTS) and Standing Liquidity Facility (SLF) purposes that can be made up of non-mortgage loan portfolios. The Government of Canada continues to provide longer-term funding to the economy through programs such as the IMPP, the Canadian Secured Credit Facility (CSCF), and the Business Credit Availability Program (BCAP). Participation in many of these programs has also declined, which underscores the improvement in financial conditions.

The Bank of Canada has continued to provide term liquidity to the financial system.

Regulatory reform to foster a resilient financial system

Authorities worldwide remain committed to multilateral work aimed at a fundamental reform of financial sector regulation that will address the causes of the crisis and enhance the resilience of the financial system.

Following the Pittsburgh Summit in September, G-20 leaders reiterated their determination to develop and implement sweeping reforms to ensure the soundness of the international financial system. Specifically, they committed to: (i) build high-quality bank capital and mitigate procyclicality; (ii) reform compensation practices to support financial stability; (iii) improve over-the-counter derivatives markets; and (iv) develop internationally consistent firm-specific contingency and resolution plans for systemically important institutions, including the establishment of crisis-management groups for major cross-border firms and the development of a legal framework for crisis intervention. They also announced a "Framework for Strong, Sustainable, and Balanced Growth," which aims to manage the transition to a more balanced pattern of global economic growth, and therefore to limit the risk associated with global imbalances.

The Basel Committee on Banking Supervision has made progress on its broad program to strengthen the regulatory capital framework for internationally active banks.

The Basel Committee on Banking Supervision (BCBS) has made progress on its broad program to strengthen the regulatory capital framework for internationally active banks. This includes initiatives to raise capital requirements, promote the buildup of capital buffers that can be drawn down in an economic downturn, enhance the quality and consistency of bank capital, and introduce a limit on leverage. The BCBS recently agreed on various changes related to the three pillars of the regulatory capital framework. First, under Pillar I (minimum capital requirements), beginning at the end of 2010, more stringent capital requirements will be applied for risky or complex activities in the trading book. Second, under Pillar II (supervisory review), the BCBS modified its standards for risk management in order to improve governance and risk management at banks and to better capture the risk associated with off-balance-sheet items and securitized products. These modifications, to be implemented immediately, will provide incentives for banks to better manage risk and return over the long term. Finally, under Pillar III (market discipline), the BCBS increased its disclosure requirements for securitizations, off-balance-sheet exposures, and trading activities. These changes will be implemented by the end of 2010, at the latest.[7]

Prudential regulators are working on global standards to strengthen the management of liquidity risk in the banking sector.

In addition, prudential regulators are working on global standards to strengthen the management of liquidity risk in the banking sector.[8] It is likely that banks around the world will need to increase their holdings of high-quality liquid assets and increase the stability of their funding. A number of suggestions for addressing macroprudential challenges associated with such liquidity requirements are discussed in the report, "Liquidity Standards in a Macroprudential Context" on p. 35.

Quantitative impact analysis will be conducted in 2010 by the BCBS to calibrate the changes to supervisory requirements for both capital adequacy and liquidity.

Canadian authorities are actively contributing to this international work to raise global standards.

The Bank of Canada and other Canadian authorities are actively contributing to this international work to raise global standards and are assessing the appropriate domestic response. In addition, in October 2009, the Government of Canada released a reform plan to modernize the federal legislative and regulatory framework for private pensions. Reform proposals include measures to enhance protection for plan members and to reduce funding volatility for defined-benefit pension plans.

Assessment

The global macrofinancial environment has improved materially since the June FSR. Downside risks to the economic outlook have diminished, and conditions have generally strengthened throughout the international financial system. These developments have reduced the risk that further shocks to global funding and liquidity conditions will have adverse effects on the Canadian financial system. Concerns over the capital adequacy of domestic banks have also diminished as a result of the reduced uncertainty about the global recovery and further increases in capital. As well, some improvement has recently been observed in global current account

7 See BIS press release of 13 July 2009 at <http://www.bis.org/press/p090713.htm>.
8 See BIS press release of 7 September 2009 at <http://www.bis.org/press/p090907.htm>.

imbalances. While vulnerabilities remain, it is judged that, overall, the near-term risks to the domestic financial system have decreased over the past six months.

Nevertheless, several medium-term risks have intensified. First, in many countries, there are no clear policies to move fiscal conditions to a sustainable path. Thus, concerns over fiscal positions could trigger a disorderly adjustment of global imbalances with higher risk premiums and greater volatility in asset prices and exchange rates. The risk of a disorderly scenario will be heightened if major countries do not allow their exchange rates to play their role in the adjustment process.

Several medium-term risks have intensified.

A second medium-term risk relates to the possibility of future increases in asset prices outpacing the improvement in underlying fundamentals. This scenario could arise if the current environment of low interest rates led market participants to resume imprudent or risky practices. For example, to the extent that easy access to low-cost short-term funding in some countries encourages carry trades, any correction in asset prices would lead to sharp revaluations of assets and liabilities and significant portfolio losses on these positions. Asset valuations may also pose risks if interest-sensitive capital flows into emerging economies lead to further momentum in asset prices beyond that justified by underlying conditions. The low interest rate environment could also raise funding liquidity risk over the medium term by increasing maturity mismatches between assets and liabilities at some financial institutions.

Against this background, maintaining momentum on global regulatory reform will be critical to address many of the shortcomings exposed by the financial crisis. This may become increasingly difficult as economic and financial conditions improve, thus raising a third source of vulnerability for the medium term. Given the complex nature of the reforms and the speed of implementation, there is also a clear risk that some reforms will have unintended consequences. In addition, a lack of clarity regarding authorities' intentions for new capital and liquidity standards could create uncertainty during the transition period, delaying the easing in credit conditions and slowing the pace of the economic recovery. These considerations imply that the international community will need to remain vigilant as the architecture of the financial system is reformed.

Maintaining momentum on global regulatory reform will be critical to address many of the shortcomings exposed by the financial crisis.

Although global conditions are the primary source of the medium-term concerns outlined above, the realization of these risks would have significant adverse spillover effects on the Canadian financial system, including higher risk premiums and volatile movements in asset prices. An additional source of vulnerability in Canada is the potential for system-wide stress arising from substantial losses on household loan portfolios. This risk will rise over the medium term if household indebtedness continues to increase.

The Macrofinancial Environment

This section of the *Review* assesses how financial and macroeconomic developments over the past six months have affected financial stability. It begins with an analysis of trends and issues in financial markets before focusing on the outlook for the global economy as well as the balance sheets of Canadian businesses and households. The section concludes with a discussion of the implications for Canadian financial institutions.

Financial Markets

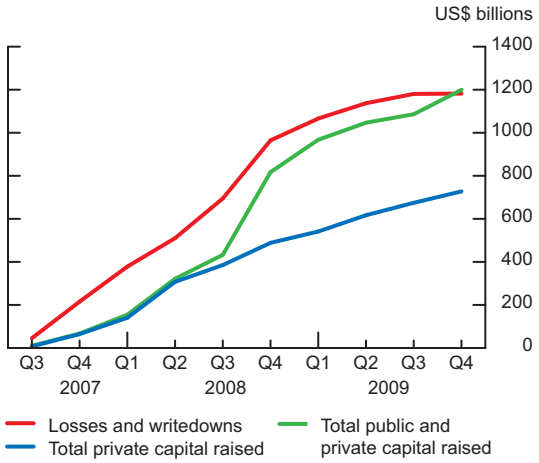
Conditions in global financial markets have continued to improve since the publication of the June 2009 FSR. In particular, funding pressures have eased further, with spreads in short-term funding markets returning to pre-Lehman levels and the availability and cost of funding at longer maturities improving as well. As a result, the demand for liquidity from central banks around the world has declined, and some facilities have begun to be wound down. Global equity markets have also rallied. This overall improvement in market conditions reflects mounting evidence that a global economic recovery is now under way. The recovery is predicated on unprecedented support from macroeconomic policies around the world, and this is contributing to market participants shifting their portfolios towards longer-term and riskier assets.

Nevertheless, risks concerning the strength and sustainability of the economic recovery remain. This is reflected in the still-elevated volatility of asset prices in a number of markets over the past few months. Since the economic recovery and the momentum in markets are underpinned by fiscal and monetary stimulus and the extraordinary policy responses to dislocations in funding and credit markets, there is a risk of a correction if the recovery is slower than expected.

Despite the overall improvement in financial markets, there are still signs that certain segments remain impaired. For example, notwithstanding some signs of revival in North America and the United Kingdom, particularly for simpler, so-called "plain vanilla" securities, term securitization markets remain considerably impaired, except for segments that benefit from direct support from authorities.

Global banks have raised more capital from private sources (US$100 billion) than from public sources (US$42 billion) since the June FSR, reflecting reduced uncertainties regarding the health of the global banking sector. Global banks have also taken advantage of improved access to capital markets to repay part of

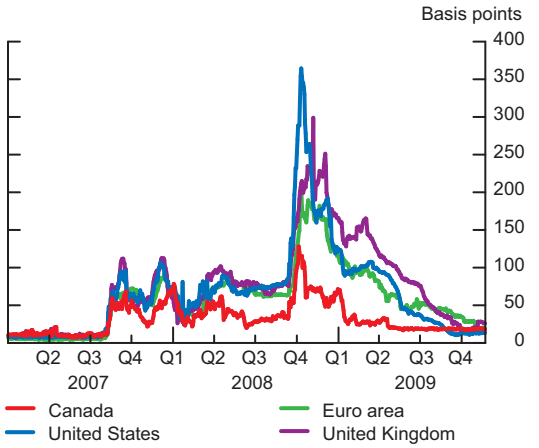
Chart 1: The pace of writedowns at global financial institutions has stabilized



Source: Bloomberg Last observation: 23 November 2009

Chart 2: Conditions in short-term funding markets have improved further

Difference between 3-month interbank offered rates and their respective overnight index swaps[a]



a. For the United States and the United Kingdom, LIBOR; for the Euro area, EURIBOR; and for Canada, CDOR

Source: Bloomberg Last observation: 23 November 2009

the capital support from the public sector. For example, as of 23 November, U.S. banks had repaid close to US$71 billion out of US$205 billion from the Troubled Asset Relief Program (TARP), and a number of banks in Europe and the United Kingdom have raised capital from shareholders to repay part of the capital injections from the public sector.

Confidence in financial institutions has also benefited from the recent rally in equity and credit markets and from increased trading and market-making revenues. As a result of improved market and economic conditions, the pace of writedowns and losses has stabilized **(Chart 1)**. Expectations of further writedowns and losses have also declined. For instance, in its October 2009 *Global Financial Stability Report*, the International Monetary Fund (IMF) reduced its estimate of actual and potential global writedowns from US$4 trillion to US$3.4 trillion. However, since the global recovery is expected to take time to fully materialize, and with some markets at risk of deteriorating further (e.g., the commercial real estate market), banks are still expected to experience further losses on their loan portfolios, and there is considerable uncertainty surrounding the size of future writedowns. Although progress is being made in some jurisdictions, the issue of impaired assets on banks' balance sheets has not been fully resolved. This could be detrimental in the future, since it may significantly hamper the ability of some banks to extend enough credit to generate a more vigorous economic recovery.

Short-term bank funding markets

Conditions in global short-term funding markets have continued to improve since the June FSR, as illustrated by a further decline in spreads between LIBOR and rates on overnight index swaps (OIS) across major jurisdictions **(Chart 2)**. In Canada, at the time of the June FSR, the spread between 3-month CDOR and OIS rates had already reached its lowest value since August 2007 and has remained stable since then, at about 18 basis points. The U.S., U.K., and European LIBOR-OIS spreads, which were markedly higher than in Canada at the time of the June FSR, have declined to close to Canadian levels. Of note, the 3-month U.S. LIBOR-OIS spread is now lower than the Canadian CDOR-OIS spread, which may be the result of particularly elevated U.S.-dollar liquidity in the financial system. Another indication of improving conditions in short-term funding markets is the decreased use of central bank liquidity facilities in many jurisdictions.

In Canada, recent auctions of Term Purchase and Resale Agreements (PRAs) suggest a decline in demand for central bank liquidity support, as illustrated by lower bid-to-coverage ratios, lower average yield relative to OIS rates, and a narrowing of the range between high and low yields. In addition, a number of operations of the Term PRA Facility for private sector instruments have not attracted any bids. As a result, the Bank of Canada has continued to gradually reduce the amount of term liquidity that it provides to the financial system. At the end of July, the Bank reduced the amount of liquidity provided at each Term PRA operation, and at the end of October, it terminated the Term Loan Facility and the Term PRA Facility for private sector instruments and reduced the frequency of regular Term PRA operations from

weekly to biweekly. Finally, the Bank announced on 5 November that the eligibility of non-mortgage loan portfolios as collateral for LVTS and SLF purposes would be gradually reduced to 80 per cent of posted collateral as of 2 February 2010, 50 per cent as of 1 March 2010, and 20 per cent as of 1 April 2010. Since non-mortgage loan portfolios are an efficient source of collateral for LVTS and SLF purposes, they will remain eligible on a permanent basis, subject to a 20 per cent limit of total collateral pledged, after 1 April 2010.[9]

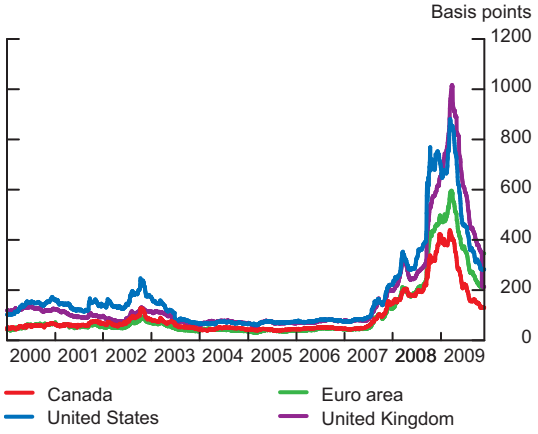
Although conditions in short-term bank funding markets have improved, significant tiering across banks continues. This is particularly the case outside Canada and at longer maturities, where spreads remain somewhat elevated, highlighting ongoing concerns over the perceived risk associated with lending for longer terms.

Canadian money markets have been functioning relatively well since the June FSR, with spreads and yields relatively unchanged or slightly lower, in general. Nevertheless, issuance of bankers' acceptances (BAs) and bearer deposit notes (BDNs) remains fairly limited, given the banks' lower funding needs and the reduced demand for short-term credit by corporations. Because of limited supply and low current and expected policy rates, yields on money market instruments, particularly BAs and commercial paper (CP), are at very low levels, and there seems to be little room for further declines. In the United States, CP outstanding has risen over the past two months, mostly because of a rise in financial CP. This suggests that concerns regarding U.S. financial institutions are diminishing and that U.S. banks are now better able to access money markets for their short-term funding needs.

Credit markets

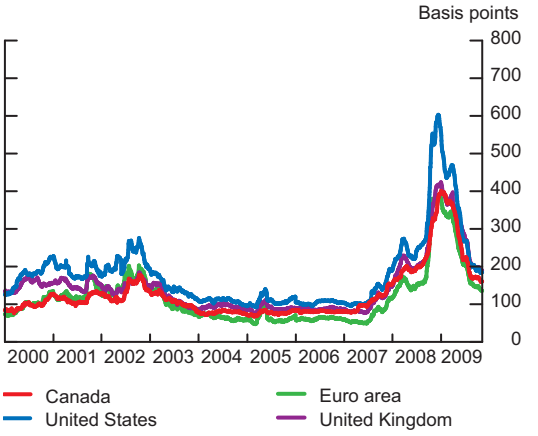
Global corporate debt markets have continued to experience a sustained improvement since the June FSR. Global corporate bond issuance as of the end of September reached a record in excess of US$1 trillion. In the U.S. market, issuance of investment-grade and high-yield bonds to date this year (US$1,033 billion and US$140 billion, respectively) has surpassed total issuance in 2008 (US$669 billion and US$76 billion). This solid issuance has been well absorbed by strong investor demand, as the trend towards the reallocation of funds from very liquid risk-free assets into riskier assets has continued. This trend is illustrated by outflows from money market mutual funds into riskier types of funds, particularly bond funds.[10] In this context, global yield spreads on corporate bonds in industrialized economies have declined further, for both financial and non-financial issuers **(Chart 3** and **Chart 4)**. The decline in yield spreads has been even more pronounced for corporate credit markets in emerging-market economies (EMEs), which had experienced sharp increases earlier in the crisis, but have since narrowed as a result of renewed investor appetite for riskier assets as well as expectations that the global economic recovery will be driven by EMEs. Nonetheless, global

Chart 3: Yield spreads in major credit markets have declined for corporate investment-grade financial issuers . . .



Sources: Bloomberg and Merrill Lynch Last observation: 23 November 2009

Chart 4: . . . as well as for corporate non-financial issuers[a]



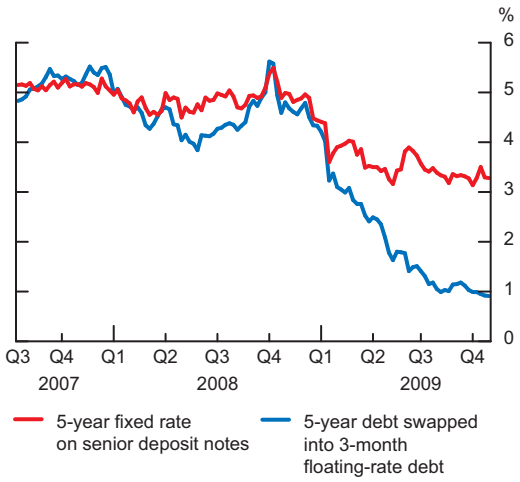
a. Options-adjusted spread

Sources: Bloomberg and Merrill Lynch Last observation: 23 November 2009

9 For details, see <http://bankofcanada.ca/en/notices_fmd/2009/notice051109_slf.html>.

10 Statistics from the Investment Funds Institute of Canada show that, over the January–October period in 2009, outflows from money market mutual funds stood at $12 billion in Canada, while bond funds and balanced funds benefited from strong inflows ($9.8 billion and $7.5 billion, respectively).

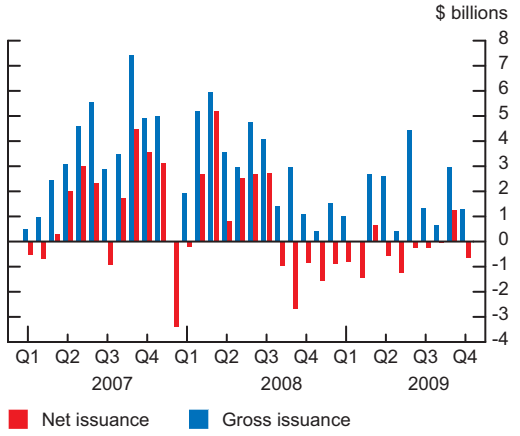
Chart 5: The cost of term funding for Canadian banks has continued to decline . . .



Sources: Bloomberg, Canadian commercial banks, and Bank of Canada calculations

Last observation: 19 November 2009

Chart 6: . . . but debt issuance by Canadian banks remains limited

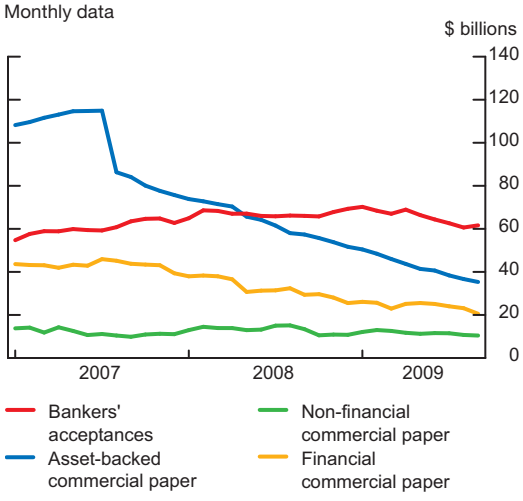


Source: Bank of Canada

Last observation: October 2009

Chart 7: Outstanding amounts of some Canadian money market instruments continue to decline

Monthly data



Source: Bank of Canada

Last observation: September 2009

yield spreads on corporate bonds remain somewhat above their historical averages, which may not be surprising, coming out of a deep recession.

The narrowing in corporate spreads is consistent with the improved economic outlook, pent-up demand from investors, very low interest rates, and high levels of liquidity in the financial system. These factors have encouraged investors to purchase risky assets to earn additional returns. Nevertheless, to the extent that yield spreads may have declined by more than would be justified by an economic recovery that is expected to be slow and protracted, the recent rally may not be fully sustainable.

Longer-term bank funding markets

Conditions in longer-term bank funding markets have also improved since the June FSR. In the United States, bond issuance by financial institutions has continued at a solid pace. Furthermore, while bank bond issuance had been dominated by debt guaranteed by the Federal Deposit Insurance Corporation (FDIC) in the first half of the year, this trend has since reversed.[11]

In Canada, the cost of term funding for banks **(Chart 5)** has continued to decline since the June FSR as a result of falling risk premiums and relatively unchanged risk-free rates. For example, since June, the spread on 5-year bank senior deposit notes over comparable Government of Canada yields has declined from a range of 110 to 125 basis points to about 60 basis points. Moreover, anecdotal evidence suggests that investor demand for Canadian bank debt is robust, resulting in improved access to the Canadian market. While debt issuance by the largest Canadian banks had been relatively low in 2009 until the end of October **(Chart 6)**, a number of Canadian banks have accessed credit markets with new debt issues in recent weeks.[12] Compared with an annual average of close to $39 billion over the past three years, total issuance by financial institutions in 2009 was running at $23 billion as of 23 November. The lower funding needs of Canadian banks reflect the fact that they continue to take advantage of the IMPP to secure term funding (albeit to a lesser extent than earlier in the year). Strong retail deposits and slower growth in the demand for business credit in the present economic environment are also affecting bank funding requirements.

