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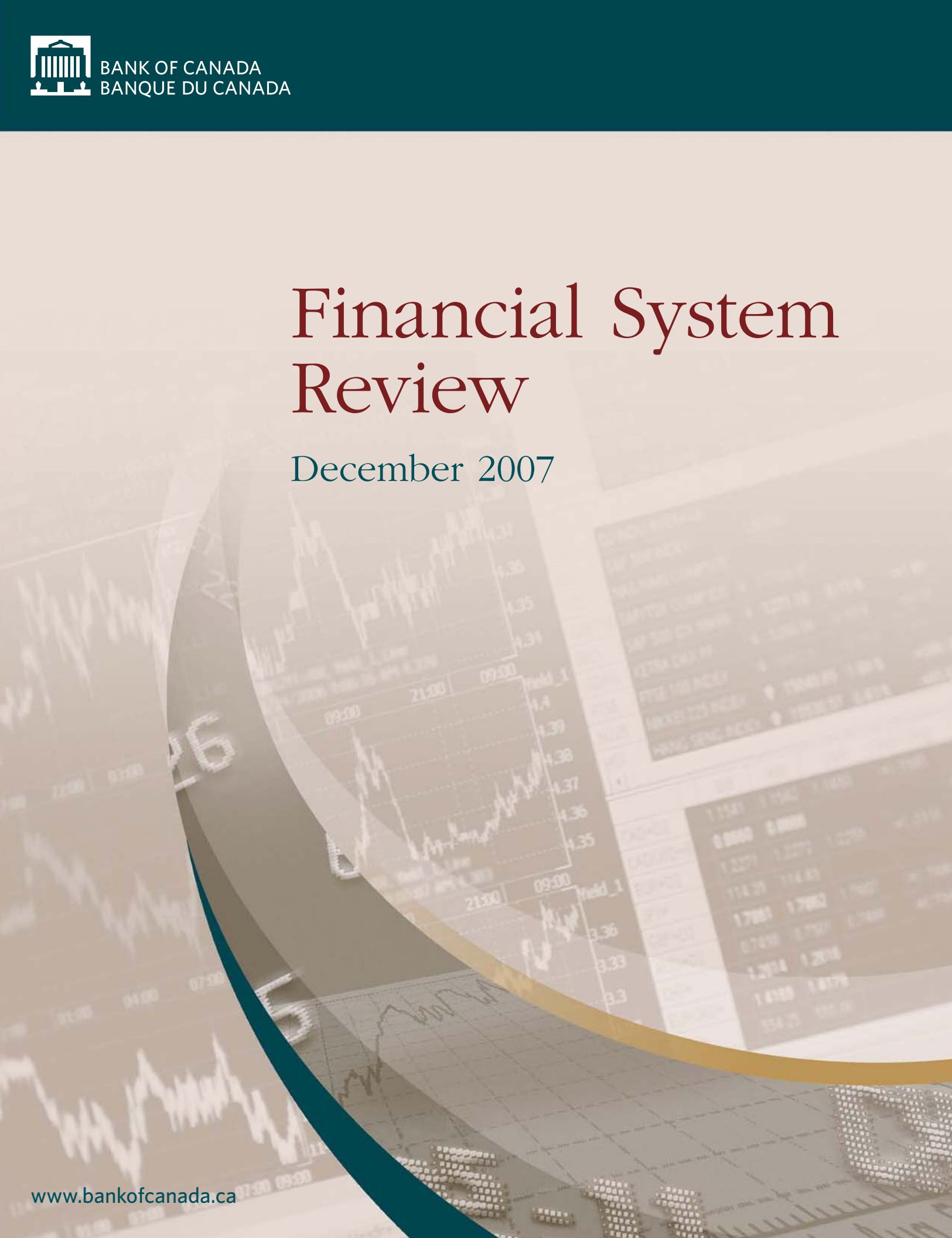
Financial System Review

December 2007



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The *Financial System Review* and Financial Stability

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

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

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

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

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

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Developments and Trends

Notes

The material in this document is based on information available to **22 November 2007** unless otherwise indicated.

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

Assessing Risks to the Stability of the Canadian Financial System

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

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

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

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

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

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

Financial System Risk Assessment

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

Key Points

- Sudden repricing of risk has been accompanied by considerable turbulence in the money market.
- Liquidity evaporated in the market for structured products.
- Increased demand for short-term liquidity by banks, together with concerns about the creditworthiness of counterparties, put upward pressure on money market rates internationally and in Canada.
- There has been some tightening in credit conditions.
- The solid financial positions of the Canadian financial, non-financial corporate, and household sectors have helped them weather the turbulence.
- Fears of a much-greater-than-expected deterioration in the U.S. housing market and in the quality of U.S. mortgage-related assets in the future have further exacerbated liquidity problems in some financial markets, increasing counterparty concerns, and raising risk premiums.
- Financial market turbulence, together with a significant slowdown in the U.S. economy, could lead to and be exacerbated by a disorderly resolution of global current account imbalances.

Overview

The *Financial System Review* has been highlighting the possibility of a sudden repricing of risk for some time, pointing to unusually narrow risk spreads that resulted from the search for yield in an environment of low interest rates, and the difficulty of assessing the risks of the increasingly complex products being generated by new financial engineering. Since the publication of the June FSR, the sudden repricing has materialized. Risk spreads have widened, volatility in financial markets has increased, and liquidity in the markets for some structured products has evaporated. The turbulence has primarily affected money markets, although longer-term spreads have also widened. The U.S. dollar has also fallen significantly against all other major currencies, including the Canadian dollar.

The turbulence in global financial markets was triggered by concerns about the value of structured products based on U.S. subprime mortgages, reflecting growing delinquencies in these mortgages. This disquiet subsequently broadened to include a wide range of structured products—because some of these products contained subprime mortgages and because investors had difficulty in valuing these securities, owing to their complex structures and a lack of information about the assets backing them. Liquidity evaporated in the secondary market for structured products since investors feared that they would be unable to sell assets quickly at prices commensurate with what they thought they should be worth—a fear that became a self-fulfilling prophecy. There was a flight to quality assets, and yields on treasury bills and government bonds dropped significantly. Yield spreads widened, albeit less for long-term debt than for short-term debt, and equity markets fell significantly.

The effects have been most marked in short-term money markets. One market that has been particularly affected is that for asset-backed commercial paper (ABCP). As concerns

increased about the quality of the underlying assets in these structures, issuers had trouble rolling over commercial paper. Rates on the paper rose sharply, and the maturity of the paper fell. In Canada, an additional difficulty was that some non-bank-sponsored conduits were unable to draw on backup liquidity lines from banks, prompting a call for a standstill (the Montreal Proposal)[1] to effect an orderly workout.

An unexpected consequence of these developments was their impact on interbank markets. Many banks were affected, both in Canada and abroad, because of commitments to provide funding to the ABCP conduits, and because it became much more difficult to securitize assets. As well, with commercial paper rates elevated, companies began to draw on their lines of credit with banks. Banks were also concerned that they would be called upon to provide financing to companies that had formerly made use of longer-term financial markets. Banks started to build up liquidity, and interbank rates, especially for term lending, rose well above their usual spread over expected future overnight rates. In many cases, this was exacerbated by concerns about the creditworthiness of counterparties. Central banks in many countries, including Canada, offered assistance to overnight markets to keep overnight rates near target levels when pressures on short-term funding emerged.

Although liquidity in some short-term markets in Canada has improved since mid-August, and rates for bank funding and bank-sponsored ABCP have come off their August peaks, these rates remain elevated. Banks have taken back onto their balance sheets some of the asset-backed commercial paper issued by conduits that they sponsored. The market for non-bank-sponsored ABCP remains frozen with the standstill period under the Montreal Proposal having been extended to 14 December. But, at the time of writing, it appears that progress is being made in the negotiations to establish a framework to convert short-term non-bank ABCP into medium-term tradable financial instruments. It was announced that the restructuring process should be completed by the end of March 2008.[2]

In most countries, including Canada, longer-term markets have been less affected by the turbulence. Although credit spreads have widened from the low levels seen earlier this year, they remain far below the peaks seen in 1998 and 2002. Moreover, the effect on funding costs for corporations has been mitigated by a decline in government bond yields.

It is unlikely that financial markets will return to their pre-turbulence state. First, as discussed in previous issues of the FSR, the narrow credit spreads observed then did not adequately reflect the risks that were being taken. As well, one would expect some changes in the functioning of the financial system because of the difficulties highlighted by the recent market events: the principal-agent problem associated with the way that the originate-and-distribute model has been applied, and the difficulty that investors face in evaluating opaque and complex financial assets. For example, sponsors of asset-backed commercial paper conduits may have to give a clearer idea of the assets being funded before there is a ready market for the commercial paper they issue.

Indeed, a number of international groups have recognized the importance of carefully examining the sources of the recent turbulence and the lessons that can be learned from it. In September 2007, G-7 finance ministers and central bank governors asked the Financial Stability Forum (FSF) to establish a working group to identify weaknesses that merit attention from policymakers and to recommend actions needed to enhance market discipline and institutional resilience. The working group (which includes the Canadian Superintendent of Financial Institutions) is examining:

- risk-management practices (including liquidity management, stress testing, and assessment of counterparty risk)
- valuation and risk disclosure
- the role of credit-rating agencies
- principles and practices of prudential oversight, particularly with respect to off-balance-sheet exposure
- key issues related to authorities' capacity to respond to episodes of market turbulence, including the tools and instruments available to central banks and supervisors in times of distress

1. See <http://documentcentre.eycan.com/pages/main.aspx?SID=35> for information concerning developments in the Montreal Proposal.
2. Purdy Crawford, letter to *Financial Post* and *Le Devoir* newspapers, 22 November 2007.

The group's preliminary report was presented to the G-7 ministers and governors on 16 October 2007. [3]

The Bank of Canada is working closely with other Canadian regulatory authorities in reviewing the recent market events and the issues that they raise. The Department of Finance is coordinating these efforts.

In this context, the Bank of Canada will be examining the principles and practices relating to its liquidity facilities. In particular, it will examine whether it might be useful to have a facility that would provide liquidity to banks at terms longer than overnight, possibly collateralized with a wider range of securities than the Bank currently accepts. This examination will involve identifying the kinds of market failure any such facility would be designed to deal with. It will also benefit from parallel work going on in other central banks.

Market participants, including financial institutions, hedge funds, and rating agencies, are also assessing the need for changes in light of recent events. The Institute of International Finance[4] has established a committee to review risk-management issues, the use of off-balance-sheet vehicles, the valuation of complex products, the interpretation and evaluation of credit ratings, and transparency. A group chaired by Sir Andrew Large has published a consultation document proposing best practice standards for hedge funds, focusing on valuation, risk management, disclosure, and fund governance. The practices would be voluntary and would operate on a "comply or explain" basis.[5]

Canadian financial situation

While there may be some continued dislocation in some financial markets as they struggle to reprice risk, this does not appear to pose a systemic threat to the Canadian financial system. There will be some impact on the Canadian economy directly through credit spreads and availability, and indirectly through the effects on the U.S. economy. The effects on the Canadian financial system, however, should be mitigated by the strong balance sheets of financial and non-financial corporations built up through years of strong growth and substantial profits. Moreover, Canadian domestic demand and high commodity prices provide support for the incomes of Canadian corporations and households. In fact, the tightening of credit conditions resulting from the turbulence is not unwelcome, given the strength of the housing market and the continued increase in the indebtedness of the household sector.

Canadian banks appear to be well positioned to absorb the effects of the recent market turbulence, because of their initial sound capital positions and strong profits. Although bank funding costs have increased, major Canadian banks have been able to bolster their liquidity positions by issuing medium-term paper. They have also been able to issue some capital-eligible subordinated debt. Their loan-loss performance has been good, and their exposure to the U.S. subprime-mortgage market and to leveraged loans appears to be small and manageable. With the Canadian household and non-financial corporate sectors also in good financial shape for the most part, and given that banks' exposures to the more vulnerable sectors are not large, the deterioration in the quality of bank loans should be limited. Canadian banks have relied much less than their U.S. counterparts on the originate-and-distribute model, which should also mitigate the effect of the turbulence.

As noted above, the recent developments will affect the Canadian non-financial corporate sector directly through their effects on the cost and availability of credit. There will also be an impact through reduced exports because of a slowing U.S. economy, which will exacerbate the effect of the sharp appreciation of the Canadian dollar. The non-financial corporate sector appears reasonably well positioned, overall, to withstand the effects of recent events. For the most part, profits have remained high and balance sheets are healthy, with low debt-to-equity ratios and high levels of corporate liquidity (although a small portion of this liquidity is held in the form of, now-frozen, non-bank-sponsored ABCP). Thus, while there may be major challenges for some companies, especially those in export sectors, it is unlikely that there will be widespread problems.

The household sector also appears to be in good financial shape. While the debt-to-income ratio has continued to rise, arrears on loans and

3. Available at <http://www.fsforum.org/publications/publication_24_88.html>.
4. "Regulators urged to take a back seat," *Financial Times*, 22 October 2007.
5. Available at <http://www.hfwg.co.uk/?section=10365>.

bankruptcies all remain at relatively low levels, reflecting the buoyant labour market, solid growth in household disposable income, and a relatively low debt-service ratio. In contrast to the United States, there is little likelihood of a widespread weakness in house prices that might pose a threat to household net worth.[6] As with the corporate sector, a major source of stress to the household sector is likely to be slowing U.S. demand for Canadian products, which might lead to job losses. This risk should be mitigated, however, by the current strong domestic demand in Canada. Recent events appear to have had little effect on the availability of credit to the household sector, although the cost of credit has increased. While this may cause a small increase in the number of households with high debt-service ratios, the effect on the banking system is likely to be limited.

Risks

Uncertainty remains in financial markets. The fragility of some markets—especially those for structured products—is continuing to hinder the ability of market participants to value assets normally traded in those markets. The difficulty in valuing assets is creating uncertainty about the accuracy and comparability of the losses reported by participants.

Amid this uncertainty, a shock could lead to a marked increase in risk aversion, a further deterioration in liquidity in markets, and a widening in risk premiums. The impact could extend to some markets that, to date, have been little affected.

One such shock could be a much greater deterioration in the U.S. housing market than financial markets currently expect—a deterioration reflecting the oversupply of housing and the number of mortgages that are likely to be subject to a resetting of interest rates over the next year. A significant decline in house prices could lead to a large unexpected increase in mortgage delinquencies causing more foreclosures and a further tightening in credit conditions for households. This would exacerbate excess supply in the housing market and cause a further deterioration in the quality of mortgage loans, and of the financial assets that have been created using them. Deteriorating conditions in the U.S. housing sector could also shake consumer confidence more widely, leading to a more pronounced slowing of consumer spending and of the U.S. economy more generally.

Such a deterioration in the U.S. economy, and in the quality of mortgage assets that are present in many structured products, could exacerbate the liquidity problems in the markets for structured products and the difficulty in valuing these assets. A possible need to sell assets to meet margin calls, together with other forced sales, could trigger a downward adjustment in structured-asset markets; the turmoil might also spread into other asset markets. This could reignite counterparty concerns, as institutions might have to mark down assets further. Increases in risk premiums might spread to long-term credit markets, which have been relatively unaffected by the recent market events.

A further increase in risk premiums, together with the slowing in the U.S. economy, could also lead to a slowing of activity in the world outside the United States. This could reduce or reverse the recent improvement in global imbalances, again raising the prospect of a disorderly resolution of these imbalances. This could entail an abrupt and sizable decline in the value of the U.S. dollar, greater volatility in financial markets, a further rise in risk premiums, and an increase in protectionism. The resulting slowing in world growth would lead to a decline in commodity prices.

The probability of this scenario is low. But if it were to materialize, the greater-than-expected slowing in the U.S., and possibly the global, economy, together with a decline in commodity prices and an unexpected rise in the Canadian dollar, would reduce the profitability of Canadian exporters and increase stress on Canadian businesses, households, and financial institutions. This would have a significant effect on the Canadian financial system. The deterioration in the quality of structured-asset markets would again raise questions about the quality of assets held by conduits. Canadian banks might also be affected by a worldwide ratcheting up of concerns about counterparties, which could affect the cost and availability of interbank credit.

6. In addition, the non-prime-mortgage market accounts for a much smaller proportion of originations in Canada than in the United States, is not as dependent on securitization, and was not characterized by the same relaxation of lending standards.

At the same time, Canadian businesses could find it more expensive and difficult to obtain credit in financial markets and would turn to the banks for financing. However, some companies, especially those without a strong ongoing business relationship with a Canadian bank, and those seeking funding for transactions perceived to be risky (e.g., leveraged mergers and acquisitions) could find it more difficult to obtain funding. This might threaten the viability of a number of firms.

The Financial System

Financial markets

Since August, credit markets in Canada and in other major economies, particularly the market for the short-term debt of banks and corporations, have been characterized by a marked decline in market liquidity and a repricing of risk. Aside from particular issues related to the type of liquidity facility used in Canada to backstop ABCP conduits, many of the factors affecting Canadian credit markets have been those that generated turbulent credit markets in Europe and the United States; namely, the transmission of problems in U.S. subprime-mortgage debt via the market for securitized instruments.

The global strains in credit markets can be traced back to the past spring, when a repricing of credit was triggered by news that delinquency rates and foreclosures associated with subprime mortgages in the United States had been rising quickly (Box 1). In June, credit-rating agencies began to downgrade mortgage-backed securities (MBSs) and collateralized debt obligations (CDOs) that included U.S. residential subprime-mortgage debt. The extent of the downgrades surprised market participants and led to a reappraisal of credit risk, as well as fears that more downgrades were forthcoming. The underlying backdrop, prior to the repricing, was an environment of historically low risk-free interest rates, which boosted global demand for higher-yielding and riskier financial products, including MBSs and CDOs. Indeed, central banks, including the Bank of Canada, had for some time voiced concern that credit risk might be mispriced as a result of this "search for yield" phenomenon.[7] The news about rising defaults on U.S. subprime mortgages in the spring initiated a sustained widening of long-term credit spreads in Canada and elsewhere (Chart 1).

Spreads on longer-term credit continued to widen as the summer progressed, not only because of further news of downgrades, but also increasingly because of declining liquidity in the secondary market for CDOs and MBSs backed by debt related to subprime mortgages. This, in turn, negatively affected the valuation of these instruments (Box 2). The speed and extent of the decline in market liquidity created broader problems in the market for structured products as the mark-to-market valuation of these, often leveraged, instruments fell. Declines in market liquidity were partly driven by the "forced" selling of structured products by leveraged investors, such as hedge funds and structured investment vehicles, to meet margin calls and/or (anticipated) redemptions.[8] (See Box 2.)

The announcement by BNP Paribas on 9 August that it had closed redemptions of three investment funds because it could not value their assets in the prevailing illiquid market environment for structured products, provided the catalyst for a sharp decrease in the global appetite for risk. This triggered a broader repricing of risky financial assets in world financial markets, including in Canada. Around that time, the secondary markets for leveraged loans related to leveraged buyouts also shut down.[9] Yields on government bonds and treasury bills plummeted as investors fled from risky asset holdings

7. For more on this, see the Highlighted Issue on p. 18 of the June 2007 FSR.

8. The collapse of two Bear Stearns funds resulted primarily from these funds having to mark-to-market their positions in illiquid and declining CDO and MBS markets. This highlighted to market participants the degree of illiquidity in the market for CDOs and other similarly structured products, as well as the risk that other market participants could be forced to mark-to-market at significantly lower prices, incurring significant losses in the process. This led to heightened concerns that this would generate more margin calls, a further wave of selling, and expose other leveraged investors to large losses.

9. This reflected both a broad-based decline in risk appetite and a sharp drop in the demand for the type of CDOs that typically purchased leveraged loans. This, in turn, cut out an important source of funding for leveraged loans, closing the market to new issuance and to the sale of leveraged loans in secondary markets and, thus, forced banks to warehouse loans that had already been committed.

Box 1

Recent Developments in Subprime-Mortgage Markets[1]

Developments in the United States

The continued deterioration in the U.S. subprime-mortgage market over the past few months has had a widespread impact on financial markets. After about three years of sustained declines, the delinquency rate on U.S. subprime mortgages started to increase in early 2006 and is currently over 9 per cent (Chart A). Rising delinquencies and the associated difficulties in securing funding in financial markets have led to financial problems among the originators of subprime and Alt-A mortgages,[2] with a number of originators filing for bankruptcy or stopping activity. The deterioration in the subprime market also led to tighter lending standards[3] and to the removal of several alternative mortgage products—notably the 2-28 mortgages that are particularly prone to delinquency.[4]

Problems in the U.S. subprime-mortgage market are likely to continue for some time, with further increases in delinquencies and losses. Thus, the pace of new non-prime mortgage originations—which accounted for nearly half of total mortgage originations in 2006—will likely slow further. This, together with a general tightening in mortgage-lending standards, may contribute to further weakness in the housing sector.

The U.S. government recently proposed measures to allow a small number of vulnerable borrowers to renegotiate the terms of their mortgages. The impact of these measures on the subprime-mortgage market is likely to be limited.

Developments in the United Kingdom and Canada

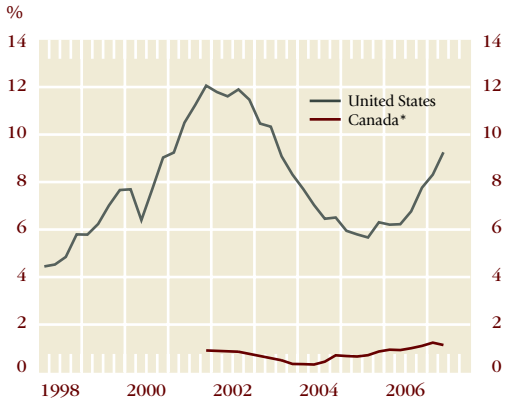
Over the past few years, subprime-mortgage lending has grown rapidly in a number of other countries, notably the United Kingdom and Canada, although such lending accounts for a much smaller share of their mortgage markets than in the United States.[5]

In the United Kingdom, underwriting standards appear to have remained tighter than in the United States.[6] The U.K. Financial Services Authority, however, recently concluded that a number of intermediaries and lenders in the U.K. subprime-mortgage market had failed to adequately assess customers' ability to afford the mortgage or to check the plausibility of information provided by borrowers.[7] Securitization—mainly in the form of Residential Mortgage Backed Securities (RMBS)—is the predominant technique used to fund subprime mortgages in the United Kingdom. Because of problems in the U.S. subprime market and the associated liquidity crunch, some U.K. subprime lenders have recently tightened their lending conditions as market funding becomes more expensive. Recent market developments suggest that growth in the U.K. subprime-mortgage market should slow.

In Canada, subprime lenders have been focusing on near-prime and Alt-A customers. Moreover, subprime products are more "conservative" than U.S. products since they do not contain some of the features that have contributed to the recent rise in delinquencies among U.S. subprime mortgages. Consequently, the quality of the Canadian subprime-mortgage market remains good, as illustrated by low delinquency rates (Chart A). While market funding is used in the Canadian market, it is less predominant than in the United States and the United Kingdom, since some subprime lenders in Canada also rely on deposits. Because of more expensive market funding conditions, a number of Canadian subprime lenders recently announced that they would not provide loans to new customers, at least in the near future, and others have tightened their lending conditions. Thus, growth in subprime-mortgage lending in Canada is likely to slow, although this slowing may be less pronounced than in other countries, since the subprime lenders that rely on deposits do not encounter the same funding problems as those that rely on market funding.

Chart A Delinquencies on Subprime-Mortgage Payments

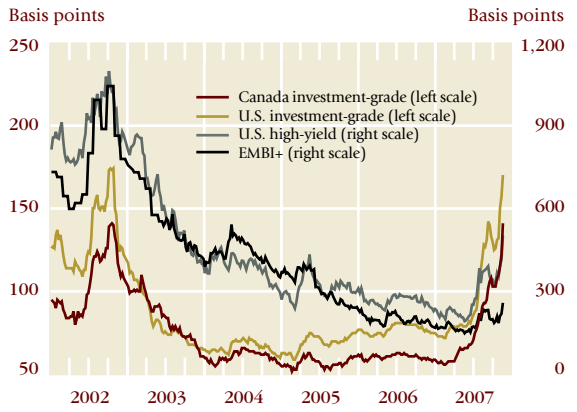
Per cent in arrears over 90 days or in foreclosure



* Average of major subprime lenders
Source: Mortgage Bankers Association and Bank of Canada

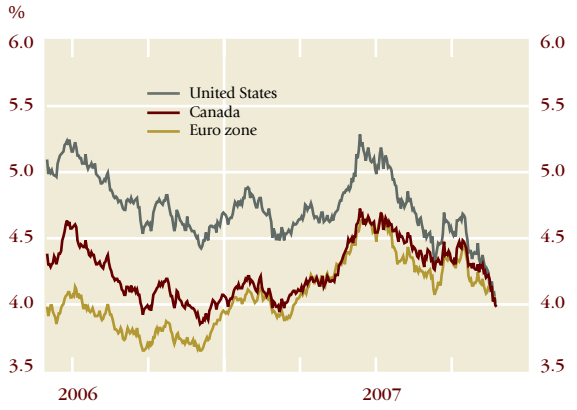
1. For an extensive discussion of the U.S. and Canadian subprime-mortgage markets, see the June 2007 FSR, pp. 6–9.
2. Alt-A customers are borrowers who have a good credit history but lack income documentation.
3. The July 2007 Federal Reserve Senior Loan Officer Survey shows that of the 16 institutions that reported having originated subprime residential mortgages, about 56 per cent had tightened standards on such loans. Moreover, 14 per cent of the banks surveyed have tightened lending standards for prime loans.
4. After the initial two-year period of fixed low interest rates, rates are reset at higher levels for the remaining 28 years of the loan.
5. In the United Kingdom, subprime mortgages are estimated at 3 to 4 per cent of the total mortgage market (Bank of England, *Financial Stability Report*, October 2007, p. 25). In Canada, subprime-mortgage originations are estimated to account for only 5 per cent of total mortgage originations and less than 3 per cent of total mortgage loans outstanding in 2006. In the United States, subprime mortgages accounted for approximately 14 per cent of total mortgages outstanding and 22 per cent of new mortgage originations in 2006.
6. See Bank of England *Financial Stability Report*, April 2007, pp. 28–29.
7. For more details, see <http://www.fsa.gov.uk/pages/Library/Communication/PR/2007/081.shtml>.

Chart 1 Corporate Bond Spreads



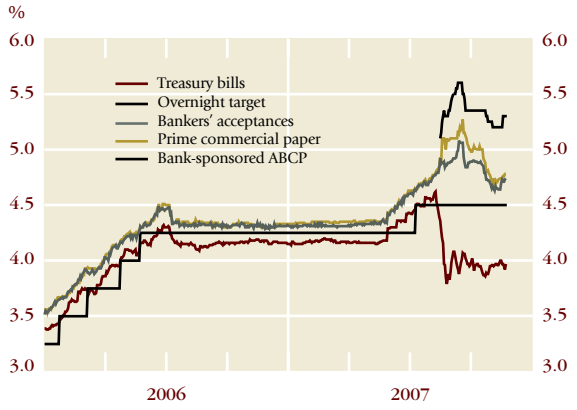
Source: JPMorgan Chase & Co. and Merrill Lynch

Chart 2 Yields on 10-Year Government Bonds



Source: Bank of Canada

Chart 3 Canadian Short-Term Interest Rates



Source: Bank of Canada and Reuters

to the safety and liquidity of these securities (Charts 2 and 3). Yields on longer-term corporate bonds rose only modestly or remained relatively stable as these events unfolded (Chart 4), owing to the decline in yields on government benchmark bonds. In short, the broad-based decline in risk appetite reflected a cumulative buildup of negative news about the U.S. housing market, ratings downgrades, and the reporting of losses at financial institutions and leveraged funds, which preceded the triggering event of 9 August. (See Table 1 for the chronology of events.)

The most pronounced impact of these events—aside from major ongoing concerns regarding the market for longer-term structured products—has been a widening of spreads in the short-term credit markets of most industrialized countries. In particular, these events led to a sharp and, in many cases, unprecedented widening in the spreads between rates in short-term credit markets (such as ABCP, corporate paper, 3-month LIBOR, and 3-month bankers' acceptances), and expected overnight rates (over the same term) in Europe, the United States, and Canada (Charts 3 and 5).

This rise in interbank lending spreads, such as those on LIBOR and bankers' acceptances, reflected an increase in the precautionary demand for liquidity by banks, mainly because of uncertainty regarding funding requirements arising from a potential expansion of bank balance sheets. Specifically, as money market investor demand for ABCP dissipated (Highlighted Issue, p. 13), it became more likely that the various types of conduits would draw on backup lines of liquidity or that banks would effectively move these ABCP conduits onto their balance sheets. This occurred at a time when major banks already faced the prospect of warehousing on their balance sheets loans made in support of leveraged buyouts, which would normally have been sold shortly after the loan commitments were made. This greater demand for liquidity was amplified by heightened concerns about counterparty risk, largely generated by the broad-based uncertainty as to where the losses related to U.S. subprime-mortgage debt and the mark-to-market losses related to market illiquidity in structured products resided. Banks faced difficulties over the period in obtaining funding with a maturity beyond a week or two.

Box 2

The Loss of Confidence in Ratings Assigned to Structured Products

The turbulence in global credit markets can be linked to difficulties in the U.S. subprime-mortgage market and the transmission of these problems via the market for asset-backed securities and structured products. This partly reflects the increased repackaging, or securitization, of mortgage loans, particularly in the United States and, to a lesser extent, in other industrialized countries, into asset-backed securities (ABSs) such as mortgage-backed securities (MBSs). More recently, these MBSs, along with other ABSs, have been further repackaged into complex structured products, such as collateralized debt obligations (CDOs), and CDOs have themselves been used as the underlying assets in asset-backed commercial paper (ABCP).[1]

When liquidity fell in the market for CDOs backed by U.S. subprime-mortgage debt, selling by leveraged investors spread to other more liquid segments of the structured-product market, to the ABCP market (Highlighted Issue, p. 13) and, to some extent, to other "more standard" segments of credit markets. Since the valuations of CDOs are usually model based and assume that markets are relatively liquid, forced sales of these assets into an illiquid market led to unanticipated mark-to-market losses for many CDO investors. This led to a widespread repricing of structured and securitized products more generally, including higher-rated U.S. mortgage-backed securities (unrelated to subprime mortgages), mortgage-backed securities in other countries, and ABCP backed by more "standard" receivables such as credit card payments, as well as, to a lesser extent, corporate and emerging-market bond debt and leveraged loans.

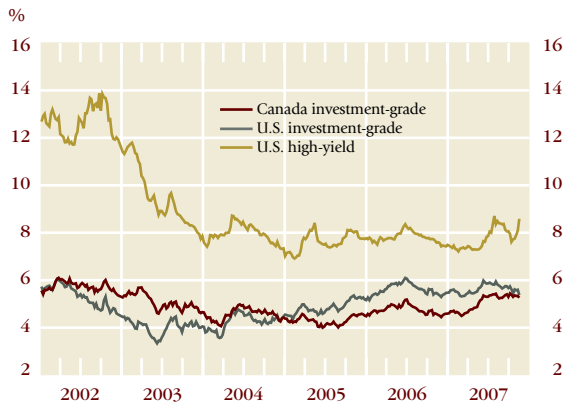
This widespread increase in credit spreads reflected not only the growing uncertainty of market participants about the valuations of a broad range of structured credit instruments and their concern that forced "fire sales" of these assets would engender more mark-to-market losses for financial institutions, conduits, and leveraged funds, but was also amplified by a loss of confidence in the credit-rating process for structured products (including, later on, ABCP). When the CDO market (and, to some extent, the MBS market) came under stress, investors questioned the appropriateness of ratings, given sharp, largely mark-to-market declines in the valuations of structured instruments (partly because of market illiquidity), which were not necessarily accompanied by declines in the ratings for these instruments.

The complexity of CDOs, as well as the requirement of many institutional investors to have the level of their fixed-income holdings driven by credit ratings, may have led the ultimate investors to place too great a reliance on the rating of the CDO tranches to guide their investment decisions. (See Zelmer, p. 51.) They may not always have paid sufficient attention to how the credit and liquidity characteristics of these CDOs differed from those of more "ordinary" debt instruments, such as corporate bonds. It appears that these investors may have underestimated the market liquidity risks in these instruments.[2]

Since many of these structured products are very complex and relatively opaque—particularly those that are themselves backed by other structured or securitized products—it is often more difficult for investors to determine their direct exposures to various risks than it is for more traditional debt instruments.[3] While securitization helps disperse risk to those more willing to bear it, it can also make it difficult for market participants to easily understand the full extent of their exposures to poorly performing underlying assets and, in turn, the full extent of their counterparties' exposure to these same assets. This greater uncertainty about risk exposures and valuations contributed to a greater degree of indiscriminate selling of structured products and to lower market liquidity.

1. For definitions and a discussion of ABCP, MBSs, and CDOs in a Canadian context see Kiff and Morrow (2000), Kiff (2003), Toovey and Kiff (2003), Armstrong and Kiff (2005), and Kamhi and Tuer (2007).
2. See Gravelle (2007) for more on the mispricing of liquidity.
3. See Barker (2007) for a discussion on the opacity and complexity of CDOs.

Chart 4 Yield Levels on Corporate Bonds



Source: Merrill Lynch

Rates for overnight loans in the United States, Europe, and Canada also moved above the respective target policy rates. As a result, several central banks, including the Bank of Canada, moved quickly to provide significant amounts of overnight liquidity to their financial systems to keep the overnight rates close to policy target rates (Box 3). Shortly after mid-August, conditions in the overnight markets began to stabilize.

In Canada, between mid-September and early November, there were an increasing number of transactions at longer maturities in short-term credit markets, including the market for bankers' acceptances, and spreads narrowed. More recently, credit conditions have again begun to deteriorate. Thus, spreads on short-term credit market instruments remain elevated, both in Canada and abroad. Further news of significant losses and writedowns among financial institutions, funds, and some monoline insurers and reinsurers, announced in October and November, has served to prolong

Table 1

Chronology of Events

Date	Event
15 June	Moody's downgrades the ratings for 131 MBSs backed by U.S. subprime-mortgage debt.
20 June	Two Bear Stearns funds that invested in structured products backed by subprime debt are reported to be about to fail.
10–11 July	S&P places US$7.3 billion of MBSs backed by residential mortgages on a negative ratings watch. Moody's places 184 mortgage-backed CDO tranches on a downgrade review and downgrades US$5 billion.
30 July–1 August	Germany's IKB warns of losses related to U.S. subprime-mortgage debt, and its main shareholder (KfW) assumes the liquidity facilities that IKB provided to an IKB-backed ABCP conduit highly exposed to U.S. subprime loans. On 1 August, a US$3.5 billion bailout of IKB is announced.
1 August	Coventree, the largest third-party sponsor of ABCP in Canada, issues a statement to its selling group regarding the extent of the exposure of its ABCP conduits to U.S. subprime-mortgage debt.
6 August	American Home Mortgage Investment Corp files for Chapter 11 bankruptcy, leading to a term extension on outstanding ABCP by one of its funding conduits.
9 August	• BNP Paribas freezes redemptions for three funds, citing an inability to appropriately value them in the current market environment. • Bank of Canada issues statement on its readiness to provide liquidity to support the efficient functioning of financial markets.
13 August	Coventree announces that it could not roll over its maturing ABCP conduits, and third-party ABCP funding effectively stops.
15 August	Bank of Canada announces a temporary expansion of the list of securities eligible for SPRA transactions.
16 August	The Montreal Proposal is announced in which major participants in third-party ABCP agree to a 60-day standstill to work on converting their holdings of ABCP into floating-rate notes that match the maturity of the underlying assets.
17 August	The U.S. Federal Reserve cuts its discount rate by 50 basis points, to 50 basis points above the target federal funds rate.
6 September	Bank of Canada restores standard terms for SPRA.
18 September	The U.S. Federal Reserve cuts its discount and target federal funds rates by a further 50 basis points.
15 October	Participants involved in the Montreal Proposal announce an extension of the standstill agreement until 14 December.
22 November	The chairman of the Pan-Canadian Committee of Investors in third-party ABCP announces that the complex restructuring process should be completed by the end of March 2008.

Source: *BIS Quarterly Review* (September 2007) and Bank of Canada

Box 3

The Bank of Canada's Activity in the Overnight Funding Market

The financial market turbulence that began in August caused a sharp decrease in liquidity in markets for short-term funding, including the overnight interbank market (where banks provide unsecured overnight loans to each other) and the overnight repurchase market. This deterioration reflected perceptions of increased counterparty risk, combined with precautionary hoarding of funds by financial institutions. This box provides a brief summary of how the Bank of Canada implements monetary policy by influencing liquidity in the overnight market and how it has addressed the needs of Canadian short-term credit markets during this period of market stress.

To meet the increased demand for overnight liquidity, the Bank of Canada used the standard tools it employs for implementing monetary policy. The Bank's monetary policy implementation framework centres on keeping the overnight rate close to its target.[1] The Bank's primary influence on the overnight rate is through its 50-basis-point operating band.[2] To reinforce the target when there is deviation in the overnight rate, the Bank uses open market buyback operations. If the overnight rate is generally trading above the target rate intraday, the Bank will intervene with special purchase and resale agreements (SPRAs). If the overnight rate is generally trading below the target rate, the Bank will intervene with sale and repurchase agreements (SRAs). The Bank can also adjust the targeted level of settlement balances above or below the typical $25 million setting. SPRAs are routinely conducted around month-, quarter-, and year-end periods, and when large payment flows are going through the system.

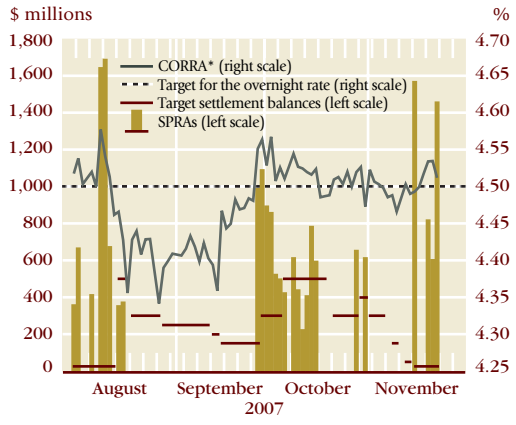
In the initial stages of the market "dislocation," starting on 9 August, the increased demand for liquidity caused the rate on overnight collateralized loans to move well above the target overnight rate (Chart A). This market response was not unique to Canada. In the United States and Europe, the overnight interbank rate also moved significantly above the respective target policy rates. In this circumstance, the Bank of Canada engaged in multiple rounds of SPRAs, providing overnight funds to the primary dealers at the target overnight rate in exchange for Government of Canada securities. The Bank also increased the level of settlement balances to $500 million beginning 15 August. Since that time, the target level of settlement balances has fluctuated (between $25 million and $500 million) in response to the occasional upward pressure on the collateralized overnight lending rate.

After being well above target in the first two days of the market dislocation, the overnight rate fell below target. The broader money market remained under stress, however. On 15 August, the Bank responded by temporarily expanding the list of securities acceptable for SPRA transactions to include those securities that are already eligible as collateral for the Standing Liquidity Facility. Subsequently, on 6 September, the Bank of Canada restored the standard terms for SPRA, accepting only Government of Canada securities, since it judged that the temporary expanded facility was no longer required.

In late September and early October, the rate of collateralized loans tended to set slightly higher than the target overnight rate. The Bank responded with higher levels of settlement balances and the use of multiple rounds of SPRAs. After a period of relative stability in late October and early November, there has more recently been some occasional upward pressure on the overnight rate, requiring the use of SPRAs.

Overall, the Bank relied on the standard tools it employs for implementing monetary policy in providing overnight liquidity during the credit market dislocation. This framework has generally served the Bank of Canada well in supporting the efficient functioning of capital markets. It has become evident, however, that the statutory framework within which the Bank conducts these operations needs to be reviewed. The Bank of Canada Act defines the range of securities that the Bank may buy and sell in its open market buyback operations. Some of the powers to buy and sell securities are outdated and open to differing interpretations as to how broad a range of securities may be accepted by the Bank for its buyback operations in situations such as that which developed in August. The Bank is therefore reviewing these powers to determine whether amendments to the Act may be needed to clarify the types of securities it may buy and sell in various situations, so that it can respond effectively to market conditions.

Chart A Overnight Market Conditions

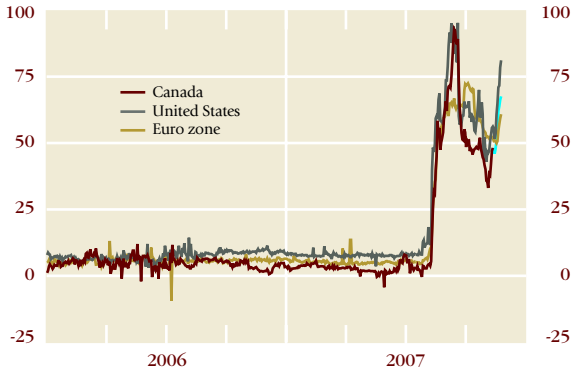


* CORRA: Canadian overnight repo rate average
Source: Bank of Canada

1. See C. Reid, "The Canadian Overnight Market: Evolution and Structural Changes." *Bank of Canada Review* (Spring 2007): 15–29 and <http://www.bankofcanada.ca/en/lvts/lvts_primer_2007.pdf>.
2. The Bank of Canada pays 25 basis points below its target overnight rate on settlement balances left overnight and charges 25 basis points above the target rate on overdrafts.

Chart 5 Spreads between 3-Month LIBOR and Overnight Index Swaps

2 January 2006–22 November 2007



Source: Bloomberg

stressed market conditions. These more recent announcements of losses and writedowns have led to declines in major equity markets.

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Highlighted Issue

The market for Canadian asset-backed commercial paper, revisited

Prepared by Nadja Kamhi and Eric Tuer

Since the publication of the June 2007 FSR, which featured a discussion of the recent developments in the market for Canadian asset-backed commercial paper (ABCP) by Kamhi and Tuer, global credit markets, including this commercial paper market, have come under stress. This Highlighted Issue updates that

discussion, outlining the series of events and factors that led to the disruption in the non-bank-sponsored segment of the Canadian ABCP market.

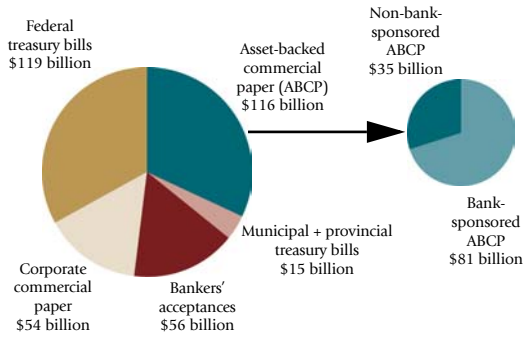
Background

At the end of July 2007, $116 billion of ABCP was outstanding in Canada, which is approximately one-third of the total money market (Chart 6). Of this, about $81 billion was ABCP sponsored by the major Canadian commercial banks who also provide the backstop liquidity. The remaining $35 billion was non-bank-sponsored or third-party ABCP. Non-bank or third-party sponsors are independent, non-bank-affiliated firms that acquire assets in order to structure conduits backed by liquidity facilities provided by large commercial banks, usually foreign based. The majority of assets in these conduits have been CDOs (Kamhi and Tuer 2007). In fact, off-balance-sheet vehicles, such as ABCP conduits, have been a dominant source of demand for CDOs globally. ABCP conduits that purchase longer-term CDOs typically have lower funding costs (through the issuance of short-term debt in the commercial paper market) than the returns on the underlying assets. Funding a portfolio of longer-duration assets with short-term paper, however, creates the need for programs that continually "roll over" the notes and exposes ABCP programs to a considerable "funding mismatch" risk.

Global conditions

Over the past several years, a search for higher yields and some complacency with respect to risk on the part of Canadian and global fund managers became prevalent across credit markets, partly because of the long time span since any class of assets was subject to a significant adverse credit event. This complacency was most evident in the market for ABCP backed by complex structured products. Reassured by the high credit ratings assigned to the paper, investors were willing to finance these conduits despite the lack of transparency with respect to the assets that the conduits were funding and other risks associated with structured financial instruments.[10] As concerns mounted regarding the underperformance of U.S. subprime-mortgage securities, market participants found it difficult

Chart 6 Composition of Canadian Money Market (July 2007)



Source: Bank of Canada and DBRS

10. These risks include illiquidity, opaqueness, and valuation difficulties (Barker 2007).

to assess their direct and indirect exposure to this market or the exposure of their counterparties. Although concerns initially centred on mortgage-backed securities and ABCP backed by U.S. subprime mortgages and CDOs, investors quickly stopped discriminating between the different types of ABCP programs. This stemmed from concerns that the relatively illiquid structured products and their related valuation problems would generate further mark-to-market losses; from a loss of investor confidence in the credit ratings given to these instruments; and from a worldwide retrenchment from risk taking that came to the forefront with the freezing of three BNP Paribas investment funds on 9 August.

As maturities on ABCP came due and were not renewed (i.e., rolled), designated liquidity providers had to be called upon to extend funding to ensure timely repayment of maturing paper. In Canada, the non-bank-sponsored segment of the ABCP market was especially affected, since some liquidity providers refused to provide funding, arguing that the conditions of a general market disruption (GMD) that would have triggered their involvement had not been met.[11]

Non-bank-sponsored ABCP

Amid deteriorating conditions in the global market for ABCP, Coventree, the largest sponsor and administrator of non-bank ABCP conduits in Canada, issued a public announcement on 13 August stating that it could not roll its outstanding ABCP and was thus unable to continue to finance its conduits. Many providers of liquidity to non-bank-sponsored ABCP conduits refused to extend the liquidity support requested, since their obligation was limited to conditions of a general market disruption. Those banks, largely foreign based, argued that the conditions in the market did not constitute a GMD because commercial paper could still be issued in spite of severe liquidity problems. At this point, trading in the market for non-bank-sponsored ABCP came to a halt. In an effort to restore confidence and liquidity, major financial market players involved in the market for non-bank-sponsored ABCP reached a standstill agreement that became known as the Montreal Proposal.[12] The agreement incorporated a commitment to hold the non-bank-sponsored ABCP, while conduit sponsors agreed not to draw down any liquidity facilities until a restructuring solution was reached. The long-term solution would involve restructuring the financing into floating-rate notes (FRNs) that align with the various maturities of the underlying assets in the conduits. This would effectively eliminate the need for liquidity facilities. Work on the agreement is ongoing. The target date to present a restructuring plan to noteholders, originally set for 15 October, has since been extended to 14 December 2007.[13] It has been announced that the restructuring process should be completed by the end of March 2008.

Bank-sponsored ABCP

Problems were not restricted to non-bank-sponsored ABCP programs. Bank-sponsored ABCP has also been affected by concerns regarding exposure to U.S. subprime mortgages and the robustness of its liquidity facilities. Starting in early August, the yields on bank-sponsored ABCP increased dramatically. Nevertheless, unlike non-bank-sponsored ABCP, this market continued to function as major banks pledged liquidity support for their programs.[14] However, ABCP that had previously traded at yields just above CDOR,[15] was being offered at 50 to 60 basis points above that benchmark near the end of the month. Despite these attractive yields, investor demand for ABCP remained hesitant, particularly for maturities greater than one month, forcing the sponsoring banks to inventory the unsold paper. CDOR has declined from its late August peak by around 35 basis points. However, yield spreads on ABCP remain at about 50 to 60 basis points above CDOR.

11. The limitations of a GMD condition as a trigger for liquidity were discussed in the June 2003 (p. 45) and June 2007 (p. 25) issues of the FSR. These limitations caused U.S. rating agencies to refuse to rate ABCP backed by GMD liquidity provisions.
12. See <http://documentcentre.eycan.com/pages/main.aspx?SID=35> for information concerning Montreal Proposal developments.
13. See <http://documentcentre.eycan.com/eycm_library/Canadian%20Commercial%20Paper/English/Media%20Releases/ABCPPressRelease15Oct07.pdf> for the press release.
14. See Bank of Canada press release dated 21 August 2007.
15. CDOR, the Canadian Dollar Offer Rate, is the interest rate for Canadian bankers' acceptances and is determined daily.

After a sharp run-up in August and September, bank inventories of ABCP have come down moderately. Total bank-sponsored ABCP outstanding declined to roughly $84 billion in October from $86 billion in August.

Changes to liquidity facilities standards

In reaction to these events, all major Canadian banks have agreed to replace GMD-style facilities with global-style liquidity facilities. As discussed in Kamhi and Tuer (2007) and in Toovey and Kiff (2003), global-style liquidity facilities, which are the standard in the United States and Europe, are available under a much broader set of conditions than a GMD. The use of global-style liquidity facilities will likely lead U.S. rating agencies to start rating these Canadian ABCP programs in the future.[16]

In January 2007, Dominion Bond Rating Service (DBRS), the only rating agency that has been providing ABCP ratings in Canada, made global-style liquidity facilities a condition for providing the highest rating to new issues of ABCP backed by structured financial assets (i.e., CDOs) (Kamhi and Tuer 2007). This led to a substantial reduction in new issuance of this type of program. In September 2007, DBRS further announced that it would be adopting a new rating framework under which all conduits will have to have global liquidity facility standards if they wish to be assigned the highest rating. Moreover, DBRS stated that ratings on ABCP programs issued prior to the September announcement might be revised unless they adopt the global liquidity facility standard by December 2007 (Loke, Feehely, and Wong 2007). Since the announcement was made, virtually all bank-sponsored ABCP has met global liquidity facility standards.

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Payment and settlement systems

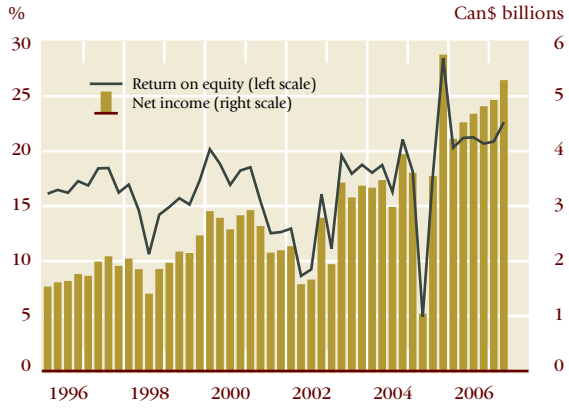
During the financial market turmoil in August, the designated Canadian payment, clearing, and settlement systems, which include the LVTS, CDSX, and CLS Bank, managed their operations well. While a marked increase in transaction volumes in all three designated systems put extra pressure on their processing capacity, there was only one settlement delay related to capacity pressure in August. However, the capacity issue was dealt with quickly and effectively, and no delays occurred on subsequent record-volume days.

The drying up of liquidity in the market for ABCP resulted in a number of defaults and extensions of entitlement payments related to securities held in CDSX.[17] On 13 August 2007, approximately $2 billion in maturities of ABCP held at CDS was not paid. Issuers of this ABCP then had to either extend the maturities of this paper, where this right existed, or leave the maturities unpaid. In the event, about $1.6 billion of ABCP was left unpaid, and another $500 million was extended. CDS was not exposed to any financial risks arising from the unpaid maturities, because CDS does not execute an entitlement payment in CDSX unless it is pre-funded by the issuer's paying agent. On 14 August, CDS took steps to assist issuers and participants holding the defaulted paper, including facilitating direct interaction between issuers and participants, to reach mutually agreeable solutions, and enabled procedures to process partial payments on maturing ABCP. As well, CDS issued daily bulletins to system participants to provide information on unpaid and extended maturities, and on the evolving value of unpaid ABCP held at CDS.

16. Earlier this year, a few Canadian ABCP programs satisfied U.S. rating-agency criteria and were thus rated by them.

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

Chart 7 Profits of Major Banks



Source: Banks' quarterly financial statements

Financial institutions

The major Canadian banks were profitable and well capitalized before the recent market turbulence. In the third quarter of fiscal 2007 (ending 31 July), the after-tax profits of the major banks were at a near-record level of $5.3 billion, with returns on equity (ROEs) averaging about 22 per cent (Chart 7). This trend continued to be driven by strong loan growth, as well as strength on the wealth-management side. Operations in capital markets continued to make a sizable contribution to earnings, although two banks reported significant trading losses on specific transactions. Loan-loss provisions are at very low levels, although some recent data (mainly for consumer and credit card loans) suggest a modest weakening in credit quality.

Prospects for bank earnings in the immediate future may be less robust if market-based activity slows. In addition, funding costs, both short- and long-term, have risen and become volatile, which, at least initially, could result in narrower spreads, as banks' funding costs are not automatically passed on to borrowers.

Given the market turbulence, the major banks used the occasion of their third-quarter profit announcements to provide an update on certain exposures in areas highlighted by the recent market events. The banks generally indicated minimal or manageable exposure to "pipeline risk"; that is, bridge financing commitments that backed loan syndications related to merger/acquisition transactions.[18] They reiterated that, for the most part, their exposures to the U.S. subprime-mortgage market (either through direct lending or structured transactions) and to the third-party-sponsored ABCP market were minimal. The major banks also reported that their exposures to hedge funds are

18. A study by BMO Capital Markets ("Bridge Anyone?" 1 August 2007) concluded that overall bank exposure to this type of activity, particularly in the context of the size of their overall balance sheets, was manageable. The study noted that if every dollar of the estimated $14 billion of bridge loan commitments had been drawn at that date, the overall Tier 1 capital ratio for the major banks would have dropped by 15 basis points.

modest, collateralized, and typically well diversified by counterparty and investment style.[19]

In early November, the major banks as a group pre-announced roughly $2 billion of losses on a pre-tax basis for the fourth quarter. These were largely related to their holdings of ABCP and U.S. subprime securities.

The banks sponsor and provide liquidity support for about $130 billion in securitization conduits issuing ABCP, both in Canada and in other countries. In general, bank-sponsored ABCP has been much less affected by the turmoil than third-party ABCP. Nevertheless, the banks have taken back onto their balance sheets at least some of the assets in conduits that they have sponsored. Moreover, they may see a strong demand for credit from corporations previously able to fund themselves in capital markets.

With their healthy capital, profitability, and liquidity positions, banks had at least some capacity to add to their assets at the onset of the turbulence. Since mid-August, the banks have been successful in funding through a number of instruments, such as medium-term notes, subordinated debt, CMHC-insured mortgage-backed securities and mortgage bonds, and covered bonds. Balance sheet data suggest that, as a group, they were able to raise wholesale deposit funding from both financial and non-financial sectors.

It should be noted that Canadian banks rely on securitization for a relatively small proportion of their funding. Securitized credit accounts for about 13 per cent of total household and business credit in Canada. Specifically, it accounts for about 21 per cent of residential mortgage credit (of which 83 per cent is through the CMHC-sponsored MBS program, which continues to run smoothly), 18 per cent of consumer credit, and 5 per cent of business credit.

Even though bank share prices have underperformed the market, the Bank of Canada's indicator for distance to default suggests that markets continue to view banks as financially healthy in the aftermath of the crisis (Chart 8). For example, the average distance to default for the major banks has declined only slightly from its recent high. Simulations suggest that if the recent volatility were to persist for a full year, all else remaining the same, the distance to default for the major banks would decline to a level slightly below its historical average, but would remain above the trough reached during the technology-sector adjustment in the early 2000s.[20]

The major Canadian life and health insurance companies reported firm growth in profits in the third quarter, ending 30 September 2007, with ROEs in the 15 to 19 per cent range. The diversity of their business lines rewarded the firms with strong sales posted in both wealth-management and protection products. Both domestic and international operations contributed to the strong profits. Credit quality remains firm in fixed-income portfolios. Two of the major life and health companies had reported modest exposures to the U.S. subprime-mortgage market.

There has been a marked increase in the exposure of Canadian financial institutions to Canada's non-residential commercial real estate sector in the past three years.

The exposure of Canadian banks has increased by 30 per cent to $40 billion over this period, following 10 years in which exposure remained relatively stable.[21] Despite the large increase, this exposure has remained relatively stable as a proportion of assets (at around 2.2 per cent) and as a percentage of Tier 1 capital (below 40 per cent). The exposure of banks to commercial real estate outside Canada[22] has also been increasing—from $8 billion in 2004Q2 to $22 billion in 2007Q2.

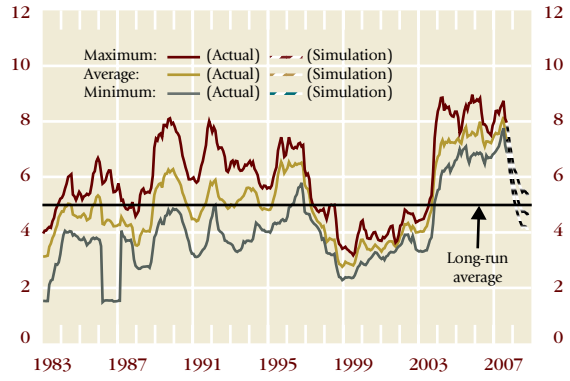
19. Early in 2007, OSFI conducted a review of Canadian bank exposures to hedge funds and concluded that banks' exposures are relatively small and that risk-management practices are adequate (J. Dickson, Remarks to Senate Standing Committee on Banking, Trade and Commerce, 31 January 2007).