Canadian corporate credit markets

Total outstanding amounts of short-term credit instruments remain on a downward trend in Canada **(Chart 7)**. This decline is partly the result of the very low interest rate environment and improved access to long-term credit markets, which have induced issuers to move towards longer-term funding to reduce rollover risk and take advantage of current favourable conditions.

11 The FDIC Debt Guarantee Program was terminated at the end of October. However, the FDIC established a limited, 6-month emergency guarantee facility through to 30 April 2010, under which certain participating entities can apply to the FDIC for permission to issue FDIC-guaranteed debt.

12 The majority of debt issued in 2009 has been in the form of securities that count towards regulatory capital.

Conditions in Canadian long-term credit markets have improved markedly, with yield spreads on corporate bonds declining slightly across the credit spectrum **(Chart 8)**. Nevertheless, bid-offer spreads on corporate securities remain wide in the secondary market, which reflects diminished competition among market-makers.

Gross issuance of debt securities by non-financial corporations increased markedly in the second quarter of 2009. Up to the end of October, it had surpassed the average issuance for the corresponding period over the past three years **(Chart 9)**. Improved access to, and lower costs in, credit markets for non-financial issuers are likely due, in part, to the limited issuance by Canadian banks, which has increased investor demand for non-financial debt securities to replenish corporate securities portfolios. This suggests that yield spreads on corporate bonds could increase when Canadian banks renew bond issuance. Anecdotal evidence also suggests that non-traditional buyers of corporate securities (e.g., retail investors and equity investors) have recently been quite active in the Canadian corporate credit market, adding to the strong demand for corporate bonds and thus contributing to the compression of credit spreads.

Despite the overall improvement in Canadian credit markets, Canada's term securitization market—excluding National Housing Act Mortgage-Backed Securities (NHA MBS)—remains largely impaired. Nevertheless, there have recently been signs of marginal improvement in global securitization markets: there has been some issuance in Canada, the United States, and the United Kingdom, primarily of simpler, plain vanilla structures, and spreads for traditional asset-backed securities (ABS)—for example, those backed by credit cards—have narrowed markedly. Anecdotal evidence suggests that conditions for new issuance will continue to improve.

In the United States, the Term Asset-Backed Securities Loan Facility (TALF) has also contributed to increased issuance and tighter spreads. While the TALF initially contributed to reducing spreads on TALF-eligible ABS only, the impact gradually broadened to other ABS, particularly for securities backed by credit card and prime auto loans. The TALF has also had an impact on the commercial mortgage-backed security (CMBS) market, as illustrated by the announcement in November of new CMBS deals after more than a year without issuance.

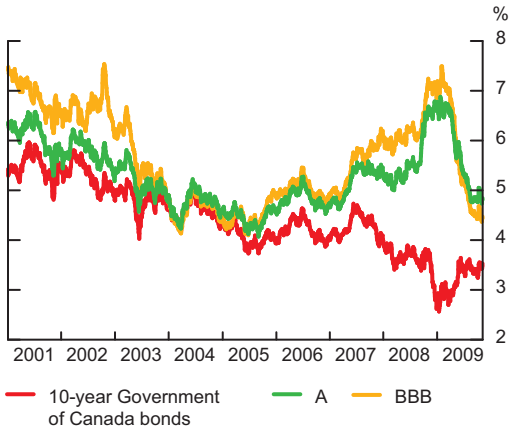
A number of international and domestic policy initiatives are currently under way to restart securitization markets on a sounder basis, with a view to aligning economic incentives among securitization participants and achieving greater transparency and standardization. This is discussed in more detail in the report, "Reform of Securitization" on p. 47.

Sovereign markets

Many countries have continued to implement fiscal stimulus packages to counteract the deterioration in their economies. While sizable stimulus is crucial to support the economic recovery, increased fiscal deficits are expected to persist for an extended period of time, which could raise concerns about the long-term

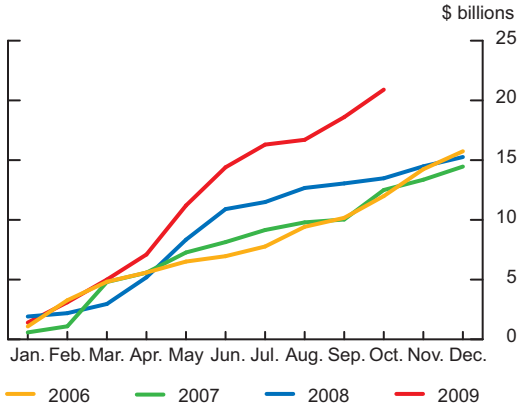
Chart 8: The improvement in Canadian corporate bond markets has continued

Yields on Canadian corporate and government bonds



Sources: Bloomberg and Merrill Lynch Last observation: 23 November 2009

Chart 9: Non-financial issuance in 2009 is higher than in the previous three years[a]

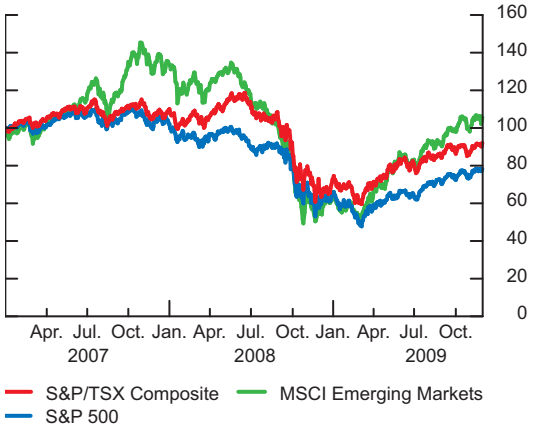


a. Gross issuance

Source: Bank of Canada Last observation: October 2009

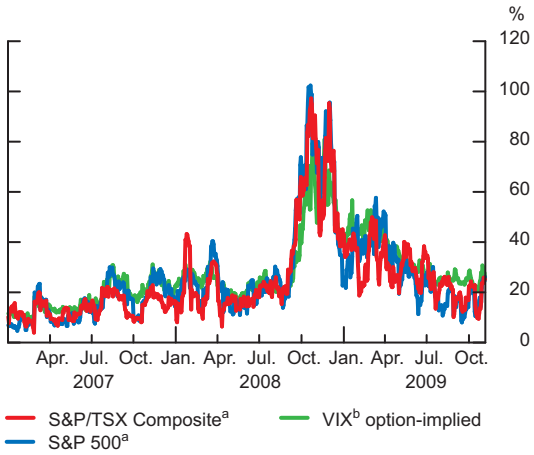
Chart 10: Global equity markets continue to recover . . .

Equity indexes (January 2007 = 100)



Source: Bloomberg Last observation: 23 November 2009

Chart 11: . . . and volatility has declined further



a. The S&P 500 Index and the S&P/TSX Composite Index are based on 10-day historical volatility.

b. The VIX is a measure of the implied volatility obtained from option contracts on the S&P 500 Index.

Source: Bloomberg Last observation: 23 November 2009

sustainability of the fiscal situation in a number of countries and adversely affect the yield curve going forward. So far, yields on government securities in advanced countries have remained largely unaffected by the strong issuance of public debt in many jurisdictions, suggesting that concerns over fiscal sustainability have yet to affect markets. This likely reflects several factors, including continued strong demand for risk-free securities, notably from banks as they improve their liquid-asset positions, as well as demand from some central banks for their reserves. Relatively muted inflation expectations are likely a factor as well. The purchase of government securities by some central banks in the context of unconventional monetary policy has also likely helped to keep government bond yields lower than they would otherwise have been, suggesting that, when central banks discontinue these purchases, risk-free rates will increase. Exiting from extraordinary policies may thus have a material impact on financial markets.

The improvement in risk premiums for the sovereign debt of EMEs has continued since June, which likely reflects the combination of a stronger global economic recovery, a generalized narrowing of risk premiums across asset classes, and the fact that the medium-term fiscal positions in many EMEs have not deteriorated as much as those in industrialized countries.

Equity markets

Equity markets around the world have continued to recover since the June FSR, with major exchanges in industrialized countries increasing by about 50 to 65 per cent from their mid-March lows. In EMEs, the recovery has been sharper, with the MSCI Emerging Markets Index increasing by 102 per cent. Despite this rally, equity market indexes remain below their August 2007 levels in industrialized countries, while those in EMEs are now roughly in line with their pre-crisis levels **(Chart 10)**. Moreover, volatility has declined further, to levels closer to those observed in the winter and spring of 2007 **(Chart 11)**. However, implied volatility remains above realized volatility, which illustrates the considerable uncertainty surrounding the strength and pace of the economic recovery. The improved tone in equity markets has contributed to a rebound in issuance, including in Canada.

The recent rally in equity markets is supported, at least in part, by better-than-expected earnings in the second and third quarters of 2009, with 70 per cent of S&P 500 firms surpassing expectations in the second quarter, and with 80 per cent of those reporting third-quarter earnings up to 23 November exceeding expectations. In the second quarter, these better-than-expected earnings were largely the result of cost-cutting measures, while third-quarter earnings were also supported by revenue growth. For the recent improvement in equity markets to be sustainable, future earnings will have to be driven by revenue growth. Equity markets may thus experience some reversal if earnings growth proves to be disappointing. While indicators point in different directions, various measures, such as forward price-earnings ratios, suggest that equity prices may have increased by more than warranted in the context of an expected slow recovery.

Box 1

Operational Risk and the Influenza Pandemic

Reports from public health authorities indicate that the H1N1 influenza pandemic is a milder influenza than was anticipated. It therefore appears unlikely to materially affect the economy and the financial system. The Bank of Canada and the operators of the systemically important payment, clearing, and settlement systems are nonetheless preparing to address operational risks arising from an outbreak that could be more severe than expected.

The primary objective of this effort is to ensure the continuous operation of infrastructure critical to the functioning of the financial system should several of the key individuals supporting these functions be absent from work concurrently. The Bank has been working with the Canadian Depository for Securities Limited (whose subsidiary company, CDS Clearing & Depository Services Inc., operates the CDSX, the securities clearing and settlement system) and the Canadian Payments Association (which operates the Large Value Transfer System) to ensure that appropriate contingency arrangements are in place. These efforts include tests to ensure that operations can be conducted effectively from alternative locations, developing and sharing lists of contact information for key personnel, and implementing enhanced cleaning routines to limit the spread of the virus. In addition, these organizations have educated their employees on precautions to limit contact with the H1N1 virus.

Policy response

Authorities around the world have continued to provide substantial public sector support to the financial system in response to the ongoing crisis, although the support in the form of liquidity provision has declined since the June FSR, owing to lower demand for central bank liquidity.

Measures to restore confidence in the solvency of major global banks have continued. The U.S. stress-testing exercise reported in the June FSR played a significant role in restoring market confidence regarding large U.S. banks. Similarly, European authorities recently conducted a stress-testing exercise to assess the capital position of the 22 largest European banks. This exercise suggested that, although those banks would experience further losses if economic conditions were to deteriorate in 2009 and 2010, they would still be able to maintain Tier 1 capital ratios significantly above the current Basel II minimum of 4 per cent.[13]

In addition to its continued support to the financial system in the form of liquidity provision, in recent months, the Bank of Canada has been working with operators of the systemically important payment, clearing, and settlement systems to ensure the continuous operation of critical infrastructure in the event of a severe outbreak of the H1N1 influenza **(Box 1)**.

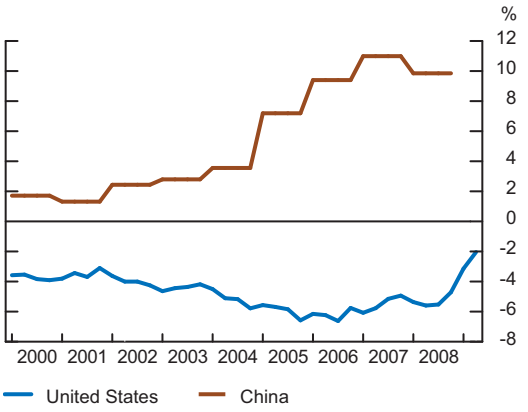
Global Economy

As outlined in the October 2009 MPR, prospects for global economic growth have been revised upwards **(Table 2)**. While the recovery has been led primarily by Asian economies, recent

13 For detailed results, see <http://www.dnb.nl/binaries/Persbericht%20CEBS%201%20oktober%202009_tcm46-222942.pdf>.

Chart 12: The U.S. current account deficit has narrowed

United States and China: Current account balances as a percentage of GDP

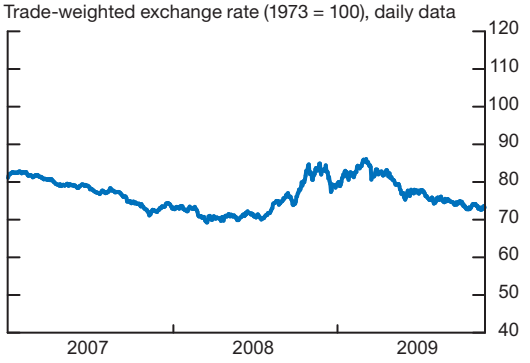


Sources: U.S. Bureau of Economic Analysis; China, Global Insight

Last observation: United States, 2009Q2; China, 2008 (annual data)

Chart 13: The U.S. dollar has continued to depreciate

Trade-weighted exchange rate (1973 = 100), daily data



Source: Bloomberg

Last observation: 23 November 2009

Table 2: Projection for global economic growth

	Share of real global GDP[a] (per cent)	Projected growth (per cent)[b]			
		2008	2009	2010	2011
United States	21	0.4 *(1.1)*	-2.5 *(-2.4)*	1.8 *(1.2)*	3.8 *(2.9)*
Euro area	16	0.5 *(0.7)*	-3.9 *(-3.5)*	0.9 *(-0.2)*	2.4 *(1.6)*
Japan	7	-0.7 *(-0.7)*	-5.7 *(-6.2)*	1.7 *(0.1)*	2.5 *(2.5)*
China	11	9.1 *(9.1)*	8.1 *(6.7)*	8.9 *(7.7)*	8.9 *(8.9)*
Rest of the world	45	3.9 *(4.2)*	-2.1 *(-0.1)*	3.3 *(2.5)*	3.7 *(3.8)*
World	**100**	**2.9** *(3.2)*	**-1.6** *(-0.8)*	**3.1** *(2.2)*	**4.0** *(3.7)*

a. GDP shares are based on IMF estimates of the purchasing-power-parity (PPP) valuation of country GDP for 2007.
Source: IMF, *WEO*, April 2009

b. Projection values from October 2009 *Monetary Policy Report*. Country breakdown differs from the April 2009 *Monetary Policy Report*. Numbers in parentheses show projection values for the April 2009 *Report* based on the new breakdown.
Source: Bank of Canada

indicators suggest that a broader-based recovery is in place, supported by considerable fiscal and monetary stimulus across the G-20 economies. Overall, the risk of a renewed downturn in global economic growth has receded since June, and the adverse feedback loop between the real economy and the financial sector has reversed.

The Bank projects a more subdued global recovery than in previous cycles, with stimulus from fiscal and monetary policies tempered by the effects of the important structural changes that are under way. These adjustments include a significant rebalancing of spending and saving patterns across major trading partners, including the United States and China. This rebalancing will set the stage for more broadly based, sustainable medium-term growth. The transition is expected to involve some material fluctuations in exchange rates over the medium term. There is a risk that this adjustment could be disorderly.

The U.S. current account deficit has narrowed from its peak **(Chart 12)**. This is the result of lower U.S. demand for imports and lower oil prices, and it was also facilitated by the orderly depreciation of the U.S. dollar on a trade-weighted basis **(Chart 13)**.

In addition, the financial crisis has increased fiscal deficits that were already rising in response to demographic pressures. The IMF projects that gross public debt in advanced countries will reach over 120 per cent of GDP by 2014. This is predicated on deteriorating fiscal deficits resulting from support to the financial system, discretionary stimulus measures, and long-lasting reductions in certain tax revenues. The stabilization of public debt levels will require large and sustained improvements in primary fiscal balances.[14] However, the G-20 countries are focused on the sustainability of the recovery and have yet to produce comprehensive medium-term fiscal plans. Given the potential for disruptions in credit markets and for higher risk premiums, large fiscal deficits pose a risk to financial stability.

14 The primary fiscal balance of a country is the difference between government revenues and non-interest expenditures.

Canadian Non-Financial Sector

Credit growth

Credit growth in Canada has generally continued to moderate since the June FSR. However, as firms continue to deleverage, the slowdown is more evident for business credit than for households, which continue to borrow at a robust pace **(Table 3)**. Other industrialized countries, including the United States and the United Kingdom, have experienced weak credit growth for businesses and households alike.

Table 3: Credit—annualized growth rates

	Distribution %	10-year average[a]	Pre-crisis trend[b]	2008H2	2009H1	2009Q3[c]
Total Household Credit	**100.0**	**8.9**	**10.5**	**10.3**	**6.7**	**7.8**
Residential mortgage credit	**68.7**	**8.5**	**10.8**	**11.7**	**6.4**	**7.7**
NHA MBS program	20.4	31.1	19.9	34.1	25.5	9.0
Other securitized	1.2	2.0	19.5	-8.4	-20.4	-22.0
Chartered bank	33.4	6.9	9.7	5.2	-2.5	13.3
Non-bank[d]	13.8	4.2	7.1	5.3	2.6	9.0
Consumer credit	**31.3**	**9.7**	**10.0**	**7.3**	**7.4**	**8.2**
Securitized	3.3	13.2	17.1	-8.8	-21.3	-17.1
Chartered bank	23.4	12.4	9.0	13.0	14.1	14.2
Non-bank[d]	4.7	5.1	8.0	0.9	3.6	8.4
Total Business Credit	**100.0**	**4.9**	**6.8**	**4.3**	**0.8**	**-1.5**
Securitized	3.1	11.5	19.7	-15.4	-15.9	-18.9
Chartered bank	24.5	4.0	13.1	7.2	-12.2	-17.1
Non-bank[d]	11.6	5.4	4.8	8.8	0.3	-1.3
Commercial paper	0.9	-1.1	7.5	47.9	11.9	-25.0
Market[e]	60.0	5.8	4.1	4.4	9.8	6.5

a. Average of the annualized 3-month growth rates for 1999Q3 to 2009Q3
b. Average of the annualized 3-month growth rates for the four pre-crisis quarters (2006Q3–2007Q2)
c. Non-bank and securitization data for 2009Q3 are estimates.
d. Non-bank includes trust and mortgage loan companies, credit unions and caisses populaires, life insurance companies, and non-depository credit intermediaries and other institutions (e.g., auto leasing and sales finance companies).
e. Bonds and debentures, equities and warrants, and trust units. Includes both domestic and foreign issues.
Source: Bank of Canada

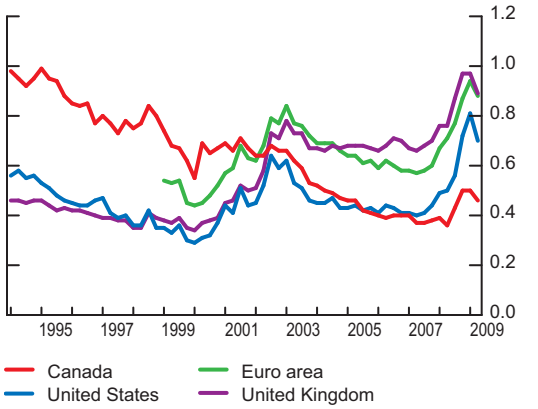
Chart 14: Canadian corporate leverage has declined . . .

Debt-to-equity ratio[a]

a. At book value
Source: Statistics Canada *Quarterly Financial Statistics for Enterprises*
Last observation: 2009Q3

Chart 15: . . . and remains below that of other countries

Non-financial corporate sector: Debt-to-equity ratio[a]



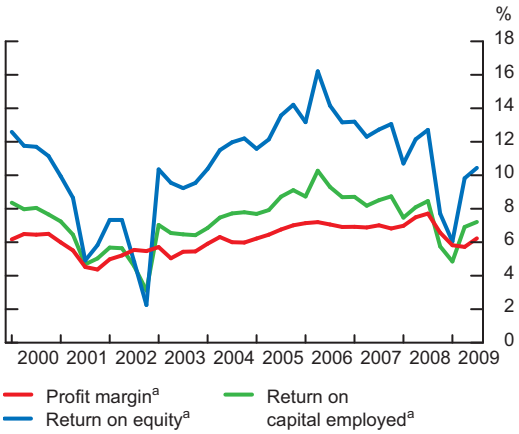
a. For international comparability, data for Canada are measured at market value rather than at book value.
Sources: Statistics Canada, U.S. Federal Reserve, ECB, U.K. Office for National Statistics
Last observation: 2009Q2

According to the autumn issues of the *Bank of Canada's Senior Loan Officer Survey* and *Business Outlook Survey*, sluggish business credit is largely related to lower demand for funds by firms, although continued tight lending conditions are also likely to have played a role. Improved access to capital markets has led to a notable increase in new debt issues by non-financial borrowers and a shift away from the heavy reliance on bank financing experienced in the wake of the crisis.

Corporate sector

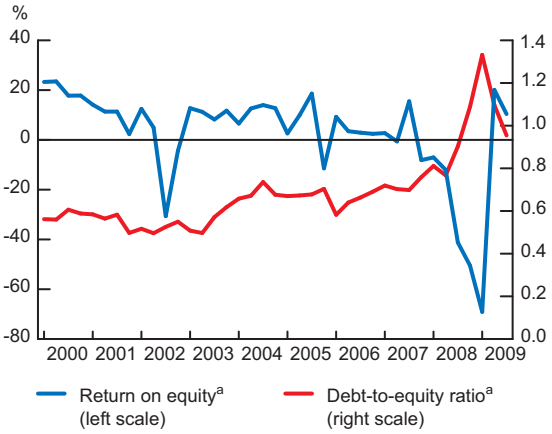
As noted in the June FSR, the financial position of the Canadian non-financial corporate sector remained reasonably solid throughout the financial crisis. New information received since June indicates that the aggregate financial position of this sector has improved. Corporate leverage, as measured by the ratio of debt-to-book-value equity, declined in both the second and third

Chart 16: Canadian corporate profitability has increased . . .