20. The high-volatility scenario takes the average of daily deviations in equity market capitalization (from the one-year mean) as observed over the period from 24 July 2007 to 21 November 2007. This average is then assumed to be constant one year into the future, *ceteris paribus*.

21. This exposure is calculated as the sum of resident non-mortgage loans (in Canadian dollars and foreign currency) to commercial builders and developers, land developers, and real estate operators, plus non-farm, non-residential mortgage loans for properties in Canada.

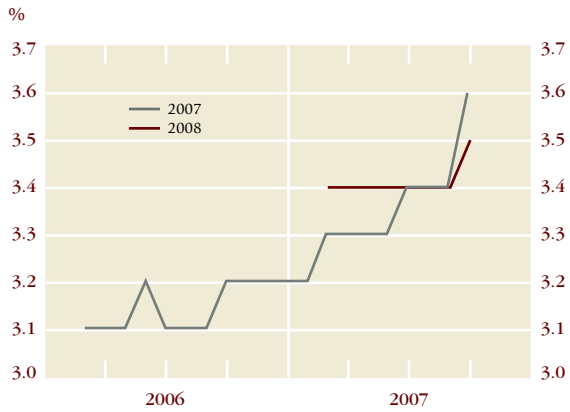
22. This includes non-residential mortgages secured by property located outside Canada and the sum of non-resident non-mortgage loans to commercial builders and developers, land developers, and real estate operators.

Chart 8 Distance to Default for Major Banks



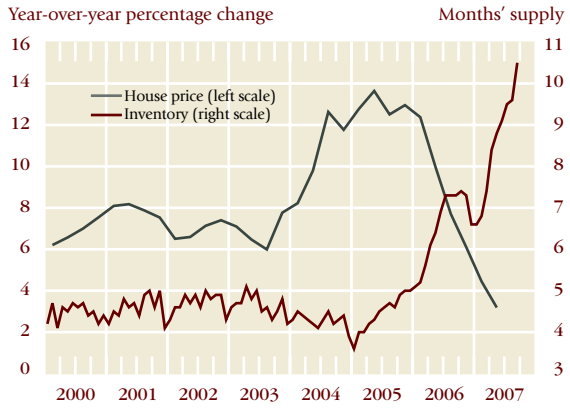
Note: See text for a description of the simulation.
Source: Bank of Canada calculation based on data from OSFI and Thomson Financial Datastream

Chart 9 Evolution of Consensus Estimates for Annual Global Economic Growth*



* This estimate covers over 46 countries. Country weights are determined using country GDPs converted at 2006 market exchange rates.
Source: Consensus Economics Inc.

Chart 10 U.S. House Prices and Inventory: Existing Homes



Source: Office of Federal Housing Enterprise Oversight and National Association of Realtors

The data on other financial institutions cover only non-residential mortgages. There has been a steady increase from close to $37 billion in August 2002 to over $51 billion in August 2007. Much of the increase is accounted for by the credit unions. Life insurance companies, which account for over half of the exposure of non-bank financial institutions, have had only marginal increases.

The Macrofinancial Environment

The international environment

The outlook for global economic growth in 2008 has been revised up slightly since June 2007 (Chart 9), with an acceleration in emerging Asia offsetting an expected slowing in the advanced economies.

In the United States, recent developments in the mortgage market are expected to prolong the adjustments in the housing sector. Sales of new and existing homes continue to decline, the inventory of unsold homes remains elevated, and price declines are expected to continue (Chart 10). Consumption growth slowed appreciably in the second quarter of 2007 and is expected to be weak for the remainder of this year. U.S. GDP growth is likely to remain modest in 2007 and through 2008.

The turbulence in financial and credit markets, coupled with a further deterioration in the housing sector, has heightened the risk of an abrupt slowdown in the U.S. economy. The recent monetary loosening by the Federal Reserve should help to mitigate this risk.

Growth in the overseas advanced economies is expected to slow gradually in response to previous monetary policy tightening and the recent financial market turmoil. In the latest consensus forecasts, expected growth in 2008 has been lowered marginally for the euro area and the United Kingdom, and is unchanged for Japan. Meanwhile, growth in emerging Asia has shown stronger momentum, and effects from the financial market turbulence are expected to be modest.

We continue to expect that global imbalances will unwind in a smooth and gradual manner. The U.S. current account deficit has narrowed modestly, and the continued depreciation of the U.S. dollar and expectations of more

balanced growth internationally (slower growth in the United States and continued strong growth elsewhere) are consistent with a further reduction in the deficit. That said, the trade surpluses of Asian and oil-exporting countries continue to expand, underpinned by high oil prices and official intervention to support fixed exchange rate regimes. One development that bears further monitoring is the willingness of foreigners to hold U.S. assets. The U.S. Treasury's International Capital (TIC) data showed net foreign outflows in August and September, the first such outflows since 1998. Markets will be looking for any signs of a decline in foreign willingness to finance the U.S. current account deficit, including an increase in the cost of U.S. borrowing.

In comparison with previous market disruptions, emerging markets have held up well, owing to stronger macroeconomic fundamentals, ample foreign exchange reserves, and reduced external debt (Chart 11). The main risk for emerging markets remains the potential for a global slowdown with reduced demand for exports and commodities.

Canadian developments

Canadian economy

Economic growth in Canada picked up markedly in the first half of 2007 (Chart 12). In the October *Monetary Policy Report*, momentum in domestic demand was projected to remain strong, despite tighter credit conditions. However, net exports were expected to exert a more significant drag on the economy in 2008 and 2009 than previously expected. Major downside risks to the outlook would materialize if the Canadian dollar were to persist above the level of 98 cents U.S. assumed over the projection horizon for reasons not associated with stronger-than-projected demand for Canadian products, or if the effect of the weakness in the U.S. housing sector turned out to be greater than anticipated.

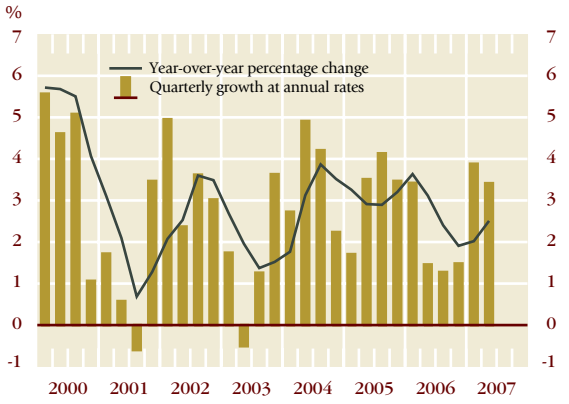
Corporate sector

The financial position of the aggregate non-financial corporate sector was still relatively solid in the third quarter of 2007. Indeed, profitability picked up, partly owing to higher crude oil prices, and the ratio of debt to equity fell still further (Chart 13).

Chart 11 Emerging-Markets Sovereign Bond Spread (EMBI+)

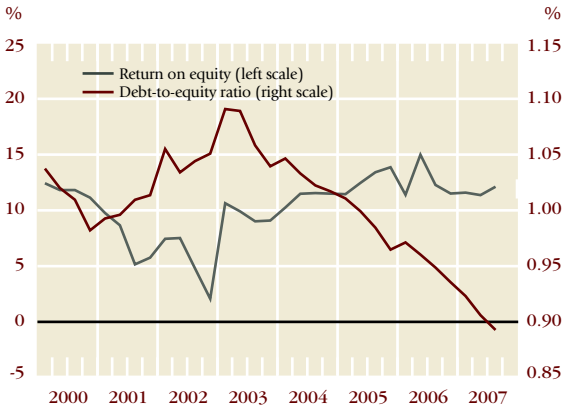
Source: JPMorgan Chase & Co.

Chart 12 Real GDP Growth: Canada



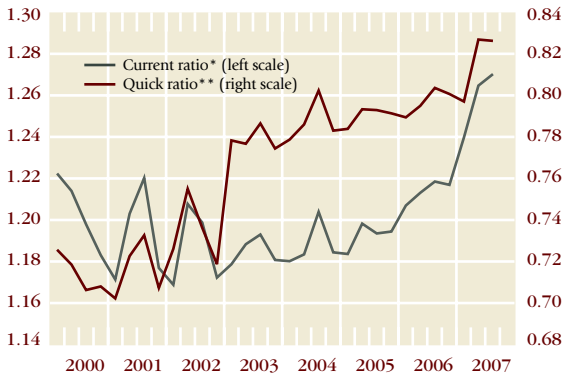
Source: Statistics Canada

Chart 13 Financial Position of the Canadian Non-Financial Corporate Sector



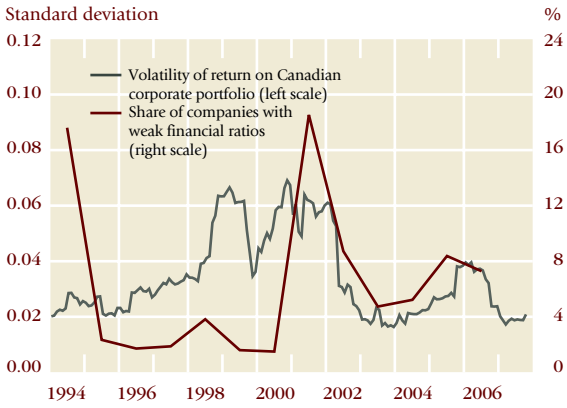
Source: Statistics Canada

Chart 14 Liquidity Indicators



* The current ratio is calculated as current assets divided by current liabilities.
** The quick ratio is calculated as current assets minus inventory divided by current liabilities.
Source: Statistics Canada

Chart 15 Indicators of Credit Quality



Source: Bank of Canada calculation based on data from Thomson Financial Datastream, the *Globe and Mail*, the *Financial Post*, and Moody's KMV. For CCA, all datapoints denoted January 2005 and thereafter are provided by Moody's KMV; datapoints prior to January 2005 continue to be provided by the *Globe and Mail* and Thomson Financial Datastream.

By and large, firms have continued to have access to credit. Markets for long-term debt remain open, at least for investment-grade firms; enough bonds were issued in August and September to roughly offset maturing issues, and modest growth in bonds outstanding resumed in October. Non-financial firms have retained ready access to bank lending since the turbulence began, and bank credit to the sector grew at a strong pace in August and September. However, there has been some tightening of credit conditions, particularly for large firms. The weighted average cost of credit (taking into account both market and bank financing) has increased modestly since the end of July.

In general, the non-financial sector seems well placed to deal with the tightening of credit conditions, given high levels of retained earnings, low leverage, and high levels of liquidity (Chart 14 and Box 4). Although reported liquid assets would include investments in ABCP, overall, it would appear that the third-party ABCP holdings by non-financial firms represent a relatively modest proportion of the total liquid assets of the non-financial corporate sector (which amount to $255 billion). Bank of Canada indicators of corporate credit quality—namely, the volatility of returns on the Canadian corporate portfolio (CCA indicator) and the share of companies with weak financial ratios (microdata indicator)—continue to suggest that overall corporate credit quality remains robust (Chart 15).[23] While the latter indicator remains unchanged from the June FSR, the former has risen only slightly in recent months, driven mainly by modestly higher volatility of returns in the industrial and utilities sectors.

Industry

Weakness in U.S. demand for housing continued to exert significant adverse effects on the

23. The CCA indicator represents the volatility of market-valued assets in a portfolio consisting of nine broad non-financial corporate industries. The monthly CCA indicator is based on data up to, and including, October 2007. The microdata indicator represents the share of total assets attributable to companies with a comparatively weak leverage ratio, current ratio, and net profit margin. The annual microdata indicator is currently based on data up to the end of 2006. Detailed descriptions of the CCA and microdata indicators can be found in the June 2006 (pp. 43–51) and December 2005 (pp. 37–42) issues of the FSR, respectively.

Box 4

Special Survey Question on Excess Liquidity

Since 2003, Canadian firms have been holding a significantly higher level of liquidity than usual (Chart A). This increase has been attributed to (i) the amount of uncertainty facing some businesses and/or (ii) preparation for future investment. Because these two factors have different implications for the economy, it is important to understand more about which businesses are holding excess liquidity and why.

Consequently, a special question was added to the Bank's *Business Outlook Survey*. From September 2006 through June 2007, firms were asked, "If you are currently holding a level of liquid assets (cash, deposits, and short-term financial assets) that is above normal, what is the main reason for doing so?" The results are reported below.

Who reported holding excess liquidity?

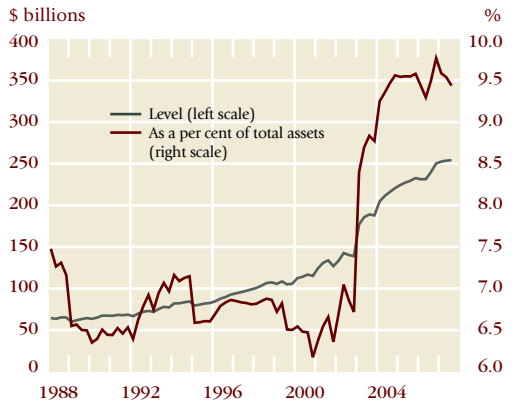
Of the 392 firms surveyed, 125 (32 per cent) were holding above-normal levels of liquidity, and the phenomenon was relatively widespread. Larger firms (37 per cent) were somewhat more likely to be holding above-normal levels of liquidity than smaller or medium-sized firms. The manufacturing and trade sectors had the lowest incidence of excess cash (29 per cent), while the highest was among primary firms (38 per cent). Ontario (21 per cent) was well below other regions (Table 1).

Why were firms holding excess liquidity?

Reasons most often cited (Table 2) were: planning to undertake a capital expenditure project (32 per cent); planning to undertake a merger or acquisition/financial investment (24 per cent); and currently evaluating possible investment opportunities (23 per cent).[1] In comparison, only 9 per cent of firms holding excess cash said they were doing so because of uncertainty about the economic outlook and/or their financial situation, and only 4 per cent said that they were using liquidity to improve their balance sheets. Although the reasons for holding excess liquidity were fairly evenly spread across regions and sectors, several interesting differences are worth noting:

- Forty per cent of Western Canadian firms holding excess liquidity were planning to undertake more capital spending, compared with 26 per cent in the rest of the country.
- A large proportion of the 31 firms that cited increased capital spending as the primary reason for holding excess cash were small or medium-sized firms. Only 4 were manufacturers.
- The reasons most often cited by the 31 manufacturing firms holding above-normal amounts of liquidity were merger/acquisition-related activity and distributions to shareholders.
- Companies planning to undertake mergers/acquisitions were almost exclusively large or medium-sized.
- Companies holding excess liquidity because of economic and financial uncertainty tended to be small and/or located in Eastern Canada. They were mainly in the manufacturing or transportation sectors.
- Service sector firms were more likely to be evaluating all possible investment opportunities.

Chart A Liquid Assets of the Non-Financial Corporate Sector



Source: Statistics Canada

1. These percentages are based on the results of the last three surveys, owing to a change in the list of possible responses. Since December 2006, 97 of 292 firms surveyed (33 per cent) reported holding excess liquidity.

Box 4

Special Survey Question on Excess Liquidity (cont'd)

Table 1

Firms Holding Excess Liquidity

Region	Per cent holding excess liquidity	Industry	Per cent holding excess liquidity	Firm size*	Per cent holding excess liquidity
National	32	Primary	38	Small	30
Atlantic	41	Manufac-turing	29	Medium	28
Quebec	32	Trade	29	Large	37
Ontario	21	FIRE	33		
Prairies	38	CITU	34		
British Columbia	32	CPBS	33		

Note: FIRE represents finance, insurance, real estate and leasing; CITU stands for construction, information, transportation, and warehousing, and utilities; CPBS represents commercial, personal, and business services.

* Firm size: Small <100 full-time employees (FTE); medium, 100 to 499 FTE; and large >500 FTE

Table 2

Reasons for Holding Excess Liquidity and Firm Distribution

Percentage of firms*

Reason**	National	East	West	Goods	Services	Small firms	Medium firms	Large firms
Uncertainty about the economic outlook and/or financial situation	9	13	5	11	8	24	0	7
To improve their balance sheet	4	6	2	4	4	4	0	7
Currently unable to find suitable capital project	9	9	9	6	12	8	7	12
Mergers and acquisitions/financing investment	24	22	26	26	22	12	28	28
Currently evaluating all possible investment opportunities	23	28	16	15	30	16	28	23
Planning more capital expenditures	32	26	40	34	30	24	34	12
Planning to distribute dividend or equity buyback to shareholders	19	20	16	19	18	20	7	26
Other/firm-specific reason	12	15	9	13	6	20	14	7

* Reflecting the learning that took place in the September 2006 survey, the list of possible responses was adjusted for the December 2006 round. These percentages are based on the final three quarterly surveys. Since December 2006, 97 out of 292 surveyed firms reported holding excess liquidity. Firm size: Small <100 full-time employees (FTE); medium, 100 to 499 FTE; and large >500 FTE

** Those conducting the survey were asked not to read this list to the firms and to record all applicable responses. Twenty per cent of firms cited more than one reason for holding excess liquidity.

profitability of Canada's forest products industry in the first three quarters of 2007. On the other hand, profitability in Canada's auto manufacturing industry did recover somewhat over this period from a weak financial performance in 2006. However, a slowdown in U.S. growth, combined with the rapid appreciation of the Canadian dollar, would contribute to a further deterioration in the financial positions of these particular industries and could possibly result in a further major restructuring of their operations. But many firms in the automobile manufacturing industry had significantly bolstered their liquidity prior to the onset of the turbulence in global financial markets by securing long-term funding.

Profitability in many Canadian manufacturing industries other than autos and forest products has also been lower than normal in recent years, chiefly owing to the appreciation of the Canadian dollar and strong competition from overseas producers. A prolonged slowdown in the growth of U.S. consumer spending (together with adverse effects from the ongoing rise in the Canadian dollar) would likely have a major negative impact on the financial positions of a broader range of Canadian manufacturers of consumer products (such as food and beverages, furniture and household appliances, and printing and publishing). In addition, many Canadian livestock producers have been experiencing significant losses in recent months as a result of the sharp rise in the Canadian dollar and the appreciable increase in feed costs.

Although a number of manufacturing companies continue to face serious financial risks, it remains unlikely that their problems would have significant adverse effects on the Canadian financial system, since the exposure of Canadian banks to these industries remains limited.

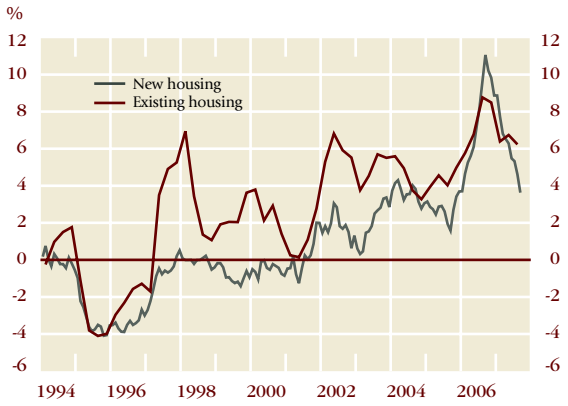
House prices

The Canadian housing market is much healthier than that in the United States.

House prices across Canada have continued to increase, albeit at a slower pace, fuelled by sustained income growth, low unemployment rates, robust consumer confidence, and still relatively low interest rates (Chart 16). The Canadian housing market remains characterized by regional differences, with stronger price increases in Western Canada—where strong labour markets continue to support housing

Chart 16 Real Prices for Housing in Canada*

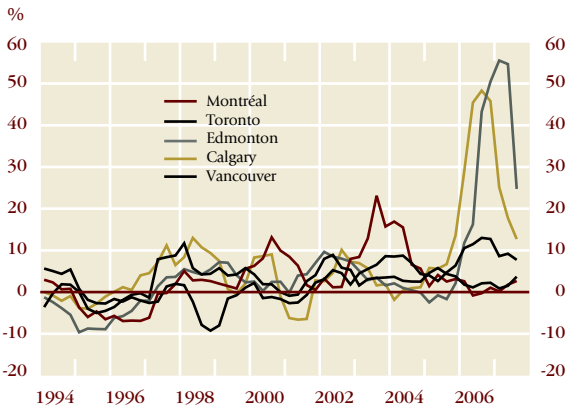
Year-over-year percentage change



* Deflated by CPI
Source: Royal LePage, Statistics Canada, and Bank of Canada calculations

Chart 17 Real Prices for Existing Houses by City*

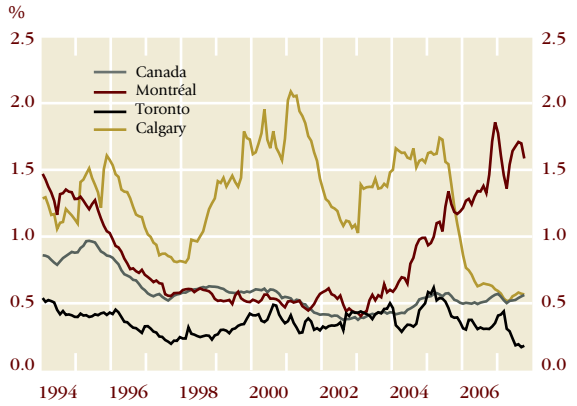
Year-over-year percentage change



* Deflated by CPI
Source: Royal LePage, Statistics Canada, and Bank of Canada calculations

Chart 18 Recently Completed Unoccupied Dwellings

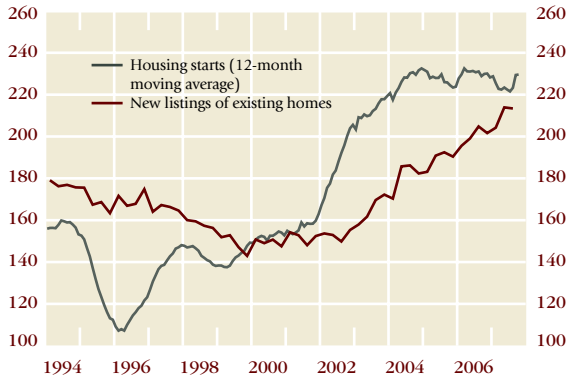
As a percentage of population



Source: Statistics Canada and Bank of Canada calculations

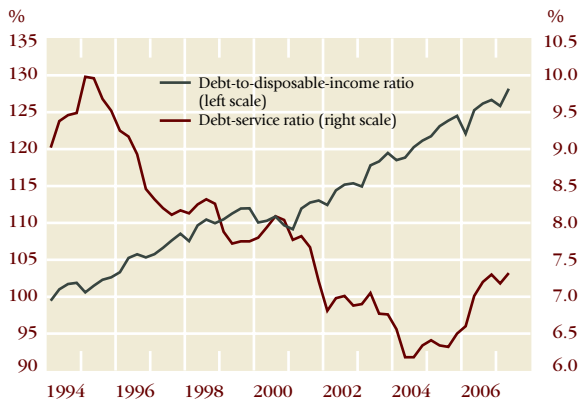
Chart 19 Housing Supply

Thousands



Source: CMHC and MLS

Chart 20 Household Sector: Indebtedness Indicators



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

demand—than in Central Canada (Chart 17). The growing use of mortgages with longer amortization periods and, to a lesser extent, other innovations such as near-prime mortgages may have added to housing demand. New mortgage insurance products have also likely contributed to rising housing demand, since they allow new borrowers into the mortgage market.[24] Anecdotal evidence suggests that there has been some speculative buying and construction in certain local housing markets or segments of markets.

The proportion of unoccupied dwellings in most cities remains below historical averages—and well below the peaks of the early to mid-1990s—suggesting that a major widespread reversal in house prices is most unlikely (Chart 18).[25] However, there should be some slowdown in the pace of increase in house prices as a result of the continued high level of supply in both the market for new houses and the resale market (Chart 19) and a recent deterioration in the affordability of home ownership.

Overall, recent indicators support the view that the Canadian housing market does not pose a major threat to the stability of the Canadian financial system, although there may be risks of a decline in house prices in particular local markets.

Household sector

Disposable income continued to increase at a solid pace over the first half of 2007. But since households continued to accumulate debt at a faster pace, the debt-to-income ratio has risen further, reaching 128 per cent in 2007Q2 (Chart 20). This increase in indebtedness has been accompanied by higher interest rates. As a result, the household aggregate debt-service ratio (DSR) rose further, to 7.3 per cent in 2007Q2, up from 7.15 per cent in 2007Q1 (Chart 20).[26] The aggregate DSR will likely continue to increase, since Canadian households continued to accumulate debt at a solid pace in the third quarter,

24. See the June 2007 FSR, pp. 23–24, for a list of product innovations in the mortgage insurance market.
25. There could, however, be imbalances in certain segments of local housing markets. The increase in the proportion of unoccupied multiple dwellings in Montréal, for instance, suggests some possible downward pressure on condominium prices there.
26. The aggregate debt-service ratio includes only interest payments on debt. For details about the estimation of the aggregate DSR, see Box 2 in the December 2006 FSR.

including during the period of financial market turbulence, and effective borrowing costs have increased over the same period.[27]

Despite rising indebtedness and a rising debt-service ratio, the household sector appears sound, as illustrated by aggregate indicators of household financial stress. Mortgage loans in arrears have remained at historically low levels, and the personal bankruptcy rate increased modestly in the third quarter of 2007 (from an 11-year low) (Chart 21).

Nevertheless, the proportion of vulnerable households —defined as households with a DSR above specific thresholds—and the proportion of debt they hold have recently increased, and are currently above their 1999–2006 average.[28] (See Table 2 on p. 29.) However, they remain below the peaks observed in 2001.

Overall, the financial position of the Canadian household sector does not seem to pose a threat to the stability of the Canadian financial system at present, although some households may become more vulnerable to negative shocks over time. The following Highlighted Issue suggests that the vulnerability of the household sector could rise if indebtedness and/or interest rates continue to increase.

Chart 21 Household Sector: Financial Stress Indicators

* As a percentage of population aged 20 and over
** As a percentage of total mortgage loans outstanding
Source: Statistics Canada and Bank of Canada

Highlighted Issue

Stress testing the Canadian household sector using microdata

Prepared by Ramdane Djoudad and Virginie Traclet

Household credit accounts for 62 per cent of the total loan exposure of the Canadian banking sector, 30 per cent of its total assets, and 710 per cent of Tier 1 capital. Consequently, assessing the financial health of Canadian households is an important part of our assessment of risks in the financial system. Past analysis, based on micro-data indicators, concluded that Canadian households are currently in relatively good financial

27. See Technical Box 3 in the October 2007 *Monetary Policy Report*, p. 20.
28. We use two vulnerability thresholds for the DSR: 23 per cent and 40 per cent. For information on how these thresholds were chosen, see the December 2006 FSR, pp. 15–16.

health (Faruqui, Lai, and Traclet 2006). Forward-looking simulations of the aggregate household debt-service ratio (DSR), however, suggested that the Canadian household sector will become more vulnerable to shocks over time. (See June 2007 FSR, p. 14.) Projections of the aggregate DSR can illustrate what might happen to the average household under hypothetical scenarios; however, they cannot indicate what might happen to the proportion of vulnerable households, since aggregate data mask information about the underlying distribution of debt. This Highlighted Issue supplements our past analysis by using a stress-testing exercise to assess the effect that various hypothetical scenarios might have on the distribution of the DSR and on the proportion of vulnerable households. This analysis supports the conclusion in the June 2007 FSR: The household sector is becoming more vulnerable to shocks as indebtedness continues to increase. Moreover, a higher proportion of households could become vulnerable to negative shocks if interest rates were to rise significantly.

Data and methodology

Our focus here is the distribution of the DSR, which we calculate as total debt payments (interest and principal payments on debt) divided by household gross income for the households that have debt.[29] We simulate the impact that rising indebtedness and/or rising interest rates would have on the distribution of the DSR over time under different stress-test scenarios. We are also interested in the proportion of households that have a DSR above some critical level indicative of vulnerability and in the proportion of debt held by these households. At this time, it is not clear what this critical level is; research is ongoing to identify this threshold. We use two thresholds that have been used in past FSRs: 23 per cent and 40 per cent. The 40 per cent threshold is a rule of thumb used by financial institutions in Canada to assess whether or not a loan should be granted. (Note that empirical evidence indicates that this is not a hard-and-fast rule.)

A number of assumptions are required to undertake this stress-testing exercise.[30]

First, it is assumed that all components of non-mortgage consumer debt, except credit card debt, are at a variable interest rate, which is consistent with stylized facts for consumer credit.[31,32] Consumer debt payments include an interest rate component and a principal component. For each component of consumer debt, the historical interest rate is taken directly from the dataset as reported by households. For the simulation period, we assume that the interest rate on each component of consumer debt moves by the same amount as the prime rate (which has moved closely with movements in the target overnight rate).