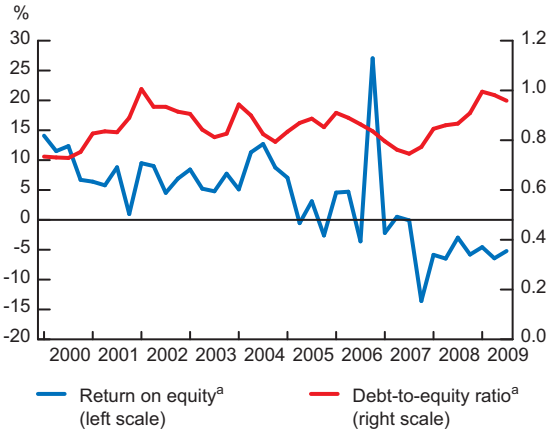
a. At book value
Source: Statistics Canada *Quarterly Financial Statistics for Enterprises*
Last observation: 2009Q3

Chart 17: . . . with improved profitability in the automotive industry . . .



a. At book value
Source: Statistics Canada *Quarterly Financial Statistics for Enterprises*
Last observation: 2009Q3

Chart 18: . . . but the wood and paper products industry continues to incur losses



a. At book value
Source: Statistics Canada *Quarterly Financial Statistics for Enterprises*
Last observation: 2009Q3

quarters, after being relatively stable since the third quarter of 2007 **(Chart 14)**. Measured at market value, leverage also declined in the second quarter of 2009, and remains well below that of the United States, the United Kingdom, and the Euro area **(Chart 15)**. Liquidity in the Canadian non-financial corporate sector, as measured by the quick ratio, has continued on the upward trend that began in 2006.[15]

After three consecutive quarters of decline, the profit margin of the Canadian non-financial corporate sector increased in the third quarter of 2009, owing to a sharp increase in operating revenue and cost-cutting measures taken by Canadian firms over the course of the recent recession **(Chart 16)**. The rate of return on both book-value equity and book-value capital rose in the second and third quarters, largely owing to the reversal of earlier asset writedowns and to an improvement in operating revenues. In light of the anticipated recovery in the global economy, along with a firmer outlook for commodity prices, Canadian corporate profits are expected to increase further.

Industry

Despite the favourable outlook for the corporate sector as a whole, companies in certain industries remain under financial stress. While noteworthy, their problems are unlikely to have a major adverse impact on the Canadian financial system, given the marked reduction in the exposure of Canadian banks to these industries since 2002.

The motor vehicle and parts industry has been hit by substantial losses since the end of 2007. However, following six consecutive quarters of losses, the rate of return on both book-value equity and book-value capital has been above zero since the second quarter **(Chart 17)**. As well, operating revenue increased sharply in the third quarter. Asset revaluations during the second quarter of 2009 contributed to this improvement in profitability. The financial position of the industry also improved, with the debt-to-equity ratio declining in both the second and third quarters. This improvement is attributable to the restructuring of the debt of the major industry players, which resulted from bankruptcy protection, rationalization of costs, and government funding assistance.

For the eighth consecutive quarter, the wood and paper products industry again incurred losses in the third quarter of 2009, largely because of ongoing weakness in the U.S. housing market. The persistent weakness in profitability implies additional financial stress for this industry **(Chart 18)**.

Household sector

The net worth of Canadian households increased in the second quarter of 2009 **(Chart 19)**, largely owing to the rebound in stock prices since March.

Recent indicators of household financial stress have been less favourable, however, as evidenced by the continued upward trend of payments in arrears on household credit and the recent sharp

15 The quick ratio is defined as short-term assets (less inventories) over short-term liabilities.

rise in bankruptcies **(Chart 20)**. Indeed, personal bankruptcies as a proportion of the population aged 20 and over increased to its highest level since 1991. Residential mortgage loans in arrears as a percentage of mortgage loans outstanding have also increased since the June FSR. Arrears and insolvencies are expected to rise further, but should slow as the economy improves.

In contrast to the United Kingdom and the United States, the household debt-to-income ratio in Canada has continued to rise since the last FSR **(Chart 21)**. This ratio reached a new high of 1.42 in the second quarter of 2009, mainly because of rising indebtedness. Although Canadian household debt as a share of personal disposable income is lower than in the United States and the United Kingdom, its upward trend implies that households have a growing vulnerability to additional adverse shocks.

The current historically low levels of interest rates **(Chart 22)** have, however, enabled Canadian households to reduce the proportion of their disposable income devoted to servicing their debt, despite increased debt levels. In the second quarter of 2009, the aggregate debt-service ratio (DSR) stood at 7.7 per cent, down from 8.1 per cent recorded in the same period last year **(Chart 23)**.

Stress testing the household sector

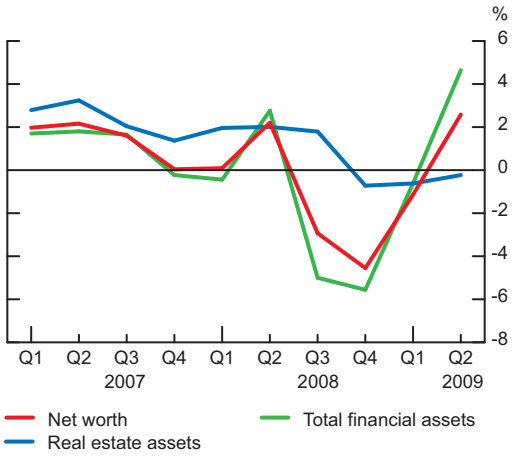
In the June 2009 FSR, the Bank presented the results of a stress-testing simulation to assess the impact of a more severe economic downturn than anticipated on the vulnerability of Canadian households. The results illustrated how a hypothetical sizable increase in unemployment would heighten financial stress for households and likely produce loan losses for financial institutions.

While the risk of a renewed downturn in the global economy remains a key source of vulnerability for the financial system, recent indicators point to the start of an economic recovery. As such, the near-term risk to Canadian households arising from a sharp deterioration in labour markets has diminished. However, the medium-term risk to financial stability arising from the household sector is judged to have increased. This judgment is predicated on concerns that the sustained growth of household debt in the context of an environment of rising interest rates will increase the vulnerability of households to an adverse shock over the medium term.

The Bank has conducted a stress-testing simulation to gauge the evolution of the DSR of Canadian households in such an environment. The future distribution of the DSR is simulated using microdata from the second half of 2008 and the first half of 2009.[16] From this starting point, the evolution of the DSR is determined for each household based on a hypothetical scenario that establishes assumed future paths for the debt-to-income ratio and for interest rates.

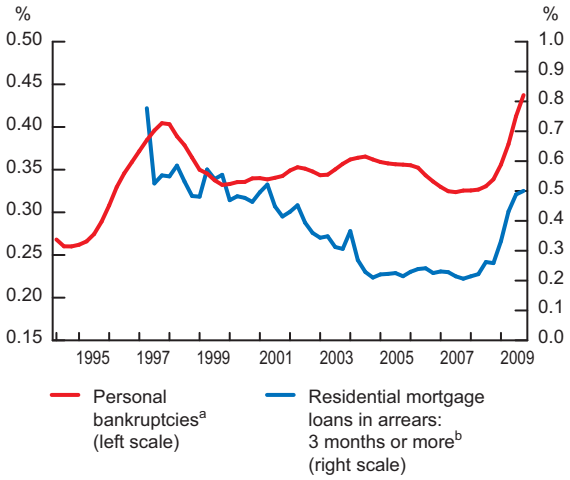
Two hypothetical paths for the overnight rate over a three-year period, beginning in the third quarter of 2009, are considered **(Table 4)**. Both assume that the overnight rate will remain at its

Chart 19: Household net worth has increased
Quarter-over-quarter growth rate



Source: Statistics Canada — Last observation: 2009Q2

Chart 20: Financial stress among Canadian households has increased further . . .

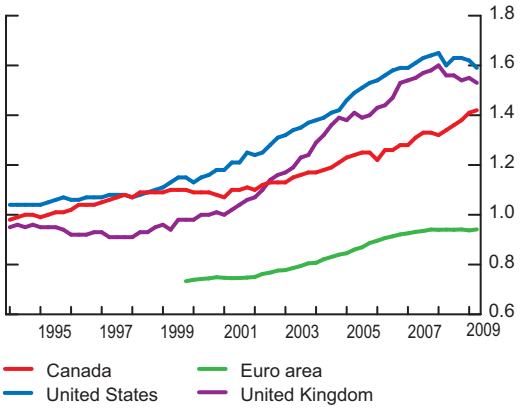


a. As a percentage of population aged 20 and over
b. As a percentage of total residential mortgage loans outstanding
Sources: OSFI, Statistics Canada, Office of the Superintendent of Bankruptcy Canada — Last observation: 2009Q3

16 A brief description of this data set is provided in the December 2006 FSR. These microdata are from Ipsos Reid's Canadian Financial Monitor (CFM), a survey that provides detailed information on household balance sheets.

Chart 21: . . . and the household debt-to-income ratio is still rising in Canada

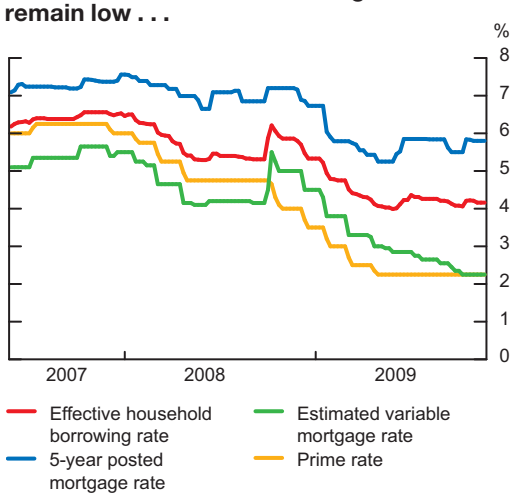
Household debt as a share of personal disposable income



Sources: Statistics Canada, U.S. Federal Reserve, ECB , U.K. Office for National Statistics

Last observation: 2009Q2

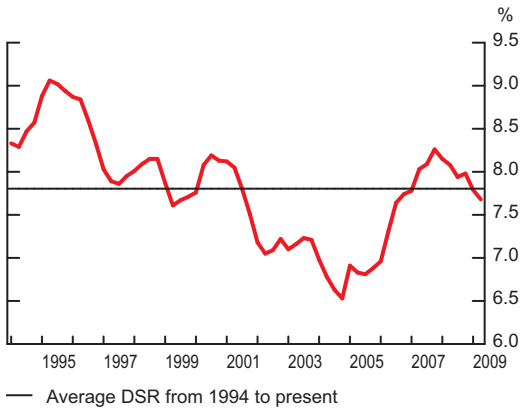
Chart 22: Household borrowing costs remain low . . .



Source: Bank of Canada

Last observation: 20 November 2009

Chart 23: . . . and the debt-service ratio has declined



Note: The DSR includes interest payments only.

Source: Statistics Canada

Last observation: 2009Q2

current level until the end of the second quarter of 2010. Thereafter, Scenario 1 is consistent with expectations embodied in current yields on Government of Canada securities, while Scenario 2 assumes a larger increase in interest rates than currently priced in markets. Both the term and the risk premiums for mortgage rates relative to the Government of Canada yield curve are assumed to fall gradually from current levels towards their historical averages over the simulation horizon, for terms of one to ten years. **Table 4** provides assumptions for both the overnight rate and the effective interest rate on outstanding household debt over the simulation period.[17]

Other assumptions presented in **Table 4** are identical under both scenarios. Income growth is assumed to be modest in 2009, and then to pick up to a 5 per cent pace, close to its average between 2000 and 2008. Household credit and its components—consumer credit and mortgage debt—are assumed to continue growing at a pace near their average in the first three quarters of 2009 throughout the entire simulation period.[18] Thus, the debt-to-income ratio is assumed to increase from 1.42 in the second quarter of 2009 to approximately 1.60 in the second quarter of 2012.

Simulation results for the period up to the second quarter of 2012 are shown in **Table 5**. They suggest that the proportion of households with a high DSR would increase. In particular, the proportion with a DSR exceeding 40 per cent[19]—a threshold above which households are considered to be financially vulnerable—would rise to 8.5 and 9.6 per cent, respectively, under Scenarios 1 and 2 in the second quarter of 2012, compared with an average of 6.1 per cent over the past ten years and a historical peak of 7.4 per cent in 2000.[20] Moreover, the percentage of debt owed by these vulnerable households would increase from an average of 10.7 per cent during the second half of 2008 and the first half of 2009 to 15.9 and 18.9 per cent, respectively, in the second quarter of 2012 under Scenarios 1 and 2. Both of these levels are well above the peak of 13.8 per cent in 2000.

To gauge the potential impact on the banking sector of such an increase in the DSR, the default rate of vulnerable households is assumed to be 25 per cent, consistent with data on bankruptcy rates.[21] It is also assumed that loss-given-default on all unsecured debt is 100 per cent and that Tier 1 capital is assumed to grow annually at a constant rate of 7 per cent. Columns three and six of **Table 5** indicate potential bank losses as a percentage of banks' Tier 1 capital under Scenario 1 and Scenario 2,

17 The effective interest rate for households is a weighted average of various mortgage and consumer credit interest rates. The weights are derived from residential mortgage and consumer credit data, adjusted for additional information provided by financial institutions.

18 This scenario for credit growth implicitly assumes that the downward effect on the demand for credit arising from the assumed rise in interest rates and the upward effect of growing income will offset each other.

19 This threshold is consistent with industry standards. See S. Dey, R. Djoudad, and Y. Terajima, "A Tool for Assessing Financial Vulnerabilities in the Household Sector." *Bank of Canada Review*, Summer 2008.

20 The Bank has recently re-examined its methodology for conducting stress-test simulations with household microdata. In past FSRs, households with a measured DSR equal to or greater than 50 per cent were excluded, given the possibility that a high proportion of these very large debt burdens might reflect reporting errors. New evidence has resulted in the cut-off being raised to 100 per cent.

21 Only domestic banks are taken into account in these calculations. They account for close to 94 per cent of all consumer credit from banks.

Table 4: Assumptions for stress-test simulations

Period	Scenario 1		Scenario 2		Both scenarios			
	Overnight rate (%)	Effective borrowing rate (%)	Overnight rate (%)	Effective borrowing rate (%)	Household income (annualized growth rate)	Total household credit (annualized growth rate)	Consumer credit (annualized growth rate)	Residential mortgage credit (annualized growth rate)
2009Q3	0.25	4.27	0.25	4.27	1	8	8.5	7.3
2009Q4	0.25	4.25	0.25	4.25				
2010Q1	0.25	4.23	0.25	4.23	5	8	8.5	7.3
2010Q2	0.25	4.21	0.25	4.21				
2010Q3	0.75	4.34	0.75	4.34				
2010Q4	1.50	4.51	1.50	4.51				
2011Q1	2.15	4.60	2.25	4.69	5	8	8.5	7.3
2011Q2	2.60	4.68	3.00	4.88				
2011Q3	3.05	4.78	3.50	5.03				
2011Q4	3.10	4.79	4.00	5.20				
2012Q1	3.15	4.81	4.25	5.33	5	8	8.5	7.3
2012Q2	3.20	4.82	4.50	5.41				

Note: The effective interest rate for households is a weighted average of various mortgage and consumer credit interest rates.

Table 5: Impact on households of continued growth of debt-to-income ratio in the context of an environment of rising interest rates

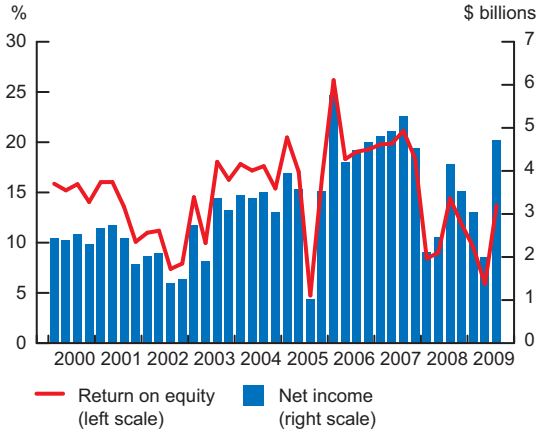
	Scenario 1			Scenario 2		
	1	2	3	4	5	6
	Proportion of households with DSR > 40%	Proportion of debt owed by households with DSR > 40%	Percentage of bank losses relative to Tier 1 (%)	Proportion of households with DSR > 40%	Proportion of debt owed by households with DSR > 40%	Percentage of bank losses relative to Tier 1 (%)
Historical peak, 2000	7.4	13.8		7.4	13.8	
2008H2–2009H1 (observed)	5.9	10.7	3.0[a]	5.9	10.7	3.0[a]
2010Q4	6.4	11.7	3.4	6.4	11.9	3.5
2011Q4	7.7	14.4	3.9	8.9	17.4	4.7
2012Q2	8.5	15.9	4.0	9.6	18.9	4.8

a. Based on banks' balance sheets for the second quarter of 2009.
Source: Bank of Canada calculations

respectively. Mortgages are excluded from the calculation of potential losses because a large proportion of household mortgages are insured, which limits expected losses for the banking sector.[22] The results suggest that, should the aforementioned stress scenarios materialize, the ratio of potential bank losses relative to Tier 1 capital would rise from 3.0 per cent in the second quarter of 2009 to 4.0 per cent in the second quarter of 2012 under Scenario 1, and to 4.8 per cent under Scenario 2 in that same quarter. This suggests that the banks' current capital buffers above the regulatory minimum are more than enough to absorb the potential losses shown in these stress-test scenarios, with both stress scenarios implying a hit of approximately 0.4 percentage points to the Tier 1 capital ratio. This represents only a

22 Uninsured mortgages have a low loan-to-value ratio. It is assumed that there will not be a major decline in house prices and that loss-given-default will be near zero.

Chart 24: The Canadian banking industry continues to be profitable



Source: OSFI

Last observation: 2009Q3

partial simulation exercise that does not attempt to capture any of the additional losses that could occur should the financial stress of the household sector increase.

While these simulation results are purely illustrative, based on simplifying assumptions, they remain qualitatively informative. They suggest that, over the medium term, more households would have a reduced ability to weather adverse shocks with further growth in the debt-to-income ratio in an environment of rising interest rates. Banks should carefully consider the aggregate risk to their entire portfolio of household exposures when evaluating even an insured mortgage. A household defaulting on an insured mortgage would likely be unable to meet its other debt obligations, resulting in a deterioration in the quality of the bank's entire household loan portfolio, even if no loss is incurred on the insured mortgage itself. In addition, claims to recover losses on insured mortgage loans are not themselves without cost. When borrowing funds, especially for mortgages, households also need to assess their ability to service their debts over the entire maturity of the loan, taking into account both the likely changes in income and in interest rates, as well as the risks surrounding this outlook.

Global Banking Environment

The financial position of major international banks has continued to strengthen since the June FSR. Funding costs are lower, and while some banks continue to rely on government assistance, many have been able to raise private capital, increasing not only their capital buffers but also their stock of liquid assets.

Since the quality of the assets of some banks remains a concern, improvements in capital and liquidity positions are important developments. While writedowns on structured finance securities appear to have stabilized with the improvement in financial markets, there continue to be sizable losses on the banks' loan books. In particular, the downturn in real estate markets and rising unemployment have resulted in increasing losses on residential mortgages and commercial real estate loans, as well as on personal loans such as credit cards and lines of credit.

The increasing provisions for credit losses have put some downward pressure on earnings. However, this has been more than offset by the recent rally in debt and equity markets, which has resulted in a rebound in trading revenues and in earnings. Nonetheless, a number of downside risks to bank profitability remain. First, should the risk of a correction in capital markets materialize, this would lead to further writedowns on securities as well as decreased trading revenue. It could also result in higher private funding costs and, for some banks, continued reliance on government support programs. As well, should the global economy experience a further negative shock or a more protracted recovery than expected by market participants, this would put further pressure on credit quality, and may result in larger-than-expected loan losses.

Canadian banks

Canada's major banks have remained broadly profitable throughout the crisis **(Chart 24)**. However, credit losses on loan

portfolios—although below those of previous downturns—are running at elevated levels and are expected to remain there for several quarters. Of particular concern is the exposure of Canadian banks to the more challenging banking environment in the United States, as evidenced by the disproportionate share of total loan losses in their foreign subsidiaries.

Outside of their traditional personal and commercial banking operations, Canadian banks have benefited from the favourable conditions in financial markets. Revenues from capital market activities have rebounded sharply, which has helped to offset the increase in loan-loss provisions.[23] Banks continue to hold sizable amounts of capital, with their stock of capital rising further since the last FSR and remaining well above regulatory minimums.

Loan portfolios

The economic downturn has caused a deterioration in the quality of loans to Canadian households, with banks currently experiencing a cyclical increase in loan losses. The deterioration in the credit quality of loans to Canadian households has resulted in losses primarily on unsecured personal loans and credit cards. In contrast, loans to Canadian households secured by residential property, which include mortgages and home equity lines of credit ("HELOCs"), have not resulted in significant losses at this point in the cycle. Residential mortgages account for 57 per cent of total loans to households, and about half of these mortgages are insured against default, thus representing minimal risk for banks. Uninsured mortgages must have loan-to-value ratios of 80 per cent or less at origination, which limits their riskiness. Nonetheless, uninsured mortgages have resulted in material losses at some of the smaller financial institutions.

As noted in the preceding section, household credit has continued to grow at a relatively robust pace since the June FSR. This could expose banks to the possibility of higher-than-expected losses over the medium term. In the future, this could represent an even greater concern for banks if the composition of their loan portfolios continues to shift away from business lending and towards household lending.

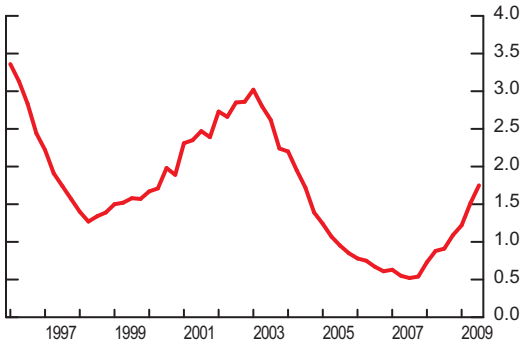
While the recession has lessened the quality of the banks' corporate and commercial loan portfolios, losses are no worse than in previous cycles. Impaired business loans and associated provisions have increased from cyclically low levels since the June FSR **(Chart 25)**, but there are tentative signs of stabilization.

Nonetheless, there are some specific areas of concern with respect to the quality of the loan portfolios of Canadian banks. For example, several Canadian banks have large foreign operations, and losses in corporate and commercial lending in these operations are significantly higher than in their Canadian operations. Lending to businesses includes loans for commercial real estate, an area of particular concern at the moment. Losses on U.S. loans at these banks account for a disproportionately large share of total loan losses **(Chart 26** and **Chart 27)**. These losses were large

23 Capital market revenue is defined as the sum of trading revenue, underwriting fees, brokerage commissions, investment-management fees, and recognized gains and losses on instruments held for purposes other than trading.

Chart 25: Impaired business loans are increasing from cyclically low levels

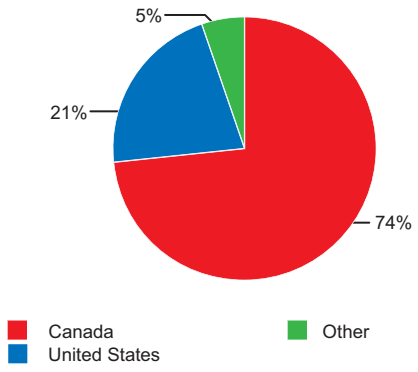
Impaired business loans as a percentage of total loans



Source: OSFI Last observation: 2009Q3

Chart 26: Loans to U.S. residents represent a modest share of total bank loans . . .

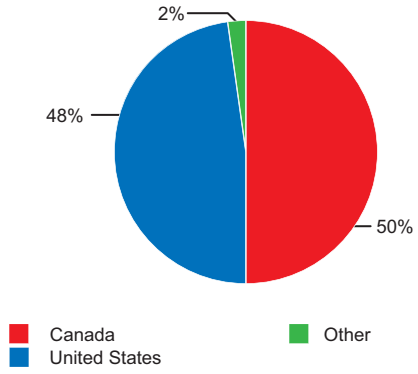
Geographic distribution of loan portfolio
(November 2008–July 2009)[a]



a. BMO, TD, and RBC
Source: Banks' quarterly financial statements

Chart 27: . . . but a larger share of loan losses

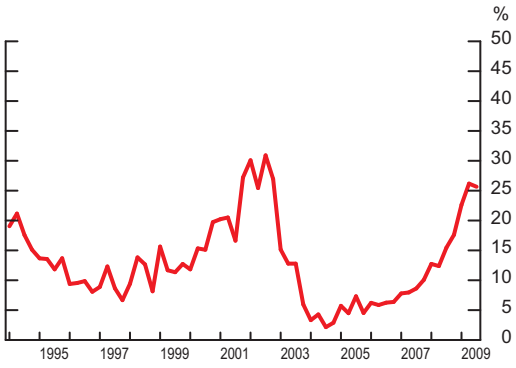
Geographic distribution of provisions for loan losses
(November 2008–July 2009)[a]



a. BMO, TD, and RBC
Source: Banks' quarterly financial statements

Chart 28: Banks have the capacity to absorb further increases in loan losses

Provisions for loan losses as a percentage of net interest income

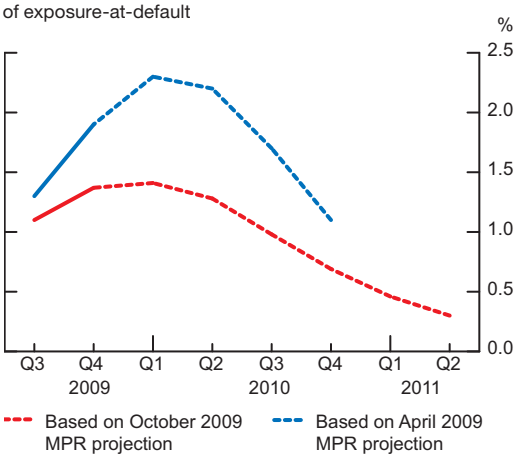


Source: OSFI

Last observation: 2009Q3

Chart 29: Projected loan losses have declined

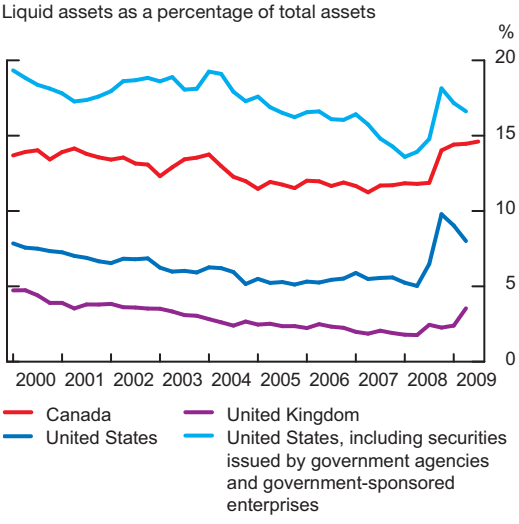
Annualized quarterly loan losses as a percentage of exposure-at-default



Source: Bank of Canada calculations

Chart 30: Bank holdings of liquid assets have continued to rise since the crisis

Liquid assets as a percentage of total assets



Sources: OSFI, U.K. Office for National Statistics, and U.S. Federal Reserve

Last observation: 2009Q3

enough that U.S. subsidiaries produced only small or negative returns in the first three quarters of 2009. In contrast, the core Canadian personal and commercial banking franchises of these banks have remained quite profitable.

Despite the above concerns, especially with regard to unsecured consumer credit and foreign exposures, total loan losses are expected to remain at manageable levels. For example, total provisions for credit losses as a percentage of pre-provision net interest income are about 26 per cent, leaving the banks with the earning capacity to absorb further increases in losses, should they occur **(Chart 28)**. The Bank estimates that, in a macroeconomic environment consistent with the projection outlined in the October 2009 MPR, loan losses will peak at 1.41 per cent of exposure-at-default (EAD) in the first quarter of 2010—a clear improvement compared with estimates consistent with the more adverse economic environment outlined in the April 2009 MPR **(Chart 29)**. The timing of peak losses is generally in line with private sector forecasts. Overall, expected loan losses are comparable with those in previous cycles, and not at a level that would threaten banks' stability. **Box 2** provides an overview of the model used by the Bank to estimate future loan losses. The assumptions underlying this projection are benign relative to those used for stress testing the household sector (pp. 23–26).

Liquidity

Since the last FSR, Canadian banks have maintained their stronger liquidity positions. Holdings of the most-liquid assets, namely cash and government securities, remain well above pre-crisis levels **(Chart 30)**. Moreover, Canadian banks appear to hold larger pools of liquid assets than their peers in the United States and the United Kingdom. They also appear to have sufficient funding, partly owing to a strong supply of retail deposits, whose share of total deposits has risen markedly in the last twelve months **(Chart 31)**. In addition, there has been less demand from banks for the extraordinary public sector liquidity programs. Taken together, the above factors suggest a continued improvement in the liquidity and funding profile of major Canadian banks.

Some challenges remain, however. Canada's banks face an increase in the amount of loans maturing over the coming years, owing to high pre-crisis levels of debt issuance, the shorter term to maturity of debt issued during the crisis, and maturities coming due from the extraordinary public sector liquidity programs.

The crisis clearly demonstrated that, around the world, banks did not give liquidity-risk management the attention it deserved. As discussed in the report, "Liquidity Standards in a Macroprudential Context" on p. 35, prudential regulators in Canada and abroad are working on standards to strengthen banks' management of liquidity risk.

Capital

Throughout the crisis, Canadian banks have maintained healthy capital ratios, and were able to raise capital from private markets and to continue extending credit (see **Table 3** on p. 21). Capital ratios have increased significantly since the last FSR

Box 2

Expected-Loss Model

To estimate future loan losses, the Bank uses an empirical model originally developed for the macro stress-testing exercise conducted as part of Canada's Financial Sector Assessment Program (FSAP) update in 2007.[1]

This model relates sectoral default rates, π^s, to the overall performance of the economy, where s represents sectors of economic activity using the classification employed by banks in regulatory reporting. Macroeconomic indicators used as control variables include Canadian GDP growth, the unemployment rate, the interest rate (medium-term business-loan rate), and the ratio of credit to GDP. The specification adopted for the model allows for non-linearities.[2]

Expected sectoral default rates are calculated as fitted values from the model's regressions, using the paths of the macroeconomic variables noted above that are consistent with the Bank's economic projection.

For each bank, a distribution of expected loan losses (El_t) over the simulation horizon is then calculated as follows:

$$El_t = \sum_{s=1}^{S} \pi_t^s * EAD^s * LGD^s,$$

where

- π_t^s is the fitted default rate in sector s at time t.
- LGD^s is the average rate of loss on defaulted loans to sector s. For the purpose of this exercise, the most recent sectoral LGD numbers provided by banks were used.
- EAD^s is the bank's estimate of its total credit exposure to defaulted loans in sector s at the risk horizon (typically one year), as required under Basel II. The most recent exposures-at-default (EADs) reported by banks were used, on the assumption that they remain constant over the scenario.

1. For a detailed description of the 2007 FSAP exercise, see D. Coletti, R. Lalonde, M. Misina, D. Muir, P. St-Amant, and D. Tessier, 2008, "Bank of Canada Participation in the 2007 FSAP Macro Stress-Testing Exercise." Bank of Canada *Financial System Review* (June): 51–59.
2. For more details on the construction of historical default rates and the importance of non-linearities, see M. Misina, and D. Tessier, 2007, "Sectoral Default Rates under Stress: The Importance of Non-Linearities." Bank of Canada *Financial System Review* (June): 49–54.

(Chart 32 and **Chart 33)**. This recent increase comes from two sources: declines in risk-weighted assets (the denominator of the ratio) and an increase in regulatory capital (the numerator of the ratio). The decline in risk-weighted assets appears to be due to both the ongoing shift from business lending towards secured residential lending and lower financial market volatility. Loans secured by residential property have a low risk weighting because they are insured. As well, lower market volatility reduces the amount of capital required to be held against both market risk and counterparty credit risk in the trading book, even in the absence of any change in the underlying trading positions.[24] Earlier this year, Canadian banks raised capital from financial markets, primarily in the form of non-common Tier 1 capital. More recently, the further increase in regulatory capital was primarily derived from growth in retained earnings, since banks earned profits in excess of dividends paid to common shareholders.

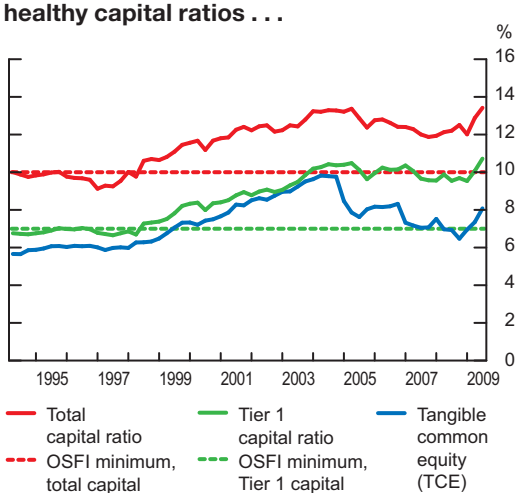
As is evident from their high stocks of tangible common equity capital, which is considered to be of higher quality than other forms of Tier 1 capital, the quality of capital of Canadian banks

Chart 31: Retail deposits are increasing
As a percentage of total deposits

Source: OSFI
Last observation: September 2009

24 This dynamic can contribute to procyclicality of capital requirements, as discussed in the June 2009 FSR.

Chart 32: Canadian banks maintain healthy capital ratios . . .

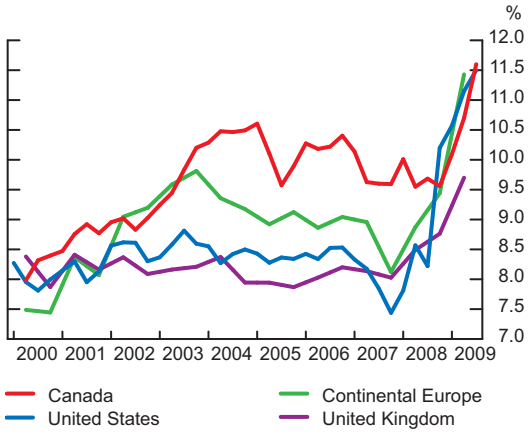


Source: OSFI

Last observation: 2009Q3

Chart 33: . . . and capital ratios are rising around the world

Tier 1 capital ratio

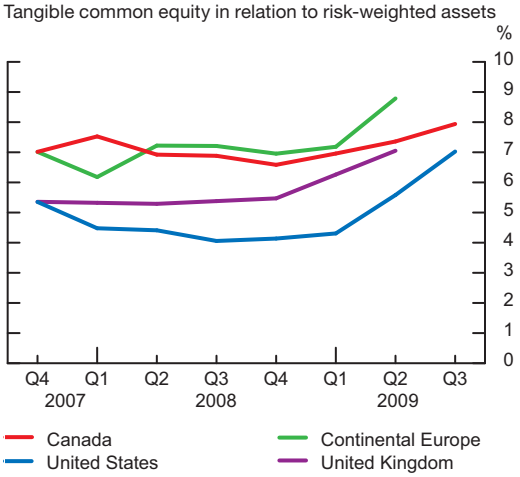


Source: Bloomberg

Last observation: Canada and United States, 2009Q3; Continental Europe and United Kingdom, 2009Q2

Chart 34: The quality of capital is improving

Tangible common equity in relation to risk-weighted assets



Source: Bloomberg

Last observation: Canada and United States, 2009Q3; Continental Europe and United Kingdom, 2009Q2

continues to compare well with that of their international peers, and has improved since the June 2009 FSR **(Chart 34)**. Moreover, the increase in the level and quality of the capital held by Canadian banks has not been a result of government support. There are a variety of regulatory and accounting changes on the horizon, however, that will increase the required amount of regulatory capital and tighten the definition of Tier 1 capital. The uncertainty surrounding the ultimate impact of these reforms on capital is likely a reason why banks continue to hold high levels of capital.

Leverage has been fairly stable. The leverage of Canadian banks was lower than that of many of their international peers before the crisis and, consequently, Canadian banks have not had to significantly deleverage **(Chart 35)**.

The upcoming adoption of International Financial Reporting Standards (IFRS) in Canada is expected to affect the capital of certain institutions. In particular, it will become increasingly difficult to obtain off-balance-sheet treatment for asset securitizations **(Box 3)**.

Continued profitability, encouraging signs on credit quality, and high capital ratios all suggest that capital adequacy is not a major risk for Canadian banks and that they are well positioned to deal with forthcoming regulatory changes.

Life insurance companies

Canadian life insurance companies continue to hold capital well above the current minimum requirements, but have seen significant volatility in their earnings and continue to face near-term challenges.

In recent years, life insurance companies increased the size of their segregated funds business segment. Since a significant portion of segregated funds guarantee the investors' principal investment and, in some cases, minimum returns, earnings of life insurance companies are highly sensitive to declines in equity markets. In 2008 and early 2009, the sharp downturn in equity markets caused a decline in earnings because the life insurance companies had to increase their provisions against these guarantees. This has since reversed, with the net income of life insurance companies benefiting from the sharp rebound in equity markets in the third quarter of 2009.

As well, life insurance companies hold large portfolios of corporate bonds related to their traditional business line, which can also be sensitive to market and credit conditions, although they primarily hold investment-grade bonds of relatively high quality. On the liability side of their balance sheets, life insurance companies are exposed to changes in market interest rates since they have long-duration liabilities, the value of which rises when interest rates fall. While they attempt to hedge this exposure by matching the duration of their assets and liabilities, some exposure remains. Accordingly, the earnings of some major life insurance companies were significantly affected in the third quarter by losses related to an increase in the value of their liabilities, primarily as a result of falling interest rates.

Box 3

Transition from Canadian GAAP to IFRS

Canadian publicly accountable enterprises will be required to adopt International Financial Reporting Standards (IFRS) for fiscal years beginning on or after 1 January 2011. IFRS are a set of globally accepted accounting standards issued by the International Accounting Standards Board (IASB) and used by many enterprises in the European Union and in much of the Pacific Rim.

While Canadian Generally Accepted Accounting Principles (GAAP) and IFRS are broadly comparable, there are some differences that will affect the financial reporting of Canadian enterprises.

For Canadian financial institutions, one of the primary differences between Canadian GAAP and IFRS is that it will become increasingly difficult to obtain off-balance-sheet treatment for asset securitizations. It is expected that many securitized assets will likely have to be brought back on balance sheets upon the transition to IFRS, including insured mortgages securitized through the National Housing Act Mortgage-Backed Securities (NHA MBS) and the Canada Mortgage Bond (CMB) programs of the Canada Mortgage and Housing Corporation (CMHC). Although this could affect regulatory capital ratios, the impact is not expected to be severe, since the majority of securitizations in the Canadian market are backed by insured mortgages, and these exposures usually carry a zero or low risk weighting. Assets-to-capital multiple (ACM) levels are expected to be under more pressure, since they rely on accounting measures. Small financial institutions that rely on government-sponsored NHA MBS/CMB programs as important funding sources will likely have to reassess their funding models, given the implications of changes in balance-sheet values for capital and leverage.

The transition towards IFRS has become increasingly complicated by numerous revisions to existing standards under both Canadian GAAP and IFRS, undertaken in the wake of the financial crisis. For example, the IASB is currently revising IAS 39 ("Financial Instruments: Recognition and Measurement"). The first phase of this project was completed on 12 November, with the publication of a new standard setting out when financial assets are to be measured either at fair value or amortized cost and eliminating the loans and receivables, held-to-maturity, held-for-trading, and available-for-sale categories. The IASB is also considering a move to an expected-loss model for the impairment of financial assets and changes to standards for the treatment of financial hedges.

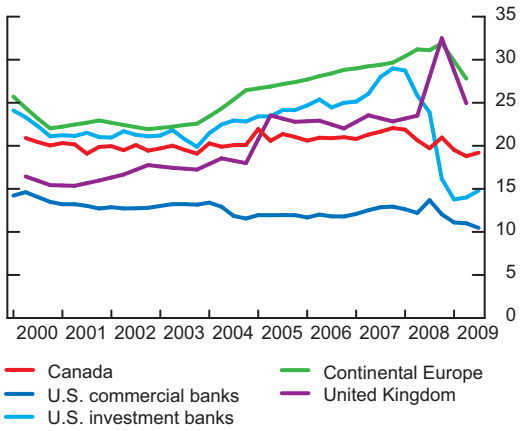
Given the joint program between the U.S. Financial Accounting Standards Board (FASB) and the IASB to make further progress towards a single set of global accounting standards, the number and the pace of changes are expected to remain elevated for the foreseeable future. This will increase the challenges faced by Canadian financial institutions in planning for the application of the new standards.

Canadian life insurance companies have raised additional capital over the past year, with Manulife, the largest insurer, raising a further $2.5 billion in common equity in November. It also cut its dividend to common shareholders by 50 per cent as additional protection against possible future shocks to earnings.

As in the banking industry, forthcoming changes in accounting and capital-adequacy standards could have significant implications for the insurance sector. Canada will converge towards IFRS in 2011, and accounting standards for insurance contract liabilities are being revised by the IASB. These changes could increase the volatility of earnings and capital at life insurance companies. In addition, regulators are considering improvements to regulatory capital regimes, with OSFI, which supervises Canada's federally incorporated insurers, considering enhancing the capital framework for insurers.

Chart 35: Canadian banks maintain relatively low leverage compared with many global peers

Leverage ratio[a]



a. Balance-sheet assets to shareholders' equity

Source: Bloomberg

Last observation: Canada and United States, 2009Q3; Continental Europe and United Kingdom, 2009Q2

Reports

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

Introduction

In light of recent events, there is now widespread recognition among policy-makers of the need to pay greater attention to the forces contributing to the buildup of systemic risk. This involves more explicit monitoring of the interlinkages across the financial system and of feedback between the financial system and the real economy, with a view to mitigating the buildup of financial imbalances.

An important agenda led by the G-20 has emerged with respect to implementing such a macroprudential approach. In Canada, a macroprudential approach is the shared responsibility of the Department of Finance and all of the federal financial regulatory authorities, including, of course, the Bank of Canada, the Office of the Superintendent of Financial Institutions, and the Canada Deposit Insurance Corporation. Ultimately, it is the Minister of Finance who is responsible for the sound stewardship of the financial system. The reports in this section of the *Financial System Review* provide an overview of some specific topics relevant to this work.

As highlighted by the recent crisis, confidence in the ability of financial institutions to meet their financial obligations is of paramount importance for the stability of the financial system, since a liquidity shortfall at a single institution can have system-wide repercussions. This has highlighted the need for improvements in the management of liquidity risk by individual institutions. **Liquidity Standards in a Macroprudential Context** examines ongoing international work to introduce liquidity standards based on commonly agreed metrics and discusses several issues related to the design and application of these standards.

Since financial institutions and market-makers rely on a subset of core markets to obtain the funds they need to perform their intermediation role, the continuous operation of these markets, even in times of stress, is essential to the stability of the financial system. **Improving the Resilience of Core Funding Markets** examines the importance of core funding markets to the liquidity of the Canadian financial system and outlines a range of policies designed to foster their resilience. These include policies to support the creation of more transparent, standardized, and well-designed financial instruments, and to improve the infrastructure underpinning core funding markets in order to prevent contagion.

Since the onset of the crisis, securitization markets, which had become an important source of funding in certain sectors of the economy (e.g., credit cards, auto and equipment loans and leases, and mortgages), have been affected by a significant decline in trading and issuing activity. **Reform of Securitization** examines some shortcomings in the securitization process, as well as a range of options for addressing them and for restarting securitization markets on a sounder basis. The objective is to reduce conflicts of interest, realign incentives, reduce the complexity of securitized instruments, and increase their tradability during periods of stress.