Second, the interest rate on fixed-rate mortgages is calculated as the sum of the overnight rate, a term premium, and a risk premium. For each maturity, the risk premium is proxied by the 2000Q1–2007Q2 average of the difference between the mortgage rate and the yield on government bonds of the same maturity.[33] The risk premiums remain unchanged during the simulations.[34] In the simulations, the term premiums rise from their current level to their average historical yield spread for each maturity within the period over which the overnight rate increases under the scenario of rising interest rates, while they remain unchanged at their current level under the scenario of unchanged interest rates.

29. This measure of the DSR differs from the aggregate DSR, which focuses on interest payments only, is calculated for all households—whether or not they have debt—and is based on personal disposable income. Thus, the results of the simulations presented here are not directly comparable to those done with the aggregate DSR in the June 2007 FSR. Data used here come from the Canadian Financial Monitor (CFM). For more details, see December 2006 FSR, p. 14.
30. The methodology used here will be discussed in greater detail in an upcoming *Bank of Canada Review* article.
31. Consumer debt in the CFM includes personal loans, personal lines of credit, vehicle loans, and credit card debt.
32. Because of data constraints, it is assumed that all households make payments on credit card debt equal to 2 per cent of their current balance each month. This is the minimum payment required by most credit card companies.
33. Mortgage maturities in the CFM are 6 months, 1 year, 2 years, 3 to 4 years, 5 years, 7 years, and 10 years and more.
34. This may create a downward bias in the simulated DSR: As indebtedness increases further, financial institutions might increase individual risk premiums to compensate for the potentially higher riskiness of some individual borrowers.

Third, it is assumed that, for households that have variable-rate mortgages, mortgage payments are not affected by changes in the interest rate.[35]

Finally, a certain proportion of households are assumed to renew their mortgages each year. For each mortgage term, this proportion is equal to one divided by the term of the mortgage; e.g., 20 per cent of households that have a 5-year mortgage renew each year.[36] For simplicity, the distributions of mortgages by type (variable, versus fixed-rate) and by term are assumed to remain similar to the distributions in 2006.[37]

The simulation period is 2007Q3–2010Q2.

Impact of rising indebtedness on the distribution of the debt-service ratio

To assess the impact of a rising debt-to-income ratio on the distribution of the DSR, we consider a debt-to-income scenario similar to that used in the simulations of the aggregate DSR in the June 2007 FSR. This is done in two steps. First, we develop an aggregate scenario that sets the assumptions for total growth in debt and income. Second, we model what is happening to individual households in order to take heterogeneity among households into consideration; this is implemented in a simple way.[38]

The aggregate scenario assumes that total consumer debt and mortgage debt continue to increase at their average annual growth rates over the 2000Q1–2007Q2 period.[39] But to allow for the different preferences and initial debt levels of households, the magnitude of the increase in debt is not the same for all households. For those with relatively high DSRs, debt increases at a slower pace than for those that have lower DSRs. This is consistent with the rule of thumb used by financial institutions to assess whether or not a loan should be granted. The aggregate scenario also assumes that aggregate income continues to increase at a trend rate of 5 per cent.[40] Here again, to account for heterogeneity, it is assumed that income increases at different rates for different households. Based on these two assumptions, the increase in the aggregate debt-to-income ratio over the simulation period is similar to its recent trend.

To study the impact of such an increase in the debt-to-income ratio on the DSR distribution, we use a scenario in which the overnight interest rate remains unchanged at its current level (4.5 per cent). Under this scenario, the mean DSR would increase by 0.94 percentage points—to 16.6 per cent—over the simulation period.[41]

The distribution of the DSR would also change over time. As illustrated in Chart 22, the proportion of households with a high DSR would increase. There would be an increase in the proportion of households above both of the thresholds typically used to assess vulnerability and in the proportion of debt owed by those households (Table 2). For example, using the 40 per cent threshold, rising indebtedness would lead to an increase in the proportion of "vulnerable" households and the debt they owe to levels higher than their 1999–2006 averages and higher than in 2001 (Table 2).

35. In practice, when interest rates increase, payments on most variable-rate mortgages do not increase, but their composition changes, with a decrease in the proportion allocated to the principal and an increase in that allocated to interest. Payments would increase when mortgages are renewed at higher rates. Because of data constraints, it is not possible to determine when variable-rate mortgages are due for renewal. Consequently, we keep payments on these mortgages unchanged over the simulation period. This creates a downward bias in the simulated DSR, but other calculations suggest that this bias is relatively small.
36. One hundred per cent of households with a 6-month or 1-year mortgage renew each year.
37. In practice, if interest rates were higher at the time of renewal, some households would likely switch from variable- to fixed-rate mortgages to limit the increase in their DSR. It is difficult to include this in our simulations, since it would require arbitrary assumptions about which households would switch (and to which term) and which would not.
38. Heterogeneity among households could be taken into account with a model that endogenizes household borrowing decisions. But this would require numerous underlying assumptions and behavioural responses, for which empirical evidence is quite limited.
39. It is also assumed that all components of consumer debt increase at the same pace as total consumer debt (8 per cent annually) and that all components of mortgage debt increase at the same pace as total mortgage debt (6 per cent annually).
40. Household gross income—the income measure in the CFM—is assumed to increase at the same trend pace as household disposable income.
41. This compares with a simulated 0.70 percentage point increase in the aggregate DSR over the same period (June 2007 FSR, p. 14–15).

Chart 22 Impact of Rising Debt-to-Income Ratio on the Distribution of the Debt-Service Ratio

Source: Ipsos Reid and Bank of Canada calculations

Table 2

Impact of Rising Indebtedness on Vulnerable Households[a]

	Proportion of households with DSR>23%[b]	Share of total debt owed by households with DSR>23%	Proportion of households with DSR>40%[b]	Share of total debt owed by households with DSR>40%
1999–2006 average	26.13	43.87	3.33	6.28
2001[c]	28.47	47.84	4.04	7.83
2006H2-2007H1	23.35	43.96	3.45	7.40
Stress-test results				
2008Q2	27.38	48.58	4.17	8.46
2009Q2	30.14	52.20	5.46	9.96
2010Q2	32.07	52.12	6.46	11.46

a. Historical numbers for vulnerable households and vulnerable debt have been revised compared with the numbers reported in the December 2006 FSR for two reasons. First, credit card debt is now taken into account in the calculations of the DSR, which was not the case previously. Second, the population weights used to calculate the distributions have been modified to make the sample more representative of the population.
b. As a percentage of total households with debt
c. We report data for 2001 because the share of debt held by vulnerable households was at its maximum during the sample period (1999–2006) in that year. This provides a reference point to assess the results of our simulations.

Impact of rising interest rates on the distribution of the debt-service ratio

To assess the impact of interest rate changes on the distribution of the DSR, we consider a stress-test scenario in which interest rates increase sharply. Specifically, the overnight rate rises from 4.5 per cent to 6 per cent within four quarters and remains at this level for the rest of the simulation period. This increase is transmitted to consumer and mortgage interest rates, as described above. As in the previous scenario, the aggregate debt-to-income ratio continues to increase at a pace similar to that observed over the recent past. This combination of rising indebtedness and rising interest rates can be viewed as unlikely, since it is assumed that debt continues to increase at the same pace over the simulation period, despite significantly higher interest rates (by comparison, the average overnight rate over the 2000–2007Q1 period was 3.50 per cent), whereas higher rates would likely be accompanied by some slowing in debt accumulation.

With such an increase in interest rates and indebtedness, the mean DSR would rise by 3.26 percentage points—to 18.89 per cent—over the simulation period. As illustrated in Chart 23, the distribution of the DSR would shift more than under the previous scenario, with a stronger increase in the proportion of households with a high DSR. The proportion of "vulnerable" households and the proportion of debt owed by those households would also rise more markedly than under the previous scenario (Table 3).

While these results must be viewed with caution, given the biases in the simulated DSR that are due to some of our assumptions,[42] they remain qualitatively informative: They suggest that more households would see their ability to weather negative shocks significantly reduced if both indebtedness and interest rates were to rise markedly.

To put into perspective what such an increase in the proportion of debt held by "vulnerable" households means for the financial system, we consider a stress-testing exercise using two extreme assumptions. First, we assume that 25 per cent of the change in the proportion of debt

42. It is difficult to measure the extent of these biases and their impact on the simulated DSR.

owed by vulnerable households (as defined with the 40 per cent DSR threshold) during the simulation period under the second scenario presented above goes into default. Second, we consider that the loss-given-default is 100 per cent of the defaults.[43] Under these extreme assumptions, the associated losses for the Canadian banking sector would represent 0.5 per cent of the total assets in that sector or 11 per cent of Tier 1 capital. This suggests that the banking sector would not be significantly affected by rising vulnerability in the household sector.

References

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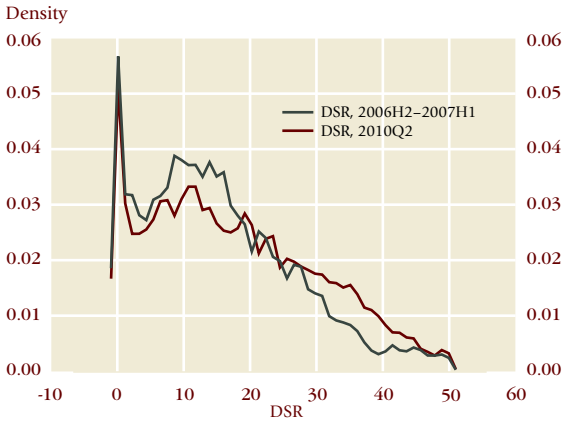
Chart 23 Impact of Rising Debt-to-Income Ratio and Rising Interest Rates on the Distribution of the DSR



Source: Ipsos Reid and Bank of Canada calculations

Table 3

Impact of Rising Indebtedness and Rising Interest Rates on Vulnerable Households

	Proportion of households with DSR>23%	Share of total debt owed by households with DSR>23%	Proportion of households with DSR>40%	Share of total debt owed by households with DSR>40%
2006H2–2007H1	23.35	43.96	3.45	7.40
Stress-test results				
2008Q2	28.56	50.36	4.57	9.05
2009Q2	31.53	54.46	6.36	12.05
2010Q2	34.28	55.49	7.37	13.57

43. Actual losses would be much lower, because a 100 per cent loss-given-default certainly overestimates the actual loss-given-default on household debt, particularly on mortgage debt. In addition, since a large proportion of mortgages are insured, the losses associated with those would be borne by the mortgage insurers and not the banking sector.

Important Financial System Developments

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

Financial Collateral for Eligible Financial Contracts

The March 2007 federal budget set out plans to amend Canadian bankruptcy and insolvency legislation to ensure full protection for financial collateral arrangements supporting eligible financial contracts (EFCs) in Canada. Bill C-52, the bill containing the provisions in the federal budget, was granted royal assent on 22 June 2007. The majority of the amendments came into force at that time.[44]

Prior to the amendments, uncertainty existed in Canada as to whether and how quickly creditors could access financial collateral pledged against EFCs in the event of the insolvency of a counterparty. The amendments seek to address these deficiencies by clarifying collateral-protection rights and the priority pertaining to them. In addition, they seek to modernize the definition of EFCs and financial collateral to keep pace with market developments.

The use of financial collateral to reduce counterparty risk in the event of default on obligations has become an increasingly important risk-management tool. Financial collateral is unique, differing from other types of collateral, such as that used to secure loans for commercial property or plant and equipment. The legislation recognizes that it is important that financial collateral be appropriated quickly, without the delay associated with court proceedings, should the provider default and go into bankruptcy. Liquidation permits the proceeds to be applied against losses to the creditor quickly, thus minimizing the risk of potential damage to collateral value. The changes should ensure both the more efficient functioning and the continued development of the use of collateral in financial transactions in Canada, resulting in reduced risk for market participants and, in the end, a more efficient financial system.

44. The section pertaining to EFCs and financial collateral is contained in Part 9 of the bill and provides for amendments to the following acts: Bankruptcy and Insolvency Act, Companies' Creditors Arrangement Act, the Winding-up and Restructuring Act, the Canada Deposit Insurance Corporation Act, and the Payment Clearing and Settlement Act. Each of these acts would be amended to provide specific protection against stays on financial collateral for obligations under EFCs so that counterparties can realize on their collateral in a timely manner.

Elimination of Withholding Tax on Interest

The elimination of the withholding tax announced in the 2007 budget takes effect on 1 January 2008 for interest paid on or after this date between arm's-length parties. For non-arm's-length parties, the maximum withholding rate on interest payments between Canada and the United States will be eliminated in three stages. This initiative will facilitate cross-border investments and is expected to reduce the costs of Canada's multinational enterprises, increase their access to cross-border capital, and contribute to the evolution of the Canadian marketplace.

The Mortgage Insurance Market

A third private mortgage insurer started operations in the autumn, thus bringing the total number of players in the Canadian mortgage

insurance market to four. Another private insurer (that received federal regulatory approval to commence and carry on business earlier this year) is still in the process of receiving provincial licences to begin to actively market its products.

There has recently been further product innovation in the mortgage insurance market. In September, CMHC introduced mortgage loan insurance for mortgages with no down payment for investment properties. This may add pressure to housing demand at a time when it is already high and may also contribute to a further increase in household indebtedness.

Highlighted Issue

Free trade in securities

Prepared by Karen McGuinness

Global financial markets are changing rapidly and are becoming more integrated. One important area in which securities regulation has not kept pace with changes in global markets is the treatment of direct cross-border securities transactions, which most domestic securities regulators prohibit in their jurisdictions. An investor wishing to trade a foreign security thus needs to go through a broker from that jurisdiction. For example, a Canadian broker must engage a U.S. broker to purchase a U.S. security on behalf of a Canadian client. Free trade in securities is a policy initiative aimed at simplifying cross-border securities transactions and reducing the barriers and costs that investors face when trading foreign financial instruments. This Highlighted Issue examines some of the major issues related to free trade in securities.

Free trade in securities would put in place a process where nations participating in an accord would broadly agree on the equivalence of one another's regimes as they apply to brokers and securities exchanges. The approach that is likely to be adopted is based on the concept of *mutual recognition* of regulatory regimes. For instance, the regulator of an exchange's or a broker's home market would be responsible for overseeing their activities and for protecting the interest of all investors, regardless of their geographic location. Such a framework could permit trading screens for a Canadian exchange, such as the TSX, to be placed on a U.S.-based market participant's desk, and the U.S. market participant could trade directly on the exchange without the need for a Canadian-based intermediary. Under this new mode of operation, the TSX would likely be subject to Canadian regulations and would bypass the U.S. Security and Exchange Commission's (SEC) exchange registration regulation (assuming that an agreement on Canada's regulatory comparability with the United States is in place). Such an agreement could also allow a U.S. broker-dealer to directly access Canadian investors without going through a Canadian intermediary broker-dealer, which is currently required. In this new set-up, the U.S. broker-dealer would be registered with the SEC and would bypass the Canadian registration regulation (assuming that an agreement on U.S. regulatory comparability with Canada is in place).

Efficiency and investor protection

Free trade in securities should improve market efficiency by making it easier and less costly to trade in non-domestic securities. Simplifying the process and, in particular, reducing the number of intermediaries necessary for conducting a cross-border securities transaction, should reduce the cost of that transaction. Furthermore, the removal of regulatory requirements prohibiting foreign broker-dealers from entering the domestic market would expose the Canadian securities industry to increased broker-dealer competition, promoting greater efficiency and reducing the costs that Canadian investors face. The process of reaching an agreement on free trade in securities and achieving consensus on regulatory comparability would likely result in greater alignment of disclosure requirements in the two jurisdictions. From an issuer standpoint, free trade in securities should give Canadian issuers more access to foreign investors, possibly reducing their capital costs.

In Canada, financial market participants are broadly supportive of the initiative to pursue free trade in securities with the United States and other G-7 countries. For example, the Investment Industry Association of Canada (IIAC) has called for regulatory reform in trade policies, which they see as necessary for Canada to compete in an increasingly global environment.[45] The TSX has argued that free trade in securities would reduce costs and improve the efficiency of capital markets and allow Canadian market participants to grow internationally by leveraging their strengths (Cowan 2007).

Overall, the more open process to access cross-border securities should benefit both investors and issuers, since transactions would be less cumbersome and thus likely less costly.

The principal concern about free trade in securities is the risk that investor protection might be weakened. Domestic regulators would rely upon the supervision and investor-protection standards of the home regulator of the foreign broker or exchange. There could be concerns about the comparability of regulations, the practical implementation and enforcement of them, and the effectiveness of the regulatory environment. For example, not all countries employ equal resources for enforcement, and the effectiveness of enforcement may differ among countries. Regulators are aware of these issues, however, and the process of negotiating bilateral agreements may lead to greater convergence and the adoption of higher regulatory standards.[46]

How might free trade in securities be expected to work?

The SEC is expected to propose a framework (for comment) for mutual recognition sometime in the second half of 2007. The SEC held its first round table discussion in June 2007 to develop a set of criteria against which foreign regulatory regimes would be judged to determine comparability of standards.[47] This was preceded by a theoretical framework proposed by staff from the SEC in early 2007 to facilitate free trade in securities (Tafara and Peterson 2007). They suggest an arrangement with foreign regulators in which each side would rely on the other's regulatory systems, an approach known as mutual recognition. The arrangement would allow foreign exchanges to offer their listed securities and foreign broker-dealers to offer only foreign investment products to U.S. investors directly without having to submit to SEC regulation (if approved by a regulator abroad with equivalent rules). The proposal outlined a four-step process applicable to both foreign exchanges and broker-dealers: i) a foreign entity petitions the SEC to seek an exemption from SEC registration; ii) the home market regulator of an entity and the SEC assess comparability of regimes, including enforcement, and negotiate a co-operative and information-sharing arrangement; iii) the SEC and the petitioning entity establish an agreement as to jurisdiction and service of process; and iv) the SEC assesses the petition, following public notice and public comment.

Canadian context

In Canada, the 2007 federal budget discusses pursuing free trade in securities with the United States and other G-7 countries. In February 2007, the G-7 countries agreed to explore free trade in securities based on the concept of mutual recognition of regulatory regimes. High-level discussions exploring the potential benefits of free trade in securities have occurred in the G-7 and between Canada and the United States; the European Union has also been exploring this issue with the United States.[48]

Canada faces potential obstacles, however, in pursuing free trade in securities agreements. The Multi-Jurisdictional Disclosure System (MJDS) offers a precedent that can be built on, and demonstrates that mutual recognition between Canada and the United States in the field of securities regulation is possible. But free trade in securities may represent a significantly more complex undertaking than the disclosure component already achieved in MJDS.[49] A greater degree of comfort in the regulatory framework

45. The IIAC has formed a national committee on free trade in securities, the initial mandate of which is to gain better access to the U.S. institutional marketplace for Canadian investment dealers. In September 2007, the IIAC submitted a proposal to the SEC relating to free trade in securities, focusing on the institutional market.
46. The European Union has a history of mutual recognition. The E.U. Financial Services Action Plan began a process of breaking down barriers and enhancing financial integration. See European Commission (2005).
47. U.S. Treasury Secretary Henry Paulson has led an initiative to examine the global competitiveness of U.S. capital markets. In the June 2007 update, he highlights international investment opportunities with recognition of comparable regulatory regimes as a strategy to enhance competitiveness, specifically citing the SEC consideration of mutual recognition as an effective example.
48. European Commissioner for the Internal Market and Services, Charlie McCreevy, proposed the building of a transatlantic marketplace (E.U.-U.S.) and identified principles underpinning it (McCreevy 2007).
49. The reciprocal agreement called MJDS recognizes each nation's disclosure requirements for securities offerings in each market (Wolburgh Jenah 2007).

will be necessary for free trade in securities, most notably in the area of enforcement. Canada's enforcement has been criticized and could pose a risk to the process when other countries assess the comparability of standards (Cory and Pilkington 2006). Canada might also be at a disadvantage in implementing a nationwide agreement on free trade in securities, since it has multiple securities regulators and thus greater jurisdictional complexity for implementing mutual recognition with a foreign entity.

Conclusion

While many questions remain unanswered as to how such a plan would be implemented, the potential exists for a clear net benefit to financial markets. Free trade in securities could create broader investor and issuer access, improve market efficiency, and increase competition, all of which could reduce transactions costs. Concern about a possible weakening of investor protection has been identified as a top priority in discussions between Canadian and other securities regulators. It is likely that the resolution of this issue will be found in a co-operative approach to securities regulation that is focused on regulatory outcomes rather than on detailed processes.

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Reports

Introduction

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

In **An Approach to Stress Testing the Canadian Mortgage Portfolio**, Moez Souissi presents one approach for assessing the vulnerabilities of the Canadian mortgage market. To illustrate this approach, he evaluates the overall risk of default on Canadian mortgages under a hypothetical scenario in which house prices are falling. He measures the overall default rate using two-step default analysis. First, the probabilities of default for different loan-to-value ratios are estimated using an option-pricing model. Then, the overall default rate is estimated by applying these probabilities to the loan-to-value distribution found in the Canadian Financial Monitor, a survey conducted by Ipsos Reid Canada. The simulation results appear reasonable in the light of historical experience.

The competitive landscape for securities trading is being affected by two opposing trends. Securities exchanges are consolidating, both within and across borders, and alliances between specialized marketplaces are being formed. At the same time, new trading venues offering the possibility of trading outside an exchange are being created. In **The Changing Landscape of Securities** Trading, Éric Chouinard looks at how competition among securities marketplaces is changing. Overall, the level of competition appears to be rising as the competitive power of traditional exchanges is being challenged by the emergence of alternative trading systems (ATSs). While the rise of ATSs has the potential to fragment markets, thereby reducing liquidity and hindering price discovery, this is mitigated by regulations requiring that marketplaces be linked and by technological tools that consolidate prices across the multiple marketplaces in which a security trades.

The downgrading of an unprecedented amount of asset-backed securities and collateralized debt obligations has raised concerns about the ability of credit-rating agencies to provide opinions on the credit quality of these instruments. In the report, **Reforming the Credit-Rating Process**, Mark Zelmer reviews the various proposals that have been put forward to enhance the process used to produce credit ratings, especially in the area of structured products. The report notes that there are some natural self-correcting market forces at work that should ensure that rating agencies continue to improve their processes. In that regard, the recent market turbulence should serve as a useful stress test to help calibrate their analytic tools in the future. That said, the report proposes some further steps that could be taken to reinforce market discipline in the rating industry.

An Approach to Stress Testing the Canadian Mortgage Portfolio

Moez Souissi

In Canada, residential mortgage loans account for close to 47 per cent of the total loan portfolio of commercial banks. Despite this large exposure to the housing and mortgage markets, most of the risk of default rests with the mortgage insurers rather than with the banks.[1] Currently, the default rate on mortgage loans is near its historical low. Nevertheless, it is important to improve our ability to assess the risks to the financial system associated with the housing and mortgage markets.

For example, it would be helpful to have tools to assess how a slowdown in the Canadian housing market of a magnitude similar to that observed in Canada during the early 1990s, or to that currently under way in the United States,[2] would increase the overall risk of default on mortgage loans, particularly for highly leveraged loans.

The objective of this work is to present an option-pricing approach to assessing the vulnerabilities of the Canadian mortgage market. This approach is confined to analyzing only financially motivated defaults. It is based on the microeconomic principle that default can be a rational response to adverse changes in the housing market. It does not take into account involuntary defaults caused by income constraints, such as those caused by job loss.

To illustrate how this approach could be applied, we evaluate the overall risk of default on Canadian mortgages under a scenario in which house prices are falling. This is done using the empirical distribution of loan-to-value (LTV) ratios in 2006, obtained from the Canadian Financial Monitor (CFM), a survey conducted by Ipsos Reid Canada.[3]

The Model

There is a growing body of literature on mortgage default risk and how it relates to house prices and interest rates. One strand of this literature, which is motivated by option theory, maintains that, in a perfectly competitive market, mortgage borrowers can increase their wealth by defaulting when the market value of the mortgage equals or exceeds the market value of the collateral, which depends on the price of the house.

Indeed, under conditions of limited liability, negligible transactions costs, and no exogenous reasons for residential mobility, default can be seen as a financial decision that can be separated from the real (housing) decision, and the Merton theory of the pricing of corporate debt can be applied.[4]

Here, we analyze the homeowner's decision to default based on this criterion. We use a standard two-factor theoretical contingent-claims pricing model. This model, which was initially

1. In Canada, mortgages with a down payment of less than 20 per cent must be insured. In 2006Q4, insured mortgages represented more than 45 per cent of total residential mortgage balances outstanding at chartered banks. Uninsured mortgages are associated with a low risk of default, because they are backed by a relatively large amount of collateral.
2. In the United States, the largest recent decrease in house prices was the cumulative decline in the nominal median selling price of existing houses of 8.1 per cent between June 2005 and October 2006 (NSA-National Association of Realtors). Note that this measure of house prices has increased since October 2006.
3. For details on CFM data, see Faruqui, Lai, and Traclet (2006).
4. For a more detailed discussion, see Deng, Quigley, and Van Order (2000) and Kau et al. (1995).

developed to evaluate mortgage contracts,[5] generates all the information needed to compute the probability of default on any fixed-rate mortgage contract.[6]

The first factor in the model is the price of housing, which is assumed to follow the standard geometric Brownian motion, the equivalent in continuous time of a random walk with a drift. The return from owning a house consists of price appreciation and the flow of services that the owner incurs by living in the house.

The second factor is the short-term interest rate. We assume that it follows a mean-reverting process. This process assumes that the interest rate reverts to its long-term value at a certain speed, but that this pattern is constantly disturbed by stochastic events.

In our model, for every possible outcome for house prices and interest rates over the length of the contract, the borrower faces three options: making the required payment, defaulting, or prepaying the mortgage.

The opportunity to default is treated as a put option, since it enables the borrower to sell the property to the mortgagee at a price equal to the loan's outstanding balance. This opportunity has value if the expected present value of the remaining payments becomes higher than the market price of the house.

The mortgagor also has the opportunity to prepay the mortgage loan.[7] Prepayment can be viewed as refinancing. We treat the opportunity to prepay as a call option, in that it allows the borrower to buy all future obligations remaining under the mortgage at a price equal to the loan's outstanding balance. Prepayment has value if interest rates fall below the fixed rate of the mortgage to the extent that the expected present value of the remaining payments becomes higher than the unpaid balance of the mortgage.

Note that closed mortgages generally cannot be paid off before maturity without a penalty. Prepayment penalties in Canada are frequently calculated as the greater of three months' interest or the interest differential applied to the outstanding balance. For simplicity, we use the former.

These options are "embedded" in the sense that they give the mortgagor not only the opportunity to default or prepay now, but also the opportunity to postpone the default or the prepayment by at least one period to see if it will provide additional value.

Hence, at every period, the borrower solves a dynamic problem wherein today's options are considered, as well as the potential options over the rest of the contract. At any time, the borrower observes the current values of the house price and the interest rate. Given these values and the assumed processes for how these variables evolve over time, the homeowner evaluates ex ante the possible values of the house price, the interest rate in the next period, and their respective probabilities. Based on these values, the borrower assesses whether it is less costly to default, to prepay, or to make the scheduled payment.

Caveats

Several caveats apply to our approach:

- Limited liability is assumed. This assumption may lead to an exaggerated measure of the risk of default on mortgages because, in Canada, borrowers remain liable for the unpaid balance of the mortgage loan over and above the current value of the house.
- As noted earlier, income constraints are not taken into account within this methodology.
- Costs associated with the loss of reputation for a defaulting borrower are not considered here. These costs can be significant (Kau, Keenan, and Kim 1994). The decision to default can make it more difficult for the individual to obtain credit in the future. This creates an upward bias in our estimated probability of default. These costs could be incorporated into the default decision by adding a cost term to the outstanding balance at the time of default.
- As mentioned above, prepayment can be viewed as refinancing. Although refinancing, like prepayment, implies termination of the

5. As was pointed out in Chatterjee, Edmister, and Flatfield (1998), the two-factor model is efficient in predicting market mortgage values.
6. In this work, we focus exclusively on fixed-rate mortgage loans, which account for about 75 per cent of total mortgage loans outstanding in Canada.
7. As suggested in Deng and Gabriel (2006) and Deng, Quigley, and Van Order (2000), one cannot accurately calculate the economic value of the default option without simultaneously considering the financial incentive for prepayment.