Towards a Stress-Testing Model Consistent with the Macroprudential Approach summarizes the first steps taken at the Bank to incorporate two channels of contagion into the macrofinancial model it uses to gauge the resilience of the financial system to adverse macroeconomic shocks. These channels are the network effects resulting from interlinkages among banks, and liquidity risk arising from fire sales of assets. This work suggests that taking these contagion effects into account tends to substantially increase projected aggregate losses in the banking sector stemming from an adverse macroeconomic shock.

Liquidity Standards in a Macroprudential Context

*Carol Ann Northcott and Mark Zelmer**

Introduction

The turmoil that started with the collapse of the U.S. subprime-mortgage market in mid-2007 erupted into a full-scale financial crisis in September 2008, following the bankruptcy of Lehman Brothers. Concerns about the quality of assets on bank balance sheets and uncertainty about future funding requirements associated with off-balance-sheet vehicles brought bank funding markets to a standstill. As major financial institutions (FIs) became concerned about their ability to access financial markets to meet their obligations, they significantly reduced the maturities of funds to each other in core funding markets. While perfectly rational for each individual FI, this undermined the functioning of funding markets, setting off a vicious circle. In retrospect, the practices used by FIs to manage liquidity risk prior to the crisis left them particularly vulnerable to a shock in core funding markets.

Improving the management of liquidity risk at FIs would strengthen their ability to absorb liquidity shocks. But, given the importance of markets to a bank's overall liquidity, fortifying each FI does not guarantee the stability of the financial system. Efforts must also be made to strengthen the resilience of core funding markets in times of stress, meaning that a more system-wide approach to the issue is also essential. In other words, improving the management of liquidity risk has both microprudential elements (improving liquidity-risk management at individual FIs) and macroprudential elements (the impact on markets and/or the extension of credit) that need to be carefully balanced.

Extensive public sector liquidity support for banking systems around the world led to calls by G-20 finance ministers and central bank governors in September 2009 for the introduction of new liquidity standards for internationally active banks.[1] This was accompanied by an announcement from the Basel Committee on Banking Supervision (BCBS) that it would introduce a global standard for funding liquidity that includes a "stressed liquidity coverage ratio" requirement, underpinned by a "longer-term structural liquidity ratio" (BCBS 2008). Work is continuing at the BCBS to define what these requirements will mean in practice. In this report, we outline some of the macroprudential challenges associated with such liquidity requirements and offer suggestions on how they could be addressed in the design of new liquidity requirements and through the promotion of more resilient capital markets. Taking these issues into account would help to ensure that the new requirements will promote more effective liquidity-management practices in the banking system without undermining the functioning of financial markets or the financial intermediation process more generally.

Improving the Management of Liquidity Risk

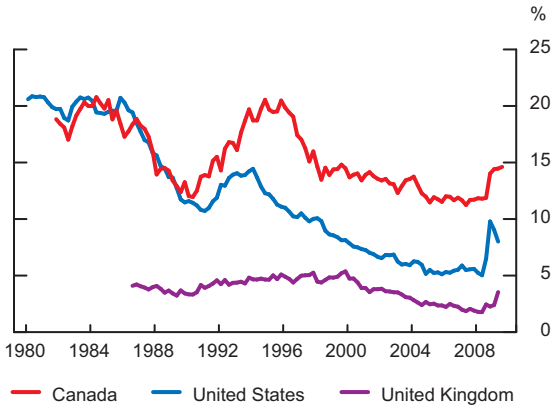
In retrospect, the management of liquidity risk by the banking sector does not appear to have been given the attention it deserved. Around the world, two trends in liquidity-risk management rendered banks particularly vulnerable to a shock: (i) their holdings of liquid assets as a share of total assets had been on a downward trend for many years; while (ii) their reliance on capital markets for funding had been on the rise, notably their reliance on wholesale deposits and securitization. In the aftermath of the Lehman failure, attention has focused on improving the management of liquidity risk at individual FIs. The argument

* Many thanks to Chris Graham for helpful comments.

1 "Declaration on Further Steps to Strengthen the Financial System," G-20 Meeting of Finance Ministers and Central Bank Governors (London, 4–5 September 2009). Available at <http://www.g20.org/Documents/FM__CBG_Declaration_-_Final.pdf>.

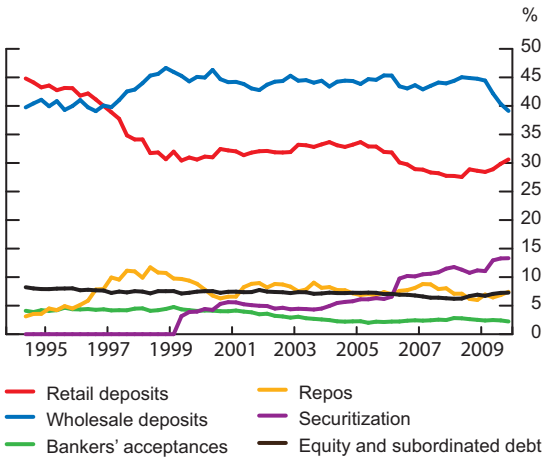
Chart 1: Canadian banks hold higher levels of liquid assets

Liquid assets as a share of total assets



Note: Liquid assets are defined as cash and cash equivalents, government issued-/guaranteed securities, and secured loans to brokers.
Sources: Canada, OSFI; United States, Flow of Funds Accounts; United Kingdom, Bank of England
Last observation: 2009Q3

Chart 2: The major Canadian banks have a mix of funding sources



Note: Wholesale deposits include business deposits and some market debt.
Source: OSFI
Last observation: 2009Q3

here is that larger holdings of liquid assets and less reliance on shorter-term wholesale funding markets should better position FIs to withstand shocks to key funding markets and result in a more resilient system as a whole. There is some validity to this argument, which can be seen by comparing the performance of major Canadian banks with that of their international counterparts.

Canadian banks were not immune to the liquidity crisis—they faced serious funding pressures, especially in foreign capital markets. Nevertheless, they fared relatively well compared with their international peers. With the support of liquidity facilities provided by the Bank of Canada and the federal government's Insured Mortgage Purchase Program (IMPP), they were able to significantly increase their holdings of liquid assets and obtain needed funding without having to engage in large sales of less-liquid assets into illiquid markets.[2]

Several factors help to explain this relative resilience of Canadian banks. First, they did not hold the same quantity of "toxic" assets as their international peers and had strong capital ratios and high-quality capital that enabled them to absorb the losses that did occur. For example, Canadian banks were not involved in the U.S. subprime-mortgage market to the same extent as many of their major foreign counterparts, and thus were (generally) seen as less-risky counterparties in funding markets. Second, and perhaps even more important, were their liquidity and funding profiles. While Canadian banks have, over time, reduced their holdings of liquid assets as a share of total assets, the relative decline was more modest than in some other countries **(Chart 1)**. Third, while Canadian banks have increasingly relied on funding from capital markets, this has been balanced to some extent by continued reliance on retail deposits for a significant share of their funding **(Chart 2)**. Moreover, their reliance on securitization markets has been markedly less than was the case internationally.[3] As noted by the International Monetary Fund (IMF), with relatively larger holdings of liquid assets and more stable sources of funding, Canadian banks were better positioned to handle liquidity shocks than many foreign banks.[4]

Liquidity Metrics Proposed by the BCBS

Given the need to enhance liquidity-management practices, in early 2008, the Financial Stability Forum (now the Financial Stability Board) set an agenda to address a range of issues, including the identification and measurement of liquidity risk and the use of stress tests to improve the funding plans of FIs (FSF 2008). The BCBS has since published several papers, including updated principles for sound liquidity-risk management (summarized in the box on p. 37) and is working on new regulatory standards for liquidity at internationally active banks (BCBS 2008).

Liquidity-coverage ratio The first proposed standard is a minimum liquidity-coverage ratio that can be applied in a cross-border setting. This standard, as specified by supervisors, would help to ensure that internationally active banks have sufficient high-quality liquid assets to withstand a stressed funding scenario. The objective is to ensure that a bank maintains an adequate amount of unencumbered,

2 See Zorn, Wilkins, and Engert (2009) for more on the actions taken by the federal government and the Bank of Canada during the turmoil to improve liquidity and funding conditions.

3 Securitization has recently become more important, owing to government programs to improve liquidity (e.g., the IMPP). Indeed, throughout the crisis, Canadian FIs were able to generate funds by insuring their mortgages and securitizing them through the Canada Mortgage Bond program operated by CMHC.

4 See Ratnovski and Huang (2009) for a recent study on the resilience of Canadian banks.

high-quality assets that can be converted into cash to meet its liquidity needs over a specified horizon under a specific stressed liquidity scenario. In connection with this proposed standard, the BCBS is also developing a definition of "highly liquid assets."

Structural liquidity ratio Second, there is an additional standard that underpins the liquidity-coverage ratio to address structural mismatches in liquidity and core funding over longer-term horizons.

From a microprudential perspective, these standards have the potential to elevate the importance of liquidity-risk management within FIs and to improve practices. However, if they are poorly designed, they could have undesirable macroprudential consequences. To achieve a balance between the micro- and macroprudential elements, one should carefully consider the objectives of the standards and how they would function in normal times and in times of systemic stress.

The Design and Operation of Liquidity Standards: Some Issues

The role of liquid assets is to allow FIs to continue to meet their obligations when a funding shock occurs without their having to excessively deleverage, reduce productive credit extension, or come prematurely to the central bank. The question is, of course, how much is enough? The more liquid assets that are held, the larger (or longer) the shock that can be absorbed. However, the more liquidity an FI holds, the less it can lend out. Therefore, a balance must be struck between appropriate liquidity management and the extension of credit to the broader macro economy.

To promote good management of liquidity risk and to mitigate moral hazard, banks should be required to hold enough liquid assets to self-insure against institution-specific and most adverse market shocks. But how far should an FI go in insuring against the latter? Clearly, it would be prohibitively inefficient, if not impossible, for an FI to fully protect

Principles for Sound Liquidity-Risk Management

In September 2008, the Basel Committee on Banking Supervision (BCBS) published updated principles for sound liquidity-risk management and supervision. The fundamental principle is as follows:

> A bank is responsible for the sound management of liquidity risk. A bank should establish a robust liquidity risk management framework that ensures it maintains sufficient liquidity, including a cushion of unencumbered, high quality liquid assets, to withstand a range of stress events, including those involving the loss or impairment of both unsecured and secured funding sources. Supervisors should assess the adequacy of both a bank's liquidity risk management framework and its liquidity position and should take prompt action if a bank is deficient in either area in order to protect depositors and to limit potential damage to the financial system.

Sixteen other BCBS principles support the fundamental principle in greater depth, covering the following key areas:

1. Governance of liquidity-risk management

   e.g., liquidity-risk tolerance; development of strategies, policies, and practices; internal pricing.

2. Measurement and management of liquidity risk

   e.g., a process for identifying, measuring, monitoring, and controlling liquidity risk; diversification in the sources and tenor of funding; management of collateral and intraday liquidity; stress testing; contingency funding plans; maintenance of a cushion of unencumbered high-quality liquid assets.

3. Public disclosure

   e.g., regular disclosure of information so that market participants can make informed judgments about each FI's liquidity risk.

4. The role of supervisors

   e.g., regular assessment of each FI's liquidity-management practices; intervention; communication with other authorities.

Further details on each of these principles can be found in the report by the Basel Committee on Banking Supervision, "Principles for Sound Liquidity Risk Management and Supervision," published September 2008 and available on the BIS website at <http://www.bis.org/publ/bcbs144.htm>.

itself against systemic shocks.[5] Thus, to balance the costs and benefits of liquid assets, we believe that, consistent with the BCBS principles for liquidity management, the objective of a microprudential tool, such as a liquidity standard, should be for FIs to protect themselves against their own institution-specific liquidity and funding shocks, as well as most adverse market shocks, including the risk of loss or impairment of both secured and unsecured funding sources. Implementing such standards should also leave FIs in a better position to manage systemic shocks when they occur.

In light of the lessons learned from the crisis, the standards should encourage holdings of high-quality liquid assets and a stable mix of funding in good times. Further, they should support the efficient functioning of funding markets in times of systemic stress. In other words, FIs should not find themselves having to boost their liquid assets and curtail their activities in core funding markets during periods of systemic stress, since these actions could undermine the functioning of those markets.

Defining highly liquid assets

Financial institutions need to hold a stock of high-quality liquid assets and have confidence that those assets can be readily sold to raise the necessary cash to deal with funding shocks. Holding these assets helps to mitigate moral hazard, since the FIs own resources are the first to be used to combat a funding shock.

Defining "liquid assets" for the liquidity standards is an important issue currently under discussion at the international level. One option under consideration is to apply a narrow definition comprising only government debt securities, since those assets are the most likely to be liquid in times of systemic market stress. Another is to broaden the definition to include high-quality assets that are liquid in a range of normal (including adverse) market conditions. An example of this type of asset would be actively traded investment-grade public and private sector debt securities with finite maturity dates.

Choosing between these two options raises some interesting macroprudential issues. Would a narrower definition distort relative prices between assets that are eligible for meeting the standard versus assets that are not? Would a narrow list undermine the functioning of the market for eligible assets? This could occur if FIs are required to effectively immobilize eligible assets to meet the requirements, thus reducing market liquidity for them.[6] In addition, a broader list may help to sustain liquidity in the markets for the additional assets when markets are unsettled, since FIs may be more willing to trade them, knowing that they meet the liquidity standards. And, finally, would a narrow set of eligible assets increase the risk seen in many developing and emerging-market economies in the past, where liquidity standards degenerated to the point of being used as instruments to compel FIs to purchase government debt?

Drawing down liquidity in times of stress

The purpose of holding a supply of high-quality liquid assets is to permit the FI to use them to meet obligations when a shock occurs. That is, liquid assets are useful only if they can be used. While standards will outline how much liquidity is appropriate for the prudent management of liquidity risk, supervisors in each jurisdiction will determine the actions banks should take to address any shortfalls.

Institution-specific shocks occur much more frequently than systemic ones. In the case of the former, there must be consequences for not adhering to the standards if supervisors are to encourage the prudent management of liquidity risk and mitigate moral hazard. For example, failure to meet the standards could result in more intense supervision or require actions to move the FI back into line with the standards. If markets notice that an FI is falling below the minimum, they may see this as a signal of poor quality and act accordingly. Standards can thus play an important role in influencing the behaviour of FIs by clearly indicating what is considered to be prudent behaviour.

The challenge comes when the event is a systemic shock, as occurred in the autumn of 2008. In this period of heightened aversion to credit risk, FIs saw their access to funding markets evaporate, since, at the height of the crisis, counterparties would only place funds with them for very short maturities. Uncertainty regarding future access to funding boosted FIs' demand for liquid assets, which, at a systemic level, could only be met by either increased issuance of government debt or by liquidity supplied by central banks.[7] In such circumstances, the liquidity positions of FIs relative to a regulatory liquidity standard that is defined in terms of funding needs over a specified horizon may deteriorate, but that deterioration is an indication of systemic stress.

5 True systemic funding/liquidity shocks are rare events, beyond those outlined in the BCBS liquidity-management principles. While there are various definitions, for simplicity, we assume that a systemic shock is characterized by a sudden and indiscriminate aversion to credit risk, a dramatic decline in the liquidity of all but the highest-quality assets (e.g., sovereign debt), and a sudden, significant increase in system-wide bank funding costs relative to government yields.

6 This may have been the case in the past when Canada had minimum liquidity requirements (called "secondary reserve requirements") that required banks to hold prescribed minimum amounts of treasury bills on their balance sheets. As noted in Bank of Canada (1987), one unintended consequence was that they inhibited the development of the treasury bill market in the late 1960s and early 1970s until the stock of treasury bills grew well beyond the needs of the banking system.

7 A key difference between non-systemic and systemic events is that, in the former, just one FI is taking action to meet the liquidity standard (selling lower-quality assets to buy high-quality assets from other market participants). In normal times, the market will absorb this behaviour. In a systemic event, a large number of FIs are attempting to take the same mitigating actions, which has negative effects on the markets. Increased demand for high-quality assets against a limited supply increases their price (reduces yields in a flight-to-quality situation).

Moreover, it may not be possible for FIs to collectively generate liquidity by reducing the amount of credit they supply to customers. Attempts by FIs to collectively reduce credit supply could result in customers withdrawing funds from the system to service their own obligations. This, in turn, would aggravate the funding pressures on the financial system as a whole, thereby negating, at least in part, the benefits gained from restricting growth in less-liquid assets.

Therefore, while there must be consequences for FIs that fall below the standards in most periods, from a macroprudential perspective, it is extremely unhelpful if, in an exceptional period of systemic stress, the liquidity standards give FIs an incentive to disengage (more than they otherwise would) from funding markets and decrease their market-making activities.

Limiting procyclicality in liquidity requirements

Ideally, one would like FIs to increase their holdings of liquid assets and fund with longer maturities in good times so that they can use the stock of liquid assets and have fewer funding pressures in bad times (however defined). This would allow them to better deal with funding shocks without excessive deleveraging by selling assets or by dramatically cutting new lending.

As noted previously, however, the funding liabilities of FIs tend to shorten in term to maturity when markets are under stress. This results in an increase in rollover risk and could cause liquidity requirements under a regulatory standard tied to funding requirements over a specified horizon to increase in a systemic event. These pressures can be addressed by central banks outside of the new liquidity standards. For example, central banks can broaden the range of assets they accept in their market operations and standing liquidity facilities in times of extraordinary systemic stress, as was done by the Bank of Canada and other central banks during the recent crisis. Nothing is more liquid than central bank money, and central banks can satisfy the financial system's demand for liquidity at all times. Thus, FIs could continue to meet the standards without having to deleverage by pledging a wide range of illiquid assets to the central bank in periods of systemic stress to obtain the liquidity they need to meet their obligations as they come due.[8]

Local versus global minimum liquidity requirements

An interesting intersection between markets and liquidity standards is the issue of whether internationally active FIs should be required to hold and manage liquidity on a local, or a global, basis and also on a currency-by-currency basis. Many internationally active FIs currently manage liquidity on a global basis and assume that funding in the major currencies is freely convertible and, hence, does not necessarily need to be matched, currency by currency. This enables them to allocate liquidity efficiently across the enterprise, thus minimizing their cost of holding liquid assets while ensuring that their obligations can be met on a timely basis. However, some regulatory authorities, most notably the U.K. Financial Services Authority, have argued that liquidity requirements should be applied on both an enterprise-wide basis and on a local jurisdiction basis. This would ensure that local branches and subsidiaries of foreign banks maintain appropriate funding structures and have enough liquid assets on hand locally to manage domestic liquidity shocks on their own before having to call on the resources of foreign parents and affiliates.

Local liquidity requirements benefit individual jurisdictions that have concerns about the ability and willingness of foreign parents to provide liquidity support to their affiliates. However, if applied too stringently, such practices could raise some interesting macroprudential questions. For example, the requirements would reduce the ability of a subsidiary or branch to draw upon the liquidity resources of the parent in times of stress.[9] They could also increase global liquidity requirements and raise the cost of financial intermediation, resulting in a reduction of the supply of credit globally. To what extent might this be a concern? The BIS Committee on the Global Financial System is currently investigating the various trade-offs.

There may be other ways to tackle the concerns of authorities in this area. For example, steps could be taken to improve the efficiency of foreign exchange swap markets to facilitate the movement of funds across borders and across currencies.[10]

Improving the Resilience of Core Funding Markets

From a microprudential perspective, liquidity standards should help FIs to cope with funding shocks when they arise. However, it is also useful to consider the steps that could be taken to reduce the risk of funding shocks occurring in the first place. An important lesson from the crisis is the need to improve the resilience of core funding markets, since those markets will continue to be an important source of funding for FIs in the future.

8 One way central banks can mitigate the moral hazard of providing liquidity support in this regard is by limiting the number of FIs with which they deal and making them compete with each other for the liquidity being supplied. This argument is outlined in more detail in Chapman and Martin (2007).

9 Pooling liquidity has long been recognized as a useful way for FIs to manage their exposures to idiosyncratic funding shocks, since the risk of all FIs (or all entities within an FI group) being exposed to the same shock at the same time is fairly low. However, the benefits of pooling are reduced in cases of systemic shocks, since most FIs (or all entities within the same FI) would be exposed to the same shock at the same time.

10 Central bank swap facilities proved helpful in this regard. Alternatively, the use of a central counterparty to clear foreign exchange swaps might also facilitate fund movements across borders.

Several initiatives are under way in various international forums to improve the transparency of financial instruments and enhance infrastructure arrangements (e.g., by establishing central counterparties) and to look at margin requirements and haircuts. Central banks are uniquely positioned to contribute to these issues, given their role as lender of last resort and their ability to provide (virtually) unlimited liquidity. Indeed, a major initiative is under way at the Bank of Canada to improve the resilience of the repo market and other core markets that are important from a system-wide perspective. For more on these initiatives, see "Improving the Resilience of Core Funding Markets" on p. 41 in this issue.

Conclusion

The recent liquidity crisis has highlighted the need for the improved management of liquidity risk by individual institutions, and for improved resilience in core funding markets. In the wake of the extensive public sector liquidity support for banking systems around the world, the BCBS has begun work on introducing liquidity standards based on commonly agreed metrics. This is important work, since such standards, if appropriately designed and applied, have the potential to greatly improve the management of liquidity risk within FIs and to improve their ability to deal with a wide range of liquidity and funding shocks.

We argue here that the objective of a liquidity standard should be to encourage FIs to self-insure against institution-specific and most market shocks. This objective will provide a balance between prudent liquidity-risk management and mitigation of moral hazard and the efficient use of liquidity. To provide these benefits, the standards should require FIs to hold a prudent stock of high-quality liquid assets and a stable mix of funding in normal times.