Table 1

Base-Case Parameters for Numerical Modelling

Parameters	Base case
Mortgage term	5 years
Amortization period	25 years
Contract mortgage rate at origination	r_c = 5.70%
Expected rate of appreciation of nominal house price	α = 6.50%
Original 1-month interest rate	r_0 = 3.00%
Transaction cost of prepayment (three months' interest, dollar amount)	1% of the mortgage balance

Note: Values of other parameters related to the stochastic behaviour of house prices and the interest rate are chosen as follows. The standard deviation of stochastic disturbances to change in house prices is estimated (over the 2001–06 period) at 4 per cent per year. The standard deviation of stochastic disturbances to interest rates and the reversion parameter, which measures the speed of return to the mean interest rate, are set equal to 10 basis points and 25 per cent per year, respectively. These values are within the range of those reported in previous works by McManus and Watt (1999) and Bolder (2001).

current mortgage contract, it also implies the origination of a new mortgage loan on which the borrower may default. This is not modelled in this study because of its complexity. Consequently, the probability of default that we compute at a given time is specific to the original mortgage contract. This leads to a downward bias in our estimated probability of default, since refinanced mortgages are assumed not to default.

The Simulations

These simulations illustrate how this model could be used to analyze the impact of decreasing house prices on mortgage defaults. [8]

We measure the *overall* default rate using a two-step default analysis. First, the probabilities of default for different loan-to-value ratios are estimated using an option-pricing model as described above. The overall default rate is then estimated by applying these probabilities to the empirical LTV distribution, which we construct from the CFM database.

Parameters of the simulations

We consider a representative homeowner who has taken out a 5-year mortgage contract with a 25-year amortization period.

To illustrate how the model works, we calibrated the parameters of our model so that they reflect as closely as possible the economic situation in Canada over the 2001Q1–2006Q1 period. This is our base case. In fact, we used the average values over the period of the 5-year discounted mortgage rate, the rate of nominal appreciation in house prices, and the 1-month treasury bill rate. The latter is used for both the original discounting rate and the rate to which it reverts over the given 5-year period. We also assume that some transactions costs are charged in the case of a prepayment. The chosen parameters are summarized in Table 1.

After valuing the probability of default for different LTV ratios at origination in the base case, we repeat the exercise, assuming other scenarios for the evolution of house prices.

8. The same method could be used to examine the potential impact of a change in interest rates.

In the first of three further scenarios considered in this illustration, the moderate case, we assume that house prices are expected to increase moderately at an annual rate of 2.5 per cent. The second scenario is the extreme case in which nominal house prices decline at an annual rate of -2 per cent (the rate of decline observed over the 1990Q1–1995Q1 period). In the third scenario, the very extreme case, nominal house prices decrease at an annual rate of -5 per cent. This value reflects a real decrease in house prices equivalent to that observed in the early 1990s. All other parameters are equal to those in the base case.[9]

Results

The results of our simulations are summarized in Table 2. The first six columns indicate the cumulative probabilities of default over the five years of the loan for mortgages with different LTV ratios.

As expected, the probability of default is greater the higher the LTV ratio[10] and the lower the rate of increase in house prices. For example, as shown in Table 2, under the base-case scenario (house price increase), a loan with a 75 per cent LTV has a 0.05 per cent chance of reaching a point where it is optimal to default. This probability is higher, 0.77 per cent, in the extreme scenario. In the case of a 100 per cent LTV ratio, these probabilities increase to 3.8 per cent (base case) and 12.1 per cent (extreme case).

For a given LTV ratio, the cumulative probabilities of default over the five years of the contract can be interpreted as the proportion of default in the pool of current mortgages that share the same LTV ratio and were signed five years earlier.

The overall default rate is a weighted average calculated by multiplying these cumulative probabilities by the weights given by the empirical distribution of LTV ratios. For simplicity,

Table 2

Probability of Default at Maturity Date

Per cent

LTV ratios						Overall default rate
40%	75%	80%	90%	95%	100%	
Base case (α = 6.50%)						
0.00	0.05	0.36	1.39	2.62	3.80	0.31
Moderate case (α = 2.5%)						
0.00	0.19	1.08	2.51	5.10	6.98	0.63
Extreme case (α = -2%)						
0.00	0.77	2.89	5.53	9.11	12.10	1.35
Very extreme case (α = -5%)						
0.00	2.01	5.96	8.13	12.47	16.22	2.25

9. To better reflect the current interest rate environment, we also simulated the outcomes of these scenarios using 4.5 per cent as the value of the original discounting rate and the rate to which it reverts over the coming 5-year period. Our results did not change significantly.
10. The insurance premium paid by a mortgagor whose down payment is less than 20 per cent increases with the LTV ratio. This is consistent with our results showing that probabilities of default increase with LTV ratios (at origination).

Table 3

Distribution of Mortgages in 2006 by LTV Ratio

As a percentage of asset values

LTV ratios	Frequency
Less than 75	79.45
75 to 80	5.34
80 to 90	8.81
90 to 95	1.53
95 to 100	0.00
100 and > 100	4.87

we used the 2006 distribution, as shown in Table 3, in our examples.

In what follows, we compare our estimated overall default rate with actual default rates. The simulated default rates differ from observed rates, because we consider only fixed-rate mortgages in our model, while actual default rates reflect defaults on both fixed-rate and variable-rate mortgages. Defaults on variable-rate mortgages may be more sensitive to changes in interest rates than defaults on fixed-rate mortgages. This comparison is intended to provide only a rough test of whether our estimates are in the general range of historical experience.

Our estimated rates of default appear reasonable and broadly within the range of historically observed default rates. The overall rate of default estimated for the base case (0.31 per cent) is slightly higher than the actual rate of default observed in 2006 (0.23 per cent).

Also, our results suggest that the rate of default would reach 1.35 per cent following a persistent decrease in house prices similar to the one observed over the 1990Q1–1995Q1 period. This rate is higher than the peak observed in Canada in 1992Q1 (0.62 per cent).[11] This is because, as mentioned in the caveats, the assumption of limited liability may lead to an exaggerated measure of the risk of default, particularly in scenarios where defaults are more likely to happen (i.e., decreasing house prices). The rate of default is still much higher in the very extreme scenario (2.25 per cent).

These rates do not reflect actual losses to banks and mortgage insurers, because the loss-given-default on mortgages is considerably less than 100 per cent of the balance of the mortgage. Anecdotal evidence suggests that the loss-given-default on mortgages may be around 10 per cent.

These comparisons should, however, be interpreted with caution, given the caveats mentioned above. Nevertheless, they suggest that the methodology applied here can be useful for stress testing the portfolio of Canadian mortgage loans.

11. The 0.62 per cent rate is measured as a percentage of the number of mortgage loans in arrears three months or more. Data on default rates as a percentage of asset values are not available before 1997.

Conclusions

This work applies a contingent-claims model of mortgage default to analyze the impact of changes in house prices on the decision to default.

This approach has limitations. In particular, it is technically very difficult to introduce additional factors into this framework to take into account other important aspects of the default decision, such as the risk of income loss. Also, we do not explicitly model the fact that, besides the options to default and to prepay, the mortgagor can choose to refinance his loan at a new mortgage rate. This would require the introduction of a third stochastic variable, which would make the solution of the model extremely complex.

On the whole, however, this work appears helpful in gauging the risk of default on mortgage loans under different scenarios and assumptions regarding the evolution of the distribution of LTV ratios.

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The Changing Landscape of Securities Trading

Éric Chouinard

The competitive landscape for securities trading is being affected by two opposing trends: on the one hand, the consolidation of exchanges, both within and across borders, and the formation of alliances between marketplaces specializing in different asset classes; on the other, the creation of new trading venues that offer the possibility of trading outside an exchange. This article examines how these changes are affecting competition among securities marketplaces. The focus here is on equity and derivatives markets that are built around a central system to match orders. Fixed-income markets (and over-the-counter market structures more generally) are not examined.

As the competitive power of traditional exchanges is challenged by the emergence of alternative trading systems (ATSs), the level of competition appears to be increasing. While the rise in ATSs has the potential to fragment markets, thereby reducing liquidity and hindering price discovery, this is mitigated by regulation and technological tools that consolidate prices across the multiple marketplaces where a security is trading.

The first section discusses the consolidation of securities exchanges, its causes, and factors that are acting as barriers to further consolidation. The second section focuses on the emergence of alternative trading systems, including dark liquidity pools, and examines the potential for fragmentation. Implications of these trends for competition are discussed in the third section. While the bulk of the discussion in this article is focused on global trends, the Canadian situation is presented briefly in the fourth section.

The Consolidation of Securities Exchanges

In recent years, the securities industry has experienced a rapid transformation as marketplace operators formed various alliances. These have ranged from full-blown mergers to looser forms of co-operation: for example, the creation of informal networks for cross-listing securities or for sharing technology. Marketplace consolidation has the potential to result in deeper, more liquid markets if the structures merging are well integrated and their order flow is, therefore, aggregated.

Marketplace consolidation is not new. A wave of exchange consolidation occurred in the United States as long ago as the 1930s, when several regional exchanges merged to better compete against the New York Stock Exchange (NYSE). What distinguishes the current environment is that, increasingly, alliances cross geographical borders. Stock exchanges are also looking to enter into derivatives trading by forming partnerships with derivatives exchanges. Table 1 presents a non-exhaustive list of the most important alliances formed since the beginning of 2006, when the pace of consolidation increased. Some of these mergers have not been finalized, pending approval either from regulators or from the exchanges' shareholders.

Developments in communication and information-processing technology play an important role in the consolidation of marketplaces. Almost all of the major exchanges around the world have adopted electronic systems.[1] In electronic markets, orders are routed to a central system using an electronic interface, and the process of matching prospective buyers with prospective sellers is largely automated.

The shift towards electronic trading has encouraged consolidation in several ways. First, it has increased the incentives for growth, since electronic

1. The New York Stock Exchange, the last important exchange that matches orders on a trading floor, is currently moving towards a hybrid model, where traders will be given the choice of trading on an electronic platform or on the trading floor.

systems can execute more trades than traditional venues, where traders physically interact with each other on a trading floor. Second, with a cost structure more heavily geared towards fixed costs, electronic trading increases the potential economies of scale resulting from a merger. Third, electronic trading permits linkages between exchanges that floor-based trading systems preclude because of geographical or space constraints. Fourth, since the cost of developing trading technology remains high, some alliances may be motivated by a desire to gain access to better technology.

Consolidation is also supported by changes to the governance of exchanges. In the past decade or so, most exchanges have evolved from member-owned mutual entities to profit-seeking corporations. Demutualization has increased the incentives for exchanges to gain a competitive edge and enhance value for their shareholders. It has also provided easier access to the capital needed to achieve their business plans.

As mentioned previously, the trend towards cross-border and cross-asset alliances suggests that exchanges want to diversify their operations geographically and to increase the scope of their services. In principle, the alliance of a market operator with a marketplace in a foreign jurisdiction could enhance the liquidity of the securities they trade, because they would have access to a larger investor base. Moreover, with multinational exchanges, investors could diversify away from country-specific risks or implement investment strategies involving multiple securities listed in different countries more easily and with less market risk than by trading in a number of different exchanges.[2] Alliances combining a stock and a derivatives exchange could have the same type of benefits if they facilitated the simultaneous trading of related cash securities and derivatives instruments.

Currently, however, regulatory constraints limit the benefits of cross-border consolidation. Regulators have oversight responsibilities for both the operation of exchanges and the securities listed on them, and most regulators restrict the access of marketplaces that they do not oversee to investors from their jurisdiction. This limits

Table 1

Significant Exchange Mergers, 2006 and 2007

Mergers that combined trading in cash and derivatives	
Sydney Futures Exchange and Australian Securities Exchange	Completed in July 2006
International Securities Exchange (U.S.) and Deutsche Börse (Germany)	Announced in April 2007
Mergers of derivatives exchanges	
Chicago Mercantile Exchange and Chicago Board of Trade	Completed in July 2007
Mergers of stock exchanges	
New York Stock Exchange (U.S.) and Euronext (pan-European)	Completed in February 2007
NASDAQ (U.S.), OMX (Scandinavia), and Borse Dubai (U.A.E.)	Announced in September 2007
London Stock Exchange (U.K.) and Borsa Italiana (Italy)	Completed in October 2007

2. An example of such an investment strategy is a "long-short" trade, which involves buying a security while simultaneously selling short another, in the hope of profiting from changes in the price difference between the two securities.

the integration of market structures when exchanges from different jurisdictions merge. In most cases, the newly formed entity continues to operate two distinct marketplaces, each offering trading for a separate group of securities. Therefore, cross-border consolidation does not necessarily facilitate trading at present, and economies of scale can be limited. Such mergers may involve sharing technology. They may also increase revenues—for example, from listings—and diversify these revenue streams geographically.

This situation could change if the G-7 countries make significant progress in achieving free trade for financial securities. (See Highlighted Issue on p. 32.) Countries reaching such an agreement would allow investors within their borders direct access to foreign marketplaces. This would be made possible by a mutual recognition regime of rules and enforcement decisions of foreign regulatory authorities from participating jurisdictions. Free trade would facilitate the integration of marketplaces involved in a cross-border merger.

Another constraint to consolidation is the fragmentation of clearing and settlement systems. Clearing involves the confirmation of the terms of a trade by the buyer and the seller after the trade has been executed and the calculation of each party's obligations. Settlement entails the transfer of funds and assets between the buyer and the seller. Clearing and settlement processes are a key component of any securities transaction.

Many exchanges (for example, those trading derivatives) are vertically integrated, using their own subsidiary to perform this service.[3] Ownership of clearing and settlement systems can be profitable for exchanges, because it reduces their post-trading costs. It can also be a source of revenue, if clearing and settlement of trades conducted over-the-counter or in another marketplace is offered.

Differences in clearing and settlement systems complicate the integration of exchanges because of the lack of fungibility or interoperability between systems. Efforts are under way to enhance the interoperability of post-trading systems, both within and across borders, which will reduce the difficulties of integrating two marketplaces. These efforts involve agreeing to common technical standards for messaging and communications, eliminating paper, and strengthening risk-management standards (Group of Thirty 2006).

It is difficult to anticipate how far convergence will go. Many believe that the industry will reach an equilibrium, where a small number of large exchanges with a global reach and offering trading in various types of assets may coexist with smaller exchanges specializing in the trading of particular securities: for example, those issued by firms from a given industry or country.

Most stock exchanges are actively looking to expand into derivatives markets—the most profitable and fastest-growing segment of the industry. Both NASDAQ and NYSE Euronext have expressed a desire to continue to expand geographically by merging with an Asian marketplace.

The Emergence of Alternative Trading Systems

Many ATSs are simple order books in which buy and sell orders are electronically matched. They differ from traditional exchanges in two important ways. First, ATS operators can—and often do—grant direct access to their system to institutional investors, allowing them to trade without a securities dealer acting as an intermediary. Second, ATSs do not restrict trading to securities that meet certain admission requirements. Any security can, in principle, be traded on any ATS, provided its issuer is registered with regulators.

By allowing securities to trade on marketplaces other than those where they are officially listed, ATSs represent perhaps the most significant development for the competitive structure of markets. Traditionally, exchanges have enjoyed a natural monopoly in the trading of the securities listed on them, except when the issuer made the decision to list on multiple exchanges.

A particular type of ATS has recently been receiving considerable attention: internal crossing networks. These are also known as "dark liquidity pools" because they do not display standing orders to the public. Such systems without pre-trade transparency are ideally suited for conducting large trades that might move market prices if the order was disseminated publicly. In some ways, dark liquidity pools are a substitute for the "upstairs market" of a traditional

3. European stock exchanges are also largely vertically integrated. This contrasts with stock trading in Canada and the United States, where there is a central—and independent—clearing and settlement agency.

exchange, where large trades are matched outside of the central order book.

Most dark pools are operated by securities dealers that internally match order flows originating from their various business lines, such as their retail, institutional, or proprietary trading desks. Securities dealers have followed the practice of internalizing orders for decades. What is changing is that regulation in many jurisdictions is now requiring that internal trading be automated. Dark liquidity pools must also be linked to public markets in two ways. First, transactions must occur at prices that are, at worst, consistent with the best bid or offer posted across all public markets. In practice, most dark pools conduct trades within the bid/ask spread, thereby improving on market prices. Second, regulation requires that information on completed transactions be disseminated publicly. Dark pools are therefore not entirely opaque.

Many large institutional investors value dark pools, mainly because orders can be kept private until after they are executed. As for dealers, they can save on transaction fees by matching orders from various sources internally.

The emergence of ATSs is supported in many jurisdictions by rules to improve competition and increase the efficiency of markets. In Europe, for example, the recent Markets in Financial Instruments Directive (MiFID) allows investment firms to route orders to all types of marketplaces, not only their national exchanges, as was previously the case. This greater use of alternative systems is expected to increase trading speeds and cut trading costs. It will also take away business from traditional exchanges. MiFID is being credited with triggering the recent emergence of ATSs in Europe. Several projects are in the planning stage, the most important being Project Turquoise, which is a system owned by seven large securities dealers that accounts for about half the trading on European exchanges.

In the United States, the Securities and Exchange Commission adopted Reg NMS. This regulation connects marketplaces and contains a provision preventing standing orders on an automated market from being bypassed in favour of inferior orders submitted elsewhere. This protection existed before, but did not cover orders from ATSs. The Canadian Securities Administrators (CSA) released a proposal in the spring to extend similar "trade-through" protection to ATSs. It has yet to be implemented, since comments received during a public consultation are still being reviewed.

The emergence of ATSs has raised concerns that they may fragment markets. Fragmentation arises in the context of securities markets when all orders do not interact with each other via a single order-execution mechanism. Fragmentation reduces market liquidity and hinders the price-discovery mechanism. Fragmentation is not a new concept. It occurs, for example, when a firm lists its shares on multiple exchanges. But the emergence of ATSs has brought this issue to the forefront, particularly the rise of dark liquidity pools, where orders are internalized. More traditional ATSs can also lead to fragmentation, unless quotes and trades from various markets where a security is traded are brought together to provide a consolidated overview of prices across all marketplaces.

Fragmentation is being offset by regulation requiring marketplaces to be linked together and by technological tools. These tools allow traders to connect to multiple marketplaces rapidly and inexpensively, to scan prices across them, and to direct orders to the marketplace in which the price is the most advantageous.

The development of ATSs can be seen as part of a broader response to changes in market structure, with dealers and investors attempting to counteract a possible rise in the competitive power of exchanges as they consolidate.

What Does This Mean for Competition?

The net impact on competition of these two trends is difficult to assess. Economic theory suggests that consolidation increases the market power of the firms left in the industry and that they may raise their prices. But the threat of competition from new entrants, such as ATSs, may limit their market power.

The limited data available indicate that trading costs are trending downwards, which suggests that the emergence of new marketplaces is increasing competition in the industry. According to data from Elkins/McSherry, average trading costs for stock transactions during the periods July 2004 to June 2005 and July 2005 to June 2006 decreased by about 6 basis points from the first period to the second. These average costs declined by about 29 basis points over the past 10 years (Paulden 2006; Willoughby 1998).

While this is an average over the 42 countries that Elkins/McSherry track, trading costs have consistently decreased in most countries. In Canada, for example, the TSX Group reduced trading fees up to 20 per cent in August 2007. It should be noted that the Elkins/McSherry estimates of trading costs are not entirely determined by marketplaces. They combine marketplace fees, dealer commissions, and the market impact of trades. All three components have been trending downwards.

Marketplaces collect two types of fees from traders: one for the right to access the market (these are akin to periodic membership fees) and one for conducting a trade. With electronic trading platforms, the cost of executing a trade for a marketplace is generally very small (anecdotal evidence suggests that it is close to zero in many instances). The Elkins/McSherry data suggest that most of these savings have been passed on to customers. They indicate that in developed countries, marketplace fees account for about 2 to 5 per cent of the total cost of conducting a trade.

Reduced trading costs cannot be directly attributed to increased competition—or the threat of competition—from ATSs, at least not entirely. The increasing use of electronic trading and its enhanced efficiency over traditional floor-based systems do play a role. It appears, however, that increased competition from emerging trading venues, such as dark liquidity pools and other ATSs, may be curbing the enhanced pricing power that might otherwise arise from consolidation.

Trading facilities compete for securities orders on the basis of factors other than costs. As the number of trading venues increases, operators are using issues of market design (for example, the degree of transparency or the speed of execution) to distinguish themselves from their competitors and attract order flow. Since different types of traders value these factors differently, trading venues are being shaped according to which type of trader they wish to attract.

It should be noted that the amount of trading for a given security in a given marketplace improves the competitive position of the marketplace for trading in that security. This is because liquidity is self-reinforcing. Simply put, a liquid market will, everything else being equal, attract more orders than an illiquid one, and, as these new orders are placed, liquidity will continue to improve. This partly explains the advantage that incumbent marketplaces have had when competing with less-established venues.

Canadian Developments

Canada currently has two stock exchanges: the TSX Group, which operates a "senior" marketplace for companies with a large capitalization, as well as a venture marketplace; and the Canadian Trading and Quotation System Inc., which operates a marketplace for micro-cap stocks. Five ATSs have been launched in the past two years, and other facilities are at an advanced planning stage. These facilities will offer trading in all stocks listed on the "senior" TSX marketplace.

Three types of ATSs are emerging in Canada. The first group consists of transparent central limit-order books. The first two Canadian ATSs in that category, Pure Trading and Omega, were launched this autumn. Two more, ICX and Alpha, are expected to be launched by the end of 2008. Alpha will be owned by Canaccord Capital, the Canada Pension Plan Investment Board, and the securities dealers linked to the six main Canadian banks. Its shareholders account for about 65 per cent of trading volume on the TSX.

The second group of ATSs consists of dark liquidity pools. The first Canadian dark pool, Match NOW, has been operational since July 2007 and guarantees that any trade executed on the system will be within the best bid and ask quotes available across transparent markets. Another dark pool, ATX, will be operated by the TSX and is awaiting regulatory approval.

The third group of ATSs is for trading large blocks of securities. Two facilities, BlockBook and Liquidnet, operate systems that are accessible to either dealers or institutions and allow traders with opposite needs to negotiate prices electronically while preserving their anonymity. The ability to negotiate prices is an important difference between these facilities and the dark pools. On the latter, prices are established by a mechanism according to prevailing conditions across all public markets.

The Montréal Exchange (MX) is currently the only exchange for derivatives trading in Canada. But the TSX Group has announced plans to offer derivatives trading in 2009 upon the expiration of a non-competition agreement signed by Canadian exchanges in 1999, when they

restructured markets. The TSX Group has formed an alliance with the International Securities Exchange to create DEX, a new exchange that, based on an agreement signed with Standard & Poor's, will have exclusive rights for trading derivatives on the TSX-S&P equity indexes. The Montréal Exchange is the majority shareholder in the Boston Options Exchange.

Concluding Remarks

Improvements in information technology, the globalization of financial markets, and regulatory changes are altering the competitive landscape for market providers. The capabilities of traditional exchanges to compete in each other's markets have increased, and exchanges are merging and reaching strategic alliances within and across borders. They are also facing increasing competition from alternative trading systems, which raises the potential for market fragmentation. But, to date, fragmentation appears to be more than offset by regulation and by technological tools that allow greater connectivity across marketplaces.

The structure of the industry is changing rapidly, and its future will likely be determined to a large extent by the ability of new ATSs to gain market share and by the success of policy-makers and market participants in removing the remaining barriers to consolidation.

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Reforming the Credit-Rating Process

Mark Zelmer

The downgrading (and warnings of potential downgradings) of an unprecedented amount of asset-backed securities and collateralized debt obligations (CDOs) in July have raised concerns among investors about the ability of rating agencies to assess the credit quality of these instruments. Even though the affected securities represented a small share of these markets, the action surprised investors and led them to wonder why ratings had not been cut earlier, since the problems in the U.S. subprime-mortgage market had been apparent for some time. Rating agencies have also been criticized for putting themselves in conflict-of-interest situations. These concerns have been accompanied by calls in a number of countries for greater public scrutiny of rating agencies and for more transparency in the rating process. In October, the G-7 indicated its support for the Financial Stability Forum's plans to study the role, methodologies, and use of rating agencies in structured-finance markets.

Various proposals have been put forward internationally to enhance the ratings process, especially in the area of structured products. This report provides a brief overview and discusses the merits of each one.

Increased Regulation of Rating Agencies

Citing past high-profile rating mistakes, conflicts of interest inherent in the rating business, and the oligopolistic nature of the industry, some observers have suggested that rating agencies should be regulated more closely. The major rating agencies operating in the United States are currently regulated by the U.S. Securities and Exchange Commission (SEC), which introduced a new regulatory framework for rating agencies in June.[1] To make the case for increased regulation, it must be demonstrated that there has been a market failure that is not likely to be corrected by market forces alone, and that more government regulation represents a viable, cost-effective solution.

Rating agencies have been criticized for the conflicts of interest inherent in their business: They receive a significant portion of their revenues from the issuers that they rate, even though the same ratings are provided as a service to investors purchasing the securities in question; they provide advice to issuers before securities are issued that helps them qualify in advance for desired ratings; and they publish unsolicited ratings that could, potentially at least, pressure issuers to pay them fees.

Rating agencies acknowledge these inherent conflicts of interest and argue that they have a wide

1. In September 2006, the U.S. Congress passed the *Credit Rating Agency Reform Act of 2006*, which provides new recognition standards and introduces more formal oversight of rating agencies. However, the SEC is prohibited under the Act from regulating the substance of credit ratings or the process by which ratings are determined. The SEC introduced a new set of rules to implement the Act in June 2007 and is currently in the process of redesignating rating agencies under the new rules. It is therefore too soon to assess the effectiveness of the new regulatory regime. Outside of the United States, there is little oversight of the major rating agencies. The European Commission has so far taken a "wait and see" attitude towards the rating industry. However, the recent market turbulence has resulted in calls from some European governments for more formal oversight of rating agencies, and the European Commission has asked the Committee of European Securities Regulators (CESR) to review the rating process surrounding structured products.

range of mechanisms in place to manage them. For example, they have a highly diversified client base, which does not leave them overly dependent on any one client or sector. In addition, they make their rating criteria and opinions public, which promotes a better understanding among investors of the rationale behind published ratings. Agencies also maintain a separation between the analytical and commercial activities associated with any given rating to foster the independence of their ratings. The compensation of their analysts is not dependent on the fees related to the ratings they assign, plus committees review and approve the ratings proposed by the analysts. More generally, they claim that the need to preserve their reputation is an incentive for them to try and provide fair, objective, and independent ratings—a claim supported by Covitz and Harrison (2003).

While rating agencies have experienced some controversial failures, they have also shown an ability and willingness to learn from their mistakes, and they are regularly refining their rating processes. It is not clear that regulators have any comparative advantage in overseeing the rating process, since they are further removed from the entities being rated than the agencies. Regulators may not be in the best position to evaluate the methods used by rating agencies to assess financial instruments. Venturing into this territory would expose them to the risk of being held publicly accountable for the mistakes of rating agencies. It could also stifle innovation in the rating industry, as well as the development of financial markets more generally, since regulators would have difficulty keeping abreast of the flow of new products that are regularly being developed in financial markets. It is also not clear who would be best placed to regulate the rating process, since rating agencies have significant cross-border activities and rate products that trade in more than one jurisdiction

Where public authorities may have a role to play is in continuing to press rating agencies to adhere to the provisions of the IOSCO *Code of Conduct Fundamentals for Credit Rating Agencies* (IOSCO Code) so that investors have confidence that conflicts of interest are well managed. Four rating agencies have provided the Committee of European Securities Regulators (CESR) with self-assessments of their adherence to the IOSCO Code. In general, the CESR concluded that the rating agencies' own codes of conduct comply, to a large extent, with the Code.[2]

Making Investors, rather than Issuers, Pay for Credit Ratings

For most of their history, rating agencies made money by charging investors subscription fees; they did not charge the issuers of securities. This changed in the 1970s, when agencies began charging fees to debt issuers to rate the credit quality of their securities. As credit ratings became more widely used, they were leaking into the public domain and becoming public goods with all of the attendant free-rider issues. Today, ratings are available free of charge on rating-agency websites. Furthermore, issuers have incentives to be rated because credit ratings facilitate their access to markets. Rating structured products now accounts for as much as 45 per cent of the revenues earned by some rating agencies.