The standards should also support the functioning of core funding markets in times of systemic stress. The latter must be designed so that they do not worsen the situation for funding markets already under systemic stress by motivating FIs to conserve liquid assets and disengage from funding markets, further decreasing their market-making activities. However, it is important to bear in mind that central banks can help FIs cope with the demands of the standards in periods of systemic stress by expanding the range of assets they accept in their market operations and standing liquidity facilities in exceptional circumstances.

Finally, the introduction of liquidity standards begs the question of whether they should be applied on a consolidated enterprise-wide level, on a currency-by-currency basis, or at the local entity level. As noted previously, this raises some interesting macroprudential issues, since applying them too stringently could undermine global capital flows and impede the supply of credit to the global economy.

In the end, it is important to bear in mind that the introduction of liquidity standards is only one piece of the puzzle. It is also important to consider what can be done to reduce the risk of funding shocks occurring in the first place. This is why the Bank of Canada and other central banks are working together and with major market participants on various initiatives to improve the resilience of core funding markets here in Canada and abroad.

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Improving the Resilience of Core Funding Markets

*Jean-Sébastien Fontaine, Jack Selody, and Carolyn Wilkins**

Financial markets and financial institutions are the core of the financial system. They channel savings to investment and allocate risk to those willing and able to bear it. The recent crisis revealed that *both* markets and institutions are more stable when core funding markets operate continuously, especially in times of financial stress. Core funding markets provide essential funding liquidity to financial institutions and market-makers, the key providers of liquidity to the financial system. Funding liquidity is therefore central to the efficient and stable functioning of the financial system, benefiting not only those who depend directly on core markets, but also the economy as a whole (Carney 2008).

In promoting the safety and efficiency of our financial system, and as the ultimate provider of Canadian-dollar liquidity to the financial system, the Bank of Canada has an interest in seeing that the core markets function continuously, even in times of stress. This article describes the importance of core funding markets to financial system liquidity and identifies the characteristics that are key to making these markets work effectively. Also outlined is the range of policies that are essential to supporting the resilience of core funding markets, as well as some initiatives under way in Canada and globally that are aimed at improving market infrastructure.

Enhancing the ability of core funding markets to operate under stress involves improving the infrastructure that supports these markets. As an important first step, the Bank of Canada is working closely with industry leaders (the Investment Industry Association of Canada, or IIAC) on an initiative to develop a more effective central counterparty framework for repo transactions in Canada, with the objective of making the repo markets more efficient in good times and less vulnerable in times of stress. Improving the resilience of core funding markets also involves providing liquidity support to these markets in extraordinary times, and structuring that support in such a way that it does not distort the efficiency of markets in normal times.

Core Funding Markets Provide Essential Liquidity

A modern financial system includes many types of markets that expand the opportunities for allocating risk and matching savers with borrowers, thus adding to the efficiency of the economy (Bauer 2004). A number of these markets are systemically important in that real economic activity would be significantly disrupted if they ceased to function effectively. As well, a subset of these systemically important markets—core funding markets—is necessary to the process of generating liquidity within the financial system, and thus these markets are at the centre of the financial system.

Key intermediaries use core funding markets for two main purposes. First, temporary mismatches between revenue inflows and outflows are funded in these markets to maintain the funding liquidity of financial institutions. Second, core funding markets allow market-makers to efficiently finance long positions and cover short positions associated with market-making activity. This is necessary to facilitate transactions in other markets and, hence, the market liquidity that drives asset prices closer to their fundamental values.

Core funding markets can become an important channel for contagion in times of stress (Brunnermeier 2009), as was demonstrated vividly in the recent crisis (Gorton and Metrick 2009). When the costs and risks of using these

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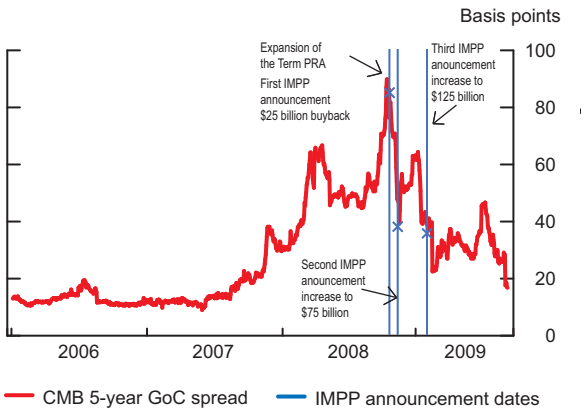
markets rise as the result of an adverse shock, as happened with the dramatic rise in uncertainty about counterparty risk and the reduction in balance-sheet capacity following the Lehman Brothers' bankruptcy in September 2008, key intermediaries may hoard liquid assets and substantially curtail—or even temporarily stop—their market-making activities. The overall capacity of core funding markets to generate liquidity for the financial system would be reduced if enough intermediaries were to simultaneously react this way. Moreover, this decrease in funding liquidity could come at a time when the financial system needs an *increase* in liquidity to buffer the shock. As a result, a vicious circle, or "liquidity spiral," can be set off (Brunnermeier and Pedersen 2009). If the shock and reaction are sufficiently severe, funding markets can effectively shut down, creating a generalized liquidity crisis.

The behaviour of spreads on Canada Mortgage Bonds (CMBs) during the recent period of market turmoil suggests that this contagion channel was at work. CMBs are explicitly guaranteed by the Government of Canada (GoC) and, thus, changes in the spreads of CMBs (above the yields on bonds issued directly by the GoC) reflect a lack of market liquidity, not changes in the risk of default. Following the collapse of Lehman Brothers in September 2008, CMB spreads rose markedly from relatively low and stable levels **(Chart 1)**. As is well known, spreads across fixed-income markets also widened sharply over this period. The rise in corporate bond spreads, or other non-government securities, also reflected expectations of a deteriorating economic environment and the associated increase in defaults. The same cannot be said of the rise in CMB spreads.

It is therefore likely that a rising system-wide liquidity premium explains the common increase in all fixed-income spreads relative to more-liquid GoC securities. Funding markets for securities other than GoC securities were severely disrupted following the collapse of Lehman Brothers, as were the funding markets for financial institutions, as evidenced by the large spike in the Canadian Dealer Offered Rate-overnight index swap (CDOR-OIS) spread **(Chart 2)**. The impact of the Bank's Term Purchase and Resale Agreement (PRA) Facility[1] and the federal government's Insured Mortgage Purchase Program (IMPP), introduced in October 2008, also suggests that illiquidity was a key factor in rising spreads.[2] For example, by December 2008 just prior to the second IMPP announcement, CMB spreads had dropped by around 33 basis points, while all other spreads had increased as the crisis intensified (including spreads on high-quality provincial bonds). By January 2009, CMB spreads had fallen further, while all other spreads were either flat or higher. With the generalized improvement in market conditions that took hold in March 2009, all spreads tightened considerably.

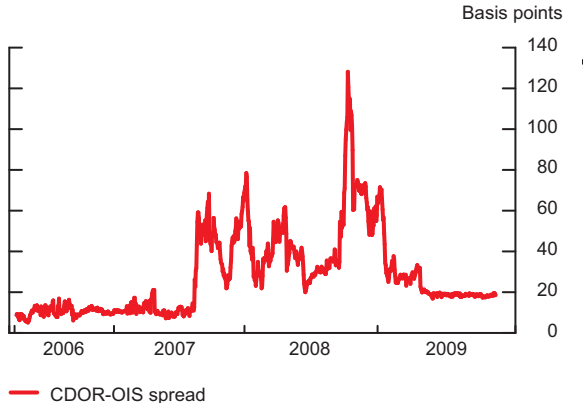
Chart 1: The increase in the spread on CMBs illustrates the rising liquidity premium during the crisis



Source: Bloomberg

Last observation: 1 September 2009

Chart 2: The sharp rise and fall in the 3-month CDOR-OIS spread highlights the pressures in funding markets for financial institutions



Source: Bloomberg

Last observation: 16 November 2009

Core Funding Markets Connect Major Players in the Financial System

As discussed above, core funding markets are at the centre of the financial system's process for generating liquidity. These markets are critically important: if any one of them disappeared, there would be no substitute for its function,

1 In particular, the Bank increased the frequency for term PRA operations to weekly (from the biweekly schedule followed earlier), expanded the list of eligible counterparties to include LVTS participants in addition to primary dealers, and added a 3-month maturity (see Zorn, Wilkins, and Engert 2009 for details). Given that CMBs are eligible securities in this program, the term PRA reduced funding costs of CMBs.

2 Under the IMPP, the government purchased, through the Canada Mortgage and Housing Corporation, large amounts of insured residential mortgage pools from eligible financial institutions. This freed up capital, thereby relaxing the aggregate borrowing constraint on financial intermediaries and reducing compensation for risk across all asset classes. Clearly, the IMPP did not affect the liquidity premium of all fixed-income assets similarly, but it is likely that corporate spreads would have continued their increase had the IMPP not been introduced.

and the system's generation of liquidity would be significantly disrupted. Moreover, these markets represent a potential source of contagion for the financial system because they facilitate vital links between systemically important financial intermediaries and market-makers and support the functioning of other core markets. This creates critical interdependencies at the centre of the financial system.

A core funding market has three characteristics:

(i) It is an important source of funding for the institutions, market-makers, and governments at the centre of the financial system.

(ii) There is no immediate substitute for this funding source, so that aggregate funding to the financial system is reduced if this source is diminished.

(iii) If a core market ceases to function, there is likely to be important contagion between major institutions and markets, which can spread into a broader array of institutions and markets.

The structures of financial systems vary between countries and over time. Consequently, what constitutes a core funding market can also vary between countries and over time. **Table 1** identifies core funding markets in Canada at the present time and describes these markets in terms of the characteristics identified above. The sovereign debt market is at the core of the financial system in Canada, as is the case in many jurisdictions. Aside from providing funds to the federal government, which is the ultimate guarantor of the financial system, this market provides the benchmark curve for pricing—directly or indirectly—all other financial transactions. Important disruptions in primary and

Table 1: Defining characteristics of core funding markets

Core funding markets		Important source of funding	Substitutes	Contagion
Government of Canada	Treasury bills, bonds	Provides funds for the Government of Canada, which is the ultimate guarantor to the system	None	Benchmark curve for pricing of most other financial transactions; facilitates secured funding
Repo	Government of Canada bonds, provincial bonds, CMBs	Important economic function because they finance major activities of financial institutions (FIs) such as: (1) financing long positions; (2) financing transactions motivated by low funding costs relative to other investments; (3) covering short positions/borrowing of securities	No real substitutes other than going to the deposit base (for banks) or being forced to sell to obtain liquidity; the latter can lead to contagion in the face of an aggregate liquidity shock.	All major FIs and a wide range of institutions are active. Supports important cash markets (i.e., Government of Canada, provincial bonds, and CMBs)
Securities lending		Small size, but important for financing activities such as: (1) borrowing to cover a short position (i.e., settlement coverage, directional shorting, market-making, and arbitrage trading); (2) borrowing as a part of a financial transaction motivated by the desire to lend cash; (3) borrowing to transfer ownership temporarily to the advantage of both lender and borrower (e.g., arbitrage of dividend reinvestment plans); (4) upgrading collateral to obtain liquidity	No real substitutes	All major FIs are active, as well as many large institutional investors (e.g., pension funds and mutual funds). Facilitates the well-functioning of the repo market and also of important cash markets
Unsecured private money markets	Bankers' acceptances (BAs)	Provide a source of short-term funding for banks and their corporate clients; perform a role similar to that of the unsecured interbank market, which is very small in Canada	FIs issuing BAs would be forced into the securitized money market or longer-term debt	All major FIs are active, as well as many large institutional investors (e.g., mutual funds, pension funds). This is an important segment of the Canadian money market and supports pricing in the market for commercial paper and asset-backed commercial paper.
Foreign exchange	Spot and swap	Important source of funding for large domestic financial institutions and corporations with foreign currency liabilities, and for foreign institutions with Canadian-dollar liabilities.	No real substitutes, other than asset sales or direct funding in local markets	All FIs, market-makers, and large corporations rely on these markets.

secondary markets for government bonds (particularly "on the run" bonds) would result in severe disruptions in other markets, including core private funding markets.

Repo markets are also clearly core, since they are used extensively by banks and market-makers to finance their inventories of securities. Repo markets can be used to fund positions in an associated cash market, as well as to fund temporary shortfalls in revenue. This implies that a repo market, although small, is core if it is essential to the liquidity of a systemically important cash market. The securities lending market is core because it facilitates the well-functioning of the repo market and also of important cash markets for various securities, including government bonds. The market for BAs is core because it is used by banks and their clients as short-term liquidity pools.[3] The foreign exchange markets are core to funding for large domestic financial institutions with foreign currency obligations, and for foreign institutions with Canadian-dollar liabilities.[4] Without the ability to convert foreign funds to Canadian dollars, or vice versa (either through the swap market or in the spot market), domestic entities with foreign currency liabilities or foreign entities with liabilities in domestic currency would be forced to fund in local markets, even at times when these markets were under stress.

Core Funding Markets Need Support to Operate Effectively When Under Stress

For funding markets to function well, they need market liquidity so that market participants are able to trade on short notice at predictable prices. Generally, market liquidity requires that key intermediaries, including financial institutions and market-makers, are ready to transact on both sides of the market in significant volumes. A number of underlying problems can undermine the liquidity of funding markets and, hence, their resilience.[5] The first challenge is incomplete or asymmetric information about the quality of securities and counterparties (Hellwig 2008). This uncertainty makes it difficult for market participants to assess the risks they face: market risk, counterparty risk, and credit risk. The second potential problem is a weak market infrastructure that magnifies risk when placed under stress and encourages herding behaviour or limits the ability of market participants to take on more risk in response to large shocks. The final problem is related to regulatory and market practices that, through the "paradox of thrift," undermine the resilience of core funding markets in times of stress (Carney 2009; Persaud 2009).

Keeping core funding markets continuously open requires that these problems be addressed through policies and infrastructure that support the private generation of liquidity and provide central bank support when required. Both of these elements are needed to support core funding markets, although the frequency of central bank intervention is reduced by a set of policies and an infrastructure that greatly reduce the risk that idiosyncratic shocks would trigger contagion that could disrupt system-wide liquidity.

Policies and infrastructure to support private generation of liquidity

Given the problems that can disrupt core funding markets in times of financial system stress, the resilience of these markets can be strengthened in at least three areas:

(i) policies that support the creation of more transparent, standardized, and well-designed financial instruments;

(ii) sound clearing and settlement processes with risk-reducing elements, such as central clearing counterparties, where appropriate; and

(iii) a solid framework governing the behaviour of market participants.

Policies that support the creation of more transparent, standardized, and well-designed financial instruments help markets to remain liquid, which, in turn, supports the resilience of core funding markets. These policies help to build focus, cohesion, and critical mass in the market (Swann 2000). Product standardization decreases informational asymmetry and uncertainty by reducing diversity in the characteristics of a product, making it less costly to acquire information about that product and to assess its quality. Ultimately, a central bank could contribute to the standardization of the securities traded in core funding markets by taking as collateral for its lending facilities only those products that conform to a certain standard.[6]

Market resilience is also supported by sound clearing and settlement processes, as well as central counterparties, where appropriate. The Bank of Canada engages in active discussions organized by industry associations (e.g., IIAC, Canadian Foreign Exchange Committee) and international bodies (e.g., Financial Stability Board, Committee on the Global Financial System) that encourage the identification, development, and implementation of best practices in a timely and consistent fashion. As noted, the Bank of Canada is working closely with the IIAC to develop an effective central counterparty framework for Canadian-

3 The commercial paper markets (both secured and unsecured), while important for financial system efficiency, are not considered to be core funding markets at the present time in Canada. The unsecured commercial paper market is too small, and to a large extent, can be replaced by BAs. The asset-backed commercial paper (ABCP) market, while larger, is also not considered to be core because it too can be replaced by BAs (and other types of bank borrowing). Some derivatives markets, such as interest rate swaps, are important because they are relied upon to manage risk in the face of financial shocks, but they are not considered core to funding.

4 Institutions also fund foreign currency obligations in local markets.

5 These factors are not unique to funding markets, but can apply to markets in general.

6 The Bank of Canada implemented strict transparency requirements for ABCP accepted as collateral in its lending facilities.

dollar repo markets to make these markets more efficient in good times and less vulnerable in difficult times.[7] This initiative is important because Canadian-dollar repo markets are central to the private liquidity-generation process, and they experienced a period of significant illiquidity in the autumn of 2008, as counterparty concerns grew following the failure of large financial institutions in foreign markets. At the same time, the practice of hoarding liquidity for precautionary purposes also increased, owing to the extreme uncertainty that prevailed. While several factors were at play, inefficient balance-sheet netting likely exacerbated the problem, since the cost of using repo markets for funding was particularly elevated as balance sheets became more of a constraint. In this regard, the identification of the solution to this problem and the establishment of a plan to implement new infrastructure constitutes important progress.

Finally, a solid framework governing the activities and conduct of market participants is also essential. As highlighted in the G-20 declarations, this would include appropriate regulation and accounting standards and credible credit-rating agencies. Another key factor for continuously functioning core funding markets is the way in which liquidity is monitored and regulated. Regulation governing reporting and accounting standards can ensure that all entities have access to a minimum and consistent body of information. Credit-rating agencies can provide independent in-depth analysis and opinions that expand the information available for outside analysis.

Central bank policies to support continuously functioning core funding markets

Enhancing the private generation of liquidity for core funding markets reduces, but does not eliminate, the likelihood that the financial system will become illiquid in a crisis. It is still possible that an aggregate shock to the central elements of the financial system, a shock that requires all financial intermediaries to rebalance risk in a similar way, will generate a demand for liquidity that is greater than the capacity of the financial system to generate it. In such circumstances, the central bank can provide liquidity to the financial system to help it cope with the shock. The central bank may want to provide liquidity to institutions or to markets, depending on the nature of the shock. Such central bank intervention supports financial stability and enhances the effectiveness of monetary policy.

A central bank can use three types of tools to support core funding markets (Cecchetti and Disyatat 2009):

(i) *Lending or borrowing in the open market.* Repos and securities lending can be used to affect the distribution of liquidity in the financial system when the private creation of liquidity breaks down in the face of an aggregate liquidity shock. This approach gives funding support to the key market participants so that they will continue to provide liquidity to the core markets and the broader financial system. These tools were the backbone of the response of many central banks to the current crisis, including the Bank of Canada (see Zorn, Wilkins, and Engert 2009).[8]

(ii) *Direct lending to financial institutions.* This approach can be used when a single institution is facing a liquidity shock but is still assessed as being solvent. By lending funding support to a single institution, contagion to other key market participants can be avoided. This support often takes the form of a standing facility (e.g., the U.S. Federal Reserve's discount window or the Bank of Canada's Standing Liquidity Facility) but can also be provided via Emergency Lending Assistance (ELA) that is accompanied by a regulatory response similar to that followed by the Office of the Superintendent of Financial Institutions (OSFI), which includes early and staged intervention (see Bank of Canada 2004).

(iii) *Outright purchases and sales*. This approach can be used when the central bank wants to directly influence the amount of aggregate liquidity in the financial system (monetary policy)[9] or to add liquidity directly to a particular market to kick-start the endogenous liquidity-generation process (financial system policy). For example, the Bank has a policy that governs intervention in foreign exchange markets in the event of a severe lack of liquidity in that market.[10] This approach can be implemented in different ways to support the market-makers (e.g., by buying existing inventory from them to make room for new inventory) or to step in for the market-makers (e.g., by acting as a counterparty to other market participants). This approach has not been used by the Bank of Canada in the recent crisis.

The implementation of these tools raises issues of moral hazard, which can distort incentives in markets and institutions to manage risk and allocate capital efficiently. The Bank will continue to review its policies for providing liquidity to core funding markets using one, or a combination, of these extraordinary facilities in a principled way to mitigate this problem.

7 The Bank is also active in work at the international level to improve the infrastructure for over-the-counter (OTC) derivatives.

8 The Bank's main tool in this regard is term PRAs. The Bank also has a securities-lending program to support liquidity of Government of Canada securities markets.

9 In its April *Monetary Policy Report*, the Bank outlined a framework for conducting quantitative or credit easing for monetary policy purposes, if required.

10 For details on the Bank's policy governing intervention in the foreign exchange market, see <http://www.bankofcanada.ca/en/backgrounders/bg-e2.html>.

Conclusion

The liquidity of core markets is central to the stable and efficient functioning of the financial system. The recent crisis has made it clear that, on their own, financial markets cannot be counted on to generate the right amount of funding and market liquidity in all circumstances. The Bank's role as liquidity provider of last resort is to ensure that markets do a better job at generating liquidity in times of stress. The Bank will continue to work on this issue by promoting policies that support the private generation of liquidity, such as policies to create transparent, standardized, and well-designed financial instruments, and putting in place an infrastructure that prevents contagion. The Bank is currently working with industry leaders on the infrastructure in the repo market and will continue its efforts to identify opportunities for improvements in other core markets. It is also ready to provide central bank support, when appropriate, and is reviewing its framework for liquidity provision with a view to refining its policy.[11]

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11 See Engert, Selody, and Wilkins (2008) for the current principles underlying the Bank of Canada's provision of liquidity.

Reform of Securitization

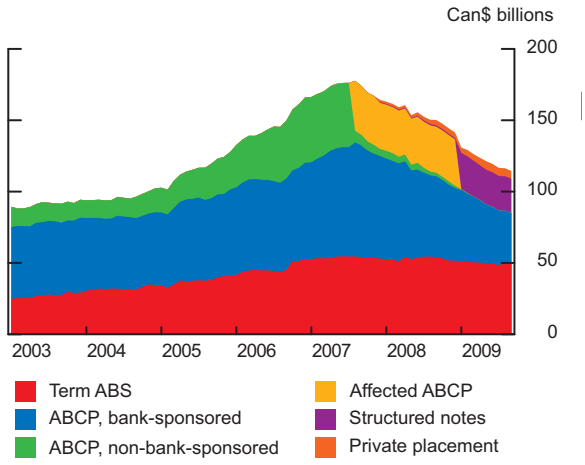
Jack Selody and Elizabeth Woodman

Securitization is the process by which non-tradable assets are transformed into asset-backed debt instruments that can be traded in financial markets. In Canada, securitized assets have become an important source of funding (e.g., auto and equipment loans and leases, trade receivables, credit cards, and residential and commercial mortgage loans) and have provided investors with increased opportunities for portfolio diversification. Prior to the financial crisis, the outstanding amount of asset-backed commercial paper (ABCP) peaked at $120 billion, which represented 50 per cent of the stock of private money market securities. Term asset-backed securities (ABS) peaked at $55 billion, which represented one-fifth of corporate bonds outstanding. Since the onset of the financial crisis, however, the outstanding amount of asset-backed debt instruments has declined considerably **(Chart 1)**.[1]

To be tradable (i.e., to be readily accepted by current and future investors), securitized debt instruments must have two basic attributes. First, the underlying assets should be of certain and predictable credit quality, so that investors know what they are buying and holding. Second, the credit quality of the instrument should be easily and quickly ascertainable, so that investors do not have to devote significant effort to monitoring their investment. The recent financial crisis has shown that, globally, many securitized products did not have these attributes, causing investors to lose confidence and trade in securitization markets to freeze.

Restoring investor confidence and restarting securitization markets will require a coordinated effort on the part of industry participants, investors, and regulators, in Canada and elsewhere. Significant reductions in the uncertainty surrounding credit quality and a reduced need for monitoring will be achieved only by improving the design of securitized products. This requires that securitizations be structured such that they are less complex and opaque, and that an appropriate alignment of incentives among the various participants in the intermediation chain is ensured (Paligorova 2009; Fender and Mitchell 2009). And, while securitization can provide benefits to the economy and the financial system by increasing the supply of credit and reducing the concentration of risk, the financial crisis that began in August 2007 serves as a reminder that a beneficial financial innovation such as securitization can become a source of financial instability if industry practice and regulation do not keep pace with innovation.

Chart 1: The rise and fall of securitization in Canada



Note: Bank-sponsored ABCP (programs of the six largest banks) was supported by the sponsors during the financial crisis. Non-bank sponsors were dependent on third parties for support. Affected ABCP was frozen under the terms of the Montréal Accord and later restructured (structured notes) through the efforts of the Pan-Canadian Investors Committee. For details, see Chant (2008).
Source: DBRS Last observation: September 2009

1 Issuance stalled in securitization markets in the period following the bankruptcy of Lehman Brothers. Since then, there have been few public issues of ABS or ABCP, although there have been a number of private placements to Canadian and U.S. institutional investors.

The Economic Benefits of Securitization

The economic benefits of securitization derive mainly from the conversion of non-tradable financial assets into tradable instruments held by third parties. This conversion has the effect of expanding the potential supply of credit and reducing concentrations of risk. With more credit available, credit constraints are relaxed, and the production potential of the economy is expanded. In addition, with greater possibilities for portfolio diversification, the financial system can manage risk more effectively.

With securitization, the supply of credit expands because sponsoring financial entities do not need to hold capital (or reserves in the case of non-bank entities) against potential losses on loans that become securitized.[2,3] Instead, they can assign this capital (reserves) to other productive uses, such as new loans. This reduces the cost of intermediation and expands the supply of credit. Further, to the extent that these entities are able to finance their activities more cost-effectively through securitization, their cost of doing business is reduced.

Securitization also increases the ability and willingness of investors to take on risk because the tradability of these instruments means that investors can rebalance the risk in their portfolios should the need arise. Furthermore, credit quality can be structured to better match the specific needs of investors—for example, by making returns less sensitive to the performance of individual loans by pooling, and through over-collateralization and other credit-enhancement techniques.[4] Securitization can also allocate different risk characteristics to different asset-backed instruments, which can then be placed with entities that are better able to manage that particular risk characteristic. The result is an increase in the financial system's capacity for managing risk. Tradability and greater specialization facilitate risk management since, in principle, investors should hold only those risks that they understand and can best mitigate.

The prevailing view before the recent crisis was that securitization was good because it increased the resilience of the financial system by transferring credit risk to a broad range of market participants able to manage the risk (Shin 2009).

Since the crisis, however, the consensus view has focused on the fragility created by conflicts of interest within the process of securitization (Paligorova 2009). Both of these views have merit. Securitization, as with any widely adopted financial innovation, is successful because of its perceived economic benefits. However, these benefits will not be realized unless industry and regulatory practice evolve to ensure that the new instruments are safe as well as effective.

Why Securitization Can Be Destabilizing

Realizing sustainable benefits from securitization requires that investors in ABS understand the inherent risks so that they are better able to manage those risks. Thus, it is necessary to reduce the complexity of these securities, introduce greater standardization, where possible, and increase transparency and disclosure. Achieving these goals requires that all of the various agents involved in the securitization process (borrowers, originators, arrangers, credit-rating agencies, asset managers, credit enhancers, liquidity providers, and sponsors) have the appropriate incentives to design and produce securitized products that function as intended.

Conflicts of interest

The potential for adverse selection[5] creates conflicts in many areas of the securitization process where agents have an incentive to act in their own self-interest rather than in the interest of the principal investor; for example, when the originator of individual loans knows more about the quality of the borrowers than does the arranger who pools and structures the loans, or when the arranger knows more about the quality of the loans than a third party, such as a credit-rating agency (CRA) whose task it is to assign a credit rating. In the originate-to-distribute model, where loans are originated for the sole purpose of securitization, such informational asymmetry makes it possible for "substandard" loans to be securitized, because there is no strong incentive for the originator to screen out problem loans. Misaligned or weak incentives can undermine the soundness of securitized products, because they make it profitable to under-report and distort information.

Another well-recognized conflict of interest relates specifically to the dual role that CRAs can perform in the rating of structured products, including ABS. They can provide advice on how to structure a product to achieve a desired credit rating, and they can then be asked to assign a credit

2 Capital is needed to cover unanticipated losses on bank loans, whereas reserves are needed for loans made by other financial entities. Securitization does not require capital or reserves because the risk of loss has been transferred to an independent third party. However, banks or other financial entities that retain an ownership interest or provide implicit contingent guarantees to the purchasers of securitized instruments would need to hold capital or reserves to protect their stakeholders from future claims.

3 The reduction in capital is not complete if the originator or sponsor retains an interest in the security (even if that interest is implicit or contingent).

4 Credit default swaps, for example, can be used to transfer default risk, or the securities may be structured such that the top-rated tranche has the first claim on returns. See Paligorova (2009).

5 Adverse selection occurs if one of the participants in the securitization process has more information than another, a situation that can exist at different stages in the process. This and other agency conflicts in securitization are discussed in Ashcraft and Schuermann (2008) and Paligorova (2009).

rating to that product. Conflict of interest arises if the CRA is paid by the same entity to both assign the credit rating and to provide advice on how to obtain that rating. In such circumstances, CRAs may have little incentive to make their methodologies, assumptions, and information used in the rating process transparent. Yet, investors and regulators need this information to manage and control risk. Furthermore, this dual role may have encouraged "ratings shopping," whereby an issuer may solicit preliminary ratings from several CRAs but pays for and discloses only the highest rating (IMF 2009).

Vanishing tradability in times of stress

Asset-backed debt instruments can lose their tradability in times of stress because these securities can be highly complex and, hence, difficult to value. Markets trading in complex instruments do not tend to work well during periods of heightened uncertainty, since unanticipated events can have significant unpredictable effects on the value of the security. Under such circumstances, market participants are reluctant to buy these securities out of a concern that they will make valuation mistakes and may not be able to sell at a similar, or higher, price in the future. There are several aspects to the complexity of securitized products. One is the above-mentioned problem of adverse selection, where complexity might be added artificially to hide the effects of incentive misalignments. A second is the use of market-making structures that do not generate public information about traded values. A third is the lack of consistent standards for legal agreements, transaction participants, and methods for building structures. The resulting complexity and uncertainty have meant that there is a risk that asset-backed debt instruments will lose their tradability in times of stress, causing markets to fail at a time when well-functioning markets are crucial for effective risk management.

Flawed prudential regulation

The potential for regulatory arbitrage arises when prudential regulation does not properly recognize implicit contingent claims. Ignoring these claims leads to the assumption that risk to the financial system is eliminated when securitized products are moved off the balance sheet of the original lender. As a result, capital is not required, even though the originator or sponsor, in effect, retains a partial liability associated with the instrument.[6] Thus, when markets for these products froze and values declined, there was instability in the financial system as retained but uncapitalized and uncommunicated liabilities came to light, causing investors to question the valuations they placed on the equity of financial institutions.

Out-of-date accounting standards

Out-of-date accounting standards[7] increase the potential for misleading financial statements, partly because disclosure standards for exposures to securitized products have not kept pace with the growing complexity of the products. On one hand, accounting rules allow implicit contingent exposures to securitization risk to be off the balance sheet and, hence, undisclosed to investors and regulators. On the other hand, rules for reporting on-balance-sheet risk are not sufficiently refined to accommodate the heterogeneity and complexity of securitized products. This means that much of the information on instrument-specific risk needed by investors is not disclosed. This lack of transparency can create doubts about counterparty creditworthiness in times of financial stress, leading to market illiquidity and valuation volatility. Valuation volatility can impair the balance sheets of financial intermediaries that hold asset-backed debt instruments for trading purposes when accounting rules require the use of "fair market" valuation techniques.

Improving Securitization

Globally, recommendations to restart securitization markets are aimed at reducing conflicts of interest and realigning incentives in the securitization process, thus reducing the complexity of asset-backed debt instruments and increasing the transparency and tradability of securitized products in times of financial stress. Greater standardization is required to improve the contribution that securitization makes to the financial system: "Standards enable a market. They are part of the infrastructure for innovation-led growth" (Swann 2000).

Reducing conflict of interest

Numerous proposals have been made for reducing potential conflicts of interest (and other issues) related to the role of CRAs. Among these are a reduction in the use of credit ratings in regulation—which would put the onus on investors to perform their own due diligence—and a requirement to move to an investor-pay business model. Zelmer (2007) argues that the quality of ratings could suffer in a move to an investor-pay model. For example, few investors may have access to the ratings, and CRAs may not be able to fund an appropriate level of supporting research. Measures that would increase the transparency of rating methodologies, encourage greater disclosure of the information used in the rating process, and require the use of a separate rating scale for structured products could help to reduce conflicts of interest and improve the quality of ratings. Issues arising from the role of CRAs in the financial crisis, including those related to potential conflicts of interest in rating structured finance products, are discussed in IOSCO (2008a) and

6 Many additional opportunities for regulatory arbitrage that were present in Basel I were addressed in Basel II. See IMF (2009).

7 This section draws on IMF (2009).

addressed, in part, in the recently revised IOSCO code of conduct for CRAs (IOSCO 2008b).

The alignment of incentives could be improved by requiring issuers to retain a portion of an issue of a new debt instrument, thereby sharing in the risk.[8] A sufficient sharing of risk would motivate issuers to perform appropriate due diligence on loan originators, continuously monitor the behaviour of originators, and, perhaps, seek representations and warranties from originators on the quality of loans and the underwriting process. The effectiveness of this proposal depends not just on the size of the retained interest, but also on how it is configured. For example, originators could be asked to hold an equal share of each tranche in the securitized structure (a vertical slice), or to retain the entire amount in a particular tranche—for example, the equity tranche, or the mezzanine tranche. This type of reform must be approached carefully, since there is some evidence that imposing a particular form of retention scheme could generate unintended costs and thus hamper efforts to restart sustainable securitization markets.[9] If, for example, retention requirements are too low, screening incentives may not be sufficiently high, but if requirements are too high, securitization may no longer be an economical form of finance.

Reducing complexity

If products are too complex, investors have difficulty understanding and managing the risks inherent in the asset-backed debt instruments they hold. Complexity can be reduced by requiring issuers to adopt common standards for the construction of products; to use standard documentation, terms, and templates in legal agreements when structuring products; and to refrain from novel techniques for enhancing credit quality. Choosing a single set of standards will not be easy and may require regulatory encouragement, since the benefits of standardization are not likely to fall evenly on all parties.

The incentive to create complex products can be reduced by eliminating opportunities for regulatory arbitrage and by encouraging issuers and investors to appropriately account for all risk exposures associated with securitized products, both on and off the balance sheet. It is important, however, to coordinate changes to securitization regulation with changes to accounting rules and standardization initiatives in order to minimize the risk of unintended consequences, especially those that might neutralize the benefits of securitization.

The ability of investors to understand the risks inherent in asset-backed debt instruments would be enhanced by increased disclosure and transparency regarding the loans included in the securitization pool, as well as details on product structure, issuer compensation, risk retention, and other elements relevant to the assessment of credit quality. Such information would also help CRAs to assess credit quality and would encourage investors to use expert advice to inform their own due-diligence assessment of credit quality. Counterparty risk assessment could be improved by revisions to accounting standards that recognize contingent claims, off-balance-sheet liabilities, and the reality that markets do not always provide fair valuation.

Improving tradability

The above changes would also lead to improved tradability. Tradability could be further enhanced by ensuring that all participants have access to the same information and that trading venues generate publicly available information about the values at which trades take place.

Progress Towards Reforming Canadian Securitization Markets

Globally, for securitization to become a stable form of intermediation, significant and coordinated reform is required to address the fundamental problems of conflict of interest, complexity, and a lack of tradability in times of stress. Additionally, investors must assume a greater role in performing due diligence. Reforms aimed at increasing transparency and disclosure would make it easier for investors to enforce market discipline. In Canada, there has been initial progress towards reforming securitization practices along these lines. This reform should be strengthened over time as various initiatives proposed by international standard-setters are implemented. Among these are the enhancements to the Basel II capital framework,[10] changes to international accounting standards for the off-balance-sheet accounting treatment of securitizations, and IOSCO's proposals to strengthen practices in securitization markets.[11] A recent report of the Financial Stability Board to the G-20 leaders (FSB 2009) lends support to these initiatives and calls on the official sector to implement various measures to restart securitization markets on a sounder basis. However, as the IMF (2009) has urged, it will be necessary to carefully examine their interactions before the initiatives are finalized, since some proposals may interact in ways that could impede securitization, rather than restart it.

In Canada, the destabilizing effects of a lack of transparency and disclosure, combined with highly complex securitization products, were evident in the ABCP market. In

8 See IMF (2009) and IOSCO (2009).

9 This is discussed in detail in Fender and Mitchell (2009).

10 These include stronger capital requirements for securitized products, higher risk weights for resecuritizations, a requirement for banks to conduct more rigorous credit analyses of externally rated securitizations, and improved disclosure of securitizations in the trading book. See "Enhancements to the Basel II Framework," July 2009, <http://www.bis.org/publ/bcbs157.htm>.

11 Among these are proposals for enhanced transparency by issuers of public offerings of ABS, improving governance and transparency of CRAs, and recommendations for regulators to address the issues in securitization markets along three dimensions: wrong incentives, inadequate risk-management practices, and regulatory structure and issues around oversight. See IOSCO (2009).

contrast to term ABS, issues of ABCP are prospectus-exempt and, hence, not subject to regulatory transparency and disclosure requirements. Consequently, the information available to investors and issuers was not symmetric—issuers did not always disclose material information, such as the composition and nature of the assets underlying the ABCP programs (both at issuance and over the life of the instrument). Since the crisis, considerable progress has been made towards increasing the transparency and disclosure of Canadian ABCP programs. These include measures undertaken by the Bank of Canada to introduce transparency requirements and minimum quality standards for ABCP accepted as collateral in its liquidity facilities,[12] increased transparency on the part of bank sponsors, and enhanced transparency and disclosure measures for both ABCP and term ABS introduced by credit-rating agencies. Of note, DBRS now includes monthly reports at the individual transaction level in its ABCP reporting process.[13]

The federal government announced in January 2009 that it would introduce the Canadian Secured Credit Facility to purchase up to $12 billion in term ABS backed by loans and leases on vehicles and equipment.[14] This program is intended as a temporary measure. One of its aims is to encourage renewed investor participation and confidence in the Canadian ABS market for the securitization of vehicle and equipment financing,[15] notably through the development of standardized terms and documentation. Although the issuance of term ABS requires a prospectus and, hence, is subject to the same transparency and disclosure requirements as other publicly issued securities, these prospectuses can be inordinately long, complex, and difficult to understand. Transparency could be enhanced by simplifying and standardizing the structure and terminology to facilitate due diligence on the part of investors and potentially reduce reliance on credit ratings. The responsibility, however, remains with investors to determine the level of due diligence required to make informed investment decisions.

Securities regulators, under the auspices of the Canadian Securities Administrators, have undertaken consultations on proposed policy responses to address the role of ABCP in the financial crisis.[16] Under consideration are investor suitability requirements, a possible amendment to the current prospectus and registration exemption for short-term debt to exclude ABCP, a review of the use of credit ratings in securities legislation, and the introduction of a regulatory framework for CRAs. As proposed in the consultation paper, the latter would require compliance with the revised IOSCO code of conduct and should provide securities regulators with the authority to require changes to a CRA's practices and procedures. Each province will be required to obtain the appropriate legislative authority to regulate CRAs, but it is probable that CRA regulation would ultimately fall under the jurisdiction of the proposed national securities regulator. A consultation document is expected to be published for comment by year-end, with implementation set for 2010.

DBRS is the only major CRA domiciled in Canada, and it is also subject to regulation by the U.S. Securities and Exchange Commission. Like Moody's, Fitch Ratings, and Standard & Poor's (the three major U.S.-based CRAs providing ratings for Canadian securitizations), DBRS is substantially in compliance with the recently revised IOSCO code of conduct. Globally, ratings agencies have taken a number of steps to restore confidence in their ratings methodology for structured credit products, including, for example, improved disclosure of ratings methodologies and the development of additional means of providing ratings information on structured finance products. These efforts have, however, stopped short of introducing a separate rating scale for structured products as recommended by the G-20.

Canada is committed to making the transition from Generally Accepted Accounting Principles to International Financial Reporting Standards by 2011. The currently proposed changes to IAS 39 ("Financial Instruments: Recognition and Measurement") with regard to the off-balance-sheet treatment of securitizations suggest that few, if any, future Canadian securitizations will be eligible for off-balance-sheet treatment. Indeed, it is likely that sponsors of asset-backed programs will be required to consolidate them on the balance sheet. Hence, the proposed changes, in combination with other initiatives such as increased capital charges and retention requirements, are likely to fundamentally alter the economics of securitization, making it a more expensive form of funding for borrowers.

In conclusion, ensuring stable, sustainable securitization markets will require a coordinated effort on the part of various stakeholders, including the industry itself, regulators, and standard-setters. Public sector leadership and coordination are also likely to be required in order to restart securitization markets on a sounder basis. Importantly, a coordinated effort will be required to ensure that the reforms are appropriate—contributing to enhanced transparency, simpler structures, and greater standardization—and that their interactions help to restart securitization, not impede it.

12 See <http://www.bank-banque-canada.ca/en/notices_fmd/2008/not310308.html>.

13 See "DBRS Initiatives to Enhance the Quality and Transparency of Its Rating Process," 5 March 2009. Available at <http://www.dbrs.com/research/227113>.

14 See <http://www.budget.gc.ca/2009/plan/bpc3a-eng.asp>.

15 See "Consultation on the Canadian Secured Credit Facility." Available at <http://www.bdc.ca/en/about/federal_budget_2009/cscf/consultation.htm>.

16 The consultation document "Securities Regulatory Proposals Stemming from the 2007–08 Credit Market Turmoil and Its Effect on the ABCP Market in Canada," October 2008, is available on the websites of the provincial securities regulators.

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Towards a Stress-Testing Model Consistent with the Macroprudential Approach

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The macroprudential approach to assessing risks to financial stability has two distinguishing features.[1] First, with this approach, the focus is on the financial system as a whole in order to limit the macroeconomic costs of episodes of financial distress. In contrast, the microprudential approach focuses on the financial strength of individual financial institutions. Second, the macroprudential perspective treats aggregate risk as being dependent on the collective behaviour of financial institutions and markets, including potential contagion channels arising from their interlinkages. Individual institutions, on the other hand, consider aggregate risk to be independent of their decisions.

The macroprudential approach has important implications for monitoring threats to financial stability using macrofinancial models, as well as for the development of prudential policy tools. In this report, we present work under way to enhance the macro stress-testing framework first used by the Bank of Canada for the exercise it conducted under the IMF's Financial Sector Assessment Program (FSAP) in 2007. In brief, that model aggregates the credit losses that would materialize at individual banks should a severe global recession occur.[2]

The recent crisis in financial markets showed how direct interlinkages among banks arising from counterparty exposures, as well as liquidity risk arising from fire sales of assets, can be important channels of contagion. This report outlines how we have integrated those two channels into the original macro stress-testing framework.[3] The results from simulations conducted to evaluate the importance of these contagion channels suggest that they can have important system-wide effects, as the recent crisis has clearly shown. Specifically, integrating these elements into the stress-testing framework tends to substantially increase the losses in the aggregate banking sector for a given macro shock, compared with the situation where we consider only "first-round" credit losses.

A Network Model of Interbank Linkages

Distress at one bank may cause distress at another if they have exposures to each other. From a macroprudential point of view, it is therefore important to consider such spillover effects. Moreover, limiting the analysis to traditional interbank lending may seriously underestimate spillover risks, since the size of off-balance-sheet exposures has increased steadily over the past decade, and other types of on-balance-sheet exposures may also be important. We therefore consider an expanded set of on-balance-sheet exposures with some off-balance-sheet interlinkages among financial institutions.[4] We integrate this channel into our core credit-risk model, which provides a distribution of banks' credit losses should a severe macroeconomic scenario materialize (see Misina, Tessier, and Dey 2007 for more details).

Following Elsinger, Lehar, and Summer (2006), we model counterparty exposures within our stylized Canadian banking system as a network of interbank obligations

1 See Borio (2003, 2009) or Gauthier and St-Amant (2005) for more details on the macroprudential approach.

2 For a summary of the objectives and results of the FSAP, see Coletti et al. (2008). For a more detailed description of the model used for this exercise, see Misina, Tessier, and Dey (2007).