Given the apparent conflicts of interest associated with rating agencies being paid by the issuers of securities they rate, some commentators have suggested that the agencies should revert to the practice of having investors, instead of issuers, pay for credit ratings. This may no longer be possible or practical, however, now that credit ratings are public goods. The quality of ratings could decline over time if rating agencies were not able to fund an appropriate level of supporting research. There would also be less public scrutiny of ratings if fewer investors had direct access to them, which might weaken the pressure on rating agencies to produce high-quality ratings.[3]

Improving Competition in the Credit-Ratings Industry

Moody's and Standard & Poor's have dominated the credit-ratings industry for many decades. They enjoy healthy profit margins, because there are

2. IOSCO (2007) reviewed the implementation of its Code by a broader set of rating agencies. It found that those recognized by the U.S Securities and Exchange Commission (SEC) have adopted codes of conduct that largely follow the provisions of the IOSCO Code with few variations, but that additional efforts are needed to promote adherence among some other rating agencies. IOSCO is also reviewing the Code to see if it needs to be revised.

significant barriers to entering the industry. A key barrier is reputation, since investor faith in the quality of credit ratings can be earned only over time through a proven track record of ratings that are reliable indicators of credit risk. Economies of scale in the ratings business reinforce reputation as a natural barrier to entry. Rating a wide range of instruments and entities helps rating agencies signal their reputations to investors. References to specific rating agencies in a large number of laws and government regulations may have inadvertently added to the barriers to entering the industry.

Increased competition in the rating industry would give investors access to a broader set of views on the credit quality of their investments and would help keep agency fees at an appropriate level. There are, however, few practical suggestions about how to do this. Some, like Pollock (2005), have suggested eliminating SEC designation of rating agencies as a way to ensure that public authorities do not inadvertently contribute to entrance barriers. But the new regulatory framework introduced by the SEC in June now provides clearer criteria for rating agencies to achieve SEC designation status, which may foster more competition.[4] In addition, designation/recognition by public authorities can help rating agencies reduce the high cost of building a reputation, thus promoting more competition in the industry.

Of broader interest is the reference to rating agencies and ratings in other laws and regulations, and the risk that this may encourage market participants to rely on ratings as a summary statistic of risk. The Bank of England commented in its October 2007 *Financial Stability Report* that there is a risk that banks may come to rely heavily on ratings, particularly for structured products. Under Basel II, banks are required to use the ratings published by the rating agencies to determine capital charges for structured products, where such ratings exist. The Bank of England expressed some concern that this regulatory requirement may result in some banks using external ratings as their only input when assessing structured products, and recommended that this potential overreliance be addressed by banks and their regulators.

Injecting More Transparency into the Rating Process

While rating agencies have a strong track record in rating financial instruments, history is replete with examples of high-profile debt restructurings and defaults that the agencies failed to anticipate in a timely manner. Some recent examples include Indonesia and Thailand in the mid-to-late 1990s and Enron and WorldCom a few years ago. The Committee on the Global Financial System (CGFS 2005) suggests that credit ratings of structured products are more fragile than those of other securities. This is consistent with data presented in a recent Moody's report, which is summarized in Charts 1 through 4. They indicate that credit ratings of structured products are generally more stable than those of corporate securities, mainly because they have a lower probability of being upgraded. But when a downgrade occurs, credit ratings of structured products are more likely to fall several notches. The latter may reflect the greater uncertainty in assessing the credit risk of structured products and the higher leverage embedded in some of those products.

The different behaviour of credit ratings for structured products has led to calls for more transparency in the process for rating those securities. These include the IMF's proposal in various Global Financial Stability Reports that a separate rating scale be used for structured products and the CESR's suggestion that rating agencies be encouraged to provide more meaningful information on the analysis underpinning rating decisions. The Bank of England has also put forward some ideas on how the information content of ratings could be improved. (See Box 6 in its October 2007 *Financial Stability Report*.) They include thoughts on how rating agencies could provide more information on the risks associated with structured products and a

3. Public scrutiny of rating agencies is also reinforced by academic research into the usefulness of credit ratings. Numerous academic studies over several decades have generally found that rating actions lagged movements in market prices. Ammer and Clinton (2004) found that rating downgrades have a larger impact on the prices of structured products than on those of traditional "plain-vanilla" instruments. By contrast, the market impact of rating upgrades is insignificant for both types of instruments.
4. For example, the new criteria require a rating agency to be in business as a rating agency for at least three years, and it would need to provide certifications from at least ten institutional investors that they use the agency's ratings.

Chart 1 Probability of No Change

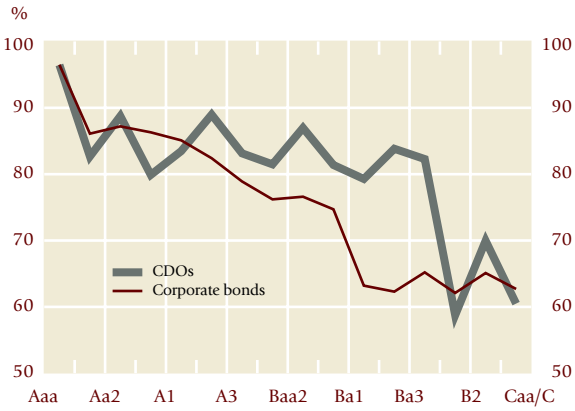


Chart 2 Probability of an Upgrade

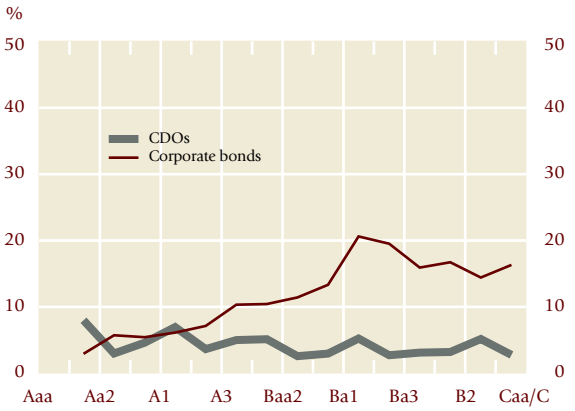


Chart 3 Probability of a Downgrade

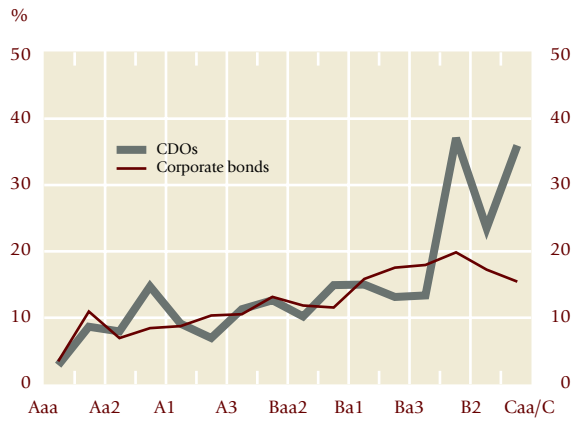
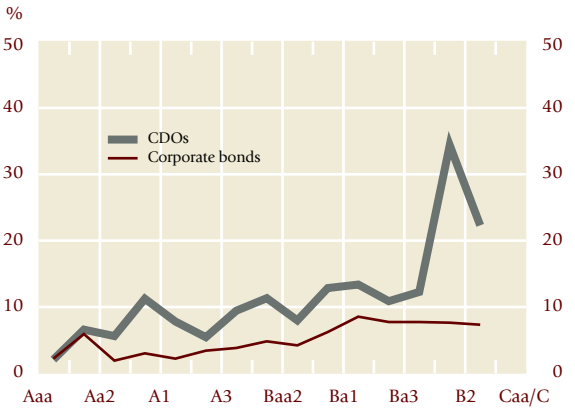


Chart 4 Probability of More than a One-Notch Downgrade



Source: Moody's "Credit Migration of CDO Notes, 1996-2006, for US and European Transactions," 28 February 2007.
Note: Charts 1 through 3 sum to 100 per cent for each rating category. Chart 4 does not show a value for the two lowest rating categories because it is not possible for these categories to be downgraded more than one notch.

suggestion that rating agencies adopt the same definitions for scoring credit risk.

A separate rating scale for structured products

A separate rating scale for structured products would emphasize that the ratings of those products behave differently from those of other financial instruments. This might make investors think twice before purchasing them. Of course, there is always a risk that investors may simply spend their time trying to map any new rating scale back to the conventional one used for other instruments. So, they would still need information about the characteristics of ratings for structured products.

Recent attempts by rating agencies to develop metrics to highlight the fragility of ratings for structured products (such as Fitch's stability scores for structured products) are an encouraging sign that market forces are at work, and that the private sector will find an appropriate solution on its own. A possible role for governments and regulators could be to speed up the process by bringing stakeholders together to discuss possible solutions.

More meaningful disclosure of supporting information

A recent assessment of rating agencies conducted by the CESR (2006) noted that they have a tendency to provide investors with descriptions of rating methods that, for proprietary reasons, are quite general and not very precise or exhaustive. In particular, CESR noted that it is often difficult to understand how a rating agency arrived at a particular rating. This makes it hard for investors to compare the opinions of various rating agencies and to draw their own conclusions, especially for complex structured products.

While market forces should ultimately determine the kind of information (and the format) that would best suit investors, there is again a possible role for governments and regulators, who could help to facilitate an improvement in disclosure by arranging stakeholder discussions of this topic or by setting principles to guide the formulation of disclosure standards.[5]

Holding Rating Agencies Legally Liable for the Ratings They Publish

Partnoy (2006) notes that in the United States rating agencies have generally not been legally liable for the credit ratings they publish, because the latter are considered to be "opinions," and are thus treated as free speech under the law. Some observers have suggested that rating agencies should be legally liable for the quality of their ratings, just as auditors are liable for the opinions they provide to investors and other stakeholders. It could be argued, however, that credit ratings require more judgment than auditor opinions.

Clearly, rating agencies must be held accountable for the quality of their credit ratings. While reputation is a barrier to entering the industry, it is also an inducement to continuous improvement in rating methods. Recent experience offers encouraging evidence that this is taking place. For example, rating agencies regularly revise their credit-assessment models in light of new information and as new analytic techniques are developed so that they can be seen by investors as being at the leading edge of credit-risk assessment. The crisis in the subprime-mortgage market will likely serve as a useful stress test that may well help to inform future rating decisions.[6]

Banning the Rating of Products for Which an Agency Has Provided Advice

Rating agencies are actively engaged in advising the issuers of securities about the credit quality of their securities before they are issued. This has led to concern about the conflict of interest of agencies that publish ratings on products for which they have provided advisory services. While rating agencies have always been ready to advise prospective issuers of securities, the concerns are magnified for structured products. Issuers of those products may have an opportunity to "game" rating agencies' credit-assessment models. This is especially true for the newest products, where lack of data may limit the usefulness of those models.[7]

Banning rating agencies from all involvement in the development of structured products or requiring them to split their rating business from

5. In its new rules for rating agencies, the SEC requires them to publish performance-measurement statistics on ratings for short-, medium-, and long-term periods. An example of such statistics is the rating-transition matrices published by the rating agencies that were used to prepare Charts 1 through 4. However, the SEC indicated that it is not prepared to prescribe standard metrics at this time. It is also studying whether it would be appropriate to require rating agencies to furnish additional types of performance statistics to be disclosed as an alternative, or in addition, to rates on historical defaults and downgrades. Examples given included comparing a given credit rating to the market value of the rated security or to extreme declines in its market value after the rating.

6. It may also result in more official scrutiny of rating agencies. For example, the SEC has launched an inquiry into the behaviour of rating agencies in the market for subprime residential mortgage-backed securities, and the President's Working Group on Financial Markets is examining the role of rating agencies in lending practices, how their ratings are used, and how securitization has changed the mortgage industry and related business practices.

7. While rating agencies have always interacted with issuers before a new instrument is rated and issued, issuers of structured products have more scope to adjust the terms and conditions of their products to achieve a desired credit rating in advance; for example, by varying the degree of over-collateralization for each tranche.

their consulting activities seems excessive. Rating agencies have useful expertise and insights to offer, which should result in better products for investors. In addition, since the transparency of the rating process continues to improve, there may not be any further tangible benefits from imposing such a separation.

Instead, one could envision a regime in which a rating agency is either: allowed to rate the products for which it has provided advisory services, but only under the condition that it fully discloses its involvement in the development of the product; or barred from rating products for which it has provided advice prior to issuance (while being free to rate other products for which its competitors provided advice). Here in Canada, recent market developments may lead investors to increasingly follow the international practice of requiring structured products to be rated by two or more rating agencies.

Market-Based Credit Ratings

There is also an issue of whether credit ratings should be replaced by market-based measures of credit risk. Moody's has already done much of the work needed to generate market-based ratings. It publishes "Market Implied Ratings," or MIRs, designed to reflect the credit-rating equivalent of the market price of credit for various instruments over time. The main advantage of such a metric is that it would incorporate all available information into a rating, including the ratings of other rating agencies. Moreover, it could be designed to be very timely. The main disadvantage is that these measures may be misleading, since market prices can be distorted by fads or bubbles. For example, many asset-backed securities traded at spreads that did not reflect their inherent liquidity risks prior to the recent market turbulence. Thus, prudence would suggest that MIRs not be exclusively relied upon in managing credit risk.

Conclusion

Investors have had a long-standing need for specialists who can advise them on the credit quality of their investments. Most find it cost-effective to delegate this task to rating agencies that can benefit from economies of scale in assessing the credit risk of a wide range of issuers and financial instruments. The advantages of this approach have become increasingly pronounced with the emergence of structured products, since proper assessment of the credit risk of these products requires sophisticated tools and modelling skills.

The difficulties that structured products have faced in the recent market turbulence have renewed concerns about rating agencies and their role in financial markets. Rating agencies have benefited handsomely from the rapid growth in those markets. While their ratings are generally consistent with actual default experience, rating agencies have had some notable failures. They also continue to have some well-recognized conflicts of interest that need to be managed. Moreover, ratings are playing an increasingly important role in financial markets as financial instruments become more complex and difficult for investors to understand. And ratings play important roles in public sector activities more generally.

Some natural self-correcting market forces are at work, which should ensure that rating agencies continue to improve their processes. Although reputation is a natural barrier to entering the rating industry, it is also an inducement to continuous improvement in rating methods. The recent turbulence in structured-finance markets will, no doubt, be a useful stress test to help calibrate analytic tools in the future and may lead investors to demand increased transparency in those markets so that they can better manage their exposure to credit risk. Moreover, the role of rating agencies in developing new structured products may increase their exposure to legal risk, making them more legally accountable for the quality of the ratings they produce.

Nevertheless, there are some further steps that could be taken to reinforce market discipline in the rating industry. For example, the rating process would benefit from greater transparency, so that investors are better able to critically assess ratings. The best solutions are likely to emerge through an active dialogue between rating agencies and their stakeholders; regulators are unlikely to have any comparative advantage in imposing solutions. They could possibly play a useful role, however, in setting or supporting some minimum principles of disclosure, which could be the basis of a dialogue between investors and issuers, and could possibly lead to an agreement on industry-led best practices or a code of conduct. Initiatives such as the CESR's assessment of rating

agency compliance with the IOSCO Code could be a useful means of maintaining public pressure on the rating agencies to continue to enhance the management of conflicts of interest in their industry. The role that rating agencies and ratings play in various laws and regulations and public sector activities could possibly be re-examined. Formally recognizing specific rating agencies may have inadvertently reinforced barriers to entering the rating industry. It may also have encouraged some investors to rely heavily on credit ratings inappropriately as a summary statistic of risk.

In the end though, investors need to accept responsibility for managing credit risk in their portfolios. While complex instruments such as structured products enhance the benefits to be gained from relying on credit ratings, investors should not lose sight of the fact that one can delegate tasks but not accountability. Suggestions such as rating structured products on a different rating scale could be helpful, in that this may encourage investors to think twice before investing in such complex instruments. Nevertheless, investors still need to understand the products they invest in, so that they can critically review the credit opinions provided by the rating agencies.

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Policy and Infrastructure Developments

Introduction

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

The market for over-the-counter (OTC) derivatives has grown exponentially in recent years; the total size, measured by the notional amount outstanding, increased at an annual average rate of 20 per cent between 1998 and 2005, reaching US$370 trillion worldwide in June 2006. Hedge funds have become far more active, and, in some segments of the market, they are among the most active participants. They have also contributed to the emergence of new practices, such as prime brokerage arrangements for OTC derivatives. There have also been significant developments in infrastructure, with vendors providing new services for processing OTC derivatives. In **Developments in Processing Over-the-Counter Derivatives**, Natasha Khan discusses the main findings of a report by the Bank for International Settlements that assesses these developments and their implications for the efficiency and stability of the OTC derivatives market.

In a standard foreign exchange transaction, parties to a trade (referred to as "banks" for simplicity) agree to exchange a value denominated in one currency for a value denominated in another currency. A bank that irrevocably pays out the currency sold to its transaction counterparty unconditional on the final receipt of the currency it has purchased is exposed to financial loss up to the principal value of the trade if its counterparty fails to deliver the purchased currency. In the current context, this risk of financial loss is referred to as "foreign exchange settlement risk." In the report, **Management of Foreign Exchange Settlement Risk at Canadian Banks**, Neville Arjani highlights key aspects related to foreign exchange settlement and discusses how major Canadian banks manage their exposure to foreign exchange settlement risk. The author suggests that some of the major Canadian banks have significantly reduced their exposure to foreign exchange settlement risk during the past decade through their participation in CLS Bank, which provides payment versus payment settlement of foreign exchange transactions, thus eliminating foreign exchange settlement risk. In addition, all of the major Canadian banks continue to employ a comprehensive framework for managing this risk, involving governance, measurement, and control. For some institutions, however, there is still room for improvement in managing this type of risk.

Developments in Processing Over-the-Counter Derivatives

*Natasha Khan**

This article discusses the main findings of the report *New Developments in Clearing and Settlement Arrangements for OTC Derivatives* (CPSS 2007) in a Canadian context. The complete report, published by the Committee on Payment and Settlement Systems (CPSS),[1] is available on the website of the Bank for International Settlements (BIS).

The market for over-the-counter (OTC) derivatives has continued to grow exponentially in Canada and abroad.[2] The size of the global OTC derivatives market, measured by notional amount outstanding, increased at an average annual rate of 20 per cent between 1998 and 2005. As of June 2006, the total notional amount outstanding had reached US$370 trillion worldwide.

By 2005, this rapid growth, coupled with limited use of automation for processing these transactions, had caused significant backlogs in trade confirmations. The backlog created uncertainties regarding counterparty risk and credit exposure for major derivatives participants, thereby raising issues concerning financial system efficiency and stability. Prudential supervisors began to express concern in early 2005. The situation, which was particularly serious in the market for credit derivatives, was highlighted in an industry-sponsored report published in July 2005.[3]

In September 2005, prudential supervisors brought 14 major derivatives dealers together at the Federal Reserve Bank of New York to encourage an industry solution. This prompted the 14 firms to make a public commitment to decrease the backlog in the credit derivatives market.

At the same time, central banks and prudential supervisors recognized that several recent developments in the broader OTC derivatives market warranted further analysis. Thus, in February 2006, the CPSS set up a working group, composed of member central banks and the prudential supervisors of major derivatives dealers, to follow up on issues identified in an earlier report (CPSS 1998) and to identify and analyze any new issues raised by more recent developments.

The working group conducted interviews with derivatives dealers in each jurisdiction and met with industry groups, trade organizations, and infrastructure service providers. The resulting report, which complements other supervisory initiatives, provides a comprehensive view of existing arrangements and risk-management practices in the broader OTC derivatives market.

The report concludes that, although the infrastructure for processing OTC derivatives has strengthened since 1998, further action is needed to ensure that all OTC derivatives trades are confirmed in a timely fashion, to identify steps

1. The CPSS was established in 1990 as a permanent BIS committee reporting to the G-10 governors. The Committee contributes to strengthening the financial market infrastructure by promoting sound and efficient payment and settlement systems.
2. In a broad sense, an over-the-counter derivatives contract is a bilaterally negotiated transaction whose value depends on the value of one or more underlying reference assets, rates, or indexes.

* The author was a member of the working group established by the Bank for International Settlements (BIS) Committee on Payment and Settlement Systems (CPSS) that published the report discussed in this article on 16 March 2007. Members of the working group included representatives from the G-10 central banks, the Hong Kong Monetary Authority, the U.K. Financial Services Authority, the U.S. Securities and Exchange Commission, and the German Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin). Secretariat services were provided by the BIS.

3. The report (Counterparty Risk Management Policy Group II 2005) called for an industry round table to address the serious and growing backlog of unconfirmed trades in the credit derivatives market.

to mitigate the potential market impact following the close-out (default) of one or more major market participants, and to achieve open access to essential post-trade services and efficient connectivity between service providers.

The study analyzes six main issues: documentation backlog, use of collateral, use of central counterparties, prime brokerage, novations, and close-out. The first three issues were raised in the CPSS report published in 1998. The last three have been identified as relevant because of developments in the marketplace since that time.

Major Issues

Documentation backlog

Unsigned master agreements

A master agreement sets the terms and conditions for all, or for a defined subset of, transactions into which two parties, such as a dealer and an institutional investor, may enter. The practice of executing trades before signing a master agreement may create legal risk by jeopardizing a firm's ability to close out and net transactions in the event of a counterparty's default.[4]

In Canada, a master agreement must be in place to achieve the benefits of netting in the event of counterparty default.[5] Canadian insolvency statutes protect close-out netting for eligible financial contracts (EFCs).[6] (See "Important Financial System Developments," on p. 31.)

In contrast to 1998, virtually all the international dealers surveyed for this report have signed master agreements with each other. Dealers report that the majority of existing unsigned master agreements are with clients who have executed only one trade and, hence, would not benefit from netting.

Moreover, most G-10 dealers surveyed have policies in place to reduce the risks associated with unsigned master agreements. The most important policy limits the number of trades that can be executed with a particular counterparty in the absence of a signed master agreement. Most dealers require a master agreement to be signed before the first trade with non-investment-grade counterparties and before the second transaction with others. Where a master agreement has not been signed, dealers typically use a "long-form confirmation," which incorporates the industry standard form of master agreement in the confirmation. In addition, dealers routinely monitor backlogs of unsigned agreements and prioritize efforts to complete documentation based on risk of, and exposure to, a particular counterparty.[7]

Outstanding confirmations

Oral contracts are legally enforceable in most jurisdictions, including Canada. Thus, although a written confirmation is best practice, failure to confirm a trade in writing does not make the trade unenforceable. Recordings of phone conversations, emails, information from brokers (for brokered trades), exchange of payments, or margin (collateral) can serve as evidence to prove the existence of a trade. But even if the existence of a transaction is not in question, the details of a trade may later be disputed between counterparties. In addition, unconfirmed trades may allow errors in the books and records of a firm to go undetected, leading to an incorrect measurement of counterparty credit risk. This may result in payment and margin breaks.[8] Therefore, a written confirmation detailing the terms of the trade is the best practice.

In 1998, dealers reported hundreds of outstanding confirmations, with a significant portion outstanding for 90 days or more. Survey data collected by the International Swaps and Derivatives Association (ISDA 2006) show that the number

4. Netting essentially means offsetting positions or obligations with a particular counterparty, so that losses incurred on one contract can be offset by gains on other contracts in the event of counterparty default. Data from U.S. commercial banks show that netting decreased counterparty exposures by 85 per cent as of June 2006.
5. In the United States and the United Kingdom, legislation provides a strong case for the non-defaulting party to close out and net swap agreements in the event of a counterparty default, even in the absence of a signed master agreement.
6. In March 2007, the Canadian federal government introduced amendments to various acts that modernize Canadian insolvency laws with respect to EFCs.
7. Dealers also have the option of suspending trading with a counterparty that has not signed a master agreement.
8. A "payment break" refers to the failure to receive an expected payment or the receipt of an unexpected payment. A "margin break" refers to disagreements about the amount of collateral required.

of outstanding confirmations continued to rise until late 2005, when the issue began to receive increased attention from the industry. Data for the 2006 calendar year suggest that outstanding confirmations have decreased across all asset classes of OTC derivatives at large firms, but outstanding confirmations for interest rate derivatives have increased at small and medium-sized firms.[9]

In Canada, anecdotal evidence suggests that, because of lower trading volumes, Canadian dealers have not experienced the huge backlogs in credit derivatives encountered by their U.S. counterparts. However, the number of outstanding confirmations for interest rate swaps has increased over the past year across the big six Canadian banks.

Interviews with dealers across the G-10 countries indicate that, in the short run, firms use various procedures to mitigate the risks arising from unconfirmed trades. Many dealers verify the key economic terms of a trade shortly after execution while the confirmation is outstanding. Some firms believe that this step, known as "economic affirmation,"[10] is important, but others feel that completing a full confirmation as soon as possible is more beneficial because non-economic terms such as "business-day conventions," "holidays," etc., can lead to problems at other stages of the trade cycle. The CPSS study states that, despite the divergent views on the merits of economic affirmation, this is an important risk-mitigation tool if full confirmation is not expected to occur promptly, especially for complex products where full confirmation can take 30 days or more.

Most of the international dealers surveyed routinely monitor backlogs of outstanding confirmations and report progress to senior management. They have policies in place to prioritize and escalate efforts to complete confirmations based on metrics such as days outstanding (age) and the value of the transaction.

The industry recognizes that, in the long run, manual procedures for obtaining confirmations are not feasible for more standardized products, given the large volume of trades, and that automation is the key to managing confirmations. Electronic confirmation platforms currently operating include Deriv/SERV, which appears to be the dominant platform for credit derivatives; SwapsWire, which is seen as the preferred platform for interest rate swaps; SWIFTNet Accord, which is being used for foreign exchange and interest rate derivatives; and eConfirm, which offers confirmation services for OTC commodity derivatives.

Most Canadian dealers are using Deriv/SERV to confirm credit derivative trades with their interdealer counterparties. However, adoption of automated confirmation services for interest rate swaps has been slower in Canada than in some other G-10 countries. When the CPSS study was published earlier this year, Canadian dealers were not using an automated service for confirmations of interest rate swaps; confirmations were being communicated by fax. Non-Canadian dealers were using SwapsWire to confirm Canadian-dollar swaps, however. While Canadian dealers recognize the operational efficiency provided by automated confirmation services, they note that the benefits of joining such a service are limited unless counterparties are also using the service. Since the publication of the report, the first Canadian dealer has joined SwapsWire.

Use of collateral

The use of collateral to mitigate counterparty credit risk has increased dramatically since the 1998 report. Collateralization has been adopted in all major jurisdictions worldwide. At the end of 2005, in excess of US$1.3 trillion was posted in collateral to support exposure to OTC derivatives versus US$200 billion in 2000. The number of collateral agreements[11] has increased even more dramatically, from 12,000 to 110,000, over the same time period.

Collateral decreases credit risk, but it does not eliminate it. Credit risk is the risk that a

9. The survey defines large firms as those with more than 1,500 deals per week, medium firms as those with fewer than 1,500 but more than 300 deals per week, and small firms as those with fewer than 300 deals per week.
10. "Economic affirmation" (also known as trade verification) is the process through which counterparties verify approximately a dozen key economic details of a trade. This additional step is taken before the two parties begin to review the full terms of a trade.
11. Collateral agreements are legal agreements that govern the use of collateral in OTC derivatives transactions. Most collateral agreements are documented using the master agreement's credit support annex (CSA).

counterparty will not settle an obligation for full value when it is due or at any time thereafter. Using collateral decreases regulatory capital and frees up bilateral counterparty credit lines, making it possible to continue trading activity. But market movements and delays in mark-to-market valuations or margin calls can lead to uncollateralized exposures.

While the use of collateral reduces credit risk, it can increase legal, custody, operational, market-liquidity, and funding-liquidity risks. Legal risk is the risk of loss because a contract cannot be enforced or because a law or regulation is being applied in an unexpected manner. Custody risk is the risk of losing securities held in custody because of the insolvency, negligence, or fraudulent action of the custodian. Operational risk is the risk of unexpected loss caused by deficiencies in information systems or internal controls. Market-liquidity risk is the risk of loss due to a decline in the market value of the collateral, while funding-liquidity risk is the risk that a counterparty will experience demands for collateral that are too large to meet when due.

Dealer interviews suggest that significant progress has been made since 1998 in reducing legal, custody, operational, and market-liquidity risks associated with the use of collateral. There is a high degree of confidence in the legal enforceability of collateral agreements. Enhancements in collateral-management systems have decreased custody and operational risks. Market-liquidity risk is typically addressed by adequate haircuts and frequent mark-to-market valuations. The effectiveness of market participants' efforts to manage funding-liquidity risk is, however, more difficult to assess, partly because it tends to crystallize during stressed market conditions.

The CPSS report notes that the issue of incorporating collateral demands into a firm's overall risk-management procedures needs continued attention from market participants.

Central counterparty

A central counterparty (CCP), such as a clearing house, is counterparty to both sides of a trade; that is, a seller to every buyer and a buyer to every seller.

Central clearing of OTC derivatives was quite limited at the time of the 1998 report. In September 1999, SwapClear was launched as a clearing house for interdealer single-currency interest rate swaps. As of December 2006, SwapClear had cleared US$35.5 trillion in swaps. This was nearly 40 per cent of the global interdealer market for interest rate swaps in 2006.[12]

Canadian dealers are not currently members of SwapClear.[13] One of the key benefits of a CCP is multilateral netting,[14] which has the potential to reduce members' credit exposures relative to those that exist in bilateral deals. It can be argued, however, that these benefits are reduced because a CCP is unlikely to clear the full range of OTC derivatives products. This could potentially increase the credit exposures of the remaining, more complex, bilateral deals. Recent interviews with dealers suggest that this concern has decreased since 1998, and that most dealers do not view the limited coverage of SwapClear as materially affecting their decision to use the service.

Some market participants, including some Canadian dealers, believe that the primary benefits of a CCP are purely operational rather than credit related and that many of the operational benefits can be realized through other services. For instance, TriOptima's triReduce service, which is being used by Canadian dealers, has been cited as providing large operational gains by eliminating trades through a multilateral, voluntary termination service.[15] Deals that are removed from the portfolio do not have to be collateralized, and they do not require further payments,

12. In the autumn of 2006, the Canadian Derivatives Clearing Corporation (CDCC), a wholly owned subsidiary of the Montréal Exchange, launched Converge, a clearing service for combining exchange-traded and OTC equity derivatives.
13. SwapClear currently has 20 members, including some of the largest international derivatives dealers.
14. Arithmetically, netting on a multilateral basis is achieved by summing each participant's bilateral net positions with the other participants to arrive at a multilateral net position, which represents the bilateral net position between each participant and the central counterparty. This allows a reduction in counterparty risk.
15. triReduce provides a service through which participants identify trades that they wish to remove from their balance sheets, subject to a set of constraints (tolerances) relating to changes in counterparty credit exposure, market risk, and cash payments. triReduce matches the identified trades with those of other participants and terminates offsetting positions, while maintaining the participant's predefined tolerances.

which reduces both margin and payment breaks.

From a systemic perspective, a CCP concentrates risk and risk management. Thus, its potential to reduce systemic risk depends on the effectiveness of its risk-management procedures. A CCP for OTC derivatives faces two particular risk-management issues. First, more complex OTC derivatives products require the use of complex pricing models that involve model risk. Second, default procedures must accommodate the inherent illiquidity of OTC derivatives instruments.

In recognition of these issues, SwapClear has limited its service to less complex, single-currency interest rate swaps and has adapted its default procedures accordingly. Market participants must recognize the differences between the default procedures adopted by a CCP for OTC derivatives and traditional procedures used by CCPs for exchange-traded derivatives.[16] Members of a CCP should also be comfortable with the valuation models used by the CCP to price positions, since margin requirements will be based on prices derived from these models. This will affect the cost and risk of participation in the CCP.

Prime brokerage

In a prime brokerage arrangement, a prime broker agrees to intermediate specified eligible transactions between a client, such as a hedge fund, and a list of approved executing dealers.

Prime brokerage services have been offered for cash equity, fixed-income securities, and foreign exchange products for some years, but prime brokerage for OTC derivatives is a very recent phenomenon. At present, the service is offered by only a very small number of large international dealers and is geared specifically to the hedge fund community.

A prime brokerage service for derivatives allows a hedge fund to enter into trades with multiple executing dealers while using the back-office systems of a single prime broker to clear and settle those trades, thus providing operational efficiency. The service can also decrease the hedge fund's margin requirements, because all eligible trades are subject to bilateral netting.

16. See CPSS (2007) for a detailed discussion of the default-management process adopted by SwapClear.

In a typical prime brokerage arrangement for derivatives, once the executing dealer and the hedge fund have agreed to a trade, each must notify the prime broker of the terms. If the prime broker accepts the trade, it becomes a counterparty to two back-to-back trades, one with the hedge fund and the other with the executing dealer.

Canadian dealers are not currently offering prime brokerage services for derivatives,[17] but they do serve as executing dealers in prime brokerage arrangements.

The 2007 CPSS report states that all parties involved in a prime brokerage arrangement should carefully assess the legal documentation and understand their rights and responsibilities.

Novations

A novation is the replacement of a contract between two initial counterparties to an OTC derivatives trade (the transferor and the remaining party) with a new contract between the remaining party and a third party (the transferee).

Novations were rare in 1998, but the practice has increased with the growth of the hedge fund sector. When a hedge fund seeks to exit an OTC derivatives position, it often does so through a novation rather than by negotiating a termination of the contract (which may require the fund to accept the price offered by the original counterparty) or by entering into an offsetting contract (which is likely to create additional counterparty exposure).

Standard master agreements allow novations as long as the transferor obtains written consent from the original counterparty prior to the transfer. Without written consent, the remaining party has full discretion to reject the proposed novation. Dealers, however, were frequently accepting novations of credit derivatives without prior consent. This was causing errors in measuring counterparty credit risk, as well as causing payment and margin breaks. The practice was one of the major factors contributing to the huge

17. Derivatives prime brokerage places very large demands on the prime broker's back-office systems, and, as stated earlier, this service is currently offered only by some of the largest international dealers. Canadian dealers offer prime brokerage services for foreign exchange products, cash equity, and fixed-income securities.

backlog of outstanding confirmations in the credit derivatives market.

In the autumn of 2005, a group of dealers announced their support for a novation protocol crafted by ISDA for credit and interest rate derivatives. The protocol requires the transferor to obtain written consent from the original counterparty before 18:00 (in the location of the transferee) on the day that the novation is initiated. If consent is not obtained, the transferor is deemed to have two contracts, one with the original counterparty and one with the transferee.

All the dealers interviewed, including Canadian dealers, have adopted the protocol, which has been effective in achieving prompt notification and consent. The 2007 CPSS report notes that if novations become common for instruments other than credit and interest rate derivatives, the protocol will need to be extended to include these products.

Close-out

Close-out netting is an arrangement to settle all contracted, but not yet due, obligations to and claims on a counterparty by a single payment, immediately upon the occurrence of one of the default events defined in the relevant documentation. Close-out netting provisions in master agreements have been identified as a powerful tool for mitigating counterparty risk. At the time of the 1998 report, some dealers had expressed concerns about the enforceability of netting provisions. Recent discussions with dealers, however, suggest that these concerns have diminished considerably, because many jurisdictions have passed legislation supporting close-out netting.[18]

Since 1998, however, concerns have arisen about the potential for significant market disruptions in the event of the close-out of a major market participant, especially if it occurs at a time when markets are already under stress.[19]

Market participants have identified two steps that can help mitigate the potential impact of a major close-out. The first is to ensure timely and accurate information on counterparty credit exposures to major participants. Regular portfolio reconciliation[20] can facilitate this step. The second step is the routine identification of trades that can be voluntarily terminated in order to reduce positions that would need to be replaced following a default. This can be accomplished by using services, such as triReduce, that offer multilateral voluntary termination of trades.

Overall Evaluation

The clearing and settlement infrastructure for the OTC derivatives market has been significantly strengthened since 1998.

Nevertheless, more progress is needed in some areas. Firms need to extend the successful efforts to decrease confirmation backlogs in credit derivatives to other OTC derivatives products so that, over time, all standardized OTC derivatives trades are confirmed within five days of the trade date (T+5), and complex, non-standardized trades are confirmed within 30 days of the trade date (T+30). The use of automated systems to confirm trades, whenever possible, will help accomplish this goal and help prevent a future buildup of confirmation backlogs. Risks of existing unconfirmed trades can be mitigated by broader use of economic affirmations, as discussed earlier.

Anecdotal evidence suggests that Canadian dealers have not experienced significant confirmation backlogs in the credit derivatives market, but the number of outstanding confirmations has increased for interest rate swaps across the big six Canadian banks over the past year. Canadian dealers have not moved quickly to adopt automated services for confirming interest rate swaps, compared with dealers in some other G-10 countries. Increased use of automation in confirming interest rate swaps will help Canadian dealers confirm these trades in a timely fashion and will prevent a future backlog.

The 2007 CPSS report notes that daily portfolio reconciliation with active counterparties is appropriate for firms that are frequently involved

18. As stated earlier, close-out netting is supported by Canadian insolvency statutes for eligible financial contracts.
19. Fear of major market disruptions caused by the closing out and replacement of positions with Long-Term Capital Management (LTCM) prompted a consortium of LTCM's counterparties to recapitalize the fund, thereby preventing a close-out.
20. Portfolio reconciliation involves verifying the existence of all outstanding trades and comparing their principal economic terms.

in novations, terminations, or amendments of contracts. This will help ensure that firms have accurate records on their counterparty credit exposures. The report also concludes that market participants should work together to identify further steps that can mitigate the potential market impact of the close-out of one or more major market participants.

Over time, market infrastructure will continue to evolve. With increased centralization, open access to essential post-trade services and convenient connectivity to their systems will assume greater importance.

Centralized processing of trades and post-trade events may leave the infrastructure more susceptible to disruptions at single points of failure. Supervisors and central banks will need to determine whether existing standards for operational reliability of securities settlement systems and CCPs (CPSS-IOSCO 2001 and 2004) need to be applied to providers of clearing and settlement services for OTC derivatives that are not already subject to these standards.

In addition, if an entity other than a CCP starts settling payments associated with OTC derivatives on a multilateral net basis, central banks and supervisors will need to consider whether principles for systemically important payment systems (CPSS 2001) should be applied to the money settlement arrangements.

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Management of Foreign Exchange Settlement Risk at Canadian Banks

Neville Arjani

In a standard foreign exchange transaction, parties to a trade agree to exchange value denominated in one currency for value denominated in another currency. The transfer of funds to settle each party's payment obligation typically takes place within the relevant payments systems of the currencies involved in the trade. Settlement of foreign exchange (FX) trades across national payments systems and legal jurisdictions can expose banks to different types of risk. The principal types of risk include credit, liquidity, operational, and legal risk.[1] Together, these risks comprise foreign exchange settlement risk.

The focus here is on the credit risk dimension of foreign exchange settlement risk, henceforth referred to as "FXSR." A bank that irrevocably pays out the sold currency to its counterparty unconditional upon final receipt of the currency it has purchased is exposed to financial loss up to the principal value of the trade if its counterparty fails to deliver the purchased currency. That is, a bank is exposed to FXSR if settlement does not take place on a payment-versus-payment (PvP) basis.

Given the global scope of the FX marketplace, trades often settle across international time zones. Differences in time zones could exacerbate a bank's exposure to FXSR, since it may be required to pay out the sold currency before the business day begins in the country of the currency it has purchased.[2] Thus, exposure to FXSR could last up to two business days, and possibly longer, when settlement is interrupted by weekends and holidays. At any given time, therefore, the value of a bank's exposure to a single counterparty could equal two or more days' worth of trades, potentially exceeding the value of its capital (CPSS 1996). With almost US$4 trillion settling daily in the FX marketplace, large counterparty FXSR exposures are likely to exist.

This report highlights the key aspects of FX settlement and banks' management of FXSR. Available methods for settling FX trades and the risk characteristics of each are discussed. The necessary components of an effective risk-management strategy for individual banks are outlined. The report goes on to discuss how Canada's major banks use these settlement methods and risk-management strategies.

Methods of Foreign Exchange Settlement and Associated Risk

FX trades are usually settled using one of four methods, each of which is characterized by a different degree of risk.

Gross non-PvP settlement

Under this settlement arrangement, payment obligations relating to each currency leg of an FX trade are transferred individually through national payments systems. Where a bank does not participate directly in the national payments system for currencies that it actively trades in, it must rely on a correspondent (or nostro) bank to settle its payment obligations in those currencies.

When settling trades using gross non-PvP settlement, a bank's delivery of the sold currency is generally not made conditional on final receipt of the purchased currency. This exposes the bank to financial loss up to the principal value of the trade until final settlement.

1. For a description of these and other risks, see Aaron, Armstrong, and Zelmer (2007).
2. Settlement of each currency leg must take place in the country or region where the currency is issued.

On-us settlement

On-us settlement takes place where both currency legs of a trade are settled across the books of the same bank. This could be a scenario in which a bank is settling an FX trade across its books on behalf of two of its clients, or where the settlement bank is a counterparty to the trade. That is, one party to the trade is a client of the other party. This report deals with the latter arrangement only, where the settlement bank is a counterparty to the trade.[3]

When settling an FX trade on-us, a transfer of funds through national payments systems is not necessary. Nonetheless, on-us settlement can also expose a bank to FXSR, especially where the trade is booked by the settlement bank across time zones in separate subsidiaries or branches. If the bank credits the sold currency to its client's account prior to debiting the bought currency from the client's account, the bank is exposed to FXSR up to the principal value of the trade. This is because there is a possibility that the client would not have sufficient funds available to meet its obligation and that the bank would be unable to retrieve the sold currency.

Bilateral netting agreement

This method involves the netting of individual payment obligations in the same currency stemming from two or more underlying FX trades that are due to settle on the same date. Bilateral netting of payment obligations between a particular pair of banks typically involves one bank sending a single net payment in the respective currency to the other, rather than settling each trade between them individually. Net payment obligations are settled on a non-PvP basis.

To better understand bilateral netting, consider the following example. Suppose that Bank A owes Bank B individual amounts of 50 and 100 in currency X, stemming from two trades between them. In addition, Bank B owes Bank A 125 in currency X to settle a third trade between them. All three trades mature on the same date and are eligible to settle under the bilateral netting agreement established between the banks. Bilaterally netting these trades results in Bank A owing a single amount of 25 in currency X to Bank B, while Bank B's payment obligation to Bank A in currency X is eliminated altogether.

Banks typically maintain bilateral netting agreements with certain counterparties. Provided that an agreement is legally enforceable in all relevant jurisdictions, bilateral netting has the potential to reduce counterparty credit risk, but may not eliminate it completely, as demonstrated in the example above. That is, under a legally valid bilateral netting agreement, a bank is exposed to FXSR vis-à-vis its counterparty for an amount equal to the net value owing from all trades in the purchased currency.

Continuous linked settlement (CLS Bank)

CLS Bank owns and operates an electronic infrastructure linking together fifteen national payments systems, including Canada's Large Value Transfer System, in real time.[4] This arrangement—Continuous Linked Settlement (CLS)—facilitates the simultaneous (PvP) settlement of each currency leg for accepted FX transactions on a trade-by-trade basis. By employing specific risk controls to limit participants' exposure in the system, CLS virtually eliminates credit risk associated with settling foreign exchange transactions. Further, since participants' settlement obligations to the system are calculated on a multilateral net basis, CLS also economizes on settlement funding.

Management of FXSR

Banks exposed to FXSR are encouraged to have in place an appropriate risk-management framework to contend with this exposure. However, previous surveys conducted by the Bank for International Settlements (CPSS 1996 and 1998) found that some banks did not recognize their exposure to FXSR as being similar to other credit exposures, and thus were not taking appropriate action to manage it.

3. The larger a bank is, and the more extensive its client base and FX operations are, the greater the scale of its on-us settlement activity will likely be.

4. The CLS Bank began operations in September 2002. The Canadian-dollar leg of CLS is subject to Bank of Canada oversight under the Payment Clearing and Settlement Act. For more information on CLS Bank and the Bank of Canada's oversight of CLS, see Miller and Northcott (2002). For a more recent update on CLS oversight, see Goodlet (2007).

Citing the large scale of the FX trading and settlement activity by banks, and the resulting size and systemic implications of their exposures to FXSR, these studies set out a strategic framework for action on the part of individual private banks, central banks, and industry groups. Indeed, the introduction of the CLS Bank was one response at the industry-group level to this call for action.

For an individual bank, a framework for managing FXSR should incorporate the following elements: a corporate governance structure that acknowledges exposure to FXSR; accurate measurement of the exposure associated with each settlement method; and the use of appropriate tools to control this exposure where it exists.

Acknowledgement of exposure

Exposure to FXSR should be recognized as a short-term credit exposure for a bank. To that end, clear lines of responsibility should be established for managing this exposure throughout the organization, including the involvement of senior management.

Measurement of exposure

Banks should acknowledge the degree of exposure associated with each settlement method. That is, they should recognize exposure to FXSR when settling trades using gross non-PvP settlement (including settlement of bilaterally netted amounts owing) and on-us arrangements involving non-PvP settlement. At the same time, they should also recognize that certain settlement methods, such as CLS and on-us arrangements providing PvP settlement, can virtually eliminate FXSR.

For settlement methods that expose them to FXSR, banks should employ a measurement mechanism that accurately gauges the extent of this exposure, where exposure has both a value and duration element. For example, with gross non-PvP settlement, the value of a bank's exposure to FXSR should be measured as the principal amount of the trade.

With regard to the duration of exposure, a bank should be able to identify its minimum and maximum exposure associated with settling gross non-PvP. A bank's minimum exposure is defined as the period of time between when payment of the sold currency becomes unilaterally irrevocable to when the purchased currency is expected to be received with finality.[5] Of course, it may not be possible for a bank to verify final receipt of the purchased currency immediately, especially where a correspondent bank is receiving these funds on its behalf. Until receipt has been confirmed, there is a possibility that a counterparty could default on its obligation. Thus, a bank's maximum exposure is defined as the length of time between when delivery of the sold currency becomes unilaterally irrevocable to when the bank is able to verify its final or failed receipt of the purchased currency. Only when non-receipt of payment within the allotted time frame has been verified can a bank take action to recover settlement losses.[6]

Control of exposure

Once identified and measured, procedures should be put in place to limit exposure to FXSR within parameters that are acceptable to the bank. For example, this could include the use of daily settlement limits for FX counterparties. A daily settlement limit (DSL) granted to a counterparty represents the maximum receivable (i.e., purchased) currency settlement position vis-à-vis that counterparty that the granting bank is willing to incur on a given day. DSLs are more effective in limiting exposure when they are binding (e.g., pre-trade authorization by the credit-risk department is necessary for anticipated limit breaches before a trade can be confirmed). Further, counterparty exposures against these limits should be monitored and updated in real time on a global basis (i.e., limits should be enforceable across all of a bank's trading centres).

An institution should also employ a reporting and follow-up procedure to deal with a counterparty's failure to deliver the purchased currency as expected. For instance, a counterparty may experience an internal operational problem that temporarily prohibits it from transferring funds through the payments system. Alternatively, a counterparty may suffer from a more serious liquidity problem that prevents it from meeting some or

5. Finality refers to the unconditional and irrevocable receipt of funds.
6. As alluded to earlier, with gross non-PvP settlement across international time zones and/or where correspondent banks are involved, there is a possibility that the banks' exposure to FXSR could be greatly increased.

all of its payment obligations over a longer time frame. Regardless of the cause, a failed trade represents continued exposure to the counterparty for the principal value of the trade. Hence, banks should account for failed trades in their measurement and control of FXSR.

The Canadian Environment: Stylized Facts

In 2006, the Bank of Canada, in conjunction with several other central banks, organized and conducted a survey of financial institutions regarding their use of various FX settlement methods and their FXSR management strategies.[7] Canada's major banks participated in the survey.[8] The survey is intended to identify changes in the use of available FX settlement methods and to assess progress in managing FXSR exposure since the CPSS-BIS survey published in 1998. The FX settlement landscape has changed considerably since then, particularly with the introduction of the CLS Bank.

The survey consists of two sections. The first asks respondents to report on average daily FX settlement values according to currency, counterparty type, and settlement method for April 2006. The second section consists of questions pertaining to the measurement and control of FXSR. The survey covers settlement of FX spot, forward, and swap transactions.

Some stylized facts from the survey of major Canadian banks are as follows.[9]

- The average daily FX settlement value (in terms of currency sold) reported by the Canadian banks in April 2006 was US$98.3 billion.[10] The settlement value of Canadian banks represents close to 3 per cent of the total daily FX settlement value for all institutions participating in the survey.
- Settlement value of the Canadian banks is heavily concentrated in the U.S. dollar (US$), the Canadian dollar (Can$), and the euro (EUR) (Table 1). Approximately 85 per cent of daily settlement value involves these currencies. Although the survey did not collect information on trade volumes for specific currency pairings, these results suggest that the majority of FX trades by Canadian banks are US$/Can$ and US$/EUR. In 1998, trades involving the U.S. dollar and the Canadian dollar accounted for a slightly greater combined proportion of the banks' daily settlement value.
- Overall, gross non-PvP settlement continues to represent the largest source of exposure to FXSR for Canadian banks; however, its prominence as a settlement method has declined since the introduction of the CLS Bank. Gross non-PvP settlement currently accounts for 55 per cent of daily settlement value (Table 2), compared with over 80 per cent in 1998.
- Close to 23 per cent of the aggregate daily FX value settled by Canadian banks went through CLS. This accounted for about 50 per cent of the daily FX value for the three Canadian banks participating in this system in April 2006.
- Roughly 30 per cent of banks' daily FX settlement value was bilaterally netted. This percentage was greater for non-CLS participants (54 per cent) than for CLS participants (15 per cent). The proportion of total credit exposure eliminated by bilateral netting was 17 per cent, which is similar to the percentage reported in the 1998 survey.
- On-us settlement was equal to 5 per cent of daily FX settlement value. This value is heavily

7. The survey was administered by member central banks of the BIS Committee on Payment and Settlement Systems (CPSS) Sub-Group on FXSR. The subgroup released a consultative report based on the survey findings in July 2007. The report is available at <http://www.bis.org/publ/cpss81.htm>.
8. Surveyed banks include the Bank of Montreal, Scotiabank, the Canadian Imperial Bank of Commerce (CIBC), National Bank of Canada, Royal Bank of Canada, and TD Bank Financial Group.
9. Where appropriate, comparisons have been provided between the current survey findings and the survey findings from 1998. In some cases, certain factors preclude an accurate comparison of these findings.
10. This does not necessarily include all FX trades booked by each bank, since the survey focused primarily on trades booked within Canada. However, some banks did provide figures for trades booked outside of Canada as well.

Table 1

Daily FX Settlement Value by Currency[a]

April 2006, percentage

Total	100
U.S. dollar	47
Canadian dollar	31
Euro	7
Japanese yen	4
U.K. pound	3
Australian dollar	3
All others	5

a. In terms of currency sold. Similar figures emerge for currency purchased.

Table 2

Canadian Banks' Use of Available Settlement Methods

April 2006, percentage

Daily FX Settlement Value:	100 (US$98.3 billion)
Proportion of which was:	
- settled gross non-PvP	55
- extinguished by bilateral netting	17
- settled on-us	5
- settled in CLS	23

concentrated in the Canadian dollar and the U.S. dollar, with a limited amount in the euro.

The Canadian Environment: Management of FXSR

The survey also shed light on Canadian banks' management of exposure to FXSR.[11]

Acknowledgement of exposure

All of the Canadian banks surveyed view their exposure to FXSR as a short-term credit exposure and have established a comprehensive framework for managing this risk. Clear lines of responsibility have been established within each bank, including the involvement of senior management.

Measurement of exposure

All of the Canadian banks surveyed recognize that they are exposed to financial loss up to the principal value of each FX trade settling gross non-PvP and also for on-us trades settling on a non-PvP basis. With respect to bilateral netting, all banks maintain master bilateral netting agreements with certain of their counterparties and view these agreements to be legally binding.[12] Accordingly, five of the six banks measure the amount of their credit exposure stemming from bilaterally netted trades as the net amount owing from the counterparty in the purchased currency. One bank measures its exposure as the gross value owing, solely for administrative reasons.

11. Views in this section of the article are based on specific criteria identified by the CPSS subgroup—acknowledgement, measurement, and control of exposure. A comprehensive judgment about the management of FXSR at each institution would need to factor in the broader framework within which risk management takes place (e.g., an assessment of contingency planning and stress-testing procedures). For more on this issue, see BCBS (2000), which discusses supervisory guidance for managing FXSR exposure. A description of Canadian banks' broader risk-management practices can be found in Aaron, Armstrong, and Zelmer (2007).
12. Under these arrangements, the necessary legal documentation, including an ISDA agreement, must be signed with each counterparty and acceptable legal opinions for each respective currency jurisdiction must be received.

When measuring their FX settlement exposure, Canadian banks participating in CLS recognize the benefit of this system in eliminating credit risk.

Banks measure the duration of their exposure to FXSR when settling trades gross non-PvP (the largest source of the banks' exposure) as lasting between one and three calendar days, depending on the institution. With data provided by the banks on their timelines for gross non-PvP settlement, each bank's actual minimum and maximum exposure to FXSR is calculated for its major currency pairings and is compared with its measured duration of exposure.[13]

This comparison reveals that two of the six Canadian banks measure their FX settlement exposure in a way that covers both their minimum and maximum exposures for all major currency pairings settling gross non-PvP. Two banks measure their exposure in a way that covers their minimum but not their maximum exposure for some or all of the major currency pairings. And two banks measure their exposure in a way that covers neither their minimum nor their maximum exposure for some or all of the major currency pairings. A discussion of these findings is presented in the next section.

Control of exposure

All of the major Canadian banks use daily settlement limits and apply them in a manner similar to that described earlier. Limits are binding and are usually programmed directly into the banks' internal credit-control systems so that all potential FX contracts are automatically applied against the respective DSL at the time of the trade. DSLs are usually established within the broad guidelines for granting counterparty credit set by senior management. That is, DSLs may be one of several corporate credit lines that a bank chooses to grant to its counterparty. DSL values are based on factors such as counterparty type, historical trading patterns, and projected business requirements. Limits are typically reviewed on an annual basis, but they may be reviewed more frequently if necessary.

13. Major currency pairings are defined as those involving Canadian dollars, U.S. dollars, or euros against each other.

All banks have procedures in place to deal with failed trades. These typically include generating a formal report and distributing it to senior management. For all but one bank, the failed counterparty's DSL may be reduced until the purchased currency is received. All banks use discretion in dealing with failed trades. For example, if the value of the failed trade(s) is large enough, then the counterparty's DSL may be shut down completely, rather than just reduced. Banks typically encounter only a few failed FX trades per week. Temporary operational issues are the primary cause of these failures, and failed trades are generally resolved quickly.

It should be pointed out that, given current timelines for gross non-PvP settlement, by the time that banks are able to identify that a trade has failed (usually on the day after the settlement date), it may already be too late to cancel delivery of the sold currency to the counterparty for trades settling on that day. It might also not be possible to cancel delivery of the sold currency for trades settling on the following day. But this does not apply to trades involving the U. S. dollar, the Canadian dollar, or the euro, which make up the bulk of the settlement activity of major Canadian banks. Of course, this is a "worst-case" scenario, because it assumes, among other things, that a bank becomes aware of a counterparty problem only upon identification of the failed receipt, which is not likely to be the case in practice.

The Canadian Environment: Discussion

The introduction of CLS since the CPSS-BIS survey in 1998 has led to a significant reduction in the degree of exposure to FXSR for participating Canadian banks. Nevertheless, the prominent use of gross non-PvP as a settlement method means that all banks continue to be exposed to a substantial amount of FXSR. That said, the management of this exposure by Canadian banks appears to have improved since 1998, although further improvement by some banks is still possible.

As observed in the 1998 CPSS-BIS report, Canadian banks continue to view their exposure to FXSR as a short-term credit exposure, and have established a comprehensive framework for managing this risk. Currently, the measurement

method used by two banks covers their maximum exposure. This is a slight improvement from 1998, when only one of these banks measured its exposure in this way. Other banks could improve by tightening their timelines for gross non-PvP settlement where possible, thereby reducing the duration of their minimum and maximum exposure.[14]

Improvements are also observed in banks' application of DSLs. In 1998, all but one bank monitored their exposures against these limits in real time. Moreover, DSLs were enforced on a global basis by only four of the six banks. Currently, all banks monitor their exposures in real-time and enforce counterparty DSLs on a global basis. Nonetheless, the procedures used by certain banks to deal with failed trades could be improved, as discussed earlier.

Participation in CLS

Since CLS virtually eliminates the credit risk associated with FX settlement, central banks and supervisory authorities, including the Bank of Canada and the Office of the Superintendent of Financial Institutions, encourage banks to participate in and use this system (Goodlet 2006).

Three of the six major Canadian banks participated in CLS at the time of the 2006 survey. Royal Bank was the only Canadian settlement member of the CLS Bank, while National Bank of Canada and Bank of Montreal participated as third parties. CIBC was in the process of becoming a settlement member at the time of the survey.

As noted earlier, 23 per cent of the total daily FX value at Canadian banks was settled through CLS Bank in April 2006. Participating banks noted that they settle as many trades as possible through this system. There are, however, obstacles to greater use of CLS in Canada, largely related to the settlement of same-day Canadian dollar/U.S. dollar trades. Typically, these trades are agreed upon, settled, and reconciled all within the same business day, whereas CLS settlement, which occurs overnight in North America, is completed on the following day.