3 Gauthier, Lehar, and Souissi (2009) also propose some improvements to the core credit-risk model used in the IMF FSAP exercise to take into account the granularity of the loan portfolio at individual banks.

4 See the section on exposures among Canadian banks for details on the set of exposures considered.

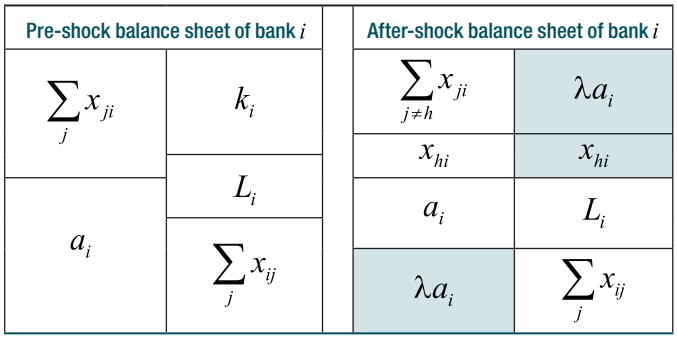
between the "big six" Canadian banks.[5] The analysis begins with the following representative balance-sheet identity of financial institution i,

$$\sum_j x_{ji} + a_i = k_i + L_i + \sum_j x_{ij}, \qquad (1)$$

where x_{ji} represents the claims of bank i on bank j, a_i represents all other non-interbank assets, k_i represents bank i's net worth, L_i represents bank i's liabilities against counterparties other than banks (or outside debt holders), and x_{ij} represents the claims of other banks on bank i.

Following a shock, exposures among banks can cause distress at one bank to spread to other banks. Whenever a bank defaults, its remaining value, once outside debt holders are paid, is distributed proportionately to creditor banks.[6] Any loss by the creditor banks is absorbed by their capital. **Figure 1** illustrates a case of spillover from bank h to bank i. The macro shock pushes bank h into bankruptcy, with the value of its assets insufficient to pay all of its interbank liabilities. The same macro shock affects bank i as well, reducing the value of its assets by a fraction equal to λa_i. Bank i has sufficient capital to absorb the impact of that shock (λa_i is smaller than k_i) but is pushed into bankruptcy because of the writedown induced by the default of bank h.[7]

Figure 1: Channels of contagion



Source: Bank of Canada

Integrating Asset Fire Sales into the Network

When an institution is unable to fully meet its obligations, it may be forced to sell assets at a loss—in other words, at prices well below their fair value—to achieve a quick sale. This is generally referred to as an "asset fire sale." These sales of assets into the market cause other banks holding the same assets to incur losses as well. Because of marking to market, an initial fire sale can trigger a chain of fire sales at other institutions, as witnessed during the 2007–08 subprime crisis.

The integration of the asset-fire-sale component into the network model is an extension of the work done by Cifuentes, Ferrucci, and Shin (2005), in which banks were assumed to be equally risky. In contrast to that work, we assume a more realistic world in which banks have various risk profiles and calibrate the model such that the equilibrium market price of a bank's illiquid assets is a decreasing function of its riskiness. This reflects the fact that riskier assets are less liquid in a crisis period.

Assets held by the banks are subject to a minimum capital ratio, which stipulates that the ratio of the bank's Tier 1 capital to the mark-to-market value of its assets must be above some prespecified minimum, r^*. When a bank violates this constraint, we assume that it has to sell assets to reduce the size of its balance sheet.[8] We use s_i to denote the units of illiquid assets sold by bank i.[9] Whereas Cifuentes, Ferrucci, and Shin (2005) used a simple (non-risk-weighted) leverage ratio, our constraint is closer in spirit to the Basel II Accord, in which banks have to hold capital commensurate with the risk on their balance sheets. This is given by:

$$\frac{p_i e_i + c_i + \sum_j x_{ji} - \sum_j x_{ij} - L_i}{w_i p_i (e_i - s_i)} \geq r^*. \qquad (2)$$

Here, bank i's stock of non-interbank assets, a_i in Figure 1, is divided into liquid and illiquid assets. Bank i's stock of liquid assets is given by c_i and includes cash holdings, government securities, and insured mortgages.[10] For simplicity, interbank assets are also assumed to be liquid. The remainder of the bank's assets, e_i, are considered illiquid. The price, p_i, of the illiquid assets of bank i is determined in equilibrium, while the liquid assets have a constant price of 1. The average risk weight of bank i's illiquid assets is represented by w_i.

5 The holdings of the big six Canadian banks represent approximately 90 per cent of the total assets of the Canadian banking sector. A useful extension would be to expand the network to include the large Canadian insurance companies and some foreign institutions with significant linkages with Canadian financial institutions.

6 The residual worth is distributed proportionately to the creditor's share of the debtor's total interbank liabilities. For simplicity, this calculation is omitted from the notation.

7 Eisenberg and Noe (2001) show that, following an initial default, there is a unique vector of payments between banks that clears the obligations of all parties.

8 We do not consider the possibility of raising fresh capital or the need to sell assets because of a loss of funding. The consequences of the latter would be similar to those described here, assuming that the assets would have to be sold at a discount (see the April 2009 *Global Financial Stability Report* for an example).

9 Selling liquid assets does not help to reduce the size of the balance sheet because of their zero risk weight. Note, however, that holding more liquid assets reduces the size of the balance sheet ex ante.

10 We consider insured mortgages to be liquid because they also carry a zero risk weight.

The numerator is the equity value of the bank, where the interbank claims and liabilities are calculated in terms of the realized payments. The denominator is the mark-to-market risk-weighted value of the bank's assets after the sale of s_i units of the illiquid assets. The underlying assumption is that assets are sold for cash, and cash does not require capital. Thus, if the bank sells s_i units of the illiquid assets, the value of the numerator is unchanged, since this involves only a transformation of assets into cash. However, the value of the denominator is decreased, since cash has a zero risk weight, whereas the illiquid assets sold carry a positive risk weight. Thus, by selling some illiquid assets, the bank can reduce the size of its balance sheet and increase its capital-to-assets ratio.

An equilibrium of the model is represented by a combination of interbank payments, individual sales of illiquid assets, and their prices, such that:

(i) equity holders have limited liability and debt holders have priority over interbank liabilities;[11]

(ii) either the bank is liquidated altogether, or its sales of illiquid assets reduce its assets sufficiently to comply with the capital-adequacy ratio; and

(iii) the price of the illiquid assets is determined by the intersection of a downward demand curve and the aggregate supply curve.

Data on Exposures Among Major Canadian Banks

As in previous studies of systemic risk in foreign banking systems, our data cover exposures among banks that arise from traditional lending (unsecured loans and deposits).[12] We expand the set of exposures among banks to also cover those arising from other on-balance-sheet items, such as cross-shareholdings (in terms of common shares), and from off-balance-sheet instruments, such as exposures related to derivatives.[13] Of course, there are other types of exposures among banks—most notably, those arising from intraday payments and settlements, from bank holdings of preferred shares (and other forms of capital), and from holdings of debt instruments issued by banks, such as debentures and subordinated debt. Owing to data limitations, however, they are not considered here.

Data on these exposures were collected on a consolidated basis and were drawn from various sources, as described below. Available data were collected for May 2008 (except for exposures related to derivatives, which are as of April 2008). We present descriptive statistics for these data in **Table 1**.

Table 1: Summary statistics on exposures among Canadian banks

	Aggregate exposure (Can$ billions)	Exposure as a percentage of Tier 1 capital		
		Minimum	Average	Maximum
Traditional lending	12.7	5.25	16.3	38.6
Derivatives exposures	5.4	0.0	5.9	21.1
Cross-shareholdings	3.5	0.3	4.1	8.8
Total	21.6		26.3	

Source: Authors' calculations

Data on deposits and unsecured loans were taken from the banks' monthly balance-sheet reports to the Office of the Superintendent of Financial Institutions (OSFI).[14] Data on exposures related to over-the-counter (OTC) derivatives were obtained from a survey initiated by OSFI at the end of 2007. In that survey, banks were asked to report their 100 largest mark-to-market counterparty exposures that were greater than $25 million. These exposures were related to both OTC and exchange-traded derivatives and were reported after netting and before collateral and guarantees.[15] The reported data were used to construct a matrix of the bilateral exposures of the big six banks. Data on cross-shareholdings were collected from the Bank of Canada's quarterly securities returns.[16]

The aggregate size of interbank exposures was approximately $21.6 billion for the big six Canadian banks. As summarized in Table 1, total exposures among banks accounted for more than 26 per cent of bank capital, on average. The available data suggest that exposures related to traditional lending (deposits and unsecured loans) and derivatives were more important than exposures related to cross-shareholdings.[17]

11 In reality, the legal situation might be more complicated, and the seniority structure might differ from the simple procedure we employ here.

12 See Upper (2007) for a survey.

13 Zero risk exposures were excluded, despite their large size. These exposures, consisting mainly of repo-style transactions, accounted for more than half of total exposures among the big six Canadian banks in the second quarter of 2008.

14 For deposits (unsecured loans), we combined the information contained in the banks' L4 and M4 (L4 and A2) reports to estimate the total exposures of each of the big six banks to the other five banks in the group.

15 The derivatives exposures reported may be biased upward, since they were reported before collateral and guarantees. In particular, anecdotal evidence suggests that the major Canadian banks often rely on high-quality collateral to mitigate their exposures to OTC derivatives.

16 A thorough description of the linkages among Canadian banks requires a complete matrix of the bilateral exposures. Such a complete matrix was available only for exposures related to derivatives. Unavailable bilateral exposures were estimated under the assumption that banks spread their lending and borrowing as widely as possible across all other banks. This is called *entropy maximization*. A difficulty with this solution is that it assumes that all lending and borrowing activities among banks are completely diversified.

17 Including repos and excluding exposures related to derivatives and cross-shareholdings (not available for other countries), these exposures make up a comparable proportion of banks' balance sheets in Canada, the United States, and the United Kingdom.

An Overview of the Simulation Results

To assess the importance of the two risk-propagation channels described above, we first simulate the macro stress-testing framework under a severe recession scenario without allowing for any second-round effects.[18] In such an environment, where only credit risk is taken into account, the default risk of individual banks is extremely low. This is consistent with the strength of the balance sheets of Canadian banks and the objective of the regulatory framework to limit risk at individual institutions.

The introduction of the network of interbank linkages has only a slight impact on risk at individual banks and on systemic risk, even with the expanded set of exposures.[19] However, these results might change if the exposures to foreign financial institutions were included. This is left for future research. Once asset fire sales are considered, default probabilities increase significantly, and even more so when the expanded set of exposures is included.[20] This speaks further to the importance of accurately capturing the interlinkages among banks.

Some caveats should be noted, however. First, all default probabilities are under the assumption of a severe macro stress scenario, which is a rare event. Thus, while our analysis explores the financial stability of Canadian banks in a severe economic downturn, the overall probability of a systemic crisis remains low. Second, the default probabilities resulting from the asset-fire-sales channel depend crucially on assumptions about the specification of the demand function that determines the price impact of asset fire sales. While there is anecdotal evidence, for example, that prices for mortgage-related securities fell as banks unloaded their holdings during the recent crisis, it is hard to differentiate price declines caused by excessive supply from those caused by the release of new information to the market. Therefore, our model, like others in the literature, must rely on assumptions about the specification of the demand function (Aikman et al. 2009). Third, the available information on exposures among banks is incomplete and forces us to make simplifying assumptions, which may affect our results.

Conclusion

The work reported here represents a first step in incorporating elements of interlinkages and network effects into our macrofinancial model. Our results suggest that these elements can have important system-wide effects, as the recent crisis has clearly shown.

Without second-round effects, the Canadian banking system is very stable. For the system to incur significant losses, relatively unrealistic macroeconomic contractions would have to occur. When a network of direct bank balance-sheet interlinkages is added to the credit-risk model, the impact of a shock remains small, even when a broader set of interlinkages that includes some off-balance-sheet exposures is considered. But, of the two potential risk-propagation channels discussed in this report, the asset-fire-sale channel is the one that could seriously increase the likelihood of bank defaults. These results imply that the risk to the system as a whole can be seriously underestimated if we ignore second-round effects and take into account only the direct impact of a macro shock on individual financial institutions.

The model could be expanded in many directions and used for different purposes. For example, additional financial institutions (both domestic and foreign), as well as other non-financial sectors, could be added to the network. We could also consider different types of exposures among banks, such as holdings of other forms of capital and debt instruments issued by financial institutions.

18 Consistent with the severity of the macro stress scenario, simulated probabilities of sectoral default are, on average, 50 per cent higher than the observed sectoral default rates over the 1988–2006 period.

19 It would be interesting to do a similar exercise with the major banking centres of the world, in which OTC derivatives exposures probably represent a larger share of bank assets than they do in Canada.

20 Detailed results can be found in Gauthier, Lehar, and Souissi (2009).

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Glossary

Readers wishing to access a more comprehensive list of financial and economic terms are directed to the Bank of Canada's online glossaries at <http://www.bankofcanada.ca/en/glossary/index.html>. Additional information on Canada's payment clearing and settlements systems is available at <http://www.bankofcanada.ca/en/financial/payments.html>.

Canadian Acronyms

A

AcSB: Canadian Accounting Standards Board

ACSS: Automated Clearing Settlement System
A CPA system through which all payments not processed by the LVTS are handled

B

BCAP: Business Credit Availability Program
A program to improve access to financing for Canadian businesses by providing new resources and flexibilities to Export Development Canada and the Business Development Bank of Canada

C

CDIC: Canada Deposit Insurance Corporation
A federal Crown corporation that insures specified deposits of Canadians in case their bank or CDIC member institution fails

CDOR: Canadian Dealer Offered Rate
The average rate for Canadian bankers' acceptances (BAs) for specific terms to maturity, determined daily from a survey on bid-side rates provided by the principal market-makers, including the major Canadian banks. CDOR provides the basis for a floating reference rate in Canadian-dollar transactions analogous to LIBOR.

CDS: Clearing and Depository Services Inc.
Canada's national securities depository, clearing, and settlements hub

CDSX: Automated clearing and settlement system for securities. Operated by CDS and designated under the PCSA as systemically important

CFM: Canadian Financial Monitor
Survey on household balance sheets conducted by Ipsos Reid

CHT: Canada Housing Trust
Subsidiary of CMHC created to issue CMBs

CICA: Canadian Institute of Chartered Accountants

CLAF: Canadian Lenders Assurance Facility
Created in October 2008, this temporary program provides insurance on the wholesale term borrowing of federally regulated and some provincially regulated deposit-taking institutions.

CLIAF: Canadian Life Insurers Assurance Facility
Created in January 2009, this temporary program provides insurance on the wholesale term borrowing of federally regulated life insurers.

CMB: Canada Mortgage Bond
CMBs are mortgage-backed securities issued by the Canada Housing Trust, with timely payment of principal and interest fully guaranteed by CMHC on behalf of the Government of Canada.

CMHC: Canada Mortgage and Housing Corporation
Canada's national housing agency: Canada's public provider of mortgage loan insurance, mortgage-backed securities, housing policy, and related programs

CORRA: Canadian overnight repo rate average
A weighted average of rates on overnight general collateral repo transactions conducted through designated interdealer brokers

CPA: Canadian Payments Association
Operates systems for the clearing and settlement of payments in Canada, namely, ACSS and LVTS

CSA: Canadian Securities Administrator
Umbrella organization of Canada's provincial and territorial securities regulators to improve, coordinate, and harmonize regulation of Canadian capital markets

CSCF: Canadian Secured Credit Facility
A federal government facility unveiled as part of the Economic Action Plan in January 2009, which aims to improve access to financing for businesses and consumers through purchases of securities backed by loans and leases on vehicles and equipment

D

DBRS: Dominion Bond Rating Service
A privately owned Canadian credit-rating agency

E

ELA: Emergency Lending Assistance
Bank of Canada facility that provides funding for up to six months to CPA members that are solvent but facing serious and persistent liquidity problems

G

GoC: Government of Canada

I

IIAC: Investment Industry Association of Canada
Association of firms from the Canadian financial services industry

IIROC: Investment Industry Regulatory Organization of Canada
National self-regulatory organization that oversees all investment dealers and trading activity on debt and equity markets in Canada

IMPP: Insured Mortgage Purchase Program
Department of Finance program created in October 2008 to purchase insured residential mortgages from Canadian financial institutions

L

LVTS: Large Value Transfer System
An electronic system for the transfer of large-value or time-critical payments. Operated by the CPA and designated under the PCSA as systemically important

N

NHA MBS: National Housing Act Mortgage-Backed Securities
Pools of amortized residential mortgages insured by CMHC under the National Housing Act (NHA), carrying an unconditional guarantee provided by the Government of Canada of timely payment of interest and principal to the investor

O

OSFI: Office of the Superintendent of Financial Institutions
A federal agency whose mandate is to supervise all federally regulated financial institutions, monitor federally regulated pension plans, and provide actuarial advice to the Government of Canada

P

PCSA: Payment Clearing and Settlement Act
Act of Parliament giving formal responsibility to the Bank of Canada for the oversight of clearing and settlement systems in Canada that could be operated in a manner that could pose systemic risk

PRA: Purchase and resale agreement
An open market operation in which the Bank of Canada purchases securities from eligible counterparties with an agreement to resell those securities at a specified date in the future, with the price differential representing the implicit interest rate paid by the counterparty

S

SLF: Standing Liquidity Facility
Bank of Canada facility that provides access to overnight liquidity to direct LVTS participants against a set of eligible collateral instruments

T

TLF: Term Loan Facility
A temporary Bank of Canada facility introduced in November 2008 that provides term lending to direct LVTS participants against an assignment of their non-mortgage loan portfolios as collateral

TSX: Toronto Stock Exchange

Other Selected Abbreviations

A

ABCP: asset-backed commercial paper
A form of commercial paper whose value and income payments are derived from, and collateralized by, a specified pool of underlying assets

ABS: asset-backed security
A security whose value and income payments are derived from, and collateralized by, a specified pool of underlying assets

ACM: assets-to-capital multiple
Total assets in relation to capital

B

BA: bankers' acceptance
A negotiable short-term credit instrument created by a non-financial firm and guaranteed by a bank

BCBS: Basel Committee on Banking Supervision
A forum for regular international co-operation on supervisory matters, served by a secretariat housed at the BIS

BDN: bearer deposit note

BIS: Bank for International Settlements
An international organization that fosters international monetary and financial co-operation and serves as a bank for central banks

C

CDS: credit default swap

CGFS: Committee on the Global Financial System
A BIS committee charged with monitoring developments in the global financial system for the central bank governors of the G-10 countries

CLS: continuous linked settlement
A multi-currency cash settlement system (supporting trades in 17 major currencies) designed to eliminate settlement risk for foreign exchange payment instructions. Designated as systemically important under the PCSA

CMBS: commercial mortgage-backed security

CP: commercial paper
Unsecured promissory note with a fixed, short-term maturity

CRA: credit-rating agency

CRMPG: Counterparty Risk Management Policy Group

D

DSR: debt-service ratio
Payments of interest (and principal) on household debt as a proportion of income

E

EAD: exposure-at-default
Potential exposure to a counterparty in the event of, and at the time of, its default

ECB: European Central Bank

EME: emerging-market economy

EURIBOR: Euro Interbank Offered Rate
Benchmark interest rate used to gauge the cost of euro interbank term deposits within the Euro area

F

FASB: U.S. Financial Accounting Standards Board

FDIC: U.S. Federal Deposit Insurance Corporation

FI: financial institution

FSAP: (the IMF's) Financial Sector Assessment Program

FSB: Financial Stability Board
Created in 2009 by re-establishing the Financial Stability Forum with a broadened mandate and expanded membership that includes the G-20, Spain, and the European Commission. The FSB is serviced by a secretariat housed at the BIS.

FX: foreign exchange

G

G-7: Group of seven industrialized nations (Canada, France, Germany, Italy, Japan, United Kingdom, and United States)

G-10: Group of major economics comprising the G-7 plus Belgium, the Netherlands, Sweden, and Switzerland

G-20: Group of twenty major economies (members are the G-7 plus Argentina, Australia, Brazil, China, India, Indonesia, Mexico, Russia, Saudi Arabia, South Africa, South Korea, Turkey, and the current E.U.-presiding country)

GAAP: Generally Accepted Accounting Principles

GDP: gross domestic product

H

HELOCs: home equity lines of credit

I

IAS: International Accounting Standard

IASB: International Accounting Standards Board

IFRS: International Financial Reporting Standards (set by the IASB)

IMF: International Monetary Fund

IOSCO: International Organization of Securities Commissions

L

LGD: loss-given-default
Estimated loss to a creditor in respect of a default on a particular asset, expressed as a proportion of the total exposure of the creditor to that asset

LIBOR: London Interbank Offered Rate
Daily benchmark interest rate used to gauge the cost for banks to borrow unsecured funds from other banks in various currencies in the wholesale international money market

M

MSCI: Morgan Stanley Capital International

O

OIS: overnight index swap
Short-term interest rate swap where the reference interest rate is tied to an overnight interest rate (the CORRA in Canada). OIS is often used as a gauge of market expectations for future policy interest rates.

OTC: over-the-counter

P

PD: probability of default
Estimated probability that a debtor will default on their obligations over a given time horizon

S

S&P: Standard & Poor's

T

TALF: Term Asset-Backed Securities Loan Facility
A program created by the U.S. Federal Reserve to support the issuance of asset-backed securities

TARP: (U.S.) Troubled Asset Relief Program

TCE: tangible common equity

TRWA: total risk-weighted assets
Total of all assets held by a financial institution, weighted for credit, market, and operational risk

V

VaR: value at risk
A statistical estimate of the maximum probable loss over a given time horizon with a given level of confidence. Used extensively by banks to measure risk arising from trading activities

VIX: Measure of implied volatility obtained from option contracts on the S&P 500 Index