Same-day settlement is estimated at between 35 and 70 per cent of Canadian dollar/U.S. dollar daily settlement value, depending on the institution. Banks not participating in CLS cite the lack of same-day settlement as significantly hindering the business case for their participation. Those banks participating in CLS share that concern, but feel that participation by Canadian banks is important. All banks expressed a strong interest in the possibility of multiple daily settlement sessions in CLS to accommodate settlement of FX trades for same-day value.

Regardless of its current inability to settle same-day trades, the use of CLS Bank by Canadian banks continues to increase. CIBC began participating as a settlement member in September 2006. Because CIBC is an important counterparty in the Canadian-dollar FX market, this is expected to increase the total value settled through CLS Bank by Canadian banks and by other international users of CLS.[15]

Conclusion

Canada's major banks are using a comprehensive framework to manage FXSR that focuses on governance, measurement, and control. While some improvement has been observed since the 1998 CPSS survey, there is still room for certain banks to make further progress in managing this risk.

Gross non-PvP settlement continues to be the primary source of exposure for Canadian banks; however, the proportion of their FX activity that settles through CLS Bank is increasing. Currently, four of the six major Canadian banks participate in this system. Greater use is hindered by the inability of CLS to settle same-day FX trades.

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14. For example, a bank could extend the cancellation deadline for paying out the sold currency with its correspondent bank, or perhaps identify its final and failed receipts earlier.

15. For a trade to be eligible for settlement through CLS, both counterparties must participate in the system.

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Research Summaries

Introduction

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

Policies for providing liquidity vary from central bank to central bank. But a generic feature of all these policies is the restriction to a small number of agents and a reliance on a market for liquidity. In the paper, **The Provision of Central Bank Liquidity under Asymmetric Information**, James Chapman and Antoine Martin consider a stylized economy in which the central bank has less-precise information about credit conditions than the rest of the financial market to which it is providing liquidity. The authors find that the optimal policy in this model is for the central bank to restrict its liquidity injections to the financial market to a small subset of market participants and to make these injections in a way that is sensitive to the underlying market conditions. The authors then briefly describe the Bank of Canada's policies for providing liquidity.

Collateral Portfolios and Adverse Dependence by Alejandro García and Ramazan Gençay summarizes the second of two papers that develop a framework for calculating haircuts for assets used as collateral. In their first paper (summarized in the December 2006 FSR), García and Gençay proposed a framework for comparing different methods of computing haircuts for individual assets. Particular attention was paid to selecting a method that would provide sufficient collateral in the case of low-probability events (large unexpected declines in asset prices) that might affect the stability of the financial system while also taking into account the cost of pledging collateral. In the paper summarized here, they examine how haircuts should be calculated in situations in which a variety of assets are pledged as collateral. This time, the focus is on the relationship among the prices of the different assets pledged as collateral and, in particular, how this relationship can change when markets are under stress. This situation is characterized as an event where there is a change in the correlation among the returns of the assets in the pool of collateral.

In the article, **Housing Market Cycles and Duration Dependence in the United States and Canada**, Rose Cunningham and Ilan Kolet explore data on real house price cycles at the aggregate level and city level for the United States and Canada. Using data for 137 cities, the authors examine the duration, size, and correlations of housing market cycles in North America. They find that North American housing cycles are long, averaging over five years of expansion and four years of contraction, and that there is a fairly high degree of positive correlation in house price cycles between U.S. and Canadian cities. The authors then estimate a model for expansions and contractions in house prices that allows them to test for duration dependence. The results suggest that housing market expansions have positive duration dependence—that is, the longer that expansions in house prices continue, the more likely they are to end. At the same time, there seems to be no relationship between the length of a contraction and the likelihood of its ending. Standard determinants of house prices (interest rates, income, and population growth) are included as controls.

The Provision of Central Bank Liquidity under Asymmetric Information

*James T. E. Chapman and Antoine Martin**

Central banks provide liquidity in various contexts to promote the stability and efficient functioning of the financial system. While the exact institutional aspects of liquidity provision vary among central banks, some basic features seem to be generic. First, the provision of central bank liquidity in normal periods is restricted to a small subset of possible agents who are encouraged to compete for liquidity with each other instead of automatically receiving liquidity from the central bank. Second, in extraordinary cases, the central bank has the option of providing liquidity to a much broader range of agents, and this liquidity can be provided independent of financial market conditions.

This article summarizes Chapman and Martin (2007), in which we develop a stylized economic model that captures these features. In the model, the central bank has two instruments with which to inject liquidity into a payments system: an instrument whose use depends on prevailing market conditions (the market-sensitive instrument), and an instrument whose use does not depend on market conditions (the market-insensitive instrument). These two instruments have different effects on the behaviour of agents in the economy.

We find that when the central bank is modelled as having less-precise information than other agents about what actions agents take to insure themselves against credit risk, the optimal policy for the central bank has the features noted above.

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The Model

The key features of the model borrow heavily from the seminal work of Freeman (1996, 1999). The model abstracts from many important features of real-world financial and payments systems but contains the four criteria, stated by Zhou (2000), necessary to effectively model a payments system: First, it captures the underlying transactions that lead to a need for some non-cash payments. Second, the debt instruments used in trade for goods are different from saving/investment debt. Third, there is a potential shortage of liquidity, for at least some agents, when payment debt is settled. Fourth, there exists credit risk that is generated endogenously by the choice of agents.

The model features two types of agents: debtors and creditors, who interact with each other to trade money and short-term debt for goods and later for money to settle the short-term debt. The debtors that trade for goods may default instead of settling their debt. To avoid this default, a creditor can pay the cost of monitoring the debt and thus reduce the probability that the debtor will default (credit risk).

The investment to reduce the probability of default is observable only by other agents in the economy and is not observable by the central bank. This assumption is consistent with two real-world characteristics: First, agents in the financial system can take actions to limit their exposure to credit risk. Second, since the central bank is usually not an active participant in the financial system, its information about these actions is less precise than that of other financial system agents. Thus, at the margin, participants in the banking sector have better information about their counterparties than the central bank.

When these loans are settled, there is a coordination problem in the timing of settlement.

That is, there is a chance that the creditor who is waiting for a debt to clear may have an unexpected need for the funds before the debt is settled. When this happens, the creditor can borrow funds (liquidity) from other creditors, using their unsettled claims as collateral. From the point of view of the other creditors, the unsettled debt may be unsettled either because of a coordination problem in the settlement of debt or because of default.

The market for liquidity

In the model, the interest rate at which creditors are able to borrow is efficient in that it accurately reflects the credit risk inherent in the claims they hold. The total supply of liquidity comes from debts that are already settled. But when the coordination problem is severe, the supply of funds available is small relative to the demand for funds, and there will be a liquidity shortage. In this case, the interest rate that equates the supply of liquidity to the demand for liquidity will primarily reflect a liquidity premium and will not accurately reflect credit risk. Previous work (Freeman 1996, 1999; Martin 2004) has shown that such a liquidity shortage is suboptimal and requires the central bank to intervene with a temporary injection of liquidity.

Central bank liquidity provision

If the model contained no credit risk, it would be optimal for the central bank to intervene directly to eliminate the liquidity shortage. Indeed, since the coordination problem in settling debt does not arise because of a choice made by agents, the central bank's intervention would not affect incentives to monitor. The problem is attributable to a missing market that would coordinate the settlement of funds at an exact time within a day. The central bank's intervention, in this case, can be viewed as an attempt to correct the inefficiency arising from the missing market.

When there is credit risk and agents can take on too much of this risk, the optimal action for the central bank is not as straightforward. Agents in the economy form rational expectations about the effect that the central bank's policy will have, and they will behave accordingly. If the central bank's policy on providing liquidity is too liberal, it will increase the credit risk in the financial system, since it will reduce the incentive for private agents to monitor credit risk. This distortion of incentives is caused by two factors: First, the central bank in the model will misprice liquidity because of its less-precise information. Second, if the central bank intervenes and provides liquidity by extending uncollateralized loans, it would distort the allocation of credit risk in the financial system by taking credit risk on its own books at an incorrect price.

The market-sensitive instrument

If the central bank provides liquidity to all creditors in a way that is not conditional on any market variables, then creditors will have no incentive to put any effort in avoiding credit risk, since the price that they are charged for liquidity from the central bank is not affected by the amount of monitoring they do. Since they gain no benefit from monitoring, agents will not monitor their exposure to credit risk. And the central bank will again take on credit risk from agents when it provides liquidity. It follows that an optimal policy must be conditional on the underlying market price for liquidity.

For liquidity provision to give the correct incentives to all creditors, liquidity must be provided to a subset of the creditors. This subset (i.e., central bank counterparties)[1] has more-precise information than the central bank about the amount of monitoring of credit risk. They use this information when supplying liquidity to the rest of the payments system, thereby charging the correct price. Agents in the economy who are not central bank counterparties then know that the price they have to pay for liquidity will depend on the amount of credit-risk monitoring that they undertake. They will therefore choose the amount of monitoring that equates the cost of monitoring to the expected cost of obtaining liquidity.

The optimal policy should be set up to encourage competition between the central bank counterparties. Without this competition, these counterparties would use their privileged position to earn economic rents. In addition, liquidity should

1. In the working paper, these are referred to as primary dealers. The term "central bank counterparty" is used here to avoid confusion, since the term "primary dealer" is used in Canada to denote distributors of government securities whose participation in primary and secondary markets for Government of Canada bonds is above a certain threshold.

be provided to the central bank's counterparties on a collateralized basis, so that all credit risk resides with the agents in the economy and not with the central bank.

A role for the market-insensitive instrument

To be effective, the optimal policy described by the model (a market-sensitive policy) has two requirements. First, it needs a well-functioning market for liquidity. Second, it requires that the central bank know exactly how much liquidity to supply to its counterparties. The lack of either of these requirements implies a role for a market-insensitive policy to supplement the market-sensitive policy.

In certain situations, however, the market for liquidity may be disrupted. In these cases, the first requirement is missing. When this happens, liquidity must be provided using a market-insensitive policy, since the market among the central bank's counterparties is not functioning properly.

If the second requirement is missing, then the central bank in the model does not know the amount of liquidity demanded by the market, and it must forecast the amount of liquidity to inject. Large errors in the central bank's forecast will cause distortions in the pricing of credit risk. A market-insensitive policy that is set so that it is inactive in normal market conditions will help limit such distortions; it will provide an upper bound on the effect that errors in the forecast of liquidity can have.

Liquidity Provision by the Bank of Canada

In general, the provision of liquidity by the Bank of Canada to the financial system is centred on its monetary policy framework.[2]

Liquidity provision by the Bank shares some of the key features implied by the model, although it is significantly more complex. First, in normal circumstances, the model suggests that the central bank should use a market-sensitive policy, which is intended for a small subset of all market participants. In the case of the Bank of Canada, open market buyback operations (special purchase and resale agreements and sale and repurchase agreements) and the Large Value Transfer System (LVTS) cash setting are essentially market-sensitive policies. The use of open market buyback operations is based on market conditions (including importantly, observed rates in the overnight market); they are transacted with only a subset of the market; and they are carried out in such a way that virtually no credit risk is assumed by the Bank of Canada. The Bank can adjust the targeted level of settlement balances depending on actual and expected conditions in the overnight market (Arjani and McVanel 2006). Access to these settlement balances is restricted to direct participants in the LVTS.

Second, when it is difficult to accurately forecast the level of liquidity needed, the model suggests that the central bank should provide liquidity through a market-insensitive policy. This policy should be designed in such a way that it encourages participants to transact with each other for their liquidity needs and use the market-insensitive instrument only for unexpected shortfalls. In the case of the Bank of Canada, the Standing Liquidity Facility (SLF) is available to LVTS direct participants experiencing temporary unexpected shortfalls in their end-of-day settlement balances. The rate paid on loans from the SLF encourages direct participants in the LVTS to seek liquidity from each other rather than from the SLF.[3]

Finally, the model suggests that in extraordinary circumstances the central bank should provide liquidity to a larger set of participants through a market-insensitive policy. In cases of extraordinary stress, the Bank provides Emergency Lending Assistance (ELA) to member institutions in the Canadian Payments Association, not only to the direct participants in the LVTS, under the restrictions set out in its policy.[4]

2. Details of the Bank of Canada's framework for implementing monetary policy may be found in Bank of Canada (2007). For a description of how the Bank of Canada has recently used some of these facilities, see Box 3 on p. 12.

3. The rate paid to use the SLF is 25 basis points above the target overnight rate, while the rate that the Bank of Canada pays on balances left with it overnight is 25 basis points less than the target overnight rate.

4. For a fuller description, see Daniel, Engert, and Maclean (2004–05).

Conclusion

Our model suggests that central bank liquidity is best provided through a tiered structure: The central bank provides liquidity to a subset of the market that, in turn, provides liquidity to others. This is fundamentally because the provision of liquidity by the central bank can distort the price of credit risk in the market to which the liquidity is provided. The model implies that a central bank that has relatively less information than market participants should effectively delegate the monitoring of credit risk to a subset of the market.

The Bank of Canada's policy for liquidity provision shares many of the policy features that are optimal in this model. In particular, it has the aspects of limited access and market sensitivity in normal circumstances and wider access in extraordinary circumstances.

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Collateral Portfolios and Adverse Dependence

Alejandro García and Ramazan Gençay

As financial markets and their supporting infrastructure continue to develop over time, banking professionals and regulators are taking steps to make them safer. Many of those steps involve the use of collateral to manage financial risks.[1] But collateral itself may consist of risky assets whose value can change over time. Consequently, a pledge of collateral must be large enough to adequately cover all losses in the event of a counterparty default. Thus, the initial value of collateral is discounted. In other words, the amount of collateral pledged must be larger than the amount owing. This discount, often referred to as the "haircut," lowers the risk associated with a transaction. But because collateral is costly to pledge, the framework established for setting haircuts must recognize the inherent trade-off between costs and risks associated with collateral. This framework could also provide useful information to determine the desirable allocation of the portfolio of collateral.

This article summarizes the second of two papers that explore a framework for calculating haircuts for different assets. The first, García and Gençay (2006), proposed a framework for comparing different methods for computing haircuts for individual assets. Particular attention was paid to selecting a method that would accomplish two goals. First, it would provide sufficient collateral in the case of low-probability events (large unexpected declines in asset prices) that might affect the stability of the financial system. Second, it would take into account the cost of pledging collateral. The second paper, García and Gençay (2007), examines how haircuts should be calculated in situations where a variety of assets are pledged as collateral. Here, the focus is on the relationship among the prices of the different assets pledged as collateral and, in particular, how this relationship can change when markets are under stress. We refer to this change as a change in the dependence structure,[2] which is caused by an event that changes the relationship between the returns on the assets in the pool of collateral. For example, during normal market conditions, a given pool of collateral may exhibit diversification benefits. However, during extreme market conditions, few, if any, such benefits may be evident for the same pool.

Financial Risks during Extreme Events

When collateral consists of a variety of assets, note should be taken of two effects generally associated with extreme events. The first is associated with the individual security, and the second with the portfolio as a whole. The former is referred to as the *individual effect*, the latter as the *portfolio effect*. The individual effect occurs when there is a negative return on an asset pledged as collateral, but the dependence structure of the portfolio does not change significantly. The portfolio effect occurs when there is a change in the relationship among the various assets pledged as collateral; that is, the dependence structure between the assets changes and exhibits smaller diversification benefits than observed historically.[3] To illustrate the portfolio effect, consider two hypothetical securities, x and y, that are pledged as collateral; and two states of the world:

1. According to Khan (2007), the use of collateral to mitigate counterparty credit risk has increased substantially.

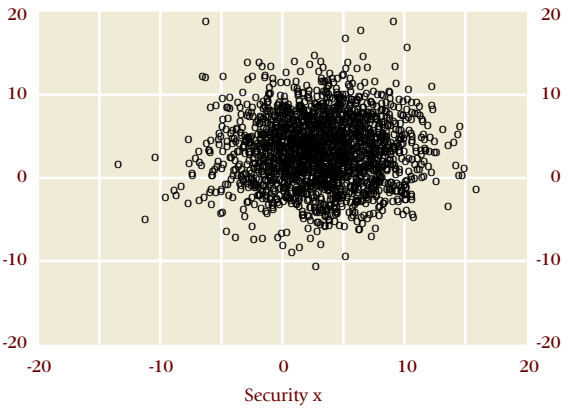
2. This is usually referred to as a change in correlation, but this is not always correct, since there can be a change in the dependence structure without a change in the correlation.

3. Chan et al. (2005) refer to this as a "phase-locking" effect. The authors offer an explanation for these effects from a financial-engineering perspective.

a normal state and an extreme state. During the normal state, the scatter plot of per cent losses for x and y may be represented by Chart 1; during the extreme state, it can be represented by Chart 2.[4] In this example, we assume that the distribution of returns for each asset was the same in both states, but that the dependence structure between the assets changes.

Chart 1 illustrates that, in a normal state, there are many instances in which a large loss for one asset does not coincide with a large loss for the other. In contrast, as Chart 2 shows, in an extreme event, the diversification benefits are significantly reduced compared with those observed in normal periods. Chart 2 shows a greater degree of positive dependence, that is, large losses in one asset coincide with large losses for the other asset.[5]

Chart 1 Scatter Plot of Losses during Normal Periods



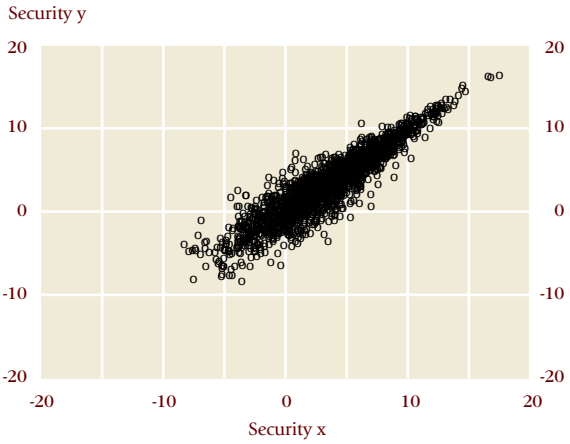
Scatter plot of 2,000 points representing losses from two hypothetical securities with normal marginals N(3,4) and the dependence structure of a Normal copula with correlation 0.1.

Managing Portfolio Effects

To manage the financial risks associated with the portfolio effect, the dependence among assets must be modelled in a way that reflects what could happen if there were an extreme event. We accomplish this using copulas—multivariate distributions that are very useful in financial-engineering problems involving modelling two or more random variables. Because copulas allow the multivariate distribution of returns for the portfolio to have a wide range of marginals (i.e., the distribution of returns for each asset) and dependence structures, they allow us to separate the behaviour of the dependence structure from the behaviour of individual asset prices. This separation is not possible with traditional representations of multivariate distribution functions and may lead to a misspecification of the multivariate distribution. The use of copulas thus facilitates the aggregation of risk across securities that may have different return distributions.

We use the copula-based method to determine whether a collateral pool contains assets that

Chart 2 Scatter Plot of Losses during Extreme Events



Scatter plot of 2,000 points representing losses from two hypothetical securities with normal marginals N(3,4) and the dependence structure of a Gumbel copula G(4).

4. Charts 1 and 2 represent losses as positive values and profits as negative values. This is a standard convention in statistics, since actuarial risk theory is a theory of positive random variables.
5. Note that other outcomes are possible during extreme events. For example, if the portfolio is composed of a risk-free asset and a risky asset, the result could be a more negative dependence.

have a low probability of joint losses.[6] This is done to assess whether, during extreme events, the returns of the assets in the portfolio are likely to continue to be as diversified as they were historically.

Note that while a receiver of collateral would prefer to have a collateral portfolio with large diversification benefits, the collateral pledgor would normally decide which assets will be pledged, subject to the rules of the collateral-pledging agreement. A copula-based methodology could be an input in determining maximum limits for classes of assets that can be pledged as collateral (i.e., sector limits), creating incentives for those pledging collateral to supply a diversified pool. In the event of a counterparty default, having a diversified pool of collateral could reduce the costs associated with selling (liquidating) the collateral portfolio, because it may be easier to find counterparties to take those assets that still exhibit diversification benefits. In contrast, a portfolio with lower diversification benefits may require a significant discount in order to sell the assets in time to cover the losses.

Stress Testing Portfolio Dependence

García and Gençay (2007) also present a methodology for examining the performance of the portfolio in the face of an event that negatively affects the dependence structure. The collateral pool in question is subjected to stress tests in which the dependence is changed by (i) using a comprehensive set of copula families that represent different dependence structures and (ii) increasing the degree of positive dependence for each copula. When conducting stress tests, we assume that the characteristics of the individual assets in the portfolio do not change, only their dependence on each other. We estimate the distributions for each asset based on historical data, and, for the dependence structure, we start with a scenario based on historical observations of the dependence. This approach provides a range of the possible adverse dependencies (and their associated losses) that may occur during extreme events. For example, using various copula models to capture the dependence between the price changes of two Canadian investment-grade assets, we observe that the portfolio losses (negative returns) can vary by as much as half of a percentage point. This result, coupled with the substantial size of collateral portfolios, may translate into a large discrepancy between the different models in dollar terms.[7]

Conclusion

This work, together with García and Gençay (2006), proposes: (i) a framework for calculating haircuts for individual assets, (ii) a method for monitoring changes in the dependence structure of assets, and (iii) a method for stress testing and measuring the possible effects of adverse dependence structures on portfolio value.

This research has two policy implications. First, there is a need for caution when considering the extent to which a haircut should be reduced to take account of diversification benefits in a collateral pool. While those benefits may be evident in normal situations, they may decline significantly during extreme events. This could lead to uncollateralized exposures, or even losses, if collateral has to be liquidated in a period when markets are under stress. Second, when the number of assets accepted as collateral increases, it is important to consider not only the individual characteristics of the asset in question, but also its effect on the overall dependence structure of the portfolio of collateral.

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6. Based on Carmona (2004) and Zivot and Wang (2006), our copula-based method uses a semi-parametric approach to model the marginals and a copula to model the dependence.

7. Note that this result is specific to the portfolio examined.

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Housing Market Cycles and Duration Dependence in the United States and Canada

Rose Cunningham and Ilan Kolet

Attention has recently been focused on the deterioration in the housing and credit markets in the United States and the effects that this may have on financial institutions and, more broadly, on financial stability. After an extended upswing, the rate of increase in U.S. house prices has slowed sharply, and prices have even declined in some areas. House price cycles play an important role in the consumption and savings decisions of consumers. Developments in housing markets can have a significant impact on performance in the banking sector and, thus, on the financial system, since residential mortgages account for a large share of the loan portfolios of Canadian banks. Therefore, it is important for policy-makers to have a good understanding of the cycles in house prices.

Canada and, until recently, the United States have been experiencing the longest period of rising house prices on record. A natural question is whether such a long expansion is more or less likely to end than a shorter one; that is, whether cycles in the housing market exhibit duration dependence. If there is duration dependence in housing cycles, then turning points can, to some extent, be predicted by the length of the phase. Thus, duration could prove to be a useful indicator for policy-makers. This is particularly interesting in the current context, given that the surge in house prices in the United States seems to be over, while Canadian house prices continue to increase.

The aim of this study is to examine house price expansions and contractions in the United States and Canada using a panel data sample of 137 cities, spanning a period of at least 20 years.[1] The goal is to improve our understanding of housing market cycles in North America. First, we compare housing market cycles in the United States and Canada with respect to duration, size, and correlation. We then estimate a model[2] to test for duration dependence during periods of expansion and contraction in house prices.

This study builds on the housing cycle literature and, to the best of our knowledge, is the only one that tests specifically for duration dependence in housing market cycles. One reason for the lack of such an approach may be the lack of long-term time series for aggregate house prices, which makes time-series econometric estimates unreliable. To address this problem, we use a panel data estimation technique.

Descriptive Analysis of House Price Cycles

Housing market cycles in Canada and the United States exhibit a number of differences. First, there have been fewer national housing cycles in the United States than in Canada (two U.S. contractions since 1975 compared with four in Canada since 1980). Second, aggregate real house prices have been considerably less volatile in the United States than in Canada, with a standard deviation in growth of 3.5 per cent, compared with 6.5 per cent in Canada. Finally,

1. A panel data sample creates more variability by combining variation across micro units with variation over time. With this more informative data, more efficient estimation is possible.

2. We construct indexes of U.S. real house prices using the city- and national-level nominal house price indexes from the Office of Federal Housing Enterprise Oversight deflated by the CPI data published by the Bureau of Labor Statistics. Canadian house prices can be measured using data on the average selling price compiled from the multiple listing service (MLS). The MLS series are then deflated using the Canadian national consumer price index from Statistics Canada. Both of these data sources have limitations that are described in detail in Cunningham and Kolet (2007).

housing market cycles in Canada have tended to be shorter and sharper than those in the United States, particularly during periods of declining prices. The longest nationwide contraction in Canada occurred in the early 1980s and lasted three years, and the accompanying price declines were generally as large or larger than in the United States.[3]

An analysis of aggregate housing market cycles is not sufficient, however, because housing is inherently local. The analysis of city-level data shows that local housing cycles in the two countries have been quite similar overall: the average expansion lasts 5.8 years, with an average increase in real prices of about 32 per cent in both countries, and during a typical contraction, real prices decline by about 10 per cent in both countries. Contractions are shorter in Canadian cities, however, lasting an average of 3.5 years compared with 4.4 years in U.S. cities.

It is important to note that unconditional correlations between housing cycles in Canada and the United States do not imply causality between the two countries.

A Model of Duration Dependence

To more formally examine the full course of housing cycles, we estimate a duration model. Also known as survival analysis, this technique, commonly used in microeconomics, has also been used in several studies of economic cycles, most notably stock market and business cycles. It is particularly relevant for our work because a natural question regarding house prices is, "Given the recent increase in home prices, what is the probability of the expansion ending?"

We estimate separate discrete-time survival models for expansions and contractions in housing cycles:

$$Pr(y_{it} = 1) = \Phi(DUR3...DUR10UP, GINC, GPOP, DRM).$$

The dependent variable is a binary variable, y_{it}, which represents the phase that city i is in at time t. In the model for expansions, $y_{it} = 1$, if city i is in an expansion phase, and $y_{it} = 0$, if it exits the expansion phase in period t. This dependent-variable phase is estimated using a standard probit model in which the right-hand side contains a variable that measures the duration in the current phase ($DUR3...DUR10UP$), along with other variables that control for fundamental factors affecting the duration of housing cycles (income, $GINC$; population, $GPOP$; and mortgage rates, DRM).

A non-zero coefficient on the duration variable indicates duration dependence. More specifically, a statistically significant positive coefficient implies that the longer the current phase has lasted, the more likely it is to continue. Conversely, a significant negative coefficient on the duration variable implies that the longer the current phase has gone on, the more likely it is to end. A statistically insignificant coefficient means that the phase is duration independent.

Results and Implications

We find that the longer a housing expansion lasts, the more likely it is to move into a contraction phase.[4] In contrast, contractions seem to have no duration dependence, but the results are sensitive to the particular specification. The control variables (i.e., the fundamental factors—income, population, and interest rates) explain most of the transition dynamics of contractions, but there is a role for duration to help us predict expansions. The asymmetric nature of our findings on duration dependence may be due to the fact that duration acts as a proxy for other variables that could explain the transition out of housing market expansions. One potential interpretation is that the duration dependence in expansion cycles may be a proxy for speculative activity. Speculation may only appear in expansion phases because, unlike other asset markets, short selling of houses is not possible.

These results are interesting for policy-makers for several reasons. First, the findings and estimation results suggest that fundamental factors, notably interest rates, have a significant impact

3. Commodity price shocks have had larger effects on the Canadian economy than on the U.S. economy and may explain some of the differences in housing and business cycles in the two countries.

4. The duration dependence results for expansions are remarkably robust, but the contraction results are more sensitive. Furthermore, we find the magnitude of the duration dependence in expansions to be economically significant.

on the transition out of both contractions and expansions.[5] Second, the fact that duration is significant for expansion phases could prove to be a useful indicator in predicting the length of housing market expansions. Since financial institutions in Canada are exposed to the housing market through their residential mortgage loan portfolio, the ability to predict the length of housing market expansions could be useful in assessing the expected impact of housing market developments on these financial institutions and on the financial system as a whole.

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Cunningham, R. and I. Kolet. 2007. "Housing Market Cycles and Duration Dependence in the United States and Canada." Bank of Canada Working Paper No. 2007-2.

5. Rising interest rates tend to decrease the survival probability of expansions. We find that the real policy rate variable is robust to all our specification changes, and its effect on survival probabilities is statistically and economically significant. In particular, for contractions, the change in the real policy rate has a large effect of roughly the same magnitude as growth in income per capita.